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1900.

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PROCEEDINGS
OF THE
GENERAL MEETINGS FOR SCIENTIFIC BUSINESS
OF THE
ZOOLOGICAL SOCIETY OF LONDON.

January 23, 1900.

Dr. ALBERT GÜNTHER, F.R.S., V.P., in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of December 1899:—

The registered additions to the Society's Menagerie during the month of December 1899 were 69 in number. Of these 25 were acquired by presentation and 11 by purchase, 2 were born in the Gardens, and 31 were received on deposit. The total number of departures during the same period, by death and removals, was 131.

Mr. Sclater exhibited a photograph of a young specimen of the Rocky Mountain Wild Goat (*Haploceros montanus*) now in captivity in British Columbia, which had been forwarded to him by Dr. A. R. C. Selwyn, C.M.G., F.R.S., C.M.Z.S., and read a letter from that gentleman kindly offering his assistance in obtaining the specimen for the Society's Collection. It was stated to have been captured on the 15th June last by a shooting party near Field, British Columbia. The mother was shot and the kid captured. It was then about a month old and weighed only 6 lbs. On the 22nd December last it weighed 55 lbs. and had an excellent winter coat, as was shown in the photograph.

Mr. Sclater exhibited a collection of Birds formed by Mr. Alfred Sharpe, C.B., C.M.Z.S., during a recent journey from Zomba to the
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British South Africa Company's headquarters at Fort Jameson in Mpeseni's country in Northern Rhodesia. Mr. Selater added that the 135 specimens had been kindly determined by Capt. Shelley, and referred by him to 66 species, of which the following was a list (according to Capt. Shelley's nomenclature) with the localities added:—

		No. in Shelley's List.	Locality (where stated).
1.	<i>Cinnyris falkensteini</i>	36	Mkukula.
2.	<i>Chalcomitra kirki</i>	54	Buwa.
3.	<i>Anthothreptes longuemarii</i>	74	Buwa.
4.	<i>Parus afer</i>	124	
5.	<i>Motacilla vidua</i>	143	
6.	<i>Anthus rufulus</i> ..	165	
7.	<i>Macronyx croceus</i>	170	Liwonde.
8.	<i>Mirafra fischeri</i>	198	Buwa.
9.	<i>Pyrrhulauda smithi</i>	234	Katunga.
10.	<i>Passer diffusus</i>	268	Katunga and Mkukula.
11.	<i>Vidua principalis</i>	312	Katunga and Mkukula.
12.	— <i>paradisea</i>	316	
13.	<i>Urobrachya axillaris</i>	328	Kotakota.
14.	<i>Pyromelana xanthomelana</i>	333	Buwa, Mkukula, Katunga.
15.	— <i>flammiceps</i>	338	Mkukula and Kotakota.
16.	<i>Ploceipasser pectoralis</i>	470	Liwonde.
17.	<i>Hyphantornis shelleyi</i>	543	Katunga.
18.	<i>Oriolus larvatus</i>	572	Buwa.
19.	<i>Lamprocolius sycobius</i>	600	Liwonde.
20.	<i>Prionops talacoma</i>	666	Buwa.
21.	<i>Campophaga nigra</i>	675	Buwa.
22.	<i>Fiscus collaris</i>	693	Mkukula and Buwa.
23.	— <i>sousæ</i>	701	Buwa.
24.	<i>Enneoctonus collurio</i>	709	Kotakota, Mkukula, and Buwa.
25.	<i>Laniarius mosambicus</i>	723	Kasungu.
26.	<i>Dryoscopus cubla</i>	742	Kasungu.
27.	<i>Telephonus senegalus</i>	751	Buwa.
28.	<i>Malaconotus blanchoti</i>	778	Buwa.
29.	<i>Andropadus oleaginus</i>	844	Liwonde.
30.	<i>Erythropygia barbata</i>	1143	Buwa.
31.	<i>Turdus libonianus</i>	1234	Buwa.
32.	<i>Bradyornis murinus</i>	1302	Katunga and Kotakota.
33.	<i>Eurystomus glaucurus</i>	1509	Kotakota.
34.	<i>Coracias caudatus</i>	1515	Liwonde.
35.	<i>Rhinopomastes cyanomelas</i>	1559	Liwonde.
36.	<i>Ceryle rudis</i>	1599	Liwonde.
37.	<i>Corythornis cyanostigma</i>	1606	Kotakota.
38.	<i>Halcyon chelicutensis</i>	1619	Kotakota.
39.	<i>Colius erythromelon</i>	1638	Liwonde.
40.	<i>Schizorhis concolor</i>	1664	Kotakota and Liwonde.
41.	<i>Centropus burchelli</i>	1690	Kotakota.
42.	<i>Coccytes cafer</i>	1696	Liwonde.
43.	<i>Chrysococyx cupreus</i>	1712	Mkukula.
44.	<i>Melanobucco torquatus</i>	1739	Katunga and Buwa.
45.	<i>Smilorhis sowerbyi</i>	1759	Katunga and Buwa.

		No. in Shelley's List.	Locality (where stated).
46.	<i>Campothera abingdoni</i>	1812	Buwa.
47.	<i>Chalcopelia afra</i>	1895	Kotakota.
48.	<i>Nisaëtus pennatus</i>	2025	Liwonde.
49.	<i>Lophoaëtus occipitalis</i>	2030	Liwonde.
50.	<i>Asturinaula monogrammica</i>	2046	Liwonde.
51.	<i>Astur polyzonoides</i>	2060	Liwonde.
52.	<i>Circus ranivorus</i>	2082	Liwonde.
53.	<i>Ardea purpurea</i>	2123	Kotakota.
54.	<i>Phalacrocorax lucidus</i>	2149	Kotakota.
55.	— <i>africanus</i>	2153	Kotakota.
56.	<i>Plotus levaillanti</i>	2154	Kotakota.
57.	<i>Larus cirrhocephalus</i>	2205	
58.	<i>Sarcidiornis melanonota</i>	2255	Liwonde.
59.	<i>Porphyrio alleui</i>	2297	Kotakota.
60.	<i>Turnix lepurana</i>	2324	Katunga.
61.	<i>Francolinus coqui</i>	2346	Buwa and Katunga.
62.	<i>Phyllopezus africanus</i>	2441	Liwonde and Katunga.
63.	<i>Lobivanellus lateralis</i>	2445	Buwa and Katunga.
64.	<i>Pavoncella pugnax</i>	2484	Mkukula.
65.	<i>Rhynebaea capensis</i>	2501	
66.	<i>Cursorius temmincki</i>	2517	Buwa.

Mr. Selater remarked that the route from Lake Nyasa to Mpeseni's country and Fort Jameson would be found described in an article by Mr. R. I. Money and Dr. Kellett Smith in the 'Geographical Journal' for 1897 (vol. x. p. 146).

Capt. Shelley had informed Mr. Selater that examples of the following 3 species had not previously been obtained in Nyasaland, but it should be remarked that Fort Jameson itself, being over the water-parting, was just outside the border of the B. C. A. Protectorate:—

1. *Parus afer* Gm.: Gadow, Cat. B. viii. p. 39.
Not previously recorded from the north of the Zambesi.
2. *Smilorhis sowerbyi* Sharpe, Ibis, 1898, p. 572, pl. xii. fig. 1.
Originally described from Mashunaland.
3. *Phalacrocorax lucidus* (Licht.): Grant, Cat. B. xxvi. p. 351.

A communication was read from Mr. G. A. Boulenger pointing out that an unfortunate mistake, for which he was in no way responsible, had been made in printing the characters of the genus *Xenotilapia* in part 4 of vol. xv. of the Society's Transactions, lately issued. The characters of the genus *Xenotilapia* (page 92) should stand as follows:—

XENOTILAPIA, g. n.

Body moderately elongate; scales ctenoid; three lateral lines. Mouth small, very protractile; upper jaw with two series of minute

conical teeth; mandibular teeth turned outwards, in a single series; maxillary concealed under the præorbital when the mouth is closed. A large papillose pad on each side of the pharynx, between the gills. Dorsal with 14 or 15 spines, anal with 3.

The following papers were read:—

1. On a Collection of Insects and Arachnids made in 1895 and 1897, by Mr. C. V. A. Peel, F.Z.S., in Somaliland, with Descriptions of new Species. By C. V. A. PEEL, F.Z.S., E. E. AUSTEN, F. A. DIXEY, M.A., M.D., HERBERT DRUCE, F.L.S., F.Z.S., C. J. GAHAN, M.A., GILBERT J. ARROW, R. McLACHLAN, F.R.S., MALCOLM BURR, F.Z.S., and R. I. Pocock.

[Received November 9, 1899.]

(Plates I.–IV.)

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1. NARRATIVE OF THE EXPEDITIONS.

By C. V. A. PEEL, F.Z.S., F.R.G.S.

(First expedition to Somaliland. April 16 to August 7, 1895.)

Somaliland has always been known as the big-game hunter's paradise, and in consequence but few have had the energy to collect insects as well. Mr. E. Lort Phillips and Dr. Donaldson Smith, however, are notable exceptions. I always kept a killing-bottle in my tent and also collected outside whatever I happened to meet, but I must honestly confess that I never devoted my time seriously to collecting insects. Owing to the great sameness of thorn-bush and undergrowth, the Lepidoptera of Somaliland are disappointing. The Butterflies are few and somewhat uninteresting,

and the Moths are very local. The latter were nearly all collected on the banks of river-beds where there were trees, long grass, and undergrowth. The Beetles, on the other hand, simply swarmed, and there was also no lack of Orthoptera, Chilopoda, Diplopoda, Arachnida, &c.

On April 20th, 1895, I started from Berbera, the coast town of Somaliland, wending my way south-west along the maritime plain to Hargaisa. Insect-life was by no means plentiful in this hot parched-up desert country, but birds were numerous by the sides of the dried-up river-beds.

Hargaisa is a permanent Somali village on a gentle slope, overlooking a river-bed. There was luxuriant undergrowth and a few trees. Insect-life was consequently more plentiful, and I collected my first butterflies and moths here. Of the latter, the large species *Cylogramma latona* Cr. and *Sphingomorpha chlorea* Cr. came to my lantern in great quantities at night. After leaving Hargaisa, I went south across the great waterless Haud District, through dense thorn-bush jungle. *En route* we suddenly emerged upon the Bun Saylah, a large open plain literally covered with game, notably Oryx, Hartebeest, Sæmmerring's Gazelle, and Ostriches. It took us a day to cross this, and then we entered dense jungle again. All this time I did but little insect-collecting, as, owing to the scarcity of water, I was always on the quick march. At Sassabanah we encountered water in deep wells and under the surface of a river-bed, the Webbi Jerrar. Here I collected some of the ticks described. Thence I marched to the Boorgha Country, and passed the everlasting red sand, entering a stony, hilly district. In this latter, Orthoptera were very numerous. I went as far as Mount Kuldush, marching along the Webbi Shebeyli, the great river of Somaliland.

The banks of this river were lined with trees and dense jungle, and butterflies and other insects were very abundant. Being unable to find a path for the camels down to the river-edge, and as I was running short of food, and many of my men had fever, I retraced my steps at the end of June. I followed the Sule River for a long way and reached Bun Jijjiga, a gigantic plain at the foot of the Harah Hills. Here I fell in with Abyssinians, who, however, behaved most cordially. Game was extremely abundant on this plain; but insects were somewhat scarce except at Whardi Datal, where there was long grass, in which Orthoptera simply swarmed. After leaving the plain I traversed thick jungle until reaching Hargaisa, where I rested to take up water before recrossing the great maritime plain called Gubau (the hot country).

During this latter journey I came across a small herd of the Somali Wild Ass (*Equus somalicus*), and passed through a dense locust-cloud, which darkened the sun for hours and looked like a great fall of snow, the air being *white* with them. After a very exhausting march through this desert, where we encountered terrific dust-storms every day, we finally returned to Berbera and the coast.

(Second expedition. June 5th to October 29th, 1897.)

Being anxious to continue my researches in the Natural History of Somaliland, and if possible to cross the Ganana River and explore Lake Rudolph, I set out from Berbera again in 1897, accompanied by Mr. J. Bennett-Stanford, F.Z.S., and his wife. We took with us a very large caravan of camels and escort. We crossed the great Gulis Range of mountains by the Gerato Pass, and encamping at Lehello, there awaited more camels, which were being bought for us in Berbera. Lehello lay in stony ground by the everlasting dried-up river-bed. Here insect-life was fairly abundant, as will be seen from a perusal of the subsequent parts of this memoir.

We removed next to the Toyo Plain, a vast open space devoid of trees, and then crossing the waterless Haud District reached the wells of Farfanyer in Ogaden. Here we were overtaken by a messenger from the political officer at the coast, forbidding us to go to the Ganana River, as the Somalis were reported to be fighting the Abyssinians there. This was a great disappointment to us, after getting together such a large caravan and escort. At Farfanyer we fell in with a great number of Somalis armed with rifles, which they had looted from the Abyssinians, whom they had defeated in two battles on the Webbi Shebeyli. At Farfanyer Mr. and Mrs. Stanford stayed, looking for rhinoceros, whilst I, with my separate caravan, went in search of a reported lion. Eventually I lost the Stanfords altogether, and although I sent guides to look for them, it was of no use, owing to the denseness of the bush. I had a very bad attack of fever, and after waiting for over a fortnight to try and get news of my friends, or to get a guide to take me back, I was obliged to give it up and march on alone.

Hearing of elephants in the Marehan and Haweea Countries, I determined to explore this little-known territory, and so marched across the great Marehan Desert and reached Habr Heshi, where we at length found water. Here I shot a fine lion which charged me, but I managed by great good luck to stop the animal when it was within a few yards.

After leaving Habr Heshi we encountered stony barren country, and pitched camp at Sinnadogho in the Haweea country, where there were fresh tracks of elephants. Here the natives were extremely troublesome, and I had a very anxious time. Several of my rifles, cloth for barter, and a pony were looted from me, and my followers were frequently attacked. I marched to Joh, the furthest point south-east I was destined to reach. We were then about six days' distance from the east coast. Finding no elephants, I went on to Kadea, looting on the way a pony in exchange for the one taken from me. Upwards of five hundred armed men made their appearance at this point, and I thought we were in for a big fight, some of the young men dancing themselves into a perfect frenzy. I was obliged to fire over their heads, to keep them from looting my camels. They succeeded, however, in stealing some

rifles, and I was obliged to take out my little army twice against villagers; but luckily no blood was shed, as the villagers, seeing the rifles coming, immediately restored my stolen property. I did not collect to speak of here, as I was ill with fever and was having a very anxious time. I could get no guide to take me across the great waterless desert of the Marehan, and was obliged to load up the water-vessels at Doosa Moreb and start without one. I believe I was the first white man to visit the heart of the Marehan and Haweea Countries, and was right glad to shake off the dust from my feet on quitting those inhospitable tribes. How I lost my way crossing the Marehan Desert, ran short of water, and all but died of thirst, I have already described in the pages of the 'Wide World Magazine.' We reached Galadi in the Mijertain Country, and found water in the very nick of time, when I was almost at the last gasp. Here I became delirious, and knew nothing that was going on around me for hours. After leaving Galadi I became so ill and weak with fever that I did no further collecting, but was practically carried by my pony the whole way across the waterless Haud again to the Gulis Range, where I remained a few days to rest, and at length reached Berbera more dead than alive.

A full account of my two expeditions, together with a complete list of every mammal and bird known to inhabit the country, will be found in my book 'Somaliland,' published in 1899 by Messrs. F. E. Robinson & Co., London.

The specimens mentioned and described in the following pages are in the Hope Collection, University Museum, Oxford, with the exception of those which are expressly stated to be in the British Museum.

2. DIPTERA.

By E. E. AUSTEN, Zoological Department, British Museum.

Mr. Peel's collection of Diptera was not extensive, amounting only to four specimens belonging to three species, one of which, however, is apparently new.

Fam. TABANIDÆ.

Subfam. PANGONINÆ.

PANGONIA Latr.

PANGONIA (*sens. strict.*) Rond.

PANGONIA TRICOLOR, sp. n. (Plate I. fig. 8.)

♀. Length 17 millim.; length of wing 15·5 millim.; length of proboscis 4 millim.

Shining black; first and second segments of abdomen (except a somewhat triangular area in the middle of the second segment, which, however, like the first and remainder of the second segment, is clothed with appressed silvery-white pile) white above; sixth and seventh segments and the narrow posterior margin of the fifth ochraceous, and

clothed with golden ochraceous pile; wings dark brown; alula, greater portion of the area behind the sixth longitudinal vein, and sometimes a narrow margin extending from the tip of the second vein to the apex of the anal cell, hyaline.

Head with an area surrounding the bases of the antennæ, extending from eye to eye, and including the lowest third of the front and an equal space below the antennæ, covered with white dust; face on each side below the antenna sparsely clothed with fine silvery hairs; cheeks dark brown; occiput covered with greyish dust, and base of head below thickly clothed with short white hairs; antennæ uniformly black, a distinct shoulder at the base of the third joint above. Thorax with a few short golden hairs in front of scutellum; pectus clothed with silvery-white pile, which extends on to the pleuræ above the front coxæ, and also in a stripe running up to the base of the wing, where the stripe ends in a fork; a narrow stripe of silvery-white pile extends from the base of the scutellum to the wing on each side. Abdomen: the white posterior margin of the second segment is narrowed in the middle above (thus leaving the black triangular area mentioned in the diagnosis), and continued on the ventral side as a narrow transverse band. Legs: coxæ greyish pollinose, and clothed with silvery-white pile; tibiæ with a slight reddish tinge. Wings with a fleck of silvery-white pile on the base of the first vein; halteres tawny.

Two specimens (both ♀). Type in British Museum; co-type in Hope Museum, Oxford. From Bun Feroli, north of Shebeyli River, West Somaliland; June 10–20, 1895: "biting men and animals."

In the present species the eyes are bare and the first posterior cell of the wing is closed; it is therefore a true *Pangonia* in Rondani's restricted sense.

Pangonia tricolor is closely allied to *P. bricchettii* Bezzi (Ann. Mus. Civ. Genov. xxxii. (1892), p. 181), also from Somaliland (Milmil). *P. tricolor* differs from *P. bricchettii* (which apparently is a somewhat smaller species) *inter alia* in only the first two, and not the first four¹, abdominal segments being marked with white, thus leaving between the white of the base and the ferruginous tip a broad shining black space, which is absent in Bezzi's species.

It may be noted that in the marking of the base of the abdomen of *Pangonia tricolor* there is a certain similarity to *Tabanus leucaspis*, v. d. Wulp (Notes Leyden Mus. vii. (1885), p. 74, pl. v. fig. 3), from the Gold Coast.

The collection of the British Museum contains two specimens of *Pangonia tricolor*, obtained by Capt. Swayne in Somaliland, from

¹ There is a discrepancy between Bezzi's diagnosis and his detailed description; in the former he writes (*op. cit.* p. 181) "*abdomine fasciis tribus transversis ex tomento albido ad marginem posticum segmentorum,*" while in the latter he describes (p. 182) the fourth segment also as "*a orlatura posteriore bianca,*" with the dorsum "*Fornito di peli bianchi*"; he describes the 5th, 6th, and 7th segments as "*a peli ferruginosi.*"

nearly the same region as that in which Mr. Peel's specimens were found. Capt. Swayne also captured a single specimen of another species of *Pangonia* (too much damaged for determination), and three examples of a small Tabanid, somewhat resembling a *Hæmatopota* in form, but with clear wings; as the latter specimens are headless, it is impossible to determine them more precisely.

The following extract from a letter from Capt. Swayne, sent along with the flies to Dr. P. L. Sclater, is interesting as showing the apparent effect of the bites of these flies upon domestic animals. It is possible, however, that the real offender in these cases is either *Glossina longipennis*, Corti (the Somaliland Tsetse-fly), or else a species of *Stomoxys*, which abounds all over E. Africa. The latter species was found by Dr. J. W. Gregory to kill his camels on the Tana River, and was discovered by Capt. A. G. Haslam, A.V.D., to carry the *Trypanosoma* of Tsetse-fly disease. Since *Stomoxys* is a fly of small size, while *Glossina longipennis* is in shape not unlike a *Hæmatopota*, the true culprits may escape notice, the effects of their bites being attributed to the Tabanidæ. In the extract from Capt. Swayne's letter the *Pangonia* are called "Doog," and the small Tabanid "Balaad." Capt. Swayne writes as follows:—

"I send you three specimens of 'Doog' (a large fly) and three specimens of 'Balaad' (a small fly). I was very much pestered by 'Doog' on my way through Ojaden to the Webbe Shabeyli in Somaliland. They swarmed on my camels, constantly drawing blood. The other fly, 'Balaad,' which looks not unlike the common house-fly, is far the worst fly on the Webbe; a valuable camel, on which I caught three or four, two months ago, is now dying, and the Somalis say that this is due to the bites of 'Balaad.' If there are many of them they kill horses and camels, and the Somalis will not have their live-stock grazing where 'Doog' and 'Balaad' are found."

Fam. ASILIDÆ.

Subfam. LAPHRINÆ.

LAMYRA Loew.

LAMYRA VORAX Loew.

Lamyra vorax, Loew, Öfvers. af K. Vet.-Akad. Förhandl. 1857, 355. 47; id. Dipt.-Fauna Südafrika's, 114 [1860].

A single ♀, West Somaliland, between April 16 and Aug. 7, 1895.

I refer Mr. Peel's specimen to this species with some hesitation. Its length is 15 German lines, instead of 11 or 12; the pollinose spots on the second and third abdominal segments are practically invisible; and there are differences in the length and coloration of the hair on the ventral surface of the abdomen. The specimen, however, is in poor condition, and even should it eventually prove to belong to a new species, it is too much damaged to be selected as a type.

Fam. MUSCIDÆ.

GLOSSINA Wied.

GLOSSINA LONGIPENNIS Corti.

Glossina longipennis, Corti, Ann. Mus. Civ. Genov. xxxv. (1895) p. 138.

A single ♀, West Somaliland, June 23–25, 1895.

Mr. Peel's note on this specimen says:—"Fly-belt sharply defined from Biernuddo to Boholo Deno."

This species, which is the Somaliland Tsetse-fly, was described from a male specimen obtained by Capt. Vittorio Bottego in June, 1893, on the Uelmal River, in the Boran Galla country. The British Museum possesses four examples from Somaliland (the exact locality not being known), collected and presented by Mr. Th. Greenfield.

Corti states (*loc. cit.* p. 139) that *G. longipennis* is "related to *G. tachinoïdes*, Westw., but differs in having the antennæ yellowish and not brown." It is, however, much more closely allied to *G. tabaniformis*, Westw., in which the length and size of the wings are even greater.

3. LEPIDOPTERA RHOPALOCERA.

By F. A. DIXEY, M.A., M.D., Fellow of Wadham College, Oxford.

DANAINÆ.

LIMNAS CHRYSIPPUS Linn.

Twenty-two specimens: 16 ♂, 6 ♀. It is remarkable that not one of these is of the type form, 14 ♂ and 6 ♀ being var. *klugii*, in which the black and white of the apical portion of the fore wing are wanting; while the remaining 2 ♂ are var. *dorippus*, which resembles var. *klugii* in every respect except that both surfaces of the hind wing are more or less suffused with white as in the *alcippoides* form of the type. The dates and places of capture were as follows: Hargaisa (North-west Somaliland), April 25–28, 1895, *klugii*, 4 ♂, 1 ♀, *dorippus*, 1 ♂; Arigumeret, Farfanyer District (Central Somaliland), June 20, 1897, in thick bush, *klugii*, 4 ♂, *dorippus*, 1 ♂; Haud, Odewein (North Central Somaliland), June 23, 1897, in dry river-bed with thickly wooded banks, *klugii*, 1 ♂, 1 ♀; Haud District, Eyk (North Central Somaliland), July 2, 1897, *klugii*, 1 ♂, 1 ♀; Habr Heshi, Marehan Country (East Central Somaliland), Aug. 26, 1897, in thick bush, *klugii*, 4 ♂, 3 ♀.

The ground-colour of the present specimens varies, the majority being of the usual light reddish amber seen in Oriental specimens of the type. Two or three of the *klugii* are of a pale dull fawn, and one or two approach the duller and darker ground-tint of the African *chrysippus*. These differences are not sexual, and there are transitional forms. The marginal white spots of the hind wing

are generally obsolete on the upper surface; they are, however, conspicuous in one of the two *dorippus*. Most of the male *klugii* show a slight powdering of white scales in the neighbourhood of the submedian scent-patch.

In describing the collections made fifteen years ago in Somaliland by Col. Yerbury and Messrs. Thrupp, Lort Phillips, and James (Proc. Zool. Soc. 1885, p. 756), Dr. Butler remarked of *L. klugii*: "This is clearly the prevalent *Limnas* in Somaliland; *L. chrysippus* and *L. alcippus* having, apparently, entirely disappeared, and *L. dorippus* being scarce." The fact that the only specimens of *L. chrysippus* obtained by Mr. Peel in his two distinct visits to Somaliland were of the *klugii* and *dorippus* varieties, confirms the above conclusion. It is also worthy of note that the collection made by Capt. Swayne in the Harar Highlands (Proc. Zool. Soc. 1898, p. 821) contained *L. klugii*, but no specimens of *L. chrysippus*, *L. alcippoides*, or *L. dorippus*.

ACRÆINÆ.

ACRÆA NEOBULE Doubl.

Four specimens: 2 ♂, 2 ♀. Caught at Gonsali (West Somaliland), June 24, 1895.

ACRÆA DOUBLEDAYI Guér.

1 ♀. Gonsali, June 24, 1895.

ACRÆA SERENA Fabr.

3 ♀. Gonsali, June 24, 1895. In one of these specimens the subapical oblique dark bar on the fore wing is well marked, in the other two it is almost or altogether absent. One of the latter has the inner portion of the hind-marginal dark border of the fore wing almost obsolete, except near the apex.

ACRÆA MIRABILIS Butl. (Plate I. fig. 4.)

Acræa mirabilis, Butl. Proc. Zool. Soc. 1885, p. 760, pl. xlvii. fig. 1.

Seven specimens: apparently 5 ♂, 2 ♀. The British Museum possesses five specimens of this interesting *Acræa*, including the types. The present specimens differ from those in the National Collection (one of which retains a violet bloom) in the following particulars:—(1) The upper surface is generally of a warmer chestnut tinge. (2) The paler marks beneath, including the subapical patch of the fore wings, are rich yellow-ochre, instead of being nearly white as in the British Museum examples. In one of the latter, a female, the subapical patch on the upper surface also is creamy white. (3) In the present specimens there is a definite yellow band immediately external to the darker median band of the hind wing beneath. This is not the case in the British Museum examples, where the drab submarginal area gradually pales inwards towards the darker median band. In the ♀ type

this submarginal pale area is somewhat more distinct than in the other British Museum specimens, but it does not reach the condition seen in Mr. Peel's examples. The dated specimens in the National Collection were taken at Bundu Maria, Somaliland, in April. Mr. Peel's were all captured at Aoho, near Hodayu, Ogaden Country, Central Somaliland, on Aug. 20, 1897. The country consisted of stony hills, with thick bush. From the dates it seems probable that the present specimens belong to the wet-season, and the British Museum specimens to the dry-season form of the species.

Nymphaliniæ.

JUNONIA CEBRENE Trim.

Six specimens, all males. Three were captured at Hargaisa, April 25-28, 1895; the other three in the summer of 1897, two bearing the date June 20, and the locality Arigumeret, Farfanyer District. These latter have the underside generally darker and more speckled than the spring examples; this is less apparent in the third specimen, from Central or East Somaliland, June 5-Oct. 29, 1897.

JUNONIA CLELIA Cram.

Six specimens: 3 ♂, 3 ♀. Hargaisa, April 25-28, 1895. The undersides of these specimens vary, but in all the ocelli are more distinct and the general tint is less uniform than in the ordinary "dry-season" form of the species.

JUNONIA TAVETA Rogenh.

One male. Hargaisa, April 25-28, 1895.

BYBLIA ILITHYIA Drury.

Four specimens: 3 ♂, 1 ♀. These are of the "intermediate" seasonal form, the female verging towards "wet"¹. All are dated Hargaisa, April 25-28, 1895.

HYPOLIMNAS MISIPPUS Linn.

Twenty-eight specimens: 26 ♂, 2 ♀. It is very remarkable that of the only two female specimens obtained by Mr. Peel, one should be of the ordinary form, resembling the type of *L. chrysippus*, and the other of the var. *alcippoides*, differing from the former only in the whitish suffusion on both surfaces of the hind wing. From the facts given above (see under *L. chrysippus*, p. 10), it would appear that the form *klugii* of *L. chrysippus* occurs in Somaliland to the exclusion of the type, and it might have been expected that the form of *H. misippus* ♀ which so closely resembles *klugii*, viz. *H. inaria* Cram., would have been the form similarly

¹ For a discussion of geographical and seasonal forms in the genus *Byblia* Hübn., with especial reference to the relations between the forms occurring in Somaliland and Socotra, see Dixey, Proc. Zool. Soc. 1898, pp. 376-379.

prevalent in that region. So far as the evidence of Mr. Peel's collection goes, the reverse is the case. Another remarkable fact in the distribution of these parallel forms is that while *H. klugii* is extremely rare in India, the corresponding variety of *H. missippus* ♀ occurs there not infrequently¹. It is also worthy of note that the white-winged West-African form, *Limnas alcippus* Cram., is accompanied by the ordinary, and not the white-winged, form of *H. missippus* ♀.

The dates and localities of the present examples are as follows:—Hargaisa, April 25–28, 1895, 6 ♂, 1 ♀ (ordinary type); Arigumeret, Farfanyer District, June 20, 1897, in thick bush, 2 ♂, 1 ♀ (var. *alcippoides* Butl.); Bally Maroli, Haud District (North Central Somaliland), June 25, 1897, in open plain, 14 ♂; Eyk, Haud District, July 2, 1897, 3 ♂. One other male was taken in Central or East Somaliland between June 5 and October 29, 1897, the exact locality being uncertain.

HAMANUMIDA DÆDALUS Fabr.

One male, Hargaisa, April 25–28, 1895. The underside is of the "dry-season" form, though not extreme.

LYCÆNINÆ.

POLYOMMATUS BÆTICUS Linn.

Two specimens, both males. On the thickly wooded banks of a dry river-bed, Haud, Odewein, June 21 & 23, 1897.

PLEBEIUS TROCHILUS Freyer.

Two females. Gerato Pass, Goolis Range (North-west Somaliland), June 9, 1897.

AZANUS JESOUS Guér.

Five males. Of these, four were captured on the dry sandy plateau of Edegan in the Haud District (North Central Somaliland), July 9, 1897; the remaining one was taken at Joh in the Haweea Country (East Central Somaliland), Sept. 20, 1897.

AZANUS THEBANA Stdgr.

Lycena macalenga, Trim. S.-Afr. Butterfl. vol. ii. p. 74 (1887).

Three specimens: 1 ♂, 2 ♀. One pair from Odewein, Haud, June 21–23, 1897, dry river-bed with thickly wooded banks; the other female from the sandy plateau of Edegan, in the same district, July 9, 1897.

LYCÆNESTHES PRINCEPS Butl.

Two females apparently belonging to this form, though somewhat smaller than the type, which came from Abyssinia. Edegan, Haud District, July 9, 1897.

¹ See Swinhoe, Journ. Linn. Soc., Zool. vol. xxv. pp. 340, 341. For a summary of the facts at present known with regard to the distribution of the forms in question, see Poulton, 'Nature' July 6, 1899, p. 223.

SPINDASIS SOMALINA Butl.

Spinlasis somalina, Butl. Proc. Zool. Soc. 1885, p. 764, pl. xlvii. fig. 5.

Two specimens, both males. Webbi Shebeyli, near Mount Kuldush (West Somaliland), June 28, 1895.

IOLAUS NURSEI Butl.

One male. Webbi Shebeyli, near Mount Kuldush, June 28, 1895.

PIERINÆ.

CATOPSILO FLORELLA Fabr.

Forty-three specimens; 40 ♂, 3 ♀. Of these, 34 ♂ on July 2, 1897, and 1 ♀, July 4, 1897, were caught at a pool in the open plain of Eyk in the Haud District. The other captures were as follows:—Bun Feroli, N. of Shebeyli River (West Somaliland), June 10–20, 1895, 1 ♂; Odewein, Haud District (dry river-bed), June 21, 1897, 4 ♂, 2 ♀; Bally Maroli, Haud District (open plain), June 25, 1897, 1 ♂. The males, even those caught on the same day, vary much in size; in a few of the smaller examples the freckling of the underside is very faint or absent. The three females are all of the yellow form.

COLIAS MARNOANA Rogenh.

One female. Hargaisa, April 25–28, 1895.

TERIAS HAPALE Mab.

Two males. Hargaisa, April 25–28, 1895.

TERACOLUS EUPOMPE Klug.

Seven specimens; 4 ♂, 3 ♀. These were captured as follows:—a “dry season” ♂, and “intermediate” ♂ & ♀ at Hargaisa, April 25–28, 1895; a “wet season” ♂ in the dry river-bed at Odewein, Haud, June 23, 1897; a “wet season” ♂ & ♀ on the plateau of Edegan, July 9, 1897.

A remarkable form, apparently of the female of this species, was caught on the Sule River (West Somaliland), May 29, 1895. The wings have no marginal black except at the apex of the fore wing, and no black at the bases except a slight dusky powdering like that of the “dry season” male. The crimson apical patch has no chain of submarginal dark spots, but an ill-defined inner dark border to the patch is present, widened between the second and third median nervules. Beneath, there is only a very faint indication of the crimson apical patch, but the submarginal chain of dark spots in the fore wing is well-developed, except that there is no spot between the first and second branches of the median. The hind wings show a faint drab irroration, and the submarginal spots are ill-developed. The first submarginal spot of the fore wing, and the first two of the hind wing, together with the discoidal spot of the hind wing, are pale-centred, looking like incipient ocelli.

The "intermediate" female shows in some respects an approach to this condition, and the specimen just described may perhaps be considered as an extreme "dry season" form, though this would scarcely be expected in view of the recorded date.

TERACOLUS OMPHALE Godt.

Two specimens; ♂ & ♀. These were both caught at Hargaisa, April 25-28, 1895. They are of the "intermediate" form, and are smaller than the average size of the species.

TERACOLUS PHILLIPSI Butl.

Teracolus phillipsi, Butl. Proc. Zool. Soc. 1885, p. 772, pl. xlvii, fig. 11.

Nine specimens; 6 ♂, 3 ♀. The males are all of the "wet season" form; four were taken on July 4, 1897, at a pool in the open plain of Eyk, in the Haud District; the remaining two on the dry plain of Edegau in the same district, on July 9, 1897. Two "wet season" females were taken at Odewein, Haud, on June 21, 1897; and a "wet" or "intermediate" female at Hargaisa, April 25-28, 1895.

TERACOLUS HELVOLUS Butl.

Teracolus helvolus, Butl. Proc. Zool. Soc. 1888, p. 94.

Seven specimens; 5 ♂, 2 ♀. Four males and one female at Hargaisa, April 25-28, 1895. These are of the "dry season" form. A "wet season" ♂ & ♀ were taken in the river-bed at Odewein, June 23, 1897, and at the pool of Eyk on July 4, 1897, respectively.

TERACOLUS HELIOCAUSTUS Butl.

Teracolus heliocaustus, Butl. Proc. Zool. Soc. 1885, p. 768, pl. xlvii, figs. 8 & 9.

One male. Odewein, June 21, 1897.

TERACOLUS PROTOMEDIA Klug.

One male. Sibi (West Somaliland), May 27, 1895.

HERPÆNIA MELANARGE Butl.

Herpænia melanarge, Butl. Proc. Zool. Soc. 1885, p. 774.

Herpænia iterata, Butl. Proc. Zool. Soc. 1888, p. 96.

One male. Sibi (West Somaliland), May 27, 1895. A "wet season" form.

BELENOIS PEELI, sp. nov. (Plate I. figs. 5 ♂, 6 ♀.)

Types (♂ & ♀) in Hope Museum, Oxford.

Exp. al., ♂ 50 mm., ♀ 52 mm.

Male. Above white, with a pearly lustre at the base of the wings as in *B. gidica*, *B. abyssinica*, &c., best marked in the fore wing. Costa of the fore wing with a very thin edging of black. A black marginal spot at the termination of each of the following

veins:—in the fore wing the 2nd and 3rd subcostal, the two radial and the three median branches; in the hind wing the 2nd subcostal, the radial, and the three median. These marginal spots are oval in the hind wing, the long axis being parallel with the border of the wing; in the fore wing they are more or less triangular, with their bases at the margin. The first two at the apex of the fore wing are more or less fused; the remainder in both wings are distinct. There is a slight submarginal powdering of black scales in the fore wing between the 2nd and 3rd subcostal, and also between the two radials. A much fainter powdering occurs between the 3rd subcostal and upper radial, and the slightest possible trace of a similar powdering between the 2nd and 3rd median. The marginal spots and the submarginal powdering mark out between them a very indistinct series of white subapical spots, the first three more or less wedge-shaped, the fourth nearly circular; these are barely to be separated from the general white surface. Beneath, the wings are white; there is a thin dusky line along the costa of the fore wing, and dark marginal spots, like those of the upper surface but smaller, occur at the extremities of the same veins in both wings. There is an orange-yellow patch at the base of the fore wing, occupying about one-fifth of the cell, and somewhat prolonged along the course of the subcostal vein. The same orange-yellow colour occurs in the hind wing as a streak along the costa, as a well-defined patch between the roots of the median and submedian veins, and as a median chain of spots crossing the disc of the wing from the costa to the inner border; these latter are seven in number, one occupying each interspace posterior to the costal vein except the space between the second subcostal and discoidal, and that between the second and third median. The third of the series surrounds the discocellular venule. This and the four succeeding spots are fairly distinct; the other two are faint. There is also a very slight indication of a submarginal series of dull yellow spots running parallel with the hind border of the wing.

Female. Above, like the male, but with the marginal dark spots somewhat larger. These are triangular in the hind wing, and in the fore wing become fused towards the apex into a narrow marginal band. The dark subapical powdering forms more definite and larger patches than in the male, and the white subapical spots are consequently more distinct. There is a trace of a marginal dark spot at the termination of the submedian vein of the fore wing, which is hardly if at all visible in the male. The basal pearly gloss is well marked, and the basal orange-yellow shows slightly through from the lower surface. Beneath, as in the male; but the basal orange-yellow occupies from one-third to one-half of the cell instead of only one-fifth. The submarginal series of spots is somewhat more distinct than in the male, and appears to be of the same orange-yellow as the median series.

In both sexes the first subcostal branch of the fore wing coalesces with the costal. The wings of the male are slightly more pointed,

as in *B. gidica*, &c., than those of the female. This species can readily be distinguished from any other of its genus by the entire absence of a dark discoidal spot from both surfaces of both wings in each sex, and by the presence of a double row of yellow or orange spots, unaccompanied by any dark markings, on the underside of the hind wing. It is probably a "dry-season" form, and perhaps most nearly recalls the dry-season *B. abyssinica* Luc., but it is far less heavily marked.

Two specimens; ♂ & ♀. Sule River, West Somaliland, May 29, 1895. Both, especially the female, somewhat worn.

BELENOIS MESENTINA Cram.

Nine specimens; 6 ♂, 3 ♀. Dates and localities as follows:—Sule River, May 29, 1895, 2 ♂; Odewein, Haud, June 21, 1897, 2 ♂, 1 ♀; pool at Eyk, Haud District, July 4, 1897, 2 ♂, 1 ♀; summer or autumn of 1897 (Central or East Somaliland), 1 ♀.

NYCHITONA MEDUSA Cram.

1 ♀. Hargaisa, April 25–28, 1895. This is of the form *alcesta* Cram.

MYLOTHRIS AGATHINA Cram.

1 ♀. Sibi, May 27, 1895.

PAPILIONINÆ.

PAPILIO DEMOLEUS Linn.

Four specimens; 2 ♂, 2 ♀. Webbi Shebeyli, near Mt. Kuldush, June 27, 1895.

HESPERIIDÆ.

SARANGESA ELIMINATA Moore.

Two females, one at the Webbi Shebeyli, June 28, 1895; the other at Odewein, Haud, June 21–23, 1897.

RHOPALOCAMPTA ANCHISES Gerst.

4 ♂, 2 ♀. Two males and a female at Odewein, Haud, June 21–23, 1897; the remainder in the summer or autumn of 1897, in Central or East Somaliland, the exact locality being uncertain.

4. LEPIDOPTERA HETEROCERA.

By HERBERT DRUCE, F.L.S., F.Z.S.

Mr. Peel's collection of Moths includes specimens of four new species.

ARCTIADÆ.

SECUSIO STRIGATA Wlk.

North-west Somaliland, Hargaisa, April 25–28, 1895. One example.

DEIOPEIA PULCHELLA Linn.

N. Central Somaliland, Odewein, in the Haud District, June 21-23, 1897. In dry river-bed with thickly wooded banks. Two specimens.

NOCTUIDÆ.

HELIOTHIS ARMIGERA Hübn.

N. Central Somaliland, Odewein, June 21-23, 1897. In dry river-bed. One example.

EUPLEXIA OPPOSITA Wlk.

N. Central Somaliland, Odewein, June 21-23, 1897. In dry river-bed. One example.

AMYNA SELENAMPHA Guen.

N. Central Somaliland, Odewein, June 21-23, 1897. In dry river-bed. Two specimens.

AMYNA OCTO Guen.

N. Central Somaliland, Odewein, June 21-23, 1897. In dry river-bed. Two specimens.

TARACHE CAFFRARIA Cram.

N. Central Somaliland, Odewein, June 21-23, 1897. In dry river-bed. Two specimens. Somaliland, 1895 or 1897. One example.

COSMOPHILA SABULIFERA Guen.

N. Central Somaliland, Odewein, June 21-23, 1897. In dry river-bed. One example.

EUTELIA SUBAPICALIS Wlk.

N. Central Somaliland, Odewein, June 21-23, 1897. In dry river-bed. Two specimens. North-west Somaliland, Berbera, June 5-9, 1897. One example.

PSEUDOPHIA OPPIA, sp. n. (Plate I. fig. 1.)

Male. Head, antennæ, and collar white; thorax and tegulæ pale greyish brown; abdomen pale brown, each segment edged with white; the underside of the thorax, abdomen, and legs white. Primaries brown, the outer margin grey; a reddish-brown band edged with a metallic line crosses the wing about the middle from the costal to the inner margin; a short yellowish-white band at the end of the cell. Secondaries white, broadly bordered with black from the apex to the anal angle; the fringe black and white. Expanse 1 inch.

Hab. E. Somaliland: Joh, in the Haweea Country. Three specimens captured September 20, 1897. Type and co-type in the Hope Collection, co-type in the British Museum.

PSEUDOPHIA LINEATA, sp. n. (Plate I. fig. 7.)

Head, collar, thorax, and tegulæ pale greyish brown; abdomen wanting; antennæ whitish; legs and underside of the thorax white. Primaries greyish brown, palest at the base and on the costal and inner margin; a zigzag creamy-white line at the end of the cell extending to the base; a zigzag yellowish submarginal line extends from the costal margin near the apex to the anal angle; the marginal line bluish grey; the fringe dark brown. Secondaries greyish brown; the outer margin broadly bordered with dark brown; the fringe alternately brown and white. Expanse $1\frac{2}{5}$ inches.

Hab. North Central Somaliland: Haud, Odewein, June 21-23, 1897. In dry river-bed. One example. Type in Hope Collection, Oxford.

CEROCALA MUNDA, sp. n. (Plate I. fig. 3.)

The head, tegulæ, and thorax pale reddish brown; abdomen and legs reddish brown; antennæ and palpi brown. Primaries reddish grey, with a large reddish-brown spot near the base, one at the end of the cell and one on the inner margin close to the anal angle; the apex dark brown; a submarginal reddish line extends from the apex to the anal angle; the outer and inner margin greyish; the fringe white at the apex, the rest dark brown. Secondaries pale reddish brown; the outer margin spotted with black; a dark brown spot at the end of the cell; the fringe pale brown. Expanse $1\frac{1}{4}$ inches.

Hab. North Central Somaliland: Haud, Odewein, June 21-23, 1897. In dry river-bed. One example. Type in the Hope Collection, Oxford.

GNAMPTONYX VILIS Wlk.

N. Central Somaliland, Odewein, June 21-23, 1897. In dry river-bed. One broken example.

PLECOPTERA REFLEXA Guen.

N. Central Somaliland, Odewein, June 21-23, 1897. In dry river-bed. Two specimens.

TRIGONODES HYPASIA Cram.

N. Central Somaliland, Odewein, June 21-23, 1897. In dry river-bed. One example.

POLYDESMA OTIOSA Guen.

N. Central Somaliland, Odewein, June 21-23, 1897. In dry river-bed. One example.

CYLLOGRAMMA LATONA Cram.

N. Central Somaliland, Odewein, June 21-23, 1897. In dry river-bed. Eleven specimens.

Somaliland (1895 or 1897). Four specimens.

OPHIUSA MELICERTE Cram.

N. Central Somaliland, Odewein, June 21-23, 1897. In dry river-bed. Two specimens.

Somaliland (1895 or 1897). Four specimens.

SPHINGOMORPHA CHLOREA Cram.

N. Central Somaliland, Odewein, June 21-23, 1897. In dry river-bed. One example.

Somaliland (1895 or 1897). Four specimens.

REMIGIA REPANDA Fabr.

N. Central Somaliland, Odewein, June 21-23, 1897. In dry river-bed. Two specimens.

ZETHES HESPERIDOIDES Guen.

N. Central Somaliland, Odewein, June 21-23, 1897. In dry river-bed. One example.

HYPENA ABYSSINIALIS Guen.

N. Central Somaliland, Odewein, June 21-23, 1897. In dry river-bed. Two specimens.

HYPENA ABYSSINIALIS var. *JUSSALIS* Wlk.

N. Central Somaliland, Odewein, June 21-23, 1897. In dry river-bed. Three specimens.

SPHINGIDÆ.

DEILEPHILA LIVORNICA Esp.

N. Central Somaliland, Haud District, Eyk, July 3, 1897. In the open plain, by thick bush. One ♀ example.

PHLEGETHONTIUS CONVULVULI Schauf.

N. Central Somaliland, Eyk, in the Haud District, July 3, 1897. In the open plain, by thick bush. One ♀ example.

GEOMETRIDÆ.

TEPHRINA DISPUTARIA Guen.

N. Central Somaliland, Odewein, June 21-23, 1897. In dry river-bed. One example.

LASIOCAMPIDÆ.

CHILENA SABRINA, sp. n. (Plate I. fig. 2.)

Male. Head and front of the thorax white; antennæ yellow; the collar and thorax pale brown; tegulæ pale brown edged with white; abdomen and legs white. Primaries pale brown, with two white bands extending from the base almost to the outer margin, the first line straight, the second curved; the costal margin edged with

white; the fringe white. Secondaries yellowish white. Expanse $1\frac{1}{4}$ inches.

Hab. West Somaliland (1895). One example. Type in Hope Collection, Oxford.

LIMACODIDÆ.

PARASA FULVICORPUS Hmpsn.

N. Central Somaliland, Odewein, June 21-23, 1897. In dry river-bed. One example.

ARBELA QUADRINOTATA Wlk.

N. Central Somaliland, Odewein, June 21-23, 1897. In dry river-bed. One example.

5. COLEOPTERA.

By C. J. GAHAN, M.A., and GILBERT J. ARROW.

With the exception of three species of *Curculionida* and two or three other species belonging to genera at present undetermined, all the species of Coleoptera of which examples were collected by Mr. C. V. A. Peel in Somaliland are enumerated in the following list. Mr. Arrow has contributed that portion which deals with the Lamellicorn beetles and has assisted also in the determination of some of the species belonging to other groups. Mrs. M. K. Thomas has been good enough to determine the species of *Mylabris* and to describe one new form belonging to that genus. One or two species have been described from African specimens other than those collected by Mr. Peel. Full reference to the history of such specimens will be found in the descriptions. [C. J. GAHAN.]

CARABIDÆ.

CALOSOMA RUGOSUM De Geer.

Central or East Somaliland. One example. June 5 to Oct. 29, 1897. A widely distributed species, being found in South and East Africa, Abyssinia, Nubia, and in the island of Socotra.

ANTHIA FEROX Thoms.

N.W. Somaliland, Galadi in the Mijertain Country. One example, Oct. 4, 1897. Occurs also in Abyssinia.

POLYHIRMA CALLIAUDI Casteln., var.

N.W. Somaliland, Galadi, Oct. 4, 1897. One example. The sutural vitta behind the scutellum is longer, and the elytra somewhat less strongly punctured than in normal examples from Abyssinia. Type of variety in British Museum.

CHLÆNIUS sp.

Central or East Somaliland. One example (1897).

HYDROPHILIDÆ.

HYDROPHILUS SENEGALENSIS Perch.

East Central Somaliland, Sinnadogha in the Haweea Country. One example, in water-tank, Sept. 8, 1897. This species is widely distributed throughout Africa.

HISTERIDÆ.

HISTER MEMNONIUS Erichs.

Central or East Somaliland. One example (1897). Occurs also in Senegambia, Nubia, Abyssinia, and East Africa.

HISTER GEHINI Mars.

Central or East Somaliland. One example (1897). Found also in Senegambia, Abyssinia, and East Africa.

SAPRINUS SEMIPUNCTATUS Fabr.

Central or East Somaliland. Six specimens (1897). (One perhaps 1895 Expedition.)

SAPRINUS CHALCITES Ill.

Central or East Somaliland. Four specimens (1897). Occurs also in Egypt, Abyssinia, and East Africa.

DERMESTIDÆ.

DERMESTES VULPINUS Fabr.

Central or East Somaliland. Ten specimens (1897).

SCARABÆIDÆ.

HYBOSORUS ILLIGERI Reiche.

Somaliland. Three specimens (1895 or 1897). This insect appears to be of almost world-wide distribution.

PHÆOCHROUS BECCARII Har. Coleopt. Hefte, viii. p. 26.

Somaliland. Four specimens (1895 or 1897), apparently belonging to this species, which was described from N. Abyssinia.

TROX SQUALIDUS Oliv.

Somaliland (1895 or 1897). Two specimens were found of this insect, which is distributed generally throughout Africa.

TROX EXPANSUS Arrow, sp. n. (Plate I. fig. 16.)

Breviter ovatus, modice convexus, ferrugineo-tomentosus; capite bituberculato; prothoracis latitudine quam longitudine duplo majore, lateribus fortiter explanatis, serratis, angulis posticis fere rectis, disco quadri-carinato, carinis post medium convergentibus; elytrorum marginibus late explanatis, biseriatim tuberculiferis, dorso confluentur seriato-tuberculato, interstitiis

parce granulatis; antennis ferrugineis, articulo primo nigro, fusco-hirto; tibiis anticis acute quadridentatis, aliis serratis.
Long. 21 mm., lat. 13 mm.

Type in British Museum.

The single specimen was obtained in Central or Eastern Somaliland (1897). This species is allied to *T. denticulatus* Oliv., which also occurs in Somaliland, but it is considerably larger and relatively broader, the widely dilated margins of the elytra making their outline almost circular. The elytral costæ consist of irregular tubercles which are separate at the base, more or less confluent on the disc, and small and scattered towards the apex; the alternate rows only of these reach the basal margins of the elytra. The anterior tibia is armed with four acute teeth placed at right angles to its axis and regularly increasing in size towards its extremity, the last being very sharp and prominent. *T. funestus* Lansb., a W. African species, appears to be nearly related to this insect, but is smaller and narrower, *T. expansus* being one of the largest at present known in the genus.

SCARABÆUS ISIDIS Cast.

North Central Somaliland, Bally Maroli in the Haud District. Two examples, June 25, 1897. This occurs throughout the Nile Valley and also in S.W. Asia.

SCARABÆUS BETTONI Waterh. Ann. & Mag. Nat. Hist. (6) xx. p. 553 (1897).

One specimen found July 26, 1895, at Whardi Datal, Northwest Somaliland. It was recently discovered by Mr. Betton in British East Africa.

GYMNOPLÉURUS LÆVIS Arrow, sp. n.

G. splendenti valde affinis, sed colore, et sculptura minus evidente, distinctus, fusco-niger, lævis, opacus; pedibus antennisque fusco-rufis, harum clavis ferrugineis; capite subtiliter granulato, antice acute quadridentato; prothorace convexo, subtiliter coriaceo, linea media lævi angusta, basi bi-imprensa, lateribus parum grosse foveolatis, marginibus lateralibus anguste reflexis postice obtuse angulatis; elytris subtilissime disperse granulatis et vix striatis, absque plicatulis; pedum anteriorum tibiis serratis, dentibus tribus terminalibus acutis et longissimis munitis, femoribus emarginatis et dentatis. Long. 16 mm.

Type in British Museum.

One example (1895 or 1897). This insect is almost black without a trace of metallic lustre. The surface is very smooth, with a fine granulation which is most apparent on the head and exceedingly minute on the elytra. The striation of the latter is almost obsolete and only visible under a lens. The three teeth upon the anterior tibiæ are very long and acute.

G. lugens of Fairm. is very near this species, but is more nearly related to *G. splendens* Cast., if not merely a variety of it.

COPRIS HARRISI Waterh. Ann. & Mag. Nat. Hist. (6) vii. p. 515 (1891).

Two female specimens of this insect, described from Abyssinia, were found at Whardi Datal (July 26, 1895).

ONTHOPHAGUS GERSTAECKERI Har.

A single specimen was brought from Central or East Somaliland (1897).

ONTHOPHAGUS GAZELLA Fabr.

One example (1895 or 1897). This insect occurs throughout Africa and even extends to Madagascar.

ONTHOPHAGUS sp.

A single female of another small species, probably new (1895 or 1897).

SCHIZONYCHA SQUAMOSA Raffray.

Three specimens (1895 or 1897). This species appears to be common in Somaliland, having occurred in several collections from that country.

SCHIZONYCHA NIGROFUSCA Arrow, sp. n.

Ovato-cylindrica, fere nigra, antennis pallidioribus, pectore flavo-hirto; clypeo aequaliter punctato, margine arcuato vix sinuato fortiter reflexo, fronte acute bicarinata, vertice spatioso post carinam anteriorem levibus; prothorace antice et postice valde contracto, grosse et confluentem punctato, punctis squamiferis, lateribus crenatis et piliferis, ante marginem posteriorem utrinque elevato et levigato; scutello fere levi punctis nonnullis grossis sulcaque obsolete mediana; elytris cum pygidio dense sat grosse punctatis, punctis squamas setiformes vix perspicuas ferentibus; tibiis anticis tridentatis, dente superiore parvo. Long. 18-19 mm. ♀.

Type in British Museum, co-type in the Hope Coll., Oxford.

Two specimens, both females (1895 or 1897).

This insect is readily distinguishable from the majority of its congeners by its dark colour. It has some resemblance to the common W. African *S. crenata*, but the prothorax is relatively much smaller.

Single specimens of two other apparently new species were found (1895 or 1897), but in view of the large number of closely related forms described, it seems advisable to leave them for the present unnamed.

ANOMALA, sp. n.

Two specimens, ♂ and ♀, were collected (1895 or 1897), exhibiting a difference in the structure of the claws, and probably allied to *A. transvalensis* Arrow. As the anterior tarsi of the male

are imperfect, the affinity of the species cannot be decided with certainty, and it will therefore not be described.

There are two more single specimens (1897) of species of this genus, which can only be properly described from individuals of both sexes.

PHYLLOPERTHA HORTICOLA Linn.

One example (1897). The distribution of this insect is very remarkable. It is properly a northern insect, occurring throughout the North of Europe and Asia from the British Islands to Japan. In the British Museum, however, are specimens from South Africa, and Mr. Peel has now brought a specimen from Somaliland. It seems possible that these African examples have been artificially introduced.

HOMOTHYREA HELENÆ Schaum.

Two specimens (1897). This species has also been found in Abyssinia, in East Africa, and at Aden in South Arabia.

RHABDOTIS SOBRINA G. & P.

Fifteen specimens, found by Mr. Peel on mimosa bushes at Arigumeret, Farfanyer District of Central Somaliland.

BUPRESTIDÆ.

JULODIS LATICOLLIS Gahan, sp. n. (Plate I. fig. 15.)

Viridi-metallica, supra fere glabra, infra subaurata sat dense cano-pilosa; capite dense punctato; prothorace brevi, lato, supra valde convexo, dense minus fortiter punctato et subopaco, lateraliter rugoso-punctato, basi utrinque fortiter sinuato, medio acutangulatim producto; elytris quam prothorace vix latioribus, dense irregulariterque foveolatim impressis; foveolis subauratis, dense punctatis et plus minusve pubescentibus, interstitiis elevatis, angustis, reticulatis et impunctatis. Long. 18, lat. 8 mm.

Hab. Somaliland (1895 or 1897). One female example. Type in British Museum.

This species seems to be allied to *J. vittipennis* Fähr., and *J. subvittata* Saund. (*Amblysterna*), but is readily distinguished from either by its broader form, its shorter, broader, and more convex prothorax, and its differently sculptured elytra.

STERASPIS sp.

Central or East Somaliland (1897). One example.

PSILOPTERA SOMALICA Gahan, sp. n. (Plate I. fig. 10.)

Purpureo-violacea, elytris (foveis pubescentibus propter 40 cupreatis, prætermisissis) nigris, tarsis supra viridibus; capite inter oculos sat lato, dense fortiterque punctato, versus medium sparse, ad latera dense sat longeque, pubescente; prothorace quam longiore sesqui-latiore, antice a medio angustato, supra sat dense forti-

terque punctato, area parva triangulare ante scutellum levi; elytris punctato-striatis, apice acuminatis, interstitiis antice fere planis, versus apicem angustis et conveaxis. Long. 25, lat. 9 mm.

Hab. Central or East Somaliland (1897). One example. Type in British Museum.

Head, prothorax, legs, and underside of a purplish-violet colour; tarsi metallic green above. Elytra black, each with about twenty shallow cupreous pits, which are densely punctured and more or less completely covered with greyish-white pubescence: six or seven of the smallest of these pits are placed at irregular intervals along the third elytral interstice, three of the larger pits on the fifth, three on the seventh, and about seven, diminishing in size from before backwards, along the ninth interstice; one of the larger pits on the fifth interstice, a little in front of the middle, and one at a short distance behind the middle, encroach upon the sixth interstice and nearly join two correspondingly large pits upon the seventh interstice.

This species differs from all other African species of the genus known to me in the disposition of the pubescent pits on the elytra, and is further distinguished by having each of the elytra narrowed to a single point, and not truncate at the apex.

ELATERIDÆ.

AGRYPNUS LONGICORNIS Gahan, sp. n. (Plate I. fig. 11.)

Rufo-brunneus, luteo-pilosulus; antennis nigris, basin elytrorum paullo superantibus, articulo 3° quam 2° haud longiore, articulis 4° ad 10^{um} angulatim sat valde productis; prothoracæ quam latiori via longiori, supra sat valde convexo, lateribus medio paullo rotundatis, angulis posticis tenuibus, acutis, divaricatis; elytris tenuiter punctato-striatis. Long. 17, lat. 5 mm.

Hab. Central or East Somaliland (1897). One example. Type in British Museum.

In general appearance this species resembles *A. bocandei* Cand., but is easily to be distinguished by the black colour and greater length of its antennæ. The third joint of the antennæ is a little broader, but not longer, than the second, and the joints from the fourth to the tenth are each produced antero-distally into a strong angulate process; the disc of the prothorax is more convex and somewhat less densely punctured, and the sides are more rounded in the middle than is the case with *A. bocandei*.

DASCILLIDÆ.

GENECERUS NEBULOSUS Gahan, sp. n. (Plate I. fig. 9.)

Piceo-brunneus, cinereo- sat dense pubescens; elytris brunneo-nebulosis, longitudinaliter subcostatis; antennis (♂) flabellatis vel (♀) serratis. Long. 14-16, lat. 4-4½ mm.

Hab. Brit. E. Africa: Samburu, Voi and Ndi (C. S. Betton);

Central or East Somaliland (1897), two males (*C. V. A. Peel*). Type in the British Museum, co-type in Hope Coll.

Dark brown to reddish brown in colour; covered with an ashy-grey pubescence. Elytra with a number of dark-brown blotches, which are, however, absent in some specimens, so that the elytra have a nearly uniform grey colour. Head with a Y-shaped glabrous mark reaching from the antennary condyles to the occiput; eyes rather large, hemispherical, finely faceted. Prothorax about one half broader than long; its antero-lateral angles rounded and obtuse; the postero-lateral very slightly projecting and acute; the disc marked with a faint median impressed line extending from the anterior margin almost to the base. Elytra with some feebly raised and obtuse longitudinal costæ, along which the grey pubescence seems somewhat more dense than over the rest of the surface. Mesosternum with a small projecting process near the middle of its anterior margin, this process being fringed with fulvous hairs at its sides and apex. Posterior margin of the fifth abdominal sternite of the male bisinuate.

This species, though very distinct from *Genecerus cervinus* Walk., appears to be truly congeneric with it, agreeing as it does in all essential points of structure. The genus *Genecerus*, stated by Walker to be allied to *Plastocerus*, and by subsequent authors placed in the family *Cebrionidæ*, seems to me to belong to the family *Dascillidæ*, in which I should place it near *Anorus* Lec.

LYCIDÆ.

LYCUS AMPLIATUS Fähr.

North-west Somaliland, Hargasia, April 25-28, 1895. One example. This species is found also in East Africa as well as in Natal and the Cape of Good Hope.

CLERIDÆ.

NECROBIA RUFIPES De Geer.

Central or East Somaliland (1897). Three specimens.

BOSTRYCHIDÆ.

APATE TEREBRANS Pall.

West Somaliland, Bun Jijiga, July 15, 1895. Three examples. This species occurs also in West Africa from the Gold Coast to Angola, in Natal, Nyasaland, and East Africa.

BOSTRYCHUS sp.

Central or East Somaliland (1897). Two specimens.

TENEBRIONIDÆ.

ZOPHOSIS AROMATUM Gestro, Ann. Mus. Civ. Gen. (2) xv. p. 258.

Central or East Somaliland (1897). The two examples obtained by Mr. Peel are somewhat larger than the type from Archeisa

described by Dr. Gestro, but in other respects fully agree with the description.

HOMALA AGONA Fairm.

Central or East Somaliland (1897). Two specimens.

RHYTIDONOTA DELICATULA Fairm.

Central or East Somaliland (1897). Two specimens.

RHYTIDONOTA ROBUSTA Gahan, sp. n. (Plate I. fig. 13.)

Capite supra subtilissime punctato, clypeo utrinque leviter impresso; prothorace quam longitudine paullo latiori, lateribus marginatis antice arcuatim convergentibus, versus basin minus fortiter convergentibus, angulis posticis sat latis et retro paullo productis; elytris quam prothorace paullo latioribus, basi marginatis et ad humeros angulatis. Long. 19–20, lat. $7\frac{1}{2}$ mm.

Hab. Central or East Somaliland (1897), two specimens; and West Somaliland (1895), one specimen. Type (Central or East Somaliland) in British Museum, co-type in Hope Collection.

Prothorax nearly one-fourth broader than its length; widest across the middle, with sides converging strongly towards the apex, less strongly towards the base; basal margin straight in the middle, oblique towards each side and there forming with the lateral margin a subacute angle slightly projecting backwards. Elytra widest a little in front of the middle, narrowed slightly towards the base, and strongly towards the apex; completely margined at the base, and with a small projection at each of the humeral angles. Third joint of the antennæ twice as long as the second, and nearly equal in length to the fourth and fifth united.

HIMATISMUS sp.

Central or East Somaliland (1897). One example.

OCNERA sp.

Somaliland (1895 or 1897). One mutilated specimen.

PIMELIA HILDEBRANDTI Har.

P. cenchronota Fairm.

Central or East Somaliland (1897). Four specimens.

PSAMMODES sp.

Somaliland (1895 or 1897). Two specimens.

AMIAANTUS sp.

Central or East Somaliland (1897). One mutilated specimen.

AMIAANTUS SEXCOSTATUS Gahan, sp. n.

Niger; prothorace supra valde convexo, dense fortiterque punctato, lateribus paullo rotundatis, postice leviter marginatis; elytris ad suturam haud elevatis, utroque carinis tribus sat valde

elevatis instructo, carinis omnibus fere æquilongis, a basi ad declivitatem apicalem extensis; segmentis 2^o 3^oque abdominis in medio rufulo-pilosis. Long. 19, lat. (ad med. elytrorum) 10½ mm.

Hab. Central or East Somaliland (1897). One example. Type in British Museum.

Black; prothorax strongly convex above, and strongly and rather thickly punctured; its sides slightly rounded in the middle and feebly marginate posteriorly, the margins becoming obsolete in front. Elytra depressed along the suture, each with three well-marked carinæ reaching from the base to the posterior declivous portion, the intervals between the carinæ being rather strongly concave; the concave sutural area between the innermost carinæ is sparsely granular in its anterior half. Femora rugosely punctured. Second and third abdominal segments with a patch of reddish pubescence in the middle.

SEPIDIOSTENUS ERINACEUS Fairm.

North Central Somaliland: Bally Maroli in the Haud District, June 25, 1897. Nine specimens, captured in the open plain.

SEPIDIUM MAGNUM Gahan, sp. n. (Plate I. fig. 12.)

Pube pallide cervina dense obtectum: prothorace utrinque plaga subnuda nigra, elytris rugis elevatis glabris nigro-fuscis, et plagis adspersis cretaceis; prothorace basi apiceque constricto, lateraliter carinato, carina antice obtusa, pone medium tuberculatim dilatata, disco in medio carinato, antice valde tuberculato, tuberculo crasso, apice rotundato supra sulcato-impresso haud bifurcato; elytris utrisque longitudinaliter bi-carinatis, transversim reticulatimque rugosis. Long. 29-35, lat. (ad med. elytrorum) 12-15 mm.

Hab. Central or East Somaliland (1897). Four examples. Type and co-type in British Museum, co-types in Hope Collection.

Brownish black, with the head, prothorax, underside, legs, and antennæ thickly covered with a pale fawn-coloured pubescence. Prothorax furnished with a large prominent tubercle, directed obliquely forwards from the anterior part of the disc; this tubercle is rounded at the extremity, impressed along the middle with a linear groove, and has on each side a naked and rugose black patch; from the base of the tubercle a median carina runs along the disc to the base of the prothorax. On each side of the prothorax there is a carina, obtuse in front, but more acute and prominent behind the middle, there forming a flattened tubercle, behind which the prothorax is abruptly constricted. Elytra each with two longitudinal and more or less sinuous carinæ, each of which gives off short transverse or reticulating ridges on both sides.

This species is one of the largest of the genus, being equal in size to *S. ruspolii* Fairm., from which it differs chiefly in having the lateral tubercles of the prothorax placed behind the middle

and in the presence of short transverse ridges running from the dorsal carina of each elytron towards the suture.

SEPIDIUM BILOBATUM Gahan, sp. n. (Plate I. fig. 14.)

Pube rufulo-cervina dense obtectum: elytris supra plus minusve cinereis; prothorace antice valde tuberculato, tuberculo crasso antrorsum directo et bilobato; elytris dense fortiterque punctatis, utriusque disco tuberculato, tuberculis in seriebus duabus irregularibus ordinatis. Long. 17, lat. 6 mm.

Hab. Somaliland (1895 or 1897). One example. Type in British Museum.

Closely covered with a reddish-fawn-coloured pubescence, with the disc of each elytron ashy grey along the middle. Prothorax with a large tubercle directed almost horizontally forwards from the anterior part of the disc; this tubercle is distinctly bilobed in front, each lobe being rounded at the extremity; each side of the prothorax carinate, the carina dilated to form a tubercle just behind the middle. Elytra densely and strongly punctured; the disc of each with a number of sharply raised tubercles forming two irregular, longitudinal series.

SEPIDIUM CRASSICAUDATUM Gestro.

Somaliland (1895 or 1897). Nine examples.

VIETA sp.

Central or East Somaliland (1897). One example.

VIETOMORPHA FOVEIPENNIS Fairm.

Central or East Somaliland (1897). One example.

MICRANTEREUS sp.

Central or East Somaliland (1897). One male example.

MICRANTEREUS ASIDOIDES Fairm.

Central or East Somaliland (1897). One example.

AMARYGMUS sp.

Somaliland (1895 or 1897). One mutilated example.

PRAOGENA NIGRA Gahan, sp. n.

Nigra; capite prothoraceque crebre punctatis et opacis; elytris nitidis, seriatim haud fortiter punctatis, interstitiis planis, sparse minutissime punctulatis. Long. 13, lat. 4½ mm.

Hab. Somaliland (T. Greenfield and C. V. A. Peel, 1895 or 1897). Type in British Museum, co-type in Hope Collection.

Entirely black, with the elytra somewhat glossy and the rest of the surface more or less opaque. Head and prothorax closely punctured, the latter a little broader than long, slightly rounded at the sides. Elytra each with nine rows of rather small punctures, the first row (that next the suture) being very short;

intervals between the rows flat and sparsely and very minutely punctulate.

This species is larger and less convex than *P. gogatina* Mäkl., its prothorax is relatively a little broader, the rows of punctures on its elytra are much finer, and it is distinguished further from that species by its darker coloration and its glossy elytra.

CANTHABIDÆ.

MYLABRIS HYPOLACHNA Gestro.

Central or East Somaliland (1897). Two examples.

MYLABRIS SENNÆ Gestro.

Central or East Somaliland (1897). Three examples

MYLABRIS LATEPLAGIATA Fairm.

Central or East Somaliland (1897). One example.

MYLABRIS SOMALICA Thomas, sp. n.

Black, opaque, rugose, clothed with short yellow pubescence interspersed with longish black hairs. The head (which has an elevated shining median longitudinal line), prothorax, and elytra all thickly and coarsely punctured; the elytra dilated and widening towards the apex.

Each elytron ornamented with two long oval basal yellow markings, the marginal one joining a transverse yellow band extending to suture, and with a second transverse band, starting from but not quite touching the suture, extending down margin and curving round across the apex of elytron back to the suture: these markings are all margined by a fine brownish-red line. Antennæ red, with the exception of the first and second joints, which are black. The underside, legs, and tarsi are all black with long yellow hairs; the nails and spurs red.

This species is very similar to *Mylabris hypolachna* of Gestro¹ in size, form, and general characteristics, but it differs in having the second transverse band continued along the outer margin and thence across the apex to the suture.

Length 12 millim., breadth 4 millim.

Hab. Central or East Somaliland (1897). Type in the British Museum. [M. K. THOMAS.]

EPICAUTA AMETHYSTINA Mäkl.

Somaliland (1895 or 1897). One example.

CERAMBYCIDÆ.

MACROTOMA PALMATA Fabr.

West Somaliland: South-west Haud, Owari, East of Milmil (March 16, 1895). One example of this widely distributed African Prionid.

¹ Ann. Mus. Genov. (2) xv. p. 393 (1895).

PLOCEDERUS MELANCHOLICUS Gahan, var.

Central or East Somaliland (1897). This variety occurs also in South Arabia and in British East Africa.

PLOCEDERUS PEELI Gahan, Ann. & Mag. Nat. Hist. (7) ii. p. 42 (1898).

Somaliland (1895 or 1897). One example. Co-type in Hope Collection.

This species has been found in British East Africa as well as in Somaliland.

PACHYDISSUS (DEROLUS) SOMALICUS Gahan, sp. n.

Piceo-brunneus, griseo-pubescentis; prothorace supra rugoso, lateraliter paullo rotundato, area opaca excisa inter notum pleurumque; elytris absque punctis (punctulis minutissimis pubescentiam gerentibus exceptis); femoribus subtus leviter bicarinatis; antennis (♀) quam corpore paullo brevioribus. Long. 17, lat. 4 mm.

Hab. Somaliland (1895 or 1897). One example. Type in British Museum.

Head and prothorax dark brown, with a greyish pubescence. Head with a sulcate impression on the vertex between the upper lobes of the eyes. Prothorax a little longer than broad; transversely wrinkled above; slightly rounded in the middle on each side, with a small excised space, bare of pubescence, just below the pronotum. Elytra parallel-sided throughout the greater part of their length, rounded at the apex; clothed with a short closely laid grey pubescence, and devoid of all punctures, excepting those very minute ones from which the hairs of the pubescence spring. Femora feebly carinate along each side near the ventral border. Prosternal process subvertical behind; the small antero-lateral processes of metasternum almost completely shutting off the epimera from the intermediate cotyloid cavities.

PHYLLOCNEMA SEMIJANTHINA Fairm.

Central or East Somaliland (1897). Two examples.

ALPHITOPOLA PEELI Gahan, sp. n.

Fusca; capite, prothorace, scutello et corporis inferioris lateribus pube fulvo-ferruginea obtectis; elytris fuscis, vitta suturali et vitta postica submarginali cinnamomeis, utroque elytro puncta basali et maculis quatuor—duabus (quarum interna elongato-ovali, medio fusco-punctata) ante medium, duabus (elongatis et postice conjunctis) pone medium—niveis ornato. Long. 17, lat. 5½ mm.

Hab. Galadi in N.W. Somaliland. One example, Oct. 4, 1897. Type in British Museum.

Head and prothorax dark brown, covered with a short reddish-tawny pubescence. Prothorax transverse; with a small blunt tubercle at the middle of each side; with two transverse sulcate impressions near the base and two near the apex. Elytra dark brown, somewhat thickly punctured, with the punctures rather large near the base and diminishing in size posteriorly; a sutural

vitta, and a submarginal vitta on each elytron reaching from the middle to the apex, where it joins the sutural vitta, cinnamon-coloured; a small punctiform spot at the extreme base, two spots in front of the middle and two behind the middle of each elytron, snow-white; the inner spot of the anterior pair larger than the outer, elongate-oval in shape, and marked in the middle with a narrow brown spot; the outer spot of the same pair emarginate in front; the two spots of the posterior pair elongate, with the inner one commencing before the outer and coalescing with it behind. Body underneath with an ashy-grey pubescence along the middle, fulvous brown towards the sides; legs brown, more or less suffused with grey at the base and on the ventral side. Intercoxal process of the mesosternum very feebly tubercled in the middle. Last abdominal segment feebly and sinuately emarginate at the apex.

Antennæ longer (by the last three or four joints) than the body, third joint half as long again as the fourth.

CEROPLESIS REVOILI Fairm.

West (April 16 to Aug. 7, 1895) and North-west Somaliland, Galadi (Oct. 4, 1897). Three examples, two from the latter locality.

CERATITES JASPIDEUS Serv.

Somaliland (1895 or 1897). Ten specimens. This species occurs also in West and East Africa and in Abyssinia.

CALOTHYRZA PAULI (Fairm.).

Anoplostetha pauli Fairm. C. R. Soc. Ent. Belg. 1884, p. 124; Ann. Soc. Ent. Fr. 1887, p. 338.

West Somaliland, Bularli (May 24, 1895). One specimen.

In this species and in the closely allied South-African *A. jardinei* White the claws of the tarsi are divaricate, and the scape of the antennæ is entirely devoid of a cicatrix. Both species are out of place in *Anoplostetha* and should be referred to the genus *Calothyrsa* Thoms., with which they agree in all essential points of structure. A third African species of *Calothyrsa* has been described by Dr. Gestro (Ann. Mus. Civ. Gen. (2) xv. p. 423), the remaining species of this genus being the two Indian forms—*C. sehestedi* Fabr. Ent. Syst. Suppl. p. 146 (= *C. margaritifera* Thoms.) and *C. margaritifera* Westw.

CROSSOTUS PLUMICORNIS Serv.

North-west Somaliland, Hargaisa (April 25 to 28, 1895). One example. This species is found in Senegambia, in East Africa and Natal, an example from the last-mentioned locality forming the type of White's *C. natalensis*.

CROSSOTUS sp.

Central or East Somaliland (1897). One somewhat rubbed female specimen.

6. NEUROPTERA.

By ROBERT McLACHLAN, F.R.S. &c.

PLANIPENNIA.

PALPARES PAPILIONOIDES Klug, var.

West Somaliland, Sule River, May 29, 1895. One female.

It appears to me to be safer to regard this single specimen as a variety of *P. papilionoides* rather than to describe it as new. Klug's species was from Arabia Felix. When compared with Klug's description and figures, this female is somewhat larger and the dark bands of the anterior wings are more distinctly fenestrated in consequence of the dark colour being restricted to margining of the network. Some examples of *P. tristis* Hagen, diverge from the type form in the same manner, and I have a female from Somaliland that at first I thought was specifically identical with that from the Sule River, but there is a slightly different form of wing, and in *papilionoides* the abdomen has black longitudinal bands which are wanting in *tristis*.

PALPARES WALKERI McLachlan.

Sule River, May 24, 1895. One female.

The male of this species was described by me in the Ent. Monthly Mag. for August 1894 from two examples taken by Mr. J. J. Walker, R.N., F.L.S., at Aden, which are in my collection. Subsequently Col. Yerbury, R.A., F.Z.S., found examples of both sexes at the same place and presented them to the British Museum. Upon comparing the female from Somaliland with those from Aden, I see nothing that can be considered of specific difference. The female has never been described. It is larger (expanse about 130 mm.) and the wings are broader (19 mm.), the isolated black markings on the anterior wings are larger; on the posterior wings the fasciæ are both broader and longer, the second of them extending to the dorsal margin, and very broad and strongly angulate in the middle; the third is also very broad and connected more or less with a series of spots towards the dorsal margin. (In no two specimens do the dark bands and other markings precisely agree nor are they symmetrical on the opposing wings.)

MYRMELEON VARIEGATUS Klug.

West Somaliland (1895). One male, without indication of further locality. Described originally from Arabia Felix. I have what appears to be exactly the same species from the Sinai Peninsula. Probably widespread.

ODONATA.

CACERGATE LEUCOSTICTA Burm.

East Central Somaliland: Haweea Country, Sinnadohga, by a water-tank, Sept. 8, 1897. One female.

A widespread African insect.

GYNACANTHA sp. ?

One immature female from the same locality as the preceding. This in all probability represents a new species, but I am not disposed to describe and name a species of this very critical genus from an immature female. It appears to be quite distinct from any West-African species.

7. ORTHOPTERA.

By MALCOLM BURR, F.Z.S., F.E.S.

(Except *Phasmatodea* by Dr. C. BRUNNER VON WATTENWYL.)

The collection of Orthoptera made by Mr. C. V. A. Peel in Somaliland is not large, but contains examples of a good number of genera and species new to science. These are distributed as follows:—

	Number of species.	New Genera.	New Species.
Blattodea.....	4	—	—
Mantodea	6	1	1
Phasmatodea	3	1	2
Acridiodea	15	1	2
Locustodea	11	1	7
Gryllodea	4	—	—
Total	43	4	12

It will be noticed that there are no less than seven novelties out of the eleven Locustodea captured, a high percentage, which is probably due to the stationary habits of these insects. Most of these new species are *Phaneropteridæ*, for there are only one Conocephalid and one Stenopelmatid, both of which are flightless forms.

The collection contains no Forficularia.

An account of a collection of Orthoptera made in Somaliland by the late Prince Ruspoli has been published by Herr Dr. Schultess Rechberg-Schindler. They are mostly of the same genera, but the species are different. This is especially noticeable among the new forms.

I take this opportunity of acknowledging my deep indebtedness to Herr Dr. C. Brunner von Wattenwyl, for his invaluable assistance in the identification of many of the more difficult and obscure species, especially for the determination and descriptions of the *Phasmatodea*, upon which group his knowledge is unrivalled.

BLATTODEA.

PHYLLODROMIIDÆ.

ISCHNOPTERA ATRA Walk.

Somaliland (April 16 to Aug. 7, 1895, or June 5 to Oct. 29, 1897). One male.

PERISPHERIDÆ.

DEROCALYMMA BOTTEGIANA Sauss.

Central or East Somaliland (1897). Two female specimens.

I cannot distinguish *D. analis* Sauss. from *D. bottegiana* Sauss. The former is merely referred to and included in the synoptical table, which is very difficult to follow. Mr. Peel's two examples appear to agree entirely with the description of *D. bottegiana* Sauss., which is described from Somali specimens. One of these specimens still retains the yellowish velvet coat which is so easily lost in handling. They are both a shade smaller than de Saussure's types.

PERIPLANETIDÆ.

BLATTA ORIENTALIS L.

Somaliland (1895 or 1897). One female.

PERIPLANETA AMERICANA (L.).

Somaliland (1895 or 1897). One female.

MANTODEA.

ORTHODERIDÆ.

CHARIEIS, gen. nov.

Oculi conici, apice pedunculati. Caput haud valde depressum. Colore griseo. Ocelli in triangulum positi; antennæ elongatæ, graciles, testaceæ; occiput convexum. Pronotum breve, sulculo irregulari transverso instructum, margine antico subsinuato, dilatato, margine postico rotundato, postice angustatum. Elytra et alæ perfecte explicatæ. Illa membranacea, remote venosa, hyalina, venis infuscatis, venulis transversis ramorum venæ radialis incrassatis, bicoloribus; membrana anulis brevis, sed longior quam latior. Hæ hyalinæ, venulis arcæ anticæ infuscatis. Pedes graciles; femora antica gracilia, spinis discoidalibus 3 parvis armata, spinis marginis externo irregularibus, primæ minimo, 2^o longiori, 3^o-6^{um} parvis, dehinc margine crenulato. Tibiæ anticæ spinis brevibus armatæ. Lamina subgenitalis ♀ magna, fornicata, rotundata. Cerci ♀ sat longi, laminam subgenitalem haud superantes. Lamina supraanalis ♀ brevis, transversa. ♀. ♂ ignotus.

This genus is a link between Brunner's two sections of the *Orthoderidæ*. In the form of the pronotum it agrees with *Chaetessa* Burm., while the presence of small discoidal spines on the anterior femora would place it in the second division. The conical and pedunculated eyes, the spines of the anterior tibiæ, the discoidal spines, the somewhat long anal membrane of the elytra separate it from *Chaetessa* Burm.; the form of the pronotum satisfactorily divides it from the *Eremiaphilæ*, *Humbertiellæ*, and *Chiropachæ*.

In general appearance and coloration it resembles *Chiropacha* and *Tarachodes*, but it differs in the depressed head.

CHARIEIS PEELI, sp. n. (Plate II. fig. 4.)

Parva, grisea. Elytra hyalina, venulis infuscatis. Alæ hyalinæ, venulis partis anticæ infuscatis. Pronotum inerme. ♀.

	♀.
Long. corporis	24 mm.
„ pronoti	3.5
„ elytrorum	22
Lat. max. pronoti	3
„ min. „	2
Long. fem. anticorum	3.5
„ tiliarum „	2.5

Patria. West Somaliland: North-west Haud, Abriordi Garodi, May 4, 1895. One female example. Type in Hope Collection, Oxford.

(In the figure, the antennæ and apex of the abdomen are wanting.)

CHIROPACHA DIVES Sauss.

West Somaliland: North-west Haud, Abriordi Garodi, May 4, 1895. Three male specimens.

CHIROPACHA GILVA Charp.

West Somaliland: North-west Haud, Abriordi Garodi, May 4, 1895. Two specimens, male and female.

MANTIDÆ.

POPA UNDULATA (Fabr.).

West Somaliland: North-west Haud, Abriordi Garodi, May 4, 1895. Two specimens, one male and one nymph.

MIOMANTIS FENESTRATA (Fabr.).

West Somaliland: North-west Haud, Abriordi Garodi, May 4, 1895. One male.

HIERODULA sp.

North-west Somaliland, Berbera, April 16, 1895. One mutilated specimen.

PHASMATODEA.

By C. BRUNNER VON WATTENWYL.

CLITUMNIDÆ.

BURRIA, gen. nov.¹

♀. *Caput elongatum. Antennæ tertiam partem femorum anticorum haud attingentes, articulo secundo moniliformi. Thorax granulatus. Femora omnia acute carinata, mutica. Segmentum abdominale octavum longum, segmenta bina terminalia unita superans. Segmentum anale parum compressum, minime emar-*

¹ In honorem scrutatoris assidui Malcolm Burr.

ginatum, lamina supraanali minima apposita. Cerci breves, recti, teretes. Operculum longissimum, segmenta abdominalia tria terminalia triplo superans, compressum, acuminatum.

Dispositio specierum.

1. Mesonotum et metanotum irregulariter granulosa.
 Statura major *longixipha*, sp. n.
 1'. Mesonotum in margine laterali dense granulose, medio granulis raris obsitum. Metanotum laeve.
 Statura minor *farinosa*, sp. n.

1. BURRIA LONGIXIPHA, sp. n. (Plate II. fig. 6.)

♀. *Mesonotum et metanotum irregulariter granulosa.*

	♀.
Long. corporis (operculo excluso)	104 mm.
„ mesonoti	20
„ metanoti cum segmento mediano . .	15
„ segmenti mediani	3
„ femorum anticorum	25
„ „ intermed.	21
„ „ posticorum	24
„ operculi	32

Patria. West Somaliland (1895). One female. Type in Hope Collection, Oxford.

2. BURRIA FARINOSA, sp. n.

♀. *Caput totum farinosum. Thorax vitta mediana longa farinosa ornatus, necnon apex abdominis farinosus. Mesonotum murginibus dense granulosis, medio in vitta farinosa raro granulose.*

	♀.
Long. corporis (operculo excluso)	68 mm.
„ mesonoti	12
„ metanoti cum segmento mediano . .	11
„ segmenti mediani	2
„ femorum anticorum	19.5
„ „ intermed.	14.5
„ „ posticorum	18
„ operculi	26

Patria. West Somaliland, Bun Jijjiga (July 15, 1895). One female. Type in Hope Collection, Oxford.

LEPTYNIA sp.

West Somaliland, Bun Jijjiga (July 15, 1895). Five mutilated specimens.

ACRIDIODEA.

TRUXALIDÆ.

TRUXALIS NASUTA (L.).

North-west Somaliland, Whardi Datal, July 26, 1895. Three females.

TRUXALIS UNGUICULATA Ramb.

North-west Somaliland, Whardi Datal, July 26, 1895. Seven females, one male.

MACHLERIDIA BILINEATA Stål.

North-west Somaliland, Whardi Datal, July 26, 1895. I refer a mutilated larva to this species.

EPACROMIA THALASSINA (Fabr.).

West Somaliland (1895). One example.

ÆDIPODIDÆ.**HUMBERTIELLA TENUICORNIS** (Schaum).

West Somaliland: Boholo Deno, near R. Shebeyli, June 24, 1895; three male specimens, one female. Somaliland (1895 or 1897); one male and one female.

This species is purely a native of tropical Africa.

GASTRIMARGUS VERTICALIS Sauss.

West Somaliland (1895). One male and one female specimen.

Var., *fusca*, *fascia fusca alarum vix perspicua*.

North-west Somaliland, Hargaisa, April 25-28, 1895. One female specimen.

ÆDALEUS INSTILLATUS, sp. n.

Pronotum haud valde elongatum, fusco-testaceum, indistincte fusco-notatum. Tempora acuta, trigonalia. Statura minore. Gracilior. Frons subreclinata; costa frontalis latior, marginibus a vertice subdivergentibus; vertex ad frontem haud rotundatus. Pronoti crista humilis, acuta, sinuata, margine postico acutangulo. Elytra venis spuriiis completis, area ulnari irregulariter reticulata, fusco-testacea, dimidia basali fasciis 3 latis fuscis, 2 latis pallidis, opacis, dimidia apicali plus minus hyalina, maculis nebulosis infuscatis ornata. Alæ basi flavicantes, fascia fusca lata semilunari, marginem posticum attingenti ornatae, ultra hanc hyalinæ, apice macula fusca, 2 lobos includenti ornata. Pronotum metazona quam prozona haud brevior. Femora postica testacea, extus punctulata, vel irregulariter fasciata. Tibiæ posticæ rufescentes. ♂ ♀.

	♂.	♀.
Long. corporis	20 mm.	29 mm.
„ pronoti	5	6
„ elytrorum	22	26·5
„ femorum posticorum . . .		15

Patria. West Somaliland (1895). Two specimens. Types, male and female, in Hope Collection, Oxford.

This new species falls into the second division of de Saussure's subgenus *Ædaleus sensu stricto*. It is a great deal smaller than

Æ. nigrofasciatus de G., and *Æ. infernalis* Sauss., and falls between *Æ. senegalensis* Kr. and *Æ. abruptus* Sauss. From both of these it differs in the acute angle of the posterior border of the pronotum, at least in the male (this angle is more obtuse in the female). I have drawn up the description on the model of de Saussure's synoptical table, in which he distinguishes these two species.

ACROTYLUS LONGIPES (Charp.).

Somaliland (1895 or 1897), one female. West Somaliland (1895), one male and two females.

These specimens are the red variety, the same as recorded by me from Sokotra (P. Z. S. 1898, p. 384).

PYRGOMORPHIDÆ.

CHROTOGONUS LUGUBRIS Blanch.

Somaliland (1895 or 1897). One male, two larvæ.

PHYMATEUS STOLLII Sauss.

North-west Somaliland, Whardi Datal, July 26, 1895. Two males and two females.

PH. MORBILLOSUS Serv. ?

North Central Somaliland: Haud, Odewein, June 23, 1897. Two larvæ. ("Dry river, thickly wooded banks."—C. V. A. P.)

I refer these larvæ with some hesitation to *P. morbillosus*.

PYRGOMORPHA GRYLLOIDES (Latr.).

North-west Somaliland: Whardi Datal, July 26, 1895. One female.

ACRIDIIDÆ.

SCHISTOCERCA PEREGRINA (Oliv.).

North-west Somaliland: Gooban District, between Hargaisa and Berbera, August 6, 1895. Six males, one female.

North Central Somaliland: Haud, Odewein, July 23, 1897. Four nymphs. ("Dry river, thickly wooded banks."—C. V. A. P.) Also five very young larvæ.

ACRIDIDIUM SUCCINCTUM Serv.

(nec Linn. = *ruficornis*, Serv. et Stål).

West Somaliland (1895). One male and one female.

SAURACRIS, gen. nov.

Corpus apterum, depressum, granulatum, nitidum. Oculi prominenti, a supero visi, subcontigui. Frons reclinata; antennæ filiformes. Pronotum deplanatum, carinis nullis, sulcis 3 instructum, margine postico subsinuato, lobis deflexis marginibus antico et postico obliquis, inferiore subrecto. Elytra minima,

rudimentaria vel nulla. Alæ nullæ. Abdomen segmentis 1^o et 2^o deplanatis, ceteris compressis, carinulatis. Pedes crassiusculi. Femora postica valde incrassata, haud serrulata; tibiæ posticæ margine externo 6-8, interno 8-9 spinis armatæ; tarsi postici segmentis 1^o et 3^o elongatis, 2^o parvo. Cerci ♂ breves, compressi, conici, apice obtusi. Lamina supraanalis ♂ obtusa, apice paullo bi-emarginata, medio plus minus sulcata. Lamina subgenitalis ♂ magna, fornicata; lamina subgenitalis ♀ simplex. Valvulæ ovipositoris breves, granulatae. Corpus glabrum, partibus genitalibus ♂ ♀ tibiis posticis hirsutis.

This new genus falls into the group *Coptocræ*. The absence of elytra, wings, and of the carinæ of the pronotum separate it from *Cyphocerastes* Karsch, *Epistaurus* Bol., *Acridoderes* Bol.

SAURACRIS LACERTA, sp. n. (Plate II. fig. 3, ♂.)

Statura mediocri, testacea, nigro varia. Caput pallide testaceum; oculi globosi, badii. Pronotum pallide testaceum, fasciis 3 fuscioribus longitudinalibus ornatum. Elytra minutissima, granulati, lobiformia, segmenti abdominalis primi dimidium vix attingentia, vel nulla. Abdomen testaceum, vittis et maculis nigris ornatum. Pedes testacei; femora postica extus fusco vel utro ornata; tibiæ posticæ spinis extus 6-8, intus 9 armatæ. Abdomen subtus nigro variegatum. Femina mare major, fuscior. ♂ ♀.

	♂.	♀.
Long. corporis	25.5 mm.	39 mm.
„ pronoti	6	8
„ elytrorum (si adsunt) . .	1.75	1.75
„ femorum posteriorum . .	13-13.5	17

Patria. North-west Somaliland, Hargaisa, April 25-28, 1895; 1 male, 1 female and 1 nymph. Central or East Somaliland (1897); 2 males. Female, type from Hargaisa, in Hope Collection, Oxford. Male type from Central or East Somaliland, in Hope Collection. Co-types at Oxford and in the collection of Malcolm Burr.

LOCUSTODEA.

PHANEROPTERIDÆ.

PERONURA sp. inc.

North-west Somaliland, Whardi Datal, July 26, 1895. One female nymph.

It is impossible accurately to determine this immature specimen.

PHANEROPTERA PUNCTULATA, sp. n.

Parva, læte viridis; pronoto, cruribus, abdomine nigro-punctulatis. Pronotum lobis deflexis æque altis ac longis; carinæ haud valde expressæ, flavidæ. Elytra breviora, venulis transversis haud prominulis, partē anali usque ad apicem nigro-punctulata. Alæ elytris longiores. Femora postica gracilia, apicem elytrorum

superantes, basi incrassata. Lamina supraanalis ♂ oblonga. Cerci ♂ longi, teretes, acuminati, apice mucronati. Lamina subgenitalis ♂ elongata, triangulariter emarginata, cercos haud superans. ♂.

Long. pronoti	♂. 12·5 mm.
„ corporis	4
„ alarum	23·75
„ elytrorum	14·75
Lat. elytrorum medio	2·75
Long. femorum posticarum	16

Patria. North-west Somaliland, Whardi Datal, July 26, 1895. One male. Type in Hope Collection, Oxford.

This species comes nearest to *Ph. nana* Charp., but may be distinguished by the absence of the basal spots of the elytra, which also separates it from *Ph. quadripunctata* Br. The minute black dots all over the body resemble those of *Leptophyes punctatissima*, Bosc.

MILITITSA, gen. nov.

In tribum *Terpnistriarum* locandum. ♂ ignotus.

Fastigium verticis sulcatum et compressum. Frons brevis, perpendicularis. Oculi valde globosi. Pronotum selleforme, disco antice elevatum, obtusum, postice deplanato, margine ipso subelevato, rotundato, carinis lateralibus nullis; lobis deflexis altioribus quam longioribus, marginibus rotundatis. Elytra angusta, paullo ante medium latiora, dehinc attenuata, margine postico sinuato, apice oblique truncata; venæ 2 radiales subcontiguæ, apicem versus divergentes, ramis 1-3 venæ ulnaris conjunctis, ramo ultimo in marginem apicalem elytri ecurrente; vena ulnaris a vena radiali valde remota, in marginem posticum elytri deflexa, ramos nonnullos furcatos albo-circumdatus venam radialem versus emittens, quorum postremi ramis venæ radialis conjuncti; campus analis basi latus, dehinc angustissimus, venulis rectis transversis plurimis instructis, in tertia parte apicali elytri evanescens; campus marginalis latus, ad conjunctionem venæ radialis anterioris cum margine antico productus; intra marginem per totam longitudinem elytra anguste decolor, hyalinus. Alæ elytris longiores. Coxæ anticæ spina nulla instructæ. Femora omnia teretes, postica subtus spinulis 3 armata, lobis genicularibus acuminatis; tibiæ anticæ et intermedicæ compressæ, margine postico spinulis minimis armatæ. Tibiæ anticæ utrinque foramine aperto, oblongo, instructæ; tibiæ posticæ per totam longitudinem utrinque supra spinis albidis, apice rufescentibus, armatæ. Meso- et metasternum lobis obtusis instructa. Ovipositor satis magnus, sensim incurvis, apice obtusus, valvula superiore minime crenulato, valvulam inferiorem muticam superans. ♀.

This genus may be at once separated from *Terpnistria* Stål by the unspined pronotum and unlobed legs. The unarmed coxæ

and open tympana of the anterior tibiæ distinguish it from *Diogena* Br.

MILITITSA SOMALIENSIS, sp. n. (Plate II. figs. 5 & 7.)

Corpus ferrugineum. Caput et pronotum viridia. Elytra viridia, venulis transversis hyalino-circumdatis, margine antico hyalino, margine postico sordide ferrugineo. Ovipositor nitidus, viridis, apice infuscatus. Cerci recti, conici. Lamina subgenitalis ♀ parva, apice angusta, truncata. ♀.

	♀.
Long. corporis	20·5 mm.
„ pronoti	4
„ elytrorum	27
„ femorum posticorum	17
„ ovipositoris	11

Patria. North-west Somaliland, Whardi Datal, July 26, 1895. One female specimen. Type in Hope Collection, Oxford.

TYLOPSIS PERPULCHRA, sp. n.

Viridis, elongata. Pronotum dorso deplanatum, viride, minutissime fusco-punctulatum, marginibus antico et postico subsinuatis, carinis lateralibus rectis, parallelis, albis, antice subtus atromarginatis; lobi deflexi angulato inserti, margine inferiore recto, angulo postico retroproducto, margine postico valde sinuato, antico perpendiculari. Elytra elongata, angusta, lanceolata, ramo primo vene radialis apice furcato, viridia, antice late albo-marginata, vitta pallide purpurea intra, apicem versus attenuata ornata. Alæ elytris valde longiores, venis radialibus mediis valde infuscatis. (Pedes antici et intermedii desunt.) Pedes postici gracillimi, longissimi, fusco-testacei. Cerci longi, validi, apice valde undulato-incurvi, apice decussati et infuscati. Lamina subgenitalis ♂ elongata, apice triangulariter excisa. ♂.

	♂
Long. corporis	20 mm.
„ pronoti	3·5
„ elytrorum	28
„ femorum posticorum	28

Patria. North-west Somaliland, Whardi Datal, July 26, 1895. One male specimen. Type in Hope Collection, Oxford.

This species agrees with *T. bilineolata* Serv. in the straight inferior borders of the side flaps of the pronotum, but may be distinguished by the variegated elytra.

OTIAPHYSA ANGUSTIPENNIS, sp. n. (Plate II. fig. 2.)

Flavo-ferruginea; elytra, alarum apices, virides; elytra venulis transversis albido-circumdatis, margine antico valde sinuato, margine postico recto, paullo ante medium latiora, pone medium valde angustata, apice oblique truncata. ♀.

	♀.
Long. corporis	26 mm.
„ pronoti	5
„ elytrorum	40
Lat. max. elytrorum ante medianam	9
„ „ „ prone medianam	6
Long. ovipositoris	5·75

Patria. North-west Somaliland, Whardi Datal, July 26, 1895. One female specimen. Type in Hope Collection, Oxford.

This species differs from *O. hebetata* Karsch in its smaller size, narrowed elytra, and slightly longer ovipositor. In *O. hebetata* the elytra attain their greatest breadth (12 mm.) just before the apex; in this species, in the first half of the elytra.

RHEGMATOPODA PEELI, sp. n. (Plate II. fig. 1.)

Pallide virescens. Pronotum disco infuscato. Elytra translucida, longiora. Alæ elytris longiores. Pedes graciles; femora antica et intermedia subtus utrinque spinulosa; tibiæ anticæ et intermedicæ triseriatim spinulosæ. (Femora postica desunt.) Elytra venæ radiales basi remotæ, dehinc appropinquantes, subcontiguæ, deinde divergentes, venâ posticâ rami furcatum in apicem elytri emittens; venâ ulnari sinuata; area unguis magis explicata; venulæ transversæ omnes rectæ, parallelæ; campus tympanalis valde prominulus. Lamina supraanalis ♂ brevis, rotundata. Cerci ♂ laminam subgenitalem multo breviores, acuminati, mucronati. Lamina subgenitalis ♂ elongata, deplanata, apice triangulariter emarginata, lobis obtusis. ♂. ♀ ignota.

	♂.
Long. corporis	19 mm.
„ pronoti	5·75
„ elytrorum	34

Patria. North-west Somaliland, Whardi Datal, July 26, 1895. One male specimen. Type in Hope Collection.

Tabula specierum generis Rhegmatopodæ.

1. Elytra campo marginali sensim angustato, tertia parte apicali evanescenti, venâ ulnari decurva; area ulnari (pone venam ulnarem) sat lata. Pronotum lobis deflexis, margine postico vix sinuato, margine infero convexo. Femora antica
1. *leptocerca* Stål.
2. Elytra campo marginali latiori, apicem elytri attingenti; venâ ulnari sinuata, undulata, apice recurva, area ulnari latissima. Pronotum lobis deflexis, margine postico valde sinuato, margine infero obliquo. Femora antica et intermedia subtus spinulosa
2. *peeli*, n. sp.

EURYCORYPHA VARIA Brunner.

Patria. North-west Somaliland, Whardi Datal, July 26, 1895.
One female. Recorded from Kilimanjaro by Brunner.

CONOCEPHALIDÆ.

XIPHIDIUM SOMALI, sp. n.

X. natalensi Reult. vicinum. *Fastigium verticis ab antico visum lateribus haud distincte divergentibus. Caput et pronotum flava, fasciis tribus, media lata, lateralibus angustis fuscis ornata; pronotum inerme, lobis deflexis obtuse triangularibus, marginibus obliquis, via sinuatis, callo convexo nullo. Elytra abbreviata, lobiformia, pronoto breviora, testacea, margine antico infuscato. Alæ obliterate. Abdomen fusco-testaceum, utrinque flavido-bilineatum. Femora postica inerme, genibus inermibus. Pedes testaceis. Ovipositor longissimus, rectissimus. Lamina subgenitalis ♀ apice truncata. ♀. ♂ ignotus.*

	♀.
Long. corporis	17.5 mm.
„ pronoti	3.5
„ elytrorum	3
„ ovipositoris . . . . .	.8

Patria. North-west Somaliland, Whardi Datal, July 26, 1895.
One female specimen. Type in Hope Collection, Oxford.

This species differs from *X. natalense* Redt. in its unarmed knees and differently coloured head and pronotum. From *X. brevicercus* and *X. armaticeps* Karsch it may be distinguished by its unarmed head and pronotum.

HETRODIDÆ.

EUGASTER LORICATUS Gerst.

North Central Somaliland: Haud District, Eyk ("in open plain by thick bush"), July 2-4, 1897. One male and one female specimen.

SPALACOMIMUS TALPA (Gerst.).

North Central Somaliland: Haud District, Eyk, July 2-4, 1897. ("Open plain by thick bush."—C. V. A. P.) One male and one female specimen.

STENOPELMATIDÆ.

MAGRETTIA OBSCURA, sp. n.

Fusco-testacea, nitida. *A M. abominata* Br. differt femoribus tantum spinula minima unica apicem versus armatis, tibiis anticis inflatis. *A M. mutica* Br. differt femoribus spinula unica, neque 4-5 armatis, pronoto antice quam postice paullo latius. ♂.

	♂.
Long. corporis.....	22 mm.
„ pronoti.....	5·5
„ fem. post.....	16·5

Patria. North Central Somaliland: Haud District, Eyk ("on open plain by thick bush"), July 2-4, 1897. One male specimen. Type in Hope Collection, Oxford.

This species seems to be a link between *M. abominata* Br. (African), which has many-spined femora and compressed anterior tibiæ, and the pronotum slightly broader anteriorly than posteriorly, and *M. mutica* Br. (Asiatic), in which the femora have only 4-5 minute spines beneath, while the anterior tibiæ are sub-inflated and the pronotum is cylindrical.

GRYLLODEA.

GRYLLIDÆ.

LIOGRYLLUS BIMACULATUS (De Geer).

North-west Somaliland, Hargaisa, April 25-28, 1895. Four female specimens.

GRYLLUS sp.?

North-west Somaliland, Hargaisa, April 25-28, 1897. One female, one nymph. Both specimens are too mutilated for determination. The elytra are abbreviated, and the ovipositor is as long as the body. The general colour is dull black.

GRYLLUS MELANOCEPHALUS Serv.

North-west Somaliland, Hargaisa, April 25-28, 1895. One male specimen. Possibly only a dark variety of *G. domesticus*.

GRYLLUS LUGUBRIS Stål (= *G. afer* var.?).

North-west Somaliland, Hargaisa, April 25-28, 1895. One male specimen.

8. INSECTS OF OTHER ORDERS.

By various Contributors.

[Mr. Peel also brought several Hymenoptera and a few Hemiptera. The known species of the former have been kindly identified by Mr. W. F. Kirby, of the latter by Mr. W. L. Distant.

E. B. POULTON.]

HYMENOPTERA.

Terebrantia. *Entomophaga.*

BRACONIDÆ.

BRACON sp. A single specimen (1897).

*Aculeata.**Heterogyna.*

FORMICIDÆ.

PALTOTHYREUS PESTILENTIUS (Smith).

Three specimens from Bularli (West Somaliland), May 25, 1895. Mr. Peel describes the species as excessively abundant at this locality.

Fossores.

MUTILLIDÆ.

MUTILLA ARENARIA (Fabr.).

A single female specimen (1897).

POMPILIDÆ.

SALIUS MEGAERA (Smith).

A single specimen from the Webbi Shebeyli, near Mount Kul-dush, June 28, 1895.

LARRIDÆ.

LARRADA sp. allied to *L. diabolica* (Smith).

A single specimen from Sibi (West Somaliland), May 27, 1895.

Diptera.

EUMENIDÆ.

EUMENES LEPELLETIERI (Sauss.).

Seven specimens from Eyk, in the Haud District of North Central Somaliland, July 2-4, 1897. "Open plain by thick bush" (C. V. A. P.).

EUMENES DIMIDIATIPENNIS (Sauss.).

A single example from West Somaliland (1895).

RHYNCHIUM sp.

Two specimens from the Bun Feroli, north of the Webbi Shebeyli, June 10-20, 1895.

Anthophila.

APIDÆ

XYLOCOPA sp. near to *flavilabris*.

A single example (1897).

APIS LIGUSTICA (Spin.).

Eight specimens from the Haveea Country in East Central Somaliland, Sept. 8-27, 1897. (W. F. K.)

HEMIPTERA.

Two species of Rynchota Hemiptera were obtained by Mr. Peel.

ODONTOPUS SEXPUNCTATUS (Lap.).

One specimen from Bularli in West Somaliland, May 25, 1895; and others from the 1897 Expedition in Central and East Somaliland (no further locality).

Two specimens of another species in bad condition were also obtained in 1897. (W. L. D.)

9. CHILOPODA AND ARACHNIDA.

By R. I. POCOCK.

The Arachnida collected by Mr. Peel proved on examination to be exceptionally interesting. Of the six species of Acari, two of the parasitic species of the genus *Rhipicephalus* seem to be well-marked new forms. One of them is represented by both males and undistended females; the other unfortunately by a single male, but this specimen differs so strikingly in colour from all the species of the genus recently recorded in Neumann's useful monograph of the group, that I have not hesitated to describe it as new. Mr. Peel was even more fortunate with his Scorpions. He collected only five specimens; but they represent four species, three of which have never been previously described. Two of these, *Buthus calviceps* and *Pandinus pugilator*, are exceptionally well-marked forms; while the third species, which I have dedicated to Mr. Peel, belongs to a section of the genus peculiar to Somaliland and hitherto represented by a single species.

The working out of this material has entailed a revision of the Scorpions of Somaliland, based upon those contained in the collection of the British Museum. The results have been incorporated in a supplement to the report upon Mr. Peel's collection, in the hope that sportsmen and naturalists who visit this country may see at a glance what is known of these animals and may be induced to follow, so far as collecting is concerned, the examples of Messrs. Lort Phillips, Donaldson Smith, and Peel,

Class CHILOPODA.

Family SCOLOPENDRIDÆ.

Two representatives of this family were obtained, April 25-28, 1895, at Hargaisa, North-west Somaliland, namely *Ethmostigmus trigonopoda*, a species which is distributed throughout tropical Africa, and a damaged example of a species of *Rhysida* probably referable to *R. paucidentis*, Pocock¹, originally procured at Loga in the Arneq Galla country, but the absence of the anal legs makes the determination doubtful.

The specimens of these species are in the Hope Museum at Oxford.

¹ In Donaldson Smith's 'Through Unknown African Countries,' p. 404 (1897).

Class ARACHNIDA.

Order ACARI.

Family TROMBIDIIDÆ.

Genus TROMBIDIUM.

TROMBIDIUM TINCTORIUM (Linn.), Trouess.

Trombidium tinctorium, Trouessart, Ann. Soc. Ent. France, 1894, pp. 89-91 & 94, fig. *a*.

Loc. Hargaisa in North-west Somaliland (April 25-28, 1895).
Two specimens in the Hope Museum at Oxford.

Family ARGASIDÆ.

Genus ORNITHODOROS Koch.

ORNITHODOROS SAVIGNYI (Aud.).

Argas savignyi, Aud., Description de l'Égypte, Hist. Nat. i. pl. iv. fig. 5; Explanation of Plates, p. 183 (1827).

Ornithodoros savignyi, Neumaun, Mém. Soc. Zool. France, x. p. 26 (1897).

Loc. Bularli in West Somaliland (May 1895). Six specimens, two in the British Museum, the rest in the Hope Museum at Oxford.

Family IXODIDÆ.

Genus HYALOMMA C. Koch.

HYALOMMA GROSSUM C. Koch.

Hyalomma grossum, C. Koch, Arch. Natur. x. i. p. 220, no. 2, Uebersicht etc. iv. p. 34, pl. ii. fig. 8 (1847).

Loc. Bularli in West Somaliland (May 1895).

A single distended female, probably referable to this species; in the Hope Museum at Oxford.

Genus RHIPICEPHALUS C. Koch.

RHIPICEPHALUS SANGUINEUS (Latr.).

Ixodes sanguineus, Latreille, Hist. Nat. Crust. Ins. i. p. 157 (1804).

Rhipicephalus sanguineus (Latr.), Neumann, Mém. Soc. Zool. France, x. p. 385 (1897).

Loc. Bularli in West Somaliland (May 1895).

Three specimens, one in the British Museum and two in the Hope Museum at Oxford.

RHIPICEPHALUS MARMOREUS, sp. n. (Plate III. figs. 1-1 d.)

♂. *Colour*. Capitulum yellowish brown; dorsal surface of body yellowish white, with five large deep red-brown patches, one on each side extending backwards from the cervical groove, one on each side longitudinal and sending off towards the middle line a broad transverse bar, and a large posterior median patch with convex hinder border and anterior border produced forwards in the middle line, also a narrow brown band running round the margin of the dorsal scute; legs yellowish brown, with a broad longitudinal white band on the upperside of the femora, patellæ, and tibiæ; ventral surface of body whitish, with chitinous sclerites deep brown like the legs.

Posterior border of *capitulum* evenly concave, the angles moderately produced; lateral margins moderately, not strongly diverging, the anterior border only a little wider than the posterior.

Dorsal plate almost entirely covering the sides of the body, leaving merely a narrow marginal membranous rim; cervical grooves distinct, short; marginal groove represented by a series of coarse punctures; three posterior punctured grooves on the posterior dark patch; for the rest the dorsal plate is without grooves but is pitted with coarse scattered punctures; the posterior rim divided by short sulci into eleven festoons. Ventral area with a single long piriform adanal plate, which is narrowed in front and extends backwards almost to the posterior coxæ; its external border slightly convex, internal border concave in the middle, convex in the anterior and posterior third, posterior border oblique and ending internally in a rounded rectangular prominence; a single small median sclerite on the postanal membranous area. *Coxæ* of anterior legs produced into two strong spiniform processes; of 2nd to 4th with a single distal spiniform process on the posterior side.¹

Total length of dorsal plate 3·8 mm.

Loc. Bularli in West Somaliland (May 1895).

A single specimen (♂ type) in British Museum.

RHIPICEPHALUS ARMATUS, sp. n. (Plate III. figs. 2-2 f.)

♂. *Colour* a tolerably uniform deep brown, with black markings on the grooves of the dorsal plate; legs deep brown; ventral area pale.

Capitulum with posterior border straight in the middle, its angles more abruptly spiniform than in *R. marmoreus*, its lateral margins more obliquely diverging in their posterior two-thirds, then abruptly converging. *Dorsal scute* not quite covering the lateral area, with normal cervical grooves; marginal groove deep, strongly pitted, extending from a point on a level with the cervical groove to the beginning of the festoons of the posterior border; posteriorly there is a pair of deep pitted grooves, and between

¹ Owing to the dried state of the specimen, satisfactory examination of the mandibular armature was impossible.

them and the marginal groove on each side another similar but curved groove which extends from in front of the middle of the dorsal area back as far as the posterior end of the marginal groove; in addition to the punctures in the grooves there are a few coarse punctures scattered here and there; posterior border with eleven festoons. *Adanal plates* narrowed in front, but not extending far forwards beyond the anus; their inner border nearly straight, external border convex; posterior border produced into a short external and a long spiniform internal tooth, which projects nearly as far back as the posterior border of the dorsal plate, the apex of this spine is obliquely truncate and subbifid, above it is a second strong spine; a pair of postanal sclerites. *Coxæ* of 1st leg strongly bidentate; of 2nd to 4th also bidentate, the two teeth being on the posterior border, one proximal, the other distal and thinner. Total length 4.8 mm.

Two undistended female specimens, probably referable to this species, have the cephalic plate about as wide as long, reddish in the middle, blackish at the sides, the cervical grooves deep, a row of large punctures representing the marginal grooves on each side, some large punctures along the lateral edge in front of the eye, a few between the cervical grooves, and a few large ones and many smaller ones on the middle of the posterior area. The *abdomen* is impressed posteriorly with three shallow grooves and is obsolete festooned. *Coxæ* of the legs posteriorly weakly bispinate, the external spine being the larger.

Loc. Bularli in West Somaliland (May 1895).

Six specimens. Type (male) and two co-types (male and female) in the British Museum. Three co-types (2 males and 1 female) in the Hope Museum at Oxford.

The males of the three species of this genus obtained by Mr. Peel may be determined as follows:—

- (♂) *a.* Dorsal plate marked behind with a pair of moderately long grooves, one on each side of the middle line; between these and the deep marginal groove there is a third long and deep groove extending from the second or third sulcus of the festooned border past the middle of the dorsal plate; adanal plate produced behind into a long and strong spiniform process, immediately above which there is a second strong spine; a pair of chitinous postanal sclerites *armatus.*
- b.* Dorsal plate with a longish posterior median sulcus and a pair of shallower impressions, one on each side of it, with only a very short shallow and inconspicuous groove between the marginal groove and the middle line; adanal plate not produced behind into a long spiniform process; no spine above the termination of this plate.
- a'.* Dorsal plate yellowish white, with large symmetrically disposed reddish-brown patches; legs brown, painted with white above; dorsal plate sparsely punctured; marginal groove represented by a series of punctures. *marmoratus.*
- b'.* Dorsal plate deep brown with blacker patches and yellow lateral margin; legs uniformly brown; dorsal plate closely and irregularly punctured; marginal groove distinct *sanguineus.*

Order ARANEÆ.

Unfortunately the few Spiders obtained by Mr. Peel were not all preserved in such a manner as to make their specific determination possible, being dried, pinned, and for the most part very much shrivelled. The following forms, however, are recognizable.

1. *ARANEUS HOPLOPHALLUS* Poc. (Bull. Liverpool Museum, ii. p. 40, 1899.)

An adult male certainly belonging to this species and a female doubtfully referred to it, the former from Berbera in North-west Somaliland, the latter from East Central Somaliland (1897). The type was procured in Sokotra and is preserved in the British Museum; the specimens procured by Mr. Peel are in the Hope Museum.

2. *ARANEUS NAUTICUS* L. Koch.

A single female, most likely of this species, from Berbera, in the Hope Museum.

3. *CEBRENNUS ÆTHIOPIUS* Simon.

A single immature female, probably referable to the Abyssinian species, was taken in Eastern Central Somaliland. In the Hope Museum.

4 & 5. *OXYOPES* sp.?

Two specimens from Western Somaliland, each representing an indeterminable species. In the Hope Museum.

Order SCORPIONES.

Family SCORPIONIDÆ.

Genus PANDINUS Thorell.

PANDINUS PUGILATOR, sp. n. (Plate IV. figs. 1, 1 a.)

Colour of chelæ, tail, and upperside of body olive-brown, the hands rather paler; legs and vesicle of tail clear pale yellow.

Carapace smooth, sparsely punctured above, granular at the sides, its length exceeding that of the movable digit and almost equalling that of the 3rd and 4th tail-segments.

Tergal plates granular laterally; the last more or less granular throughout. *Sternal plates* smooth, the last weakly crested.

Tail short and slender, less than three times the length of the carapace, considerably narrowed posteriorly; the 4th segment about twice as long as wide, the 5th considerably more than twice as long as wide; 1st segment weakly granular above, for the rest smooth, all its keels smooth; 2nd segment entirely smooth, 3rd with the four inferior keels strong, rugose, the intervening spaces granular; 4th with the infero-lateral keels strong and denticulated,

the inferior median keels not differentiated amongst the coarse granules covering the lower surface of the segment; 5th segment with the inferior keels denticulated, the area between them coarsely granular; upperside of the 3rd, 4th, and 5th segments smooth, the keels also smooth or at all events only roughened with pores; vesicle granular, narrow, its width equal to its height and only about one-third the length of the vesicle and aculeus.

Chelæ: humerus coarsely granular above, its anterior surface with strongly granular crests; lower surface granularly crested behind; brachium finely granular in front, also roughened with pores and granules behind; hand wide, its width about equal to the length of the movable digit, its upper surface smooth posteriorly on the lobe, the area just above external keel coarsely granular, the rest covered with low more or less anastomosing tubercles, which are, however, more distinct towards the base of the immovable digit: the inner edge smooth, though the granules of the lower surface run right up to it or even project slightly beyond it; the lower surface sparsely granular, with two weakly defined keels; keel defining the hand-back above very strong and prominent.

Legs smooth; protarsal segment of 1st and 2nd with a single external apical spine; tarsi armed with eight spines, two on each side being on the lobe, one on its lower angle, the other in the middle as in *P. colei*, *P. bellicosus*, &c.

Pectinal teeth 17.

Measurements in millimetres. Total length 93; length of carapace 18, of tail 48; width of 1st segment 5·8, of 4th 3·5, of vesicle 3·2; width of hand 16, length of movable digit 17.

Loc. North-west Somaliland (Berbera or Hargaisa). A single specimen (type) in the British Museum.

Recognizable by the granulation of the lower side of the 4th caudal segment and the obsolescence of its inferior median crests, &c.

PANDINUS PEELI, sp. n. (Plate IV. fig. 2.)

♂. Closely allied to *P. colei* (Pocock), but differing in the characters pointed out in the table given below (*cf.* p. 62).

Carapace quite smooth above, sparsely punctured, much less closely granular laterally than in *P. colei*. *Terga* weakly granular at the sides only, not closely granular throughout the posterior half as in *P. colei*. *Chelæ* larger than in *P. colei*; upper crest of brachium smooth; upperside of hand externally granular as in *P. colei*, but internally much smoother, the granules anastomosing and running together into ridges which become almost obsolete on the posterior lobe of the hand. Fourth abdominal *sternum* obsoletely granular in the middle. *Pectinal teeth* 15.

Measurements in millimetres. Total length 81; length of carapace 14·5, of tail 38, of underhand 10; width of hand 13·5.

Loc. North-west Somaliland (Berbera or Hargaisa). A single specimen (type) in the British Museum.

Family BUTHIDÆ.

Genus UROPLECTES Peters.

UROPLECTES FISCHERI (Karsch).

Lepreus fischeri Karsch, Mitth. Münch. ent. Ver. 1879, p. 124.

The two specimens of this species that were obtained in North-west Somaliland (at Berbera or Hargaisa) agree closely in characters with those collected by Dr. Donaldson Smith at Luumo and Turfa, and discussed on pp. 400-401 of that author's account of his expedition. One of Mr. Peel's specimens is in the British Museum, the other in the Hope Museum at Oxford.

Genus BUTHUS Leach.

BUTHUS CALVICEPS, sp. n. (Plate IV. figs. 3-3 a.)

Colour (dry specimen): trunk blackish yellow; appendages uniform pale yellow.

Carapace weakly granular; keels almost entirely obsolete, only the anterior median distinct but failing to attain the front border of the carapace. *Tergal plates* rather coarsely granular; keels normal and granular. *Sternal plates* smooth and polished; the last very finely granular at the sides, polished and rather coarsely but sparsely punctured in the middle; the lateral keels almost obsolete, represented by about three larger granules.

Tail of medium thickness, nearly five times the length of the carapace, posteriorly narrowed; the sides and upper surface of the segments normally crested, the intercarinal spaces finely granular; the median lateral keel complete on the 2nd and almost complete on the 3rd segment; lower surface of 1st, 2nd, and 3rd segments rather coarsely but strongly punctured with setiferous pores; the median keels of the 1st obsolete, those of the 2nd and 3rd strong and denticulated, increasing in strength posteriorly, the inferior laterals of these segments also strong and denticulated, converging posteriorly and fusing, like the medians, with a transverse granular crest; lower surface of the 4th weakly granular, without median keels; 5th segment without a trace of superior lateral keels, finely granular below, with a few coarser granules intermixed, the median keel denticulated; the laterals strongly denticulated, with at least one large lobate tooth behind the middle of their length, ending behind in a big subdivided lobe on each side of the anal aperture; *vesicle* of medium size, smooth, punctured.

Chelæ weak; humerus granular above, normally crested; brachium smooth, weakly crested, anterior surface with two weakly granular keels; hand smooth, small, narrower than brachium, movable digit with eight rows of teeth along the middle line, the basal row long and rising right at the extremity of the segment, the lateral teeth forming short oblique rows of three each, two

outer and one inner; finger a little more than twice the length of the underhand.

Legs with granularly crested femora; the feet with two rows of hairs below.

Pectinal teeth 21.

Genital operculum considerably longer than sternum.

Measurements in millimetres. Total length 31; length of carapace 3.5, of tail 17.5; length of movable digit 3.

Loc. North-west Somaliland (Berbera or Hargaisa). A single specimen (type) in the British Museum.

In size and some points of structure this little *Buthus* approaches *Nanobuthus andersoni* Poc., obtained at Duroor to the north of Suakim (Journ. Linn. Soc., Zool. xxv. p. 314). The dentition of the mandible and of the digits of the chelæ, however, is quite normal for the genus *Buthus*. The most striking structural peculiarities of the species are: (1) the obsolescence of all the cephalothoracic keels with the exception of the anterior median; (2) the coarse but sparse punctuation of the last sternite and of the lower side of the first caudal segment, accompanied as it is by the disappearance of the median keels; (3) the disappearance of the median keels on the lower side of the 4th caudal segment. These characters do not co-exist in any species known to me. Judging from the structure of the inferior lateral keels of the 5th caudal segment and of the inferior keels of the 2nd and 3rd segments, this species belongs to the same category as *B. occitanus*.

10. GENERAL LIST OF THE SCORPIONS OF SOMALILAND AND THE BORAN COUNTRY. By R. I. POCKOCK.

Family BUTHIDÆ.

Genus UROPLECTES Peters.

UROPLECTES FISCHERI (Karsch).

Lepreus fischeri, Karsch, Mitth. Münch. ent. Ver. iii. p. 124 (1879).

Loc. Barawa (*Karsch*), Turfa and Lummo (*Donaldson Smith*), and Berbera and Hargaisa (*C. V. A. Peel*).

To the south of Somaliland the typical form of this species is replaced by two subspecies, one paler, the other darker than *U. fischeri typicus*. The three may be contrasted as follows:—

- | | |
|---|--------------------------------------|
| a. Hands entirely pale, body banded above as in <i>fischeri typicus</i> | <i>f. flavimanus</i> , subsp. [nov.] |
| b. Hands wholly black or at least lined with black and black at base of fingers. | |
| a'. Terga yellow, with a pair of black spots; carapace and terga broadly yellow at the side ... | <i>f. typicus</i> . |
| b'. Terga mostly black, with a narrow median and lateral marginal band, much less yellow at side of carapace..... | <i>f. nigrimanus</i> . |

The subspecies *nigrimanus* was based upon a single example from Mombasa (see Proc. Zool. Soc. 1890, p. 130, pl. xiv. fig. 2). *U. flavimanus* is based upon a specimen in the British Museum obtained by Mr. J. Wilson at Mombasa in British East Africa.

It is interesting to note that the two subspecies most distinct from each other, namely, *U. f. flavimanus* and *U. f. nigrimanus*, occur in the same locality, whereas the subspecies intermediate between them is found elsewhere.

Genus PARABUTHUS Pocock.

PARABUTHUS GRANIMANUS Pocock.

Parabuthus granimus, Pocock, Journ. Linn. Soc., Zool. xxv. p. 311 (1895).

Loc. Zeyla in North-west Somaliland (*E. W. Oates*), Goolis Mountains (*Lort Phillips*). In the British Museum.

PARABUTHUS HETERURUS Pocock.

Parabuthus heterurus, Pocock, in Donaldson Smith's 'Through Unknown African Countries,' p. 402 (1897).

Loc. Hargaisa, Silul, Shebeli River (*A. Donaldson Smith*); Goolis Mountains (*E. Lort Phillips*). In British Museum.

The two species of this genus may be recognized as follows:—

- | | |
|--|------------------------|
| a. Hand and brachium closely granular; 5th segment of tail strongly infuscate at least below | <i>P. granimanus</i> . |
| b. Hand and brachium smooth, punctured, hairy; 5th caudal segment clear yellow throughout, 4th segment and vesicle black | <i>P. heterurus</i> . |

Genus BUTHUS Leach.

BUTHUS OCCITANUS (Amoreux), subsp. nov. BERBERENSIS.

Colour yellow, with black lines along the keels of the upperside of the trunk, humerus, brachium, and hand, also the distal half of the femora infuscate and the base and keels on the patellæ. *Body* and *tail* crested and granular as in the typical form, the granules of the inferior keels of the 2nd and 3rd caudal segments about as much enlarged as in the Spanish form; external surface of hand with a few granules, a pair of strong granular finger-keels running along its upperside and inner edge.

Total length 38 mm.

Somaliland (*Miss Gillett*). In British Museum.

Subsp. nov. ZEYLENSIS.

Colour a uniform reddish yellow, the appendages and tail clearer than the trunk. Frontal intercarinal area of *carapace* covered with granules; a median row of granules running along

the middle of the ocular tubercle. *Terga* closely and finely granular throughout. Inferior keels of 2nd and 3rd *caudal segments* strongly dentate. *Hand* smooth, with a pair of weak and weakly granulate crests on its upperside.

Total length 50 mm.

Loc. Zeyla in North-west Somaliland (*E. W. Oates*). In British Museum.

BUTHUS CALVICEPS Poc.

Cf. supra, p. 54.

BUTHUS ACUTECARINATUS Simon.

Buthus acutecarinatus, Simon, Ann. Mus. Genova, xviii. p. 245, pl. viii. fig. 18 (1883).

Loc. Zeyla (*E. W. Oates*). In British Museum.

Occurs also in Egypt and Arabia.

BUTHUS POLYSTICTUS Poc.

Buthus polystictus Pocock, Ann. Mag. Nat. Hist. (6) xviii. p. 178, pl. xi. fig. 1 (1896).

Goolis Mountains in Somaliland (*E. Lort Phillips*). In British Museum.

BUTHUS EMINI Pocock.

Buthus eminii, Pocock, Ann. Mag. Nat. Hist. (6) vi. p. 98 pl. i. fig. 2 (1890); *id.* op. cit. (6) xviii. p. 179 (1896).

Loc. Aimœa in the Boran Country, 3000 ft. (*A. Donaldson Smith*). In British Museum.

This species and perhaps also *B. polystictus* may prove to be subspecies of *B. trilineatus* Peters, described from Tete.

The species and subspecies of *Buthus* mentioned above may be diagnosed as follows:—

- a.* Inferior lateral keels of 5th caudal segment posteriorly lobate; inferior median keels of 2nd and 3rd with the granules enlarged towards the posterior end.
- a*¹. Carapace without distinct median, lateral, and posterior keels, inferior keels on 4th caudal segment obsolete *calviceps*.
- b*¹. Carapace with distinct median posterior and lateral keels, the posteriors turning outwards and uniting with the laterals, inferior keels on 4th caudal segment developed *occitanus*.
- a*². Legs, chelæ, and body uniformly yellow, not lined with black; intercarinal ocular area closely granular subsp. *zeylensis*.
- b*². Chelæ and body with black-lined keels, femora of legs distally infusate; patellæ also infusate basally and along keels; frontal area of carapace sparsely granular in the middle subsp. *berberensis*.

- b. Inferior lateral keels of 5th caudal segment and inferior median of segments 2 and 3 uniformly granular throughout.
- a*³. Hand carinate and densely granular; dorsal abdominal keels posteriorly strongly spiniform. *acutecarinatus*.
- b*³. Hand smooth, not carinate; dorsal abdominal keels not strongly spiniform posteriorly.
- a*⁴. Less coarsely granular; tail thinner and lower, height of 4th segment barely half its own length and distinctly less than length of 1st; upper surface of caudal segments much less strongly excavated, &c. *polystictus*.
- b*⁴. More coarsely granular; tail thicker, its superior keels more strongly elevated; height of 4th segment more than half its length and equal to length of 1st *emini*.

Family SCORPIONIDÆ.

Genus PANDINUS Thorell.

PANDINUS MEIDENSIS Karsch.

Pandinus meidensis, Karsch, Mitth. Münch. ent. Ver. iii. p. 127 (1879); Kraepelin, Das Tierr., Scorpiones, &c. p. 119 (1899).

Loc. Meid in Somaliland. In Berlin Museum.

PANDINUS SMITHI (Pocock).

Scorpio smithi, Pocock in Donaldson Smith's 'Through Unknown African Countries,' p. 198 (1897).

Loc. Hargaisa, Silul, Abdeh, and Turfa in Somaliland (*A. Donaldson Smith*). In British Museum.

PANDINUS PALLIDUS (Kraepelin).

Scorpio pallidus, Kraepelin, Mitt. Mus. Hamburg, xi. p. 60 (1894).

Pandinus pallidus, id. Das Tierr., Scorpiones, &c. p. 120 (1899).

Loc. Barawa in Somaliland. In Hamburg Museum and British Museum.

The typical form of this species was based upon immature individuals measuring only up to 75 mm. long. Until the adult is known it seems to me impossible to classify the species with certainty. It is undoubtedly nearly allied both to the following species, *P. phillipsi* from North-west Somaliland, and to the more southern Masailand form *P. gregorii*, but it will probably prove to be at all events subspecifically different from both.

PANDINUS PHILLIPSI (Pocock).

Scorpio phillipsii, Pocock, Ann. Mag. Nat. Hist. (6) xviii. p. 101 (1896).

Pandinus phillipsii, Kraepelin, Das Tierr., Scorpiones, &c. p. 120 (1899).

Loc. Doolob and the Goolis Mountains, inland of Berbera (*E. Lort Phillips*). In British Museum.

This form is evidently allied to the typical *P. pallidus*; but until adults of the latter come to hand for comparison, it is impossible to say what the exact relationship between the two may be. The original examples of *P. phillipsi* are a pair of females obtained at Dooloob. Mr. Lort Phillips subsequently procured an adult male and a young female on the Goolis Range of mountains. The former has 17-18 pectinal teeth, a longer tail and larger vesicle than the female, and lobate movable finger on the chela. The young one is as large as a co-type of *P. pallidus*, the carapace in the two measuring 11 mm. Moreover the posterior tarsal lobe is tipped above with bristles as in *P. pallidus*, not with a spine as in the adult *P. phillipsi*. But the shape of the hand in the young *P. phillipsi* is different, this organ being very noticeably narrower, and the tubercles on its upperside are much sharper and more strongly defined.

The following actual measurements (in millim.) of the two examples may be advantageously compared:—

	Total length (without vesicle).	Carapace.	Length of brachium.	Length of underhand.	Length of movable finger.	Width of hand.
Young of <i>P. pallidus</i> .	71	11	7.5	7	11	10
Young of <i>P. phillipsi</i> .	68	11	7.5	7	11	8.5

As will be seen, there is practical identity of measurements¹ except where the width of the hand is concerned.

PANDINUS COLEI (Pocock).

Scorpio coleii, Pocock, Ann. Mag. Nat. Hist. (6) xviii. p. 180, pl. xi. figs. 2, 2 a (1896).

Pandinus coleii, Kraepelin, Das Tierr., Scorpiones, &c. p. 120 (1899).

Loc. Berbera and Goolis Mountains (*E. Lort Phillips*). In British Museum.

This species was based upon a subadult specimen from Berbera.

Mr. Lort Phillips subsequently procured in the Goolis Mountains and kindly sent to the British Museum three additional examples, an adult male and female and a young specimen considerably smaller than the type. The characters upon which the species was based prove perfectly constant. The adult male and female are much alike; the former, however, has the terga of the abdomen finely and closely granular posteriorly, whereas in the female they are nearly

¹ The difference in total length in this and in many other cases is due to the degree of distension of the abdominal region. The length of this region is so very liable to alteration in accordance with the mode of preservation of the specimen after death, and depends so largely upon the fasting or full-fed, pregnant or not pregnant condition of the Scorpion, that the relative lengths of the tail as compared with the trunk, which Kraepelin, Karsch, and others so frequently quote, have but little importance. The length of the carapace, which does not vary, should be taken as standard for comparison.

smooth. Again, the 2nd and 4th abdominal sterna are finely granular in the middle; and, lastly, the vesicle is more strongly inflated, its width considerably exceeding its height and being equal to that of the 4th caudal segment.

In the female the width of the vesicle is scarcely greater than its height and less than the width of the 5th segment.

Pectinal teeth 11-13 (♂ ♀).

Total length (♂) 82 mm., carapace 13.5, tail 38, underhand 8.5, width of hand 12.

PANDINUS PEELI Pocock.

Cf. supra, p. 53.

PANDINUS HAWKERI, sp. n.

Colour of carapace and palpi yellowish brown; tergal plates and tail reddish brown; vesicle brown with yellow lines; legs entirely pale yellow, abdominal sterna testaceous.

Carapace smooth, polished; terga also smooth, punctured along the posterior margin, the last very weakly granular laterally, the crests obsolete. *Sterna*, with exception of the last, smooth; the last obsoletely crested, but mesially closely granular.

Tail short, only a little more than two and a half times the length of the carapace, which is almost as long as its first three segments; the inferior median keels absent on segments 1-5, the inferior laterals present, smooth on segments 1 and 2, granular on 3 to 5, the area of the lower surface of the tail between them granular as in *P. colei*; superior and superior-lateral keels of tail weak, punctured, but not granular; sides of tail smooth; upper surface at most very sparsely granular, except along the posterior edge of segments 1-4, where there is a series of denticuliform granules; *vesicle* strongly punctured and setose beneath, but scarcely granular, its width exceeding its height. *Chelæ*: humerus smooth below and behind, the crests on its upper and anterior surfaces coarsely granular, its upperside sparsely granular in the basal half; brachium smooth, except for some minute granules in front and some coarser ones along the anterior inferior crest: hand moderately wide, its width equal to three-fourths the length of the carapace; upper surface granular on the external slope above the strong keel of the underhand; the rest of the upper surface nearly smooth and polished, beset with a fine reticulation of ridges which are almost obsolete in adult, coarser in young; inner edge almost smooth, punctured, lower surface sparsely and weakly granular towards the base of immovable digit; immovable digit with its basal width less than half the length of its biting-edge; movable digit shorter than carapace, exceeding width of hand, equal to length of 3rd and 4th caudal segments.

Legs smooth; protarsi of 1st and 2nd with one posterior apical spine; tarsal lobes with two spines; lower surface of tarsi with one anterior and three posterior spines; anterior claw much

weaker than posterior. *Sternum* long, about one-third longer than wide.

Pectinal teeth 12-15 in ♀.

Measurements in millimetres. Total length 81, carapace 15, tail 50; width of hand 12; length of movable digit 13, of hand-back 8.

Loc. Jifa Uri inland from Zeyla (*R. M. Hawker*). In British Museum.

Differing from *P. colei* and *P. peeli* in the characters pointed out below (p. 62).

PANDINUS PUGILATOR Poc.

Cf. supra, p. 52.

PANDINUS MILITARIS, sp. n.

Scorpio bellicosus, L. Koch; Pocock, in Donaldson Smith's 'Through Unknown African Countries,' p. 397 (1897) (nec *P. bellicosus* L. Koch).

♀. *Colour* yellowish brown; legs paler yellow, hand reddish brown with black fingers. *Carapace* granular laterally, entirely smooth above except for a few granules in the antecular groove. *Terga* finely granular laterally. *Tail* a little more than two and a half times as long as the carapace, the inferior keels on segments 1-3 quite smooth, those on 4th at most slightly rugose; superior and superior-lateral keels of all the segments granular or weakly denticulated; superior surface of 1st granular, of 2nd less so; width of 1st exceeding length of 3rd, almost equal to that of 4th; 5th about twice as long as wide. *Chelæ*: *humerus* granular above at least on its basal half, smooth below; *brachium* almost entirely smooth, its anterior side weakly granular above, more coarsely below; *hand* wide, its width in adult exceeding length of 3rd and 4th caudal segments, inner edge smooth, upper surface smooth, finely reticulated, a few low tubercles just above the keel of the underhand and at the base of the immovable digit; external portion of upper surface rising vertically above keel of underhand; thickness of hand at the front equal to length of 4th caudal segment. Lower side of hand granular distally, scarcely crested.

Pectinal teeth 12-15.

Measurements in millimetres (of type). Total length 112, carapace 19, tail 51; width of hand 16.8, underhand 10.5.

Loc. Aimola in the Boran Country (*Donaldson Smith*); also Ndi, on the Weiss Road inland from Mombasa (*C. Stuart Betton*). In British Museum.

Nearly allied to the East-African species *P. cavimanus*, but differing in the following characters:—the carapace in the female is longer than the 4th and 5th caudal segments, and the basal width of the immovable finger is only about half the length of its free margin; whereas in *P. cavimanus* (♀) the carapace is shorter than 4th and 5th caudal segments, and the basal width of the immovable digit is about two-thirds the length of its free margin.

I at one time supposed this species to be the female of the Abyssinian *P. bellicosus* L. Koch, but judging by Kraepelin's recent diagnosis of the latter species (*Das Tierr.*, Scorpiones, p. 121, 1899), *P. militaris* certainly differs in having the superior caudal keels denticulated, the hand finely punctulate above and below, and the last abdominal sternite scarcely visibly crested.

Synopsis of the Somali Species of Pandinus.

- a.* Median eyes always some distance behind middle of carapace; tarsi more numerous spined, the lobes with 3-4 spines, total number on lower side of tarsi 9 behind, 6 in front.
- a*¹. Tarsal lobes with 4 spines, a strong spine being on the tip of the lobe; humerus of chela furnished below with two short rows of denticles..... *meidensis.*
- b*¹. Tarsal lobe with 3 strong spines, the spine on the tip smaller and usually filiform distally; humerus of chela smooth below.
- a*². Ornamentation of hand consisting of conical tubercles; inner margin of hand distinctly tubercular and denticulate from base of finger to carpal articulation, width of hand greater than length of carapace; pectinal teeth 18-21 *smithi.*
- b*². Ornamentation of hand consisting of low rounded or irregular shaped, often anastomosing tubercles; lobe of hand with smooth posterior edge; length of carapace exceeding width of hand; pectinal teeth 15-18 *philippsi.*
- b.* Median eyes in middle of carapace, rarely a little behind the middle; total number of spines on tarsi 5 behind, 3 in front, 2 only being situated on each lobe, the tip of which is furnished with bristles.
- a*³. Lower surface of all the caudal segments and the middle of at least the last abdominal sternite closely granular and not keeled.
- a*⁴. Upper surface of hand from inner edge to crest of underhand uniformly covered with coarse granules which do not anastomose; upper crest of brachium distinctly granular *colei.*
- b*¹. Upperside of hand coarsely granular only above crest of underhand, the rest of its upperside either almost smooth or ornamented with low rounded tubercles which run into ridges; upper crest of brachium quite smooth.
- a*⁵. Upperside of hand covered with ornamentation of low, more or less anastomosing tubercles; its lower surface distinctly granular; hand larger, carapace equal to length of underhand + one-third of movable digit, and only as long as the hand from the posterior edge of the lobe to the base of the immovable finger; immovable finger not twice as long as its basal width *peeli.*
- b*⁵. Upperside of hand smooth, at most ornamented with a network of low ridges, lower side very sparsely granular; hand smaller, carapace as long as underhand + half the movable finger, and as the hand measured from the posterior edge of the lobe + half the immovable finger; immovable finger twice as long as its basal width. *hawkcri.*



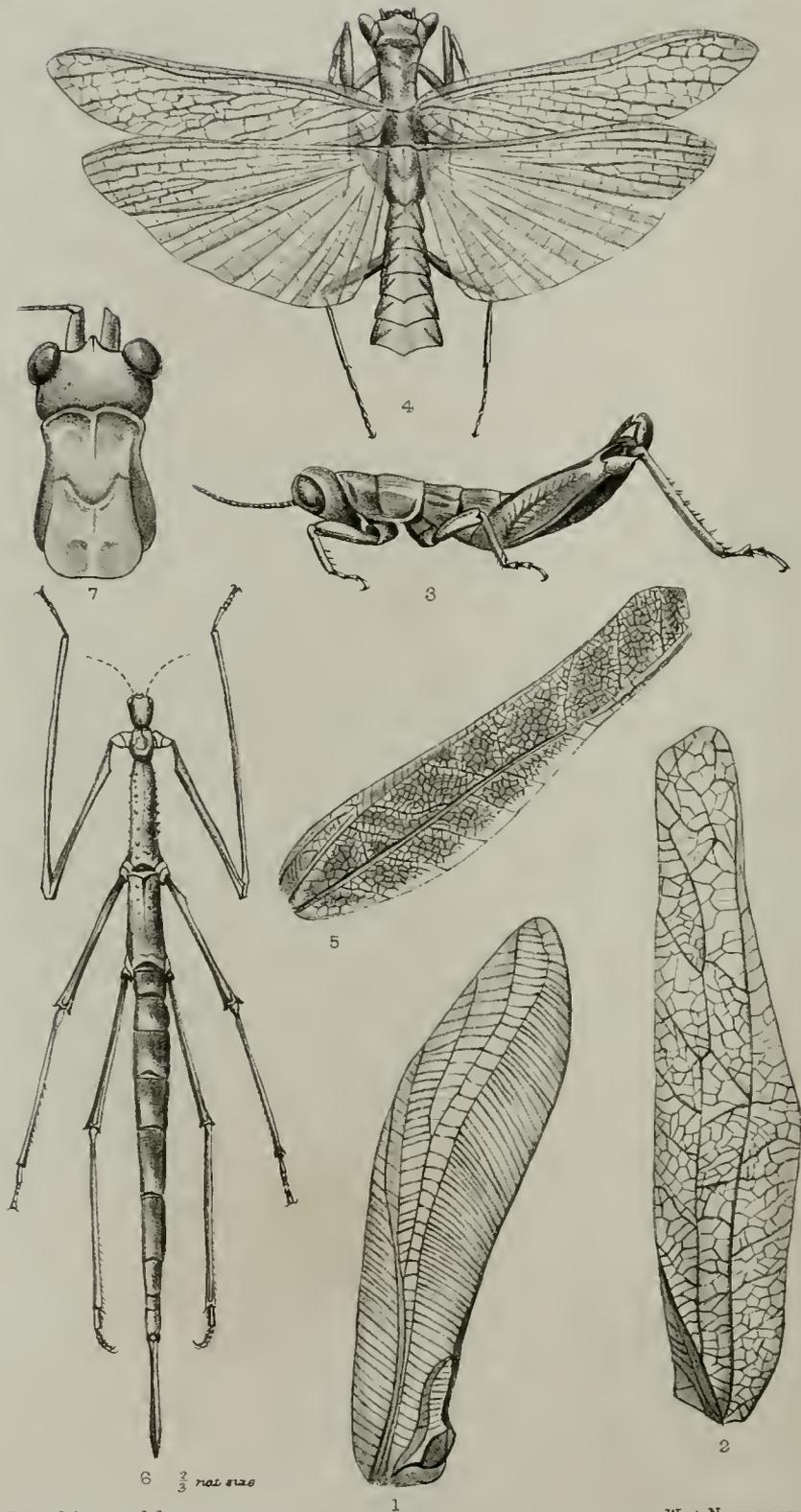


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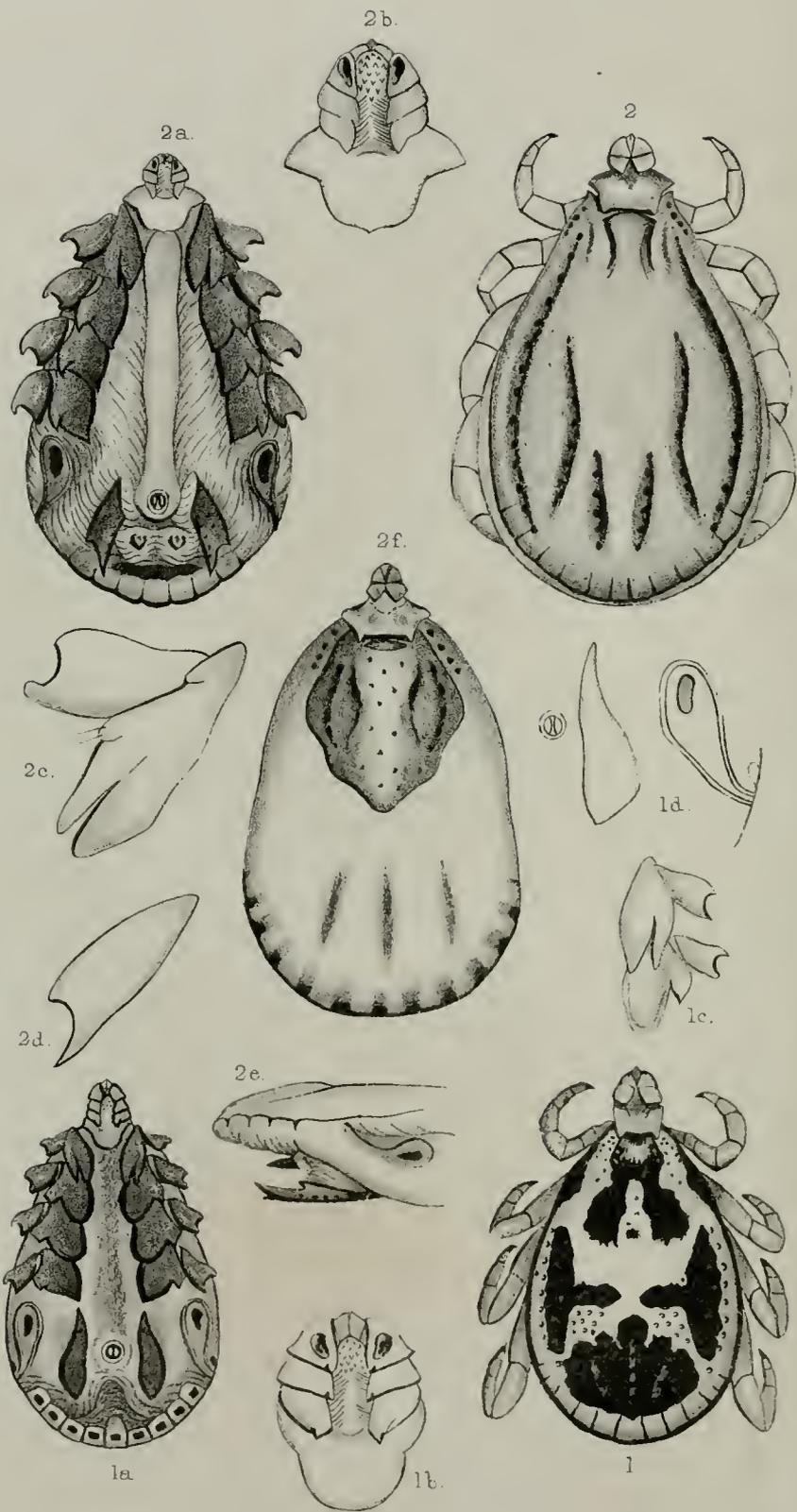


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West, Newman imp

ORTHOPTERA FROM SOMALI-LAND.



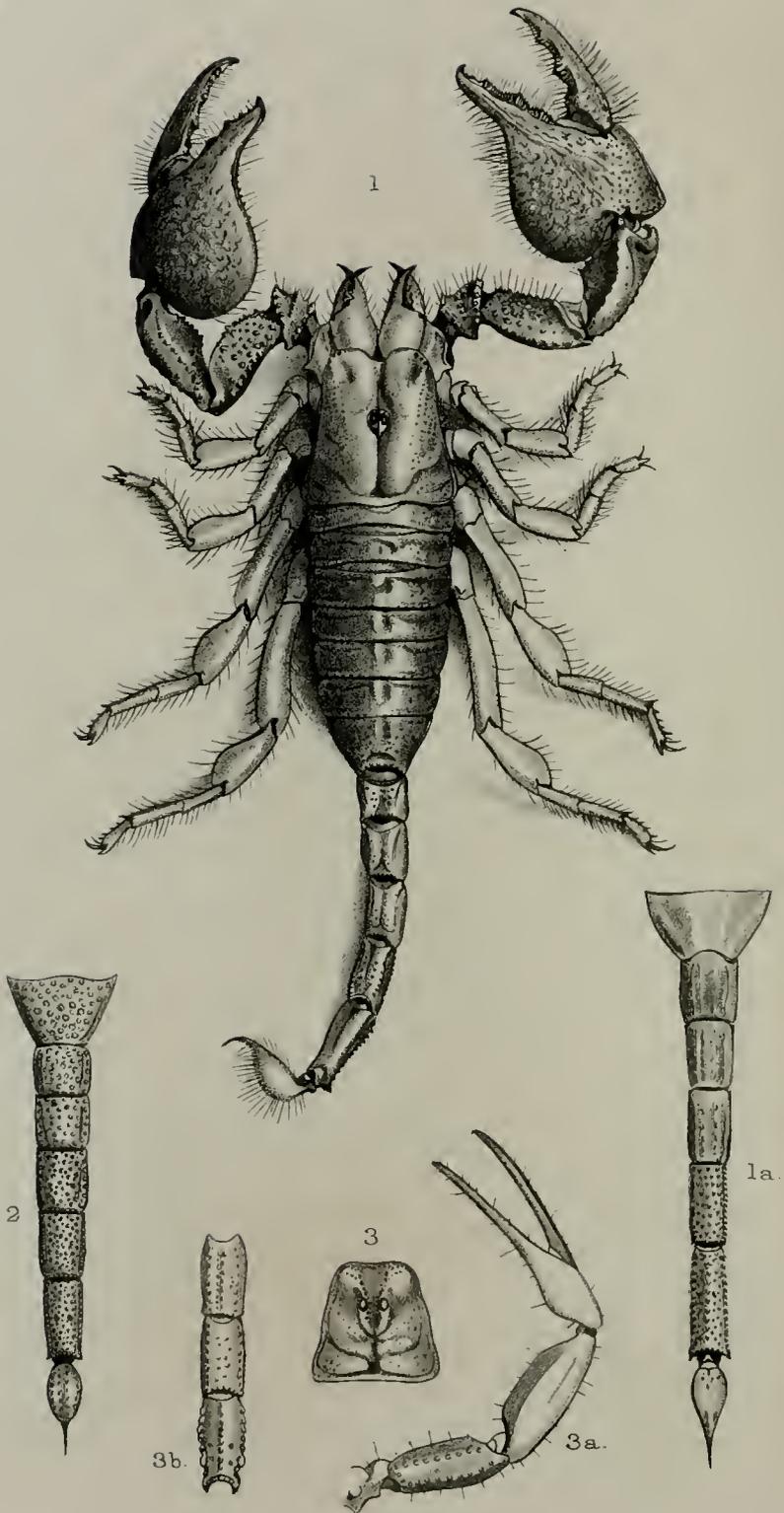


F. O. Pickard-Cambridge del et lith.

West, Newman imp.

TICKS FROM SOMALI-LAND.





F. O. Pickard-Cambridge del. et lith.

West, Newman imp.

SCORPIONS FROM SOMALI-LAND.

- b*³. Last abdominal sternite and lower side of 1st and 2nd caudal segments, and usually also of 3rd, smooth; caudal segments 1-3 keeled below.
- a*⁶. Lower surface of 4th caudal segment coarsely but sparsely granular, the median keels obsolete, the lateral keels strongly denticulate; superior and superior-lateral crests of tail smooth; protarsal segment of 1st and 2nd legs with a single external apical spine *pugilator*.
- b*⁶. Lower surface of 4th caudal segment not uniformly and coarsely granular, furnished with four normal, subequally strong keels; superior and superior-lateral crests of tail denticulated; protarsi of 1st and 2nd legs with at least two external spines..... *militaris*.

EXPLANATION OF THE PLATES.

PLATE I.

Lepidoptera, Coleoptera, &c., from Somaliland.

- | | |
|--|---|
| Fig. 1. <i>Pseudophia oppia</i> , p. 18. | Fig. 9. <i>Genecerus nebulosus</i> , p. 26. |
| 2. <i>Chilena sabrina</i> , p. 20. | 10. <i>Psiloptera somalica</i> , p. 25. |
| 3. <i>Cerocala munda</i> , p. 19. | 11. <i>Agrypnus longicornis</i> , p. 26. |
| 4. <i>Acræa mirabilis</i> , p. 11. | 12. <i>Sepidium magnum</i> , p. 29. |
| 5. <i>Belenois pæli</i> , ♂, p. 15. | 13. <i>Rhytidonota robusta</i> , p. 28. |
| 6. " " ♀, p. 15. | 14. <i>Sepidium bilobatum</i> , p. 30. |
| 7. <i>Pseudophia lineata</i> , p. 19. | 15. <i>Julodis laticollis</i> , p. 25. |
| 8. <i>Pangonia tricolor</i> , p. 7. | 16. <i>Trox expansus</i> , p. 22. |

PLATE II.

Orthoptera from Somaliland.

- Fig. 1. *Rhegmatopoda pæli*, p. 44. Left elytron. ♂.
2. *Otiaphysa angustipennis*, p. 43. Left elytron. ♀.
3. *Sauracris lacerta*, ♂, p. 41.
4. *Charicis pæli*, ♀, p. 37. (Antennæ and apex of abdomen missing.)
5. *Milititsa somaliensis*, p. 43. Right elytron. ♀.
6. *Burria longixipha*, ♀, p. 38.
7. *Milititsa somaliensis*, p. 43. Head and pronotum.

PLATE III.

Ticks from Somaliland.

- Fig. 1. *Rhipicephalus marmoratus*, p. 50. ♂. Dorsal view. ×11 times linear.
- 1 a. " " Ventral view.
- 1 b. " " Capitulum and mouth-parts from below.
- 1 c. " " Coxæ of 1st and 2nd legs.
- 1 d. " " Stigma, adanal plate, and anus of left side.
2. *Rhipicephalus armatus*, p. 50. ♂. Dorsal view. ×11 times linear.
- 2 a. " " Ventral view.
- 2 b. " " Capitulum and mouth-parts from below.
- 2 c. " " Coxa and trochanter of 1st leg.
- 2 d. " " Adanal plate of right side.
- 2 e. " " Lateral view of posterior end of abdomen showing adanal plate, spike above it, and stigma.
- 2 f. " " ♀. Dorsal view.

PLATE IV.

Scorpions from Somaliland.

- Fig. 1. *Pandinus pugilator*, p. 52. Nat. size.
- 1 a. " " Underside of tail.
2. *Pandinus pæli*, p. 53. Underside of tail.
3. *Buthus calviceps*, p. 54. Carapace.
- 3 a. " " Underside of 3rd, 4th, and 5th caudal segments.
- 3 b. " " Chela.

2. On some Remains of *Grypotherium* (*Neomylodon*) *listai* and associated Mammals from a Cavern near Consuelo Cove, Last Hope Inlet, Patagonia. By A. SMITH WOODWARD, LL.D., F.Z.S.

[Received January 23, 1900.]

(Plates V.-IX.)

Last February, when presenting to this Society an account of the skin of a Ground-Sloth discovered in a cavern in Southern Patagonia, Dr. Moreno mentioned that further excavations were being made in the hope of finding other remains of the same animal (P. Z. S. 1899, p. 148). The task referred to was undertaken by Dr. Rudolph Hauthal, geologist of the La Plata Museum, who met with complete success¹. He not only found another piece of skin, but also various broken bones of more than one individual of a large species of Ground-Sloth in a remarkably fresh state of preservation. Moreover, he discovered teeth of an extinct horse and portions of limb-bones of a large feline carnivore, in association with these remains; he likewise met with traces of fire, which clearly occurred in the same deposits as the so-called *Neomylodon*. All these remains were found beneath the dry earth on the floor of an enormous chamber which seemed to have been artificially enclosed by rude walls. In one spot they were scattered through a thick deposit of excrement of some gigantic herbivore, evidently the Ground-Sloth itself; in another spot they were associated with an extensive accumulation of cut hay. Dr. Hauthal and his colleagues, indeed, concluded that the cavern was an old corral in which the Ground-Sloths had been kept and fed by man.

As the result of these explorations, Dr. Moreno has now the gratification of exhibiting to the Society complete proof that the piece of skin described on the former occasion belongs to a genuine Pampean Ground-Sloth, not *Mylodon* itself, but a very closely related genus [*Grypotherium*], of which skulls are already known from Pampean deposits in the Province of Buenos Ayres². The collection which we now have the privilege of examining distinctly supports his contention that the large quadruped in question belongs to an extinct fauna, though contemporary with man. The

¹ R. Hauthal, S. Roth, and R. Lehmann-Nitsche, "El Mamífero Misterioso de la Patagonia, *Grypotherium domesticum*," Revista Mus. La Plata, vol. ix. pp. 409-474, pls. i.-v. (1899).—F. P. Moreno, "Note on the Discovery of *Miotania* and of *Glossotherium* (*Neomylodon*) in Patagonia," Geol. Mag. [4] vol. vi. pp. 385-388 (1899).

² J. Reinhardt, "Beskrivelse af Hovedskallen af et Kampedovendyr, *Grypotherium darwini*, fra La Plata-Landenes plejstocene Dannelser," K. Dansk. Vidensk. Selsk. Skr. [5] vol. xii. (1879), pp. 353-380, pls. i., ii.—H. Burmeister, 'Atlas de la Description physique de la République Argentine,' sect. ii. (1881), p. 119, woodc. (*Mylodon darwini*).—R. Lydekker, "The Extinct Edentates of Argentina," Anales Mus. La Plata—Paleont. Argentina, vol. iii. pt. 2 (1894), p. 85, pl. liv.

discovery is thus unique in the history of palæontology, on account of the remarkably fresh state of preservation of all the remains. Some of the new specimens exhibit no indication whatever of having been buried. Many of the bones retain their original whitish colour, apparently without any loss of gelatine; while both these and other bones, which have evidently been entombed in brownish dust, bear numerous remnants not only of the dried periosteum, but also of shrivelled muscles, ligaments, and cartilages. Very few of the bones are fossilized, in the ordinary sense of the term.

An admirable brief description of this collection has already been published (*op. cit.*) by Dr. Roth, who was the first to recognize the generic identity of *Neomyodon* with *Grypotherium*. Some of the specimens, however, are worthy of a more detailed examination; and Dr. Moreno has kindly entrusted them to me for study in connection with the collections in the British Museum and the Royal College of Surgeons. The following notes, supplementing Dr. Roth's original memoir, are the result of this further investigation.

I. REMAINS OF *GRYPOTHERIUM LISTAI*.

Number of Individuals.

Among the fragmentary bones of the Ground-Sloth, it is easy to recognize evidence of three individuals, which do not differ much in size. There are three distinct examples of the occiput (nos. 1, 2, 3), and fragments of the dentigerous portion of three mandibles. It is also noteworthy that the three malar bones preserved (no. 8) are all different in shape, while three corresponding fragments of the acromial process of the scapula differ in size. One portion of maxilla (no. 5) seems to represent a fourth individual, being probably too small for either of the skulls to which the occiputs belong. Finally, as Dr. Roth has pointed out, one shaft of a humerus (no. 22), which appears to be the bone of an adult, belongs to a much smaller animal than is indicated by any other specimen in the collection.

Remains of three individuals are thus recognizable with certainty; two others can probably be distinguished; while some of the fragments may even belong to a sixth specimen. It must also be noted that other portions of jaws are said to have been discovered by E. Nordenskjöld¹.

Skull and Mandible.

The largest portion of cranium (no. 1) is not stained in any way, and does not retain a trace of the material in which it was buried in any hollow or crevice. It is shown of nearly one-half the natural size, from the right lateral and inferior aspects, in the drawing (Pl. V. figs. 1, 1 a). It does not appear to have been damaged during

¹ R. Hauthal, *op. cit.* p. 4.

excavation, but exhibits fractures which were almost certainly made when the animal was freshly killed. The cranial roof near the occipital region is battered in four places, though the injuries do not affect the brain-case itself; while the right occipital condyle is partly removed by a sharp, clean cut. There can, indeed, be no doubt that the animal was killed and cut to pieces by man.

This skull is evidently that of an adult animal, all the sutures in the hinder region being closed. The inner wall of the temporal fossa is much flattened, without any irregular convexities, but marked with the characteristic reticulately-decussating, fine ridges of bone, and studded with adherent patches of muscle-fibre. The upper border of the fossa is a remarkably sharp edge, while the narrow flattened cranial roof is only marked by a faint longitudinal median furrow and by a diminutive tuft of fibre in a small median pit near the occipital edge¹. The fractures exhibit the very large cancellated chambers surrounding the brain-case dorso-laterally; while a median longitudinal section (Pl. V. fig. 1 b) shows both these cells and others in the basisphenoid. The basi-cranial axis is nearly straight, inclining a little upwards in front. The anterior condyloid foramina (Pl. V. fig. 1 a, f.) piercing the basioccipital are remarkably large, as usual; the basisphenoid (*b.s.*) is very long and narrow, flattened mesially on its lower face, but with one slight median prominence near its hinder end; the presphenoid (*p.s.*) forms a short acute rostrum, above which there are remains of the vomer. The hinder ends of the pterygoids (*pt.*) are shown to be inflated with large cancellæ, but the sides of the base of the skull are somewhat obscured by the dried soft parts. The mastoid process of the petiotic, with its articular facette (*m.*) for the stylohyal, seems to be rather smaller than in *Mylodon*. The tympanic bone (*t.*) is preserved on the right side, though wanting on the left. It is an irregular curved plate only slightly bullate, but forming a complete floor to the tympanic cavity. As usual in Edentata, it is not produced into an auditory meatus.

The right maxilla (no. 4) is in precisely the same state of preservation as the specimen just described, and probably belongs to the same skull. It is shown of nearly one-half the natural size, from the outer aspect, in the drawing (Pl. V. fig. 2). Its anterior margin is perfectly preserved, indicating that the facial region is very short in front of the anterior end of the zygomatic arch, which is pierced by a rather large suborbital canal. Its upper border proves that the nasal region was raised into a slightly convex dome; while its antero-superior angle is not rounded as in *Mylodon*, but curves upwards and forwards and ends in a point as in *Grypotherium*. At the oral border there are the shattered bases of four teeth.

The fragment of the nasal region (no. 13), shown of nearly one-half the natural size, from the right lateral and anterior aspects, in the drawing (Pl. V. figs. 3, 3 a), may also have belonged to the same

¹ See S. Roth, *op. cit.*, pl. ii. fig. 1.

skull, but its state of preservation is a little different from that of the two specimens just described. It has clearly been buried in a powdery deposit, which has stained it brown; but the enveloping dust must have been extremely dry, for fragments of cartilage adhere to it, as well preserved as in the nasal chamber of the cranium itself (no. 1). It also bears traces of the integument.

Judging by the figures of the skull of *Grypotherium* published by Reinhardt (*loc. cit.*), this specimen seems to have occupied the anterior position in the nasal region represented in Pl. V. fig. 3. It is thus of great interest, because the three known skulls of *Grypotherium* leave the precise nature of the bony arcade separating the narial openings undecided. According to Reinhardt, the nasal bones terminate as in *Myloodon*, and the arcade is an element interposed between them and the premaxillæ. According to Burmeister, the nasals themselves extend forwards and constitute the greater part, if not the whole, of the problematical bar. The fragment now under consideration is clearly in favour of the latter interpretation. Its lower thickened end (*a*) is a massive bone, not bilaterally symmetrical, and not showing any trace of a median suture. Its inferior face is irregular and roughened, and can scarcely be regarded as an articular facette. Its upper portion consists of a pair of bones (*na.*), separated by a very well-marked median longitudinal suture. These are not thickened at their contracted upper end, where they have evidently been broken, and are not quite bilaterally symmetrical. They doubtless fuse at their lower end with the problematical azygous bone already mentioned, but the arrangement is obscured by the enveloping soft parts. A pair of bones, which may be regarded as nasals, thus extend forwards in a narrow arch to a point just above the anterior end of the premaxillæ; while the massive bone effecting a union between the two normal pairs of elements is probably an ossification in the internasal septum. It is interesting to note that there is an incipient trace of a similar forward production of the nasals in the genus *Scelidothorium*; while there is sometimes an ossification of the internasal septum in *Megatherium*¹.

The three specimens now described, when placed approximately in their natural positions, as in the drawing (Pl. V. figs. 1-3), afford a very satisfactory idea of the form and proportions of the skull when complete. The malar bone is the only important part to be added; but unfortunately it is impossible to decide which of the three specimens of this element in the collection belongs to the individual now under consideration. As already mentioned, these three bones are all different in the shape and proportions of the hinder bifurcated end. They are all very fresh in appearance, but have been stained reddish brown by the earth in which they must have been buried. The best example, from the right side, is shown of one-half the natural size in the drawing (Pl. VI. fig. 1). One

¹ R. Lydekker, *Anales Mus. La Plata—Paleont. Argentina*, vol. iii. pt. 2 (1894), p. 73, pl. xlv. fig. 1.

of the other specimens is less deep at its hinder fork and has a more slender descending process.

The hinder portion of the second skull already mentioned (no. 2) comprises the occiput and brain-case as far forward as the front of the cerebral hemispheres. It is much battered and broken, and in quite as fresh a state as the cranium already described, with a considerable investment of dried soft parts on its base. It is only very slightly smaller than no. 1, but is of interest as exhibiting some of the sutures, besides a roundness and smoothness indicative of immaturity. The supraoccipital is shown to be very large; a small median point of it enters the foramen magnum, while the suture separating it from the parietals and squamosals extends along the rounded lambdoidal ridge. The horizontally-extended suture between the squamosal and parietal on the inner wall of the temporal fossa is seen in the position where Owen determined it to occur in *Mylogdon*¹. Both tympanics are preserved, but they are more obscured by soft parts than in no. 1.

To this cranium probably belongs a detached portion of the left side of the facial region (no. 5), in a similar state of preservation and slightly smaller than the maxilla no. 4 (Pl. V. fig. 2). The suture between the frontal and the maxilla still persists, while the oral border is preserved further forward than in the last-mentioned specimen, showing a fragment of the much-reduced premaxilla united with the maxilla by a jagged suture.

The third imperfect occiput, comprised among the fragments numbered 3, is about as large as the immature specimen no. 2, but does not exhibit any features worthy of special note.

The largest and most important portions of the mandible are nos. 9 and 11, which evidently belong to the right and left rami of one and the same jaw. They are much broken and are in the same fresh condition as the skulls, with traces of the periosteum and even considerable portions of the soft parts of the gum. The right ramus (Pl. VI. fig. 2) is preserved sufficiently far forwards to show that there was no caniniform tooth in front of the series of four ordinary molars. Judging by the extent of the latter series, the specimen probably belongs to the same individual as the skull no. 1.

Another portion of a mandibular ramus (no. 10) of the left side is slightly smaller than the last and may well have belonged to the immature individual no. 2. It is similarly quite fresh in appearance, and bears the shrivelled remains of the gum. It is interesting as exhibiting the two posterior molars slightly different in shape from those of the former mandible. In this specimen (Pl. VI. fig. 3) the longer axis of the third molar is oblique, whereas in no. 9 (Plate VI. fig. 2*a*) it is coincident with the axis of the mandible; while in the former the fourth molar is not so long in proportion to its width as in the latter. Such slight differences,

¹ R. Owen, 'Description of the Skeleton of an Extinct Gigantic Sloth, *Mylogdon robustus*, Owen' (1842), p. 18.

however, cannot be regarded in the Edentata as more than individual variations.

Brain-cavity and Cerebral Nerves.

By the kind permission of Dr. Moreno, the cranium no. 1 has been vertically bisected to display the character of the cranial cavity and the nerve-foramina. An instructive plaster cast of the cavity (shown of one-half the natural size in Pl. VII.) has thus been made by Mr. C. Barlow, the Formatore of the British Museum.

The olfactory lobes (*ol.*) are shown to have been well-developed, projecting a little in front of the cerebral hemispheres (*c.*). These hemispheres are together somewhat longer than broad, slightly broader behind than in front, and a little constricted in the middle. They do not overlap the cerebellum (*cb.*), which is relatively large. The origins of the nerves (fig. 1 *b*) are very imperfectly shown in the cast; only their exits from the cranial cavity are clear. The most interesting are the optic (II.) and trigeminal (V.) nerves, which pass out of the cranial cavity at first by a common exit, which is soon subdivided by a bony partition into two canals, the former no less than 0.08 m., the latter 0.045 m. in length. The fourth (IV.), seventh (VII.), eighth (VIII.), and twelfth (XII.) nerves are also recognizable on the cast; and one prominence of plaster (*f.*) has filled the foramen lacerum posterius.

Compared with the brains of *Myiodon* and *Scelidothorium*, so far as known from casts of the cranial cavity¹, that of *Grypotherium* is observed to be more elongated, with less divergent and prominent olfactory lobes, less constricted cerebral hemispheres, and a larger cerebellum. In the form and proportions of the cerebrum and cerebellum, it similarly differs from *Megatherium*². The cerebral hemispheres of the existing *Choloepus didactylus* and *Bradypus tridactylus*³ are more tapering forward, and their cerebellum is relatively smaller than in *Grypotherium*.

Auditory Ossicles.

The auditory ossicles were preserved in the tympanic cavities of both skulls, nos. 1 and 2, being retained by the dried soft parts. They were detected by Prof. Charles Stewart, who kindly extracted them, with great skill, from both sides of each skull. The series of the right side of the first specimen is shown of twice the natural size in the drawing (Pl. VI. fig. 4). Comparing these ossicles with the fine collection in the Royal College of Surgeons, they prove to be closely similar to those of all the existing Sloths, but most nearly resembling those of *Choloepus didactylus*. The malleus (*m.*) is bent exactly as in the latter species, and is of similar shape. As observed by Prof. Stewart, it is remarkable in articulating with the incus not

¹ P. Gervais, "Mémoire sur les Formes Cérébrales propres aux Édentés vivants et fossiles," *Nouv. Arch. Mus.* vol. xv. (1869), p. 39, pl. iv. figs. 1, 2.

² P. Gervais, *loc. cit.* p. 39, pl. v.

³ P. Gervais, *loc. cit.* p. 38, pl. iv. figs. 3, 4.

only by the head, but also by a diminutive lower facette, which is in contact with a small faceted process (*x*) on the anterior arm of the incus. A feeble indication of the same secondary articulation is also observable in *Cholæpus*; but it is curiously absent in the second specimen of *Gryppotherium*. The two divergent arms of the incus (*i.*) are equal in length, as usual in the Sloths. The stapes (*s.*) is only very slightly perforated in both specimens; while a small circular disc firmly fixed to the incus represents the orbicular bone in the second skull. The auditory ossicles of *Gryppotherium*, therefore, are very different from those of *Myrmecophaga*, in which the malleus is less sharply bent, the incus has divergent arms of unequal length, and the stapes exhibits a large perforation¹.

Vertebræ and Limb-bones.

Nearly all the remains of vertebræ and limb-bones are in the same state of preservation as the portions of skull and mandible already described, with adherent cartilage and traces of muscles and ligaments. With some of the ungual phalanges there are also well-preserved examples of the epidermal sheath. The best of the latter, probably belonging to the fourth digit of the manus, is shown of two-thirds the natural size in the drawing (Pl. IX. figs. 1, 1*a*). As already remarked by Roth, its edges are quite sharp, and indicate that if the animal walked on its fore feet it resembled *Myrmecophaga* in the peculiar twist of the manus.

All the specimens in this series seem to have been accurately determined and sufficiently described by Roth. It is only necessary to emphasize the fact that the two shafts of humerus with abraded, not sharply-broken, ends have a much more fossilized appearance than any other specimen in the collection, and are deeply stained throughout by ferruginous matter. The small shaft, no. 22, certainly seems to have belonged to an adult animal, as remarked by Roth, and it was probably much smaller than any individual indicated by the other remains.

Skin and Hair.

The new piece of skin, which is stated by Hauthal to have been found in the deposit of excrement, is not quite so well preserved as the original piece. It is much folded in an irregular manner; and the hair, which is yellower than in the previous specimen, is preserved only in patches on the outer face. It must have been stripped from the body of the animal by man; but the only distinct marks of tools, which were evidently made when the skin was fresh, are a few indents and small pits on the outer face. The indents must have been made by oblique thrusts of a stick, or a small, blunt, chisel-shaped instrument, and are well shown in Roth's photograph (*loc. cit.*) on the portion marked *d*, *e*. The small pittings are

¹ J. Hyrtl, 'Vergleichend-anatomische Untersuchungen über das innere Gehörorgan des Menschen und der Säugethiere' (1845), p. 135, pl. v. fig. 6.

nearer the middle of the specimen and less conspicuous. A vacuity in the skin seems to be due to accidental tearing or to a thrust after it was dry: it may even have been caused by the fallen blocks of stone found lying upon it.

The specimen, as preserved, measures about a metre across in one direction by 93 centimetres in another direction. As already observed by Roth, its irregular folding makes the determination of its position on the trunk very difficult; but I am convinced that its state of preservation is not sufficiently good to justify an attempt to unfold the skin by the ordinary method of steaming. Taking all facts into consideration, Roth seems to be correct in ascribing it to the right flank and the postero-superior part of one of the limbs. It most probably belongs to the fore limb, as Roth supposes; but there is no clear proof that it is not referable to the hind-quarters. The direction of the comparatively short hair of the flank determines the anterior and posterior borders of the specimen to be those respectively marked *f, b, g, i* and *e, d, h, k* in Roth's photograph. The border marked *f, a, e* is thus directly antero-posterior, parallel with the median longitudinal line of the back; while the piece bounded by the letters *g, i, c, k, h*, with comparatively long hair, which is inclined chiefly towards a median vertical line, but also slightly downwards, can only be referred to the posterior face of a limb.

The original situation of the piece of skin being thus determined, it is interesting to observe the disposition of the ossicles in the lower layer. Owing to abrasion, contraction, and partial disintegration, they are conspicuous in most parts of the specimen. They are very irregular in shape and size, and closely compacted together, as in the previous specimen. It is, however, to be noted that in some parts (Pl. VIII. fig. 1) there is a distinct tendency to arrangement in regular, straight, parallel rows. The long axes of the elongated ossicles are nearly always coincident with the direction of these rows. They are especially well shown on the middle of the flank, from which the drawing is taken; and, as might be expected, the rows are here disposed vertically, parallel with the ribs.

In some parts of the skin the ossicles are exposed on their outer face; but appearances render it almost certain that this exposure is due to the disintegration and abrasion of the specimen. In one patch (Pl. VIII. fig. 2) thus uncovered by the removal of the soft parts, the ossicles are seen to form a closely-arranged, flattened pavement; and their outer face is much more conspicuously marked by pittings than that of any ossicle extracted from the first discovered piece of skin. In fact, as Roth remarks, the pitting is here quite similar to that observable on many ossicles dug up in association with the fossil skeletons of *Myiodon*; though it does not form so regular a reticulate pattern as that of the dermal ossicles of *Myiodon* in the British Museum figured on the former occasion¹.

¹ P. Z. S. 1899, pl. xv. figs. 4-6.

Another interesting feature of the new piece of skin consists in the dwindling and even total absence of the ossicles towards the ventral border. A section along the edge marked *d* in Roth's photograph exhibits only two diminutive nodules of bone in a length of 0.1 m.; while another similar section taken vertically from the skin of the limb near *k* shows no trace of ossicles, except perhaps two little specks. It must, however, be noted that the limb was not entirely destitute of armour; for on the border marked *g*, *i*, the bones are as well developed and conspicuous as on the middle of the flank. In the newly-cut sections the skin has a translucent aspect, showing that it is merely dried and not tanned in any way.

The hair on the new specimen varies in length from 0.07 m. or 0.10 m. at *b* to 0.15 m. or 0.22 m. on the limb. It is thus longer than that of the previous piece of skin. Masses of still longer hairs—some 0.30 m. in length—were found detached among the excrement, and these are also believed by Roth to belong to the same animal. His determination is probably correct; for, when examined microscopically, these long hairs are observed to have a perfectly smooth cuticle, while some transverse sections (kindly made by Mr. R. H. Burne) demonstrate the complete absence of a medulla, exactly as in the short hairs. The latter feature proves that they cannot be referred either to the horse or to the guanaco.

Excrement.

The large cylindrical pieces of excrement, which may be referred to *Grypotherium* without any hesitation, have already been described and figured by Dr. Roth. They consist of irregular discoids of herbaceous matter closely pressed together, the largest measuring no less than 0.18 m. in diameter. Mr. Spencer Moore has kindly examined them from the botanist's point of view and reports that they are composed "in large part apparently of grasses, as the haulms, leaf-sheaths, fragments of leaves, &c. of these plants are frequent in the mass. A spikelet, almost entire, of what seems to be a species of *Poa*, and the flowering glume of another grass, probably avenaceous, have also been found. Besides these there are at least two dicotyledonous plants, one herbaceous and the other almost certainly so, the latter having a slender greatly sclerotized stem. Unfortunately, as no leaves have hitherto been observed attached to the fragments of stem, their affinities are altogether doubtful. There are numerous siliceous particles in the excrement, and there are many pieces of the underground parts of the plants, suggesting that they have been pulled out of the ground. A few pieces of stems are sharply cut, not bruised or torn at the end." The latter fact is especially important in connection with Dr. Hauthal's discovery of cut hay in the cavern, and his theory that the *Grypotherium* was kept in captivity and fed by man.

Generic and Specific Determination.

The fortunate discovery of all parts of the skull and dentition renders the generic determination of this Ground-Sloth now quite certain. The teeth show that it belongs to the family Mylodontidæ; the presence of only four instead of five upper molars separates it from the genera *Myodon*, *Lestodon*, and *Scelidotherium*; the forward production of the nasals and the ossification of part of the internarial septum place it definitely in the allied genus *Grypotherium*, as originally diagnosed by Reinhardt. The only question needing consideration is, whether the fragment of cranium described by Owen in 1840 as the type of the genus *Glossotherium*¹ is really identical with that subsequently described by Reinhardt under the name of *Grypotherium darwini*, as now seems to be commonly believed.

Darwin's original specimen, on which the genus *Glossotherium* of Owen was founded, is preserved in the Museum of the Royal College of Surgeons. It has thus been possible to compare it directly with the undoubted cranium of *Grypotherium* from the Patagonian cavern. The specimen is merely the left half of the hinder part of the cranium, and is therefore very inadequate for discussion; but several features seem worthy of note. Compared with the new skull no. 1, the fragment named *Glossotherium* has (i.) the inner wall of the temporal fossa less flattened, (ii.) the digastric fossa deeper in proportion to its width, (iii.) the hinder border of the inflated pterygoid vertical, instead of sloping downwards and forwards, (iv.) a much larger and deeper pit for the articulation of the stylohyal, and (v.) a longer canal penetrating the base of the occipital condyle for the passage of the hypoglossal nerve. In all these respects the so-called *Glossotherium* agrees much more closely with the typical *Myodon*; and Owen was probably correct in 1842 when he expressed the opinion that the two are at least generically identical².

I am therefore of opinion that *Grypotherium* is the correct generic name for the Ground-Sloth from the Patagonian cavern, while *Glossotherium* must be relegated to the synonymy of *Myodon*.

The specific determination of the new specimens is more difficult. As remarked by Roth, only two species of *Grypotherium* seem to be already known from the Pampa formation—*G. darwini* by three skulls³ and *G. bonaerense* solely by a maxilla⁴. The portions of skull and dentition now under discussion indicate an animal much larger than *G. bonaerense* (assuming the original maxilla to be that of an adult); while they are considerably

¹ R. Owen, 'The Zoology of the Voyage of H.M.S. Beagle.—Part I. Fossil Mammalia' (1840), p. 57, pl. xvi.

² R. Owen, 'Description of the Skeleton of an Extinct Gigantic Sloth, *Myodon robustus*, Owen' (1842), p. 154, footnote.

³ Described respectively by Reinhardt, Burmeister, and Lydekker, *loc. cit.*

⁴ F. Ameghino, 'Contribucion al Conocimiento de los Mamiferos de la Republica Argentina' (1889), p. 738, pl. xlv. fig. 8.

smaller than any known specimen of *G. darwini*. Moreover, the nasal arcade now described is narrower and more concave on its outer face than that of *G. darwini*, as already observed by Roth. It thus seems very probable that the animal from the Patagonian cavern represents a distinct species, which must bear the name of *G. listai*. This specific name was given by Ameghino to a fragment of the first-discovered piece of skin, and the curious argument which leads Roth to propose the substitution of a new name for it does not affect its validity.

It may be added that Dr. Erland Nordenskjöld has recently compared his specimens from the Patagonian cavern with the skull of *Grypotherium darwini* at Copenhagen, and finds no specific difference¹. No particulars, however, have yet been published.

II. ASSOCIATED MAMMALIAN REMAINS.

Felis, sp.

A feline carnivore larger than the existing Jaguar (*Felis onça*), but about the same size as an average Tiger (*F. tigris*), is represented in the collection by the distal half of a right humerus (no. 44), a left fourth metatarsal (no. 46), and the distal end of another metatarsal (no. 47). These bones have evidently been buried in dust, but are in the same fresh state of preservation as those of *Grypotherium*. They have been well described by Roth, but the new figures of the humerus here given (Pl. IX. figs. 2, 2a) will serve to illustrate his description better than the reduced photograph already published.

Careful comparison of these bones shows that they are undoubtedly feline; and there is no difficulty in determining that they belong to *Felis* rather than to the extinct *Machærodus*. A humerus of *M. neogæus*, from a Brazilian cavern, now in the British Museum (no. 18972b), is readily distinguished from the new Patagonian humerus by the remarkable lateral compression of its shaft and the much greater downward extension of its prominent and sharp deltoid ridge. The humerus in all the large species of *Felis*, on the other hand, only differs from the fossil now under discussion in very small particulars. In fact, the humerus and metatarsals of the existing *Felis onça* are essentially identical with the bones from the Patagonian cavern, except that they are rather smaller. I am therefore inclined to regard the newly-discovered remains as indicating a comparatively large variety of *F. onça*, which once lived in the temperate regions of Patagonia, beyond the present range of this species. Such an occurrence would be a precise parallel to that of the Cave-Lion in Europe. It is well-known that nearly all the remains of *Felis leo* found in

¹ E. Nordenskjöld, "La Grotte du *Glossotherium* (*Neomyiodon*) en Patagonie," *Comptes Rendus*, vol. cxxix. (1899), p. 1217.

the Pleistocene formations of the temperate parts of the Old World indicate animals of somewhat larger size than any surviving in the warmer regions to which the species is now confined¹.

It may be noted that bones of the Jaguar of ordinary dimensions have been recorded from the Pampa formation of the Province of Buenos Ayres².

Arctotherium, sp.

With the bones of *Felis* just noticed, Roth provisionally associates the imperfect distal end of a remarkably large right femur (no. 45). He is thus induced to suppose that the carnivore represented by the fragments will prove to be a new genus and species of the Felidæ. He suggests for it the name of *Iemisch listai*, on the assumption that it is the mysterious quadruped which Ameghino states is known to the natives as the Iemisch.

A comparison of the distal end of femur in question with the femora of Felidæ in the British Museum seems to prove conclusively that it cannot be referred even to the same family. Its width across the condyles is much greater, compared with its antero-posterior diameter, than that observed in any feline. Moreover, the pit for the tendon of the popliteus muscle below the external condyle is unusually deep. In both these respects the bone closely resembles the distal end of the femur of a Bear. I have been therefore led to compare it with the corresponding part of the extinct Bear of the Pampean formation, *Arctotherium*.

Fortunately, the fine and nearly complete skeleton of *Arctotherium bonaerense* in the Bravard Collection in the British Museum comprises the right femur and enables direct comparison to be made. The fragment (Pl. IX. figs. 3, 3a) lacks the inner condyle; but enough of the trochlea remains to show its broad and gently-rounded form, with a wide and deep intertrochlear notch, precisely as in *Arctotherium*. It has the same development of the external condyle as in the latter, while the fossa for the popliteal tendon is equally deep, only slightly differing in shape. In fact, there is very little discrepancy, except in its smaller size; and species of *Arctotherium* smaller than *A. bonaerense* are already known both from the Pampa formation of Argentina³ and the caverns of Brazil⁴.

The fragment just described has evidently been severed from the rest of the bone by a sharp, clean cut made by man; and Dr. Hauthal is quite certain that this was not done by one of his workmen during excavation (*op. cit.* p. 59). At least one medium-

¹ Dawkins & Sanford, "The British Pleistocene Mammalia" (Palæont. Soc. 1869), p. 150.

² F. Ameghino, 'Contribucion al Conocimiento de los Mamiferos de la Republica Argentina' (1889), p. 342.

³ F. Ameghino, *op. cit.* (1889), p. 317.

⁴ H. Winge, "Jordfundne og nulevende Rovdyr (Carnivora) fra Lagon Santa, Minas Geraes, Brasilien" (Æ Museo Lundii, 1895), p. 31.

sized species of *Arctotherium* must therefore have survived until the human period in Southern Patagonia¹.

Onohippidium saldiasi.

A horse is represented in the collection by an upper molar (no. 55), a fragment of premaxilla with two incisors (no. 56), an imperfect atlas (no. 57), and two well-preserved hoofs apparently of a fœtus or perhaps of a newly-born animal (no. 58). Of these remains only the upper molar is capable of satisfactory determination.

This tooth is the second upper molar of the left side, and has been exhaustively compared with corresponding teeth by Dr. Roth, who gives a good series of figures. It is readily distinguished from the homologous molar in the genus *Equus* by the peculiar form of its two inner columns—a fact which I have been able to verify by the examination of an extensive series of specimens, both recent and fossil, in the British Museum. Further comparison, indeed, shows that it must be referred to the extinct Pampean genus *Onohippidium*². Dr. Roth assigns it, apparently quite rightly, to the same species as a maxilla from the Pampean formation of the Province of Buenos Ayres, for which he proposes the name of *Onohippidium saldiasi*.

Large Extinct Rodent.

The proximal end of the femur of a large rodent (no. 52) has already been recognized by Roth, and compared with the extinct *Megamys*. It cannot be more exactly determined.

Existing Species.

One imperfect fragment of pelvis and sacrum (no. 48) seems to belong to a puma (*Felis concolor*) of rather large size; but it is not sufficient for precise determination.

The small mandibular ramus of a musteline (no. 51) referred by Dr. Roth to *Mephitis suffocans* does not pertain to this genus and species. Mr. Oldfield Thomas determines it to belong to the rare *Lyncodon patagonicus*, which still lives in Patagonia and has not hitherto been found fossil. A slightly larger extinct species of the same genus has been described by Ameghino on the evidence of a skull from the Pampean formation near Luján, in the Province of Buenos Ayres³.

A cranium, some vertebræ, and a tibia and fibula (nos. 53, 54) appear to represent the existing *Ctenomys magellanicus*, as noted by Roth.

¹ Dr. Moreno has lately received reports of bear-like tracks in remote parts of the Cordillera, which he thinks may imply that a species of *Arctotherium* still lives in Patagonia.

² F. P. Moreno, *Revista Mus. La Plata*, vol. ii. (1891), p. 65; R. Lydekker, *Anales Mus. La Plata—Paleont. Argentina*, vol. ii. pt. 3 (1893), p. 77, pl. xxix.

³ F. Ameghino, *op. cit.* (1889), p. 324.

The remains of the Guanaco (*Lama huanacos*) do not present any features worthy of special remark.

Man is represented by a diseased scapula (no. 111), and by two bone awls (nos. 49, 50), which are clearly made from the tibia of a species of *Canis* intermediate in size between *C. jubatus* and *C. magellanicus*.

III. RELATIVE AGE OF THE REMAINS.

As the result of Dr. Roth's researches, supplemented by the additional observations now recorded, it is evident that the majority of the mammalian remains from the cavern near Last Hope Inlet belong to the extinct fauna which occurs in the Pampean formation of more northern regions. To this category are referable the genera *Grypotherium*, *Onohippidium*, *Megamys*, and *Arctotherium*; also *Macrauchenia*, which is said to have been discovered in the same deposit on the floor of the cave by Dr. E. Nordenskjöld. The large *Felis* likewise probably belongs to the same series. Remains of mammals of the existing fauna, on the other hand, are comparatively few and insignificant, referable to the genera *Ctenomys*, *Cervus*, *Lama*, *Lynxodon*, and *Felis*.

Although Dr. Hauthal's explorations were rather hurried and Dr. Nordenskjöld's results have only been published hitherto in abstract¹, their account of the deposits on the floor of the cavern seem to confirm the suspicion that the remains of these two faunas were introduced at two successive periods. According to Hauthal, the remains of the Guanaco were found along with fragmentary bones of Deer, shells of *Mytilus chorus*, branches of trees, and dried leaves, in the superficial dust of the cavern near the outer wall. The skin of *Grypotherium* and all the other remains of this and the associated Pampean genera were discovered in the deeper layer of excrement and cut hay between the mound and the inner wall of the cavern. According to Nordenskjöld, three distinct strata can be recognized on the floor of the cavern as follows:—

- A. A thin surface layer, containing ashes, shells, and bones of recent animals broken by man.
- B. A middle layer, containing numerous branches of trees and dried leaves, with remains of *Lama* and the extinct horse, *Onohippidium*. Said to be probably the stratum in which the original piece of skin was found.
- C. A bottom layer, usually about a metre in thickness, without any traces of branches or leaves, but only dried herbs. Remains of *Grypotherium* numerous and confined to this stratum, associated with its excrement and hair, also with remains of a large variety of *Felis onça*, *Macrauchenia*, and *Onohippidium*.

It is unfortunate that the question of the contemporaneity of the various bones cannot be tested by the ingenious method of chemical analysis which has been applied with success to similar problems by M. Adolphe Carnot in France. The French chemist

¹ E. Nordenskjöld, "La Grotte du *Glossotherium* (*Neomyiodon*) en Patagonie," *Comptes Rendus*, vol. **cxix**. (1899), pp. 1216, 1217.

has shown that when bones are buried in ordinary sediments they undergo changes which gradually cause the percentage of contained fluorine to increase. According to him, the longer a bone has been buried, the greater is the percentage of fluorine found in it on analysis. In one case¹ he examined the scapula of a deer and a human tibia, discovered together in fluviatile sand near Billancourt (Seine); he found that the former had 7 or 8 times its usual percentage of fluorine, while the human bone did not differ in any respect from the normal in this constituent. He therefore concluded that the latter bone was not of the same age as the former, but had been introduced comparatively recently by burial. In this and the other recorded cases, however, it is to be observed that the sediment was of a uniform character and admitted of free percolation of water. In the Patagonian cavern, on the contrary, the bones occur partly in dust, partly in dried herbage, partly in dried excrement, and partly in the burnt residue of the same. Moreover, they must always have been subjected to intense dryness, and the usual process of chemical alteration cannot have taken place.

Considering all circumstances, I think that, even without chemical evidence, zoologists and geologists cannot fail now to agree with Dr. Moreno and his colleagues of the La Plata Museum, that the remarkably preserved *Grypotherium* from the Patagonian cavern belongs to the extinct Pampean fauna of South America and need not be searched for in the unexplored wilds of that continent. If we accept the confirmatory evidence afforded by Mr. Spencer Moore, we can also hardly refuse to believe that this great Ground-Sloth was actually kept and fed by an early race of man.

EXPLANATION OF THE PLATES.

PLATE V.

- Fig. 1. *Grypotherium listai*; hinder portion of cranium, right lateral and inferior (1 *a*) aspects, and in median longitudinal section (1 *b*), nearly one-half nat. size. *b.s.*, basisphenoid; *f.*, anterior condyloid foramen; *m.*, facette for stylohyal; *p.s.*, presphenoid; *pt.*, pterygoid; *t.*, tympanic.
2. Ditto; portion of right facial region, nearly one-half nat. size.
3. Ditto; anterior portion of nasal arcade, right lateral and anterior (3 *a*) aspects, nearly one-half nat. size. *na.*, nasal bones; *x*, ossification in internasal septum.

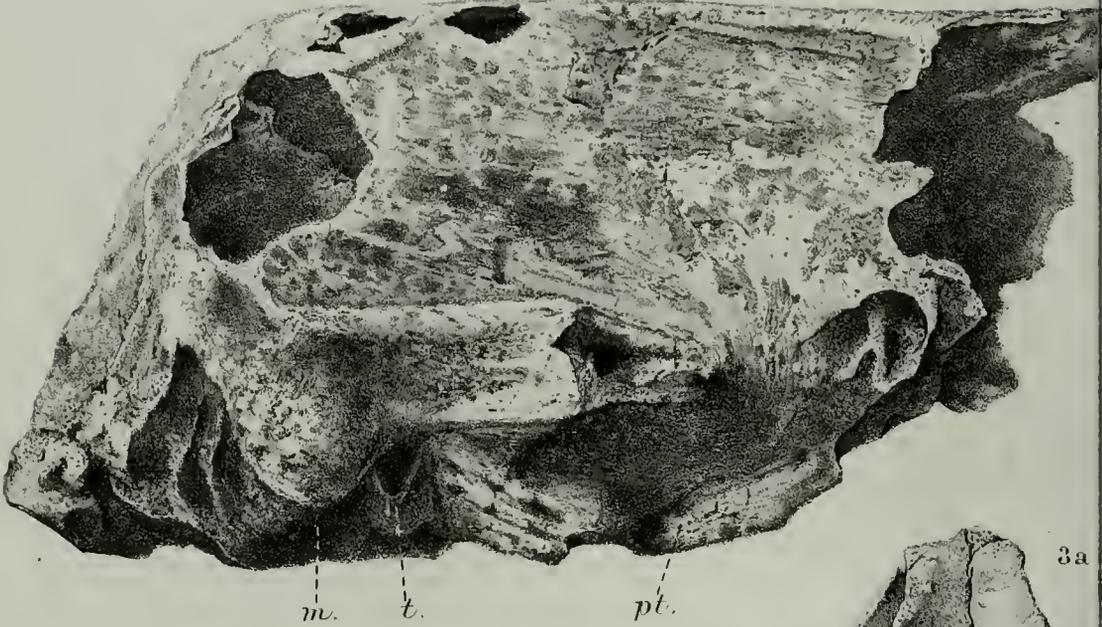
PLATE VI.

- Fig. 1. *Grypotherium listai*; right malar bone, outer aspect, one-half nat. size.
2. Ditto; portion of right mandibular ramus, inner aspect, and dentition of left ramus, oral aspect (2 *a*), one-half nat. size.
3. Ditto; dentition of another left mandibular ramus, oral aspect, one-half nat. size.
4. Ditto; auditory ossicles of right side of skull no. 1, twice nat. size. *i.*, incus, inside view; *m.*, malleus, outside view; *s.*, stapes, outside view; *x*, facette.
- 4 *a*. Ditto; incus of left side of skull no. 2, inside view, twice nat. size, showing orbicular bone (*o.*) attached.

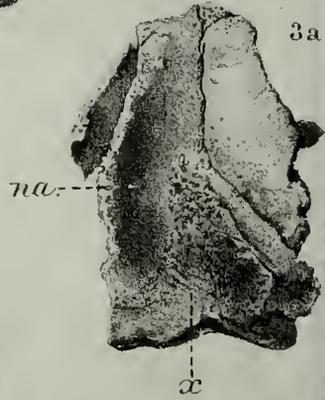
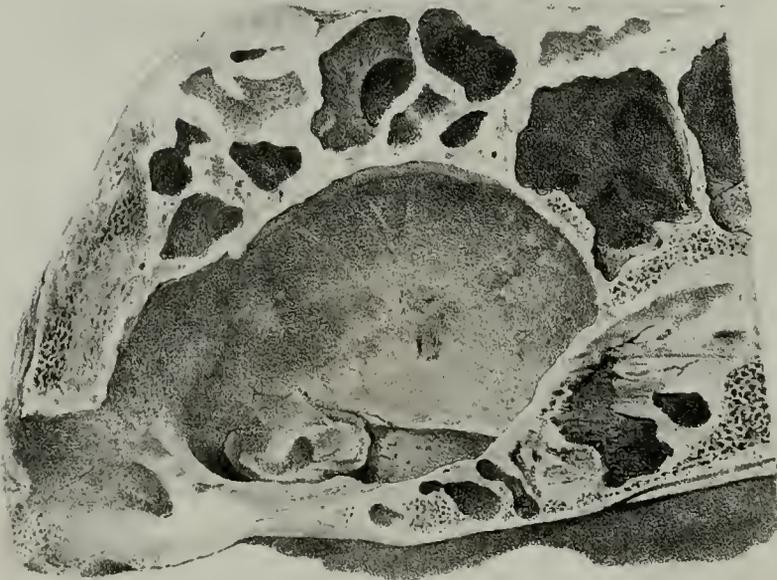
¹ A. Carnot, "Sur une Application de l'Analyse chimique pour fixer l'Age d'Ossements humains préhistoriques," *Comptes Rendus*, vol. cxv. (1892), pp. 337-339.



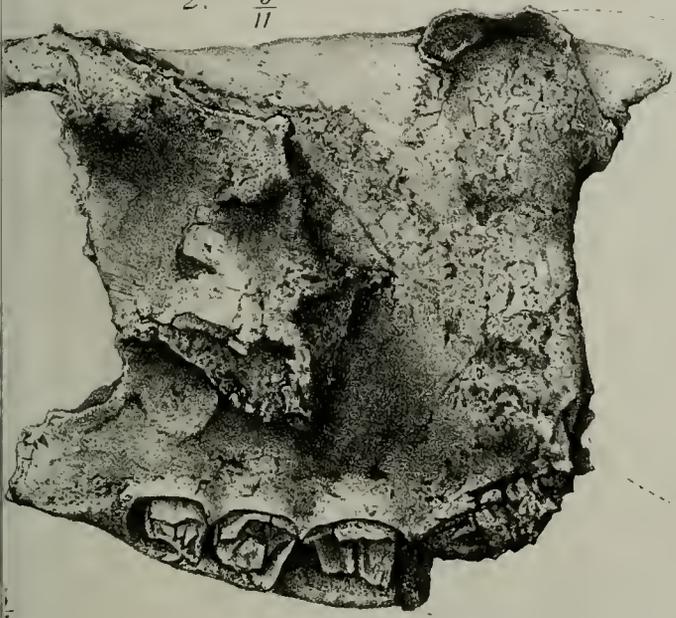
1. $\frac{5}{11}$



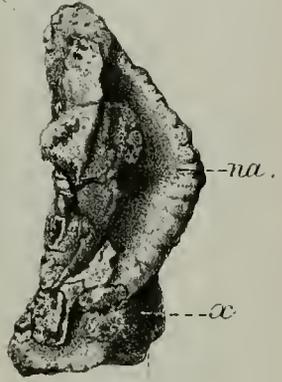
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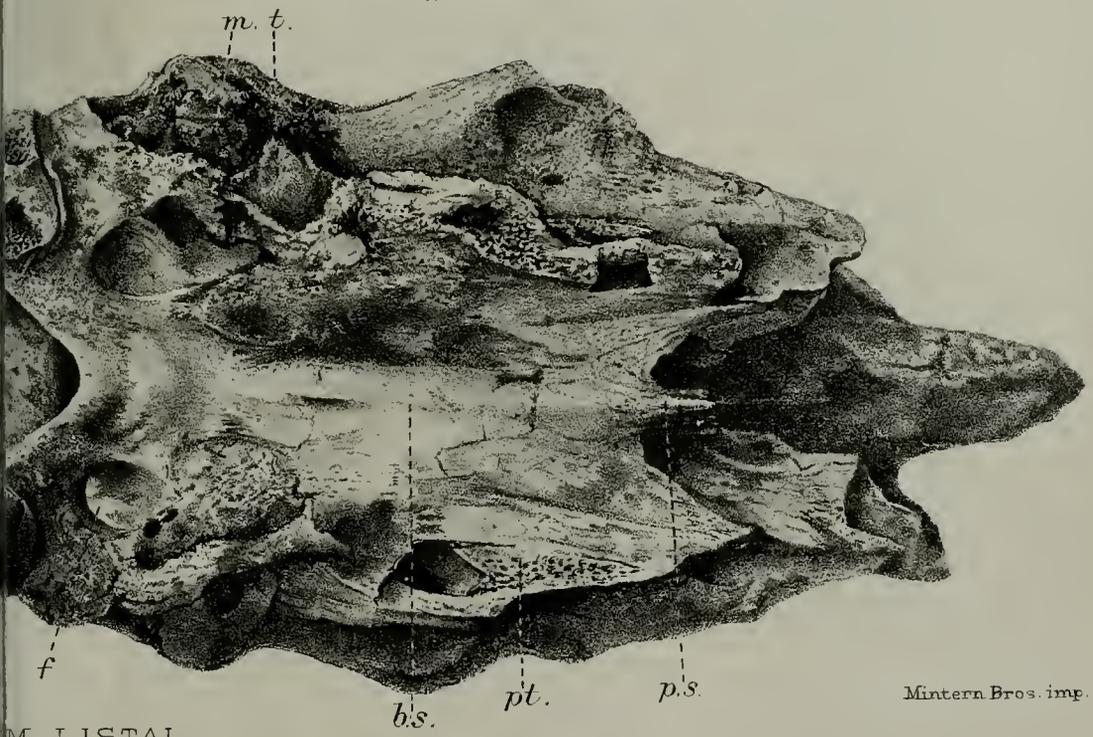
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3. $\frac{5}{11}$

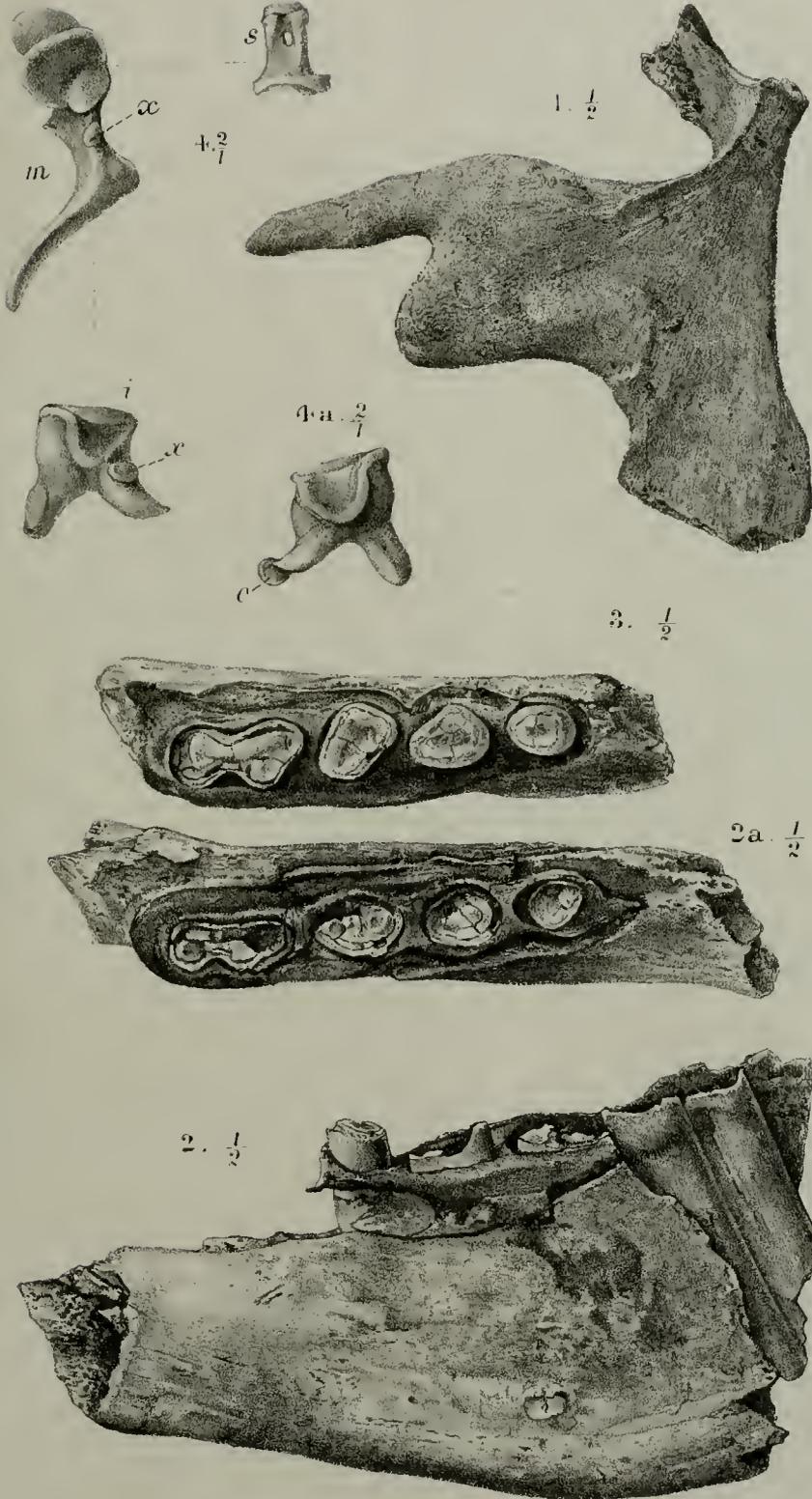


1a. $\frac{5}{11}$



Mintern Bros. imp.





J. Green del. et lith.

Mintern Bros. imp.

GRYPOTHERIUM LISTAI.





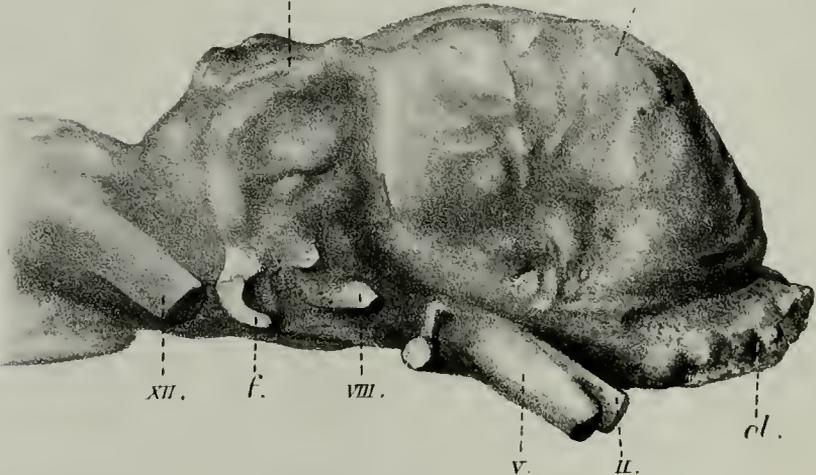
la. $\frac{1}{2}$



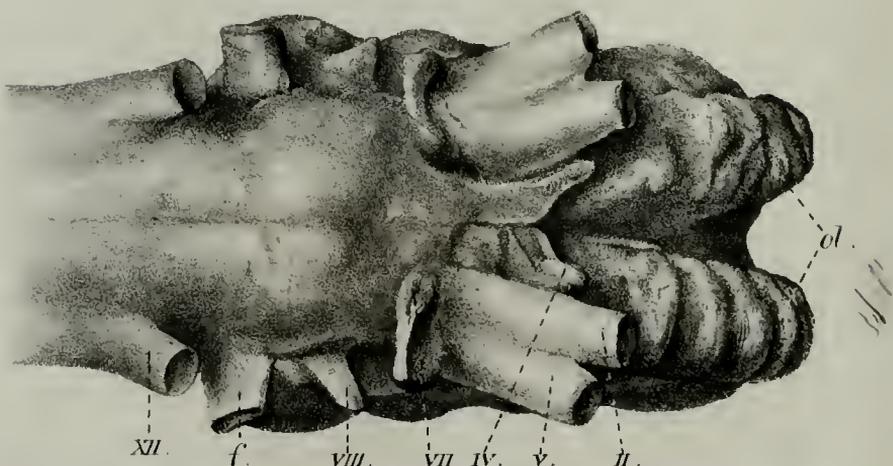
cb.

l. $\frac{1}{2}$

c.



1b. $\frac{1}{2}$



XII.

f.

VIII.

VII.

IV.

V.

II.

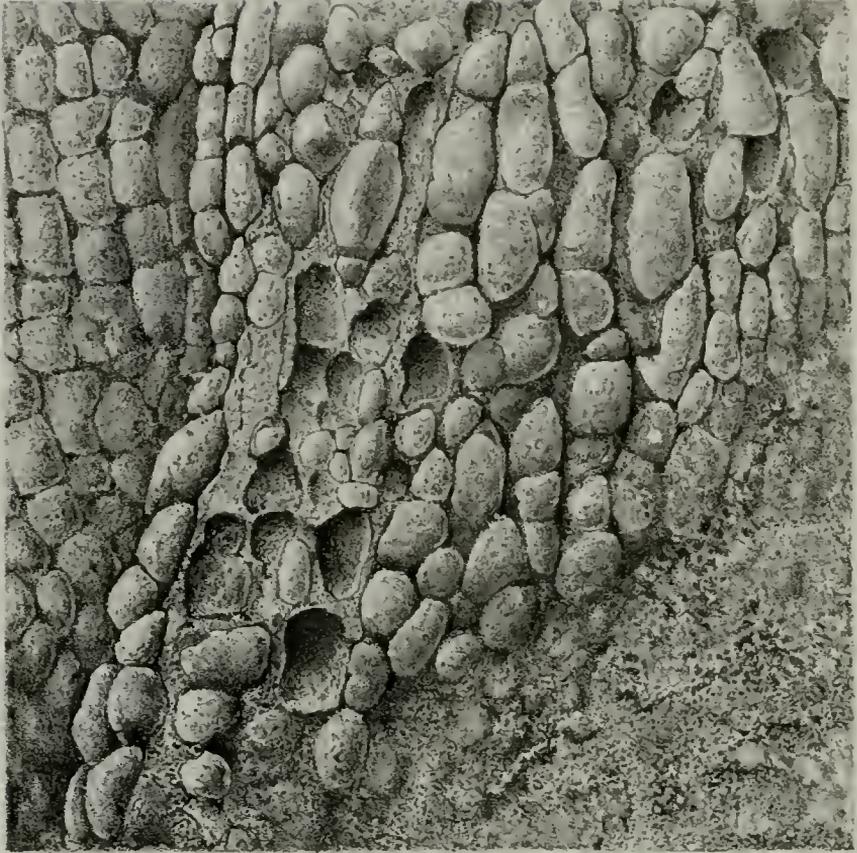
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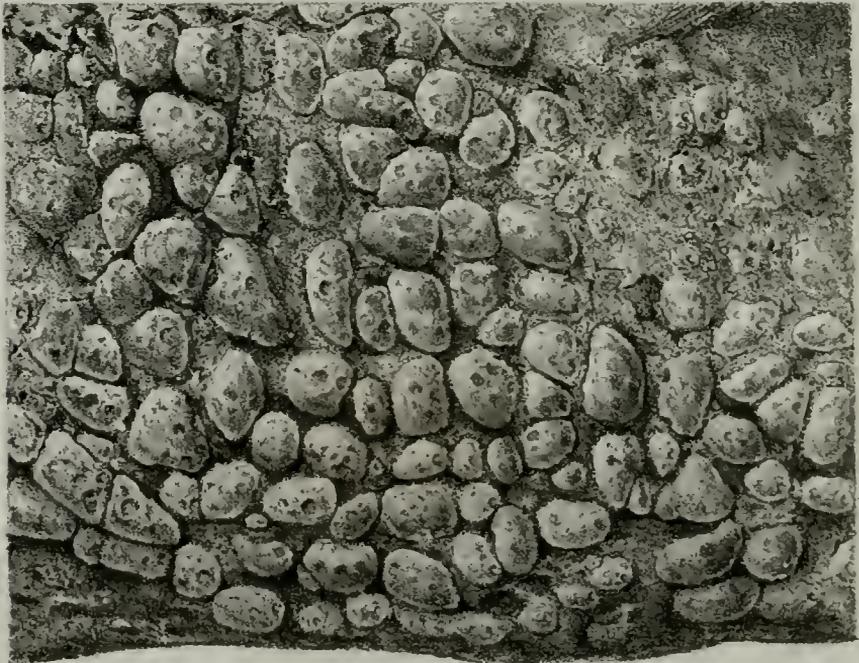
Mintern Bros. imp.

GRYPOTHERIUM LISTAI.





2. 1/2

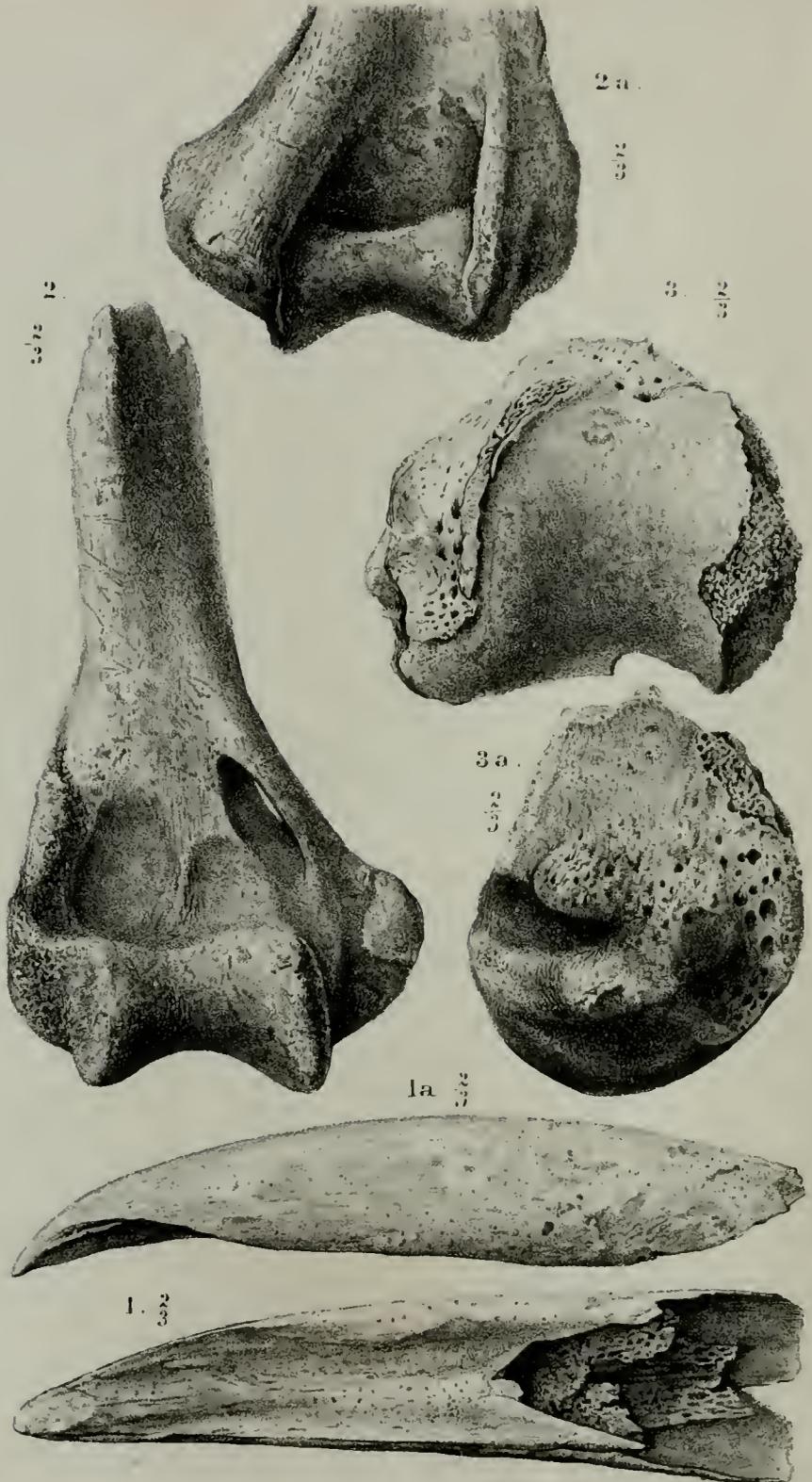


J. Green del. et lith

Mintern Eros .1mγ

GRYPOTHERIUM LISTAI.





J. Green del. et lith.

Mintern Bros. imp.

1. GRYPOTHERIUM LISTAI.
 2. FELIS ONÇA. 3. ARCTOTHERIUM sp. inc.

PLATE VII.

Fig. 1. *Grypotherium listai*; plaster cast of brain-cavity, right lateral, upper (1 a), and lower (1 b) aspects, one-half nat. size. *c.*, cerebrum; *cb.*, cerebellum; *f.*, infilling of foramen lacerum posterius; *ol.*, olfactory lobes; II., IV., V., VII., VIII., XII., exits of nerves as numbered.

PLATE VIII.

Fig. 1. *Grypotherium listai*; inner aspect of part of skin of flank, somewhat abraded, showing ossicles, one-half nat. size.
2. Ditto; group of dermal ossicles exposed from outer face, one-half nat. size.

PLATE IX.

Fig. 1. *Grypotherium listai*; epidermal sheath of claw of fourth digit of manus, inferior and lateral (1 a) aspects, two-thirds nat. size.
2. *Felis onça*, var.; portion of right humerus, anterior aspect and lower part of posterior aspect (1 a), two-thirds nat. size.
3. *Arctotherium* sp.; portion of distal end of right femur, anterior and outer (3 a) aspects, two-thirds nat. size.

3. On the Mammals obtained in Southern Abyssinia by Lord Lovat during an Expedition from Berbera to the Blue Nile. By W. E. DE WINTON, F.Z.S.

[Received December 13, 1899.]

(Plate X.)

Lord Lovat's party consisted of five Europeans, including Mr. H. Weld Blundell, and Mr. Harwood as Naturalist. Starting from Berbera about the middle of December 1898, and travelling *via* Machanis Hill and Fijambiro, they reached Harrar towards the end of the month, and continuing almost west *via* Shola, Laga Hardim, and Jiffa Densa, they arrived at Addis Abeba towards the end of January 1899.

During February an expedition was made to the northward *via* Wogodi and Koosa to Borameda, only some 20 miles south of Magdala; then turning a little to the eastward, they returned by way of the Djimma Valley *via* Kombolsha, Tickka Chika, and Angola.

Finally leaving Addis Abeba at the end of February, the expedition travelled due west *via* Managasha, Sellen, Goodur, Chellika, Bilo, and Lekemti to about 35° E.; then turning to the north *via* Mendi, they crossed the Dabus River at about 10° N., and so on through the Beni Schongul, crossing the Blue Nile at Famaka, and following the eastern or right bank of the river past Roseires, they reached Karkjof towards the end of May 1899, whence a passage was obtained in a boat to Khartoum.

The valuable collection of Birds brought home by the expedition will be found fully described by Mr. W. R. Ogilvie Grant in the 'Ibis' for January 1900, where a map of the route is also given. The collection of Birds has been presented to the British Museum,

together with all the small mammals and some of the most interesting of the Antelopes.

1. MEGADERMA FRONS.

♂, ♀. Roseires, Blue Nile, 1600 ft.

“Hanging on thick dead bushes ; readily fly in daylight.”

2. SCOTOPHILUS NIGRITA.

♀. Bilo, 5500 ft., 10th March, 1899.

“Slightly wooded country.”

3. HELOGALE ATKINSONI.

♀. Fijambiro, 5500 ft., 25th Dec., 1898.

“Shot on rocky hill among others.”

4. FUNISCIURUS MULTICOLOR.

♂. Mendi, 1st April, 1899.

“Shot on tree in very marshy ground ; native name ‘Shaila’.”

The resemblance in colour of this Squirrel to the last species (*Helogale atkinsoni*) is very striking. In laying the two side by side, the only difference observable is the form of the tail ; for while that of the Squirrel is uniformly bushy throughout its length, that of the Mongoose is tapered towards the tip. The general colour of the body in both animals is very much the same, but the annulations on the fur of the Squirrel are slightly broader. Knowing so little of the habits of these two animals, it is impossible to draw any conclusions as to the object of the likeness in two species of such different families, but the striking resemblance at once calls to mind the parallel instance of the Tree-Shrew (*Tupaia*) and the Squirrel in the Oriental Region.

5. GERBILLUS MURINUS.

Roseires, Blue Nile, 1400 ft., 15th May, 1899.

6. MUS ALBIPES.

♂, ♂. Borumeda, 8000 ft., 13th February, 1899.

“Caught in camp on grassy plain ; native name ‘Tet’.”

♂. Lekemti, 6885 ft., 18th March, 1899.

♂. Mendi, 6th April, 1899.

♂. Beni Schongul, 2nd May, 1899.

7. MUS MAHOMET.

♂. Chellika, 8000 ft., 8th March, 1899.

“Caught on old corn-field ; native name ‘Ait’.”

Measurements taken in the flesh—head and body, 60 millim., tail 48, hind foot 14, ear 12.

This is the first example received in the British Museum of this species, which was described by Mr. S. N. Rhoads, of Philadelphia, from specimens obtained by Dr. Donaldson Smith at Sheikh Mahomet in Western Somaliland.

8. *ARVICANTHIS DEMBEENSIS*.

♀. Kombolsha, 16th February, 1899.

“Shot close to water-side among reeds. Small colony; native name ‘Ait’.”

Measurements taken in the flesh—head and body 113 millim., tail 105, hind foot 26, ear 17.

This species, described by Rüppell in 1842, is represented in the British Museum by only a single specimen obtained by Dr. W. T. Blanford while accompanying Lord Napier’s expedition to Magdala. The fur of this species is much softer and the annulations finer than in *A. abyssinicus*, and the belly is almost entirely white. The skull is rather less angular, and the palatal foramina are shorter, not reaching so far back as the first molar. The molars of the two species (see figs. A & B) are strikingly different; the first upper molar of *A. dembeensis* is oval in shape, having only 7 cusps (the 8th being vestigial), three in the middle line with two inner and two outer of almost equal size placed in the intermediate spaces, so that the tooth is almost rose-shaped, six of the cusps surrounding the central one. It will be seen that the usual third outer cusp is almost entirely wanting.



A. Right upper molar series of *Arvicanthis abyssinicus*.
B. Right upper molar series of *A. dembeensis*.

The second upper molar is formed of six cusps, two larger in the middle line and four smaller—two outer and two inner—set in advance of the larger pair, so that the front of the tooth is concave, and the hind part convex, being formed of the middle cusp only. The pattern formed by the cusps of these two molars is very symmetrical, with the row of five large cusps of equal size in the middle line, and four smaller cusps on either side placed in the intermediate spaces.

The last molar is quite one-sided, being formed of one large cusp, in a straight line with the large middle line of cusps in the other teeth, and three smaller ones, all on the inner side, the hindermost forming the posterior border of the tooth.

The drawings (A & B) will more readily explain the formation of the teeth of these two species.

9. *ARVICANTHIS ABYSSINICUS*.

♀. Laga Hardim, 15th January, 1899.

♀. Jiffa Densa, 7800 ft., 23rd January, 1899.

♂. Addis Abeba, 7800 ft., 25th January, 1899.

♂, ♂. Koosa, 11,000 ft., 8th February, 1899.

♂. Ticka Chika, 4200 ft., 22nd February, 1899.

♂. Sellen, 6800 ft., 5th March, 1899.

♂. Goodur, 6th March, 1899.

“Large colony” is written on every label.

No doubt this is the common field-rat of the country, and is found on all soils and at any altitude.

Some specimens are labelled native name “Ait,” some “Tet,” so it is therefore probable that these names are simply the rendering of our “Rat” and “Mouse.”

10. *DENDROMYS LOVATI*, sp. n. (Plate X.)

The fur in its general appearance and texture resembles that of *Malacothrix typicus*, but the ears are much shorter and the tail is longer; the whole upper surface longitudinally striped with black and fawn. The tail is not so long as in any known species of *Dendromys*, and is besides thickly covered with short adpressed hair; the fore and hind feet resemble those of *Dendromys* excepting that the long fifth toes in the hind feet have no nails.

The pattern of the markings are strikingly *Tamias*-like—a broad black dorsal stripe, having a grizzled central line in its middle portion, is flanked by two pale buff stripes, these again bordered with black stripes. A dark stripe runs up the centre of the face from the nose to the crown; darkish stripes also pass through the eyes to the ears, leaving the sides of the forehead and cheeks buff. The part of the ear which naturally folds over in front has a black spot as in *Malacothrix*; the edges of the ears are rusty, and the fur round them is also rusty buff.

The whole of the underparts are dirty white; the bases of the fur in all parts of the body are dark slate-grey.

The tail is two-coloured, rusty above and silvery whitish beneath; the fore and hind feet are thinly covered with very short pale buff hairs.

The fore feet have three long toes with claws, the first and fifth toes being quite vestigial. The hind feet have three long toes with claws; the outer or fifth toe is long, thumb-like, and partly opposable, but, so far as the single example shows, differs from that of the known forms of *Dendromys* in being quite destitute of a claw.

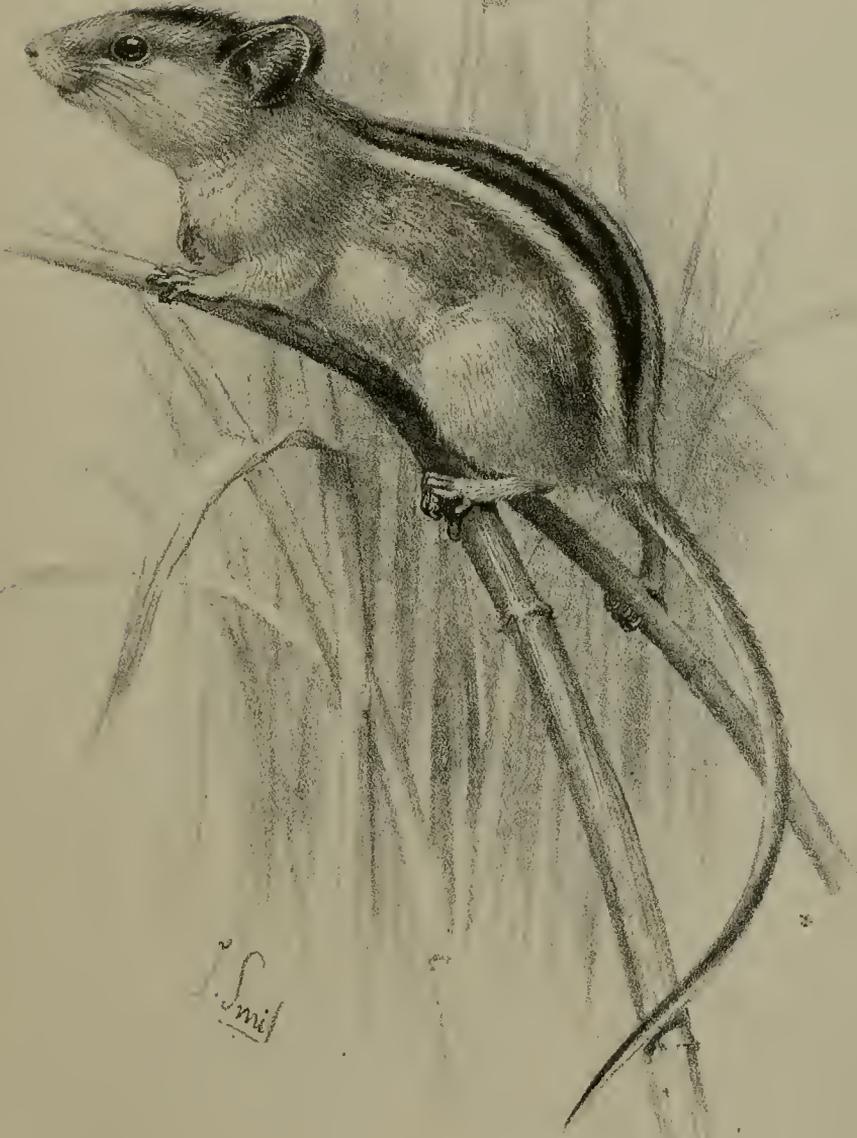
Type. ♂. Managasha, 7000 ft., 2nd March, 1899.

“Picked up on grass plateau.”

Measurements taken in the flesh—head and body 73 millim., tail 69, hind foot 19, ear 14.

Of another specimen—head and body 76, tail 76, hind foot 17, ear 16.

Skull: greatest length 22.5, length of nasals 8.9, interorbital constriction of frontals 3.1, breadth of brain-case 9.5, length of upper molar series (c.) 3.9, length of first molar only 2. Mandible: greatest length, tip of incisors to condyle 14, bone only





12, tip of incisors to coronoid 11·1, tip of incisors to angle 13·5, height (angle to coronoid) 6·6, length of lower molar series 3·1.

The skull of the type is unfortunately crushed, so that full description or measurements are impossible; another skull is likewise much damaged, and being broken in two across the frontals dividing the molar series, the measurement of the tooth-row cannot be taken with absolute accuracy, and other measurements which it would be desirable to record are not possible. The skull resembles other species of *Dendromys* in general form.

The molars resemble those of *Dendromys typicus* in the strongly cuspidate form of the first tooth with numerous small supplementary cusps, while the second and third are flat on the surface and laminate, with one more fold than in the teeth of *Mus*.

11. TACHYORYCTES SPLENDENS.

♀. Shola, 7000 ft., 9th January, 1899.

“Caught on black soil, working near the surface; native name ‘Farr’.”

12. PROCAVIA SHOANA.

♂. Wogodi, 9000 ft., 6th February, 1899.

“Shot among rocks, out of a colony. Half size; observed one yellow. Burrs in fur of all. Native name ‘Sessa’.”

Examples of the following larger mammals were obtained during the trip. At Machanis Hill on the border of the Haud—*Bubalis swaynei*, *Gazella soemmerringi*, *Lithocranius walleri*, *Madoqua phillipsi*; in the Djimma valley—*Strepsiceros imberbis*; to the north of Addis Abeba—*Cervicapra bohor*, as well as Lions and Servals; in the Beni Schongul country, between the Dabus and Blue Nile—*Bubalis* sp. inc., *Tragelaphus decula*, *Cephalophus abyssinicus*, *Ourebia montana*, *Dorcotragus megalotis*, as well as numerous Elephants and Wart-Hogs; in the Blue Nile valley—*Cobus defassa*, *Hippotragus equinus*, *Oryx beisa*, and *Strepsiceros kudu*.

I leave the specific identification of the Hartebeeste from the Blue Nile undetermined for the present, for there appears to be much uncertainty as to the range of the different species. Herr Oscar Neumann has lately stated (SB. Gesellsch. naturf. Fr. Berlin, 1899, p. 76) that *Bubalis jacksoni* from near Lake Naivasha and Heuglin's species *B. lelwel* from the White Nile are identical. I consider this statement should be received with reserve, for, on comparing typical specimens of the two forms as represented in the British Museum, I find them very widely distinct. Again, on comparing a large number of skulls, from the White and Blue Niles, Lake Rudolf (*B. neumanni*, named after Mr. Arthur Neumann), and a fine series obtained by Mr. F. J. Jackson from between Lakes Baringo and Naivasha, there will be seen a complete bridging over of all the differences, and it may be found that *all* these forms are but local races of the same species.

By far the most important point with regard to the larger

mammals is the discovery of *Dorcotragus* in the Blue Nile Valley. Up to now, the only known habitat of this Antelope was a few flat-topped hills scattered about Somaliland, where it has been met with in very small numbers. Lord Lovat gives me the following note respecting it:—

“The Beira Antelope is common all down the Blue Nile to Roseires; it inhabits the slopes leading down to the river-bed, and is also seen on the barer hill-tops. Some specimens were seen with considerably better heads than the ones I shot. The natives call the animal ‘El Mor’.”

EXPLANATION OF PLATE X.

Dendromys lovati, p. 82.

February 6, 1900.

HOWARD SAUNDERS, Esq., F.L.S., V.P., in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of January 1900.

The total number of registered additions to the Society's Menagerie during the month of January was 105, of which 29 were by presentation, 12 by purchase, 62 were received on deposit, and 2 were born in the Menagerie. The total number of departures during the same period, by death and removals, was 140.

The middle of winter seems to be an unusual time for a South European Passerine Bird to breed; yet a young Black-headed Bunting (*Emberiza melanocephala*) is entered in our register as having been hatched on Jan. 21st. The Head-keeper sends me the following report on this occurrence:—

About the middle of January last, a young Black-headed Bunting was observed in the Western Aviary by the keeper. A pair of this species of Bunting was purchased from a dealer in Dover in April 1899. No nest was built, and the egg or eggs were laid in an old thrush's nest in the ivy growing in the Aviary. The keeper had no idea that the birds were breeding, until he missed the female. On shaking the ivy the bird flew out, and a few days afterwards the young bird appeared. No traces of eggs were found in the nest.

Mr. Oldfield Thomas exhibited the heads of some rare Antelopes from Fashoda and the Sobat River which had been submitted to him by Messrs. Rowland Ward & Co. They had been obtained by the late Capt. H. G. Majendie, of the Rifle Brigade.

The most interesting was a fine head of Mrs. Gray's Waterbuck (*Cobus mariae* Gray), of which no perfect examples had come to

this country since the original heads were obtained by Consul Petherick in 1855. The specimen had been shot on the Upper Sobat River, 220 miles above its junction with the Nile, and just above the junction of the Adura and Peebon affluents. Capt. Majendie had never seen examples of it below the junction of these two affluents, but the natives told him there were lots of them up the Baro, as they called the Adura. The White-eared Kob (*Cobus leucotis* Licht. & Peters) was obtained on the Sobat River, and the Red-fronted Gazelle (*Gazella rufifrons* Gray) near Fashoda. The occurrence of the latter W. African species in the Soudan was a most noteworthy fact, and had been first brought to our knowledge last year by Mr. F. Burgess, who had been good enough to present to the British Museum a skin and two skulls of it obtained by him during the recent Soudan campaign at Faki-Kowi, on the White Nile, 200 miles south of Khartoum. Mr. Thomas had been quite unable to find any difference between these specimens and the types from West Africa, and it seemed probable that the species ranged all round the southern and western borders of the Great Saharan Desert, being represented on the north by the closely allied *G. rufina* Thos. The Tiang (*Damaliscus tiang* Heugl.) was obtained on the Sobat River.

Mr. G. E. H. Barrett-Hamilton, F.Z.S., exhibited some specimens of Dormice (*Muscardinus*), and made the following remarks:—

Recent accessions of Dormice to the British Museum Collection demonstrate the occurrence of at least two clearly marked local races or subspecies, in addition to that which I recently described under the name of *pulcher*¹. Thus the British Dormouse may be at once distinguished by the greater intensity of its coloration, and in other respects, from its representative in neighbouring Continental areas, such as Calais, Manonville, and Haute-Savoie (France), and Saxony.

There are also two specimens, Nos. 94.3.1.42 and 241, the latter from my own collection (without dimensions), from Zuberec, North Hungary, taken at an altitude of 2500 metres, which are slightly darker in colour than *M. avellanarius typicus*. Two others (Nos. 94.3.1.43 & 45), from Csaloköz Somorja, in the plains (1000 metres) of Western Hungary, are intermediate between the subspecies *typicus* and *speciosus*. Their relationship cannot well be made out until we receive further specimens, nor have we, in the absence of specimens from Scandinavia, an exact idea of the appearance of the form with which Linnæus was acquainted.

It is remarkable that in the British Dormouse we have what, at first sight, may seem to be an exception to the general rule that the representatives of a species inhabiting the British Isles² are duller than those of the neighbouring Continent. But if British

¹ Ann. & Mag. Nat. Hist. ser. 7, vol. ii, Nov. 1898, p. 423.

² British Harvest Mice are brighter than those of Western Hungary (see Ann. & Mag. Nat. Hist. ser. 7, vol. iii. April 1899, pp. 342 & 343).

animals are duller they are also usually more deeply coloured, and in this respect the Dormouse is melanochroic, and may, I think, be regarded as no exception to the general rule. I suspect that, when our knowledge of the distribution of colour amongst animals is greater, we shall find that this subspecies is only another instance of the influence of climate upon mammals, or, if it is preferred to regard the matter from a different standpoint, of the adaptation of animal coloration to suit prevailing climatic conditions.

The following forms are recognizable; they may, I think, be best regarded as subspecies:—

- (1) MUSCARDINUS AVELLANARIUS TYPICUS (Linnæus), Syst. Nat. ed. x. p. 62 (1758).

Myoxus muscardinus, Schreber, Säugthiere, iv. p. 835 (1792).

Typical locality. Upsala, Sweden.

Distinguishing characteristics. Upperside tawny yellow, not rufous or orange; the underside light buff, no distinct line of demarcation between colours of upper and under surface: a moderately distinct white breast. Tail long and slender.

Dimensions of specimens (in millim.).

	Head and body.	Tail.	Hind foot.	Ear.	Skull.	
					Greatest length.	Greatest breadth at base of zygoma.
94.6.6.12. ♂. Forest of Guines, Pas de Calais, alt. 80 met. (Oldfield Thomas), 26th May, 1894	72	71	16.2	...	22.5	13
94.6.6.13. ♀ (suckling). Do. do., 20th May, 1894; taken from nest with 5 blind and naked young ...	77	74	16.4	...	23.5	13
Three, Manonville, France (Mons. Lamont), taken from the nest, 18th Oct. 1895, of which the dimensions of one are	70	68	15	10	...	...
♂. Montauban, Haute-Savoie, 900 met. (A. Robert), 22nd Nov. 1899.	75	67	...	11	23.5	12.5
♂. Lucinges, Haute-Savoie, 1100 met. (A. Robert), 7th Dec., 1899.	78	61	15	11	24	12.5
99.1.9.16. ♂. "Oberwald bei Gros Hennersdorf," Stäts Oberlausitz, Saxony, 400 metres (W. Baer), 24th April, 1898.....	74	65	15	11.2	...	...

The dimensions of the Hungarian skulls range from 22.5 to 23 × 12.5 mm. The largest skull I have seen, next to that of the type of *M. a. anglicus*, is that of the type of *M. a. pulcher*, which reaches 24 × 12.5 mm.

- (2) M. AVELLANARIUS ANGLICUS, subsp. nov.

Type. No. 99.11.27.6 of Brit. Mus. Coll. (for particulars see below).

Distinguishing characteristics. Upper and under sides far more richly coloured with orange tints than in *M. avellanarius typicus*; line of demarcation indistinct, but white breast conspicuous; tail short and thick.

Dimensions of specimens (in millim.).

	Head and body.	Tail.	Hind foot.	Ear.	Skull.	
					Greatest length.	Greatest breadth at base of zygoma.
No. 242, coll. Barrett-Hamilton, ♀, } Wendon Lofts, Saffron Walden, } Essex (A. Wright), May 31, 1894. }	85	61	15	...	23.5	13.5
99.11.27.6. Bedford Purlieus, Thorn- } haugh, N.E. Northants (Rev. H. } H. Slater), Jan. 5, 1895. (Dug } up.) <i>Type of subspecies</i> }	86	57	16	...	24.5	14
♂, purchased in London, 15th Dec., } 1898 (W. Dodson)	71	21 ¹	16	13	23	12.7
♀, do. (do.)	73	62	16	12	...	...
♀, do. (do.)	70	55	17	12	22.7	11.5

¹ Damaged.

(3) *M. AVELLANARIUS SPECIOSUS*, A. Dehne, Allgem. deut. Naturh. Zeitung, 1855, p. 180. Type locality: Tursi in Basilicata, South Italy.

? *M. pulcher*, Barrett-Hamilton, Ann. & Mag. Nat. Hist. ser. 7, vol. ii. Nov. 1898, p. 423. Type from Siena, Italy.

Distinguishing characteristics. Upperside brilliantly coloured; underside with the orange colour (except the breast) almost absent and reduced to rich cream-colour; breast white, but the combination of colours makes this inconspicuous, and the line of demarcation on the contrary sharp and well-defined; tail long and well-haired: the type has a cream-coloured spot just in front of each ear.

Further particulars and dimensions of this subspecies may be found under the original description. I fear that my name *pulcher* must, at least provisionally, stand as a synonym of *M. speciosus*.

Mr. Barrett-Hamilton also exhibited some skins of the Variable Hare (*Lepus timidus* Linn.) and made the following remarks:—

The receipt of two Scandinavian Variable Hares kindly sent over at my request by Professor Robert Collett, of Christiania, has caused me to look through the Variable Hares in the collection of the British Museum, with the result that I find that there are two very distinctly coloured groups in the Old World. One of these is reddish brown and includes the Irish Hares; the other dark brown, and includes the Scotch and such Scandinavian Hares as I have seen. The Scotch and Irish Hares are thus very clearly separated, at least in their extreme forms, and, in addition to the colour-differences, I find that the dimensions show a slight superiority of

size in favour of the latter, which is confirmed by observations on the weight of the animal. There is possibly a certain amount of intergradation between North Irish and South Scottish specimens, but I have as yet no evidence of it. I suspect that Scandinavian Hares are larger than those of Scotland, but the number of specimens at present at my disposal is too scanty to establish this fact with certainty.

The single specimen of the Altai Variable Hare which I have examined is very remarkable in that it belongs to the red-brown type, and closely resembles the Irish Hare: in fact, the only distinguishing characteristic which I can find in it is the fact that the back of each ear is black. It is a remarkable example of the manner in which a particular type of coloration may be independently assumed in quite separate localities.

There is a very peculiar local form of the Irish Hare, which is found in the County Dublin, Ireland, and in which the upperside is of a uniform buff or cinnamon colour. It seems to me to be of extreme interest to students of colour-variation, as tending to throw light on the possible evolution of species from "sports" or from discontinuous variations. That the Irish Hare may have a tendency to vary in that particular direction, even when transported to another country, is shown by the occurrence of a similar sport amongst the introduced Irish Hares of the Island of Mull, Scotland. These sports must, I suppose, be regarded in the light of partially albinistic or leucochroic variations; but, even if their origin be due in the first instance to disease, they seem to be highly hereditary, and even capable of holding their own against the ordinary form. In the particular district of the County Dublin to which I have referred they are said to occur to the total exclusion of the true *Lepus t. hibernicus*.

In addition to the above, I take the opportunity of describing from a skull in the British Museum a remarkable Variable Hare from the Island of Yezo, Japan.

The following are the various forms:—

(1) *LEPUS TIMIDUS TYPICUS*.

Lepus timidus, Linnæus, Syst. Nat. ed. x. p. 57 (1758).

Lepus variabilis, Pallas, Glires, i. p. 1 (1778).

Lepus albus, W. E. Leach, 'Syst. Cat. of the Specimens of the Indigenous Mammalia and Birds that are preserved in the British Museum,' p. 7 (1816).

"*Lepus borealis* Pall.," S. Nilsson, Skandinavisk Fauna, p. 211 (1820).

Lepus borealis sylvaticus, S. Nilsson, Illuminerade Figurer till Skandinaviens Fauna, letterpress to pl. 22 (1829-1832): nec Bachman (1837).

Lepus canescens, Öfversigt af Kongl. Vetenskaps-Akademiens Förhandlingar, p. 133 (1844).

Synonymy. All the above names, except *L. albus* which has

reference to the Variable Hare of Scotland, seem to be synonyms of the Southern Scandinavian Variable Hare.

Type locality. Upsala, Sweden.

As regards colour and size, I cannot distinguish Professor Collett's specimens from those of Scotland: all have progressed a long way towards melanism. On the other hand, not one of my Scotch series reaches the size of two skulls, supposed to be from Scandinavia, in the British Museum. It is probable, therefore, that Nilsson was right in describing two forms of Variable Hare from Scandinavia.

Distribution (provisional). South Scandinavia, Scotland, and mountains of Europe.

(2) *LEPUS TIMIDUS COLLINUS.*

Lepus borealis collinus, S. Nilsson, *Illuminerade Figurer till Skandnaviens Fauna*, pl. 19 (1829-1832).

I have seen no specimens of the second Scandinavian form, which probably inhabits the mountains and the north of the country¹.

(3) *LEPUS TIMIDUS HIBERNICUS.*

Irish Hare, Yarrell, *Proc. Zool. Soc.* 1832, p. 88.

Lepus timidus var. β , Jenyns, *Mau. Brit. Vert. Animals*, 1835, p. 35.

Lepus hibernicus, Bell, *Hist. of British Quadrupeds*, 1837, p. 341.

Typical locality. Ireland.

Colour in summer reddish brown, often of conspicuous fox-like shade: in winter similar, but in severe weather or on exposed situations a white coat, more or less complete in proportion to the need, is assumed. Size larger than that of Scotch Hares. Weight up to about 10 lbs., whereas that of Scotch Hares, according to Mr. J. E. Harting, "averages probably between 5 lbs. and 6 lbs.; the heaviest I have noticed weighed $7\frac{1}{4}$ lbs."²

It is a pity that the original describer of this Hare should have compared it with the totally distinct Common Hare of England. Hence we have had, so far as I am aware, no careful comparison of it with the Scotch Hare, and its very conspicuous coloration has consequently been overlooked. The introduced Irish Hares of the Island of Mull retain their red coloration.

Distribution. Ireland.

(4) *LEPUS TIMIDUS LUTESCENS*, subsp. nov.

Type. No. 82.2.4.1 of British Museum Collection, from Donabate, Co. Dublin (Chas. Cobbe).

Distinguishing characteristics. General colour "rich buff-shading

¹ Since the above was written I have been able (through the kindness of Mr. W. E. de Winton) to examine three skulls from Russia, which probably belong to this form, and of which the basilar length is 80, 79, and 74.5 mm. (the latter immature).

² 'Field,' Sept. 5, 1891.

into pure white on the lower parts; the eyes are a pale straw-colour, with a greenish tint" (E. Williams, *Zoologist*, 1890, p. 71). The ears are without black tips.

This form is probably not sufficiently "fixed" to warrant its full admission to subspecific rank. It may perhaps be best regarded as a very conspicuous aberration on the verge of becoming subspecific, and it is certainly of such interest that I wish to draw attention to its existence in the most conspicuous manner available, *i. e.* by bestowing upon it a third name.

Distribution. Coast from Malahide to Balbriggan, Co. Dublin, Ireland.

(5) *LEPUS TIMIDUS ALTAICUS*.

"*Lepus altaicus. Lepus variabilis altaica* Everm." J. E. Gray, *List of Mammals*, 1843, p. 126.

Typical locality. Altai Mountains (?). I cannot find the original description of this form as alluded to by Gray.

A single skin in the British Museum (No. 96.10.14.3) can only be distinguished from Irish specimens by the black colour of the back of the ears, being apparently the downward extension of this colour from the tips. The dimensions of a skull (basilar length 66.5 mm.) show an animal of rather small size. The first specimen is labelled as having been procured by Major C. S. Cumberland in the Forest Region near Chiaja Steppe, Altai.

Distribution. Altai Mountains, Central Asia: exact limits unknown.

Should it be found that Eversmann's description was (as I suspect) never published, this subspecies will stand as *Lepus timidus altaicus* Barrett-Hamilton. Gray's name is a *nomen nudum*.

(6) *LEPUS TIMIDUS AINU*, subsp. nov.

Type. No. 84.4.15.2 of the British Museum Collection, a male from the Island of Yezo, purchased from Mr. A. Owston of Yokohama, Japan.

Description. The great size of this skull and the peculiar constricted brain-case mark it out as very distinct from any other known form. The basilar length of 80 mm. reminds one of the great Polar Hares of the North.

Distribution. The Island of Yezo, Japan.

(7) *LEPUS TIMIDUS TSCHUKTSCHORUM*.

Lepus tschuktschorum, Nordquist, Vega Exped. ii. pp. 84-90, figs. 8-10 (1883).

Type locality. Pitlekaj, lat. 67° N., long. 173° W., N.E. Siberia.

To complete the list of described Palearctic Variable Hares, I add this form, which belongs to the group of large polar forms. The skull of the single specimen in the collection has a basilar length of 87.5 mm., a size not attained by any other subspecies: it even exceeds that of *Lepus groenlandicus* Rhoads, from Greenland. Although inhabiting the country just north of Kamchatka, the

Chuckchee Hare would appear to be different from the Hare of that country, for Mr. S. N. Rhoads states¹ that "four skulls from Kamchatka, in the collection of the Smithsonian Institution, show beyond question that the small *timidus* type of Polar Hare inhabiting that region is very different from the Hare which frequents the Plover Bay Territory."

Distribution. North-eastern Siberia, and North-western Alaska, from the mouth of the Kuskokwim River northward (*Rhoads*).

The following table will give some idea of the relative size and proportions of the various forms:—

<i>Lepus timidus typicus.</i>	Head and body.	Tail.	Hind-foot.	Ear.	Skull (basilar length).
<i>Scandinavian.</i>					
No. 51.11.10.70. "Norway".....	75.5
No. 44.8.3.41. " <i>Lepus canescens</i> ".....	77.5
No. 44.8.5.35. " " ".....	73
♂, 19 Sept., 1899, Eidwold, Norway (R. Collett)..... about	73*
♂, 30 Oct., 1899, do. (do.).....	67
					* Damaged.

Scotch.

Dimensions of 14 examples, from	max.	mean	min.	Head and body.	Tail.	Hind-foot.	Ear.	Skull (basilar length).
Cronalix, Dunblane, Perthsh. (Captain A. Hay Drummond); Cawdor, Nairn (Earl of Cawdor); Drynachen Lodge, Clonas (W. R. Ogilvie Grant); Altyr, Morayshire (Sir W. Gordon Cumming); and Cairn Edward, New Galloway (Colonel Gordon Maitland) ²	510	495	470	510	67	146	77.5	73.5 ³
				495	59.5	136	72.5	70
				470	50	126	67	67

Lepus timidus hibernicus.

♂. Barrett-Hamilton collection no. 257, Mull, Scotland (introduced) (C. H. Akroyd), 23rd Nov. 1895; weight 6 lbs. 9 oz.	543	.....	.....	136	76	.....	.....
♀, ditto no. 258; weight 5 lbs. 8 oz.	522	.....	.....	132	71	.....	.....
♀, ditto no. 256, Vaynol Park, N. Wales (introduced) (G. W. Assheton Smith), received 5th March, 1896; weight 5 lbs. 11 oz.	501	58	.....	142	79	.....	.....
♀, Kilmanock, Co. Wexford, Ireland, 7th Dec., 1899 (G. E. H. Barrett-Hamilton).....	517	40	.....	139	76	71.5	.....
Average of 7 Irish, Scotch, and Welsh individuals (in the two latter cases introduced).....	.....	.....	.....	136	75	.....	.....
Average of twelve ditto.....	.....	.....	.....	.....	.....	.....	73
Maximum skull measurement.....	.....	.....	.....	.....	.....	.....	78.5

¹ Proc. Acad. Nat. Sci. Philadelphia, 1896, p. 372.

² [The skull of No. 78.12.21.20, ♂, Samarowa, on the River Irtysch, Siberia, received from the Geogr. Soc. Bremen, and collected by Dr. O. Finsch in 1876, is damaged, but appears to be of the same size as those of Scotch specimens.]

³ The dimensions of the skulls are taken from 19 specimens.

	Skull (b. l.).
<i>Lepus timidus altaicus.</i>	
No. 50.5.28.3	66.5
<i>Lepus timidus ainu.</i>	
No. 84.4.15.2, ♂. Yezo, Japan, February } (A. Owston)	80
<i>Lepus timidus tshuktschorum.</i>	
No. 50.1.26.25. Kotzebue (Lieut. Wood } & Captain Kellett)	87.5
<i>Lepus timidus grænlandicus.</i>	
No. 43.6.15.7, Greenland (Juv.?).....	70
No. 43.6.15.13 " " (see } Waterhouse, Nat. Hist. Mamm., ii. } p. 107)	78
No. 78.1.23.1. Lincoln Bay, Grant Land, } 82° N. lat. (Colonel H. W. Feilden) . }	85
No. 534g. Discovery Bay, Grant Land } (H. C. Hart)	86.5

Mr. R. Trimen, F.R.S., communicated a paper by Lieut.-Col. J. Malcolm Fawcett, entitled "Notes on the Transformations of some South-African Lepidoptera." This memoir was accompanied by a series of careful and characteristic coloured drawings from life of larvæ and pupæ collected by the author during a residence in Natal, chiefly at Ladysmith and Maritzburg. The early stages of seventeen Rhopalocera and thirty-one Heterocera were described and figured. Nearly all of these appeared to have been previously unpublished, and in the few instances where previous publication had occurred, the illustrations had been inexact or insufficient. In several species, not only the variations of the full-grown larvæ, but the changes exhibited at successive moults were well shown, especially in the Natalian species of *Papilio*. Among the Heterocera was specially noticeable the striking series of Saturniid larvæ, and still more the huge and extraordinary caterpillar of *Lophostethus dumolinii*, one of the largest of the Smerinthine hawk-moths, which, in addition to the usual caudal horn, bears many strong branched spines distributed over nearly the whole of the body. Colonel Fawcett's descriptions and drawings were accompanied by notes of value on the distribution, food-plants, &c. of the species concerned.

Mr. Trimen expressed his deep regret (which he felt the Fellows of the Society would share) that the talented writer of this memoir, who had rejoined his regiment in Natal, was among those officers who were known to have been severely wounded during the siege of Ladysmith.

The paper will be printed in full in the Society's 'Transactions.'

The following papers were read:—

1. On a small Collection of Decapod Crustaceans from Freshwaters in North Borneo. By L. A. BORRADAILE, M.A., F.Z.S., Lecturer in Natural Sciences of Selwyn College, Cambridge.

[Received January 12, 1900.]

By the courtesy of Dr. R. Hanitsch, of the Raffles Museum at Singapore, I am given the opportunity of reporting on some freshwater Crustaceans obtained by him in North Borneo during the month of March 1899.

The collection contains specimens of the following species :—

1. *Palæmon pilimanus* de Man.
2. *Potamon convexum* (de Man).
3. *Potamon consobrinum* de Man.
4. *Potamon kadamaianum*, n. sp.

All the three known species have been already recorded from Borneo; and the new one is allied to a form found in that island by the Dutch Central Borneo expedition.

Suborder MACRURA.

Tribe CARIDEA.

Family PALÆMONIDÆ.

Genus PALÆMON.

1. PALÆMON (MACROBRACHIUM) PILIMANUS de Man.

Palæmon pilimanus, de Man, Notes Leyd. Mus. i. p. 181 (1879); Veth's 'Midden-Sumatra,' Crust. p. 4, pl. ii. fig. 2 (1887).

Palæmon (Macrobrachium) pilimanus, Ortmann, Zool. Jahrb. x. Syst. p. 735, pl. xlvii. fig. 9 (1891); de Man, Notes Leyd. Mus. xx. p. 158 (1898).

The single specimen, which is from the Inuman River, between Kalawal and Bungol, British North Borneo, differs from Ortmaun's figure in having the submedian spines of the telson considerably shorter; it is very possible, however, that the ends of these have been worn or broken off.

Suborder BRACHYURA.

Tribe CYCLOMETOPA.

Family POTAMONIDÆ.

Genus POTAMON.

2. POTAMON (PARATHELPHUSA) CONVEXUM (de Man).

Paratelphusa convexa de Haan, de Man, Notes Leyd. Mus. i. p. 63 (1879); Max Weber's 'Reise Ned. O.-Ind.' ii. p. 302 (1892).

Potamon (Parathelphusa) convexa, de Man, Notes Leyd. Mus. xxi. p. 142 (1899).

The single specimen seems, by the following characters, to belong to this species:—

- i. There are two epibranchial teeth on each side.
- ii. There is a spine near the end of the merus in the walking-legs.
- iii. The distance between the tip of the postorbital tooth and that of the first epibranchial tooth does not exceed the distance between the first and second epibranchial teeth.
- iv. The outer edge of the first epibranchial tooth is strongly convex.
- v. There are no spots on the carapace or limbs.

The dactyles of the walking-legs are rather shorter and stouter than is indicated in de Man's figure of the allied *P. maculatu*. The fingers of the chelæ are dark in colour. *P. convexa* is already recorded from Java, Timor, and New Guinea, and, doubtfully, from Borneo¹. *P. maculatu* (de Man) 1879, is a closely allied form from Sumatra.

1 ♀; British North Borneo.

3. POTAMON (THELPHUSA)² CONSOBRINUM de Man.

Potamon (Potamon) consobrinum, de Man, Notes Leyd. Mus. xxi. p. 99, pls. vi., ix., x. fig. 10 (1899).

This species is already reported from Borneo (Mt. Damoes and Upper Sibau River) by de Man. Ortmann (Zool. Jahrb. x. Syst. p. 301) gives a list of allied forms and their distribution.

2 ♂, 1 ♀; Kadamaian River, Kina Balu, 2100 feet.

4. POTAMON (GEOTHELPHUSA) KADAMAIANUM, n. sp.

A single female specimen of a form allied to *P. obtusipes* (Stimps.) 1858, and *P. dehaani* (Gray) 1847, seems to deserve a name of its own. Whether it were not better treated as a local race of one of the above species, or all three as local forms of *P. dehaani*, is a question to be settled when the subject of the interrelationship of the various forms in the genus comes up for discussion. In the meantime its distinctness seems quite as great as that of several of the generally accepted species. It differs from *P. obtusipes* in the greater slenderness of its legs, especially of the dactyles, which are long and narrow and end in a sharp claw. The branchial regions are tuberculate, and their hinder portions rugose. The front is more finely tuberculate. The wrist and palm are rugose-tuberculate. Behind each orbit is a shallow, triangular depression of the carapace reaching backwards through rather less than half the length of the cephalothorax, and separating the branchial from the gastric region.

¹ Miers, Ann. Mag. Nat. Hist. (5) v. p. 306 (1880).

² According to Ortmann (Zool. Jahrb. x. Syst. p. 200) *Thelphusa* is the correct name for the subgenus in which this species should be placed.

The length of the cephalothorax is 15 mm.

The colour in spirit is dark brown.

P. dehaani has been found in Japan and the Loo Choo Islands; *P. obtusipes* in the Loo Choo Islands and the Philippines.

P. bicristatum de Man, 1899, is an allied species from Borneo (Mount Liang Koeboeng). In view of the peculiarities of the distribution of the genus, it seems best to choose a territorial name for the new species. That of *kadamaianum* is therefore proposed, derived from the name of the river in which the present specimen was found.

1 ♀; Kadamaian River, Kina Balu, 2100 feet.

2. On the Mammals obtained in South-western Arabia by Messrs. Percival and Dodson. By OLDFIELD THOMAS, F.Z.S.

[Received December 19, 1899.]

On the initiative of Mr. Ogilvie Grant, and by the active assistance of General Creagh, Governor of Aden, an expedition was arranged during the past autumn to South-western Arabia for the purpose of obtaining zoological specimens for the British Museum. The expedition consisted of Mr. A. B. Percival and Mr. W. Dodson, the latter having especial charge of the mammal-collecting.

Mr. Dodson had already had some experience as a collector of small mammals during a trip to Roumania in the spring, and he had shown such keenness and aptitude for the work that he would evidently have become an exceptionally able collector, but most unfortunately he contracted fever at El Khaur, and having been brought back to Aden by Mr. Percival, died there on the 20th of October.

The present collection, in the formation of which Mr. Dodson took, to the last, the most vivid interest, is naturally very similar in character to that obtained by Col. Yerbury in the same region in the spring of 1895, of which an account was given by its collector and myself in the Society's 'Proceedings' for that year¹. Further examples of the interesting Gerbilles discovered by Col. Yerbury were obtained and valuable series of various other forms.

The following species are additional to those recorded in the previous list:—*Papio arabicus*, *Canis pallipes*, *Fulpes leucopus*, *Mellivora ratel*, *Gerbillus gerbillus*, *Procavia syriaca jayakari*.

The animal that proves to be of greatest interest is the Baboon, of which one specimen, unfortunately a female, but fully adult and in good condition, was obtained. This specimen is so different from the African *Papio hamadryas* as to require specific distinction.

The collection was made mainly in two districts—the one at and around Lahej, Col. Yerbury's chief collecting-ground, and the

¹ P. Z. S. 1895, p. 542.

other in the neighbourhood of El Khaur, a place about forty miles north-east of Aden, and some twenty-five miles west of Shukra. But, as might be expected, no defuabable difference is to be found in the animals of the two localities.

The notes on habits &c. placed in inverted commas have been contributed by Mr. Percival.

1. *PAPIO ARABICUS*, sp. n.¹

a. ♀. Subaihi Country, about 60 miles north-west of Aden. Alt. 1000 metres, 16th October, 1899.

“The mountains run up to nearly 2000 metres, but the Baboons keep to the lower slopes.”

Allied, so far as can be determined from the female, to *Papio hamadryas*, and therefore probably the form from Aden which has been commonly referred—though without the examination of specimens—to that species². But this is by no means certain, and it may be that either the true *P. hamadryas* occurs naturally in the Aden district, or that examples of it have been brought across from Somaliland to Aden during the long-continued native intercourse between the two places, and that the Aden herd is the offspring of escaped specimens.

But whatever may be the case with the herd occurring close to the town of Aden, certain it is that the present specimen, which was obtained by a native about sixty miles to the north-west, cannot be referred to the true *P. hamadryas*.

The main difference appears to be in size, but it unfortunately happens that while the present example is a female, all the available specimens of *P. hamadryas* are males, so that sexual difference has to be allowed for in distinguishing the two forms.

But greatly as the sexes of Baboons may differ in general size and length of skull, the dimensions of the teeth, at least of the cheek-teeth, seem almost or quite unaffected by sex. Thus of a pair, male and female, of the East-African Baboon (*Papio thoth*) of about the same age (the male slightly older, but both rather immature), the following are the respective measurements (in millim.) of the skull and teeth:—

		Combined lengths of		
	Total length of skull.	5 upper cheek-teeth.	4 posterior lower cheek-teeth ³ .	Length of last lower molar.
♂	187	50	46	15
♀	159	50	46·4	15·6

The teeth are therefore of about the same dimensions in the two sexes, in spite of the difference in the size of the animals themselves. A similar result has been found in Man, and is, indeed,

¹ Preliminary notice, P. Z. S. 1899, p. 929.

² See Matschie, SB. Ges. nat. Freunde, 1893, p. 25.

³ The anterior lower premolar in Baboons partakes of the sexual specialization of the canine, and has therefore to be eliminated in a comparison of this sort.

common throughout the Mammalia. Naturally every craniologist is more or less familiar with this fact, but in describing a new species on such material as the present it is necessary to emphasize the value of the size of the teeth as a criterion of species, irrespective of sex.

Taking for comparison a good adult skull of a male Hamadryad from Abyssinia we find, in marked contrast to those given above, the following dimensions (in millim.):—

	Total length of skull.	Combined lengths of		
		5 upper cheek- teeth.	4 posterior lower cheek- teeth.	Length of last lower molar.
♂. Abyssinia ..	174	50·4	48	17·4
♀. Arabia	140	41·5	39·5	13·1

Such a difference in the size of the teeth evidently indicates specific distinction.

In its general physiognomy the skull is, as might be expected, much less prognathous than that of the male of *P. hamadryas*, the orbits are similarly high and rounded, the facial ridges are less marked, the chin is much developed, and the shape of the coronoid is different, being more vertical and less slanted backwards. The complete measurements of the skull are as follows (in millim.):—

Greatest length (gnathion to occiput) 140, basal length (gnathion to basion) 98; zygomatic breadth 90; gnathion to lower edge of orbit 61; tip of nasals to orbit 32; orbits, width 24, height 22·5; brain-case, length from occiput to nasion 91, breadth on squamosals 67; interorbital breadth 46; palate length 57, breadth outside tooth-row 44; lower jaw, length from condyle 101, height at coronoid 50.

In its external characters the skin may be described as follows:—

Fur thin and scanty, rather wavy in texture across the back, the hairs across the shoulders but little lengthened beyond the rest. General colour dull greyish; the hairs on the crown and those of the middle line of the loins annulated, blackish with a buffy subterminal ring, those on the temples, sides of neck, shoulders, and flanks unannulated, dull grey. Hairs on the rump above the callosities with a strong rufous suffusion. Under surface and inner side of limbs practically naked. Hairs of arms and legs scanty, dull greyish, gradually passing into annulated black and whitish hairs on the hands and feet. Tail-hairs annulated above, pale greyish below, those at the tip forming a small dull whitish tuft.

Measurements of a remade skin, approximate:—

Head and body 590 mm., tail 410, hind foot 135.

Considering the former extension of the genus into India, it was quite to be expected that the Arabian Baboon should prove different to that found on the African side of the Red Sea. But it may be noted that the two Siwalik species, *Papio subhimalayanus* and *P. falconeri*, both have teeth as large as (or larger than) any of the African Baboons.

2. ROUSETTUS STRAMINEUS Geoffr.

a-d. Lahej, 19th August.

"*Large Fruit-Bats.*—These fine Bats were seen for a few days in considerable numbers among the palms near Lahej, but only for a very short time, less than a week. They are very noisy in their roosting-places, squeaking and swearing, making a great fuss early in the mornings. They were feeding, so far as I could make out, on dates, which were just ripe. They and the crows are so troublesome when the dates are ripening that every bunch is put into a bag made of palm-leaves for protection. We had some difficulty in getting these Bats down; if killed they remained hung up, it was only the wounded ones who tried to move about that came down. They hung in bunches of 10 to 50 on the highest palms in the plantation, and were not at all easy to move when once they had hung up for the day."

3. ROUSETTUS AMPLEXICAUDATUS Geoffr.

a-d. Lahej, 22nd August.

e, f (2 in alc.). Lahej, 22nd August.

In the previous paper on Aden mammals this Bat was referred to *R. ægyptiacus*, but in Dr. Matschie's recent work¹ it is assigned to *R. amplexicaudatus*, and pending further enquiry I use that name. I am, however, sure that *R. ægyptiacus* and *R. amplexicaudatus* cannot always be distinguished by the palate-ridge character used in Dr. Matschie's synopsis of species.

"*Small Fruit-Bats.*—In working up Wadi Bilih we found a cave or rather passage in the bank, which had been cut out by water and is about 15 yards through, from 15 to 20 feet high and about 6 to 12 feet across. About the mouth of the cave there were always a few Rock-Doves, but inside the roof was covered by Bats. The Bats were very easily driven out into sunlight, where they flew all round, settling on sides of the wadi in clusters of 10 to 20. On the first occasion I was at the cave after driving out the Bats I was making my way down the gully into the wadi, when I heard a thud in the air: I looked up just in time to see a Falcon passing over and a Bat falling to the ground. I waited a few minutes and as the Falcon came down on to the Bats again I got a shot and killed him neatly. On several occasions when at the cave and Bats were driven out, Falcons came down on to them. I bagged one more."

4. TRIENOPS PERSICUS Dobs.

a, b (in alc.). No exact locality.

5. HIPPOSIDERUS (ASELLIA) TRIDENS Geoffr.

Yerb. & Thos. P. Z. S. 1895, p. 546.

a-d. Skins, and a number of specimens in spirit. Lahej, Sept. 1899.

¹ Flederm. Berl. Mus. i. p. 65 (1899).

These specimens are larger than Egyptian examples, agreeing in size with Anderson's "var. *murraiana*" from Karachi¹; the latter form is also recorded by its describer from Bushire.

6. *NYCTERIS THEBAICA* Geoffr.

a-h (in alc.). Myba, 1760 feet, 17th August.

7. *SCOTOPHILUS SCHLIEFFENI* Pet.

a. Jimel, 16th August.

b-f. Sheikh Othman, 18th-27th September.

g, h (in all.). Lahej.

8. *TAPHOZOUS PERFORATUS* Geoffr.

a-d. Lahej, 22nd August.

e, f (in spirit). Lahej, 22nd August.

9. *RHINOPOMA MICROPHYLLUM* Geoffr.

a-g. Myba, 17th August.

"*Small Bats* (various).—Most of the villages in the interior of S. Arabia have one or more towers, into which they drive the pick of their stock, and into which they retreat for a last stand in case of war. They are built of mud or stone (Nub, Dar, or Hassan²). In times of peace they are, as a rule, only used as store-houses for grain, &c. In these towers Bats live in hundreds, one or two species in each tower.

"In the Sultan's palace at Lahej the passages leading to his private apartments are haunted by hundreds of Bats, and the strong pungent smell is almost unbearable. They were difficult to get at, as the roof is formed of sticks put across from wall to wall, and it is in between the sticks that the Bats hang. There were more Bats in Dar Mansur³ than any other place I have seen. Their droppings were fully 6 in. deep in many parts of the tower. The smell was terrible, but not quite so bad as at the palace, the reason being that Dar Mansur is a ruin, more open and drier than the palace. In this tower there only seemed to be two species—the Long-eared, *Nycteris thebaica*, and the Long-tail, *Rhinopoma microphyllum*: these two were the commonest species we met with; as a rule they were to be found in every tower, and perhaps we would get one other species in small numbers as well. The long-tails were the worst Bat to skin I have seen; they were so very fat—a regular store of fat being at the base of the tail. One or two Bats were shot round the Lahej bungalow and a few at Sheikh Othman, but most were caught in towers or in caves in banks of wadis. It is quite a sight to see the hundreds of Bats streaming out of these towers in the dusk and scattering all over the place. Some of them are very high fliers, and at once shot up, while others never seemed to go far and would hang round the villages."

¹ Cat. Mamm. Ind. Mus. i. p. 113 (1881).

² Nub or Dar = a tower of mud or unburnt bricks. Hassan = a stone tower.

³ = Mansur's Tower.

10. FELIS MANICULATA Cretzschm.

a. ♀. Lahej, 27th August. "Shot on desert in bush." Native name "Erri."

It is impossible to say with any certainty what specific name should be used for this little Wild Cat until the whole group has been properly revised. Additional material from all localities is much needed.

"*Wild Cat*.—Only this one specimen was obtained, though I tried hard to get another with the traps. We were riding out towards Shaka, a village above Lahej, when the shikari pointed out this cat slinking off towards Wadi Bilih: away we went as hard as the camels could go and managed to cut the beast off from the wadi—a bit of a run over the desert, and she took refuge in a bush. I jumped down, took off my coat, went in and managed to pull her down as she bolted. On examination we found it was a female, and had, I think, young ones still sucking. When in the open desert the colour was most perfect, blending with the sand. I afterwards saw spoor in the wadi which I put down to this animal or one very near it. It was just after dawn when we killed this cat, so I suppose she was just returning from a night's hunting."

11. FELIS CARACAL Güld.

a. Habil, W. of Lahej, 26th September.

"*Lynx*.—The Lynx was caught in a trap set for Hyæna on night of September 26th at Wadi El Kabir. He was a pleasant looking creature in the morning when we visited the trap; as I wished to get down into Sheikh Othman quickly, I thought I would take him down alive. We made a couple of nooses and threw over the beast's head, drew them tight, and an Arab shoved a sack over him, loosed off the traps and then tied up the legs of our prisoner; we all lost skin and blood in the process. Into my Horig¹ he went, and off I set for the bungalow. On arrival I found the poor beast dead, one of the nooses not having come off—so I had to turn to there and then, and make a skin of him.

"I think the beast is not uncommon, for I saw spoor on many occasions near villages, and twice I was sent for to come and shoot an animal that was doing great damage among the sheep—always tearing the throat out. Now a wolf almost invariably attacks the flank and kills that way, so it was no wolf, and the only other animal I could put it down to was this cat. Native information is more unreliable in Arabia than anywhere I have been; they know nothing of habits of animals, nor do they know tracks of different beast when they see them."

12. HYÆNA HYÆNA L.

a. Habil, 25th September.

"*Hyæna*.—We were very unfortunate with Hyænas, for they were not rare, their spoor to be seen almost any morning, but they kept

¹ Large saddle-bag on Camel.

out of sight and out of our traps, only the one specimen being caught, and the man who went round to visit the trap unfortunately put a bullet into the lower jaw, breaking it. They keep to the hills and only come into the desert at night, although, if a meal is to be found, they often lie up in the nearest wadi that offers shelter for several nights or till the feed is finished. I never found any dead beasts that were being visited, or would have poisoned the carcass and spooed up any beast that had fed. Putting down poisoned meat was a failure (except so far as pariah dogs were concerned, and I got a good bag of them), no Hyæna ever coming near my baits; foxes came, looked at them and passed on; in fact, poison was an utter failure."

13. CANIS PALLIPES Sykes.

a. Lahej.—Presented by the Sultan of Lahej.

This specimen, like those from Muscat obtained by Surg.-Gen. Jayakar, no doubt represents Noack's *Canis hadramauticus*¹, described from puppies so young as to be useless for purposes of comparison. But, as before, I can see no valid reason for distinguishing the Arabian Wolf from that found in Iinia². Its nearest African ally is *C. lupaster*, Hempr. & Ehr.

"*Wolf*.—Not uncommon in the hills, where it does much harm to flocks of sheep and goats, even attacking donkeys and tearing the flank.

"My only specimen was presented by the Sultan of Lahej."

14. VULPES LEUCOPUS Bly.

a. ♂. Sheikh Othman, 15th September.

b. ♀. Wadi Bilik, near Shaka, N.W. of Lahej.

The latter specimen was shot while it was lying in wait for *Meriones rex*.

"*Fox* (native name 'Derain' or 'Ali ben Thile,' meaning son of a lawyer).—Not uncommon but difficult to obtain; feed chiefly on rats and mice. I twice saw them watching the burrows of *Meriones rex* (tuft-tail rats) and on one occasion bagged a female. My other specimen was shot just outside Sheikh Othman."

15. MELLIVORA RATEL Sparrm.

a-c. Habil, September.

The specimens differ among themselves in coloration. One has a white-tipped tail, as occurs occasionally in Abyssinian examples; in the others the tails are black throughout.

16. GERBILLUS PÆCILOPS Yerb. & Thos.

a-e. Lahej, 22nd to 24th August.

f-g. Wani Bana, 29th to 30th September.

h. El Khaur, 3rd October.

¹ Zool. Anzeiger, 1896, p. 356.

² In Mr. de Winton's able paper on Canidæ (P. Z. S. 1899, p. 536), I find that he has "no hesitation in referring to *C. pallipes*" a skull from Aden in the British Museum.

Further examples of this interesting species are very welcome. The adults of this series are quite similar to the type, although taken in the autumn, while that was captured in spring.

17. *GERBILLUS FAMULUS* Yerb. & Thos.

a-i (skins). El Khaur, 29th Sept. to 10th Oct. 1899.

j, k (in al.). Ditto, ditto.

This species, described from a specimen with an imperfect tail, proves to have one of the longest and handsomest tails found among the Gerbilles.

The following are the measurements of a pair of the El Khaur specimens measured in the flesh:—

♂. Head and body 105 mm.; tail 150; hind foot 27; ear 19.

♀. „ „ 100 mm.; „ 145; „ 28; „ 17.

For its terminal three inches the tail is prominently crested with black, the sides and under surface being short-haired and white; the crest-hairs forming the terminal pencil attain a length of 15 or 16 mm.

The type-specimen had only 4 plantar pads, but one of the two spirit-specimens from El Khaur has 5 and the other 6, thus giving further evidence of the unreliability of this character in the present group. At the same time the difference between the specimens in this respect is not really so great as it appears, for the pads are surrounded by granulations, and it is only a slight increase in size over its fellows which makes a “granule” worthy of the name of a “pad.”

18. *GERBILLUS* sp.

a, b. Sheikh Othman, 23rd–24th September.

c (in al.). Abyan Hill country, E. of Aden. Taken from the stomach of *Cerastes cornutus*.

Allied to *G. nanus* Blanf. and *G. dasyurus* Wagn. Not certainly determinable with the materials at present available.

19. *GERBILLUS GERBILLUS* Oliv.

a (in spirit). El Khaur.

This is the first recorded occurrence of one of the hairy-footed group of Gerbilles (subgenus *Gerbillus*) in Arabia, but their presence was quite to be expected, *Gerbillus gerbillus* occurring in Egypt, and *G. gleadowi* in Sind.

“Picked up dead in the Desert.”

20. *MERIONES REX* Yerb. & Thos.

a-d. Shaka, about 15 miles N.W. of Lehej, 30th–31st August.

Quite similar to the original series collected by Col. Yerbury at Lahej.

“*Large Tuft-tail Rat*.—These Rats were common in the wadis near Shaka, but I never saw them elsewhere. They live in large colonies of 40 or 50 holes, are arboreal feeders, all we got being shot in the bushes feeding on shoots; they come out in evening

and early morning, and are very playful. They would not look at the traps, as I suppose the bait was not correct, and yet we tried all sorts of bait we could get. Their holes are a home for many lizards, including a monitor or 'Waral.' I saw one, but was not able to get a shot, he went down the hole too quickly for me. It appeared to be about 2 ft long."

21. *ARVICANTHIS VARIEGATUS* Licht.

a-d. Lahej, 21st Aug. to 15th September.

e (in al.). Lahej.

22. *MUS RATTUS ALEXANDRINUS* Geoffr.

a, b. Lahej, 21st August.

23. *MUS* (*musculus-bactrianus* group).

a, b. Lahej. August and September.

c, d. Sheikh Othman. 26th & 27th September.

For want of material it is not at present possible to determine satisfactorily the Mice of this difficult group.

24. *ACOMYS DIMIDIATUS* Rüpp.

Many specimens. El Khaur, September and October, 1899.

The variation in colour in this series is very considerable, some being almost entirely sandy rufous, and others slaty with merely a slight wash of sandy on their flanks.

"*Spiny-back Mice.*—These interesting little mice gave us a lot of bother, for they appear to be a great dainty to the ants, and the first six or more were all spoilt—ears and noses were always eaten off. At Al Khaur in the Abyan Country we began to get specimens, and by going round the traps with a light late at night we got our specimens quite fresh. Any that were in the traps in the morning were, as usual, eaten by ants. They seem to like to be near water, for we caught nearly all close to the stream or cuttings.

"I am not at all sure about the food of these mice; I don't think they climb trees, as do most of the mice we caught. I shot several mice and rats in the trees in the dusk, but the spiny-backs seem to keep to the ground. Our traps were of awkward sizes, the small traps were inclined to hit mice on the skull and break it, while the big ones almost cut them in two.

"The spiny-backs are the most tender-skinned mammal I have met; the skin is more like wet blotting-paper than anything else, and the least thing damages them. They are early movers, in fact are often out during the day. I was very anxious to get some alive, but never was able to capture any."

25. *HYSTRIX LEUCURA* Sykes.

a. Sheikh Othman, 20th September.

This specimen confirms my previous reference of the Aden Porcupine to *H. leucura*, the Indian species, and shows no approximation to the African forms.

26. *LEPUS ARABICUS* Hempr. & Ehr.

- a. ♂. Shaka, 29th August.
 b. Hiswa, 20th September.
 c. Young. La Mileh, 16th August.

“Fairly common in the more fertile wadis, but extremely difficult to shoot—unless you have a good camel that will stand when you tell it to: then, by following as quickly as possible among the bushes, one can get them. I only shot 4 all the time I was out. Breeding-time must be about October, as the female got at Sheikh Othman late in September was in kindle, 6 young ones.”

27. *PROCAVIA SYRIACA JAYAKARI* Thos.

- a. Abyan Mountains, 70 miles N.E. of Aden.

This is the first Dassy obtained in the Aden region, the previous examples of the subspecies having come from Dofar, halfway towards Muscat (*Jayakar*), and from Nejd in Central Arabia (*Schweinfurth*).

“*Hyrax*.—Not rare in the hills behind Shukra, but very difficult to get within shot, as the Bedouins are always hunting them for food; I saw 20 or more in one place, but they all cleared before I got within 100 yards. I saw a lot of snares set for them, but while I was in the district none were captured: the snares were set in the mouth of a hole. The hyrax is not much of a wanderer and feeds close to his hole. There are two species of Eagle about the hills which subsist almost entirely on them, so they have plenty of foes. According to a Bedouin from Dethina¹, the Leopards live to a large extent on Dassies, which seem to be very common in Dethina, and Leopards are fairly numerous.”

28. *CAPRA SINAITICA* Hempr. & Ehr.

- a. Skull and horns. Abyan Mountains.

3. A Revision of the Butterflies of the Genus *Zizera* represented in the Collection of the British Museum. By
 ARTHUR G. BUTLER, Ph.D., F.L.S., F.Z.S. &c.

[Received January 18, 1900.]

(Plate XI.)

Whilst rearranging the Museum series of “Blues” referable to the genus *Zizera*, I have discovered so much of interest, that, although at present I am not prepared to assert that the genus is a good one (when examined structurally), I feel that a revision of it is greatly needed.

In De Nicéville’s ‘Butterflies of India,’ a work of great merit and therefore deserving of all respect, I find certain species regarded as synonyms which to me appear to be as distinct as

¹ Dethina lies some 200 miles N.E. of Aden.

Butterflies inhabiting different geographical areas can well be; yet I find the decisions arrived at by De Nicéville echoed by Leech in his 'Butterflies of China and Japan.'

The question which naturally occurs to me is: Did these gentlemen ever separate the whole of the specimens before them into geographical forms before deciding that they represented one widespread and variable species? If they had done so, I cannot avoid the conclusion that they would either have kept them separate, or have included the whole genus under one widely distributed and still more variable species.

The genus *Zizera* consists of small Butterflies with naked eyes; the hind wings rounded, without tail, never ocellated above or below; the costal and subcostal veins perfectly free (on which account I cannot accept the *Lycæna lulu* of Mathew as a *Zizera*, since the costal and first subcostals touch one another in that species and the hind wings usually show a black spot below to represent an ocellus).

I am not at all sure that *Z. labradus*, in which the costal vein and first subcostal branch of the fore wings are closely approximated (though they do not touch or unite), is very nearly related to any of the other species of the genus, the position of the discal series of spots on the fore wings being unique; still there seems no sufficient reason for rejecting it from the genus or group known as *Zizera*.

Before proceeding to a key to the species of *Zizera*, I wish to express my conviction that any errors which may have crept into important faunistic works with regard to the clear definition of the species have been largely due to errors of identification published previously, and almost inevitable at a time when the seasonal phases of species were not even guessed at: thus a wet phase from Calcutta might somewhat resemble a wet phase from Japan, whilst the dry phase was wholly dissimilar.

Key to Species of *Zizera*.

- A. Hind wings with first three spots of discal series below forming a tolerably regular oblique line
- a. Species with well-defined and very dissimilar seasonal forms.
- a. a. Wet phase of male silvery violet above with very broad outer border, of female brown; both sexes brownish grey below: dry phase, bluish white above, the female with very broad outer border *Z. maha*.
- a. b. Wet phase of male lavender above with much narrower outer border, of female brown; both sexes greyish stone-colour below: dry phase pale lavender shading into silvery blue above, the female with moderately broad border (as in male of wet phase)..... *Z. diluta*.
- a. c. Wet phase of male pearly lilac above, with border as in a. b, but more sharply defined, of female brown; both sexes greyish stone-colour below: dry phase silvery blue, becoming pale lilac and then cream-white, with veins of the latter colour, the female blue with broad border to primaries extending along costa; a broad costal border to secondaries *Z. opalina*.

- a. d.* Wet phase of male rich lavender, with moderately broad sharply defined blackish border; of female brown; both sexes greyish white below, with the markings very dark: dry phase rich lilacine blue, with blackish margin and fringe, the female black-brown sprinkled with blue scales; both sexes below brownish grey..... *Z. argia.*
- b.* Species with ill-defined seasonal forms.
- b. a.* A spot within discoidal cell of front wings below, discal spots sinuous.
- b. a. a.* Upper surface of male rich violet, with very broad dark brown outer border *Z. lysimon.*
- b. a. b.* Brown outer border on upper surface one third narrower, fringes of all the wings frequently whitish externally *Z. knysna.*
- b. a. c.* Generally smaller, with ill-defined browner outer border. Males above lilac with coppery reflections, outer border reduced to a dark marginal line; underside ashy, all the markings dark and well-defined; a white streak along discoidal vein of hind wings ... *Z. karsandra.*
- b. a. d.* Ill-defined but very dark brown outer border above; the discoidal and discal black spots below all very large and white-edged, the last two or three discal spots of front wings wanting *Z. atrigenmata.*
- b. b.* No spot within discoidal cell of front wings..... *Z. gaika.*
- b. c.* Discal spots on underside of front wings forming a nearly straight line, inner row of spots wanting from hind wings *Z. lorquini.*
- B.** Hind wings with first three spots of discal series below forming a triangle, the first and second being almost in a transverse line.
- a.* Discal series of markings crossing the under surface near to submarginal series.
- a. a.* Male above dull lavender, border brown, rather narrow and ill-defined, markings below usually pale... *Z. labradus.*
- a. b.* Male above lilacine, border apparently broad and diffused on apical-costal area; markings below broader and well-defined, but brown..... *Z. caduca.*
- a. c.* Male above bluish green, with broad outer border; all the markings on the underside well-defined..... *Z. antanossa.*
- a. d.* Male above often bluish green, sometimes brown; the spots below small, the discal series of front wings nearly straight, the inner series of hind wings very imperfect *Z. minima.*
- a. e.* Male above violet, with distinct rather narrow border, widening on costa of front wings; spots below small *Z. otis.*
- a. f.* Male above similar, but the border often narrower; discal spots below large *Z. indica.*

The following is a list of the species represented in the Museum:—

1. *ZIZERA MAHA.* (Plate XI. figs. 1, 2.)

Lycæna maha, Kollar in Hùgel's Kaschmir, iv. p. 422 (1848).

Polyommatus chandala, Moore, P. Z. S. 1865, p. 504, pl. xxxi. fig. 5.

Zizera ossa, Swinhoe, P. Z. S. 1885, p. 132, pl. ix. figs. 11, 12.

This species appears to be strictly confined to Western India,

occurring from the Lower Himalayas to Madras. In my opinion, *Z. maha* is the wet phase, *Z. chandala* intermediate, *Z. ossa* dry.

Although Mr. Moore describes *Z. chandala* as having a purplish-brown border and the figure represents an insect with a very dark and defined border, the dull silvery-blue colouring mentioned in the description can only apply to the intermediate phase; in the wet phase the border is much broader and there is a distinctly violet subtint.

The intermediate phase somewhat nearly resembles the wet phase of *Z. diluta*, to which fact I believe the confusion between these geographically constant forms is attributable; the males, however, are somewhat paler and more pearly in tint, with the dark outer border to the primaries browner and consequently less sharply defined.

It is possible that this species may range through Beluchistan to the Persian Gulf, as we have a female from Fao which looks suspiciously like that sex of *Z. maha*.

2. ZIZERA DILUTA. (Plate XI. figs. 3, 4.)

♂. *Lycæna diluta*, Felder, Reise der Nov., Lep. ii. p. 280, pl. xxxv. figs. 12, 13 (1865).

♀. *Lycæna squalida*, Butler, Trans. Ent. Soc. Lond. 1879, p. 41.

The range of this species seems to extend from the Eastern Himalayas southwards to Ganjam; and the differences which separate this geographical race from the Western *Z. maha* appear to me to be quite constant, such as the narrower and better defined outer border to the wings and the greater resemblance of tint between the seasonal phases. At the same time, to those who prefer to treat it as a form of *Z. maha*, I have nothing to object; only I hope that they will not, as we have all done hitherto, confound the Eastern and Western types.

3. ZIZERA OPALINA. (Plate XI. figs. 5, 6.)

Lycæna opalina, Poujade, Ann. Soc. Ent. France, 1885, p. cxliii.

Lycæna marginuta, Poujade, tom. cit. p. cli.

Plebeius alboceruleus, Röber, Iris, iii. p. 59, pl. iv. fig. 7 (1886).

This pretty little species probably occurs throughout Burma¹, Tibet, and China. The wet phase of the male is distinctly more pearly and apparently more lilacine than in either of the Indian forms: this may, however, be partly due to the darker and slightly narrower outer border of the primaries; that of the secondaries is represented along outer margin by a row of well-defined black spots, sometimes bounded internally by a lunulated line: the under surface has a yellower (more stone-coloured) tint than in *Z. maha* or *Z. diluta*. The dry phase is very distinctive, the colouring of the

¹ We have a male of the dry phase collected by the late Capt. Watson in the Southern Shan States.

males being silvery sky-blue, fading on the borders into creamy white and with similarly coloured veins.

4. *ZIZERA ARGIA*. (Plate XI. figs. 7, 8.)

Lycæna argia, Ménétrés, Cat. Mus. Petrop. ii. p. 125, pl. x. fig. 7 (1857)

Lycæna japonica, Murray, Ent. Month. Mag. xi. p. 167 (1874); Pryer, Rhop. Nihon. pl. iv. fig. 24c (1886).

Lycæna alope, Fenton, P. Z. S. 1881, p. 351.

Occurs in Mantchuria, Corea, and throughout Japan. The male of the wet phase somewhat nearly resembles the same phase of *Z. diluta*, but the much whiter under surface with sharply defined black spotting would separate the two insects at a glance: the dry form (*Z. japonica*) first induced me to conclude that the association of the four preceding geographical forms together under one specific name must be an error; it, in fact, resembles none of the other dry forms, the upper surface of the male being of a rich lavender-blue, with the extremities of the veins and a very narrow marginal line dark brown, the under surface, unlike its wet phase, being brownish grey.

When the wet phases only of these four species are compared, one is tempted to think that they may be varietal forms of the same species; but all the dry phases are perfectly distinct. No lepidopterist who possessed only *Z. ossa* and *Z. japonica* would for a single moment hesitate to regard them as evidently distinct species. As I hold that a species is represented by all its forms, and not by one alone, I should still consider the preceding species distinct if they showed no difference whatever at the wet season, so long as their dry phases exhibited such well-defined characteristics.

5. *ZIZERA LYSIMON*. (Plate XI. fig. 9.)

Papilio lysimon, Hübnér, Eur. Schmett. i. pl. cv. figs. 534, 535 (1791-1803).

Southern Europe.

Staudinger notes Mauritania and Asia Minor as localities, but I should hesitate to accept these without first examining specimens and comparing them with those of the south of France or Spain. De Nicéville quotes *Lycæna galba* as a synonym, but Staudinger widely separates the two in his catalogue. From *Z. knysna*, to which it is allied, *Z. lysimon* differs in its duller less clear violet colouring and considerably broader brown borders. What species Mr. De Nicéville identified as *Z. lysimon* in India I cannot guess: *Z. karsandra* is the nearest; but, although the illustration which he gives of a female seems to me to represent some females of the latter species, the fact that he comments upon my quoting it as *Z. karsandra* from the Malay Peninsula seems to hint at its being something different. One thing, however, is certain—*Z. karsandra* is much more nearly allied to *Z. knysna* than the latter is to *Z. lysimon*.

6. ZIZERA KNYSNA. (Plate XI. fig. 10.)

Lycæna knysna, Trimen, Trans. Ent. Soc. Lond. ser. 3, vol. i. p. 282 (1862); Rhop. Afr. Austr. ii. p. 255 (1866).

Sierra Leone southwards to the Cape, thence all along the eastern side to Abyssinia; also at Aden.

7. ZIZERA KARSANDRA.

Polyommatus karsandra, Moore, P. Z. S. 1865, p. 505, pl. xxxi. fig. 7.

Zizera mora, Swinhoe, P. Z. S. 1884, p. 506, pl. xlvii. fig. 7.

Western and Southern India, Ceylon, Burma, Penang, the Philippines, and New Guinea.

I have no doubt that the specimens recorded from Aden are referable to *Z. knysna*, from which *Z. karsandra* certainly differs less than the species of the *Z. maha* group. *Z. mora* is an aberration.

8. ZIZERA ATRIGEMMATA. (Plate XI. fig. 11.)

Lycæna atrigemmata, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. ii. p. 290 (1878).

Madagascar.

The enormous size of the black spots on the under surface at once defines this species: we possess only two examples, therefore it may prove to be an aberrant form, but it is hardly likely that two aberrations and none of the normal form would be obtained.

9. ZIZERA GAIKA.

Lycæna gaika, Trimen, Trans. Ent. Soc. 3rd ser. i. p. 403 (1862); Rhop. Afr. Austr. ii. p. 256, pl. 4. fig. 7 (1866).

Lycæna pygmæa, Snellen, Tijd. voor Ent. xix. p. 153, pl. 7. fig. 3 (1876).

From Damara-land and the Cape, north-eastwards probably to Cape Guadafui, Aden, Muscat, and probably through Persia and Afghanistan to India, the Western Himalayas, continental and peninsular India, Ceylon, Burma, the Malay Peninsula, Andaman Islands, Sumatra, and Java.

10. ZIZERA LORQUINI.

Lycæna lorquini, Herrich-Schäffer, Schmett. Eur. i. figs. 442-4 (1850).

South of France and Andalusia.

How this species ever came to be regarded as the same as *Z. minima* is a puzzle to me; the lilac colouring of the upper surface is so utterly dissimilar from the greenish-scaled brown upper surface of *Z. minima* that one would never expect to see them put together; even the pattern of the under surface, though somewhat similar, differs considerably.

11. ZIZERA LABRADUS. (Plate XI. fig. 13.)

Polyommatus labradus, Godart, Enc. Méth. ix. p. 680 (1819).

Lycæna novæ-hollandiæ, Felder, Verh. zool.-bot. Ges. Wien, xii. p. 490 (1862).

Lycæna communis, Herrich-Schäffer, Stett. ent. Zeit. 1869, p. 72 (undescribed).

Lycæna alsulus, Herrich-Schäffer, t. c. p. 75.

Zizera phœbe, Murray, Ent. Mo. Mag. x. p. 107 (1873).

Lycæna mangoensis Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xiii. p. 347 (1884).

The South Pacific Islands, Tasmania, Australia, Damma Island, and perhaps Amboina.

I do not think there is at present sufficient evidence of the identity of *Z. caduca* with *Z. labradus*: the type differs considerably from any specimens of *Z. labradus* which we possess. A single example obtained by Mr. J. J. Walker in Amboina must, I think, be referable to *Z. labradus*; it differs chiefly in the sharply defined markings on the under surface, those crossing the disk of the wings being almost black.

12. ZIZERA CADUCA. (Plate XI. fig. 12.)

Lycæna caduca, Butler, P. Z. S. 1875, p. 616.

Erromanga, New Hebrides.

This is decidedly smaller than any *Z. labradus* that I have seen, and the dark external border (of the female at any rate) is extremely broad on the costal half of the wing, where it extends to the end of the discoidal cell: in the secondaries the submarginal pale lunules are sharply defined, and on the under surface all the inner markings are considerably broader than in *Z. labradus*, being equal in width to those of the submarginal series. I cannot, therefore, at present follow my friend Mr. H. H. Druce in regarding *Z. caduca* as a variety.

13. ZIZERA ANTANOSSA. (Plate XI. figs. 14, 15.)

Lycæna antanossa, Mabille, Bull. Soc. Ent. France, ser. 5, vol. vii. p. lxxii (1877).

Madagascar, Eastern, Southern, and Western Africa.

The male of this species more nearly resembles the most highly coloured forms of *Z. minima* on the upper surface than it does any other species; on the under surface, however, it is very different, the discal series of spots on the primaries being sinuous and all the spots larger; a well-defined double submarginal series.

14. ZIZERA MINIMA.

Papilio minimus, Fuessly, Verz. p. 31 (1775).

Papilio alsus, Schiffermüller, Wien. Verz. p. 184 (1776).

Papilio minutus, Esper, Schmett. i. pl. 108. fig. 8 (1800?).

Lycæna alsoides, Gerhardt, Mon. Lyc. pl. 13. fig. 3 (1853).

Europe. "Asia Minor, Armenia, S. Siberia, Amur" (*Staudinger*).





1



3



5



2



4



6



8



7



10



11



9



12



14



13



15

F. W. Frohawk del. et lith.

West, Newman chromo.

SPECIES OF ZIZERA.

15. ZIZERA OTIS.

Papilio otis, Fabricius, Mant. Ins. ii. p. 73 (1787).

Polyommatus sangra, Moore, P. Z. S. 1865, p. 772, pl. xli. fig. 8.

Lycena lysizone, Snellen, Tijds. Ent. xix. p. 24, pl. vii. fig. 2 (1876).

Zizera oriens, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xi. p. 417 (1883).

N.E. India, Burma, Tenasserim, Pegu, Malacca, Penang, China, Formosa, Philippines, Ternate, Amboina.

I have only given the range of this species as represented by our specimens, as I consider *Z. indica* to be an easily recognizable and probably distinct species.

16. ZIZERA INDICA.

Lycena indica, Murray, Trans. Ent. Soc. Lond. 1874, p. 525, pl. x. figs. 2, 3.

Zizera indica, var. *decreta*, Butler, P. Z. S. 1883, p. 150.

Mhow, Poona, Ganjam, S. India, Ceylon. (B. M.)

In this insect, which runs somewhat smaller than *Z. otis*, the discal series of spots on the under surface of the primaries is more sigmoidal and the spots are much larger; in the secondaries the first three spots of the discal series form an obtuse instead of an acute angle.

The *Lycena lulu* of Mathew is certainly not a typical *Zizera* and should not, I think, be included in the genus: it has naked eyes, but the costal and subcostal veins touch at one point and then separate again; on the under surface of the secondaries, moreover, there is a conspicuous black subanal spot, answering to the metal-sprinkled spot common to *Nacaduba*, *Catochrysops*, and various other genera.

My so-called *Zizera unigemmata* proves to be a *Chilades* allied to *C. messapus* = *sebagadis* = *acca*: the brown upper surface of the male would alone distinguish it, at a glance, from *C. messapus* apart from other differences.

EXPLANATION OF PLATE XI.

- Fig. 1. *Zizera maha*, ♂, wet form, p. 106.
 2. " " var. *ossa*, ♂, dry form, p. 106.
 3. " *diluta*, ♂, wet form, p. 107.
 4. " " ♂, dry form, p. 107.
 5. " *opalina*, ♂, var. *marginata*, wet form, p. 107.
 6. " " ♂, typical, dry form, p. 107.
 7. " *argia*, ♂, wet form, p. 108.
 8. " " var. *japonica*, dry form, p. 108.
 9. " *lysimon*, ♂, p. 108.
 10. " *knysna*, ♂, p. 109.
 11. " *atrigenmata*, ♂, p. 109.
 12. " *caduca*, ♀, p. 110.
 13. " *labradus*, ♀, p. 110.
 14, 15. " *antanossa*, ♂ ♀, p. 110.

February 20, 1900.

Dr. HENRY WOODWARD, F.R.S., V.P., in the Chair.

Mr. Oldfield Thomas exhibited the skin of a small Kangaroo which had been presented to the British Museum by the Society's President, the Duke of Bedford. It had lived some little time at Woburn, and was said to have been brought from Queensland or North Australia.

It was most nearly allied to the West Australian *Macropus eugenii* Desm., with which it agreed in size and skull-characters, but differed in its uniform pale colour and remarkably soft thick fur.

Mr. Thomas proposed to call it *Macropus bedfordi*, and described it as follows:—

Size as in *M. eugenii*. Fur long, thick, soft, and woolly, the hairs of the back 33–35 mm. in length. General colour uniform pale isabelline fawn, quite different from the dark colour of *M. eugenii*. The hairs are slaty grey at their bases, then brown, with a whitish subterminal band and a pale brown tip. Centre of face like back, slightly darkening in middle line between ears and down the neck to form a faintly darker nuchal line. Face-markings almost obsolete, the usual light cheek-line but little lighter, and the dark orbital and ramal streaks scarcely darker than the general colour. Ears short, their backs terminally sandy fawn, basally and a patch below their bases externally dull white. Chin and throat dull white; chest and belly whitish fawn, but little lighter than the sides. Inguinal region, front of hips, and a line down the front of the lower leg white. Shoulders and outer sides of fore limbs like body, with scarcely a trace of rufous; an indistinct darker elbow-mark present; hands whitish brown above. Legs sandy brown behind and laterally, white in front; upper surface of feet sandy white, not darkening terminally, the long hairs at the base of the claws clear yellowish white. Tail short, thick, sandy fawn above and on the sides, whitish below, not darkening terminally.

Skull much as in *M. eugenii*. Disproportion rather greater than usual between the small permanent pre-molar (p^3 of modern nomenclature)¹ and the large square mp^4 (m^1 of the Catalogue of Marsupials).

Dimensions of the type, measured in skin:—Head and body 550 mm.; tail 360; hind foot 115; ear, from notch, 52.

Skull: basal length 83; greatest breadth 49; nasals 34×15.5 ; interorbital breadth 16; diastema 20.5; length of p^3 4.5; combined length of three anterior grinding-teeth ($mp^4 - m^2$) 17.

Type. Female. B.M. No. 0.2.19.1. Presented by the Duke of Bedford.

This little Wallaby differs from its only near ally, *M. eugenii*,

¹ See Lydekker, P. Z. S. 1899, p. 922.

by its long fur and peculiar pale body-colour, which latter indeed seemed to be quite unique within the genus.

Mr. Thomas also exhibited a Kangaroo which had been sent to him from Western Australia by Mr. Bernard H. Woodward, Curator of the Museum at Perth.

Judging by its skull and more essential characters, it seemed to be assignable to *Macropus robustus*, the Wallaroo, of which Mr. Sclater's *M. erubescens* was the South and Central Australian representative. Its colour, however, was so different from either the Eastern or Central forms of the species that Mr. Thomas thought it necessary to distinguish it as a local subspecies, for which he suggested the name *Macropus robustus cervinus*.

With the exception of the head (which was greyish brown, much as in *M. r. typicus*), the whole of the upper surface was of a deep rufous fawn, the hairs being of this colour to their bases. In both *M. r. typicus* and *M. erubescens* the general colour was grey, the latter being rufous across the shoulders. Tips of dorsal hairs black. The chin, throat, and centre of the belly were whitish, not sharply defined. The limbs also more whitish than the body, but darkening to black on the tips of the fingers and toes. The tail was pale sandy rufous, its extreme tip above black.

The skull and dentition were apparently quite similar to those of the true *M. robustus*, except that, in common with *M. erubescens*, the third upper incisor was less elongated.

Hind-foot of type, without claw, 241 mm.

Skull—basal length 128 mm.; greatest breadth 76.5; nasals 58×22 ; diastema (to p^3) 36; combined length of three anterior grinding-teeth 32; horizontal length of i^3 8.6, of p^3 8.

Hab. Pinda Station, Yalgoo, Murchison District, Western Australia.

Type. Female (immature). B.M. No. 0.2.6.6.; original number 1213. Killed 15th August 1899, by the Perth Museum collector. Two specimens examined.

Native name "Picquarda."

With the specimens of *Macropus r. cervinus*, Mr. Woodward had also sent several examples of the Red Kangaroo (*Macropus rufus*), a species which, when the Catalogue of Marsupials was published, was not certainly known to inhabit Western Australia¹. These examples were also from the Murchison District, and seemed to agree with the ordinary *M. rufus* of Eastern Australia, showing no approximation to either *M. isabellinus* or *M. magvus*.

Mr. Lydekker, on behalf of Mr. Rowland Ward, F.Z.S., exhibited the horns and skin of a male specimen in the winter coat of the Sheep which, on the evidence of specimens in the summer dress, he had named *Ovis sairensis* ('Wild Oxen, Sheep and Goats,')

¹ Cat. Mars. B. M. p. 27, 1888.

p. 185, 1898). The skin of this ram was of a greyish-brown colour above, with a light saddle-shaped patch on the back, a white caudal disk, which did not include the tail, and the legs below the knees and hocks pure white, as were the under-parts. Above the caudal disk was a dark brown band; the shoulders and thighs were as dark as the back; and on the nape of the neck was a tuft of very long slate-coloured hair, which was dark brown at the roots. This tuft was also present in a female skin; a much



Male of Littledale's Sheep (*Ovis sairensis*), in winter coat.

shorter one occurred in a female head of *O. ammon*, but it was absent in *O. poli*. From the latter in winter dress the present specimens also differed by the dark shoulders and thighs. The development of a white caudal disk in the winter coat alone was another peculiarity of *O. sairensis*. The specimens were said to have been obtained in the Irtish valley, which drains the Semi-palatinsk Altai.

In this connection Mr. Lydekker desired to call attention to an error in his work entitled 'Wild Oxen, Sheep and Goats of All Lands,' where it was stated that the face and lower part of the legs of *O. ammon* were always white, whereas they were so only in the typical race during summer, and then might be better described as dirty white.

Mr. Lydekker likewise exhibited the skulls, horns, and skins of a male and female Ibex obtained with the preceding specimens, which he thought might possibly belong to *Capra sibirica dauvergnei*. In the ram the general colour of the fur was light brown, with a

large white patch on the back of the lower part of the neck, and a still larger white saddle on the loins, through which ran a dark dorsal streak to the tail. The under-parts were scarcely lighter than the back; and the legs had no white, being cigar-brown in front and golden brown behind. The horns were of great size, and remarkable for their extreme depth. In the absence of white on the legs and the dark under-parts, the skin was like that of *C. sibirica sacin*, but the latter had no white nuchal patch and a very indistinct lumbar saddle. The associated female skin, in which the hair on the back was just changing, so that the grey *pashm*, or under-fur, was exposed, was remarkable for the circumstance that the whole of the under-parts were pure white, quite unlike what the describer had seen in any other Ibex.

Mr. Lydekker believed that Mr. Walter Rothschild had an Ibex skin similar to the male exhibited which would be shortly described as a new form.

The following papers were read:—

1. On the Marine Fauna of Christmas Island (Indian Ocean). By C. W. ANDREWS, B.Sc., F.Z.S., EDGAR A. SMITH, H. M. BERNARD, R. KIRKPATRICK, and F. C. CHAPMAN.

[Received January 16, 1900.]

(Plates XII. & XIII.)

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I. *Introductory Note.*

The chief objects of my recent visit to Christmas Island (Indian Ocean) were to collect the land fauna and flora and work out the structure of the island itself, and nearly the whole of my time was devoted to these ends. At the same time some small collections of the marine fauna were made, and these have been determined by various specialists, some of whose reports are printed below. The Gephyrean worms (six species, none of which are new) have already been noticed by Mr. A. E. Shipley in the Proceedings of this Society (P. Z. S. 1899, p. 54).

The shores of Christmas Island are singularly unfavourable for the collection of marine animals ; except in a very few localities, the coast-line is formed by vertical or overhanging cliffs, the base of which is washed by the heavy ocean swell, so that the narrow shelf of fringing reef, which is submerged to a depth varying from a few feet to several fathoms, is unapproachable from the land side, and, except along the north coast in very calm weather, is very difficult of access from a boat. Nevertheless, the examination of this reef and of the submarine slopes of the island between N.E. and N.W. Points, and the collection of their fauna, where possible, would no doubt yield very interesting results, and it might be worth the while of a marine zoologist to spend some time on the island for this purpose.

In a few localities on the east coast and at Flying Fish Cove, a narrow reef-flat, like that of an atoll, is exposed at low water, and it is from this in the latter locality that nearly all the specimens mentioned below were obtained. In this place an area about a quarter of a mile long and from fifty to a hundred yards wide is exposed at low tide. Its outer edge forms a slightly raised rim of rocks thickly coated with pink and red calcareous algæ, and is cleft here and there by deep narrow channels. Within this raised rim the reef-flat forms a hard concrete-like floor composed of cemented fragments of corals, larger blocks of which lie loose upon its surface. Here and there are shallow pools of water, some of which are choked with thick clumps of small branching Madreporæ (e. g., *M. clathrata*, *M. valida*, *M. aspera*), the tops of which are exposed to the air for a considerable time between the tides. In some of these pools also there are extensive patches of a pinkish-grey, leathery Alcyonarian (*Sarcophyton*). Most of the Corals obtained were from these pools or from the sides of the deeper channels near the edge of the reef. The reef is interrupted near the middle of the bay by a boat-channel with a sandy bottom running up to the beach, and it was from sand taken from about 11 fathoms in this channel that the Foraminifera described by Mr. F. C. Chapman were obtained.

The reef-flat seems on the whole rather barren of life. The swiftly running shore-crabs (*Grapsus maculatus*), which skim over the rocks like leaves driven by the wind, and two Holothurians, the smaller quite black, the larger olive-brown, are the most conspicuous objects. In the pools are numerous small fish, including a little *Periophthalmus* which jumps from stone to stone with great activity.

The Crustaceans and Echinoderms determined by Mr. R. I. Pocock and Prof. Jeffrey Bell are :—

Crustaceans :—*Actæa nodulosa*, *Eriphia levimanus*, *Actæodes tomentosus*, *Lophozozymus* sp., *Daira perlata*, *Chlorodius* sp., *Calcinus elegans*, *C. tibicen*, *Aniculus typicus*, *Stenopus hispidus*, *Pencæus* sp. ; there is also a large cray-fish which is used for food, but of which unfortunately no specimen was brought back.

Echinoderms :—*Linckia miliaris*, *L. diplax*, *Nardoa tuberculata*,

Ophidiaster sp., *Ophiocoma aethiops*, *O. scolopendrina*, *Actinopyga miliaris*, *Diadema saxatile*, *Echinometra lucunter*, *Colobocentropus atratus*. Of the Echinoids, *Echinometra* is the commonest and lives in holes in the rock, which it appears to excavate.

Towards the extreme edge of the reef many small specimens of *Tridacna gigas* nearly embedded in the rock may be seen, but they never attain very great size here. Squids and a species of Octopus are fairly common, but very difficult to discern; the Octopus is often used for food by the people, while the Squids are devoured in large numbers by the Gannets and Frigate-birds.

The reef-fish were not collected; they, however, are much the same as those found at Cocos-Keeling Islands, and probably are all common Indo-Pacific forms. They form an important part of the food of the people, and are usually obtained with the spear, in the use of which the Cocos-Islanders are extraordinarily skilful.

Below will be found lists and descriptions of the Molluscs, Corals, Sponges, and Foraminifera; and I must express my sincere thanks to the Authors of these communications for the trouble they have taken over the small collections I was able to bring back.

II. *A List of the Marine Mollusca collected by Mr. C. W. Andrews at Christmas Island.* By EDGAR A. SMITH.

No pretence of systematically collecting marine objects was made by Mr. Andrews, his direct object having been the investigation of the geology and the terrestrial fauna and flora. A certain number of specimens, however, observed during rambles upon the coast, were captured and preserved. Those mentioned in the following list were found in Flying Fish Cove on the north coast of the island. They are mostly very common forms, having a wide range in the Indian and Pacific Oceans.

1. OCTOPUS sp.
2. OMMATOSTREPHES sp.
3. CONUS HEBRÆUS Linn.
4. CONUS CORONATUS Dillwyn.
5. LEUCOZONIA SMARAGDULA (Lamk.).
6. TRITONIDEA UNDOSA (Linn.).
7. ENGINA MENDICARIA (Lamk.).
8. IOPAS SERTUM (Bruguière).
9. SISTRUM MORUS (Lamk.).
10. SISTRUM RICINUS (Linn.)

11. MITRA (STRIGATELLA) LITERATA Lamk.

12. MITRA (STRIGATELLA) PAUPERCULA, var.

A short form like *M. virgata* Reeve (Conch. Icon. fig. 197 *b*), with the spire transversely grooved and the white stripes upon the body-whorl somewhat raised, forming feeble costulations.

13. CYPRÆA ARABICA Linn.

Both typical specimens and the variety *reticulata*.

14. CYPRÆA VITELLUS Linn.

15. CYPRÆA LYNX Linn.

16. CYPRÆA MONETA Linn.

17. CYPRÆA ANNULUS Linn.

18. NEBITA COSTATA Chemnitz.

19. TURBO LAJONKAIIRII Deshayes.

Hitherto known only from Cocos-Keeling Islands, the original locality "New Zealand" not having been confirmed. Two very brightly coloured specimens, copiously blotched and spotted with purple-brown. The operculum has the central portion olive-green, instead of "dark brown" as described and figured by Pilsbry (Man. Conch. vol. x. p. 199, pl. lix. fig. 10).

20. SMARAGDINELLA VIRIDIS Rang.

21. PHYLLIDIA VARICOSA Lamk.

22. DORIS CORIACEA Abraham.

23. PERONIA PERONII Cuvier.

24. TRIDACNA GIGAS Linn.

Only a single very young specimen.

25. SEPTIFER BILOCULARIS (Linn.).

26. ARCA IMBRICATA Bruguière.

27. MELINA PERNA (Linn.).

Very variable in form, but always showing the characteristic colour-markings. Specimens in the Museum are from Cocos-Keeling Islands, Andaman and Samoa Islands.

Perna samoensis, Baird (Brenchley's Cruise H.M.S. 'Curaçoa,' p. 454, pl. xlii. fig. 8), is a synonym of this species (*vide* Hanley's *Ipsa Linnæi* Conch. p. 117, pl. ii. fig. 7).

III. *On the Madreporaria collected by Mr. C. W. Andrews at Christmas Island.* By H. M. BERNARD.

There are in all 42 specimens including fragments, representative of the following groups or genera:—

<i>Caryophyllinæ.</i>	<i>Caulastræa.</i>
<i>Dendrophyllia.</i>	<i>Galaxea.</i>
<i>Madrepora.</i>	<i>Mussa.</i>
<i>Montipora.</i>	<i>Leptoria.</i>
<i>Porites.</i>	<i>Cœloria.</i>
<i>Goniopora.</i>	<i>Prionastræa.</i>
<i>Pocillopora.</i>	<i>Agaricia.</i>
<i>Goniastræa.</i>	

Of these, one *Madrepore*, two *Montipores*, and one *Goniastræa* are described as new species, while it is suggested that the specimen provisionally named *Caulastræa* may belong to a new genus.

The specimens are often very fragmentary, and those in spirit are obscured by soft parts, making their determination difficult. In most cases, however, the genera have been easily recognized, but the specific identifications are entirely provisional. It is practically impossible to work out small collections of Corals in the present unsatisfactory state of *Madreporarian* systematics. The approximate determinations of the fragments will, however, be sufficient guide as to the general characters of the representatives of the several genera.

The biological notes were added by Mr. Andrews.

CARYOPHYLLINÆ M.-E. & H.

There are three small solitary corals growing side by side, the largest of which is 5.5 mm. high, evenly cylindrical, and 3.5 mm. in diameter; the smallest, also cylindrical, is 2.25 mm. in diameter but with the base embedded so that the height is not ascertainable. The specimens are in spirit, with the soft parts completely obscuring the columella and pali, on which the generic and specific characters of this family are founded. There are three cycles of septa in both small and large specimens, of which the primaries are slightly exsert, and apparently laterally granulate or echinulate. The living flesh extends to a variable distance down the outer walls.

GENUS DENDROPHYLLIA de Blainville.

DENDROPHYLLIA EHRENBURGIANA.

Cœnopsammia ehrenbergiana Klunzinger, Cor. iii. p. 56, pl. viii. 9.

There are two specimens, which come nearer to this type in the method of growth than to any other recorded species. The difference between *Dendrophyllia* and *Cœnopsammia* is merely the meeting of the septa in the former, which appears to me very unimportant. Hence I have not hesitated to place these two

specimens, in which the septa appear to run distinct to the columella, under the older generic name.

The specimens are both low groups of calicles rapidly budding, and in one case dying away beneath the living cluster, but in the other rising on a pedestal 2-3 cm. high, and on one side bare of polyps.

Occurs in rock-pools under the cliff on the south side of Flying Fish Cove.

Genus MADREPORA.

MADREPORA (ISOPORA) BROOKI, sp. n.

Corallum with typical growth, viz., a thick common base from which 3 or 4 stout flattened branches radiate outwards, with an upward curve. The tip of each branch expanding and branching again. [The branches are 3-4 cm. thick and 4-6 wide, but as the coral is continually thickening these measurements are of no classificatory importance.]

Certain of the calicles on the tops of the branches or of knobs are thin and cylindrical, and may be as much as 4-5 mm. long by 2.5 in diameter, and among these are others of all lengths but with one side cut down; the larger are nearly complete, the shorter are purely scoop-shaped. Here and there these incomplete calicles appear grouped irregularly round a complete calicle. The whole of the rest of the stock, except on the undersides of the branches (which are warty and nearly bare of calicles), is thickly covered with scoop-shaped calicles of all sizes and turned all ways, the majority looking upward; many are mere punctures on the surface with a slightly raised margin, others have one edge protuberant like a lip; from this all stages are found up to the long scoop-shaped calicle. The calicles show no special feature, their costal ridges are regular, smooth, and not prominent; the whole wall in the larger calicles rapidly solidifies. The interstitial cœnenchyma fills up as systems of floors supported on long spines like that typical of *Astræopora*. The smaller calicles are lighter and more openly reticular.

There is one large complete specimen, two fragments from other stocks, and a branch worn smooth, yet recognizable by the section which shows the peculiar interstitial cœnenchyma. The species differs not only in growth-form, but in size and characters of the larger tubular calicles, from all the members of the subgenus described by Mr. G. Brook in the British Museum Catalogue of Madreporaria, vol. i.

The large specimen was brought up from 11 fathoms by the sounding-lead in Flying Fish Cove. Much of the shore cement seems to be made up of rolled fragments of this madrepora.

MADREPORA (?) CLATHRATA Brook.

Madrepora clathrata Brook, Brit. Mus. Madr. i. p. 49, pls. v. & vi.

There are several fragments, one a long branching stalk (13 cm.

long), from what I take to have been a prostrate, or other one-sided growth-form. The branchlets are all turned up one side and grow out at right angles, and the scoop-shaped radial calicles project on the same side also at right angles and are chiefly obsolete on the opposite side. The branches show no trace of fusing together. In other respects, however, it comes nearest to *Madrepora clathrata*. The calicles, both radial and axial, seem to agree in shape and size, and the characters of the cœnenchyma seem to be the same as those described for this species.

The specimens of this and the next species were broken from dense clumps growing on the reef-flat in water about one foot deep at low tide, when the tops of the clumps are exposed for some time.

MADREPORA VALIDA.

Madrepora valula Dana, Zoophytes, p. 461, pl. 35. fig. 1.

There is a complete specimen consisting of a crowd of processes all reaching to about the same height (\pm cm.), and rising from a common incrusting base, which seems to come near Dana's type. The tips of most of the processes in the single specimen had been injured, and the coral had attempted to heal the injuries. The axial calicles and a few of the nearer radial calicles are swollen into cœnenchymal knobs, without or with greatly reduced or distorted calicle apertures. Where not injured, the calicles have much the aspect described and figured by Dana, and the section of the processes shows the density of the coral, also mentioned by Dana.

MADREPORA (?) ASPERA Dana.

Madrepora aspera Dana, Zoophytes, p. 468, pl. 38. fig. 1.

A specimen 8 cm. high, in which the tapering branches more or less suddenly proliferate into a number of stunted outgrowths. The septa in the radial calicles show it to belong to the subgenus *Eumadrepora* Brook. The size of its axial corallite, the variously prominent and labellate radial calicles interspersed with minute obsolete calicles, seem to ally it with *M. aspera*. It differs chiefly in the greater crowding of the radial calicles, which were comparatively sparse in the type specimen.

This species forms dense clumps growing on the reef-flat, and partly exposed at low-water.

MADREPORA DELICATULA Brook.

Madrepora delicatula Brook, Ann. & Mag. Nat. Hist. viii. 1891, p. 461.

There are two small detached clusters of twigs which agree with the branchlets of Brook's type of *M. delicatula*. The measurements and shapes of the calicles both axial and radial agree, as also do the markings on the surface as described.

There is no evidence that the growth-form resembled that of

Brook's type. Hence the identification is provisional. Some variation in this respect exists between the specimens which Brook classed under this heading (see Brit. Mus. Madr. vol. i. pl. xxviii. figs. D & E).

Found in pools and channels near the edge of the reef-flat, Flying Fish Cove.

Genus MONTIPORA Quoy & Gaimard.

MONTIPORA SPONGILLA, sp. n.

Description. The corallum forms an erect spike about 5 cm. long and from 1–1.5 thick, which flattens near the top and divides into 2 to 3 or more similar spikes running up, side by side, or diverging at very small angles. The calicles are minute, 0.5 mm., but deep and conspicuous, about 1 mm. apart. The margin, usually formed by a single skeletal thread, is round or slightly petaloid. The septa not very well developed, except the directives, one of which is usually specially conspicuous as a broad plate which may or may not be slightly exsert.

The smooth surface-cœenchyma is a light friable reticulum, very rough to the touch; the tips of the branches are open flake-reticulum and friable; the coral is very light.

This Montipore is peculiar, not only in its method of growth, but also in its lightness and friability. There is one complete stock.

Occurs in pools on the reef-flat, Flying Fish Cove.

MONTIPORA PARASITICA, sp. n.

Description. Corallum as a closely incrusting plate on other corals, 5 mm. thick, no free edges, but with a narrow smooth zone running round the margin of the stock, 2–3 mm. broad; within this zone the whole surface is covered by tubercles. These are strikingly variable and are in all sizes, from minute branching or frosted granules to rounded or cylindrical tubercles, coarsely woolly, nearly 1 mm. high, here and there fusing into short ridges, and scattered about in small patches.

The calicles are very irregularly distributed, and vary in size from .5–.75 mm.; often obscured by the rough uneven tubercular surface. The section is dense, built up of stout trabeculæ, and wherever the surface tubercles are rubbed off, the solid stony texture beneath is seen.

The single specimen is nearly complete and incrusts the base of the type specimen of *Madrepora brooki*. Among known Tuberculate Montipores this seems to stand alone in manner of growth, and in the very variable distribution and development of the tubercles. I believe many more small incrusting tuberculate forms of *Montipora* will be discovered (*cf. M. inconspicua*). They can be easily overlooked, and only attract attention when studied under a pocket-lens.

11 fathoms. Flying Fish Cove.

Genus PORITES Lamarck.

There is one small, thin, triangular chip from a stock of *Porites*. The method of growth is unknown. The lower sectional surface shows a regular, rather dense reticulum in which the radiate skeletons of the calicles can still be faintly traced. The calicles are small (1 mm.), polygonal, shallow, but sharply sunk. The walls are either thin, straight, or zig-zag threads, septa appearing irregularly along the margin, or else below it as distinct plates. The pali are stout frosted rods.

This fragment is too small to classify. It comes nearest in the character of its calicles to a group of *Porites* in the National Collection from Ramesvaram, Gulf of Manaar, which I have already described in the MS. of vol. iv. of the 'Catalogue of Madreporaria' as *Porites indica*. Until more is known of its growth and variations it may therefore be provisionally placed with that group.

On the reef-flat, Flying Fish Cove.

Genus (?) GONIOPORA Quoy & Gaimard.

In the same bottle with the spirit-specimen, provisionally identified with *Goniastrea retiformis* (see below), is a small crumpled incrusting coral with edges slightly free, which has all the appearance of a Goniopora. The specimen is complete and almost too small to allow (without spoiling) of the detachment of portions for close examination of the skeleton, which is now hidden under the retracted soft parts. The budding round the edge is quite different from that of *Goniastrea*, and the top edges of the walls which show in rough outline through the skin are not at all like those of that genus, whereas in both these respects the specimen shows more resemblance to *Goniopora* than to any other stony coral with which I am acquainted.

Explanate Goniopores are by no means common, so that even without closer identification the specimen is of interest.

In pools and channels on the reef-flat, Flying Fish Cove.

Genus POCILLOPORA Lamarck.

There are three specimens which seem to belong to two species; both form low tufts—in one case of crisp irregular branches, and in the other of thick flattened lobes. The species in this genus are mainly founded on differences of growth-form, and longer series would probably unite many of them. In the present case there appears also to be some difference in the calicles which justify their separation.

POCILLOPORA (?) BREVICORNIS Dana.

Pocillopora (?) *brevicornis* Dana, Zoophytes, p. 526, pl. 49. fig. 8.

A small tuft, the branchlets below are rounded off, above are angular; the round calicles have a distinct ring of septal striæ.

POCILLOPORA (?) FAVOSA.

Pocillopora (?) favosa Ehrenberg, Corallenthiere, p. 127.

Two small tufts of short, stout, compressed lobes, thickly covered with small conical, or rather pointed processes; no septa visible except as striæ in the very young calicles. These two specimens are placed under this specific heading with some hesitation. In M.-Edwards's description of *P. favosa* a distinct columella is mentioned, but no septa. Mr. Stanley Gardiner¹ describes septa—"the primaries being specially thick and bluntly spined;" and Dr. Klunzinger², who photographed the original type, says that there is little columella, and the septa are hardly at all developed. In these last points the two specimens from Christmas Island agree with Ehrenberg's type, but hardly with its more freely branching growth.

Occurs in pools and channels on the reef-flat, Flying Fish Cove.

Genus GONIASTRÆA M.-E. & H.

GONIASTRÆA RETIFORMIS.

Goniastrea retiformis (Lamarck) M.-E. & H. Les Coralliaires, ii. p. 446.

Two fragments of a convex small-calicled species of *Goniastrea* which may be provisionally placed with this species. The size of the calicles (3 mm.) agrees, but their depth is greater, at least on the summit of the stock, where it may reach 5 mm.; elsewhere it is 3 mm., as given by Milne-Edwards & Haime.

No locality is given for Lamarck's type.

There is further a spirit-specimen in a good state of preservation, which shows the living colony to have been of a bright green colour. The dried skeletons with attached organic matter are reddish brown.

Found in pools and channels on the reef-flat, Flying Fish Cove.

GONIASTRÆA AURICULARIS, sp. n.

Description. Colony forms ear-shaped, semicircular plates which project horizontally from the sides of rocks. Its upper surface is slightly concave, the edge thin and sharp, supported by continuous epitheca which covers the whole under surface. The thicker parts are about 1.5 cm.

The calicles, owing to the method of multiplication, vary greatly in size, the maximum being about 3.5 mm. The top of the thin wall is a fine zigzag; some 16-18 visible septa rise to the top of the wall and may even make the edge slightly denticulate; between these, faint traces of another cycle can be seen with a pocket-lens. The swollen inner edges of the primaries (at times of a few secondaries also) rise as thick, flattened, round-topped pali to within about 1 mm. of the top of the wall.

¹ Proc. Zool. Soc. 1897, p. 941.

² Corallenthiere, iii. 1879, p. 68, pl. vii. fig. 2.

In its explanate growth this is not unlike *G. planulata* of Milne-Edwards & Haime, from some unknown locality, but the calicles in that species are 7-8 mm. across, sometimes lengthening to 15 mm. before dividing. This is the second explanate species of *Goniastrea* which has been recorded, although it may be remarked by the way that the diagnosis of the genus is not so clear as might be, and it is not always easy to distinguish between *Goniastrea* and *Prionastrea* (cf. Klunzinger, *op. cit.* vol. iii. 1879).

In pools and channels in reef-flat, Flying Fish Cove.

Genus (?) CAULASTRÆA.

A few very varying fragments in spirit which appear to come between *Mussa* and *Caulastræa*. There is a single flabellate corallite (4.5 cm. long by 3.5 broad) which has died down, and from its fossa 3 new ones of different lengths and sizes have budded out. In addition there are two long (6 cm.) tapering corallites, with points free but fused near their rims, below which a bunch of (9) small buds project, curving upwards; below the bunch there are places where single buds have been broken off. There are two of these detached young corallites, which are very like single corallites of *Galaxea*, smooth below, ribbed above, and slightly curved. The variations among these small fragments are thus so great, that more material is necessary before any accurate account of the coral can be given, or its position in the system determined.

Genus GALAXEA Oken.

GALAXEA ASPERA Quelch.

Galaxea aspera Quelch, Chall. Rep. xvi. (1886) p. 72, pl. 4. figs. 5-5 d.

There is a dried specimen with a single loose corallite and a much finer specimen in good preservation in spirit. The latter shows the budding of the corallites above the level of the perithecal tissue. The specimens seem to agree in all ascertainable particulars with Mr. Quelch's species, viz., in their long projecting corallites, the septal formula, the pronounced costæ, and the dense perithecal tissue. As far as I have been able to ascertain, the locality nearest to the Keeling-Cocos group from which *Galaxea* has been recorded is the Straits of Sunda; but the specimen from that locality was referred by Milne-Edwards and Haime (see *Galaxea ellisi*, Les Cor. ii. p. 228) to the coral figured by Ellis (Phil. Trans. liii. 1764, pl. 20), which is quite different to this.

Pools in reef-flat, Flying-Fish Cove.

Genus MUSSA Oken.

MUSSA (?) REGALIS Dana.

Mussa (?) regalis Dana, Zoophytes, 1848, p. 182, pl. 8. fig. 5.

Two fragments of a meandrine *Mussa*. The fragments are chips from the ridges between adjoining calicles. In the smaller

dry specimen the adjoining calicles, or rather troughs, are closely adherent; the exsert septa almost overlap in the larger spirit-specimen (6 cm. long), in which the skeleton is obscured by the soft parts; the ridge between the calicles appears to widen here and there into an ambulacrum from 1–2 mm. wide. The calicular trough must have been 3 cm. deep and as much across, while the primary septa are very stout and exsert, and with their inner edges rather more vertical than in *Mussa regalis*, at least near the top of the ridge. The soft parts are bright green. Small cup-shaped galls are found on the septa here and there, somewhat like those occurring on the specimen of *Cœloria* (see below).

Occurs on the sides of the deep channels at the rim of the reef.

Genus LEPTORIA M.-E. & H.

LEPTORIA PHRYGIA Ellis.

Leptoria phrygia Ellis, Zooph. p. 162, 1786, pl. 48.

One fragment from a massive growth. It shows both straight and gyrating calicular troughs. A good section shows the thick plate-like columella with its lobed and also finely serrated edge.

The species is said to extend over the Indo-Pacific area. Dana records it from Ceylon.

Pools on reef-flat, Flying Fish Cove.

Genus CÆLORIA M.-E. & H.

CÆLORIA SINENSIS M.-E. & H.

Cœloria sinensis M.-E. & H. Les Cor. ii. 1857, p. 416.

One large specimen which agrees in all important points with this species. The Chinese type had calicular troughs not exceeding 2 cm. The specimen from Christmas Island has the same tendency to short troughs, some being round and only a few mm. in diameter, but a few reach to 3 and 4 cm. in length. What appear to be galls occur on the septa here and there.

Pools on reef-flat, Flying Fish Cove.

Genus PRIONASTRÆA M.-E. & H.

PRIONASTRÆA AUSTRALENSIS M.-E. & H.

Prionastræa australensis M.-E. & H. Les Cor. ii. 1857, p. 520.

There is a narrow convex strip with the angular surface characteristic of this genus. It may provisionally be placed near *P. australensis*, with which it agrees in size of calicle, thin walls, and rudimentary columella; while round the columella a ring, often incomplete, of larger septal teeth rises up, either 2–3 on each septum, or else one large paliform tooth.

There is further a very similar specimen in spirit of the same bright green which seems common to these Christmas Island Madreporaria. It appears to have much thicker walls than the dried specimen, but the presence of the soft parts would at least partly account for this. Slightly thicker skeletal walls it may

easily have, as some variation in their thickness is observable in the dried specimens.

Pools on reef-flat, Flying Fish Cove.

Genus *AGARICIA* Lamarck.

There is a fragment of what appears to be a flat incrusting disc with sharp free edges, the epitheca following about 1 cm. behind. The very young calicles are confluent in concentric rows but soon separate off, the smooth low rounded walls, finely striated by the septa, rapidly forming an irregular network over the surface; the calicles all look upwards, and are not tilted to look towards the growing edge. There are 4 cycles of septa—and if any columella, only in the deep calicles in the thicker parts of the stock. The section is very dense, the septa being thick and closely packed with traces of synapticular junctions.

Rock-pools under cliffs S. of Flying Fish Cove.

IV. *On the Sponges of Christmas Island.* By R. KIRKPATRICK.

The Sponges collected by Mr. Andrews were obtained from an area limited to the reefs of Flying Fish Cove. The majority of the specimens were found growing on the under surface of large coral blocks lying in pools left by the tide. The use of the dredge was impossible owing to the irregular rocky nature of the bottom.

Hitherto only one species (*Pachychalina spinosissima* Dendy, P. Z. S. 1887, p. 524) has been obtained from this locality. The present collection of 53 specimens, referable to 24 genera and 32 species, contains examples of 7 new species and 2 new varieties.

The Calcarea and Monoceratina are each only represented by two small specimens.

The Carnosa are represented by three species, the occurrence of *Chondrosia plebeja* Schmidt, recorded for the first time from the Indo-Pacific, being specially interesting.

The sponge-fauna of Christmas Island, so far as known at present, is very similar to that of Java.

A list of species, arranged according to the classification of Topsent, is given below.

Sub-Class CALCAREA.

1. *Clathrina primordialis* (Haeckel).
2. *Leucandra* sp.

Sub-Class DESMOSPONGIDA.

Order CARNOSA.

3. *Chondrosia reniformis* Nardo.
4. *Chondrosia plebeja* O. Schmidt.
5. *Chondrilla nuda* Lendenfeld.

Order TETRAC TINELLIDA.

6. *Sidonops pieteti* Topsent.
7. *Ecionema bacilliferum* (Carter).
8. *Stelletta simplicifurca* (Sollas).
9. *Tetilla bacca* (Selenka).
10. *Tetilla ternutensis* Kieschnick.

Order MONAXONIDA.

Suborder HADROMERINA.

Section *Clavulida*.

11. *Spirastrella curvosa* Topsent.
12. *Spirastrella decumbens* Ridley, var. *robusta*, var. nov.
13. *Pseudosuberites andrewsi*, sp. n.

Section *Aciculida*.

14. *Tethya ingalli* Bowerbank.
15. *Tethya seychellensis* (E. P. Wright).
16. *Tethya affinis*, sp. n.

Suborder HALICHONDRINA.

Family AXINELLIDÆ.

17. *Hymeniacion conulosum* (Topsent).

Family PÆCILOSCLERIDÆ.

18. *Microciona dubia*, sp. n.
19. *Iotrochota baculifera* Ridley, var. *tumescens*, var. nov.
20. *Esperella pellucida* Ridley.
21. *Desmacella* sp.
22. *Stylotella irregularis*, sp. n.
23. *Stylotella*, sp.

Family HAPLOSCLERIDÆ.

24. *Rhizochalina pellucida* Ridley.
25. *Rhizochalina sessilis*, sp. n.
26. *Gellius varius* (Bowerbank).
27. *Reniera innominata*, sp. n.
28. *Petrosia exigua*, sp. n.
29. *Halichondria solida* Ridley & Dendy.
30. *Halichondria solida*, var. *rugosa* Ridley & Dendy.

Order MONOCERATINA.

31. *Spongia* (*Euspongia* auct.) sp.
32. *Spongelia* sp.

CLATHRINA PRIMORDIALIS (Haeckel).

1872. *Ascetta primordialis* var. *protogenes* Haeckel (6. ii. p. 16, Atlas, pl. ii. fig. 13).

1892. *Clathrina primordialis* Lendenfeld (8. p. 195).

The specimen consists of a small mass about 10 mm. in area by 5 mm. in height. No oscules are visible, but this is probably due to the contracted state of the sponge.

The spicules, which are equiangular and equiradiate, are very small and slender, being smaller than in the typical Mediterranean form, and much smaller than in the Australian form named *Clathrina primordialis* var. *protogenes* by Carter (3. p. 510) and *C. protogenes* by Dendy (5. p. 58). The rays, which are $70\ \mu$ by $6\ \mu$, taper gradually to a rather sharp point.

LEUCANDRA sp.

The specimen forms a small oval mass 3×2 mm. plugging up an oscule of *Tetilla ternatensis*. The outer surface bristles with the projecting ends of stout oxeotes which pass through the dense mass of tri-radiates; gastral quadri-radiates can here and there be made out in spaces in the interior.

Spicules. Oxeotes $1500 \times 70\ \mu$; tri-radiates, rays sharp-pointed, often wavy, $245 \times 8\ \mu$; quadri-radiates, tangential rays curved inwards towards the apical ray; tangential ray $105 \times 18\ \mu$, apical ray $35\ \mu$ in length.

Canal-system: pores lead into incurrent spaces surrounding groups of large oval ciliated chambers $85\ \mu$ in diameter, and groups of the latter open into excurrent spaces.

The species is probably new; but since the specimen is very small and has been damaged in extraction, owing to its being partly involved in the tissues of the *Tetilla*, no specific name has been given.

CHONDROSIA RENIFORMIS Nardo.

One typical specimen occurs; it is bluish black on the upper surface; pale brown below, where it is attached by a narrow ridge to the rock. The one rather large oscule has a membranous slightly serrated margin. The colour on section is dirty white. I have examined some fragments of the type specimen of *Chondrosia ramsayi* Lendenfeld, and agree with Topsent in regarding this species as a synonym of *C. reniformis*.

A noticeable feature in the Australian specimen is the abundance of pigment in the interior, giving the sponge a slaty colour on section.

Distribution. Mediterranean; Kattegat; Tadjurra, Gulf of Aden; Port Jackson; Amboina; Christmas Island; Galapagos Islands.

CHONDROSIA PLEBEJA O. Schmidt.

1868. *Chondrosia plebeja* O. Schmidt (14. p. 1).

There are eight specimens, seven in alcohol and one in formol;
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their shape is subspherical, elongated or pyriform, and they vary in size from 1 to 5 c.c. in length or diameter, and in colour from yellow to dark brown. The alcohol specimens are much shrunken and corrugated, the surface being marked with polygonal or elongated depressions ("wabige vertiefungen," O. Schmidt) with pigmented stellate markings. The specimen in formol, which was unfortunately transferred to alcohol, was bluish-black and quite smooth.

On drying, the surface has a distinctly gritty appearance, caused by the shrinking of the dermal membrane on the foreign particles beneath.

The foreign bodies (fine sand-grains, sponge-spicules) form a fairly-well defined layer in the cortex and just beneath the dermal membrane; in one specimen spicules projected beyond the surface at right angles. There are no foreign bodies scattered in the interior of the body, differing in this respect from the specimens from Algiers described by O. Schmidt.

Distribution. Mediterranean; Atlantic; Christmas Island.

CHONDRILLA NUDA Lendenfeld.

1867. *Chondrilla nuda* Lendenfeld (9. p. 105, pl. x. figs. 69-71).

One small specimen of this species occurs in the form of a rounded bilobed mass $8 \times 9 \times 4$ mm. in size, growing on *Chondrosia plebeja*.

The surface is bluish-black and smooth, and shows under a lens a faint whitish reticulate pattern. The larger lobe has two minute raised oscules $\cdot 3$ mm. in diameter. The cortical layer includes columns of large granular pigmented cells, as in the specimen from Zanzibar.

The spicules are slightly larger than in Lendenfeld's specimens. The oxyasters, 30μ in diameter, possess 8 sharp spines usually slightly curved. The spherasters, 25μ in diameter, possess 25-30 sharp-pointed pyramidal prickles. In the Zanzibar specimens the oxyasters are $22-30 \mu$, and the spherasters only $10-12 \mu$ in diameter.

Distribution. Zanzibar; Christmas Island.

SIDONOPS PICTETI Topsent.

1897. *Sydonops picteti* Topsent (18. p. 431, pl. xviii. fig. 2).

1898. *Sydonops picteti* Lindgren (10. p. 349, pl. xviii. fig. 17, pl. xx. fig. 6).

There are four small specimens, the largest of which is 5 c.c. by 2 c.c. in area and 1.5 c.c. in thickness. Several small spherical buds about 2 mm. in diameter are lightly but closely attached by bundles of oxeote spicules. When a bud is detached, a shallow circular depression remains, the sterrastral crust here being thin and biconcave in section.

The slender cortical oxeas and the oscular palisade of spicules described by Lindgren are present.

Distribution. Amboina; Java; Christmas Island.

ECIONEMA BACILLIFERUM (Carter).

1887. *Stelletta bacillifera* Carter (4. p. 78, pl. vi. figs. 9-14).

1897. *Ancorina simplex* Lendenfeld (9. p. 96, pl. ix. figs. 12-34).

1898. *Ecionema bacilliferum* Lindgren (10. p. 335, pl. xvii. fig. 17; pl. xix. fig. 27).

1899. *Ecionema bacilliferum*? Lindgren (10 A. p. 88).

The largest of the four specimens in this collection is 4×5 c.c. in area and 1 c.c. in thickness, and forms a thick crust; in colour pale brown mottled with dark brown.

The type specimen from Mergui, being in the Calcutta Museum, is not available for comparison. The prototriænes are very rare in the Christmas Island specimens. The microstrongyles, which are $18 \times 2 \mu$ in size, are occasionally centrotylote. The fine cortical oxeas measure $180 \times 4 \mu$.

The asters are tylote, and with roughened actines, the same characteristics being found in the asters of *Ancorina simplex*, of which species the Museum possesses a few slides prepared from the type specimens from Zanzibar.

Distribution. Mergui, Java, Christmas Island, Zanzibar; var. *robustum*: Port Phillip, Ports Elliot and Adelaide.

STELLETTA SIMPLICIFURCA (Sollas).

1886. *Myriastria simplicifurca* Sollas (16. p. 189).

1888. *Myriastria simplicifurca* Sollas (17. p. 114,* pl. xii. figs. 29-33).

1898. *Stelletta simplicifurca* Lindgren (10. p. 332, pl. xviii. fig. 8).

Of the three specimens of this species, one is small ($8 \times 6 \times 6$ mm.) and oval; the other two are in the form of thick nodular lamellæ, the larger being 5×3 c.c. in area and from 1 to 2 c.c. in thickness.

	Small spec. Christmas I.	Largest spec. Christmas I.	Torres Straits. 'Challenger.'	Cochin China. Lindgren.
Orthotriænes. Rhabdus ...	1375 × 50	1825 × 52	2325 × 55	2700 × 84
Orthotriænes. Cladi	280	245	366	(54),? 540
Anatriænes. Rhabdus ...	1820 × 22	1330 × 15	1860 × 29	3240 × 30
Anatriænes. Cladi	105	54	120	108
Anatriænes. Chordi	122	72	127	168
Anatriænes. Sagitta	88	48	90	84
Large oxea	1925 × 49	1330 × 24	2000 × 31	2900 × 60
Small oxea	102 × 6	210 × 3	252 × 3	252 × 4
Chiasters	12	12	12	12

The surface of the lamellæ presents a tessellated pattern, the

pores being in the grooves between the lamellæ; the pattern is not present on the thick rounded edges nor on the nodular excrescences. Several small oscules $1 \times .5$ mm. are present.

The specimens described by Sollas and Lindgren are probably in an early stage of growth.

There are considerable variations in the dimensions of the spicules, as will be seen from the table (p. 131) giving the sizes in microns.

Distribution. China Sea; Torres Straits; Christmas Island.

TETILLA BACCA (Selenka).

1867. *Stelletta bacca* Selenka (15. p. 569, pl. xxxv. figs. 14-15).

1883. *Tethya merguiensis*, Carter (2. p. 366, pl. xv. figs. 6-8).

1898. *Tetilla bacca* Lindgren (10. p. 328).

There are two specimens, the larger being 2.5 c.c. \times 3.5 c.c. They are subspherical, but with a concave area below apparently resulting from radial fission. The larger specimen has 20 oval depressed pore-areas and 2 oscules, all being about 4×5 mm. in area and 2.5 mm. in depth. The oscules are cloacas, in the floor of which several openings of excurrent canals are seen; the floor of the pore-areas is covered with membrane perforated by groups of pores. A section of the sponge, which is soft and cuts easily, shows bundles of spicules radiating from a central nucleus.

The spiculation is almost identical with that of a specimen from Java described by Lindgren. The length of the oxea is 3.5 mm., of the anatriænes 5.5 mm. and of the protriænes 5.2 mm.

Distribution. Samoa; Torres Straits; Amboina; Java; Mergui; Christmas Island.

TETILLA TERNATENSIS Kieschnick.

1896. *Tetilla ternatensis* Kieschnick (7. p. 527).

1898. *Tetilla ternatensis* Lindgren (10. p. 329, pl. xvii. fig. 14, pl. xix. fig. 25).

The one specimen is subspherical, $2 \times 2 \times 3$ c.c. in size; the sponge is deeply fissured in several places. There are several oscules, the largest being 3 mm. in diameter and possessing a raised rim. As in Lindgren's specimen, the surface of the sponge is crowded with Diatoms.

The very rare protriænes are irregular, one of the arms being much longer than the other two, which may be reduced to mere knobs.

This species resembles *T. dactyloidea* Carter in certain respects, the radiating bundles of the latter being formed of oxea ($1360 \times 6\mu$) midway in size between the large oxea and microxea of *T. ternatensis*.

TETHYA INGALLI Bowerbank.

1872. *Tethya ingalli* Bowerbank (1. p. 119, pl. v. figs. 11-17).

The single specimen is free, oval, 22 mm. in length, and 16 mm

in breadth and height. The surface is level, but shows a faintly marked tessellated pattern. The cortex is 2 mm. thick, and is uniformly and densely crowded with spherasters.

The spicule-measurements are given along with those of the type specimen from Fremantle for comparison.

	Strongyloxea.	Spherasters.	Choanosomal oxyasters.	Chiasters.
Christmas Island	1360 × 24 μ	70 μ	18-24 μ	12 μ
Fremantle	1470 × 35 μ	70 μ	36 μ	12 μ

Tethya ingalli shows a considerable range of variation, but, I think, would include the Christmas Island specimen in spite of its oval form and the smaller size of its spicules.

Distribution. Seychelles; Australia; Christmas Island; Java; Amboina.

TETHYA SEYCHELLENSIS (E. P. Wright).

1881. *Alema seychellensis* E. P. Wright (19. p. 13, pl. i.)

1888. *Tethya seychellensis* Sollas (17. p. 427, pl. xlv. figs. 1-6).

There are five small, free, nearly spherical specimens, all of which are gemmiferous. The outer two-thirds of the cortex is occupied by a zone of subcortical cavities.

Spicules. Megascleres—strongyloxea, 1200 × 18 μ.

Microscleres—spherasters, 48 μ. Somal chiasters, 12 μ. Choanosomal asters, 30 μ, with well-defined centrum; actines roughened, bifurcate.

The "regular hexaster" type of the oxyasters is a characteristic of this species, distinguishing it from *T. ingalli* Bowerbank.

A comparative table of spicule-measurements (in microns) of specimens from various localities is given below.

	Type from Seychelles.	Samboangan. 'Challenger.'	Torres Straits. 'Challenger.'	Christmas Island.
Strongyloxea	1750 × 30	1910 × 23	1680 × 26	1200 × 18
Spherasters	70	95	64	48
Somal chiasters	12	12	12	12
Choanosomal asters	54	60	60	30

Distribution. Seychelles; Philippine Islands; Torres Straits; Christmas Island.

TETHYA AFFINIS, sp. n. (Plate XII. fig. 1; Plate XIII. figs. 3a-d.)

Sponge incrusting, and of irregularly conical shape; upper surface rough but level, with an obscure polygonal pattern formed by depressed conules with fimbriated edges, and with two small membranous oscular cones, the apertures being 1 × 5 mm. in area.

Cortex 1.22 mm. in thickness, with a few narrow intercortical cavities arranged vertically in the outer two-thirds, the cortical spherasters occasionally occupying the whole thickness but usually

only the inner third, where they are divided into two zones by a shallow space.

Spicules. Megascleres—strongyloxea, $1330 \times 35 \mu$.

Microscleres—spherasters, 60μ . Somal chiasters, $15-18 \mu$. Dermal chiasters, 12μ .

The unique specimen measures 2.5×2 c.c. in horizontal and 2.5 c.c. in vertical plane. The rough convex under surface appears to have been torn off from a rock.

The name given to the species denotes its close affinity to *T. japonica* Sollas; it differs from the latter (1) in its mode of growth, *T. japonica* being spherical and free, (2) in having the membranous oscular cones, and (3) in the slight difference in size between the dermal and somal chiasters.

SPIRASTRELLA CARNOSA Topsent.

1897. *Spirastrella carnosa* Topsent (18. p. 441).

The specimen is cauliflower-shaped, expanding upwards from a narrow base to a height of 2 c.c., the area of the upper surface being 2.5×1.5 c.c. The upper surface is covered with low rounded papillæ.

The tylostyles, $525 \times 18 \mu$, usually have a trilobate head. The spirasters are extremely rare and very fine, being $18 \times 1 \mu$, with minute spines, and usually with four curves.

The specimen differs from the type from Amboina in having larger megascleres, these being only 330×6 to 8μ in the latter.

In Topsent's specimens, too, the surface is ridged ("froncé").

Distribution. Amboina; Christmas Island.

SPIRASTRELLA DECUMBENS Ridley, var. ROBUSTA, var. nov.

1887. *Spirastrella decumbens* var., Ridley and Dendy (13. p. 229, pl. xlv. fig. 12).

1898. *Spirastrella semilunaris* Lindgren (10. p. 323, pl. xix. fig. 23).

There are two specimens of this variety—one (1) forming a thin yellow crust on a shell, the other (2) in the form of small fleshy lobes growing on *Sidonops picteti*. Specimen (1) has a shallow patent oscule 1.5 mm. in diameter; the surface shows a delicate reticulate pattern formed by the pore-areas, the pores being circular and 40μ in diameter; sieve-like groups of 5 to 10 pores lead into subdermal spaces.

A cavernous cortex from $.5$ to 1 mm. in thickness occurs in the type specimens of the species from Torres Straits, described by Ridley (11. p. 470, pl. xliii. fig. c). The same structure is also present in the specimens from Amboina and Christmas Island. In all these specimens the minute semilunar spirasters (12μ in length) form the outermost dermal layer. Hence I have no doubt that Lindgren's species is a synonym: at the same time it is right to add that that author is in no way to blame, owing to the incomplete description of the type specimens, which are badly preserved.

The differences between the type specimen from Torres Straits on the one hand, and the specimens from Amboina, Java, and Christmas Island on the other, are constant, and render it necessary to regard the latter specimens as belonging to a well marked variety. In the type the tylostyles are longer and narrower, and the largest spirasters are smaller than in the new variety which I have named "*robusta*."

	Type.	Var. <i>robusta</i> .
Tylostyles	507 × 8 μ	432 × 12 μ
„ head	12 μ	12 μ
„ neck	6 μ	10 μ
Spirasters, smallest	8-12 μ	8-12 μ
„ largest	36 μ	48 μ

Distribution of *S. decumbens*: Torres Straits; of *S. decumbens* var. *robusta*: Philippines, Java, Christmas Island, Red Sea.

PSEUDOSUBERITES ANDREWSI, sp. n. (Plate XII, figs. 2 a-b; Plate XIII, fig. 7.)

Sponge loosely incrusting or forming free thick lamellæ. Pale yellow in colour; surface smooth, and with canalicular markings beneath the dermis; soft in consistence and easily torn. Oscules, when present, small, circular (.75 mm. in diameter), guarded by a silvery fringe or conule of tylote spicules with points centripetal.

Skeleton composed of primary lines of multispicular fibres radiating to the surface and giving off at various angles a few scattered single spicules.

Dermal skeleton very distinct and formed of tangentially arranged bundles of spicules joining to form a reticulum with tri- or quadrangular meshes.

Spicules. Tyloles 350 × 6 μ, slightly curved in the basal third; head rounded, 7.5 μ in diameter, slightly knobbed at the summit or swollen laterally.

Of the three specimens, one is incrusting and with oscules, the others are free and without oscules; the former is 5.5 × 3 c.c. in area, and .5 c.c. in thickness; the latter are considerably thicker.

The genus at present includes, as stated by Topsent, two other species, *P. hyalina* (Ridley & Dendy) and *P. sulphureus* (Bowerbank). One of the small fragments of the type specimen of *P. hyalina* has an oscule with the palisade of spicules arranged as in the new species, but the tyloles are much larger in the former, measuring 1100 × 25 μ.

HYMENIACIDON CONULOSUM (Topsent).

1897. *Stylorella conulosa* Topsent (18. p. 466).

1898. *Hymeniacion conulosum* Lindgren (10. p. 313, pl. xvii. fig. 13; pl. xix. fig. 19).

The single specimen is pyramidal, 3 c.c. in height, and with an incrusting base 3 × 1.5 c.c.

The surface is partly even, and partly provided with small hispid tufts.

The skeleton is composed of main lines of multispicular fibre radiating from base to surface, with an irregular reticulum between formed by bundles of one or a few spicules given off from the main lines; the axial columns alone are present in the tufts.

The styles, which measure $525 \times 12 \mu$, are curved near the basal end.

The nearly related species *Stylotella polymastia* Lendenfeld, referred to by Topsent *l. c.* p. 466, is synonymous with *Hymeniacidon fenestratum* (Ridley).

The proper position for the above species appears to be in the Axinellidæ. The skeleton is composed of axial lines of monactinal spicules, the reticulation being of secondary importance and absent from the tufts; some of the spicules show a double curve, characteristic of certain typical Axinellid sponges.

Distribution. Amboina; Java; Christmas Island.

MICROCIONA DUBIA, sp. n. (Plate XII. figs. 3, 3a; Plate XIII. figs. 2 a-f.)

Sponge forming an almost free or loosely incrusting lamina with margins curled up, with foreign particles adherent to the under surface where the latter is free.

Colour yellow; upper surface smooth. Skeleton formed partly of columns, each composed of one stout subtylote spicule, and partly of plumose columns of more slender tylotes opening out from base to surface, where they almost form a distinct dermal layer; numerous short spined styli arranged vertically with bases on the basal layer of the sponge. Spongin absent.

Spicules. Megascleres—stout, slightly curved subtylotes $324 \times 7.5 \mu$, head 7.7μ , slightly spined, occasionally faceted.

Slender straight tylotes $318-328 \mu \times 5.5 \mu$, head 7μ with basal end spinous.

Short spined styli $48 \times 7.5 \mu$, with sharp, often curved, spines on the basal three-fourths of the length of the spicule.

Microscleres—palmate isochelæ from 3 to 12μ . Toxa large, slender, $39 \times 1 \mu$; a shorter but thicker form (numerous), $6 \times 1.5 \mu$.

The size of the specimen is $2.5 \text{ c.c.} \times 5 \text{ c.c.}$ in area, and 1 mm. in thickness. The unispiculate columns, which occur in parts of the sponge, recall the chief character of *Hymerrhaphia*. Again, the spiculation closely resembles that of certain species of *Rhaphidophlus* (*R. filifer* Ridley & Dendy and *R. spiculosus* Dendy), but the absence of spongin excludes the new species from this genus. The specimen is probably mature, since there are several embryos near the base of the sponge.

IOTROCHOTA BACULIFERA Ridley, var. TUMESCENS, var. nov. (Plate XIII. fig. 1.)

Specimen forming an irregular flabellate and branching growth, $6 \text{ c.c.} \times 1 \text{ c.c.}$ in area and $.3 \text{ c.c.}$ in thickness.

Spicules. Styles averaging $210 \times 10 \mu$.

Strongyles $220-250 \times 1 \mu$, with from one to three fusiform

swellings along the body, one of the ends attenuated sometimes to a blunt point. Amphidises $18\ \mu$.

The characteristic feature of the new variety lies in the strongyles with their peculiar swellings; these may, however, be dependent on some pathological cause such as the presence of a parasite, but I was unable to find any such organism. [In several descriptions of this species the dermal diactines are described as tylotes. In the type specimen from Port Darwin the ends of the strongyles are very slightly enlarged, a feature slightly exaggerated by the artist in the figures (11. p. 435, pl. xlii. fig. *f*); but there is no trace of terminal enlargement in the spicules of specimens from the Mascarenes, Madras, and Christmas Island.]

DESMACELLA sp.

A few small broken-up pieces of a very soft dark reddish-brown incrusting sponge, with a few crater-like oscules. The skeleton forms a unispicular network, the meshes of which are triangular and quadrangular and made up of styles, oxea, and strongyles. A few long slender toxa and one or two sigmata, together with some slender raphides, are present. The skeleton is renieroid, and spongin entirely absent. The dimensions of the spicules are:—

Styles (not rare) slightly curved, $150 \times 9\ \mu$; strongyles (rare) straight, $126 \times 6\ \mu$. Oxea (very abundant), curved, $180 \times 7\ \mu$.

Microscleres—toxa $48 \times 5\ \mu$ (rare); sigmata $24\ \mu$ (very rare); raphides (rare), $108 \times 1.5\ \mu$.

This species, which appears to be new, has not been named owing to the uncertainty as to whether all the above-mentioned microscleres seen in the preparations really belong to the sponge; several kinds of obviously foreign spicules were included.

STYLOTELLA IRREGULARIS, sp. n. (Plate XII. fig. 4; Plate XIII. figs. 6 *a-d*.)

Sponge incrusting or forming free irregular lamellæ; colour pale brown; with several small circular oscules 2 to 3 mm. in diameter on the upper surface.

Skeleton forming a rectangular network, the meshes being for the most part unispiculate, but with a few slender primary lines of spiculo-fibre 2–4 spicules thick.

Spicules. Styles $186 \times 9\ \mu$, smooth, straight or slightly curved.

Oxea $204 \times 9\ \mu$, curved.

Strongyla $150 \times 10\ \mu$, straight or slightly curved.

Slender oxea $150 \times 4\ \mu$, occasionally with a central fusiform enlargement, rare and scattered in the tissues.

This species is very near *Petrosia contignata* Thiele, from ebes (*Zoologica*, Stuttgart, 1899, Heft 24, ii. p. 20), but differs mainly in possessing slender fusiform oxea; unfortunately the central swelling is not shown in Pl. XIII. fig. 6 *d*.

STYLOTELLA sp.

Specimen incrusting, 2×1 c.c. in area, and .25 to .5 c.c. in thickness; pale brown, very soft, with several oscules 1 mm. in diameter.

Skeleton consisting of slender vertical main lines, loosely joined by single spicules in horizontal plane excepting near the surface, where the main fibres are isolated.

Spicules. Styles $132 \times 4 \mu$, with a sharp bend at the centre.

Oxea $144 \times 4 \mu$, sharply curved at the centre, and gradually diminishing to sharp points.

The skeleton is like that of a *Petrosia*, but very loosely arranged.

The specimen is too fragmentary to serve as the type of a new species.

RHIZOCHALINA PELLUCIDA Ridley.

1884. *Rhizochalina pellucida* Ridley (11. p. 608, pl. liv. fig. j).

There are only three small fragments of fistules, the longest being 4 mm. in length and 1.5 mm. in diameter.

The spicules are slightly smaller than in the type specimen, being $240 \times 9 \mu$ in the former, and $260 \times 10 \mu$ in the latter, but the shape is the same.

Distribution. Providence Island, Mascarene Group; Christmas Island.

RHIZOCHALINA SESSILIS, sp. n. (Plate XII. fig. 5; Plate XIII. fig. 8.)

Sponge pyramidal or digitate, sessile, arising from an incrusting base; surface smooth; consistence firm but rather brittle; colour (in formol) white-crystalline; translucent.

Skeleton consisting of an axial or central open spiculo-fibrous network formed of broad loose strands about 10 spicules thick, surrounded by a cortical network of more slender strands at right angles to the central network, and of a dermal isodictyal network with strands 2-3 spicules thick, with unispiculate strands in the interstices.

Spicules. Oxea $372 \times 14 \mu$, curved at the centre and diminishing suddenly near the ends to sharp points. Microscleres 0.

There are several specimens and fragments, most of them being of flattened digitate form, the largest being 30 mm. in height, 8 mm. in breadth, and 3 mm. in thickness. The specimens preserved in alcohol are dark yellow at the surface, and bright yellow in the interior, the formol specimens being white.

The new species is very near *Pellina eusiphonia* Ridley (11. p. 414, pl. xli. fig. z), from Port Darwin, but differs in the shape of the sponge and in the size of the spicules. These two species come within the subfamily Phlœodyctiinae rather than within the Renierinae.

RENIERA INNOMINATA, sp. n. (Plate XII. figs. 6, 6a; Plate XIII. figs. 5a-b.)

Sponge incrusting; colour pale brown with a faint reddish tinge; texture soft and elastic.

Skeleton forming a rather regular reticulum of unispiculate fibres with triangular (mostly) and quadrangular meshes with nodes cemented with spongin.

Spicules. Strongyles $126 \times 8 \mu$, slightly curved in the middle. Oxea $108 \times 2.5 \mu$, curved at the centre; also very slender oxea of the same length and shape, probably young forms of the thicker kind.

The specimen encrusts a *Melina*-shell, and is produced at one point into a short, stout, digitate process.

There is in the British Museum Collection an unnamed specimen (registered 82.10.17.246) of this species from Marie Louise Island, Amirante Group.

The species from Providence Island described by Ridley (11. p. 607, pl. liv. fig. i) as "*Reniera* sp. allied to *crateriformis*" has spicules of the same shape, but much larger ($480 \times 28 \mu$), and the meshes of the reticulum are multispiculate.

Distribution. Amirante Isles; Christmas Island.

PETROSIA EXIGUA, sp. n. (Plate XII. fig. 7; Plate XIII. fig. 4.)

Sponge forming a hard, thick, nodulated crust. Colour pale grey; surface smooth, and in parts showing an irregular reticulate pattern formed by pore-areas.

Oscules 1 to 1.5 mm. in diameter, numerous, some level with surface, others with slightly raised margin.

Skeleton formed of slender main lines of fibres passing vertically to the surface and connected at right angles to this plane by closely packed single spicules, so as to form circular or obscurely polygonal tubes about 70 mm. in diameter, the skeletal tubes being much more apparent near the surface and very ill-defined deeper, where the skeleton becomes a dense, confused network. Special dermal skeleton absent.

Spicules. Oxea $114 \times 5.5 \mu$, curved at the centre, and diminishing to very sharp points.

The single specimen is 4×4 c.c. in area, and 1.5 c.c. in thickness.

The salient character of this species lies in the very small size of the spicules, which are less than half the size of those of *Petrosia similis* Ridley & Dendy (13. p. 9, pl. ii. fig. 10, pl. iii. figs. 3 & 4), a species closely allied to it in other respects; the spicules are considerably smaller than those of any species with oxeote spicules from this region of the Indo-Pacific.

HALICHONDRIA SOLIDA Ridley & Dendy.

1886-7. *Halichondria solida* Ridley & Dendy (12. p. 326, and 13. p. 4, pl. ii. fig. 5).

The specimen, which is white and with an even surface, differs slightly from the type in having the ends of the oxea sharp-pointed; the spicules ($770 \times 22 \mu$) are curved at the centre.

Distribution. Amboina; Tahiti; Christmas Island.

HALICHONDRIA SOLIDA var. RUGOSA Ridley & Dendy.

The specimen is dark brown and wrinkled in places, as in the type of the variety from Api. There are several oscules, from 1 to 4 mm. across, with conspicuous membranous sphincters. The

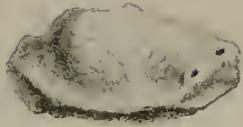
spicules are curved at the junction of the middle and outer third, the size being $770 \times 18 \mu$.

Distribution. Api, New Hebrides ; Christmas Island.

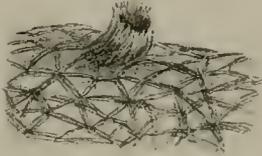
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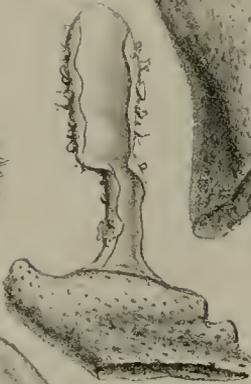




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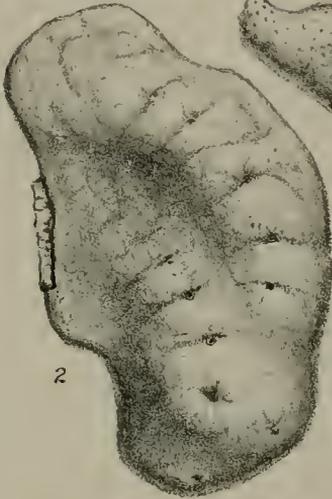
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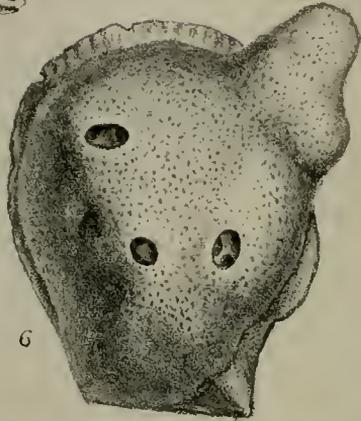
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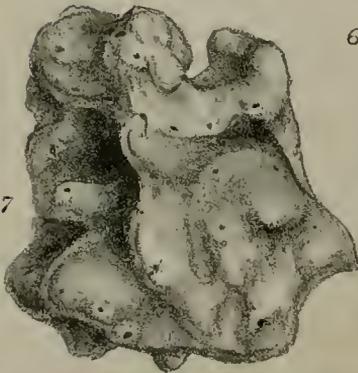
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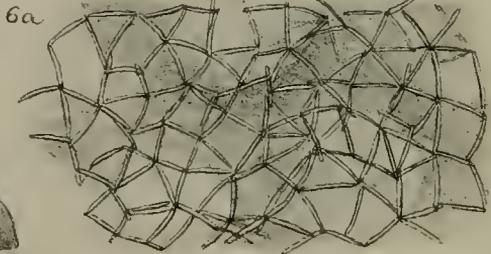
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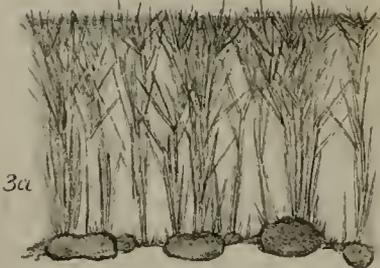
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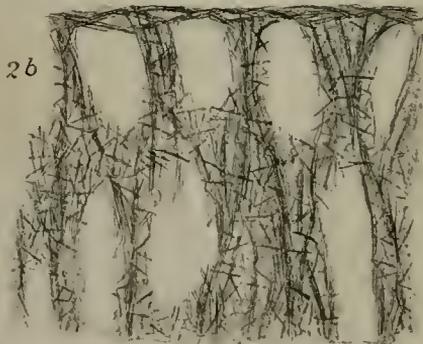
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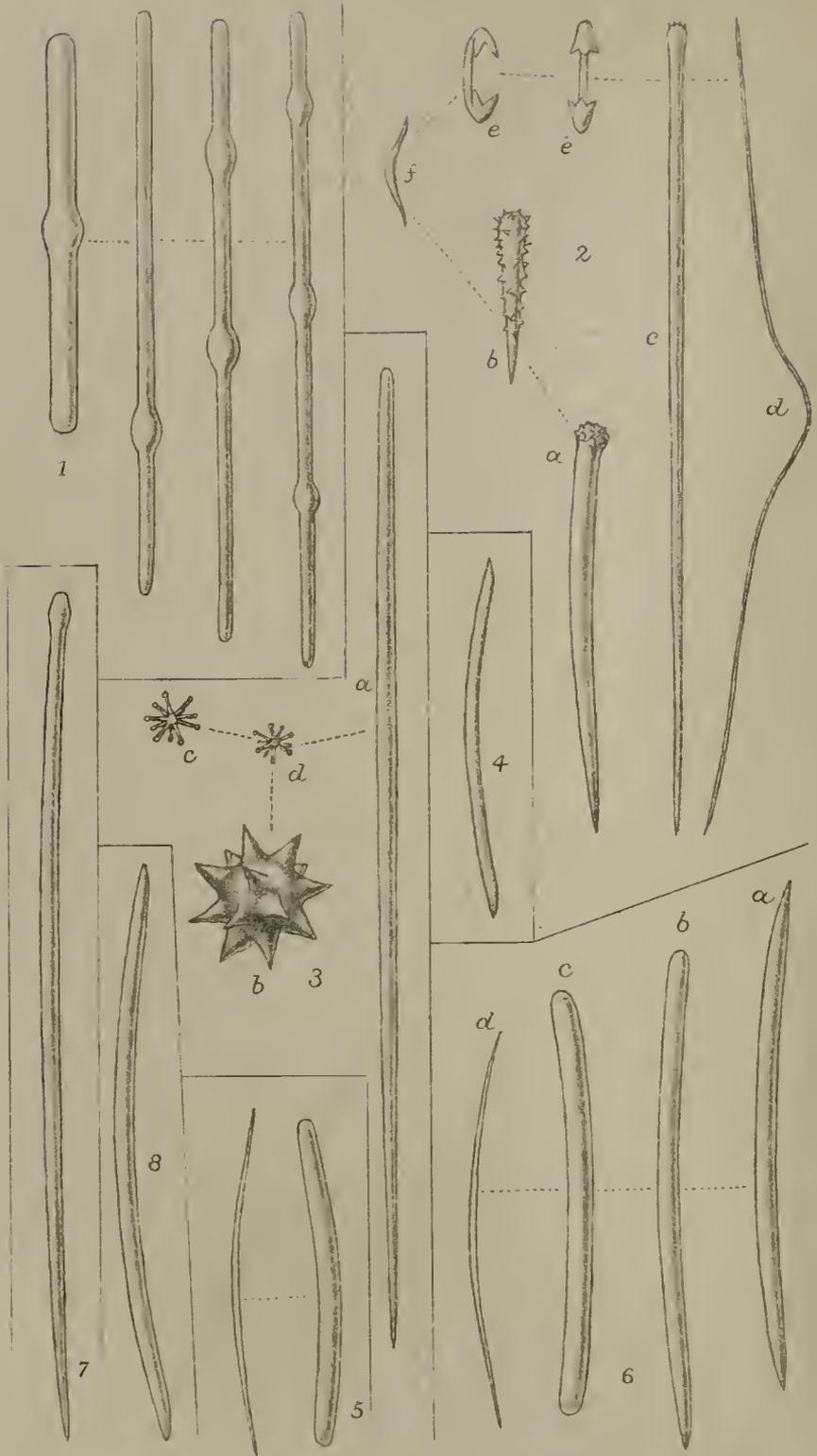
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P. Highley del. et lith.

Hanhart imp.

SPONGES FROM CHRISTMAS ISLAND.





P. Highley del. & lith.

Manhart imp.

V. *List of the Foraminifera from the Boat-channel, Flying Fish Cove, Christmas Island, 11 fathoms.* By F. C. CHAPMAN, A.L.S., F.R.M.S.

1. *Biloculina ringens* (Lamarck). Very rare.
2. *Spiroloculina fragilissima* Brady. Very rare.
3. *Miliolina oblonga* (Montagu). Very rare.
4. „ *seminulum* (L.) Frequent; small.
5. „ *aubेरiana* (d'Orb). Rare; rather small.
6. „ *parkeri* Brady. Very rare.
7. „ *bicornis* (Walker & Jacob). Very rare.
8. „ *rupertiana* Brady. Frequent; very fine.
9. „ *insignis* Brady. Very rare.
10. *Hauerinu ornatusissima* (Karrer). Rare.
11. *Orbitolites complanata* Lamarck. Frequent.
12. „ *marginalis* (Lam.). Very rare.
13. „ *duplex* Carpenter. Rare.
14. *Textularia rugosa* (Reuss). Rare.
15. *Bolivina limbata* Brady. Very common.
16. *Spirillina limbata* Brady. Rare.
17. *Truncatulina rostrata* Brady. Common.
18. „ *ungariana* (d'Orb.). Very rare; small.
19. *Pulvinulina repanda* (Fichtel & Moll). Common.
20. *Calcarina hispida* Brady. Very rare.
21. *Gypsina vesicularis* (Parker & Jones). Rare.
22. *Polytrema miniaceum* (Pallas). Common.
23. *Polystomella macella* (Fichtel & Moll). Rare.
24. *Heterostegina depressa* d'Orb. Common.

VI. EXPLANATION OF THE PLATES.

PLATE XII.—Sponges from Christmas Island.

- Fig. 1. *Tethya affinis* (p. 133), nat. size.
 2. *Pseudosuberites andrewsi* (p. 135), nat. size. 2 *a*, oscule, $\times 30$; 2 *b*, section, $\times 30$.
 3. *Microciconia dubia* (p. 136), nat. size. 3 *a*, section, $\times 40$.
 4. *Stylotella irregularis* (p. 137), nat. size.
 5. *Rhizochalina sessilis* (p. 138), nat. size.
 6. *Reniera innominata* (p. 138), nat. size. 6 *a*, section, $\times 30$.
 7. *Petrosia exigua* (p. 139), nat. size.

PLATE XIII.—Sponges from Christmas Island.

- Fig. 1. *Iotrochota baculifera tumescens* (p. 136), strongyles $\times 300$.
 2. *Microciconia dubia* (p. 136); *a-d* $\times 300$; *e-f* $\times 1600$. *a*, thick subtylote; *b*, spined style; *c*, slender tylote; *d*, large toxon; *e*, palmate isochela, side view; *e'*, ditto, front view; *f*, short toxon.
 3. *Tethya affinis* (p. 133). *a*, strongyloxeum, $\times 80$; *b*, spheraster, $\times 400$; *c*, somal chiaster, $\times 400$; *d*, dermal chiaster, $\times 400$.
 4. *Petrosia exigua* (p. 139), oxeum, $\times 300$.
 5. *Reniera innominata* (p. 138). *a*, strongyle, $\times 300$; *b*, oxeum $\times 300$.
 6. *Stylotella irregularis* (p. 137); *a-d*, $\times 300$. *a*, oxeum; *b*, style; *c*, strongyle; *d*, slender oxeum.
 7. *Pseudosuberites andrewsi* (p. 135); tylote, $\times 300$.
 8. *Rhizochalina sessilis* (p. 138), oxeum, $\times 150$.

2. On the Soft Anatomy of the Musk-Ox (*Ovibos moschatus*).
By Dr. EINAR LÖNNBERG.¹

[Received January 25, 1900.]

When last spring (1899) it was decided that a Swedish Expedition under the direction of Professor A. G. Nathorst should start for Greenland, Professor T. Tullberg suggested the importance of obtaining examples of the viscera and other parts of the Musk-ox; and sent out the necessary outfit for this purpose. Professor Nathorst, as is well-known, made in the 'Antarctic' a successful voyage; and arriving early in East Greenland, he had ample time for geographical and other researches.

Musk-oxen were found and shot at several places. The Zoologist of the Expedition, Ivar Arwidson, accordingly had the opportunity of making a good collection. The animal was, however, found to be of greater bulk than was expected, and it was therefore with no little difficulty that its different parts were preserved, the receptacles being found rather small for the purpose. Nevertheless, the following organs were secured (skins, skeletons and skulls not being counted):—

Of an old bull killed the 9th of July on Sabine Island and measuring 228 cm. in length: alimentary canal with appendages, liver, spleen, &c.; lungs and heart; urinogenital organs (partly damaged); eyes, larynx, tongue and the lining of the mouth. Of a young cow killed the 11th of July in Queen Augusta Valley: udder and histological material from different organs. Of an old cow killed the 26th of August at Emperor Franz Joseph Fjord: udder. Of an old bull killed the 29th of August: urinogenital organs. In addition to this two brains and certain other specimens.

When the expedition returned it was, with the consent of Professor Nathorst, agreed that the present writer should be allowed to investigate the material mentioned above; and he has now the honour to lay before the Society the results of this investigation.

The muzzle of *Ovibos* is covered with short hair, with the exception of a strip along the upper margin of either nostril, which is naked, and probably in the living animal moist. This naked part has a papillary surface. The naked strips above the nostrils in an adult bull are about 8 mm. broad, and extend in a median direction so as to meet on the anterior surface, where the naked region is a little broader. So far the condition of the muzzle has a certain likeness to that of a Sheep². There is, however, a great difference, because in *Ovibos* there is not the slightest trace of that vertical,

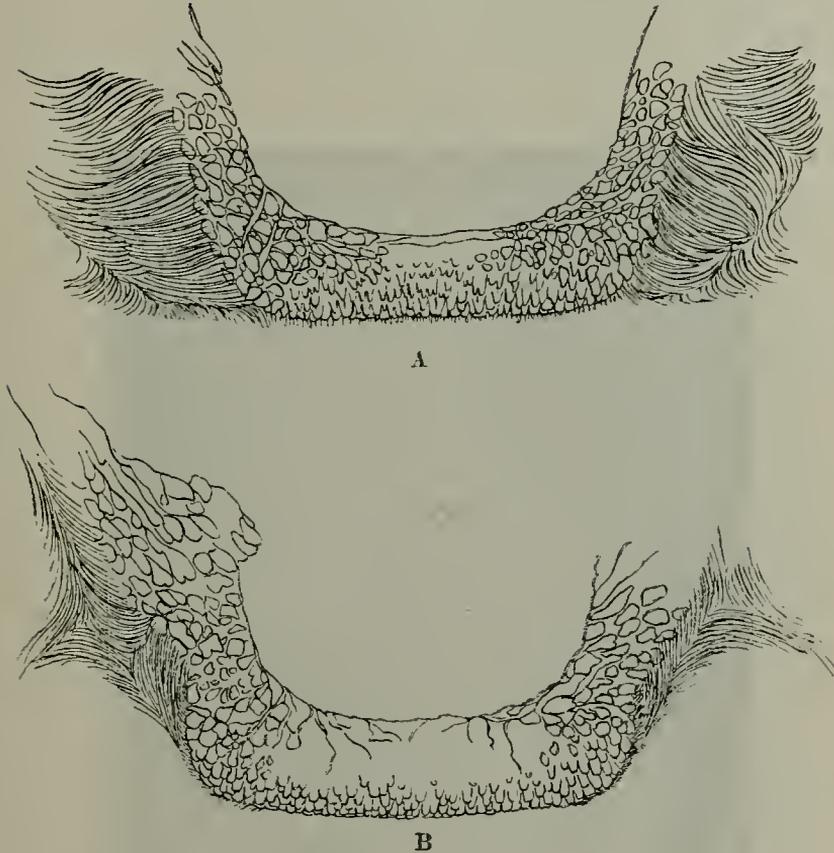
¹ Communicated by R. LYDEKKER.

² The hairiness of the muzzle can very well be explained as an adaptation to the cold climate, and there is no need to regard it as a sign of affinity between the Sheep and the Musk-ox. Compare the Reindeer! But it may also be an ancient characteristic. Compare the Antelopes!

bare fissure (*philtrum*) extending from the naked area between the nostrils over the upper lip, which is so characteristic of the Sheep and their allies. With regard to shape, the muzzle of *Ovibos* is more flat and broad, and its nostrils are wider apart than in the Sheep, although closer than in an Ox. The nostrils are not so widely open as in an Ox, and not so closed by the upper flap as in the Sheep.

Both upper and lower lips (fig. 1) are anteriorly broad and beset

Fig. 1.



Upper (A) and lower (B) lips of the Musk-ox.

with hard warts; this warty area being in an adult bull about 2 cm. broad and $7\frac{1}{2}$ cm. long. The warty areas of the lips work against each other as the jaws of a pair of pincers, and are apparently well fitted for seizing the food. The Musk-ox thus browses with its lips. The mouth is square, but must be called small, as the distance from the anterior angle to the corner of the mouth is not more than $7\frac{1}{2}$ cm., or the same as the breadth of the lips anteriorly.

The palatal ridges (*rugæ palati*), fig. 2, are 13-14 pairs in addition to the first undivided one. They are often irregular, so that in some

only the median, in others the lateral part is developed. They are in their posterior margin strongly denticulated, and resemble in this respect those of an Ox. The number of such palatal ridges is also about the same in the Ox; but in *Ovis* (11-12) and *Capra* (11) the number is smaller, and there are no denticulations, or only traces of such, in the foremost ones. In *Capreolus* I have counted 12-13 distinct palatal ridges, of which the anterior ones are striated and crenulated. In this respect *Ovibos* resembles *Bos* more than the others.

The *papilla palati* of *Ovibos* is more rounded than in *Bos* and *Ovis*, not anteriorly, but only posteriorly, and especially on the sides, where the ducts from Jacobson's organ open, divided by a

Fig. 2.



Palatal and buccal surface of the Musk-ox.

furrow from the adjoining parts. In this respect it resembles *Capra*; but *Capreolus* and *Rangifer* have a triangular *papilla*

palati, entirely surrounded by a furrow which also extends forward. The inner side of the lips and of the buccal tracts (fig. 2, p. 144) is provided with a large number of strongly developed conical papillæ. In a region of the upper lip in front of the upper molars these are simply conical, measuring 7-8 mm. in length. In other parts they are chiefly 2- or 3-pointed. In the middle part of the buccal tract and along the molars these papillæ sometimes measure as much as 5 mm. in breadth at their base, $6\frac{1}{2}$ -7 mm. in height, and they are provided with 7-8 acute points. Further in the papillæ are not so densely crowded, but become more scattered. The posterior ones are also comparatively more stout and bluntly conical, and in those parts single-pointed ones are also seen. *Ovibos* seems to differ in this respect from *Bos* and *Ovis*, in which, at least as a rule, these papillæ are single-pointed. In *Capra* the papillæ in question are mostly single-pointed, but in the row on the outside of the upper molars I have seen 2- and 3-pointed papillæ, and in the corresponding series of the lower jaw the usual number is 3 or more points. In *Capreolus* some few of the buccal papillæ have more than one point, and in *Rangifer* this is to a great extent the case.

On both sides along the insertion of the tongue there is a series of large conical papillæ. The most anterior of these especially have more than one point in *Ovibos*. In *Capra* and *Ovis* the corresponding papillæ are simple, so far as I have seen, but in *Capreolus* some of the anterior ones are double- or triple-pointed.

The *caruncula sublingualis* in *Ovibos* consists of a triangular flap inserted along its median side, and with the tip of the lateral point curved forward. At the base of this triangular flap lies posteriorly another digitiform, but flattened papilla, which extends forward along its lateral margin. This condition is different both from that of *Bos*, in which a broad flap is found, and that of *Ovis* and *Capra*, in which there is a large triangular flap anteriorly, behind which are two smaller ones. In *Capreolus* this caruncula is elongated and semilunar, with 6-7 marginal denticulations.

The tongue of an adult bull (fig. 3, p. 146) measures about 27 cm. in length. Its anterior and broadly rounded end is 6 cm. in breadth. In the middle it is narrower, measuring $4\frac{1}{2}$ cm., but its hind part is again nearly 6 cm. The posterior convex portion is very much thicker (about 56 mm.) than the flat anterior (about 33 mm.) part, and divided from it by a transverse groove. This groove is situated exactly in the middle of the tongue, $13\frac{1}{2}$ cm. from either end. On the anterior portion an asperity is produced by the dense covering of the horny *papillæ filiformes*, which are flattened and almost scale-like, but pointed. The same covering also extends $1-1\frac{1}{2}$ cm. over the lower side of the tongue, especially anteriorly. Towards the sides the papillæ are less flattened and more filiform. Posteriorly they increase in size, and are more pronouncedly scale-like. In the transverse groove their breadth is nearly 1 mm. *Papillæ fungiformes* are scattered all over the anterior portion of the tongue, although rather widely (8 mm.) separated in its central

part. Towards the sides they are more numerous, 4 mm. apart. At the margin they are still closer, 3 mm. or less apart, and on the lower side of the tip of the tongue they are separated by interspaces not even measuring 2 mm. Anteriorly, the diameter of the *papillæ fungiformes* is 1 mm. or not quite that, but they increase in size posteriorly, so that the diameter of those in the groove measures $1\frac{1}{2}$ mm.

Fig. 3.



Tongue of the Musk-ox.

The posterior thick portion of the tongue is covered by large, horny, scale-like papillæ. They are 2 ($2\frac{1}{2}$) mm. broad in the median region, but their size diminishes towards the sides, where they measure only about 1 mm. These are homologous with the small papillæ on the anterior portion of the tongue, but are rounded instead of pointed. The lateral surface of the posterior portion of the tongue is beset with minute and conical *papillæ filiformes*. Laterally, and on the posterior two-thirds of the central region of the hind tongue, rather large *papillæ fungiformes* are

found, but none on the anterior third of the central region. Their diameter measures from $1\frac{1}{2}$ to $2\frac{1}{2}$ mm. *Papillæ circumvallatæ* are placed in two irregular rows on either side of the tongue of *Ovibos*. Their number is about 12–15. *Ovis* and *Capra* have the *papillæ filiformes* on the anterior portion of the tongue similar to those in *Ovibos*, and this is also the case with *Capreolus*, but in *Bos* they are more narrow and pointed. In all four genera, mentioned for comparison, a median region of the anterior portion of the tongue is destitute of *papillæ fungiformes* except at the tip. But, on the other hand, *Rangifer* resembles *Ovibos* in having *papillæ fungiformes* scattered over the whole of the anterior portion of the tongue, although less densely in the central region. The same is also the case with *Cervus elaphus* and *C. dama*. *Rangifer* and *Ovibos* are also alike in having the papillous covering extending about $1\frac{1}{2}$ cm. on the lateral lower surface of the tongue. In *Ovis* and *Capra* a similar arrangement of the papillæ takes place, as it also does on the sides (but not at the tip) of the *Capreolus* tongue. In *Bos* the papillæ do not extend far laterally or to the lower side of the tongue.

The papillæ of the posterior portion of the tongue in the middle are large and flattened in *Ovis*. The corresponding papillæ of *Ovibos* are comparatively less enlarged, and look more like scales than tubercles. In *Bos* (and partly in *Capra*) these papillæ are more conical and curved, especially anteriorly. The papillæ of *Ovibos* may thus be said to be in an intermediate stage of development. The papillæ of *Capreolus* are scale-like, with roundish tips, resembling in their shape those of *Ovibos*, but those of *Rangifer* are rather more pointed, and the anterior ones even conical. In *Bos* only the hindmost ones are soft, the others all being more or less horny.

Capreolus and *Rangifer* are provided with *papillæ fungiformes* only on the sides of the posterior portion of the tongue, but in *Bos*, *Capra*, and *Ovis* there are some scattered on the middle of the central region as well, although not so many as in *Ovibos*. In *Capreolus* and *Rangifer* more than half of the lateral surfaces of the posterior portion of the tongue is covered by small *papillæ filiformes*, thereby agreeing with *Ovibos*. In *Capra* the same is the case anteriorly, but in *Ovis* at least two-thirds of these parts are smooth.

Papillæ circumvallatæ occur on each side in *Ovis* 18–24 (according to Ellenberger & Müller) in 4 rows, in *Bos* 10–17 in 2 rows, in *Capra* 16–17 (12 according to Ellenberger & Müller) in 2 rows, in *Capreolus* 8–9 in 2 irregular rows¹, and in *Rangifer* 7–11 in 2 irregular rows².

¹ In *Cervus elaphus* and *dama* the number of *pap. circumvallatæ* is variable, and they are disposed in two irregular rows.

² In Bronn's Klass. und Ordn., Leche mentions that the number of *pap. circumvallatæ* is "bei *Camelidæ* sechs." The primary three on each side I have found in *Camelus bactrianus* to be the largest and best developed, but accessory ones are also found, as in one instance two on each side close to the primary, and two more on each side with a more posterior and median position.

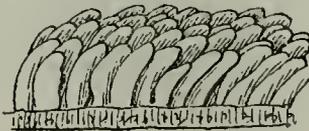
I have described the shape and arrangement of these papillæ rather fully in order to show that these conditions hardly offer any characteristics of systematic value, as they are subject to much variation even individually, and distant forms are sometimes more alike than nearly related ones. The likeness between *Ovibos* and *Rangifer* may depend on a similar way of feeding. In both the strongly developed lips are certainly of use when they nip off lichens from rocks and stones. If they had only thin lips, they might scratch and hurt their teeth when feeding on that material. The warty laminæ on the lips are also useful when seizing other food such as the twigs of the arctic willow, and against these hard twigs the strong development of the papillæ of the mouth is of protective value. There seem to be several ways of seizing the food among the Pecora. *Bos* uses the tongue; *Ovis* and *Capra* bite at once, and their lips are chiefly taste-organs; *Rangifer* and *Ovibos* use the lips as pincers; and *Alces* uses its great movable muzzle as a kind of trunk, but the lips of the latter are smooth, not provided with horny warts as in the Reindeer and Musk-ox; the function is thus different.

The tonsils in *Ovibos* have four or five openings.

The *œsophagus* is provided with a strong outer layer of muscle ($3\frac{1}{2}$ mm.), and interiorly has longitudinal folds. These are of two kinds, namely 7-8 large ones from 2 to 4 mm. in height, and small ones measuring 1 mm. or less. The former disappear by stretching and are produced by folding of the whole mucous membrane, but the latter seem to be merely epithelial ridges¹.

The paunch is of course large. The zoologist of the expedition emptied 22 litres of fodder out of that of an old Musk-ox² from Sabine Island; but there is no proof that it was fully distended, and a quantity was left in the preserved ventricle. The right and left sacs of the paunch do not extend equally in aboral directions as in *Bos*, the right being a little the longer, as in *Ovis*. Both

Fig. 4.



Papillæ of the paunch of Musk-ox.

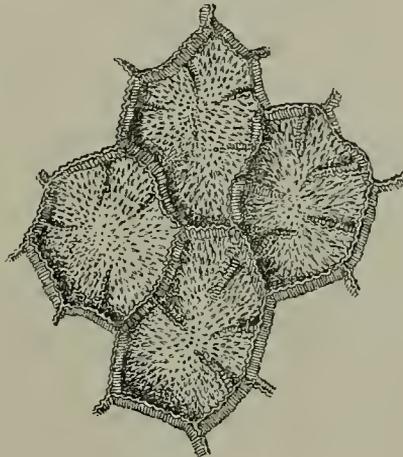
sacs are, however, more broadly rounded, and the constriction between them is, as it seems, not so strong as, for instance, in *Capra*. The distance from the cardia to the end of the left sac is 41, and to the end of the right sac 44 cm.; both measurements being taken when the stomach lies flat and empty. Transversely

¹ This agrees with the corresponding features in *Bos taurus* as described by Oppel (Lehrb. d. vergl. Anat. d. Wirbeltiere) after Schütz.

² Total length 228 cm.

measured, the diameter of the left sac is 21, and that of the right 27 cm. These measurements have of course only value for a comparison of the size of both sacs. The distribution of the exterior furrows and interior muscular ridges of the paunch seems, on the whole, to agree with the same in *Ovis*. Thus the paunch of *Ovibos* and *Ovis*, and especially its left sac, is less specialized than in *Bos*, but more so than in *Capreolus*. The papillæ in the paunch of *Ovibos* (fig. 4, p. 148) are flattened, more or less broadly tongue-shaped, and cover the whole interior surface except the muscular ridges. Their size varies from 5–15 mm. in length, and from 2 to 4 (in average $2\frac{1}{2}$ –3) in breadth. Three cm. from the cardia these papillæ measure about 8 mm. in length by 2 in breadth; at the posterior end of the left sac near the “hintere Hauptpfeiler” their length rises to 11 mm., and on the area between the spleen and the reticulum, as well as in the adjacent part of the reticulum, they are still longer, 12–15 mm. The shape of the papillæ is not different from those of *Capreolus*, *Ovis*, *Capra*, &c. It has already been hinted that a portion of the reticulum is provided with tongue-like papillæ. This area passes gradually into the normally reticulated portion. The papillæ become partly confluent and form more or less lobated walls disposed like the ridges of the typical reticulum; and at the same time the papillæ in the interspaces between these walls are greatly reduced in size. The origin of the ridges of reticulum, as well as that of the small papillæ in the meshes, can thus be plainly seen. The cells of the reticulum of *Ovibos* (fig. 5) are in the fundus about 2 cm., or a little

Fig. 5.



Cells of the reticulum of the Musk-ox.

more, in diameter, but towards the sides they are smaller, $1\frac{1}{2}$ –1 cm. in diameter. At the “Schlundrinne” the cells on one side are very small, only $\frac{1}{2}$ cm. in diameter; on the other there are no cells, only longitudinal folds. The surrounding ridges of the typical cells

are not nearly so high as in *Bos*¹, and hardly so high as in *Ovis* and *Capra*. They measure 2-3 mm. in height, but this may partly be due to contraction. The free margins of these walls in the fundus are finely denticulated, but all of them are provided with vertical ridges on their lateral surfaces. The cells are again partly divided by smaller walls into secondary cells, but this is quite irregular. The cellular interspaces are also finely reticulated by small tertiary ridges which carry small conical papillæ, and such are also found within the tertiary reticulations. This is conspicuous on places where the epithelial covering has fallen off. The reticulum of *Ovibos* is thus much more differentiated than that of *Rangifer* and *Capreolus*, in which the cells are very shallow. The difference between *Ovibos* and *Rangifer*, which both lead a similar life, indicates that no parallelism in development has taken place with regard to this organ. This, on the other hand, seems to prove that the suggestion made by Owen², that the shallowness of the cells of the Reindeer's reticulum is due to the fact that the animal obtains so much water by its swallowing snow that any reservoir for water is unnecessary, is incorrect. *Ovibos* is a representative of a more specialized ruminant type.

The diameters of the reticulum of *Ovibos* are 160 × 210 mm., and those of the psalterium 180 × 230. The latter is thus larger; and therein *Ovibos* agrees with *Bos*, and differs from *Ovis*, *Capra*, and the *Cervidæ*³.

The number of folds in the psalterium is 61, and their arrangement is plainly quadruplicate, with folds, or septa, of first, second, third, and fourth order. Eight folds of the first order are conspicuous, embracing 7 pockets of the first order. There ought, then, to be 57 folds, if it were quite regular, but some few of the fourth order are not developed; on the other hand, there are some outside the seven pockets belonging to incomplete pockets. The quadruplicate arrangement agrees with that in *Ovis*, the same in *Bos* being quinquuplicate. I do not think, however, that much stress can be laid upon this character; this opinion being confirmed by the fact that Garrod has found in the genus *Cervus* forms with quinqu-, quadri-, and triplicate arrangement of these septa⁴. *Capreolus* is said to have a quadruplicate arrangement of septa in the psalterium; but before me lies a specimen which has only a triplicate arrangement, without the slightest trace of the fourth system of folds. Likewise I have a psalterium of *Capra* with only a few indications of the folds of the fourth system⁵.

The psalterium-folds are beset with conical papillæ, usually almost as broad as high (about 1½ mm.), but more acute towards the free margin of the folds than at their bases. At the opening

¹ Vergl. Anat. d. Hausthiere, achte Auflage, 1896.

² Anat. of Vertebrates, vol. iii. p. 472.

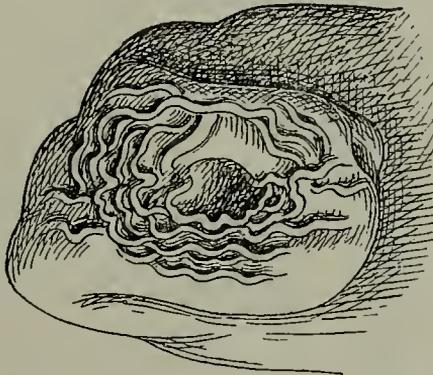
³ At least *Capreolus*, *Cervus dama*, and *C. elaphus*.

⁴ Proc. Zool. Soc. 1877, pp. 2 et seqq.

⁵ Boas has also pointed out the variability of this organ (Morph. Jahrb. 1890).

between the reticulum and psalterium are some conical papillæ, but not enlarged or curved as is usually the case in *Bos*. The psalterium-groove is also bordered by rows of conical papillæ like those of the psalterium-folds. The opening to the abomasus is surrounded by two semilunar plicæ, which are continued in the longitudinal folds of this organ. The number of the abomasus-folds of *Ovibos* is 24, many more than in *Bos* (14-16), *Ovis* (13-15), *Capra* (13), or *Capreolus* (11-12). But the folds are not very broad, at most about 3 cm. The length of the abomasus measured along the curvature is 48 cm., and its greatest breadth when lying flat and empty about 15 cm. The folds disappear 24 cm. from the pylorus. In *Ovis*, *Capra*, *Capreolus*, &c. the plicated part of the abomasus is much longer than the nonplicated. *Ovibos* has been able to shorten the plicated tract by augmenting the number of laminar folds. Towards the pylorus the musculature is strengthened, and forms a strong sphincter with a round button on the anterior side.

Fig. 6.



Irregular folds in the cæcum of the Musk-ox.

The first part of the *duodenum*, which is suspended in the *omentum majus*, is rather dilated, and measures 4 cm. in width, when it lies empty, but when it approaches the liver, 20 cm. from the *pylorus* in the *omentum minus*, it is narrowed to 3 cm. Free from this it makes a short loop about 10 cm. in length, after which it bends backward and forms another loop 33 cm. in length along the rectum, to which the ascending part is attached by a mesentery 4-5 cm. in breadth. Having returned forward, it becomes the *jejunum*, with its numerous short convolutions in the periphery of the mesentery. The last part of the small intestine is again straight, and attached to the cæcum by a narrow mesentery.

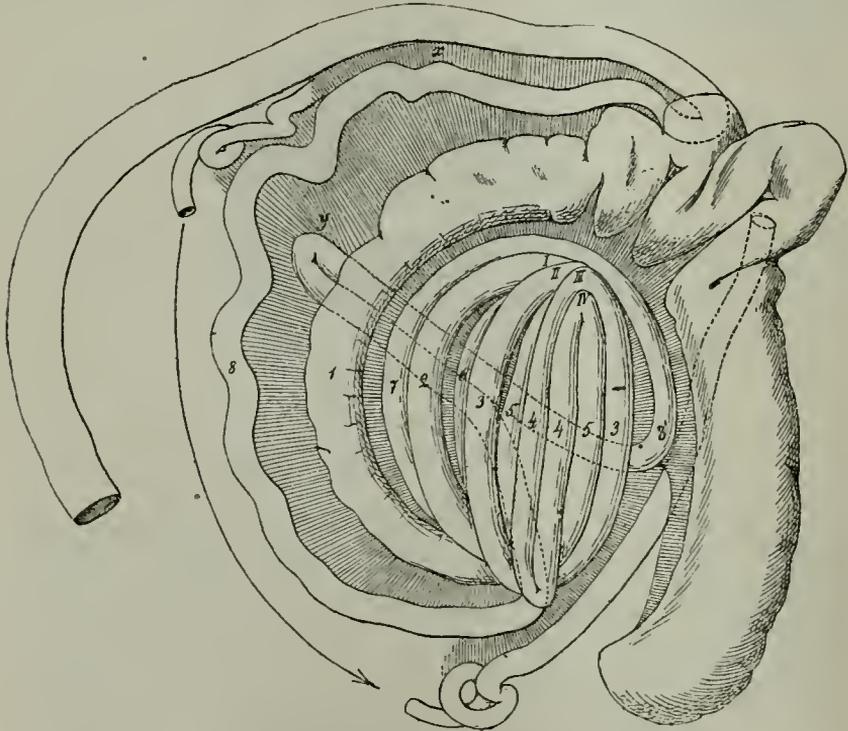
The ileum terminates by a 10-13 mm. broad circular *valvula ileo-cæcalis*.

In the fundus end of the cæcum of *Ovibos* several irregular folds are found. These are especially numerous on a spot a little more than 3 cm. in diameter, where some of the folds are 5 mm. broad. They appear to be irregularly arranged (see fig. 6). Here, too, the

wall of the cæcum is thicker. The surrounding tract shows some scattered longitudinal folds. Otherwise the internal surface is quite smooth. In the specimens of other species studied for comparison I have not seen such folds in the fundus of the cæcum.

The cæcum is dilated towards the fundus end, so that its width there is 18 cm. when it lies empty and flat, but at the opening of the ileum it is only 10 cm. The large intestine soon tapers when it enters the spiral from 10 cm., which is its width in the beginning next to the cæcum, to a diameter of 4–5 cm. in the spiral coils. It retains that width so long as it is included in the mesentery, but when it leaves this it widens to 8–9 cm. in diameter, and the rectum is still wider, 9–10 cm. When the colon leaves the spiral in the mesentery it becomes covered with fat, distributed in large oval and oblong lumps, which become still more numerous on the rectum.

Fig. 7.



Great and small intestines of the Musk-ox.

If we assume that the first spiral coil (fig. 7) begins at the point where the colon crosses the median line since it has left the cæcal tract and is bending over to the left side, then the first coil is complete at the number I in the figure, the second at II, the third at III, and the fourth at IV, but at that point the spiral turns and the colon bends back upon itself. The fifth, sixth, and seventh coils (5, 6, and 7 in the figure) are retrograde coils, and the fifth and

sixth are situated more centrally and covered by the other coils. The seventh lies between the second and first coil, but the eighth is still more peripheric. At 8 in the figure it is shown to make a long loop (*y*), and then having returned upon itself it passes out in the periphery of the mesentery near the short convolutions of the small intestine, to which it is fixed with a narrow (about 3 cm.) mesentery. Owing to this narrowness of the mesentery, the large intestine is forced to make some undulations, although not so many or so deep as the small intestine. When the large intestine has come to the pancreas region it leaves the mesentery of the jejunum, and becomes connected with the first part of the colon (the first coil) in a direction opposite to that of the latter towards the right side, and, returning upon itself, makes a loop, both ends of which are closely connected at *x* in the figure. Then it passes backward into the rectum.

With regard to the figure, it is to be observed that the intestine is laid out and the coils of the spiral are pulled apart a little; the upper parts of the spiral being to the right and the lower parts to the left, so as to make all the coils at least partly visible.

When comparing the large intestine of *Ovibos* with that of other Ruminants, it becomes evident that the former is more developed and thrown into more coils (4 centripetal and 4 centrifugal). If the spiral coils are counted in the same manner as above, we find that the colon of *Capreolus* makes $2\frac{1}{2}$ centripetal spiral coils and $2\frac{1}{2}$ retrograde or centrifugal ones. The same organ in *Capra* and *Ovis* makes 3 centripetal and 3 retrograde spiral coils. In *Bos*, as a rule, only 2 centripetal and 2 centrifugal coils (sometimes only $1\frac{1}{2}$ of each) can be discerned.

The situation of the last centrifugal coil is different in *Ovis* and *Capra* on the one side, and *Bos* on the other, since in the two former it lies peripherally quite close to the coils of the small intestine. The same is also the case in *Ovibos*, as already stated; but although this characteristic separates *Ovibos* from *Bos*, it has no value for uniting *Ovibos* with the Ovine group, because the same condition is also found in other Ruminants, as, for instance, *Capreolus*, in which the mesentery between the small and the large intestine is $1\frac{1}{2}$ – $2\frac{1}{2}$ cm. It is therefore probable that this is an ancient character retained by most Ruminants except the Bovine group. The situation of the colon gives therefore no reason for uniting *Ovibos* with *Ovis* and *Capra* in a subfamily of *Cavicornia*. On the contrary, the greater development of the spiral coils indicates that the Musk-ox is differentiated with regard to this organ from the others. The same result may be obtained by comparing the measurements of the different parts of the intestine with each other, and comparing this relation with the corresponding one in other species. The length of the different parts of the intestine of the Musk-ox measured in a preserved state, but still adherent to the mesentery, is as follows:—

Small intestine from pylorus to cæcum 26 m. 70 cm.

Cæcum 70 cm. Large intestine 12 m. 40 cm.

The terminal portion of the rectum, perhaps 25 cm., is missing.

For comparison it may be mentioned that Mr. J. Arwidson made the following measurements of the intestine of another specimen. He loosened the intestine from the mesentery and stretched it out on the deck of the steamer, which of course resulted in larger figures. Small intestine 31 m. 2 cm. Cæcum 75 cm. Large intestine 11 m. 99 cm.

But in this case, also, the last part of the rectum from the anterior end of the urinary bladder was missing. Since the intestine was stretched in this case, it may be more reliable to use my own figures. We find, then, that the small intestine is not much more than twice as long (more exactly 2·1, and according to Arwidson's measurements 2·5) as the large intestine. For comparison I have in the same way measured the intestines of a sheep and a goat preserved in formalin and still adherent to the mesentery, viz. :—

	<i>Ovis.</i>	<i>Capra.</i>
Small intestine	15 m. 15 cm.	14 m. 77 cm.
Cæcum	36 cm.	22 cm.
Large intestine	4 m. 90 cm.	4 m. 90 cm.

In both these cases we find that the small intestine is fully three times as long as the large. Similar figures occur in literature concerning other species of *Ovis* and *Capra*, and in *Bos* the small intestine is 3 to 4 times as long as the large one.

The great length of the large intestine in the Musk-ox is an adaptation suitable for the digestion of some special kind of food. It is thus probable that feeding on the twigs of the arctic willow and similar indigestible material, which, when the short arctic summer has passed, must be the only food of this hardy animal, has produced this great development of the large intestine.

The *liver* of the Musk-ox (fig. 8, p. 155) is divided into a right and a left lobe. The diameters of the left lobe are 16 cm. × 21 cm., and its thickness is between 4 and 5 cm. The corresponding measurements of the right lobe are 18, 22, and 8 cm. The spigelian lobe is small and triangular ($4\frac{1}{2}$ cm. base, $2\frac{1}{2}$ height) with a broad base, thus exhibiting that shape which has been called by Garrod¹ oviform. The *lobus caudatus* (*l.c.*) is flattened, $12\frac{1}{2}$ cm. long by $8\frac{1}{2}$ broad, and carries at the end a small lobule 3·3 cm. broad and 1·8 long. The gall-bladder (*gb*) is, as usual, situated on the posterior surface of the right lobe, 9 cm. from the umbilical fissure, the depth of which is about 6 cm. It has thus a rather central position in the right lobe. When empty and contracted it is 11 cm. in length.

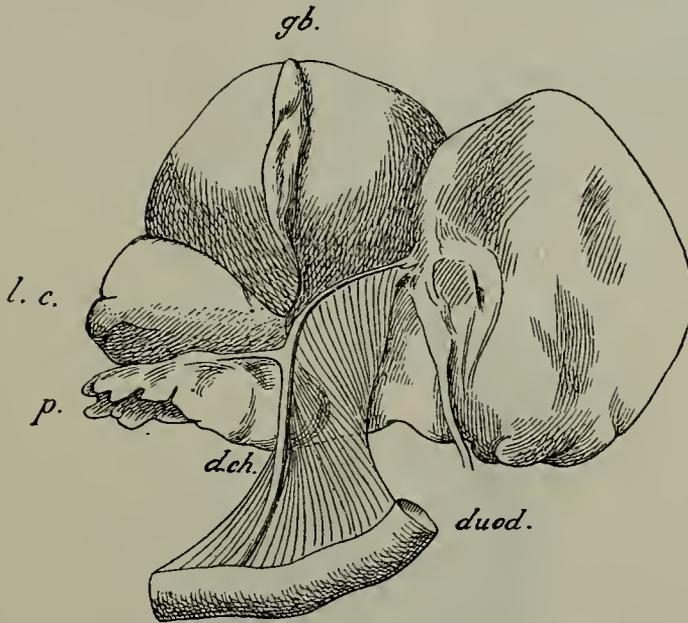
The *ductus choledochus*, which has a considerable width, opens into the duodenum 63 cm. from the pylorus. About 10 cm. before it pierces the wall of the intestine it receives the *ductus pancreaticus* (*cf.* the figure). This description being taken from the organ of a full-grown bull.

A comparison of the liver of *Ovibos* with that of other Pecora

¹ Proc. Zool. Soc. 1877, pp. 2 *et seq.*

gives the following results. With regard to its pronounced division into a right and left lobe, it resembles more the ovine than the bovine liver. But since the same division is just as much pronounced in many other forms, this characteristic has hardly any classificatory value. The *lobus spigelii* has the same form in *Ovis*, *Bos*, and *Ovibos*; but it is doubtful whether the shape of this lobe offers any valuable characteristics, since it may be absent or present in the same genus or even species, while its form in the same species may be either "rusiform" or "oviform" (cf. Garrod, *l. c.* p. 4). The shape of the *lobus caudatus* in the Musk-ox is more flattened and less trihedral than in any liver of *Cavicornia* or *Cervicornia* I have seen.

Fig. 8.



Liver, gall-bladder, and part of the duodenum of the Musk-ox.

This probably depends on the circumstance that the right kidney is not so closely impressed and capped by this part of the liver. The union of the *ductus pancreaticus* with the *ductus choledechus* before entering the intestine seems at first sight to be a character of more importance, because this presents a resemblance to Sheep and a difference from Cattle. It must be observed, however, that, according to Franck¹, *Bos* not seldom has two *ducti pancreatici*, one opening directly in the intestine, and the other uniting with the *ductus choledechus*. This considerably lessens the difference of arrangement, the more so as my preparation of *Ovibos* was a little damaged in these parts, so that I am not able to deny the possible

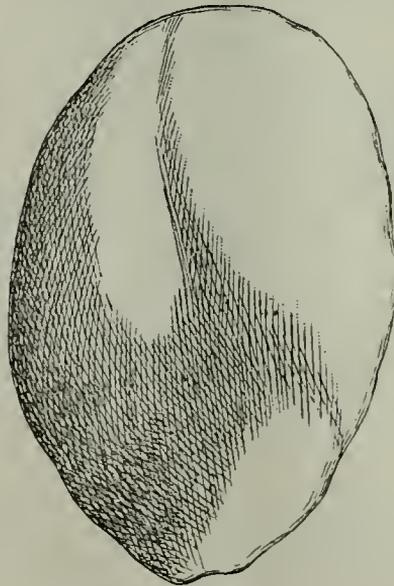
¹ Cf. Ellenberger and Müller, *l. c.* p. 433.

existence of a second pancreatic duct. By embryological investigations it has been proved that the presence of two pancreatic ducts is the primary condition, which thus is retained now and then in *Bos*; and two such ducts always exist in many Ungulata, as, for instance, *Equus*, *Tapirus*, and *Rhinoceros*. The condition in the Ruminantia does not seem to be well known (except in domesticated animals); it can, however, be concluded *per analogiam* that they originally had two pancreatic ducts. In such a case it is evident that two forms like *Ovis* and *Ovibos* have been able to reduce one and retain the other, so that this resemblance is no distinct proof of close relationship, although it may indicate such a feature.

The main mass of the *pancreas* (fig. 8, p. 155) of the Musk-ox is situated round the blood-vessels of the liver, but it extends along the paunch towards the spleen, although it does not seem to quite reach that organ. The pancreatic duct has already been spoken of.

The *spleen* of the Musk-ox is not elongate as in *Ovis* and *Capra*, but its contour is elliptic, equally rounded at both ends (fig. 9). Its length is (in an adult bull) 21 cm. and its breadth 14 cm

Fig. 9.



Spleen of the Musk-ox.

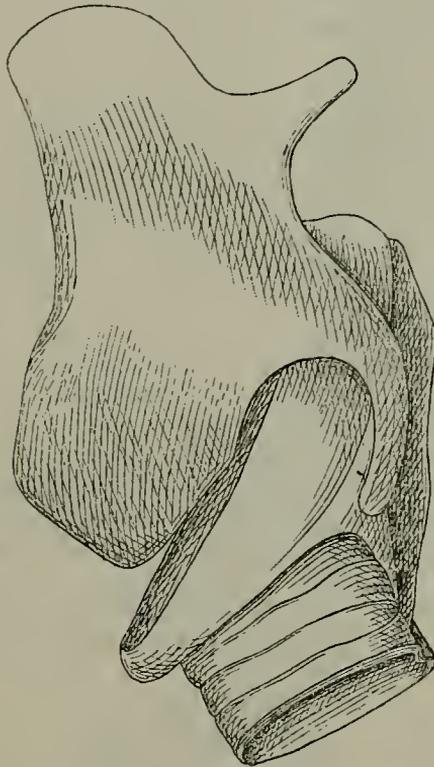
It is, however, much thicker (4 cm. in preserved state) at the side nearest to the œsophagus, and is flattened towards the other sides. Its shape thus agrees very well with that of the spleen of the *Cervicornia* (*Cervus claphus*, *Capreolus*) and *Giraffa*, and may be an ancient character.

The nostrils have already been spoken of in connection with the muzzle. The *septum membranaceum* of the posterior nasal cavity

is in the Sheep complete, and extends posteriorly into the "Naserrachen," but in the Calf it is only a ridge. In *Capra* this septum is well developed, although not quite so strongly as in the Sheep. The same structure as in *Bos* occurs in *Ovibos*, as I have seen in the salted head of a Musk-cow, in which this ridge is only 2 mm. broad and 3-4 mm. high. Even with allowance for contraction in the brine, it is evident that the posterior nasal cavity is much less narrowed by the *septum membranaceum* in the Musk-ox than in the Ovine group. This may be gathered from the fact that at the posterior end of the *palatum durum* the distance between the septum and the lateral wall is nearly $1\frac{1}{2}$ cm., while the height of the cavity measures more than 4 cm.

The *larynx* of the Musk-ox (fig. 10) is of a very elongate shape. Its greatest length (in a bull), taken as a whole, is 14 cm., but its

Fig. 10.



Larynx of the Musk-ox.

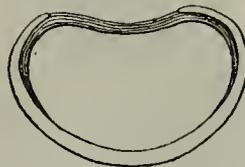
transverse (vertical) diameter is only 9 cm. This great length is mostly due to the great extension of the *cartilago thyroidea* (more than 11 cm.). It is especially the anterior part which is large, as may be demonstrated from the fact that the distance from the hind margin to the point of the *pomum adami* is contained fully three times in the distance from the latter point to the margin of

the *incisura thyroidea superior*. In *Capra* the corresponding relation is only 1 to $1\frac{1}{2}$, and in *Capreolus* I have found a similar condition. *Cornua superiora* in the Musk-ox are not so much elongated as, for instance, in *Cervus elaphus* and *Capreolus*, in which they are larger than the *cornua posteriora*, but of comparatively the same size as in *Bos* and *Capra*. They are directed dorsally, so that their direction forms a nearly right angle against the longitudinal diameter of the larynx, and is not parallel to the same as in *Capra* and *Bos*. The *cornua inferiora* are very long and arcuate. As a result of the great development of the *cartilago thyroidea* in *Ovibos*, the longitudinal diameter of the dorsal part of the *cartilago cricoidea*, which in *Capra*, *Cervus*, and *Capreolus* exceeds the length of the *cartilago thyroidea*, only equals 72% of the length of the first mentioned cartilage. In *Bos* the anterior portion of the *cartilago thyroidea* is enlarged as in the Musk-ox, so that the length of the larynx exceeds the dorsoventral diameter, but the length of the *cricoidea* equals or nearly equals the length of the *thyroidea* along the anterior keel. The *pomum adami* is less developed in *Bos* than in *Ovibos*, and the distance from the same to the insertion of the *cornua posteriora* exceeds the length of the *thyroidea* in *Bos* and still more so in *Capra*; but in *Ovibos* this distance is not much more than $\frac{3}{4}$ of the length of the *thyroidea*, although the *pomum adami* is so much protruding. This indicates that the lateral extension compared with the length of the *thyroidea* is much less in *Ovibos* than in *Bos*. This can be seen in the figure. On the whole there is, however, more resemblance with regard to this organ between *Ovibos* and *Bos* than with the others.

The *epiglottis* of the Musk-ox is strongly recurved at the apex, but blunt (nearly rounded). It thus makes a less triangular impression than that of *Capra*, *Bos*, &c. The *plica ary-epiglottica* is well developed, although not so much, it seems, as in *Ovis* and *Capra*. The basal part of the epiglottis is strongly developed and reaches the same length as the free portion. On the sides it is well curved so as to embrace the arytenoid cartilages.

The *trachea* is very wide and has a peculiar shape. It is flattened dorso-ventrally, so that the transverse diameter of its

Fig. 11.



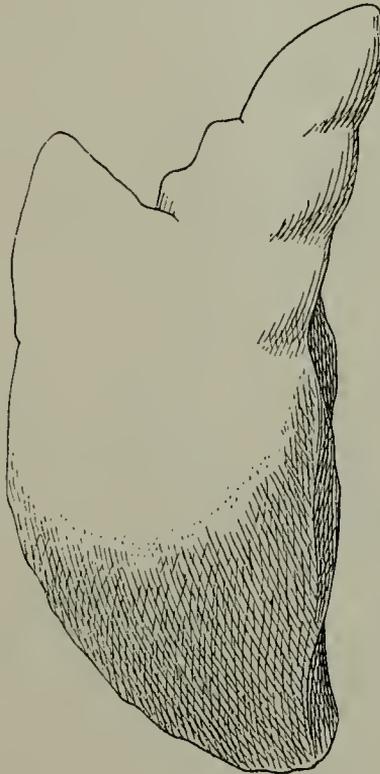
Tracheal ring of the Musk-ox.

lumen is 5 cm., but the dorso-ventral only 3 cm. This is effected by the tracheal rings (fig. 11) not meeting dorsally, but leaving a

3 cm. broad interspace between their dorsal ends¹. This interspace is occupied only by soft tissues. The dorsal surface is thus, instead of showing a median edge as in other *Cavicornia*, flat or even a little concave. The cartilages are ventrally thicker, but end dorsally in thin edges. The ventral portion of the rings is usually 7-8 mm. broad, but towards the sides, where they partly overlap each other in the antero-posterior direction, they become broader (15-20 mm.).

The *lungs* of the Musk-ox show on the right side the same division into lobes as in other *Cavicornia* (*Bos*, *Ovis*, *Capra*) and in *Cervicornia* (*Cervus elaphus*, *Dama*, *Capreolus*, and *Rangifer*), but the left lung differs (fig. 12) from all the material (of Ruminants)

Fig. 12.



Lung of the Musk-ox.

on hand except *Lama glama*. The left lung is quite simple, the upper lobe sitting with a broad base on the lower, and there being no trace of a middle lobe (see fig. 12), which latter in the Ruminants (except *Lama*) enumerated above is very deeply cleft from the lower lobe. *Ovibos* has thus in this, respect, a very isolated position. The lungs are distinctly lobulated as in *Bos*.

¹ A similar condition is said to take place in the Yak (*Bos grunniens* Linn.) according to Pagenstecher (Allgem. Zoologie, vol. iii. p. 384).

The circulatory system cannot be studied from the material on hand, I therefore only state the dimensions of the preserved heart of a Musk-ox bull, $18 \times 13\frac{1}{2} \times 9\frac{1}{2}$ (right) or $10\frac{1}{2}$ (left) cm. Its periphery is 39 cm. The dimensions seem to equal those of common cattle.

The scrotal sac of the Musk-ox is pendent, with vertical testicles, as Mr. J. Arwidson informs me. The length of a testicle with the epididymis of a bull (killed at Emperor Franz Joseph Fjord, Aug. 26) measured $12\frac{1}{2}$ cm., the transverse diameter of the same is about 6 cm. This is about the same size as in cattle, and relatively smaller than in *Ovis* and *Capra* (for instance the testicles of a young goat are fully 10 cm. in length). The *musculus cremaster* is well developed, $3\frac{1}{2}$ cm. broad. The *vasa deferentia* are arranged as usual. The thickened terminal portions are 6–7 mm. in length and about 7 mm. thick. They have an exterior muscular coat and a spongy-looking interior surface. The interspaces between these organs are filled with fat. The *ductus ejaculatorius* opens on a *colliculus seminulis* which has the shape of a ridge, but distally this ridge is cleft in two parts, which border a furrow.

The *vesiculæ seminales* are flattened, $5\frac{1}{2}$ cm. long and $2\frac{1}{2}$ cm. broad, organs with a distinctly lobed appearance. They are nearly solid and have a glandular structure. Each opens with a duct into the corresponding *ductus ejaculatorius*.

The *prostata* is only slightly developed, and covered by the thick *musculus urethralis*. Next to the bladder only small scattered lobules are seen, but distally, $4\frac{1}{2}$ cm. from the proximal border of this muscle, the gland is thickened to a layer 5–6 mm. in thickness and about $1\frac{1}{2}$ cm. in length.

The *glandulæ cowperi* are well developed, rather triangular in shape, about 3 cm. deep, and nearly $3\frac{1}{2}$ cm. long, but flattened on the median side so that the thickness does not amount to more than $1\frac{1}{2}$ cm. in the transverse diameter.

So far as the muscles are left on the preparation, the following can be discovered:—a pair of broad *ischio-urethrales*, a pair of large *bulbo-cavernosi* and the “Afterruthenmuskeln,” which run alongside each other to the S-shaped curve of the penis. There they separate, and continue laterally of the penis to a point about 6 cm. from the præputium, where they insert by means of a sinew.

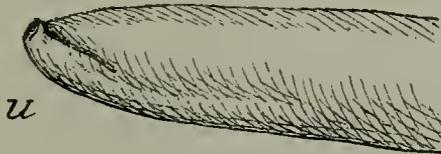
The *penis* opens into a *præputium*, which protrudes $6\frac{1}{2}$ cm. outside the integument of the belly. The distal third of this sac-like prominence is exteriorly naked in a bull killed August 29th. The base is covered by dark brown, nearly black hairs partly reaching a length of 18 cm. Distally the hairs get shorter, less numerous, and partly greyish white. The præputial cavity is distinctly differentiated into three regions with different structure. The most distal of these, which corresponds with the protruding part, is richly provided with longitudinal folds. Its integument has the same structure as the exterior surface of the tip of the præputial prominence. In a bull killed in July this portion is densely covered by fine hairs reaching a length of 6 cm. This is probably

a part of the winter coat, which extends even on to the interior surface of the præputium, for in the bull killed 29th August it is absent and the corresponding surface naked. The next præputial region, about 7 cm. in length, is also thrown into strong longitudinal folds. In the bull killed in July it is beset with fine woolly-looking hairs about $1\frac{1}{2}$ or 2 cm. in length. This portion is evidently richly provided with glands, for in the specimen killed at the end of August, at a time when the rutting-season is approaching, this region is quite covered by a hardened secretion. This is a yellowish-looking mass consisting partly of small roundish nodules like hardened drops and emitting a strong odour of musk. The third and most interior portion, which includes the distal end of the penis, is about 6 cm. in length. Its surface is thrown into a still greater number (16-18) of undulating folds. But the surface is smooth, and there is no secretion conspicuous in this part. There seems to be a rather powerful sphincter at the centre of the middle præputial portion, although it is damaged on the preparations.

The length of the two penes preserved in the retracted state is, measured along the curves, respectively 55 and 62 cm.

The end of the penis (fig. 13) is blunt, and the urethra ends as a truncate tube (*u*), which on the left side is curved upward close to the tip of the penis. The urethral tube accordingly does not

Fig. 13.



Penis of the Musk-ox.

extend beyond the penis, and the portion which is not fused together with the end of the latter is very short. On my specimens the free margin on the left lateral side is about 9 mm. and on the median side hardly 4 mm. This condition differs widely from that in the Ovine group. But there is still another difference: the apex of the penis of the Sheep is provided with an expansion like a cushion, forming a kind of glans, but in the Musk-ox nothing of that sort can be seen. The shape of the penis of *Ovibos* is most similar to that of *Damaliscus pygargus* as figured by Garrod (*l. c.* p. 11). From the fact that forms so widely different as *Giraffa*, *Moschus*, *Elaphodus*, *Addax*, *Gazella*, *Capra*, and *Ovis* have the urethra prolonged to a more or less setiform appendix beyond the tip of the penis, it may be concluded that this is an ancient characteristic¹ of the Ruminants, and the ancestors

¹ It is very difficult to understand such a feature as a parallelism, and *tertium non datur*.

of *Ovibos* probably had a similar organ. It is, however, reduced in the Musk-ox as well as in the Common Ox and many other forms. Such a thin filiform termination of the urethra must easily be damaged by frost, and it could hardly be useful to an animal living in such a cold climate that it needed even the interior of the præputial sac clothed with hairs or wool. This might therefore be the reason for its reduction in *Ovibos*, whatever it may have been in others.

The absence of this filiform prolongation (the cause may be one or the other) is, however, a resemblance to the condition in *Bos*, and the value of this characteristic seems to gain more importance as it is shared also by some Antelopes (*Bubaline* section). But it must be admitted that the reduction of such an appendix as this might have taken place in different forms independently.

The genital organs of a young virgin cow killed in the Queen Augusta Valley in July were preserved. The ovaries are irregularly bean-shaped, 22 mm. long, 17 mm. broad, and 12 mm. thick.

The *tubæ fallopæ* pursue their slightly winding course in about 10 cm. from the pavilion to the *cornua uteri*. In each cornu there are a great number of cotyledonal processes. These are neither regularly arranged nor of the same size, but in the wider part they seem to be disposed in four rows. Those of the two median rows are much the larger. The number may be estimated between 90 and 100 in each cornu. The cotyledons are thus much more numerous than in other forms, nearly twice as many as in the cow and sheep (according to Franck¹). According to Garrod's list the Giraffe is the only ruminant which has a similarly great number, namely "180 large and small" (*l. c.* p. 12). *Ovibos* has accordingly a rather isolated position in this respect.

The *corpus uteri* is very short (about 12 mm.), because the cornua nearly reach down to the *cervix*. The vaginal portion forms the largest part of the genitalia in such a young cow. It is about 19 cm. from the lower end of the *canalis cervicis* to the edges of the *labia pudendi*. About a third of this length is taken up by the *sinus urogenitalis*. The *hymen* is well developed, and at its free margin is a conical papilla. Under the *hymen* is a diverticulum in which the urethra opens.

The *vagina* from the *hymen* to the *cervix uteri* is wide and about 13 cm. in length. Not far from the end of the same, two large plicæ or valves are found, which are arranged so that each forms a pocket with the wall. The interior of these is situated on the left side about 2 cm. from the mouth of the *canalis cervicalis*, and its pocket is open downward. The exterior valve forms a still more pronounced pocket opening inward a little more than 2 cm. from the other. The function of these valves may be to retain the sperm in the vagina after copulation. Otherwise the interior surface of the vagina is smooth, but with longitudinal folds. In the Ruminants that I have used for comparison, I have not seen any

¹ Cf. Ellenberger and Müller, *l. c.* p. 556.

transverse plicæ or valves like those in *Ovibos*, which may therefore be peculiar to that form.

At the ventral angle of the *labia pudendi* is the *clitoris* with a rounded *glans*. Its visible parts are oviform, 6 mm. long by 4 broad.

The *kidneys* of *Ovibos* are bean-shaped, without trace of division into lobules. Their dimensions in an old bull are as follows:—length 13 cm., breadth at hilus $6\frac{1}{2}$ –7 cm., thickness $4\frac{3}{4}$ – $5\frac{3}{4}$ cm. In a young cow the corresponding dimensions are 11, 6, and 5 cm. When the kidney is cut longitudinally it can be seen that there is only one elongate and ridge-like mammilla formed by the more or less complete blending of many cones into one. The cones are, however, at their bases more or less distinct. This character offers a remarkable difference from the corresponding structure in *Bos*, but agrees with that of the sheep, goats, deer, and other ruminants, even the *Camelide*. It is accordingly a character of importance in distinguishing *Bos* and *Ovibos*; but, on the other hand, it does not prove any closer relationship between *Ovibos* and *Ovis*, because *Bos* is in this respect an aberrant, and *Ovibos* a normal ruminant.

Concerning the *mammary organs* of *Ovibos*, it is stated by various authors with more or less certainty that the udder is provided with only two teats. This statement is, however, erroneous, as *Ovibos*, both females and males, normally have four well-developed teats. On the 11th of July, Mr. Arwidson preserved the udder of a young cow shot in Queen Augusta Valley. The udder had four teats, the anterior pair situated 8 cm. apart. The posterior pair measured 25 mm. in length, and 4 cm. apart; the distance between the two pairs being 5 cm. On the 26th of August, an old cow, with milk in the udder, was killed at Emperor Franz Joseph Fjord. She had four normal teats and one accessory. The anterior of these measure in the preserved state about $3\frac{1}{2}$ cm., and the posterior 4– $4\frac{1}{2}$ cm. The fifth accessory teat is close to the base of the right anterior one, and is not quite $1\frac{1}{2}$ cm. long in the preserved state. In a bull killed in July on Sabine Island, Mr. Arwidson found four teats and a fifth accessory one. "At the base of the scrotum," he writes, "two rudimentary teats were situated 7 cm. apart, 5 cm. in front of these was another pair, and 6 cm. in front of these on the left side still another of small size, but the corresponding one on the right side is missing. The posterior ones are larger, measuring 1.5 cm." The udder of the cow is densely covered with hair, and even the teats, although more sparsely, are beset with hairs of a lighter, nearly white coloration. The aperture in the tip of the teats is large. In their shape the teats resemble those of the cow, although smaller and hairy.

The alleged presence of only two teats has been regarded as evidence for allying *Ovibos* with the Ovine Ruminants. The opposite view is, perhaps, proved by the existence of four teats. Indeed, the evidence is more than this; because, if there had only been two, one pair might have been reduced by parallelism, since the presence of two pairs is the primary condition, as may be gathered from

the fact that four teats are found in the *Camelidae*, in *Giraffa*, and in the *Cervidae*. That the teats in some forms have been reduced independently is more than probable, when we take into consideration the conditions presenting themselves in the Antelopes. In the Bubaline section, for instance, *Bubalis*¹ has only two, but *Connochætes* has four teats; and a similar difference is also found in the subfamily *Antilopinae*, in which all the genera have two teats except *Saiga*, which has four.

Fig. 14.



Udder of the female Musk-ox.

The ante-orbital pit or *sinus sebaceus* is well developed in *Ovibos*. On the salted head of a cow I found the glandular organ to have a lenticular shape, 23 mm. long, 18 broad, and 8 thick. It was situated in a shallow groove of the lacrymal bone, in the angle formed by the protruding orbital tube against the facial portion of the skull. It is placed rather high, as it is on a level with the upper third of the orbit. The interior of the pit itself is hairy, and round it the glands are arranged and surrounded by a capsule of connective tissue.

¹ Sclater & Thomas: The Book of Antelopes, vol. i. p. 5.

The presence of such a gland is a feature common not only to the Sheep, but to a great number of Antelopes, Deer, and other Ruminants. It is thus certainly an ancient characteristic. Its presence in the Musk-ox does not therefore prove close relationship to other forms having such a gland; and where it is missing, it may have been reduced independently in different forms.

Both in the fore and in the hind feet of the Musk-ox I have failed to find any glands. This is again another difference from *Ovis*.

It is chiefly on the study of the skeleton that the classification of the Musk-ox has been based, the soft anatomy having been almost unknown. In his paper on *Ovibos* in the Palæontographical Society's Monographs, vol. xxv., Prof. Boyd Dawkins has treated of the early opinions about this animal. We find there that the Arctic explorers and the first zoologists to whom the animal was known regarded it as a kind of ox, this being expressed by its first scientific name, *Bos moschatus*. Blainville thought he recognized in the Musk-ox intermediate characters between sheep and ox, and introduced in 1816 the name *Ovibos*, which has been adopted by most authors.

Owen believed, however, that the Musk-ox was more nearly related to the Cape Buffalo and therefore named it *Bubalus moschatus*. Rüttimeyer placed *Ovibos* near *Budorcas*, and both of these forms near the Sheep¹. Quite lately the affinity between *Budorcas* and *Ovibos* has been pleaded by Matschie². Lydekker, in his 'Wild Oxen, Sheep, and Goats of All Lands,' placed *Ovibos* as a form "*incertæ sedis*"; but it seems as if most recent authors are inclined to regard it as a true Sheep, although of a somewhat aberrant type. The question has always been, "Is it a bovine or an ovine form"? No other possibility has been discussed, except that it might perhaps be an intermediate link. Then, as there seemed to be more likeness with the Sheep than with the Oxen, the decision, as a rule, has favoured the Sheep with this strange form. The different reasons which have prevailed with zoologists to form such a judgment are chiefly founded on osteological characters; and therefore, as I hope soon to have the opportunity of treating the osteology of the Musk-ox in a separate paper, when I shall enter upon a discussion of the value of these characters, I now confine myself to consider what conclusions may be drawn from the sketch of the soft anatomy given above.

If we first ask, in what respects does *Ovibos* agree with the Ovine type, and what is the value of those characters, we arrive at the following result. The hairiness of the muzzle is a resemblance but a rather doubtful one, as *Ovibos* may independently have obtained this characteristic as an adaptation, and then as a parallelism to the same feature in the Reindeer. This seems the more probable as the broad shape of the Musk-ox's muzzle, and the absence of the mid-fissure of the lip, tend to show that its development has advanced in a different direction from that of the Sheep. On the

¹ Abh. Schweiz. pal. Ges. 1877 & 1878.

² Sitzungsab. Ges. nat. Freunde, Berlin, 1898.

other hand, as several of the Antelopes, the Llamas, and certain other Ruminants have hairy muzzles, it is possible that this is an ancient character, retained alike by *Ovibos* and *Ovis*. Whichever of these theories may be true, neither gives any reason for classifying the Musk-ox with the Sheep.

The resemblance between the Musk-ox and Sheep with regard to the relative dimensions of the right and left sacs of the paunch is shared by members of *Cervidæ*, and is therefore an ancient characteristic, merely indicating that the paunch is less developed than in *Bos*, the most specialized ruminant. The union of the pancreatic duct with the ductus choledochus has already been discussed. It indicates that one of the two primary ducts has become reduced, and the same retained in both *Ovibos* and *Ovis*, and may well be an independent parallelism. The "oviform" shape of the lobus spigelii is of no importance. The peripheral situation of the last centrifugal coil of the colon in *Ovibos* and *Ovis* is the same as in the *Cervidæ*; and is thus an ancient character, with regard to which *Bos* alone differs from the others. The same may be said about the non-lobated kidneys of the Musk-ox. The presence of ante-orbital glands is also an ancient character, common to many ruminants, although these have been reduced in *Bos*, *Capra*, some Antelopes, &c. It is thus evident that the resemblances between *Ovibos* and *Ovis* do not indicate close relationship, especially when the differences are so many and so important. For instance, the absence of the median fissure in the upper lip indicates that the muzzle of the Musk-ox has been differentiated from the ancient type still retained by the Sheep. The reticulum of the Musk-ox is smaller than the psalterium, and the abomasus differs in the number of plicæ, &c. These are features of a separate development, as are the greater number of colic coils. The spleen differs from that of the Sheep and other Cavicornia, and may be of an ancient type. The slight development of the *septum membranaceum* in the posterior part of the nasal cavity separates *Ovibos* from the Ovine type; and the same is the case with the differences indicated by the great development of the larynx of the Musk-ox, its peculiar trachea, and the undivided left lung. The shape of the Musk-ox's penis is different from that of the Ovine group. The number of cotyledons in the placenta is unusually large, and the number of teats is the primary four; both these being important characters which distinguish the Musk-ox from the Sheep. To these may be added characters of minor importance, such as the denticulated palatal ridges¹, the flattened shape of the *lobus caudatus* of the liver, the valves in the vagina, the absence of the foot-glands, &c. Taken together, all seem to prove that the soft anatomy of the Musk-ox not only does not speak for its affinity with the Sheep, but even plainly prohibits its inclusion in the same group of the Cavicornia. Neither is it allied to the Bovine group. The anatomy of *Budorcas* is not

¹ The irregular arrangement of the *papillæ circumvallatæ* compared with the regular rows in *Bos* and *Ovibos* may be an ancient feature.

known, at least not to me, and therefore I am not able to judge concerning the alleged affinity between *Ovibos* and *Budorcas*. So much may, however, be said, that if there should exist any great affinity between these forms, *Budorcas* cannot be a Sheep. It is to be regretted that the anatomy of the Antelopes is so incompletely known. When our knowledge of them becomes greater, then only will a satisfactory classification of the Cavicornia be possible. But, to judge from its soft anatomy, the Musk-ox is entitled to form a subfamily of its own, at least *pro tempore*, as well defined as the *Caprinæ* or the *Bovineæ*.

3. On a Species of Earthworm from Western Tropical Africa, belonging to the Genus *Benhamia*. By FRANK E. BEDDARD F.R.S., &c.

[Received January 30, 1900.]

A few weeks ago I received, through the kindness of Mr. Martin Woodward, a bottle containing some Earthworms which had been collected in Ashanti, and which I refer to two distinct species, both of which, so far as I can see, have already been characterized. As, however, I am able to extend our knowledge of at least one of these, I think it worth while to bring the notes of my dissections before the Society.

Benhamia cæcifera (W. B. Benham).

Five years ago Dr. Benham described¹ a large Earthworm from the Gold Coast which he referred to the genus *Benhamia*, and to a new species of that genus named by him *B. cæcifera* on account of the numerous cæca with which the intestine was furnished. The larger specimen of those kindly presented to me by Mr. Woodward appears to belong to this species. Dr. Benham's example is in the collection of Earthworms in the British Museum; and—as it was the type of his new species—he was compelled to respect its integrity as much as possible. I have been under no such necessity, and am able therefore in a few points to supplement his description. In order to avoid useless repetition, I shall in the following notes upon this species abstain from commenting upon such facts as are, according to my own investigations, rightly described in Dr. Benham's memoir. I shall only deal with those matters which he was compelled to leave unnoticed, or as to which my own observations do not agree with his. The different state of maturity of our two examples enables me, moreover, to add facts which were evidently not apparent in Dr. Benham's specimen.

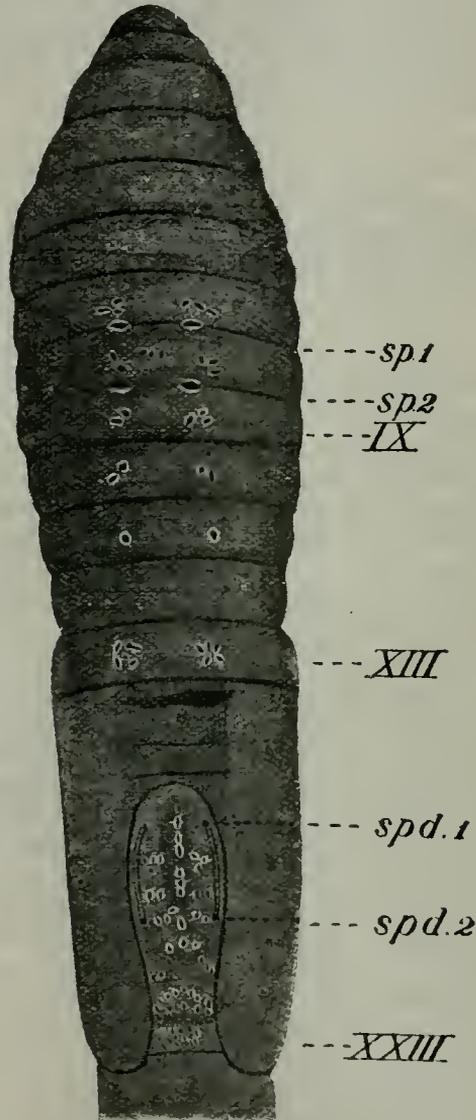
The worm was fully mature and 80 cm. long. Though much softened through imperfect preservation, a number of points were

¹ "On *Benhamia cæcifera*, n. sp., from the Gold Coast," Quart. Journ. Micr. Sc. vol. xxxvii. p. 103.

quite clear. But the state of the worm did not encourage me to pursue my studies into the microscopic structure.

As to external characters, all that I have to remark upon are the numerous copulatory papillæ. A distinguishing feature of this

Fig. 1.



Benhamia cæcifera.

Ventral surface of anterior segments: *sp.* 1 & 2, spermathecal pores;
spd. 1 & 2, orifices of spermiducal glands.

species is, as Dr. Benham has pointed out, the great number and the somewhat peculiar form of these organs. But his figure does

not entirely agree with my observations. The very greatest care has often to be exercised in defining species from these very generally present organs of adhesion, which are often when discreetly used of great value in distinguishing the species of many genera. These papillæ, however, are of more than one kind. In the present species they are, as Dr. Benham has indicated and illustrated, of the nature of pits from the bottom of which a papilla may protrude. They resemble so far the genital papillæ of the *Perichæta*, *P. novæ britannicæ*¹. But they are extraordinarily numerous—much more numerous in the specimen of *Benhamia* which I have studied than in that which forms the subject of Dr. Benham's paper. The accompanying drawing (fig. 1, p. 168) will illustrate their distribution on the surface of the body and save a full description. It will be seen from that drawing that they are as numerous in the region of the spermathecal apertures as in the neighbourhood of the male orifices. In Dr. Benham's specimen there were by no means so many of these sucker-like organs anteriorly as posteriorly. The orifices were quite small, and the fact that each was surrounded by a white circumference gave to them an exceedingly conspicuous appearance. In many cases they were crowded together upon a single segment. Elsewhere there were fewer on a single segment. I noticed no glands in the interior of the body which correspond to them. In this they differ from the (physiologically?) similar papillæ of some other earthworms.

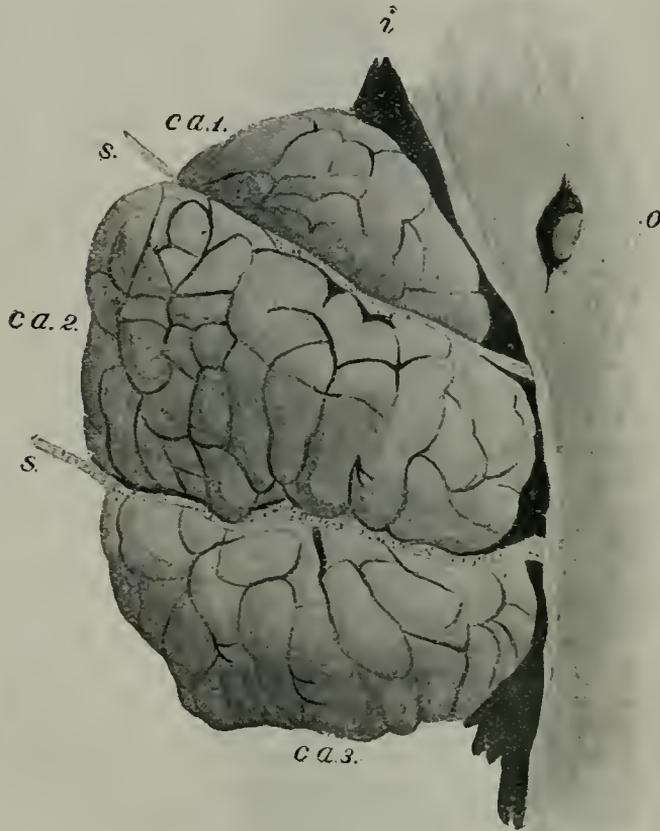
I divide what I have to say upon the internal organs of this species into three heads:—

(1) *Calciferous Glands*.—These glands, always found in the genus *Benhamia*, are present to the number of three pairs and, as is usual with the genus, lie in segments xv, xvi, & xvii. The glands are much lobulated, as is shown in the figure which I exhibit (fig. 2, p. 170); the furrows are very deep, and the appearance, as Dr. Benham has remarked, is by no means unlike that of a well-convoluted mammalian brain. The middle pair, *i. e.* those occupying segment xvi, are the largest of the three; the anterior pair are the smallest. An important anatomical fact respecting these calciferous glands is their opening into the œsophagus by a single orifice on each side, which is common to all three glands. The large size of the worm permitted this fact to be ascertained by simple dissection without any doubt; when the œsophagus was slit open the orifice was not only plainly visible, but the secretion of the glands in the form of a brownish powder was seen to escape like a cloud into the alimentary tube by one orifice only. The slightest pressure produced this result. The single orifice belonged to the anterior gland; the two following glands apparently communicated with that and with each other. Dr. Benham states of the calciferous glands that "each is . . . connected to the œsophagus by a short, narrow, but distinct duct."

¹ "On a Collection of Earthworms, &c.," Willey's Zool. Results, Cambridge, 1899.

There does indeed seem to be an attachment of each gland to the œsophageal wall, but it is rather of a membranous character; at the same time it is quite possible that the adhesion represents an embryonic duct which becomes occluded in the fully developed

Fig. 2.



Benhamia cœcifera.

Calciferous glands (*ca. 1.*, *ca. 2.*, *ca. 3.*): *o*, their orifice in œsophageal wall; *s*, septa.

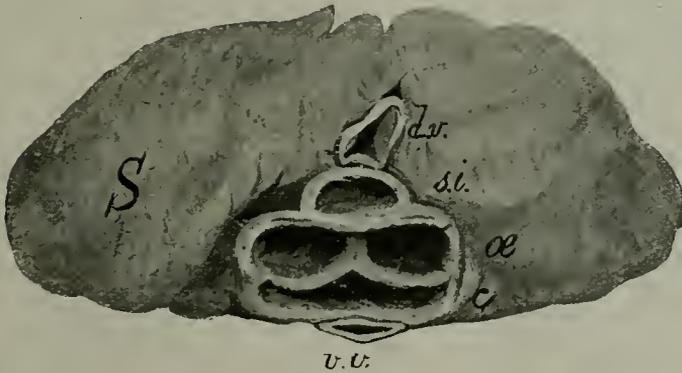
worm, like the ductus arteriosus in many mammals. The discovery of a single duct into the œsophagus which does duty for all three glands of one side of the body is not, however, my own, not even for this genus *Benhamia*.

Dr. Horst has recently given some account¹ of the anatomy of a Liberian species of this genus, *B. liberiensis*, which is characterized by precisely the same state of affairs; but it is not by any means universal in the genus *Benhamia*; for in the same memoir which

¹ "On two new *Benhamia* Species from Liberia," Notes Leyd. Mus. xvii. p. 21.

has just been referred to, Dr. Horst expressly states of *B. stampflii* that the three glands of each side open separately into the œsophagus. I have since examined a number of small species of *Benhamia* coming from various localities—East Indian, West Indian, and African; and in these I find that there is but one œsophageal duct for the three calciferous glands of each side, and that each gland is in communication with its neighbour. I have also to add that in *Millsonia rubens* the same thing occurs, as far as I could make out by a dissection. This is an additional point supplementary to those enumerated by Dr. Horst in which this worm agrees with *Benhamia*. I may observe incidentally, while mentioning this latter species, that I am quite in accord with Dr. Michaelsen¹ in regarding my *Millsonia rubens* as congeneric with his *Dichogaster minus*², since he has discovered the numerous intestinal cæca of the latter species. I am not, however, convinced of their specific identity. For in the original description there is mentioned a tract lying round the male pores which remains free of modification into the more glandular epidermis of the clitellum; I did not find this in my single example of *M. rubens*. Nor can I see any trace of diverticula to the spermathecæ. Still the generic identity being established, I must drop *Millsonia* for the present species, though I propose to retain it for *Millsonia nigra*³.

Fig. 3.

*Benhamia cæcifera.*

Septum with intestine &c. cut across: *d.v.*, dorsal vessel; *s.i.*, supra-intestinal; *v.v.*, ventral blood-vessel; *œ*, œsophagus; *c*, cæcum; *S*, septum.

(2) *Œsophageal Cæcum*.—One feature in the anatomy of the œsophagus has not been noted by Dr. Benham.

Nearly opposite to the entrance of the ducts of the calciferous glands, the œsophagus gives off a single forwardly running cæcum

¹ "Terricolen von verschiedenen Gebieten der Erde," Mitth. nat. Mus. Hamburg, xvi.

² "Terricolen der Berliner zoologischen Sammlung," Arch. Naturg. lvii. p. 212.

³ "On two new Genera of Earthworms from Western Tropical Africa," P. Z. S. 1894, p. 382.

from its ventral side. The diameter of this cæcum is nearly, if not quite, equal to that of the œsophagus itself. The accompanying drawing (fig. 3, p. 171) shows the relations of this cæcum during the course of the œsophagus. The drawing represents a part of the intersegmental septum dividing segments XII/XIII cut out of the body and viewed from behind. Above are the dorsal (*d.v.*) and supra-intestinal (*s.i.*) blood-vessels, the latter of rather greater calibre than the former. The œsophagus (α), and the cæcum (*c*), as will be seen, look like a single subdivided tube, the former having a light fold projecting into its interior from below, not to be compared therefore to a typhlosole. Below again to this comes the ventral blood-vessel (*v.v.*) This œsophageal cæcum passes forward as far as to the xith segment, where it appears to end without any diminution of calibre.

There are two structures among Earthworms with which this median ventral œsophageal cæcum may perhaps be compared. I mention them in order of probability. Dr. Benham described in *Perichæta sedgwicki*¹—and I have been able to confirm² his statement—that instead of the usual pair of cæca found in the species of this genus, there was a single median ventral cæcum, like the paired ones in general appearance but not visible until the gut was lifted up.

More comparable, as I think, are the ventral ‘Chylustaschen,’ as they have been termed by Dr. Michaelsen, of the Eudrilidæ.

They are probably more comparable in that they are œsophageal and not intestinal. Moreover, the fact that this species of *Benhamia* has numerous intestinal cæca, precisely comparable in structure to the paired intestinal cæca of most *Perichæta*, seems to negative the former comparison. The position of this cæcum, on the other hand, fits in very well with the suggestion that it represents, perhaps in an incipient form, the unpaired ventral glands of *Eudrilus*, *Polytoreutus*, and other genera of Eudrilidæ. One difficulty in the way of this comparison is the greater extent of the cæcum in this *Benhamia*; even where there are three separate ventral calciferous glands in the Eudrilidæ, they only occupy a segment apiece, extending in their totality through segments IX–XI. In the worm which forms the subject of the present remarks the cæcum lies in segments XI–XV. On the hypothesis, however, which is suggested, the differentiation of a single cæcum might easily result in the shortening of the total area. The intercommunication of two of these glands in *Polytoreutus* (as an occasional variation) is an argument in favour of the comparison urged here. In this case the unpaired ventral cæcum of *Benhamia cecifera* will bear the same kind of relation to the ventral unpaired glands of many Eudrilidæ that the single diverticulum of the enteron of *Amphioxus* does to the complex liver of higher vertebrates. On the theory that the terrestrial

¹ Journ. Linn. Soc., Zool. xxvi. p. 201.

² “On a Collection of Earthworms from New Britain &c.,” Willey’s Zool. Results, pt. ii. p. 184.

Oligochæta are related to the marine Polychæta, and in the position of forms to be derived from them, it may be possible to compare this cæcum with the siphon of the Capitellidæ.

(3) As to the *Reproductive Organs*, I have but little to add to Benham's account. As he has observed, the anterior pair of spermathecæ are the smaller; but I also found that corresponding to this the posterior pair of spermiducal glands were smaller than the anterior pair of those glands. I could find no diverticulum to either pair of spermathecæ, and no penial setæ connected with the male pores.

4. List of Mammals obtained by Mr. H. J. Mackinder during his recent Expedition to Mount Kenya, British East Africa. By OLDFIELD THOMAS.

[Received February 15, 1900.]

The Mammal-fauna of Mount Kenya, the highest mountain in British East Africa, has hitherto been practically unknown, for although Dr. Gregory collected a few specimens during his ascent in 1893, these have not hitherto been satisfactorily determined. It has therefore been with great interest that I have worked out the excellent collection obtained on the mountain during Mr. H. J. Mackinder's recent successful expedition there, an expedition of which he has himself given an account before the Geographical Society¹.

The actual collecting was done by Mr. Mackinder's two assistants, Messrs. Ernest Saunders and C. Camburn, and much credit is due to them for the way in which they have succeeded in making so admirable a collection under somewhat difficult circumstances. In addition, some of the larger animals, including the Mountain Dassies, were shot by Mr. Mackinder's colleague, Mr. C. B. Hausburg, and his Alpine guide, Cesar Ollier.

The species of mammals obtained on Mount Kenya itself are fourteen in number; and I have also added a list of those collected at Nairobi, on the Uganda Railway, where the party remained some little time. The whole series of skins has been acquired by the British Museum.

Of the special Mountain-mammals the most interesting is a new Dassy, of a rock- and not forest-inhabiting group, which appears to be isolated above the forest zone at 12,000–15,000 feet. A second new Dassy, of the forest group, comes from 8000 feet.

With the help of the fine collection of East African mammals presented to the National Museum by Mr. F. J. Jackson, and worked out by Mr. W. E. de Winton, the determination of the present series has presented few difficulties, and I must record my

¹ See Geogr. Journ. xv. p. 453 (1900).

indebtedness to Mr. de Winton for the assistance his determinations of the more obscure forms have been to me in the preparation of the present paper.

1. *COLOBUS CAUDATUS* Thos.

a-c. ♂ ♀. Western slope of Mt. Kenya, 8000–10,000 ft., 8 & 9/99.

There appears to be no difference between these specimens and examples from Kilima-njaro.

Dr. Matschie has also recorded this Monkey from Mt. Kenya ¹.

2. *CROCIDURA*, sp.

a-d. ♂ ♀. Western slope of Mt. Kenya, 8000–10,000 ft., 8–9/99.

A medium-sized species with a short tail.

3. *SCIURUS RUFOBRACHIATUS* Waterh.

a. Western slope of Mt. Kenya, 8000 ft., 14/9 99.

This specimen differs in various details from ordinary examples of *S. rufobrachiatus*, but most of its peculiarities occur in one or other of the large series in the Museum.

4. *FUNISCIURUS JACKSONI* de Wint.

a. ♂. Western slope of Mt. Kenya, 8000 ft., 16/9/99.

5. *GRAPHIURUS MURINUS* Desm.

a. ♂. Western slope of Mt. Kenya, 11,000 ft., 22/8/99.

The determination of this Dormouse is somewhat doubtful, for, as so often happens in this group, the skin has been severely singed, and the colour consequently more or less altered.

6. *MUS JACKSONI* de Wint.

a. ♂. Forest zone of Mt. Kenya, 8000 ft.

7. *MUS (LEGGADA) MINUTOIDES* Smith.

a. ♀. Foot of Mt. Kenya, 7000 ft., 17/8/99.

8. *LOPHUROMYS AQUILUS* True.

a-d. Western slope of Mt. Kenya, 8000–10,000 ft.

These specimens closely agree with examples captured by Mr. Jackson at Ravine Station, with the exception that their tails average slightly shorter. The colour of their feet varies a good deal, one having nearly white feet, while in the others they are brown or black.

“Trapped among bamboo or bushy undergrowth.”

“In Forest zone.”

¹ SB, Ges. nat. Fr. Berl. 1899, p. 138.

9. *OTOMYS IRRORATUS* Bts.

a. Western slope of Mt. Kenya, 8000 ft., 16 Sept. 1899. Forest zone.

b-g. Western slope of Mt. Kenya, 10,000 ft. Bamboo zone.

These specimens, though as usual differing among themselves in colour, are very uniform in skull-characters and size. Their dimensions, as taken in the flesh, run as follows:—Head and body 176–195 mm.; tail 75–91; hind-foot 28·5–31. Like Mr. Jackson's and other East African examples of the species, they all have seven laminae to the last upper molar.

10. *OTOMYS IRRORATUS ORESTES*, subsp. n.

a. ♂. Teleki Valley, Mt. Kenya, 13,000 ft., Sept. 3, 1899.
Type.

[b. ♀ in spirit. Höhnel Valley, Upper Alpine zone, Mt. Kenya, 1893 (Dr. J. W. Gregory).

c, d. Imperfect skeleton and separate skull. Do. do.]

Size rather smaller, feet slightly and tail decidedly shorter than in the plains form. Colour, of the single skin, corresponding to the greyish and least rufous of the ordinary specimens, rather more mottled than they usually are.

Skull, as compared with the series from 8000–10,000 feet, smaller throughout, with a shorter muzzle and much shorter, though equally broad brain-case. When viewed laterally, it appears more bowed above and higher mesially. Anterior expansion of nasals not exaggerated. Interparietal smaller, not bowed forwards mesially, its antero-posterior diameter less than the length of the coronal suture instead of greater. Molars rather narrower. Laminae of m.³ only six in number.

Dimensions of the type, measured by collector in the flesh:—Head and body 175 mm.; tail 62; hind foot 27; ear 20·5.

Skull: greatest length 39; basilar length 31·3; greatest breadth 20; nasals 17·4 × 7; interorbital breadth 4·6; interparietal 4·7 × 9; palate length from hensilion 16·7; diastema 8·8; palatine foramina 7·4; upper molar series (crowns only) 7·3.

This is evidently a mountain race of the common East African *Otomys*, and it was quite to be expected that in the colder climate of what Dr. Gregory calls the "Upper Alpine zone" of Kenya the feet and tail should be shortened, in accordance with the usual rule in such cases. It is, however, curious that, as exemplified by four examples, the Alpine form should have a lamina less in the last molar. *Otomys jacksoni* Thos., the Mount Elgon representative of the genus, agrees with the lowland form in this respect.

The spirit-specimen obtained by Dr. Gregory in Höhnel Valley measures:—Head and body 141 mm.; tail 63; hind foot 24 (26·5 cum ungue); ear 21. Its mammae number 0—2=4.

Type. B. M. No. 0.2.1.21.

Although Dr. Gregory was the first discoverer of this form, his specimens could not be distinguished before owing to the fact that

in all the skull was broken; but they now contribute most valuable confirmatory evidence as to the external proportions and the lamina formulæ of the molars, agreeing in these respects entirely with the perfect skin and skull brought home by Mr. Mackinder.

11. DENDROMYS MESOMELAS Brants.

a. ♀. Foot of Mt. Kenya, 7000 ft., 15/8/99.

There is in this specimen a very faint trace of the dark frontal band which induced Mr. True to give to the Kilima-njaro Tree-mouse the name of *D. nigrifrons*.

12. PROCAVIA¹ MACKINDERI, sp. n.

a-g. 4♂ 3♀. Teleki Valley, 13,000 ft., Sept. 1-3, 1899.

Size large. Fur very long and thick, hairs of back over 40 mm. in length; underfur long and abundant. General colour pale grizzled olivaceous grey, the longer hairs dark, with a pale yellowish subterminal band and a black tip; underfur except on the posterior back blackish basally, whitish or buffy terminally, this colour showing on the surface and lightening the general colour of the animal; on the posterior back the underfur is dark from base to tip. Dorsal patch dull yellowish white throughout, very inconspicuous, not visible without parting the long hairs of the back. Head darker, the muzzle coarsely grizzled black and white;

¹ An allied species, of which we have lately obtained specimens, may be described as follows:—

PROCAVIA JACKSONI, sp. n.

Size medium. Fur short, coarse and harsh, the hairs of the ordinary fur of the back barely attaining 30 mm. in length; underfur comparatively scanty. General colour coarsely grizzled yellowish brown, the long hairs brown with a yellow subterminal band or black tip; underfur on the anterior back brown basally, yellowish terminally, on the posterior blackish brown throughout. Cheeks grizzled yellowish; forehead rufous brown. Back of ears partly yellow, partly brown; sides of neck yellowish, a few of the longer hairs black-tipped. Dorsal spot conspicuous, dull straw-yellow, the hairs yellow to their bases. Under surface buffy yellow, not sharply defined laterally. Inner sides of limbs yellowish, outer sides like body. Upper surface of hands and feet grizzled brown and whitish.

Skull with the essential characters of that of the *P. abyssinica* group, but, at least in the female, unusually long and narrow, the nasal and frontal regions particularly narrow. Temporal fossæ ending about 4-5 mm. from the back of the skull. Interparietal sutures open. Diastema about 11 mm. in length. Teeth large and hypsodont.

Dimensions of the type, a female, measured in skin:—Head and body 490 mm.; hind foot 67.

Skull (stage vii.): basal length 83; greatest breadth 49.5; nasals 26 × 19; intertemporal breadth 25; length of upper tooth-series (p.¹ to m.³) 38; greatest breadth of m.¹ 6.9; height of crown of m.³ 7.2; length of anterior lower pre-molar 2.9.

Hab. Ravine Station, British East Africa.

Type. Female. B. M. No. 99.8.4.100. Collected and presented by F. J. Jackson, Esq.

This species differs, in its harsher fur, different general colour, and more prominent dorsal spot and narrow skull, from the only previously described species with which it could be confounded, the Abyssinian *P. abyssinica* H. & E.

forehead deep rufous brown; area round eyes blackish. Ears of medium size, the hairs of their backs dark brown, those on the edges and inner surface buffy yellow; a blackish patch on the sides of the neck just below the ears, owing to the black ends to the hairs at this point. Under surface buffy yellow; on the chin and throat the hairs are only tipped with this colour, but on the chest and belly they are buffy to their bases. Upper surface of hands and feet grizzled yellowish brown; inner sides of limbs like belly.

Skull stout and heavy, with a broad flat shield-like frontal region. On the whole it is closely similar to that of *P. abyssinica*¹, though averaging a little larger. Interparietal sutures persistent. Temporal fossæ extending to the hinder end of the skull. Diastema 10 to 12 mm. in length. Molars hypsodont, as usual in this section of the genus.

Dimensions of the type, an adult male, measured in skin and therefore only approximate:—Head and body 565 mm.; hind foot 70.

Skull (stage viii.): basal length 94; greatest breadth 58·5; nasals 30 × 25; intertemporal breadth 27·5; length of upper tooth-series (p.¹ to m.³) 41; greatest breadth of m.¹ 7·7; height of crown of m.³ (in another, younger specimen) 7·9; length of p.₁ (of another specimen) 3·2.

Type. Male. B.M. No. 0.2.1.35. Collected Sept. 3, 1899.

This fine Dassie is clearly a mountain representative of the *P. jacksoni* of Kikuyu, from which it differs by its larger size, longer form, more abundant underfur, paler colour, and the greater distinctness of the post-auricular black spot.

During his famous East African expedition of 1893, Dr. J. W. Gregory picked up in Höhnel Valley, 12,000 ft., a bleached skull of this species, but without the skin it was impossible to determine it. It was, however, provisionally referred to the Abyssinian *P. shoana*, a species of the black-backed section—a fact which shows how closely these species, so readily distinguishable externally, resemble each other in their cranial characters.

In the good series of skulls obtained by Mr. Mackinder, four mâles and three females (to which may be added the male skull brought home by Dr. Gregory), there is a decided difference between the sexes in the size of the skull, all the male skulls being longer, broader, and more heavily built than the female ones. The basal lengths are as follows:—♂ 94 mm., 92·5, 90·5, 90, 87; ♀, 84, 81·5, 74 (young).

The members of this group being essentially Rock-Dassies, not occurring in forest country, it is probable that the Kenya species will prove to be isolated by the zone of forest which surrounds the mountains at about 8000–10,000 ft. Besides Mr. Jackson's specimens from Ravine Station, no member of the group has been found in any other part of East Africa, nor are they known further to the south.

¹ Cf. Monograph, P. Z. S. 1892, p. 64.

13. *PROCAVIA (DENDROHYRAX) CRAWSHAYI*, sp. n.

a. ♂. Western slope of Mt. Kenya, 10,000 ft., 7 Sept., 1899.

Type.

[*b.* ♀. Roromo, Kikuyu Forest, 7800 ft., 29 Nov., 1899. Collected and presented by Richard Crawshay, Esq.]

Size and more essential characters very much as in *P. valida* True. Fur soft, close, and thick, the majority of the fine hairs about 30 mm. in length, though the scattered black ones are longer. General colour marbled greyish brown with a slight rufous or isabelline hue. Dorsal hairs slaty grey basally, gradually darkening to black at about three-fourths their length, then into a yellowish or isabelline subterminal band and a fine blackish point; the scattered longer hairs black from base to tip. Head coarsely grizzled grey, the grizzlings black and white, and therefore forming a true grey, very different to the dorsal colour. Hairs below base of ears dull whitish. Dorsal spot narrow, elongate, shining yellowish white; the hairs, which are 40–45 mm. in length, yellowish white to their bases. Under surface along middle line, from interramia backwards, fulvous or deep buffy, similar to but rather paler than the colour in *P. valida*; but the chin and sides of neck are grey, not buffy, and the sides of the chest, the groins, and the inner sides of the limbs are whitish. Outer sides of limbs and upper surfaces of hands and feet like sides of body, not becoming black terminally.

Skull very similar to that of *P. valida* and the other allied species.

Dimensions of the type, measured in skin:—Head and body 460 mm.; hind foot 59.

Skull (stage v.): basal length 79; greatest breadth 49·5.

Skull of Mr. Crawshay's specimen (stage viii.): basal length 85; greatest breadth 50; nasals 25 × 18; intertemporal breadth 26; diastema 15; length of molar series 33; greatest breadth of m.¹ 5·4.

Type. Specimen *a* above. B.M. No. 0.2.1.41.

This distinct species may be readily differentiated from the Kilima-njaro *P. valida* by its paler and more mottled colour, greyish head, white dorsal spot, the white inner sides of the limbs, and different general colour. The two East African species described by Dr. Matschie, *P. stuhlmanni* and *P. scheelei*, both have wholly white bellies.

Just as the present collection was being examined the second specimen above mentioned (*b*) arrived from that generous contributor to our National Museum, Mr. Richard Crawshay, and I have therefore dedicated the species to him, Mr. Mackinder having already a member of the genus named in his honour.

14. *NESOTRAGUS MOSCHATUS* v. Düb.

a. Near Niana Hill, Ngoro district, Aug. 14, 1899.

b. In forest at foot of Mt. Kenya, 27/8/99.

The mammals obtained by Mr. Mackinder's party at Nairobi are as follows:—

1. *CERCOPITHECUS ALBIGULARIS* Sykes.

a, b. ♀. Nairobi Forest, 14/7/99.

2. *FUNISCIURUS JACKSONI* de Wint.

a-e. ♀. Nairobi Forest, 5600 ft., 14-20/7/99.

3. *MUS HILDEBRANDTI* Peters.

a. ♀. Nairobi, 6000 ft., 12/7/99.

This Mouse is determined on the authority of Mr. de Winton, by whom the above name has been placed on Mr. Jackson's examples of it from Ravine Station.

4. *ARVICANTHIS ABYSSINICUS* Rüpp.

a. ♂. Nairobi, 16 July, 1899.

This specimen appears to be conspecific with Uganda specimens of *Arvicanthis* determined by Mr. de Winton as *A. abyssinicus*.

5. *TACHYORYCTES SPLENDENS IBEANUS*, subsp. n.

a. ♂. Nairobi Forest, 20 July, 1899.

Similar in all essential respects to the typical Abyssinian form, but rather larger, and on the average rather darker in colour, especially on the head.

For some years I have known that my reference of the East African *Tachyoryctes* to *T. splendens* was very doubtful, and have now taken the opportunity to investigate the question with such further material as has come in up to the present time.

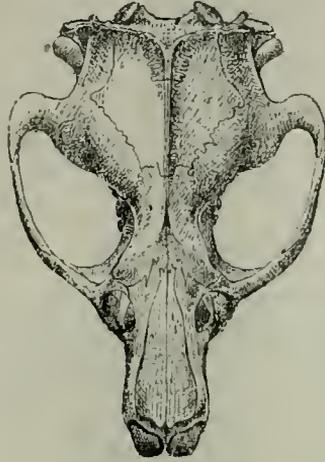
On laying out the Museum series of skulls, 9 from East Africa and 5 from Abyssinia (including one of Rüppell's co-types), it is at once evident that the former is a larger and more powerful animal, but is in other respects very closely allied. Even as to its greater size, although there is no doubt of the fact, there is some difficulty in reducing it to measurement owing to the way these animals go on increasing in size until a late period of life, so that old specimens of the small form may overtop in most measurements the nearly adult specimen of the larger. But taking only old specimens, two of each form, with sagittal crests completely developed, the following comparative measurements may be given:—

	Basilar length.	Greatest breadth.	Diastema.
<i>T. s. typicus</i>	37·5, 37·2	28, 30·5	16·7, 16·2
<i>T. s. ibeanus</i>	43, 41·5	34, 32·5	18·3, 19

In all adult skulls also a diagonal measurement across the brain-case from the squamosal edge above the meatus of one side to the most bulging antero-lateral corner of the brain-case on the other will illustrate the difference between the two forms, this

measurement being at most 18·5 mm. in *typicus* (old), and at least 19·0 in *ibeanus*, ranging up to 20 and more.

I propose to select as a type, skin and skull No. 98.1.5.9 from Machako's, British East Africa, collected and presented by Dr. S. L. Hinde. The skull-measurements are those first given above.



Skull of *Tachyoryctes splendens ibeanus*.

External measurements of Mr. Mackinder's specimen, measured in the flesh :—Head and body 188 mm. ; tail 57 ; hind foot 29 ; ear 10.

A skull of *T. s. ibeanus* in the Museum collection, obtained by Capt. Speke, dates from 1863. Since then specimens have been received from Kilima-njaro (*Hunter & Baxter*), Bukoba (*Emin*), Machako's (*Hinde*), Mumias, Kavirondo (*Ansorge*), and now the present specimens from Nairobi.

March 6, 1900.

W. T. BLANTFORD, Esq., LL.D., F.R.S., V.P., in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of February 1900:—

The total number of registered additions to the Society's Menagerie during the month of February was 123, of which 17 were by presentation, 6 by purchase, 99 were received on deposit, and 1 was received in exchange. The total number of departures during the same period, by death and removals, was 132.

Amongst the additions attention may be called to two young Tcheli Monkeys (*Macacus tcheliensis*), presented by Dr. S. W. Bushell, C.M.G., C.M.Z.S., on February 10th.

Dr. Bushell on quitting China kindly forwarded to us these two Monkeys, supposing that the two individuals presented by him in 1880 (see P. Z. S. 1880, p. 537) might be failing in health, but I am happy to say that one of these animals (the male) is still well and strong.

Mr. Arthur Thomson laid before the Meeting some mounted specimens of Lepidopterous Insects reared in the Insect-house during the past year, and read the following report:—

Report on the Insect-house for 1899.

The following is a list of the Lepidoptera exhibited in 1899:—

Silk-producing Bombyces and their Allies.

Asiatic.

<i>Attacus atlas.</i>	<i>Anthercea pernyi.</i>
— <i>cynthia.</i>	<i>Actias selene.</i>
<i>Rhodia fugax.</i>	<i>Tropaea artemis.</i>
<i>Anthercea mylitta.</i>	

American.

<i>Samia cecropia.</i>	<i>Hypochera io.</i>
<i>Telea polyphemus.</i>	<i>Anisota rubicunda.</i>
— <i>promethea.</i>	<i>Eacles imperialis.</i>
<i>Actias luna.</i>	

African.

<i>Actias mimosa.</i>	* <i>Lenodora nigrolineata.</i>
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Diurnal Lepidoptera.

European.

<i>Papilio machaon.</i>	<i>Thais cerisyi.</i>
<i>Doritis apollinus.</i>	<i>Charaxes jasius.</i>
<i>Thais polyxena.</i>	

American.

<i>Papilio asterias.</i>	<i>Papilio turnus.</i>
—— <i>philenor.</i>	—— <i>ajax.</i>
—— <i>troilus.</i>	<i>Limenitis disippus.</i>
—— <i>crephontes.</i>	

Nocturnal Lepidoptera.

* <i>Hemaris ruficaudis.</i>	<i>Deilephila alecto.</i>
* <i>Everyx cherilus.</i>	—— <i>euphorbia.</i>
<i>Acherontia atropos.</i>	—— <i>elpenor.</i>
<i>Sphinx ligustri.</i>	<i>Smerinthus modestus.</i>
—— <i>luciosa.</i>	—— <i>ocellatus.</i>
<i>Ceratomia undulosa.</i>	—— <i>tilia.</i>
—— <i>amyntor.</i>	

* Exhibited for the first time.

Of the Lepidopterous Insects which I have the honour to place before the meeting, *Hemaris ruficaudis* and *Everyx cherilus*, from North America, and *Lenodora nigrolineata*, from South Africa, were exhibited for the first time during the past season.

I regret that, owing to my absence for some time in the early summer, I am not able to exhibit a larger series of set specimens.

The following papers were read :—

1. Descriptions of new Reptiles and Batrachians from Borneo. By G. A. BOULENGER, F.R.S.

[Received January 29, 1900.]

(Plates XIV.—XVII.)

For a knowledge of the Reptiles and Batrachians here characterized for the first time, I am indebted to the kindness of Mr. R. Shelford, Curator of the Sarawak Museum, by whom they were suspected to be undescribed, and who has submitted them to me with a request that I should publish descriptions of such as might prove to represent new species. Some of the types had to be returned to the Sarawak Museum, whilst others have been retained for the British Museum.

LYGOSOMA SHELFORDI. (Plate XIV. fig. 1.)

Section *Ilinulia*. Habit lacertiform; the distance between the end of the snout and the fore limb is contained once and two-fifths in the distance between axilla and groin. Snout short, obtusely pointed. Lower eyelid scaly. Nostril pierced in a single nasal; no supranasal; rostral forming a straight transverse suture with the frontonasal, which is as long as broad; inner angles of præfrontals meeting; frontal narrow, as long as frontoparietals and

interparietal together, in contact with the two anterior supraoculars; four supraoculars, first longest; seven supraciliaries; frontoparietals and interparietal distinct, subequal; parietals forming a suture behind the interparietal; a single pair of nuchals; fifth upper labial below the centre of the eye. Ear-opening oval, a little smaller than the eye-opening; no auricular lobules. 34 smooth scales round the middle of the body, dorsals slightly larger than laterals and ventrals. A pair of enlarged præanals. The adpressed limbs slightly overlap. Digits moderately long, compressed; subdigital lamellæ smooth, 29 under the fourth toe. Olive-brown above, irregularly spotted with black; a black lateral stripe, extending from the end of the snout to the groin, passing through the eye and above the tympanum, broken up into spots on the side of the body; lower parts grey.

	millim.
Total length	135
Head	14
Width of head	9
Body	53
Fore limb	20
Hind limb	27
Tail	68

Penrissen Mt. Type in the Sarawak Museum.

LEPTUROPHIS, g. n.

Allied to *Lycodon*, with which it agrees in the dentition and the absence of hypapophyses on the posterior præcaudal vertebræ. Maxillary teeth 6 + 6. Head distinct from neck, much depressed; eye moderate, with vertically elliptic pupil; nostril very large, between two nasals and the first upper labial. Body extremely slender and elongate, cylindrical; scales with strong, finely serrated keels, lanceolate, slightly imbricate, in 17 rows, with apical pits; ventrals keeled and notched laterally. Tail extremely slender and elongate; subcaudals in two rows.

LEPTUROPHIS BORNEENSIS, sp. nov. (Plate XV.)

Snout much depressed, broadly truncate. Rostral broader than , just visible from above; internasals barely half as long as the præfrontals; frontal as broad as long, as long as the præfrontals, half the length of the parietals; loreal once and a half as long as deep; one præ- and two postoculars; temporals 2 + 2; eight upper labials, third, fourth, and fifth entering the eye; five lower labials in contact with the anterior chin-shields, which are as long as the posterior. Scales in 17 rows. Ventrals 241; anal divided; subcaudals 193. Brown above, white beneath.

Total length 1480 millim.; tail 570.

Sarawak. Type in the Sarawak Museum.

One of the slenderest snakes known.

XENELAPHIS ELLIPSIFER. (Plate XVI.)

29 teeth in the upper jaw. Eye large, twice as long as its distance from the edge of the mouth. Rostral once and a half as broad as deep, visible from above; internasals nearly as long as the præfrontals; frontal once and two-fifths as long as broad, as long as its distance from the end of the snout, shorter than the parietals; loreal a little longer than deep; one præocular, with a rather large subocular below it, wedged in between the third and fourth upper labials; two postoculars and an elongate subocular separating the eye from the fifth and sixth upper labials; temporals 2+2; eight upper labials, separated from the eye by the suboculars, or fourth entering the eye¹; five lower labials in contact with the anterior chin-shields, which are slightly shorter than the posterior. Scales smooth, in 17 rows, vertebrals not distinctly enlarged. Ventrals 186; anal divided; subcaudals 134 (♂). Head and neck pale brown, sides of neck with interrupted black longitudinal markings; body with 18 large, elliptic, black-edged brown areas separated by cream-coloured narrow interspaces; sides, between and below the brown areas, cream-coloured, spotted or marbled with black; tail, at the base marked like the body, in the second half uniform brown above with a black lateral streak; upper lip and lower parts uniform yellow.

Total length 2 metres; tail 60 centimetres.

Head-waters of Sarawak River. The type, preserved in the Sarawak Museum, was caught in a fish-trap.

This beautiful new Snake connects *Zamenis* with *Xenelaphis*. It agrees with the latter in the number of teeth and strikingly in the number and arrangement of the head-shields, but differs in the vertebral scales not being larger than the rest, a character which cannot be regarded as very important in view of its slight development in *Xenelaphis hexagonotus*.

DISTIRA SARAVACENSIS. (Plate XIV. fig. 2.)

Head moderate; body moderately elongate. Rostral broader than deep; nasals shorter than the frontal, twice and a half as long as the suture between the præfrontals; frontal nearly twice as long as broad, as long as its distance from the rostral, shorter than the parietals; one or two præ- and one postocular; seven upper labials, second largest, fourth or third and fourth entering the eye; two superposed anterior temporals; two pairs of chin-shields, in contact on the median line. 27 scales round the neck, 43 round the body; scales imbricate, keeled. Ventrals distinct throughout, bicarinate, 306. Blackish, with 85 yellowish rings interrupted by the series of ventral scales; a chevron-shaped marking on the upper surface of the head, the apex on the nasals, the branches on the præfrontal, supra- and postocular shields, and on the temple.

Total length 710 millim.; tail 80.

Sarawak coast. Type in the Sarawak Museum.

¹ The former arrangement is shown on the right side of the unique specimen, the latter on the left.

AMBLYCEPHALUS NUCHALIS. (Plate XVII. figs. 1, 1 b.)

Rostral as deep as broad; internasals narrow, band-like, hardly one-third the length of the præfrontals; frontal once and two-thirds as long as broad, twice as long as its distance from the end of the snout, once and a half as long as the parietals, which are followed by a pair of nuchals; præfrontal entering the eye; loreal as long as deep, not entering the eye; two præoculars, two postoculars, and a series of three narrow suboculars; three superposed anterior temporals; eight upper labials, eighth very long; first lower labial in contact with its fellow behind the symphysial; three pairs of large chin-shields, anterior a little broader than long. Body strongly compressed; scales in 15 rows, dorsals very feebly keeled, the keel double on the enlarged vertebral series. Ventrals 195; anal entire; subcaudals 105 (♂). Pale buff, with narrow brown transverse lines and scattered dark brown dots; a large black blotch on the nape, sending forth on each side a linear branch to the eye; a black vertical line below the eye, another on the temple.

Total length 490 millim.; tail 125.

Matang. Type in the Sarawak Museum.

RHACOPHORUS SHELFORDI. (Plate XVII. fig. 2.)

Vomerine teeth in two long, nearly straight transverse series in the middle between the moderately large choanæ. Snout pointed, as long as the diameter of the orbit; nostril equally distant from the orbit and the end of the snout; canthus rostralis strong; loreal region slightly concave; interorbital space broader than the upper eyelid; tympanum distinct, three-fifths the diameter of the eye. Fingers webbed to the disks, which are considerably smaller than the tympanum; toes webbed to the disks, which are smaller than those of the fingers; subarticular and inner metatarsal tubercles very small; no tarsal fold. The tibio-tarsal articulation reaches between the eye and the nostril. Skin smooth above, granulate on the belly. Purplish brown above; a dark band across the snout, another between the eyes, and three across the back; an X-shaped dark marking on the scapular region; loreal and temporal regions blackish; a fine yellow line on each side of the head from the tip of the snout along the canthus rostralis and superciliary edge to above the tympanum; sides of body yellowish, with a blackish network; limbs with dark cross-bands; sides of thighs blackish, closely speckled with white; web between toes marbled with blackish; lower parts colourless. Male with internal vocal sacs.

From snout 45 millim.

Penrissen Mt. Type in the British Museum.

This species is closely allied to *R. fasciatus* Blgr.

IXALUS PETERSI. (Plate XVII. fig. 3.)

Snout rounded or obtusely pointed, as long as the diameter of the orbit; canthus rostralis distinct; loreal region concave; nostril a little nearer the end of the snout than the eye; interorbital

space as broad as the upper eyelid; tympanum distinct, one half or two-fifths the diameter of the eye. Fingers free; toes half-webbed; disks of fingers a little smaller than the tympanum; subarticular tubercles moderate; a small inner metatarsal tubercle. The tibio-tarsal articulation reaches the tip of the snout. Upper parts smooth or with small flat warts; belly and lower surface of thighs granulate. Grey-brown above, with dark brown symmetrical markings, a cross-band between the eyes being constant; usually a)(or)-(shaped marking on the anterior part of the body; a dark streak on the canthus rostralis; limbs with dark cross-bars; lower parts white, with or without brown spots on the throat.

From snout to vent 40 millim.

I have examined specimens from Mts. Penrissen, Dulit, and Kina Bulu, in Borneo; also from Great Natuna. The species is closely allied to the Javan *I. aurifasciatus*, to which the first Bornean specimens were referred by the late Prof. Peters (Ann. Mus. Genova, iii. 1872, p. 44). *I. aurifasciatus* has a smaller, less distinct tympanum, shorter digits, and a brighter coloration, being marked with reddish, dark brown, green, and bright yellow.

CALOPHYRINUS HETEROCHIRUS. (Plate XVII. fig. 4.)

Tongue large, pyriform, covering the floor of the mouth. Snout very short, slightly prominent, truncate; canthus rostralis strong; loreal region nearly vertical; interorbital space broader than the upper eyelid; tympanum feebly distinct, measuring about two-thirds the diameter of the eye. First and second fingers very short, not half the length of the third, fourth shorter still, almost reduced to a knob; toes short, one-third webbed, fifth shorter than third; tips of fingers and toes bluntly pointed; subarticular tubercles feebly prominent; two feebly prominent metatarsal tubercles. The tibio-tarsal articulation reaches the eye. Skin smooth. Uniform purplish brown above, yellowish white beneath and on the sides of the head; a few large round yellowish-white spots on the lumbar region and on the back of the thighs.

A female, full of large-sized ripe ova, measures only 27 millim. from snout to vent.

Borneo (no precise locality). Type in the Sarawak Museum.

EXPLANATION OF PLATES XIV.-XVII.

PLATE XIV.

Fig. 1. *Lygosoma shelfordi*, p. 182.

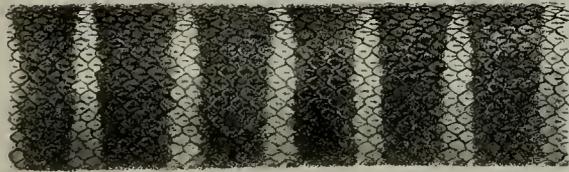
2. *Distira saravacensis*, p. 184.

Upper and side views of head and neck, side view of body, and side view of tail.

PLATE XV.

Lepturophis borneensis, p. 183.

Upper, lower, and side views of head and anterior part of body.



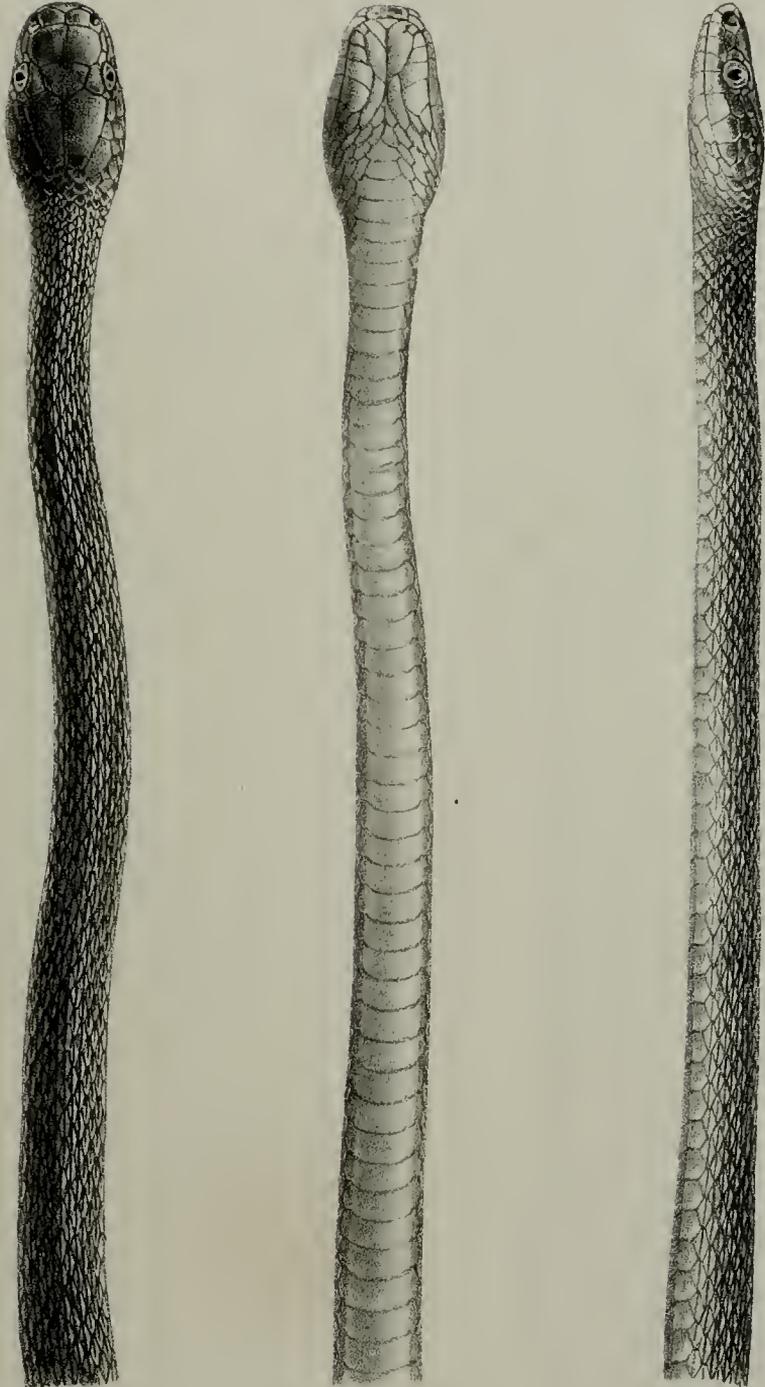
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P.J. Smit del. et lith.
1. *LYGOSOMA SHELFORDI*.

Mirretn Bros. imp.
2. *DISTIPA SARAVACENSIS*.





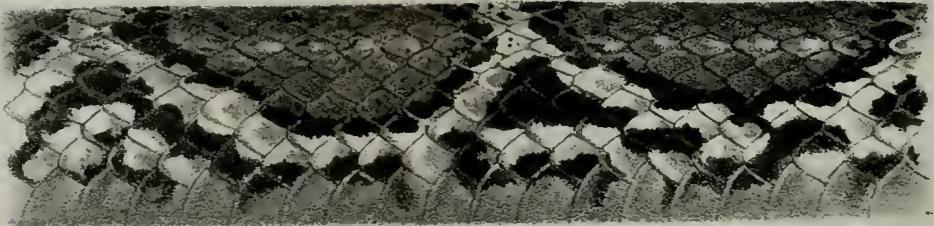
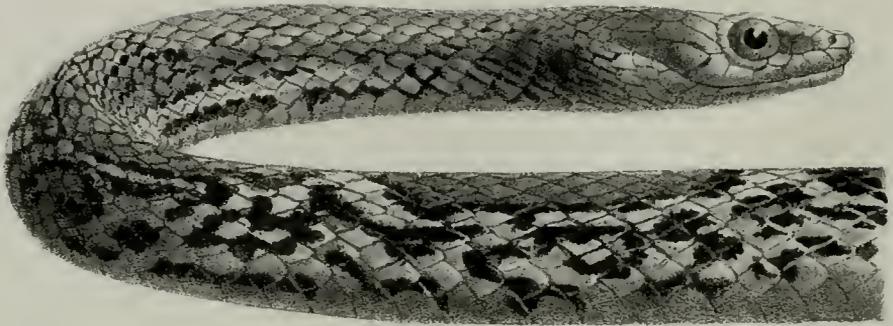
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Mintern Bros imp

LEPTUROPHIS BORNEENSIS.







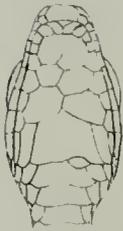




3.



4.



la.



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1b.



1.

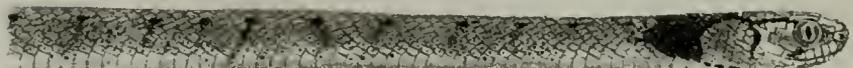


PLATE XVI.

Xenelaphis ellipsifer, p. 184. $\frac{2}{3}$ nat. size.

Upper and side views of head and neck and of middle of body.

PLATE XVII.

Fig. 1. *Amblycephalus nuchalis*, p. 185. Upper and side views of head and neck.1 a. Lower view of head, $\times 1\frac{1}{2}$.1 b. Dorsal scales, $\times 1\frac{1}{2}$.2. *Rhacophorus shufordii*, p. 185.3. *Icalus petersi*, p. 185.4. *Calophrynus heterochirus*, p. 186.

2. On the Brain of a Siamang (*Hylobates syndactylus*). By FRANK E. BEDDARD, M.A., F.R.S., Prosector and Vice-Secretary to the Society.

[Received January 30, 1900.]

The death of the Society's specimen of this rare Anthropoid Ape¹ has enabled me to study an exceedingly well-prepared brain.

In bringing before the Society some notes upon the cerebral characters of this Ape, I am not breaking new ground. More than thirty years ago Sir William Flower² described the general outline of the brain of this Ape from a cast of the cranial cavity. The account was accompanied by several woodcuts in the text, illustrating one remarkable feature in the brain, which was described in the following words: "The most striking peculiarity of the brain is the backward projection of the cerebellum beyond the level of the cerebral hemispheres, a circumstance, as far as I am aware, unknown in any of the Apes either of the Old or New World."

This feature is not shown distinctly, but there are indications of it, in Prof. Kohlbrügge's figure³ of the brain of the Siamang. It appears from the latter drawing that the cerebellum would be visible on an inspection of the brain from above, though Kohlbrügge remarks that the contrary is the case—without, however, referring to Flower's observations on the matter, having been unable to study his paper. Prof. Kohlbrügge examined eight brains of this Ape. Other writers upon the brain-structure of *Hylobates syndactylus* are Sandifort⁴ and Waldeyer⁵. Thus not more than ten brains of this species (or genus?) have been studied. It is not therefore perhaps superfluous to extend this list to eleven brains.

¹ Presented by Mr. Stanley S. Flower, F.Z.S. (See P. Z. S. 1898, p. 588.)

² Nat. Hist. Review, 1863, p. 279.

³ "Versuch einer Anatomie des Genus *Hylobates*," in Max Weber's Zool. Ergebn. Bd. ii. p. 186.

⁴ Verhandelingen over de natuurlijke geschiedenis der Nederlandsche overzeesche bezittingen. Leiden, 1840.

⁵ "Das Gibbongehirn," Internat. Beitr. z. wiss. Med. Festschr. Virchow, Bd. i. For this reference I am indebted to Dr. Keith's paper on the Gibbon in 'Nat. Science,' vol. ix.

The animal when dead weighed 5 lb. 9 oz., there being no undue distention of the stomach and alimentary canal with food. The weight of the fresh brain was 4 oz. It was preserved first of all in weak spirit (about 45 per cent.), and then, after 24 hours and removal of the pia mater, transferred to strong spirit.

With this treatment the brain seems to have altered very little from the conditions observable in life. There is no suggestion in the appearance and direction of the sulci of any changes. I was therefore very much surprised to see the relations of the cerebellum to the cerebrum, which are apparent in the accompanying drawing (fig. 1). The cerebrum not only completely covers the cerebellum, but extends for some way beyond it. With even a liberal discount for contraction (of which, however, I do not see the need), it is difficult to understand the brain-cast—of the accuracy of which there can be no question—prepared by Sir W. Flower, save on the hypothesis of an abnormality¹.

Fig. 1.



Brain of Siamang. Inner view of left hemisphere.

M.P.O., mesial parieto-occipital fissure; CA., calcarine; OPT., optic nerve; OL., olfactory.

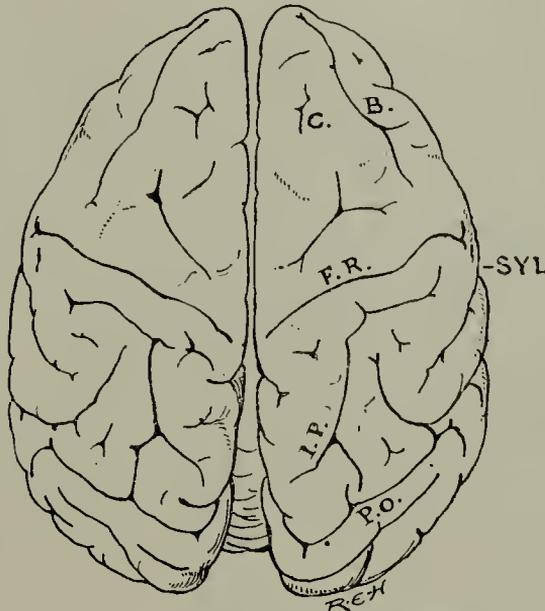
The *Sylvian fissure* seems to call for no particular remark. The anteriorly directed *fronto-orbital fissure* is well developed, and the exposed *island of Reil* is extremely conspicuous. This is, however, by no means a peculiarity of *Hylobates syndactylus* as compared with other Gibbons.

The *parieto-occipital fissure*.—I take it that the fissure lettered P.O. represents the parieto-occipital fissure of other Apes plus the Simian fissure. It will be observed that on both sides of the brain the Simian fissure, instead of terminating without reaching the mesial surface of the brain, as is often the case with Anthropoid Apes, bends forward and joins the parieto-occipital (fig. 2, p. 189).

¹ Dr. Keith has pointed out to me that the overlapping of the cerebellum by the centrum is a characteristic of youth, and that the brain-cast studied by Sir W. Flower was therefore that of an old animal.

The *mesial parieto-occipital fissure* (M.P.O., fig. 1, p. 188) on the left side of the brain passes straight downwards from the superior surface of the brain and joins the calcarine (CA.) below. On the right half there is a little complication: there is a forwardly directed branch of which only an indication exists on the left side. Slighter furrows pass forwards from the mesial parieto-occipital. In the form and direction of the mesial parieto-occipital fissure there are no noteworthy differences from the other brains with which I have compared it.

Fig. 2.



Brain of Siamang. Dorsal aspect.

SYL., Sylvian fissure; F.R., fissure of Rolando; I.P., Intra-parietal; P.O., parieto-occipital; B., frontalis inferior; C., frontalis superior.

The *calcarine fissure* (CA.) most obviously joins the mesial parieto-occipital fissure, as is shown in the accompanying drawing (fig. 1), and at a point nearer to the superior surface of the brain than it does in a brain of *Hylobates hoolock* which I have examined. On the left side of the brain this fissure forked into a Υ posteriorly. In this junction of the mesial parieto-occipital with the calcarine *Hylobates syndactylus* agrees with Man and the Chimpanzee, but apparently not with the Gorilla. In a brain of *H. leuciscus* in my possession there was no such junction; the mesial parieto-occipital curved forwards parallel with the calcarine. The latter fissure was markedly Υ -shaped, the three limbs of the Υ being almost equal in length.

As is the case with *H. hoolock*, the *fissure of Rolando* is independent of other fissures at both ends of its oblique course. On

the left side it plainly stops short some little way above the Sylvian fissure; on the right side a faint groove continues it into that fissure. Mesially neither fissure dips into the inter-cerebral sulcus. That of the right side comes a little closer than does that of the left; and it is curious that this detail is repeated in my brain of *H. hoolock*. The fissure of Rolando has no branches along its course, and is entirely unrelated to other fissures.

The hemisphere measures along its curvature $3\frac{1}{4}$ inches, and the fissure of Rolando arises $2\frac{7}{8}$ inches from the anterior end. It is thus considerably behind the middle of the cerebrum. In *H. hoolock*, which has a longer brain, the corresponding figures are $3\frac{1}{2}$ and $2\frac{1}{8}$.

The frontal lobes are thus larger in *H. syndactylus*; they have a comparatively smooth appearance as in *H. hoolock*.

Of the furrows traversing this lobe I recognize the præcentralis superior, the frontalis superior, and the frontalis inferior.

The *præcentralis superior* is deeply cut but not extensive. On the left side it begins by being parallel to the fissure of Rolando, but ultimately bends much more forward. It is not connected with the frontalis superior. On the right side the fissure is more "normal" in direction, and is connected with the second fissure referred to. It may be that the anterior half—the forwardly directed portion—of the supposed præcentralis is really the base of the frontalis superior; but I think that it is not for the following reasons: intermediate conditions are seen in two other Gibbons' brains in my possession. In one (*H. leuciscus*) the two *præcentralis* fissures are quite parallel with the fissure of Rolando; in the other brain (*H. hoolock*) both fissures have so diverged from the normal (?) that they are almost parallel to the inter-cerebral sulcus.

The *frontalis superior* is represented by detached tracts which are deeply excavated.

As is the case with the other two Gibbons' brains which I have examined, the *frontalis inferior* is a very strongly marked and long fissure. On the right side this fissure was forked posteriorly, and it is quite likely that this region really represents the præcentralis inferior, well developed in the other Gibbons, and on both sides.

Intra-parietal fissure.—As can be seen from the drawing exhibited (fig. 2, p. 189), this fissure is very much the same on both sides of the brain; that portion of the complex furrow termed by Dr Cunningham *postcentralis superior* is not well developed and is detached from the rest. It was also detached though very well developed in *H. leuciscus*; in *H. hoolock* it was perfectly confluent, the whole fissure being of the characteristic T-shape. I lay no stress upon these differences, which are in all probability individual. They only offer additional evidence of the unreliable nature of cerebral fissures for systematic purposes.

3. On a Collection of Mammals from Siam made by
Mr. T. H. Lyle. By J. LEWIS BONHOTE¹.

[Received February 2, 1900.]

(Plate XVIII.)

The following is a list of a collection of Mammals made by Mr. T. H. Lyle, British Consul at Nan, in Siam. The list, as will be seen, contains the names of 20 species, one of which is new to science. The value of a collection in these days, however, is not dependent on the number of new species, but what is required is a series of specimens carefully labelled and measured in the flesh. In this respect the collection under notice is invaluable, and great praise is due to the energetic Consul, who has voluntarily collected with such care, and has generously presented the results to the National Museum.

Among the objects of interest is a large series of the very variable *Sciurus finlaysoni*, which apparently varies irrespective of the ordinary causes, such as locality, altitude &c., which usually induce variation. The specimens of *Helictis* and *Rhizomys* are also of great interest, and will be of much assistance to the correct understanding of these groups. Nan, the centre of the locality from which these specimens come, lies on the head-waters of the Menam River in lat. 18° 40' N., long. 101° 30' E., and the other localities mentioned are near there.

1. CYNOPTERUS SPHINX Vahl.

Nan.

a-d. ♂. Nov. 1897. Mostly young.

e-g. ♀. Nov. 1897. Mostly young.

2. PIPISTRELLUS ABRAMUS (Temm.).

Nan.

a. ♂ ad. sk. Aug. 1897.

b-f. ♀ ad. sk. Aug. 1897.

3. SCOTOPHILUS KUHLI Leach.

Nan.

a. ♂ ad. sk. 8th July, 1897.

b. ♂ ad. sk. 22nd Aug., 1897.

c. ♂ ad. sk. 3rd Sept., 1897.

d-e. ♀ ad. sk. 3rd Sept., 1897.

These specimens are all nearly uniform in colour, being of a sooty-brown above and yellowish below.

¹ Communicated by Mr. OLDFIELD THOMAS, F.Z.S.

4. SCOTOPHILUS CASTANEUS Horsf.

Lakon, Chingmai.

a. ♂ ad. sk. 25th April, 1898.

b. ♀ ad. sk. 10th March, 1898.

This species is smaller than the true *S. kuhli*, and is of a uniform chestnut all over, showing no tendency to become lighter below. The Museum also possesses three specimens of it collected by Mr. Stanley Flower in the Malay Peninsula.

Dimensions :—

♂. Head and body 68 mm.; tail 41; hind foot 8; ear 12.

♀. Head and body 70 mm.; tail 43; hind foot 9; ear 13.

The average length of the forearm of the 5 specimens in the Museum is 50·7 mm., the lengths ranging from 49–52; the average length of *S. kuhli* is 60·5, showing a variation from 58–63.

5. TUPAIA BELANGERI (Wagner).

Nan.

a. ♂ ad. sk. 10th April, 1897.

b. ♂ ad. sk. 5th July, 1897.

c, d. ♂ ad. sk. 3rd & 4th Aug., 1897.

e-h. ♀ ad. sk. 4th, 8th, & 19th Aug., 1897.

Chingmai.

i. ♂ ad. sk. 24th Feb., 1898.

k, l. ♂ ad. sk. 22nd March, 1898.

m. ♀ ad. sk. 25th Feb., 1898.

These are true *T. belangeri* and not *T. ferruginea*.

6. HELICTIS PERSONATA (Geoffr.).

Nan. a-c. ♀ ad. sk. Nov. 1897.

These specimens form a valuable and much needed addition to the series of skins of this genus already in the Museum.

7. PETAURISTA LYLEI, sp. n. (Plate XVIII.)

General colour above hoary, each hair varying from dark brown to rufous at its base, succeeded by a band of white and a black tip. Colour of the hair rather more rufous on the head. Tail slightly longer than head and body, and black throughout its length but lighter at its base. Ears covered with bright red short hairs over their anterior half and long black hairs on the remainder; these latter hairs spreading on the sides of the neck to form a dark patch behind the ear. Feet and edge of the parachute deep black; shoulders, thighs, and upper portion of membrane strongly grizzled with rufous. Underparts rich chestnut, brighter on the membrane. Hairs with a tendency to a white tip, especially towards the median line; underpart of chin, whiskers, and tip of nose dark brown.

The skull shows no marked differences from that of the other allied species except in its larger size. It is rather rounder and deeper; the nasal bones, which are widened anteriorly, extend

backwards beyond the premaxillæ, and the pterygoids are large and prominent.

Dimensions of type (in the flesh):—

Head and body 464 mm.; tail 577; hind foot 85; ear 50.

Skull—greatest length 78·3 mm.; basilar length from henselion 64; zygomatic breadth 53·5; length of nasals 25·5; width of nasals anteriorly 16; width of nasals posteriorly 7.

Hab. Siam.

Type. B. M. 98.10.5.41. ♂ ad. Doi Sritepe, Chingmai, 10th April, 1898.

I have great pleasure in naming this fine species after Mr. Lyle, who has collected so carefully and thoroughly in the midst of his other duties, and has generously presented the results of his labour to the Museum.

There is no risk of confusing this species with any of the pre-existing ones. It is allied to the group of *PP. oral*, *phillipensis*, and *cineraceus*, but its larger size and red underparts distinguish it at a glance.

The skull of the Burmese *P. cineraceus*, Blyth, nearly equals that of the present species in length, but is not so deep and round, conforming in general type with that of the Indian specimens. Its nearest ally is *P. yunnanensis* Anderson, from which it is distinguished by its hoary back and uniform chestnut underparts, besides other minor differences.

Mr. Lyle got a second specimen, also an adult male and from the same locality, which closely resembles the type. The bases of the hairs of the back are not so rufous, and below there are more white tips.

8. SCIUROPTERUS PHAYREI Blyth.

Nan.

a-b. ♂ ♀ ad. sk. 22nd July, 1897.

c. ♀ ad. sk. 16th Sept. 1897.

All three specimens are slightly larger than the average, but do not differ in any other respect.

9. RATUFA GIGANTEA (Maccl.).

Nan. *a.* ♂ ad. sk. 10th April, 1898.

10. SCIURUS FINLAYSONI (Horsf.).

Sokotai. *a, b.* ♂ ♂ ad. sk. 17th & 20th Jan., 1898.

Bau Mu, Siang Hai. *c, d.* ♀ ♀ ad. sk. 8th Feb., 1898.

Memoh, Lakon, Phiné Road. *e, f.* ♀ ♀ ad. sk. 24th Aug., 1898.

Phitsamloke on Menam R. *g-k.* ♂ ♂, ♀ ♀ ad. sk. 6th June, 1898.

Pichit. *l, m.* ♀ ♀ ad. sk. 7th June, 1898.

Between Pichit and Pakuampo. *n-p.* ♂, ♀ ♀ ad. sk. 9th June, 1898.

Ban Bu Nok, Menam R. *q.* ♂ ad. sk. 9th June, 1898.

Muang Pron, above Antong. *r, s.* ♂ ♀ ad. sk. 12th June, 1898.

This fine series of specimens fully bears out Mr. Thomas's remarks (P. Z. S. 1898, p. 245) that, so far as our present knowledge is concerned, the variations met with in this species apparently follow none of the ordinary laws which are usually supposed to govern such cases.

11. *SCIURUS RUFIGENIS* Blanf.

Doi Sritepe, Chingmai. *a.* ♂ ad. sk. 29th March, 1898.

12. *SCIURUS CANICEPS* Gray.

Nan. *a, b.* ♂ ♀ ad. sk. 27th July, 1897.

Chingmai. *c-f.* ♂ ♂, ♀ ♀ ad. sk. 10th June, 1898.

13. *SCIURUS ATRODORSALIS* Gray.

Nan. *a-f.* 3 ♂, 3 ♀. March 1898.

There is hardly any sign of the black back in these specimens, which were all taken in March.

14. *SCIURUS MACCLELLANDI BARBEI* Blyth.

Nan.

a. ♂ ad. sk. 23rd July, 1897.

b, c. ♂ ♀ ad. sk. 1st & 10th September, 1897.

15. *FUNAMBULUS BERDMOREI* (Blyth).

Sokotai, Nam Phi. *a.* ♂ ad. sk. 17th Jan., 1898.

Nam Phi, near Nan. *b.* ♂ imm. sk. 23rd May, 1898.

Maang Prom, above Antong. *c, d.* ♂ ♀ ad. sk. 12th June, 1898.

16. *MUS MUSCULUS* Linn.

Nan, Siam. *a-c.* ♂ ♀ ♀ ad. sk. 13th & 27th Aug. & 8th Sept., 1897.

These specimens are light in colour and almost white underneath.

17. *MUS RATTUS* L.

Nan.

a-d. Ad. sk. July 1897.

e-l. Imm. sk. Aug., Sept., & Nov., 1897.

All the specimens in this collection belong to that form of *Mus rattus* which is found throughout Southern India and Ceylon. The general colour is light fawn, and the long black hairs are numerous and distinct. There are practically no spines, and the tail is longer than the head and body. They do not agree with the types of *MM. flavescens*, *rufescens*, *brunneusculus*, or *nitidus*, but in shape and colour most nearly approach the true *Mus rattus*, under which name I have therefore placed them.





J. Smit del. et lith.

Mintern Bros. imp.

PETAURISTA LYLEI.

-18. *MUS CONCOLOR* Blyth.

Doi Sritepe, Chingmai. *a-d.* ♂. 3rd & 25th March and 30th April.

-19. *RHIZOMYS MINOR* Gray.

Nan.

a. ♀, young but full-grown. 8th Aug., 1897. *Dimensions*: head and body 213 mm.; tail 50; hind foot 26; ear 10.

b. ♀ imm. sk. 18th Aug., 1897. *Dimensions*: head and body 160 mm.; tail 45; hind foot 25; ear 7.

c. ♀ imm. sk. 18th Sept., 1897. *Dimensions*: head and body 159 mm.; tail 52; hind foot 27; ear 8.

I have examined two specimens, now in the Museum, with which the above-mentioned specimens closely agree. One of these two specimens must have been Gray's type. One was procured in Cochin China, and the other by Dr. Finlayson in Siam. They differ in the intensity of the umber-brown tips to the hairs, the Siamese specimen showing considerably more than that from Cochin China. None of Mr. Lyle's specimens are fully adult, and though they vary slightly among themselves, show, as might be expected, a much greater affinity to the Siamese specimen. Mr. Thomas notes¹ that the bright colour is only assumed in adult individuals; and as Mr. Lyle's specimens are all young, I was at first inclined to regard *R. minor* as an immature *R. badius*.

The skull², however, of the Cochin China specimen is fully adult and is much smaller than the type skull of *R. badius*. The skull of Mr. Lyle's largest specimen, except in being that of a younger animal, agrees in all respects with the skull from Cochin China.

R. minor is therefore a southern race of *R. badius* inhabiting Siam and Cochin China, and is distinguishable chiefly by its smaller size and slightly duller colour.

The measurements of Mr. Lyle's largest specimen given above represent the average size of this species.

The measurements of *R. badius* as given by Blanford are as follows:—Head and body 228 mm.; tail 68; hind foot 31.

20. *MANIS JAVANICA* Desm.

Nan. *a.*

Doi Sritepe, Chingmai. *b.* ♀ ad. sk. 23rd March, 1898.

EXPLANATION OF PLATE XVIII.

Petaurista lylei, sp. n., p. 192.

¹ P. Z. S. 1886, p. 65.

² Fig. in Anderson, Zool. Res. W. Yunnan, pl. xvi.

4. On a small Collection of Mammals obtained by Captain Deasy in South Chinese Turkestan and Western Tibet.
By G. E. H. BARRETT-HAMILTON, F.Z.S.

[Received March 2, 1900.]

The small collection of mammals which is dealt with in the present paper includes only 16 specimens of 5 species, all rodents. These are, however, of considerable interest, since, apart from the localities in which they were procured, two of them, a Vole and a Jerboa, which I have named respectively *Microtus lama* and *Dipus deasyi*, belong to hitherto undescribed forms. A third is the extraordinary *Euchoreutes naso*, described by Mr. W. J. Sclater in 1890 from specimens obtained by the Hon. Charles Ellis somewhere in Eastern Turkestan. The acquisition of examples of this species (and genus) adds a valuable novelty to the collection of mammals in the British Museum, whither Capt. Deasy's specimens have found their way.

The following is a list of the specimens:—

MERIONES CRYPTORHINUS Blanford, J. A. S. Bengal, ii. p. 108 (1875).

No. 99.11.5.1. ♂. Kara Sai, Chinese Turkestan, 9th July, 1898, altitude 9500 ft.

MICROTUS (ALTICOLA) LAMA, sp. nov.

α & β. No. 97.1.21.3 & 4. 25 miles south-east of Lake Arucho, W. Tibet, altitude 16,000 ft., August 1897.

γ. No. 99. 11.5.2, "Camp, 1898," Chinese Turkestan, altitude 17,800 ft., August 8th, 1898.

Native name, "Such Kun."

Type, no. 97.1.21.3.

Description. External characters similar to those of *M. stracheyi* Thos., but with the teeth and posterior termination of the palate very like those of *M. roylei* Ogilvie. Agrees with *M. albicauda* True in that $\overline{m. 1}$ has 8 salient angles, but has the tail far shorter.

Dimensions of the type (in millim.):—Dried skin. Head and body 115; tail 12; hind foot with claws 19.5; hind foot without claws 8; ear 11.

Skull (damaged posteriorly)—zygomatic breadth 14.5; length of nasals 8.5; palatal length 14.5 (from posterior termination of palate to anterior margin of incisors).

The specimen γ appears to be the young of this form.

DIPUS DEASYI, sp. nov.

Type. No. 99.11.5.3. ♀, Nura, Chinese Turkestan, 7500 ft., 6th October, 1898 (original number 73).

Description. In external appearance resembles *D. loftusi* Blanford, but the colour of the upper surface is richer and not so brown;

the exact tint being somewhere between "Ecrú drab" and "Fawn colour"¹.

Skull resembles that of *D. lagopus* Licht., but the teeth are more massive and their pattern less complicated.

Dimensions of the type—head and body 125; tail 160; hind foot 59; ear 18. (All taken from the dried skin.)

This is a very distinct Jerboa, with no very near known ally, and a detailed description of which would be unnecessary. I have pleasure in connecting it with the name of its discoverer.

DIPUS, sp. inc.

Nos. 99.11.5.4 & 5. 2 males, imm., Kotaz Sangai, near Khotan, Turkestan, 4700 ft., 8th October, 1898.

The immaturity of these two specimens prevents their satisfactory determination; they may be the young of *D. deasyi*.

EUCHOREUTES NASO, W. L. Scater, P. Z. S. 1890, p. 610.

Nos. 99.11.5.6, 7 & 8. ♀. Ak Langar on the Yarkand-Khotan Road, altitude 4500 ft., 3rd July, 1898.

Native name, "Sarok Kuruk" ("Brown Tail").

The original specimens of *Euchoreutes naso*, although known to be from Eastern or Chinese Turkestan, had no exact locality attached to them. It is satisfactory to have this deficiency supplied by Captain Deasy's specimens. The Ak Langar is a Rest-house. The specimens were obtained in the night, so that, although Captain Deasy states that the animal was very common, he is unable to give any details as to its habits.

OCHOTONA LADACENSIS, Günther, Ann. & Mag. Nat. Hist. ser. 4, xvi. p. 231 (1875).

No. 99.11.5.9. ♂. Yepal Ungur, Chinese Turkestan, 15,000 ft., 22nd July, 1898.

No. 99.11.5.10 & 11, two females. Ditto, ditto, 20th July, 1898.

No. 99.8.10.1. Zad Kulan Urgi, Chinese Turkestan, altitude 12,800 ft., 25th December, 1897.

No. 97.1.21.1. 25 miles S.E. of Lake Arucho, W. Tibet.

No. 97.1.21.2. Ditto, ditto.

5. On a Collection of Butterflies from the Bahamas.

By EMILY MARY SHARPE.

[Received January 4, 1900.]

(Plate XIX.)

Mr. J. L. Bonhote, who is well known for his excellent observations in the ornithological world, was for some time Private Secretary to Sir Gilbert Carter, K.C.M.G., the Governor of the

¹ Ridgway, 'Nomenclature of Colors,' 1886, pl. iii.

Bahama Islands in 1898, and made a collection of Lepidoptera in the island of Nassau.

So far as I can discover, no papers have ever been published on the Butterflies of the Bahamas, and I think, therefore, that a list of Mr. Bonhote's specimens may be useful. The Collector's field-notes are added.

Family DANAIDÆ.

1. DANAIIS PLEXIPPUS (Linn.).

Danais plexippus, Kirby, Syn. Cat. Diurn. Lepid. i. p. 5 (1871); Godman & Salvin, Biologia Centrali-Americana, Rhop. i. p. 1 (1879).

Hab. N. America. C. America from Mexico to Panama. W. S. America to Peru.

a. ♀. April 11, 1898.

b. ♂. May 11, 1898.

c. ♀. June 30, 1898.

d, e. ♂. July 1, 25, 1898.

["Fairly common throughout the summer months: flies very swiftly, but may easily be caught on the flowers of the *Ipecechana* plant, where it frequently settles."—*J. L. B.*]

Family SATYRIDÆ.

2. CALISTO HEROPHILE Hübner.

Calisto herophile, Kirby, t. c. p. 103 (1871).

Hab. Honduras. Cuba.

a. August 23, 1898.

Family NYMPHALIDÆ.

3. AGRAULIS VANILLE (Linn.).

Dione vanille, Kirby, t. c. p. 148 (1871).

Agraulis vanille, Godman & Salvin, t. c. p. 171 (1882).

Hab. N. America. C. America from Mexico to Panama. South America. Antilles.

a, b. ♂ ♀. April 4, 1898.

c. ♂. June 15, 1898.

d, e. ♂ ♀. July 2, 25, 1898.

["One of the commonest species in the island, found everywhere throughout the year."—*J. L. B.*]

4. COLÆNIS DELILA (Fabr.).

Colænis delila, Kirby, t. c. p. 147 (1871).

Hab. Guiana. Jamaica.

a, b. June 27, 30, 1898.

c. September 30, 1898.

["The males are frequently seen where the bush has been cut down leaving a thick undergrowth; the females are seldom seen and when disturbed fly low in the undergrowth."—*J. L. B.*]

5. EUPTOIETA HEGESIA (Cram.).

Euptoieta hegesia, Kirby, t. c. p. 154 (1871).

Eupetoieta hegesia, Godman & Salvin, t. c. p. 175 (1882).

Hab. N. & C. America. S. America. Cuba. Jamaica.
a-c. June 9, 13, 18, 1898.

["A very common species, on the wing throughout the year."—*J. L. B.*]

6. PHYCIODES FRISIA (Poey).

Phyciodes frisia, Kirby, t. c. p. 173 (1871); Godman & Salvin, t. c. p. 203 (1882).

Hab. Florida. Greater Antilles. Panama. Colombia. Venezuela.

a, b. July 2, 29, 1898.

c. Clifton, July 21, 1898.

d. September 9, 1898.

["The first examples of this species were seen in June, and during July it was very common."—*J. L. B.*]

7. ANARTIA IATROPHÆ (Linn.).

Anartia iatrophæ, Kirby, t. c. p. 194 (1871); Godman & Salvin, t. c. p. 221 (1882).

Hab. Texas. Florida. C. America, from Mexico to Panama. S. America. Antilles.

a. June 10, 1898.

b. July 13, 1898.

["Fairly common in the open parts of the bush, very fond of settling on the rock or paths."—*J. L. B.*]

8. ANÆA ECHEMUS Doubl. & Hewits.

Anæa echemus, Kirby, t. c. p. 276 (1871); Godman & Salvin, t. c. p. 355 (1884).

Hab. Honduras. Cuba.

a. March 23, 1898.

b. April 12, 1898.

["The only two examples met with. They were both taken at the same place, viz., a shady roadway cut through the bush."—*J. L. B.*]

Family LYCÆNIDÆ.

9. TARUCUS CASSIUS (Cram.).

Cupido cassius, Kirby, op. cit. ii. p. 351 (1871).

Lycæna cassius, Godman & Salvin, op. cit. ii. p. 105 (1887).

Hab. C. America. Mexico to Panama. Colombia. Guiana. S. Brazil.

a. July 2, 1898.

["A common species on the wing throughout the summer."—*J. L. B.*]

10. *TMOLUS ANGELIA* Hewits.

Thecla angelia, Hewitson, Illustr. Diurn. Lepid. i. p. 162 (1874); Kirby, op. cit. Suppl. p. 777 (1877).

Hab. Antilles.

a. June 26, 1898.

11. *TMOLUS SALONA* Hewits.

Thecla salona, Kirby, op. cit. ii. p. 401 (1871); Hewitson, t. c. p. 159 (1873).

a. July 1, 1898.

Family PIERIDÆ.

12. *CALLIDRYAS EUBULE* (Linn.).

Catopsilia eubule, Kirby, t. c. p. 482 (1871).

Callidryas eubule, Godman & Salvin, t. c. p. 141 (1889).

Hab. N. & C. America, and throughout the greater part of S. America. Antilles.

a. ♂. June 13, 1898.

b-e. ♂ ♀. July 2, 8, 25, 29, 1898.

f, g. ♂ ♀. August 12, 1898.

h. ♂. September 8, 1898.

13. *KRICOGONIA LYSIDE* (Godt.).

Kricogonia lyside, Kirby, t. c. p. 487 (1871); Godman & Salvin, t. c. p. 150 (1889).

Hab. Texas. Florida. C. America, from Mexico to Nicaragua. Colombia. Venezuela. Greater Antilles.

a. June 30, 1898.

b-d. July 1, 2, 8, 1898.

14. *TERIAS DINA* (Poey).

Eurema dina, Kirby, t. c. p. 445 (1871).

Terias dina, Godman & Salvin, t. c. p. 163 (1889).

Hab. C. America from Mexico to Costa Rica.

a, b. ♂ ♀. June 27, 30, 1898.

c-h. ♂ ♀. July 1, 2, 8, 16, 25, 29, 1898.

15. *TERIAS MESSALINA* (Fabr.).

Eurema messalina, Kirby, t. c. p. 445 (1871).

Hab. Jamaica.

a. ♂. May 9, 1898.

b. ♀. June 30, 1898.

c, d. ♂ ♀. July 2, 25, 1898.

[“Flies very low in shady localities.”—*J. L. B.*]

16. *APHRISSA STATIRA* (Cram.).

Catopsilia statira, Kirby, t. c. p. 485 (1871).

Aphrissa statira, Godman & Salvin, t. c. p. 147 (1889).

Hab. S. America. C. America from Panama to Mexico.

a. ♂. June 27, 1898.

17. *PHÆBIS AGARITHE* (Boisd.).*Catopsilia agarithe*, Kirby, t. c. p. 484 (1871).*Phæbis agarithe*, Godman & Salvin, t. c. p. 145 (1889).*Hab.* Texas. C. America, from Mexico to Nicaragua. Colombia. Venezuela. Antilles.*a.* ♂. April 13, 1898.*b, c.* ♂ ♀. July 1, 8, 1898.18. *PIERIS PHILETA* (Fabr.).*Pieris monuste* (Linn.) pt., Kirby, t. c. p. 458 (1871).*a.* ♀. April 10, 1898.*b.* ♂. July 19, 1898.

Family P A P I L I O N I D Æ.

19. *PAPILIO BONHOTEL*, sp. n. (Plate XIX.)

Allied to *Papilio andraemon* of Hübner, but at once distinguished by the narrower and much paler yellow transverse band on the primaries, this band being decidedly more broken up towards the apical area; the hind-marginal border relieved by a row of sulphur-yellow spots. Secondaries with the sulphur-yellow transverse band narrower and paler than in the allied species; the hind-marginal spots pale yellow, but strongly indicated; the post-median row of blue spots somewhat more strongly pronounced than in *P. andraemon*.

Underside. General colour of both wings sulphur- instead of ochre-yellow, the spots and markings being similar to those of *P. andraemon*.

Expanse 3·2 inches. (Nassau, 13th June, 1898.)

Female. Larger, and having the hind-marginal borders and basal area brown instead of blackish as in the male. Secondaries with the marginal row of yellow spots suffused with rufous.

Underside. Similar to that of the male, but the sub-marginal markings on the secondaries more strongly tinted with rufous, these markings being pale sulphur-yellow in the male; the ocellus on the anal angle much larger and more clearly defined than in the male.

Expanse 3·7 inches. (Nassau, 15th June, 1898.)

In the British Museum are three examples of this species from the Bahamas, presented by Mr. Neville Chamberlain, who obtained them on Andros Island. He also bred several from larvæ on orange-trees, and noticed that when touched the larvæ protruded two white horns from behind the head. Three other specimens, said to be from Honduras, purchased from Mr. Müller, are identical, or at least are very nearly allied.

[“A common species, having a succession of broods throughout the summer. The larva is dark brown mottled with greyish, having two large white bands, one towards the head and the other on the hinder part of the body. It feeds on the orange, preferring

the tender shoots growing directly from the trunk near the ground, thus causing considerable damage to the plantations, as these shoots are generally the grafted buds. It lies on the upperside of the leaf along the midrib, with its head pointing towards the stem, and in this position much resembles a bird's dropping. The pupa is attached to the trunk of the tree, from which it is practically indistinguishable in colour, and is generally within two feet of the ground. The pupa stage lasts about a fortnight."—*J. L. B.*]

20. *PAPILIO POLYDAMAS* Linn.

Papilio polydamas, Kirby, t. c. p. 521 (1871); Godman & Salvin, t. c. p. 200 (1890).

Hab. Florida. C. America from Mexico to Panama. S. America. Greater and Lesser Antilles.

a. August 23, 1898.

["Appears sparingly in April and August."—*J. L. B.*]

Family HESPERIDÆ.

21. *EUDAMUS PROTEUS* (Linn.).

Thymele proteus, Kirby, t. c. p. 570 (1871).

Eulamus proteus, Godman & Salvin, t. c. p. 277 (1893).

Hab. S. United States. C. & S. America.

a, b. August 3, 8, 1898.

c. September 30, 1898.

d. October 5, 1898.

["Very common from May to September."—*J. L. B.*]

22. *EPARGYREUS ZESTOS* (Hübner.)

Telegonus zestos, Kirby, t. c. p. 574 (1871).

Hab. Surinam.

a. ♀. April 13, 1898.

b. ♂. August 23, 1898.

c. September 29, 1898.

["Double-brooded and not very numerous."—*J. L. B.*]

23. *ACOLASTUS AMYNTAS* (Fabr.).

Acolastus amyntas, Godman & Salvin, t. c. p. 304 (1893).

Hab. Florida. C. & S. America. Antilles.

a. March 10, 1898.

b. October 5, 1898.

24. *PAMPHILA*, sp. inc.

a, b. September 12, 30, 1898.

25. *PAMPHILA*, sp. inc.

a. July 21, 1898.





Horace Knight del. et lith.

West, Newman chromo

PAPILIO BONHOTI.

26. PAMPHILA MISERA Lucas.

Pamphila misera, Kirby, t. c. p. 607 (1871).

Hab. Cuba.

a. August 12, 1898.

27. PAMPHILA, sp. inc.

a. July 4, 1898.

b. October 5, 1898.

28. POLITES THAUMAS (Fabr.).

Pamphila thaumas, Kirby, t. c. p. 599 (1871).

Hab. U. S. of America.

a. July 2, 1898.

b. October 7, 1898.

29. HYLEPHILA PHYLÆUS (Drury).

Pamphila phylæus, Kirby, t. c. p. 600 (1871).

Hab. Antilles.

a, b. ♂. July 16, 25, 1898.

c, d. ♂ ♀. August 8, 1898.

e. ♀. September 29, 1898.

f. ♀. October 6, 1898.

EXPLANATION OF PLATE XIX.

Fig. 1. *Papilio bonhottei*, ♂, p. 201.

1 a. Underside of the same.

1 b. *Papilio bonhottei*, ♀.

1 c. Underside of the same.

6. On new Genera and Species of Phytophagous Coleoptera from South and Central Africa. By MARTIN JACOBY, F.E.S.

[Received February 20, 1900.]

(Plate XX.)

The present paper contains the descriptions of one hundred new species of Phytophagous Coleoptera, including also the characters of three new genera. The materials upon which they are based have been received principally from Mr. Guy Marshall in Mashonaland, the Rev. J. O'Neil in Cape Colony, from Dr. Staudinger and Herr Bang-Haas, and others; all the types are in my collection. Our knowledge of the African fauna is therefore again considerably augmented, thanks to the assistance of the above-mentioned ardent collectors.

CRIOCERINÆ.

LEMA DUVIVIERI, sp. n.

Dark fulvous, the head, antennæ, and the legs (the base of the

posterior femora excepted) black; thorax impunctate; elytra metallic dark blue, strongly and closely punctate-striate, the ninth row entire.

Length 7 millim.

Head bluish black, the neck rufous, the vertex impunctate; the eyes very deeply notched; antennæ extending to the middle of the elytra, black, the third and following joints elongate and slender: thorax not longer than broad, deeply constricted at the sides, the anterior angles with a distinct tubercle, the basal sulcation deep and placed nearly at the middle, the surface impunctate, the portion below the sulcus obsolete grooved and likewise impunctate; scutellum black; elytra with a distinct depression below the base, very strongly and closely punctate-striate, the interstices strongly costate at the sides and at the apex; legs bluish black, the intermediate femora below and the base of the posterior ones fulvous, the underside of the same colour.

Hab. Matadi, Africa. (In the collection of the Belgian Mus. and that of my own.)

Differs from *L. rubricollis* Lac. in the colour of the legs and that of the underside, from *L. sanguinicollis* Lac. in the differently structured thorax; *L. rufo-femorata* Clark is black below and has rufous femora; *L. affinis* Cl. differs similarly.

LEMA BOMAENSIS, sp. n.

Flavous, the terminal joints of the antennæ fuscous; thorax sub-cylindrical, sparingly punctured, with some obscure piceous spots; elytra strongly and closely punctate-striate, the sutural margin and a broader sublateral stripe, abbreviated posteriorly, blackish.

Length 5 millim.

Head impunctate, flavous, the vertex sometimes obscure piceous; eyes entire, not notched, supra-ocular grooves shallow; clypeus triangularly raised; labrum piceous; antennæ short and robust, the lower joints short, the fifth elongate, terminal joints widened, more or less stained with fuscous; thorax short, subcylindrical, strongly constricted at the base, the basal sulcus deep, the disc with some strong, scattered punctures at the sides and at the middle, the latter with some obsolete piceous spots (sometimes absent); scutellum piceous, its apex truncate; elytra parallel, with a very shallow depression below the base, very strongly punctured in closely approached rows, the interstices costate from the middle downwards, flavous, the suture very narrowly and a broader stripe from the shoulder to below the middle piceous or black; below and the legs flavous, the breast darker, covered with very short yellow pubescence.

Hab. Boma, Congo. (Coll. Belgian Mus. and my own.)

A very distinct species, remarkable on account of the entire eyes, shape of the thorax, which is strongly widened in front, and the pattern of the elytra.

LEMA DUNBRODIENSIS, sp. n.

Fulvous, the breast and the abdomen black; thorax sub-cylindrical, strongly punctured at the middle; elytra strongly punctate-striate, pale fulvous; a sutural band, a spot on the shoulders, and another at the sides anteriorly, black.

Length 4 millim.

Head fulvous, impunctate; the eyes entire, the accompanying grooves shallow and finely pubescent; the labrum black; the antennæ short and stout, fulvous, the second joint moniliform, the third and fourth equal, longer, the fifth and following joints subquadrately widened; thorax subcylindrical, scarcely constricted at the base, the basal sulcus deep, the surface strongly punctured near the anterior angles and at the middle of the disc, the punctures at the latter place arranged in three rows; scutellum black; elytra paler in colour than the thorax, distinctly depressed below the base, strongly and closely punctate-striate, the punctures indistinct near the apex, the interstices not raised or slightly so near the lateral margins; the suture narrowly black, this colour extending laterally as far as the second row of punctures, and having a slight dilation near the depression and near the apex; a small black spot is placed on the shoulders, followed by a short stripe below at the lateral margin; the breast and abdomen black, clothed with short yellow pubescence: the legs fulvous, the last joint of the tarsi and the claws more or less black.

Hab. Dunbrody, Cape Colony, S. Africa.

I received a single specimen of this species kindly sent by the Rev. O'Neil, who states that it is the only species he took in this locality by sweeping.

LEMA NATALENSIS Jac. = *L. tarsata* Jac., var.

Of this species Mr. Marshall has sent me some more specimens, which prove the insect to be a most variable one in regard to colour; also that *L. tarsata* Jac. (described by me P. Z. S. 1897, p. 241) is but one of the varieties. The species may always be recognized by the distinct tooth-like tubercles at the anterior angles of the thorax and the peculiar sculpture of the latter. The varieties at present before me are:—

a. The thorax and elytra fulvous, the former with a small black spot at the middle of the basal sulcation; legs piceous.

b. Thorax and legs as in var. *a.*, the elytra entirely dark blue.

In the typical form *L. natalensis* the legs are fulvous and the tarsi black, the thorax and the elytra are either fulvous with a sutural and lateral bluish stripe or entirely dark blue; the head in all the forms is always black as well as the antennæ, but the lower three or four joints of the latter are fulvous. The varieties have been obtained in Mashonaland.

LEMA NIGROTIBIALIS, sp. n.

Fulvous, the apical joints of the antennæ, the tibiæ (their base excepted) and the tarsi black; thorax not longer than broad, deeply

sulcate at the sides, nearly impunctate; elytra with deep basal depression, strongly punctate-striate anteriorly, more finely so posteriorly.

Length 5 millim.

Head not constricted behind, the vertex raised into two subdivided elevations, supraocular grooves deep; eyes deeply notched; antennæ extending to the middle of the elytra, black, the lower three or four joints fulvous, third and fourth joints equal, small, slightly longer than the second, terminal joints thickened but distinctly longer than broad; thorax not longer than broad, the anterior portion widened, the sides deeply constricted, the constriction bounded above by a longitudinal ridge, basal sulcus deep, the surface impunctate with the exception of a few fine punctures at the middle, fulvous; scutellum truncate at its apex; elytra with a short but rather deep depression near the suture below the base, regularly, strongly, and rather closely punctate-striate, the punctures much finer towards the apex, the ninth row entire, the interstices at the sides and near the apex slightly costate; below and the legs fulvous; the tibiæ, with the exception of the extreme base, and the tarsi black.

Hab. Malvern, Natal (*C. N. Barker*).

Closely allied to *L. fuscitarsis* Jac., from the same locality, but the general coloration darker fulvous, the antennæ less slender, the elytral depression much deeper, and the tibiæ black; in a single specimen the first joint of the antennæ is fulvous only. Mr. Barker has kindly sent me four specimens of this species.

CRIOCERIS MILITARIS, sp. n.

Rufous, the antennæ and legs paler; thorax strongly angulate at the sides, with rows of deep punctures and two large black spots at the disc; elytra deeply punctate-striate, flavous; the shoulders, suture anteriorly, the lateral margins, and a narrow transverse band below the middle, black.

Length 6 millim.

Head strongly constricted behind the eyes, the vertex strongly obliquely raised, rufous; the spaces in front of the eyes black, rugose-punctate, the lower portion of the face and the labrum paler; antennæ stout and short, dark flavous, the second joint moniliform, the third and fourth thicker and slightly larger, equal, the rest transversely widened; thorax subcylindrical, widened anteriorly, the sides forming a strong angle at the middle, the disc with a short oblique row of punctures at the sides and two others at the middle of the anterior portion, rufous, the middle of the surface almost entirely occupied by a large black patch which is connected at the base but divided anteriorly by a short stripe of the rufous ground-colour, the base likewise remains of this colour in shape of a narrow transverse band which has some deep depressions in front of the scutellum; the latter small, flavous; elytra strongly punctured at the anterior portion, the punctures very much finer posteriorly, the disc flavous; a spot on the humeral callus, another

sutural one at the base, the sides, and a transverse narrow band immediately behind the middle and connected with the lateral stripe, black; below and the legs fulvous.

Hab. Salisbury, Mashonaland; on lily of the valley (*G. Marshall*).

C. balyi Har. almost entirely resembles the present species, but is smaller, the head is differently constructed, and the thorax has no black spots, the elytra also have a narrow black margin. Mr. Marshall has sent two exactly similar specimens of this handsome species.

LEUCASTRA BIMACULATA, sp. n.

Fulvous, pubescent; the antennæ, breast, and the legs black; thorax impunctate, with a central black mark; elytra strongly punctured, with a black round spot placed at the middle of each elytron; pubescence pale yellow.

Length 10 millim.

Elongate and parallel; the head broad, strongly but not closely punctured, fulvous, clothed with short pubescence; the clypeus transversely depressed, flavous; the eyes deeply notched; the antennæ black, the last seven joints triangularly widened; thorax twice as broad as long, the sides rounded, the surface with a narrow transverse groove, running parallel with the anterior and posterior margins, the surface impunctate, clothed with single long yellowish hairs, the middle of the disc with a Λ -shaped black mark; elytra with rather prominent shoulders, somewhat paler in colour than the thorax, depressed near the suture at the base, strongly but not very closely punctured at the anterior portion, more finely so posteriorly, the interstices clothed with long golden-yellow pubescence; legs similarly pubescent, black as well as the breast, the femora unarmed; abdomen pale fulvous.

Hab. Malvern, Natal; Salisbury, Mashonaland (*G. Marshall*).

Mr. Marshall has sent two specimens of this species, which differs in the coloration and pattern of the elytra from any of those described by Westwood and Stål.

CLYTHRINÆ.

DAMIA CAPITATA, sp. n. (Plate XX. fig. 1.)

Fulvous; the terminal joints of the antennæ, the breast and abdomen black; head and thorax fulvous, the former with two black spots, the latter transverse, impunctate; elytra strongly and semi-rugosely punctured, a transverse band at the base and an oblique broad spot below the middle black.

Mas. Head broad, the lower portion entirely divided longitudinally as far as the eyes; the anterior legs elongate.

Length 5 millim.

Head very broad, fulvous, impunctate, with a triangular black spot in front of each eye, the lower portion longitudinally divided into two broad lamellæ, the right portion of which is longer than

the left and more pointed, these projections are distinctly raised from the parts lying underneath as well as the mandibles; the latter are black, the left being short and broad, and the right mandible long and bent at right angles; antennæ black, the lower three joints fulvous, the terminal joints strongly transverse, not extending to the base of the thorax; thorax transverse, nearly three times broader than long, of equal width, the sides strongly rounded, the posterior angles oblique, the disc with a few punctures here and there, obsoletely transversely sulcate near the anterior margin; scutellum triangularly pointed, black; elytra not wider at the base than the thorax, of paler colour, very strongly, closely, and unevenly punctured, the interstices slightly rugose, the base with a broad transverse black band which narrows considerably near the scutellum, where it is obliquely shaped and does not extend to the suture; another shorter, transverse band of oblique shape is placed below the middle, it does not extend to either margin; the sides of the elytra strongly deflexed, with a distinct lateral lobe below the shoulders; breast and abdomen black, closely covered with grey pubescence; legs fulvous, the tarsi more or less black; the anterior legs in the male elongate, their tibiæ unarmed; the tarsi rather slender, of nearly equal length.

Hab. Dunbrody, Cape Colony (*Rev. J. O'Neil*).

Of this interesting species I have seen three specimens, two males and one female; one of each sex was sent by the Rev. O'Neil, and another male is contained in the British Museum. The structure of the head in the male insect is quite unique, no instance having come under my observation of such a split or division of the entire lower portion of the face: but this is not all—in the British Museum specimen this division is not longitudinal but horizontal, and the divided portions are transversely placed. In other respects the insect agrees with mine. In the female the head is simple and the tarsi shorter, but the clypeus is also here deeply triangularly emarginate, although not divided.

DAMIA FRONTALIS, sp. n. (Plate XX. fig. 2.)

Elongate, subcylindrical, fulvous, the breast black, the head with a black transverse band; the thorax minutely punctured, with two black bands; elytra finely and closely punctured, pale flavous, the suture and a broad lateral band, connected near the apex, black; tibiæ spotted with black.

Length 8 millim.

Head fulvous, the vertex impunctate, shining, the middle finely rugose-punctate in shape of a transverse black band; eyes very distant, moderately large, slightly notched; clypeus fulvous, strongly punctured; antennæ scarcely extending to the middle of the thorax, the fourth and following joints strongly transversely serrate, the lower four joints fulvous, the others black; thorax nearly twice as broad as long, slightly narrowed in front, the sides and the posterior angles strongly rounded, posterior margin nearly straight, without basal lobe, surface only perceptibly punctured

when seen under a strong lens, fulvous, shining, the sides with a broad, slightly curved black band, not extending to the anterior margin; scutellum scarcely longer than broad, its apex rounded; elytra very slightly narrowed towards the apex, very finely punctured in closely approached irregular rows, the lateral lobes broadly rounded and moderately produced, the colour a pale flavous or yellowish white, the suture narrowly black; this colour widened towards the apex, where it is transversely connected with another broad longitudinal band which commences at the base, but does not extend to the apex nor to the lateral margins; abdomen and legs flavous, all the tibiæ with a black stripe at the outer edge of their apical portion; tarsi rather broad and short, the first joint slightly longer than the second.

Hab. Umcheki River, Mashonaland (*G. Marshall*); also Moliro, Congo (Belgian Mus.).

Of this very distinct species four specimens are before me, which agree in every respect; there is no other genus, except perhaps *Melitonoma*, where the species could find a more suitable place, on account of the rounded sides and posterior thoracic angles and the short tarsi, which best agree with *Damia*; the anterior legs are also rather longer than the others, as is the case with the other species placed in this genus. The present one is, however, much larger and resembles much in the coloration and pattern certain species of *Peploptera*; the black transverse band at the head will at once help in its recognition.

CAMPTOLENES PUBIFRONS, sp. n.

Black, the head strongly pubescent; thorax strongly but remotely punctured, black, the anterior portion and part of the sides flavous; elytra strongly and irregularly punctured, flavous, an angular band before and another narrow one below the middle, black; legs fulvous.

Mas. Mandibles long and robust, deeply concave, the right one curved; the anterior legs very elongate as well as their tarsi.

Fem. Mandibles and legs normal.

Length 7-8 millim.

Head broad, black, clothed with long yellowish hairs, the epistome not separated, its anterior edge truncate; antennæ short, the fourth and following joints transverse, black, the basal joint fulvous; thorax twice as broad as long, the sides nearly straight, rounded at the posterior angles, the base with a depression at each side, the basal margin moderately produced at the middle, the surface irregularly and strongly punctured, black, the anterior third portion and the sides flavous, somewhat thickened; scutellum black; elytra strongly and irregularly punctured, the interstices slightly rugose, longitudinally costate near the apex, flavous, with a transverse narrow black band placed before the middle and extending upwards at the shoulders to the base, and another more irregular angulate band situated at a little distance from the apex; below black, finely pubescent; legs piceous, the anterior tibiæ and

tarsi obscure fulvous; anterior tibiæ mucronate at the apex, the first joint of their tarsi very elongate, as long as the following two joints together (♂).

Hab. Delagoa Bay, received from Mr. G. Marshall.

C. abyssinica Lefèv. (Rev. de Zoolog. 1877, p. 223) seems to be very closely allied, and indeed there appear to be several African species to which Lefèvre's description partially but not entirely applies. Specimens received some time ago from Mr. Marshall, who obtained them in Mashonaland (Salisbury), agree almost entirely with Lefèvre's description of his *C. abyssinica*, but the male in my possession has not the strongly developed mandibles of which the author speaks. On the other hand, the present species agrees in this respect, but the thorax is much shorter and decidedly not rugose and confluent punctate, so that I cannot identify the species with that of Lefèvre. The apical elytral spot is only present in the female of *C. pubifrons*, and scarcely indicated in the other sex.

PEPLOPTERA APICATA, sp. n. (Plate XX. fig. 3.)

Black, the basal joints of the antennæ and the tibiæ and tarsi fulvous; thorax sparingly punctured, the anterior and lateral margins, as well as a central short stripe, flavous; elytra finely punctured, flavous, an angular narrow band near the base, interrupted at the suture, and a broad transverse band near the apex black, the latter part more or less fulvous.

Length 10 millim.

Of broad and robust shape; the head black, finely rugose and closely pubescent, the vertex swollen; eyes large, oblong, slightly emarginate at their lower portion; palpi fulvous; antennæ not extending to the base of the thorax, black, the basal five joints fulvous, second and third joints very short, the apical joints strongly transverse; thorax twice as broad as long, narrowed anteriorly, the sides straight and oblique, the median lobe distinct, broad and truncate, the surface finely and sparingly punctured near the base, more strongly so at the sides, the base with a transverse, strongly punctured depression at the middle; the disc black, very shining, a short central stripe dividing the black portion anteriorly, and the anterior and lateral margins very narrowly, pale flavous; scutellum black, its apex truncate; elytra finely punctured in irregular rows, which are nearly indistinct near the apex, flavous, a strongly angular band (which consists of two joined spots, of which one is placed on the shoulders, the other within the latter), near the suture but not extending to it, black; another very broad black band is placed below the middle across the elytra, including at the apex a transversely shaped fulvous or flavous spot; below densely clothed with silvery pubescence; the tibiæ and tarsi fulvous, the latter very broad in the male insect; last abdominal segment in the same sex emarginate at the middle, in the female provided with a deep oval fovea.

Hab. Salisbury, Mashonaland (*G. Marshall*).

Allied to *P. hæmorrhagica* Gerst., but quite distinct in the fine elytral punctation, the abbreviated humeral band and the great width of the posterior one, also in the markings of the thorax; in regard to this I may add to the description that the flavous anterior and lateral stripes are bounded by the extreme black edges of the thoracic margins. *P. abyssinica* Lefèv. seems also closely allied, but the description says nothing of an anterior flavous margin, and gives only a black humeral spot, not an angulate band, nor are the tibiæ described as fulvous. I have received several specimens of this handsome species from Mr. Guy Marshall.

PEPLOPTERA LEFÈVREI, sp. n.

Subcylindrical, black; thorax flavous, sparingly punctured, the disc with a broad black band; elytra flavous, rather regularly punctate-striate, a spot on the shoulders and a transverse band near the apex, as well as the extreme apical margins, black.

Length 7 millim.

Head black, the vertex strongly swollen, longitudinally sulcate at the middle, the space between the eyes strongly punctured and slightly rugose, non-pubescent; the antennæ not extending to the base of the thorax, black, the second and third joints fulvous; thorax twice as broad as long, but little narrowed in front, the sides nearly straight, the median lobe broad, not much produced, and preceded by a distinct transverse depression, the surface with a few fine punctures near the base and the posterior angles, fulvous; the middle of the disc occupied by a broad subtriangular black patch, which extends to the anterior margin, where it is greatly narrowed; scutellum small, black; elytra flavous, with regular rows of fine punctures, which become a little more confused at the sides and near the apex, the interstices rather closely and very minutely punctured, the shoulders with a black spot, a transverse narrow black band of somewhat irregular shape is placed below the middle, extending to the sides in some instances, but interrupted in others; below and the legs black, closely covered with silvery pubescence; tarsi broad and rather robust.

Hab. Delagoa Bay.

In spite of its great similarity in coloration to *P. angustata* Erichs., *P. cylindriciformis* Lac., and one or two other African species, the punctation of the elytra does not permit me to identify *P. lefèvrei* with either of these; the elytral rows are fairly regular and more distantly placed than in the named species, and the interstices are likewise finely punctured; in the allied forms the punctation is almost always close and irregular and that of the thorax more distinct. The species would find its place amongst Lacordaire's group in which the tarsi are broad.

PEPLOPTERA SEMIFASCIATA, sp. n.

Black, the tibiæ and tarsi fulvous; thorax strongly and sparingly punctured, fulvous; elytra strongly, closely, and semiregularly

punctate, fulvous; a spot on the shoulders, another near the scutellum, and a transverse curved band below the middle, black.

Length 6 millim.

Head black, sparingly punctured at the vertex, the space round the eyes rugosely punctate, the clypeus more strongly punctured; antennæ not extending to the base of the thorax, black, the second and third joints more or less fulvous, the following joints of strongly transverse shape: thorax twice as broad as long, subcylindrical, the sides rounded, strongly and closely punctured, the disc more remotely so, fulvous; scutellum black; elytra parallel, subcylindrical, distinctly lobed below the shoulders, not covering the pygidium, the punctuation like that of the thorax, closely placed in irregular rows, the shoulders with a small black spot, another larger one near the scutellum; a broad, slightly curved band is placed below the middle, its upper margin being highly convex and its lower one concave; below and the pygidium densely covered with silvery pubescence; legs fulvous, the femora blackish.

Hab. Headlands, Mashonaland (*G. Marshall*).

Allied to *P. punctata* Jac., but smaller, the elytra more strongly punctured and with a broad posterior band instead of two spots, the tibiæ and tarsi fulvous, not black.

PEPLOPTERA ANCHORALIS, sp. n.

Black, closely pubescent below, anterior and lateral margins of the thorax fulvous, the latter very minutely punctured; elytra more strongly punctate-striate, fulvous, an elongate humeral stripe, and a sutural band from the middle downwards, connected with an elongate spot near the apex, black.

Length 8 millim.

Head black, closely punctured and rugose near the eyes, the latter very large; antennæ not extending to the base of the thorax, black, the lower four joints fulvous, basal joint black above, closely pubescent; thorax about one half broader than long, the anterior margin a third shorter than the basal one, the sides nearly straight, anterior and posterior angles distinct, the posterior margin roundly produced at the middle, the surface very finely and somewhat closely punctured, with a distinct transverse groove near the median lobe, more strongly punctured than the rest of the surface, the latter black, in shape of a broad transverse band, the anterior margin of which is deeply indented at the sides and at the middle, this band leaves the lateral and anterior margins of the flavous ground-colour; scutellum triangular, black; elytra with strongly produced lateral lobes, regularly and moderately strongly punctate-striate, fulvous, or flavous the suture from before the middle to the apex in shape of a medially narrowed band, an ovate spot near the apex touching this band, and a short slightly oblique elongate band on the shoulders, black; this latter band terminates exactly where the sutural band begins; below and the legs black, closely covered with silky silvery pubescence; tarsi broad.

Hab. Salisbury, Mashonaland (*G. Marshall*).

Closely allied to *P. humeralis* Jac., likewise from Mashonaland, but differing in the black disc of the thorax and in not having a black stripe at the lateral margins of the elytra; the latter in *P. humeralis* have the sutural band also extending higher upwards and not ending abruptly truncate as in the present insect. *P. schimperi* Lefèv. and *P. abyssinica* Lefèv. are likewise closely allied; but the first-named species is described as having the anterior angles of the thorax fulvous only, in having a broad transverse elytral band near the apex, and a subquadrate, not elongate, humeral spot. *P. abyssinica* has similarly coloured elytra, rufous tarsi, and is smaller. Of the present insect three specimens have been sent by Mr. Marshall, of which one has the elytral spots widened into a broad band like Lefèvre's last-named insect, but the tarsi in all are black; it may, however, possibly be a variety of that insect.

GYNANDROPHALMA SUBRUGOSA, sp. n.

Entirely dark metallic blue; antennæ black; thorax strongly transverse, impunctate; elytra very strongly and closely punctured, the interstices irregularly rugose.

Length $5\frac{1}{2}$ –6 millim.

Elongate and parallel, the head nearly impunctate, with a few oblique strigæ between the eyes; the latter large, very slightly indented at their lower portion; epistome with a few punctures, triangularly emarginate at its anterior margin; antennæ black, the basal joint metallic blue, the second and third very short, obscure fulvous, the others strongly transverse; thorax twice as broad as long, slightly narrowed in front, the sides rounded, with a distinct but narrow reflexed margin, the median lobe broadly produced, posterior angles rounded, the disc impunctate, with a short transverse depression at each side; scutellum broad, its apex truncate; elytra feebly lobed below the shoulders, closely and strongly punctured, the interstices transversely rugose, less strongly so towards the apex; below very sparingly pubescent; the legs rather elongate, the first joint of the tarsi slightly longer than the second.

Hab. Cape. (Two specimens in my collection.)

G. aspatina Gerst. seems to be a closely allied species, but is described with finely and remotely punctured elytra, which cannot possibly be applied to the present species, in which these parts are distinctly rugose and strongly punctured.

GYNANDROPHALMA MARGINICOLLIS, sp. n.

Black, finely pubescent below; thorax transverse, impunctate, the extreme lateral margin fulvous; elytra finely punctured, fulvous, a spot on the shoulders, a larger one near the suture at the middle, and a transverse band below the latter, black.

Length 5 millim.

Of narrow, elongate and parallel shape; the head black, very

finely and sparingly punctured and clothed with single grey pubescence; the clypeus not separated from the face, its anterior margin concave; eyes large, ovate; antennæ extending to the base of the thorax, dentate from the fourth joint, black, the lower three joints fulvous; thorax twice as broad as long, the sides and the posterior angles rather rounded, the median lobe but slightly produced, the surface entirely impunctate, black, shining, the extreme lateral margin fulvous; scutellum black, pointed, broad at the base; elytra finely and rather closely punctured, fulvous, the shoulders with a small black spot, a larger round spot is placed near the suture at the middle, and a transverse short band, concave at its lower margin, at some distance from the apex, this band does not quite extend to either margin; the breast and abdomen black, clothed with grey pubescence; legs rather slender as well as the tarsi.

Hab. Ibembo, Congo (*Duvivier*). (Coll. Belgian Mus. and my own.)

The coloration of the thorax and that of the elytra will at once assist in the recognition of this species, of which I have seen two specimens, which were formerly contained in the collection of the late A. Duvivier. The species seems closely allied in coloration to *G. foveiceps* Lac., but is of more narrowly elongate shape, and the thorax is not fulvous but black.

COPTOCEPHALA FALKENSTEINI Karsch, Berl. ent. Zeitsch. 1882, p. 396.

This species is a true *Peploptera* and must be placed in that genus, as several specimens which I received from German East Africa have proved to me.

CRYPTOCEPHALINÆ.

CRYPTOCEPHALUS ORNATICOLLIS, sp. n.

Flavous, terminal joints of the antennæ black, the head and thorax dark fulvous, the latter with the sides and two basal spots flavous; elytra regularly punctate-striate, flavous, a spot on the shoulder, another near the middle, and a transverse narrow band near the apex, black.

Length 5 millim.

Of robust, posteriorly slightly narrowed shape; the head dark fulvous or piceous, finely and closely punctured; antennæ long, black, the lower five joints flavous, terminal joints elongate and distinctly widened; thorax twice as broad as long, strongly narrowed in front, the sides greatly deflexed, the lateral margins rounded at the middle, the surface very minutely punctured, the disc piceous or dark fulvous, the anterior margin narrowly, the sides more broadly and two large oblique spots at the base, flavous; scutellum broad, its apex rounded, flavous, the base narrowly black; elytra distinctly narrowed posteriorly, strongly and regularly punctate-striate, flavous, the interstices flat and impunctate, the

basal margin very narrowly, a spot on the shoulders, another near the suture at the middle, and a narrow transverse irregular-shaped band near the apex black, the extreme lateral margin posteriorly dark fulvous; below and the legs flavous; abdomen darker; the anterior legs rather elongate, their tarsi very broad.

Hab. Delagoa Bay (*G. Marshall*).

Of this species I received three specimens from Mr. Marshall which show no differences of any importance. There are not many African species of the present genus which have a similarly marked thorax, the nearest being perhaps *C. denticulatus*; in the present species, however, the dark portion of the thorax is not black but dark fulvous or piceous; the number and position of the elytral spots also differ from any of its allies.

CRYPTOCEPHALUS SEVERINI, sp. n.

Black, above and the legs flavous, vertex of head black; thorax impunctate, with five black stripes; elytra finely and irregularly punctured, with a subsutural and lateral black longitudinal band, the latter divided.

Length 8 millim.

Broad and robust; the head impunctate, slightly depressed, flavous, the vertex with a narrow transverse black band; eyes very broadly emarginate; clypeus concave at its anterior margin; antennæ not extending to the middle of the elytra, flavous, the terminal five joints widened; thorax subcylindrical, with strongly deflexed sides, the middle widened, the surface entirely impunctate, flavous, with five equally distant black spots or bands, the middle one narrow and extending from the base to the apex, the others much shorter and abbreviated at each end, the outer one the shortest and placed on the lateral margin; scutellum black, broad, its apex truncate; elytra not wider at the base than the thorax, slightly constricted at the sides near the middle, the punctuation very fine, placed in double rows near the suture, but irregularly at the sides, the last row placed at some distance from the lateral margin, the latter likewise accompanied by a stronger row of punctures; each elytron with two longitudinal black bands, the first placed near the suture of slightly oblique direction, abbreviated below the middle, the other placed on the shoulder, interrupted at the middle and not extending much further than the subsutural band; underside black, clothed with very short pubescence, the coxæ and the last abdominal segment flavous at the base; pygidium flavous with a central black spot; prosternum broad, pubescent, its base produced at the angles into a blunt point.

Hab. Loulouabourg, Congo. (Coil. Belgian Mus. and my own.)

One of the largest African species, and easily recognized by the system of its coloration.

CRYPTOCEPHALUS STRIGICOLLIS, sp. n.

Obscure fulvous; antennæ (the basal joints excepted) black; thorax fulvous, closely longitudinally strigose; elytra strongly

punctate-striate, the interstices convex, flavous, a broad transverse band at the base and another near the apex black.

Length 4 millim.

Head fulvous, impunctate, slightly uneven, the eyes nearly continuous at the vertex; antennæ extending beyond the middle of the elytra, black, the lower four joints flavous, the third and the following three joints gradually increasing in length, the terminal ones shorter; thorax twice as broad as long, slightly widened at the middle, fulvous, the basal margin narrowly black, the posterior angles flavous, the entire surface covered with longitudinal fine strigæ without punctures, posterior margin finely serrate; scutellum black, with a fulvous basal spot, its apex truncate; elytra very slightly narrowed posteriorly, deeply and closely punctate-striate, the interstices strongly longitudinally costate, especially so at the sides, flavous, the base with a broad transverse black band, not quite extending to the lateral margins, another similar band is placed close to the apex, leaving the latter of the flavous ground-colour; underside and legs pale fulvous, finely pubescent.

Hab. Moliro, Africa (*Duvivier*).

This is another of those species having the thorax closely strigose, which seem confined to Africa; the other two known species, *C. araticollis* Chap. and *C. natalensis* Jac., are devoid of elytral bands. I received the specimen from the Belgian Museum.

CRYPTOCEPHALUS SALISBURIENSIS, sp. n.

Head and the underside black; thorax impunctate, flavous, with two large black spots; elytra moderately strongly punctate-striate, flavous; a round spot on the shoulders, a sutural transverse spot at the middle, and a transverse band near the apex, black; legs flavous, the femora spotted with black.

Length 5 millim.

Head black, distinctly punctured and sparingly pubescent; the clypeus and the sides of the face below the eyes yellow; antennæ slender, black, the lower five joints flavous, the basal joint black above; thorax with the sides straight or nearly so, otherwise of usual shape, the basal margin near the anterior angles distinctly toothed, the surface impunctate or with a few minute punctures, fulvous, with a large black oblong spot at each side, not extending to the anterior margin, the extreme basal margin likewise black, the other margins of the ground-colour; scutellum black; elytra rather finely punctate-striate, the interstices with some extremely fine punctures, flavous, the shoulders with a black oblong spot, the suture at the middle with another transverse short spot, a transverse band extending across the suture but not quite to the sides is also placed near the apex; below black, the prosternum, mesosternum, and a spot at the base of the abdomen yellow, the posterior angles of the prosternum prolonged laterally; femora with a black spot at the middle.

Hab. Salisbury, Mashonaland (*G. Marshall*).

This species seems more nearly allied in coloration to *C. erythromelas* Suffr. than to any other, but differs in the anterior sutural spot and posterior band, which both extend across the suture; the legs also are flavous and not black; the prosternum agrees very nearly with that of *C. v-nigrum*. Two exactly similar specimens were sent by Mr. Marshall.

CRYPTOCEPHALUS FLAVO-ORNATUS, sp. n.

Flavous, the apical joints of the antennæ black, above fulvous; the thorax impunctate, the lateral margins and a central longitudinal stripe flavous; elytra rather closely punctate-striate, the interstices minutely punctured.

Length 4-4½ millim.

Of parallel, subcylindrical shape, the head with a distinct central longitudinal sulcus, sparingly punctured, fulvous, the space near the eyes flavous; the latter reniform, broadly emarginate at the middle; antennæ comparatively short and robust, black, the lower five joints flavous, second and third joints short, equal, terminal joints robust and strongly widened; thorax twice as broad as long, very convex, the sides nearly straight, the surface entirely impunctate, with a distinct oblique depression at the base on each side in front of the scutellum; the disc fulvous, interrupted by a narrow central flavous stripe from the base to the apex, the sides likewise narrowly, and the posterior angles more broadly flavous, extreme basal margin black; scutellum flavous, its apex truncate; elytra parallel, closely and rather strongly punctate-striate, the punctures somewhat closely placed and smaller towards the apex, the interstices finely punctured; the epipleuræ at the base, the underside, and the legs flavous; the pygidium rugosely punctured.

Hab. Salisbury, Mashonaland (*G. Marshall*).

This species was obtained, according to Mr. Marshall, on Mosasa; it will not be difficult to recognize it on account of its uniform coloration of the elytra and the flavous markings of the thorax. I am not acquainted with any other African representative of the genus with which it may be compared in this respect; in some specimens the extreme sutural and lateral margins are stained with flavous.

CRYPTOCEPHALUS V-NIGRUM, sp. n.

Black; the basal joints of the antennæ, the tibiæ more or less, and the thorax at the sides and middle, flavous; thorax extremely finely punctured; elytra strongly punctate-striate, flavous, a spot on the shoulder, another near the scutellum, and two subquadrate, connected spots in shape of an inverted V below the middle, black.

Length 5 millim.

Head entirely black, strongly punctured and sparingly pubescent, slightly depressed between the eyes; the antennæ scarcely extending to the middle of the elytra, filiform in the male, shorter and the terminal joints thicker in the female insect, the lower five joints

flavous, the others black; thorax rather strongly widened at the middle, extremely minutely and rather sparingly punctured, only visible under a strong lens, the sides feebly rounded, the posterior margin with some strongly marked teeth near the angles and preceded by a deep subquadrate fovea—the disc either black, with the anterior margin narrowly, the sides more broadly and angularly flavous, and a similar coloured spot at the middle of the base (*mas.*); or flavous, with a broad anteriorly divided band, not extending to the margins, on each side, and the margins themselves narrowly, black (*fem.*); scutellum black; elytra very slightly narrowed posteriorly, regularly and strongly punctate-striate, flavous, rather opaque in the male, more shining in the other sex, the shoulders with an elongate black spot, a smaller one of rounded shape is placed near the scutellum, and two subquadrate spots, which are joined together anteriorly, below the middle, the sutural and apical margins are likewise narrowly black; the underside and the femora black; tibiæ robust and widened anteriorly, fulvous, the outer margin of the anterior tibiæ and the base of the four posterior black, tarsi fulvous; prosternum prolonged laterally at the base into points, flavous, the apex of the mesosternum and a spot between the posterior coxæ likewise flavous.

Hab. Salisbury, Mashonaland, on mimosa (*G. Marshall*).

The markings of the elytra resemble somewhat those of *C. erythromelas* Suffr. and some other African species, but the shape of the posterior angular band is quite different; nor do I know of a similar structure in regard to the thorax, in which the lateral basal teeth are preceded by a distinct notch or fovea; the shape of the prosternum with its prolonged posterior angles is another peculiarity of this species, of which I have three specimens before me.

CÆNOBIUS PLAGIATUS, sp. n.

Black, the antennæ and the legs flavous; thorax impunctate, black, the anterior and lateral margins and two basal spots flavous; elytra very finely punctate-striate, black, a broad transverse band before the middle and another at the apex flavous.

Length $1\frac{1}{2}$ millim.

Of narrow, cylindrical shape; the head black, impunctate, the eyes widely separated, not strongly emarginate, parts of the mouth and the antennæ flavous, the latter short, with the sixth and the following two joints strongly dilated (the rest wanting); thorax twice as broad as long, the sides feebly rounded, narrowed towards the apex, the surface impunctate, black, very shining, the anterior margin very narrowly and the lateral ones more broadly flavous, the base with two other bright flavous transverse spots, only separated by a thin stripe of the ground-colour; scutellum broad, pointed at the apex, black; elytra not wider at the base than the thorax, scarcely perceptibly punctate-striate, the striæ widely separated, the black portion divided by a broad transverse bright flavous band, which surrounds the shoulders at the outer margin and does not quite extend to the suture, this band is placed before

the middle and of slightly oblique shape, another broad transverse band occupies the apex of both elytra; below black; the legs robust, flavous, as well as the prosternum and mesosternum, the former longer than broad, its base deeply concave, the sides raised into narrow ridges.

Hab. Port Alfred, South Africa (*Rev. J. O'Neil*).

Of this very pretty but small species I received a single example; like several of its congeners at present placed in this genus, the eyes are not approached or contiguous, but the prosternum agrees with the typical forms.

ACHÆNOPS (?) PUNCTICOLLIS, sp. n.

Yellowish white, the terminal joints of the antennæ and the breast and abdomen black; thorax very closely punctured, with or without piceous transverse bands; elytra strongly and semi-regularly punctate-striate, a spot on the shoulders and two near the apex piceous or black.

Var. Thorax without markings, underside flavous.

Length 3-4 millim.

Head broad, yellowish, strongly but not very closely punctured, the vertex with a central black narrow stripe; eyes broadly emarginate; antennæ short and stout, extending to the base of the elytra, the lower six joints pale flavous, the others black, terminal joints, with the exception of the last one, dilated; thorax more than twice as broad as long, the sides rounded, the surface very closely and strongly punctured, yellowish white, with a transverse narrow piceous stripe at each side, sending off branches at right angles to the anterior and posterior margin, another piceous spot is placed at the middle of the base, the basal margin likewise narrowly black; scutellum truncate at its apex, the latter flavous, the base black; elytra subcylindrical, pale yellowish, strongly punctured in irregular rows, of which ten are placed on each elytron, the sutural one being very short, near the apex some of the rows unite in pairs, forming broader spaces between them, all the punctures of piceous colours, a small piceous spot is placed on each shoulder, two others more or less distinct are seen near the apex, the inner one of which is placed rather higher than the other spot; legs pale flavous, the femora with a piceous spot; prosternum widened at the base, strongly punctured; breast and abdomen black.

Hab. Dunbrody, Cape Colony, S. Africa (*Rev. J. O'Neil*), on mimosa-bushes.

This little *Cryptocephalus*, of which I received two specimens, is doubtfully placed by me in *Achænops*, as the structure of the prosternum does not agree with that genus, but I do not consider it desirable to establish another genus on a single species. The present insect has very nearly the general appearance of a *Pachybrachys*; the colour and the system of punctuation is the same, but the antennæ agree better with *Monachus* on account of their shortness and the dilated terminal joints; the prosternum

has its base truncate, not rounded, and the posterior angles are but little produced; in one specimen the thorax is without any markings and the entire underside is flavous, the elytra have also the dark spots less strongly marked.

EUMOLPINÆ.

MICROHERMESIA, gen. nov. (group *Colaspine*).

Oblong; antennæ filiform, eyes entire; thorax transverse, the sides angulate and with a narrow margin; elytra semi-regularly punctured; legs robust, the anterior femora with a minute tooth, tibiæ not sulcate, the metatarsus of the posterior legs as long as the following two joints together, claws appendiculate; prosternum broad, scarcely narrowed between the coxæ, its base truncate; the anterior margin of the thoracic episternum concave.

In its general appearance, the little species for which I propose this new genus resembles *Lefevrea*, but differs in the angulate sides of the thorax, which places it amongst the group *Colaspine*, which up till now had no African representative; the much broader prosternum and the minutely dentate anterior femora separate the genus from *Colaspis* proper; the shape of the thorax agrees better with *Hermesia*, but that genus differs in other details, notably the unarmed femora, although this latter character must be used with caution and only in conjunction with others as a generic distinction.

MICROHERMESIA HIRTICOLLIS, sp. n. (Plate XX. fig. 7.)

♂. Below black, base of the antennæ and the legs fulvous; thorax æneous, closely punctured and finely pubescent; elytra strongly punctured anteriorly, flavous, the middle with a transverse broad cupreous or æneous patch.

♀ (?). Above entirely flavous, with a slight metallic gloss.

Length $2\frac{1}{2}$ millim.

Head æneous or cupreous, closely punctured and sparingly clothed with short pubescence; the clypeus not separated from the face, transverse; antennæ slender, extending to about the middle of the elytra, flavous, the terminal joints slightly stained with fuscous, basal joint much thickened, second and third equal in length, fourth and following joints slightly longer and very feebly thickened towards the apex; thorax twice as broad as long, the sides with a narrow margin and distinctly angulate at the middle, the anterior angles distinctly tuberculate, the tubercle produced and provided with a single seta, the anterior and posterior margins straight, the surface punctured and pubescent like the head; scutellum broader than long, its sides rounded; elytra broader at the base than the thorax, the shoulders angulate, the base with a feeble transverse depression, the surface rather strongly punctured in closely arranged irregular rows, with some more minute punctures at the interstices, flavous, with a slight metallic gloss, the middle of the disc with an irregular, rather ill-defined transverse

cupreous patch, which widens somewhat at the sides, the suture and lateral margins likewise more or less greenish æneous; below nearly black, the legs fulvous; prosternum strongly punctured.

Hab. Salisbury, Mashonaland, obtained by sweeping (*G. Marshall*).

It is probable that the unicolorous flavous specimen represents the female of this species, since the anterior tarsi are more slender and thinner than in the specimens which I look upon as the other sex, but there is only a single individual of the former sex before me.

COLASPOSOMA CONRADI, sp. n.

Metallic green with fulvous gloss, base of the femora flavous, tibiæ fulvous; thorax very closely and finely punctured; elytra strongly and irregularly punctured, with traces of longitudinal lines, the sides strongly rugose in both sexes.

Fem. Elytra with a smooth, rather broad, longitudinal costa near the suture.

Length 6–8 millim.

Head finely longitudinally strigose at the sides of the vertex, the latter sparingly punctured; clypeus more strongly punctate, not separated from the face, but with a small fovea at the base, its anterior margin slightly concave-emarginate; labrum and palpi fulvous; antennæ extending to the middle of the elytra, the lower six joints fulvous, the others black, rather widened; thorax three times broader than long, the sides rounded and with a narrow reflexed margin, the disc closely and finely punctured throughout, with a transverse depression near the anterior margin; scutellum broad, with a few strong punctures; elytra with a fulvous tint, strongly and closely punctured, the punctures arranged in rows near the suture; the interstices smooth and slightly raised near the apex, strongly transversely rugose at the sides, the lateral margin accompanied by two distinctly raised smooth costæ; underside nearly smooth, metallic green, the sides of the abdomen and of the breast fulvous; femora metallic green, their base flavous, tibiæ fulvous, the apex and the tarsi dark æneous; prosternum very broad, clothed with grey pubescence.

Hab. Cameroons (*Conrad*).

This species will not be very difficult to recognize on account of the flavous base of the femora and the strongly rugose sides of the elytra in both sexes; in the female this is, however, still much more pronounced, as well as the elytral costæ. I received two specimens from Dr. Kraatz. *C. antiquum* Har. is a closely allied species, but differs in the much more finely and evenly punctured elytra and in the colour of the antennæ and legs. *C. abdominale* Lefèv. (*lefevrei* Baly) is described with testaceous antennæ and legs, but seems otherwise closely allied.

COLASPOSOMA ALUTACEUM, sp. n.

Dark æneous, finely pubescent, the antennæ and tarsi piceous;

head and thorax finely and closely punctured, the latter with a smooth central line; elytra extremely finely punctured and wrinkled, clothed with short silvery pubescence.

Length 5 millim.

Of obscure brownish-æneous colour, the head finely and sub-remotely punctured; the clypeus not separated, punctured like the head; labrum piceous, lower joints of the palpi fulvous; antennæ short, not extending to the middle of the elytra, dark fulvous, the basal joint stained with æneous, terminal joints distinctly thickened, each stained with fuscous at the apex; thorax strongly transversely convex, the sides rounded, the surface closely and finely punctured throughout, clothed with very short white pubescence, the middle of the disc with a smooth central narrow space, all the margins very narrowly metallic cupreous; scutellum much broader than long, its apex blunt, the surface with a few punctures, the margins cupreous; elytra not wider at the base than the thorax, very slightly depressed below the base, opaque, extremely closely punctured and finely wrinkled, the interstices with still smaller punctures and clothed like the thorax with short whitish pubescence; underside and femora dark æneous and sparingly pubescent; tibiæ dark fulvous.

Hab. Pinetown, Natal.

This is the description of the male insect, which has the anterior legs as usual longer than in the female; this and the rather less broad thorax, however, are the only visible differences between the two sexes. *C. alutaceum* differs from the other pubescent species of the same country in the finely punctured and wrinkled elytra and the short white hairs of the upper parts, as well as the very distinct punctation of the thorax. Whether *C. pubescens* Lefèv. is identical with the present species can only be ascertained by comparing the type, as a three-lined description of insects which are so closely allied is of no use whatever, and an abuse of science, which should be, in my opinion, totally ignored with the rest of all such publications; at any rate *C. pubescens* is described with the labrum obscure rufous, and the head, thorax, and elytra densely and very finely punctured, which does not apply to the species before me.

COLASPOSOMA SUBAUREUM, sp. n.

Obscure fulvous with æneous gloss, pubescent, the apical joints of the antennæ black; thorax finely and closely punctured, clothed with long white hairs; elytra with a deep fovea below the base, closely punctured, the interstices transversely rugose throughout and pubescent like the thorax.

Length 5 millim.

Head closely punctured and clothed with rather long white hairs; labrum fulvous; antennæ extending slightly below the middle of the elytra, fulvous, the terminal five joints black; thorax strongly transverse, three times broader than long, the sides rounded, the fine punctation almost entirely covered by longish

white hairs; scutellum broader than long, punctured and pubescent; elytra with a deep fovea below the base, the interior of which is of metallic greenish or brassy colour, the rest of the surface irregularly transversely rugose and pubescent, with two or three narrow raised longitudinal ridges, the most well-marked of which is placed near the suture; below and the legs coloured as the upper surface and closely pubescent.

Hab. Tumbu, Congo.

Of this species one specimen is in the collection of the Belgian Museum and the other in my own. I know of no other *Colasposoma* having such a deep and well-marked elytral fovea in connection with the long pubescence; in *C. foveipenne* Jac., from Madagascar, there is a similar but transversely shaped fovea, but no pubescence, and a totally different sculpturing. The coloration of the present species also is peculiar, being a mixture of obscure fulvous and metallic brassy or æneous. I am at present unable to speak with certainty as to the sex of the specimens before me, but both are probably females. *C. foveatum* Jac. differs in having a transverse elytral cavity and a strongly and remotely punctured thorax.

COLASPOSOMA OBSCURUM, sp. n.

Obscure fuscous with cupreous gloss; antennæ with the second and third joints fulvous; thorax extremely closely punctured and finely reticulate; elytra strongly punctured in closely approached rows, the interstices nearly smooth.

Length 6 millim.

Of parallel shape; entirely obscure æneous or fuscous, here and there with cupreous reflections; antennæ long, black, the first joint below and the following two joints fulvous, terminal joints slightly thickened; thorax more than twice as broad as long, slightly narrowed anteriorly, the sides feebly rounded, the entire surface extremely closely and finely punctured, with the interstices everywhere finely reticulate; scutellum with a few punctures; elytra with a shallow depression below the base, rather strongly and closely punctured in irregular rows, the sides below the shoulders with an elongate depression; femora unarmed; legs nearly black.

Hab. Salisbury, Mashonaland, on *Brachystegia* (*G. Marshall*).

Mr. Marshall has sent two specimens (probably males) of this species, which I cannot identify with any of the numerous other members of the genus: the peculiar coloration, and the almost entire absence of elytral rugosities in connection with the closely and finely punctured and reticulate thorax, will assist in the recognition of the species.

DASYCHLORUS Fairm.

In the 'Bulletin' of the Société d'Entomologique de France for 1898 (p. 19), M. Fairmaire has described what he believes to be a

new genus of *Eumolpide* under this name from the West Coast of Africa. In reading carefully his descriptions of the two species he describes, I can come to no other conclusion than that the supposed new genus is simply a *Colasposoma*, and his species *D. passeti* and *D. varicolor* identical with *Colasposoma pradierei* Lefèv. and *C. fairmairei* Lefèv. respectively. M. Fairmaire compares his genus with *Sybraicus*, to which the species mentioned above bear some superficial resemblance; but as the author makes no mention of the principal characters of his genus, that is the shape of the anterior thoracic episternum and the structure of the tibiæ or claws, one cannot even tell to which section *Dasychlorus* may belong. I may be wrong in my surmise regarding the present genus. In the descriptions of Fairmaire of his two species there is, however, absolutely nothing to distinguish it from *Colasposoma*, and it is certainly remarkable that when describing a new genus of one of the most difficult sections of the Phytophaga an experienced author should not even mention the most important characters without which every clue to its proper place is lost. *Colasposoma pradierei* (the largest species of the genus) and *C. fairmairei* have both been described by Lefèvre as far back as 1877, and are well-known West African species.

MACETES CLYPEATA, sp. n.

Obscure cupreous, clothed with white and fulvous pubescence, antennæ and legs dark fulvous; clypeus deeply emarginate; head and thorax very finely and closely punctured, metallic greenish; elytra of the same colour and sculpture, finely pubescent.

Length 7 millim.

Of broadly ovate, subquadrate shape; of a dark greenish-æneous colour above, and clothed with longish white and brown pubescence; the head closely and finely punctured, with a central groove; the clypeus very deeply and subtriangularly emarginate; the labrum cupreous, the palpi fulvous; the antennæ robust, entirely fulvous, the basal joint cupreous above; thorax nearly twice as broad as long, subcylindrical, extremely closely and rather finely punctured and pubescent; scutellum broader than long, subpentagonal, finely punctured and pubescent; elytra much wider at the base than the thorax, strongly narrowed posteriorly, depressed, with another very feeble depression below the base; below cupreous, the femora fulvous with metallic gloss, clothed with dense white pubescence; the tibiæ and tarsi more or less fulvous, the anterior and posterior femora with a stout tooth, the others unarmed.

Hab. Dunbrody, Port Elizabeth, S. Africa (*Rev. J. O'Neil*).

Of this species I received a single specimen from the Rev. J. O'Neil: it is perhaps nearest allied to *M. albicans* Chap. The species is well distinguished by the deeply emarginate clypeus, the fine and close punctation of its upper surface, and the colour of the pubescence, which is white and brown above, but purely white only below. Chapuis's species is unrecognizable, his description being too brief.

PSEUDOCOLASPIS CUPREOFEMORATA, sp. n. (Plate XX. fig. 4.)

Violaceous-blue, the antennæ, tibiæ, and tarsi black; the femora cupreous; thorax subcylindrical, closely and strongly punctured; elytra punctured like the thorax, with rows of very short, white hairs, distantly placed.

Length 4 millim.

Head coarsely and closely punctured, dark blue; the antennæ entirely black, the terminal five joints strongly dilated, club-shaped; thorax scarcely broader than long, narrowed anteriorly and to a less extent near the base; the entire surface closely and strongly punctured, the punctures round and deep, the middle with a more or less distinct narrow, raised longitudinal space; scutellum subquadrate, its apex truncate, the posterior angles feebly produced, the base with two or three deep punctures; elytra with the shoulders prominent and acute, not depressed below the base, punctured like the thorax, but the punctures rather more closely placed and the interstices finely transversely rugose, sparingly furnished with very short stiff whitish hairs; legs coarsely punctured; the femora with a strong acute tooth, cupreous; the intermediate tibiæ, with the exception of the extreme apex which is more or less cupreous, black; claw-joint very long and slender.

Hab. Salisbury, Mashonaland, obtained by sweeping (*G. Marshall*).

Distinct from all its numerous African allies by its uniform dark blue colour and the cupreous femora, in connection with the strong punctation of its upper surface.

PSEUDOCOLASPIS SEVERINI, sp. n.

Black, sparingly pubescent, thorax finely and closely punctured; elytra finely punctured in semiregular rows near the apex, the interstices clothed with very short, erect, silvery hairs.

Length 4 millim.

Head closely and rather strongly punctured; clypeus broad, subquadrate, scarcely punctured; antennæ black, the lower four or five joints more or less piceous; the second and the following two joints very short, moniliform, the terminal ones strongly thickened and robust, the last longer than broad; thorax rather long, subcylindrical, but slightly narrowed in front, the surface without any perceptible sulci or depressions, closely and strongly punctured, with a smooth narrow middle line; scutellum broad, subpentagonal, impunctate; elytra narrowed posteriorly, not depressed below the base, the shoulders prominent, the surface closely, finely, and irregularly punctured, the punctures slightly more regularly arranged in rows near the apex; the interstices with single short silvery pubescence; femora with a small tooth; underside and legs rather strongly punctured.

Hab. Moliro, Congo (*J. Duvivier*). (Coll. Brussels Mus. and my own.)

There are not many entirely black species of *Pseudocolaspis*

known and only one or two from Africa, of which *P. parvula* Jac. seems closely allied, but is much smaller, of metallic gloss and quite different punctation. Whether the short sparing pubescence of the present insect is normal or whether the specimens before me are rubbed I cannot say, but all agree in this respect.

SCELODONTA SEXPLAGIATA, sp. n. (Plate XX. fig. 5.)

Cupreous, the apical joints of the antennæ black; thorax transverse, finely transversely rugose, with two small white pubescent spots; elytra strongly punctured and transversely wrinkled, each elytron with six white pubescent spots (1.2.2.1); flanks of the thorax and sides of the breast densely clothed with white pubescence.

Length 4 millim.

Head strongly punctured, the interstices with some short white hairs, supra-ocular grooves very deep; clypeus broad, strongly punctured; antennæ proportionately long, cupreous, the apical five joints black, strongly widened; thorax twice as broad as long, the sides strongly rounded, the entire surface covered with transverse rugosities, the sides with a small pubescent white spot; scutellum subpentagonal; elytra wider at the base than the thorax, narrowed posteriorly, very closely and strongly punctured in irregular rows, the sides transversely rugose, each elytron with six white small pubescent spots placed as follows:—one at the middle of the basal margin, one at the lateral margin below the shoulders, another further inwards in a line with the lateral spot, two placed transversely below the middle and slightly oblique, and the sixth at the extreme apex; patches of dense white hairs are also placed at the flanks of the thorax and the sides of the breast; femora armed with a small tooth.

Hab. Malvern, Natal.

I have received several specimens of this very distinct and handsome species from Mr. C. Barker of Natal.

MECISTES CHAPUISI, sp. n.

Black, the basal joints of the antennæ and the legs fulvous; head and thorax finely rugose, sparingly pubescent; elytra strongly and closely rugose-punctate, the interstices with longitudinal rows of short hairs; femora with a small tooth.

Length 4 millim.

Head finely rugose and clothed with short yellowish pubescence; labrum piceous; antennæ scarcely extending beyond the thorax, fulvous, the apical joints more or less infuscate, strongly transverse; thorax subconical, narrowed in front, the basal margin slightly concave at the sides, the median lobe truncate, produced, the surface closely rugose-punctate, the lateral margin rounded at the middle and widened, the disc covered with short yellow pubescence; scutellum pentagonal; elytra much wider at the base than the thorax, ovate and convex, very closely punctured, the interstices slightly longitudinally raised and furnished with rows

of short hairs ; legs fulvous ; all the femora armed with a small tooth.

Hab. Kamozi, Tumbu (*J. Duvivier*). (Coll. Belgian Mus. and my own.)

Unlike the other two or three species of the genus, the present one has armed femora, but agrees in all other details : this and the colour of the legs will easily distinguish the species.

CORYNODES NIGRIPENNIS, sp. n.

Bluish black, the head and thorax rufous, the latter very finely and subremotely punctured ; elytra black, opaque, very closely and finely rugosely punctured, the claws appendiculate.

Length 11 millim.

Of subcylindrical, parallel shape ; the head impunctate, rufous, shining ; the clypeus triangular, deeply separated from the face by a transverse, medially interrupted groove ; antennæ nearly extending to the middle of the elytra, black, the second and third joints fulvous below, the terminal six joints strongly flattened ; thorax of the same shape as in the preceding species, rufous, very shining, extremely minutely and sparingly punctured, the extreme anterior and basal margins black ; scutellum fulvous, margined with black ; elytra closely and somewhat strongly punctured, black, the interstices finely rugose, the extreme apex with a small obsolete fulvous spot ; below and the legs bluish black, the anterior tibiæ strongly curved at the apex.

Hab. Cameroons.

This species, of which I have received a single specimen from Herr Bang-Haas, agrees so closely in structural characters with the following, that I am almost tempted to look at it as an extreme variety of the latter ; but the coloration of the head, thorax, and that of the elytra (unique amongst the numerous members of the genus) is so entirely different, that, in the absence of intermediate forms, I must consider the two insects distinct.

CORYNODES BIMACULICOLLIS, sp. n.

Bluish black below, as well as the legs and antennæ, above fulvous ; thorax impunctate, the anterior and basal margins and two elongate spots on the disc black ; elytra very closely punctured, claws appendiculate.

Length 11 millim.

Head impunctate, fulvous, a small spot at the vertex and the supra-ocular sulci black ; clypeus separated from the face by a deep transverse groove ; antennæ black, the lower two joints fulvous, the apical five joints gradually and broadly flattened ; thorax about one half broader than long, narrowed anteriorly, the sides straight, the surface impunctate, the extreme anterior and basal margins black, the disc with two large, oblique, elongate black spots ; scutellum fulvous, margined with black ; elytra evenly, closely, and distinctly punctured, the interstices slightly wrinkled here and there ; anterior tibiæ strongly curved at the apex.

Hab. Cameroons.

Allied to *C. raffrayi* Lefèv. but differing in the spotted head and thorax and the black not fulvous underside. I have received a single specimen from Herr Bang-Haas.

PSEUDOSYAGRUS AFRICANUS, sp. n.

Piceous, the sides of the thorax and the legs fulvous; thorax closely punctured; elytra fulvous, finely punctate-striate, the punctures obsolete posteriorly, each with an oblique band at the shoulders and another below the middle, black; the anterior femora dilated into a strong tooth, the posterior ones with a smaller one.

Length $5\frac{1}{2}$ millim.

Head finely rugose, obscure fulvous, the middle piceous; the eyes extremely large, closely approached; clypeus not separated from the face, strongly rugose; antennæ piceous, the lower four joints fulvous, the third joint one half longer than the second, terminal joints distinctly thickened; thorax transverse, of equal width, the sides strongly rounded, with a narrow margin, the posterior angles dentiform, the disc closely impressed with strong, round punctures, piceous with a slight metallic gloss, the sides, in shape of a posteriorly narrowed band, fulvous; scutellum triangular; elytra regularly punctate-striate, the punctures entirely obsolete at the apex, the interstices flat and impunctate; a short black oblique band extends from the shoulders towards the suture and another of similar shape is placed below the middle, there is also an indication of a black short stripe near the lateral margins; legs fulvous, the four posterior tibiæ carinate, emarginate at the apex, claws bifid; anterior margin of the thoracic episternum convex; anterior femora with a very strong triangular tooth.

Hab. Matabeleland, near Tati.

This genus was established by Fairmaire on a species from Madagascar. There seems to be scarcely any difference between the present genus and *Tricliona* Lefèv., which was published at the same time and in the same French "Annals"; but which of the genera appeared first in print I am unable to say. *Tricliona* was up to the present only known from India and Sumatra, but both genera agree in most details, especially in the enormously dilated anterior femora. I think, however, that the shape of the thorax is different in *Pseudosyagrus*, the latter being not at all narrowed in front and having strongly rounded sides. There is a single specimen of the present insect contained in my collection, well distinguished by its coloration.

ODONTIONOPA CÆRULEA, sp. n.

Metallic dark blue, antennæ and tarsi black, thorax extremely finely punctured; elytra convex and cylindrical, rather strongly punctured in closely arranged longitudinal rows, the interstices with a few minute punctures, the posterior femora with a distinct tooth.

Length 5 millim.

Head finely punctured, the interstices minutely granulate, the sides at the base of the antennæ raised in shape of a ridge; antennæ filiform, black, the basal three joints more or less fulvous, the first joint metallic blue above, third joint but slightly longer than the second but shorter than the fourth, the following joints slightly thickened; thorax twice as broad as long, slightly narrowed anteriorly, the sides strongly rounded, with a narrow margin, the anterior angles produced into a short tooth, the surface very finely and rather closely punctured and minutely granulate; scutellum subquadrate, truncate at the apex; elytra subcylindrical, much more strongly punctured than the thorax, the punctuation arranged in closely approached rows, the interstices with a few minute punctures here and there, dark violaceous blue, the sutural margin greenish; below and the legs dark metallic blue, finely pubescent, the anterior femora with a very minute, the posterior with a more distinct tooth; prosternum widened at the base, the anterior margin of the thoracic episternum concave.

Hab. Salisbury, Mashonaland (*G. Marshall*).

Allied to *O. discolor* Lefèv., but in that species the labrum, palpi, antennæ, and the legs are brown and the thorax is described as densely punctured; the present insect, on account of the concave margin of the thoracic episternum, the entire tibiæ, appendiculate claws, and other details, possesses all the characters peculiar to the genus.

LEFEVREA BRUNNEA, sp. n.

Entirely pale fulvous, the head and thorax rather strongly and closely punctured; elytra closely punctate-striate, the punctures very fine towards the apex.

Length 3 millim.

Of the general shape of a small species of *Colaspis*; the head finely punctured on each side, the clypeus contiguous with the face, its anterior margin moderately emarginate in the middle and on each side, its surface sparingly punctured; antennæ extending to about the middle of the elytra, fulvous, the intermediate joints sometimes stained with fuscous, the third and fourth joints equal, one half longer than the second joint, terminal ones slightly thickened; thorax twice as broad as long, the sides rounded, the anterior and posterior margins straight, of equal width, the angles acute, the surface closely and somewhat strongly punctured, the punctures more crowded at the sides, the latter with an obsolete depression, scutellum with the sides rounded; elytra not wider at the base than the thorax, convex, punctured in closely approached rows, the punctures themselves scarcely larger than those of the thorax; below and the legs fulvous, the latter unarmed; claws appendiculate; prosternum strongly narrowed between the coxæ.

Hab. Salisbury, Mashonaland (*G. Marshall*).

Distinct from all its allies in the uniform pale fulvous coloration.

LEFEVREA ABDOMINALIS Jac.

Of this species described by myself (Proc. Zool. Soc. 1897, p. 529) both sexes have now been sent by Mr. Marshall, taken by him "in cop." They prove that the male is of totally different coloration to the other sex and of smaller size, but whether this is always the case I have not enough material before me to judge from. I give here the description of the male insect:—

Blackish æneous, the basal joints of the antennæ and the legs more or less fulvous; thorax strongly and somewhat closely punctured; elytra finely punctate-striate anteriorly only, greenish-æneous; a humeral spot of semitriangular shape, flavous.

Length 2 millim.

In comparing the description of the typical form, the female, it will be seen that the latter is larger, devoid of the elytral humeral spots, and that the abdomen is fulvous: these differences are great and peculiar, but there is certainly no difference in the sculpturing between the two sexes, nor in the structure of the antennæ; and if, as I remarked above, the differences between the two sexes are constant, it proves again how important it is to know the sexes in descriptive entomology before one can judge a species with certainty.

LEFEVREA HIRSUTA, sp. n.

Black, the antennæ and legs pale fulvous; thorax strongly punctured and pubescent; elytra more finely punctured in rows, pubescent, flavous, the sutural and lateral margins and a spot near the middle greenish black.

Length 3 millim.

Head blackish, with an æneous tint, sparingly punctured and pubescent, the clypeus not separated from the face, the labrum and palpi fulvous; antennæ entirely flavous or fulvous, not quite extending to the middle of the elytra, the lower joints nearly equal in length, the terminal six joints widened; thorax scarcely twice as broad as long, the sides rounded, the angles not produced, the surface of equal width, dark æneous or greenish, remotely and strongly punctured, the interstices clothed with long pale hairs; scutellum rather broad, piceous; elytra slightly wider than the thorax, subcylindrical, rather finely punctate-striate, flavous, the surface clothed with long greyish-white hair, the sutural and lateral margins dark greenish, the sides with a subquadrate dark greenish spot immediately below the middle and attached to the lateral margin, another similar very small spot is (sometimes) seen within the humeral callus; below black with a slight metallic gloss; legs fulvous, the femora unarmed, the tibiæ not emarginate, the claws appendiculate; prosternum narrow, convex, and truncate at the base.

Hab. Salisbury, Mashonaland (*G. Marshall*).

From the other species of the genus described by me in a previous paper (Proc. Zool. Soc. 1897, p. 527) the present one differs entirely in the long pubescence of the upper surface and in its coloration, but not in structural characters.

SYAGRUS OPACUS, sp. n.

Elongate and parallel, piceous, opaque; the head, antennæ, and tarsi obscure fulvous, head rugose; thorax very closely and strongly punctured; elytra deeply punctate-striate, the interstices subcostate at the sides.

Length 5 millim.

Of entirely opaque colour; the head fulvous, closely and strongly rugose, the clypeus not separated from the face; the labrum and palpi pale fulvous; antennæ slender, fulvous, the terminal joint stained with fuscous, the second joint one half shorter than the third one, the apical joints elongate; thorax about one half broader than long, subquadrate, not much convex, the sides rounded, the surface closely covered with large round punctures which extend to all the margins, the lateral margins slightly crenulate; scutellum broad, smooth; elytra without basal depression, strongly punctate-striate, the punctures closely placed, the interstices subconvex, more strongly so at the sides; below more shining; all the femora armed with a small acute tooth, the apex of the tibiæ and the tarsi more or less fulvous; prosternum concave at its surface, constricted at the middle, rather abruptly dilated at the base.

Hab. Salisbury, Mashonaland, under bark (*G. Marshall*).

Distinct from any of its congeners by the entirely opaque coloration, the fulvous and rugose head, and the almost rugose surface of the thorax. The species seems to approach more *S. rugifrons* Baly than any other, but that insect is of cupreous coloration and has a differently shaped thorax. Of the present species Mr. Marshall has sent three specimens.

SYAGRUS ANTENNATUS, sp. n.

Below obscure fulvous, above flavous; antennæ with joints 6 and 7 and the apical one black; thorax closely punctured; elytra strongly punctate-striate, flavous, the interstices flat; femora with a minute tooth.

Length $3\frac{1}{2}$ millim.

Of subcylindrical shape; the head sparingly and finely punctured, with a deep but narrow sulcus in front of the eyes; clypeus distinctly separated from the face, its anterior edge deeply concave, the surface with a few fine punctures; antennæ extending to about the middle of the elytra, flavous, the sixth and seventh as well as the apical joint black, terminal joints distinctly thickened; thorax subcylindrical, the sides nearly straight, the anterior angles thickened, the surface strongly and rather closely punctured, the punctures extending to the sides and outer margins, but rather less closely placed at the middle; elytra very strongly punctate-striate, the punctures nearly as strong at the apex as at the base, closely approached, their interior more or less piceous in colour; legs robust, the femora with a very minute tooth, the tibiæ deeply emarginate at the apex.

Hab. Dunbrody, Cape Colony (*Rev. J. O'Neil*).

Differing from every other species of the genus in the colour of the antennæ, in connection with the distinctly punctured thorax and very strongly punctured elytra.

IVONGIUS PUNCTICOLLIS, sp. n.

Below black, above metallic dark greenish; legs piceous, the basal joints of the antennæ and the tibiæ flavous; head dark fulvous; thorax rather strongly punctured; elytra strongly punctate-striate; femora unarmed.

Length 3 millim.

Of short, ovate, and very convex shape; the head obscure fulvous, the vertex greenish piceous at the base, the surface impunctate or with a few fine punctures; the clypeus entirely obsolete; the eyes surrounded by a narrow sulcus; antennæ flavous, the terminal four joints black, second joint but slightly shorter than the third, the apical joints very slightly thickened; thorax nearly twice as broad as long, not narrowed anteriorly, the sides straight, the surface closely and rather strongly impressed with round punctures, which leave only a small longitudinal space at the middle smooth; elytra scarcely wider at the base than the thorax, narrowed towards the apex, dark greenish, strongly punctate-striate, the interstices with some minute punctures, convex near the lateral margins, the shoulders acutely raised and slightly obliquely costate, lateral margins reflexed; below blackish; the legs robust, dark fulvous, the femora stained with piceous; prosternum broad, transversely rugose, its anterior margin elevated.

Hab. Mozambique.

The principal characters of *Ivongius*—the unarmed femora and elevated anterior margin of the prosternum—are present in the species described here, of which two specimens are contained in my collection; but the line of separation between the epistome and the head is entirely absent, so that this character used by itself is unreliable as applying to the genus, but it is used by the author (v. Harold) as one of the distinguishing features of *Ivongius*. The dark fulvous head, punctation of the thorax, and colour of the legs will separate this species from any of its allies, which for the most part are inhabitants of Madagascar.

EURYDEMUS MARGINATUS, sp. n.

Pale fulvous, the breast piceous; thorax impunctate; elytra strongly punctate-striate, with basal depression, the extreme sutural and lateral margins black.

Length 4 millim.

Head remotely punctured as well as the clypeus; the latter separated from the face, subquadrate, its anterior margin straight; eyes rather large, distinctly notched; antennæ slender, fulvous, the second joint nearly as long as the third, the following joints elongate; thorax one half broader than long, strongly narrowed anteriorly, the sides oblique, scarcely rounded, the angles dentiform, the surface deflexed at the sides near the anterior angles, entirely

impunctate; elytra slightly broader at the base than the thorax, distinctly depressed below the base, strongly punctate-striate, the punctures diminishing in size towards the apex, the sutural and lateral margins narrowly black; below and the legs fulvous, the breast piceous, the abdominal segments likewise more or less of this colour at the middle, the femora with a strong tooth, the tibiæ longitudinally sulcate; prosternum broad, impunctate.

Hab. Boma, Congo. (Coll. Belgian Museum and my own.)

The eyes in this species are fairly typical of the genus and proportionately large and closely approached; the narrow black margins of the elytra are the principal marks of distinction in this species.

EURYDEMUS MACULIPENNIS, sp. n.

Dark fulvous below, flavous above; head and thorax coarsely punctured, spotted with piceous; elytra strongly punctate-striate, the interstices costate, with three piceous spots at the base and three others, more elongate, below the middle; knees and base of the tibiæ black.

Var. The posterior elytral spots absent.

Length 4-5 millim.

Head very coarsely and closely punctured, flavous, the vertex with a large triangular black patch; clypeus distinctly separated from the face, subquadrate, as strongly punctured as the head; eyes large, rather closely approached, distinctly notched; antennæ fulvous, the basal two or three joints flavous, second and third joints equal; thorax about twice as broad as long, the sides rounded, the angles slightly tuberculiform, posterior margin with the median lobe very slightly produced, the surface flavous, impressed with very strong punctures, which at the sides are partly confluent, the disc with two closely approached irregular-shaped elongate piceous spots, the sides with another round and small spot; scutellum fulvous, small; elytra slightly wider than the thorax, flavous, strongly and closely punctate-striate, the interior of the punctures piceous, the interstices longitudinally costate, especially so at the sides, the second and fourth interstice with a short blackish spot at the base, a similar spot is placed on the shoulders, in a line with these spots are three others, more elongate, below the middle, the innermost of which is much longer than the others; the sutural margin is likewise very narrowly black; the under surface fulvous or piceous; the legs flavous, knees and the base of the tibiæ piceous, the posterior femora with a spine, the others unarmed.

Hab. Boma Sundi, Congo. (Coll. Belgian Museum and my own.)

This is probably a variable species in regard to coloration, of which I have seen two specimens. From other species of the genus it differs in having only the posterior femora armed with a tooth; the very strong punctuation of the head and thorax and the design of the elytra will at once separate *E. maculipennis* from any of its congeners.

EURYDEMUS BREVILINEATUS, sp. n.

Fulvous, the sides of the breast and the knees black; thorax impunctate, the lateral margins and a central spot black; elytra strongly longitudinally costate, the interstices closely punctured, each elytron with two or three short black stripes at the base and one below the middle; femora with a tooth.

Length 6 millim.

Head impunctate, fulvous; clypeus separated from the face by a shallow, transverse, bilobed groove, finely punctured; labrum fulvous, vertex of the head with two small piceous spots; eyes large, rather closely approached, distinctly notched; antennæ slender, fulvous, the terminal joints more or less fuscous, the second joint slightly shorter than the third; thorax twice as broad as long, the sides strongly obliquely narrowed anteriorly, the angles produced into a tooth, the disc entirely impunctate, fulvous, the middle with a short transverse black band, the lateral margins also narrowly black; scutellum fulvous, its apex broadly rounded; elytra with a shallow depression below the base, strongly longitudinally costate, the interstices impressed with closely arranged punctures, the space between the second and third, and the fourth and fifth rows of punctures with a short longitudinal black stripe at the base, another stripe is also placed below the middle in a line with the second basal spot, and the lateral margins are likewise more or less marked with black; below and the legs fulvous, the sides of the breast, the knees, extreme apex of the tibiæ, and the first joints of the tarsi black; all the femora armed with a long tooth.

Hab. Chiloango, Congo. (Belgian Mus. Collection and my own.)

Somewhat similarly marked as *E. maculipennis* Jac., but of double the size, the thorax with a central black spot, and the elytra strongly costate.

RHEMBASTUS GEMINATUS, sp. n.

Below blackish, above æneous; the antennæ, tibiæ, and tarsi obscure fulvous; thorax closely and strongly punctured; elytra subcylindrical, closely punctate-striate, the punctures often geminate, the last interstice longitudinally costate; femora with a small tooth.

Length 4 millim.

Of elongate, subcylindrical shape; the head subremotely and strongly punctured; epistome separated by a narrow transverse groove from the face, closely punctured, its anterior edge deeply emarginate; eyes surrounded by a narrow sulcus; antennæ extending to about the middle of the elytra, fulvous, the second and third joints equal; thorax scarcely twice as broad as long, narrowed anteriorly, the sides rounded, the surface closely, evenly, and rather strongly punctured, the lateral portion rather strongly deflexed, invisible if viewed from above; scutellum broader than long, impunctate; elytra very convex, subcylindrical, not wider at the base than the thorax, with a feeble transverse depression

before the middle, the punctation strong anteriorly, rather finer towards the apex, often irregular and consisting of double punctures, those at the sides deeper and the interstices at the same place rather costate, the last one more strongly so; legs fulvous, the femora darker, mucronate; prosternum with lateral sulci.

Hab. Salisbury, Mashonaland, on mimosa (*G. Marshall*).

The most nearly allied and described species seem to be *R. puncticollis* Har. and *R. natalensis* Lefèv. (sub *Syagrus*): the first named is, however, described as having an opaque thorax and the elytra distinctly broader at the base, with much finer punctures posteriorly; of double rows the author says nothing. Lefèvre's species is described in four lines, and the colour as "brunneo-festaceous" with an æneous gloss; the length is given as 3 millim.: the certain recognition of the species is accordingly an impossibility. *R. micans* Gerst. has a more finely punctured thorax and regularly simply punctate-striate elytra.

RHEMBASTUS AFFINIS, sp. n.

Oblong-parallel, piceous with æneous gloss; antennæ with the apical joints piceous, legs dark fulvous; thorax coarsely punctured; elytra strongly punctate-striate, the interstices slightly convex.

Length 3 millim.

Head rather strongly and closely punctured, with a central longitudinal groove; the clypeus separated from the face, transverse, impressed with a few punctures; eyes preceded by a rather broad sulcus; antennæ scarcely extending to the middle of the elytra, flavous, the terminal two joints piceous, the second and the following four joints equal, the next two slightly dilated, the ninth joint rather thinner, the terminal ones stouter again; thorax transverse, the sides feebly rounded, the anterior margin about one-third less wide than the posterior one, the surface coarsely and rather closely punctured, the punctures extending to all the margins; elytra with a very shallow depression below the base, very strongly punctate-striate, the interstices with some very fine punctures, convex at the sides, the lateral margin preceded by a row of closely placed punctures; legs robust, fulvous, the femora with a very minute tooth; prosternum longer than broad, its surface rugose, longitudinally sulcate at the sides.

Hab. Salisbury, Mashonaland, obtained by beating (*G. Marshall*).

Allied to *R. obscurellus* Gerst. and *R. cylindriciformis* Jac., but distinguished from either by the strong punctation of the thorax and the elytra. The present species greatly resembles *Liniscus natalensis* Lefèv., but the sulcus in front of the eyes and that of the prosternum place the insect in *Rhembastus*, with which it also agrees in other respects.

RHEMBASTUS NIGRIPES, sp. n.

Black below as well as the legs, the lower joints of the antennæ, the head, and the thorax fulvous; thorax closely punctured; elytra

strongly convex, finely punctate-striate, dark metallic blue; femora minutely toothed.

Length 5 millim.

Of robust and strongly convex shape, the head broad, impunctate; the epistome separated from the face, transverse; labrum and palpi fulvous, the eyes surrounded by a narrow sulcus, large, distinctly emarginate; antennæ slender, black, the lower six joints fulvous, second joint thickened, as long as the third joint; thorax twice as broad as long, the sides nearly straight, the angles acute, the posterior margin produced and rounded at the middle, the surface closely and rather strongly punctured; scutellum fulvous; elytra subcylindrical, not depressed below the base, dark metallic blue, finely punctate-striate, each elytron with ten rows of punctures, the first sutural one short, the interstices flat, here and there with a few minute punctures; below and the legs black, shining, the femora with a very small tooth; the prosternum broad, longitudinally sulcate at the sides.

Hab. Salisbury, Mashonaland, on mimosa (*G. Marshall*).

Larger than *R. cyanipennis* Gerst. and *R. recticollis* Jac.; the thorax more strongly punctured and the underside and legs deep black.

RHEMBASTUS UNIFORMIS, sp. n.

Entirely pale fulvous, the apical two joints of the antennæ fuscous; thorax finely and remotely punctured; elytra very finely punctate-striate; femora unarmed.

Length 5 millim.

Head with a few fine punctures and a longitudinal groove at the middle; clypeus separated from the face by a transverse groove, more closely punctured than the head, of transversely subquadrate shape, its anterior margin emarginate; antennæ extending to the middle of the elytra, flavous, the apical two joints fuscous, the second and the following four joints of equal length, the others slightly thickened; thorax twice as broad as long, the sides straight, the posterior margin produced at the middle, oblique at the sides, the anterior margin straight, the disc sparingly covered with fine punctures; scutellum oblong; elytra very convex, finely punctate-striate, the punctures rather irregularly placed, nearly absent at the apex, the suture raised at the posterior portion, preceded by an impressed line; below and the legs pale fulvous.

Hab. Salisbury, Mashonaland, on mosasa (*G. Marshall*).

Much larger than *R. flavidus* Lefèv., of uniform coloration, the thorax much more finely and sparingly punctured, and the femora unarmed.

RHEMBASTUS INTERSTITIALIS, sp. n.

Fulvous, the apical joints of the antennæ black; thorax transverse, distinctly and subremotely punctured; elytra strongly punctate-striate, the interstices extremely minutely punctured.

Length 5 millim.

Head impunctate, with a distinct fovea between the eyes; the clypeus subquadrate, separated from the face by an obsolete transverse groove, impunctate, its anterior edge concave at the middle; eyes distant, notched; antennæ slender, the lower six joints fulvous, the rest black, second joint elongate, nearly as long as the third, terminal joints scarcely shorter; thorax twice as broad as long, narrowed in front, the sides straight, the surface finely and subremotely punctured, impunctate near the lateral margins; elytra moderately strongly punctate-striate, the punctures closely placed, distinct to the apex, the interstices flat, with single very fine punctures; below and the legs fulvous, the femora with an extremely minute tooth.

Hab. Boma, Congo. (Coll. Belgian Mus. and my own.)

Of this *Rhembastus* three specimens are before me, of which one shows a slight metallic gloss at the apex and at the sides of the elytra. The species is no doubt closely allied to *R. striatipennis* Lefèv., *R. flavidus*, and *R. nigritarsis*, but seems to differ from all in the minutely punctured interstices of the elytra, or the sculpturing of the thorax and the impunctate head; the uniformly coloured legs separate the species from *R. nigritarsis*, and the very minute tooth of the femora and other details from *R. collaris* Gerst.

RHEMBASTUS IRREGULARIS, sp. n.

Below black, above dark metallic greenish, the basal joints of the antennæ fulvous; head and thorax closely and finely punctured; elytra strongly punctate-striate near the suture, much more closely and irregularly punctured at the sides.

Length 4 millim.

Head closely punctured, the clypeus not separated from the face, mandibles robust, piceous; eyes surrounded by a very narrow sulcus; antennæ not extending much below the base of the elytra, black, the lower six joints fulvous, terminal joints thickened; thorax twice as broad as long, widened at the middle, the sides obliquely narrowed anteriorly, the surface closely and distinctly but finely punctured; elytra ovate, convex, more strongly punctured, the punctures arranged in more distinct rows near the suture, the others much more closely placed and less regular, all the punctures distinct to the apex; breast and abdomen black; legs with a metallic green or æneous gloss, the tarsi more or less fulvous or piceous; prosternum twice as long as broad, narrowed at the middle, impunctate.

Hab. Boma and Matadi, Congo. (Coll. Belgian Mus. and my own.)

R. irregularis may be separated from any of its congeners by the punctation of the elytra, which differs from other species in not being regular but only partly so; the punctation of the head and thorax will further help to distinguish the species.

HIMERIDA CHAPUISI, sp. n.

Oblong-ovate, convex, below æneous, clothed with white pubescence; above obscure cupreous, covered with white and fulvous scales, forming transverse bands; antennæ black; femora armed with a strong tooth.

Length $4\frac{1}{2}$ millim.

Head broad, covered with white and piceous scales, through which cupreous patches can here and there be distinguished. sparingly punctured, anterior edge of the clypeus deeply emarginate, labrum fulvous, palpi piceous; antennæ not extending much below the base of the thorax, black, the basal joint subquadrately thickened, the following four joints equal, the terminal five strongly widened; thorax rather more than twice as broad as long, the lateral margins distinct at the base only, the median lobe moderately produced, the disc convex, exactly similarly covered with scales as the head, their colour white and dark brown; scutellum densely clothed with white scales, much broader than long, pentagonal; elytra very slightly wider than the thorax, similarly provided with scales, these forming three more or less distinct transverse irregular bands and more densely white patches at the sides and at the apex; legs piceous, clothed with white scales; below densely clothed with white pubescence, the ground-colour (where visible) eupreous; prosternum much broader than long, claws bifid.

Hab. Salisbury, Mashonaland, on mimosa (*G. Marshall*).

The general broadly ovate shape of this insect, its scale-like pubescence, the thickened terminal joints of the antennæ, concave anterior margin of the thoracic episternum, &c. seem to me to place this species in Chapuis's genus *Himera*, changed later by Lefèvre to *Himerida*. The only species of the genus, of which a two-line description is given by the author, seems closely allied to the present one, and it is just possible that the latter is identical with the type; but Chapuis gives the basal joints of the antennæ as ferruginous, which is not the case in the four specimens before me, and says nothing of white scales forming bands, although the latter are sometimes very indistinct; the inner divisions of the claws are very small.

ODONTIOMORPHA, gen. nov.

Body ovately subquadrate, glabrous above; antennæ with widened terminal joints; thorax transverse, with a distinct transverse sulcus; elytra convex, punctured in semiregular rows; femora with a very minute tooth, the intermediate tibiæ emarginate at the apex; tarsi short, triangular; claws appendiculate; prosternum broad, subquadrate, its base truncate; the anterior margin of the thoracic episternum concave.

The only group, according to Lefèvre's or Chapuis's arrangement, which the present small species could enter would be the *Odontionopine*, which contains at present three genera, all inhabiting

Africa. From all of these *Odontiomorpha* is at once distinguished by the distinct thoracic sulcus, a rather rare character amongst the *Eumolpidae*; the terminal short and dilated joints of the antennæ and the emarginate apex of the intermediate tibiæ will further assist in the recognition of the genus. Only a single, very small specimen was sent by Mr. G. Marshall.

ODONTIOMORPHA MINUTA, sp. n. (Plate XX. fig. 6.)

Black, the basal joints of the antennæ and the legs fulvous; above æneous or obscure cupreous; head and thorax closely punctured; elytra strongly punctured in irregular rows, the interstices costate at the sides.

Length 2 millim.

Head finely and rather closely punctured, the clypeus not separated from the face, its anterior edge concave; labrum and palpi fulvous; antennæ scarcely extending to the middle of the elytra, fulvous, the apical five joints black, the second joint scarcely shorter than the basal one and similarly thickened, the third as long but thinner, apical joints widened; thorax strongly transverse, twice as broad as long, the sides strongly rounded, the surface with a distinct transverse sulcus, slightly interrupted at the middle, closely and strongly punctured; scutellum with the apex truncate; elytra strongly convex and slightly widened towards the apex, distinctly transversely depressed below the base, the shoulders prominent, the punctation strong and close, arranged in semiregular lines, the interstices near the lateral margins longitudinally costate; underside black, legs fulvous.

Hab. Malvern, Natal (*G. Marshall*).

PAUSIRIS SUBFASCIATUS, sp. n.

Cupreous, the antennæ and the tibiæ fulvous; head and thorax closely and finely punctured, sparingly covered with white pubescence; elytra finely and semiregularly punctured, with white hairs arranged in two more or less distinct transverse bands at the base and near the apex.

Length 3 millim.

Of ovate posteriorly slightly dilated shape; the head very finely and remotely punctured, the interstices furnished with very short single white hairs; antennæ extending to the base of the elytra, fulvous, the terminal five joints strongly widened; thorax about one half broader than long, the sides rounded, with a narrow margin, the anterior portion not more constricted than the posterior one, the disc punctured like the head, cupreous, the interstices at the sides and at the middle with some longish white hairs; scutellum subpentagonal, closely pubescent; elytra wider at the base than the thorax, shoulders prominent with a shallow transverse depression below the base, more strongly and closely punctured than the thorax, the punctures arranged in irregular rows, the surface with an indistinct band of white hairs at the base and another at the apex cupreous; below greenish-cupreous, sparingly

pubescent; legs fulvous, the femora more or less æneous, unarmed, claws bifid; prosternum broad, subquadrate, punctured and pubescent; the posterior legs widely separated.

Hab. Duubrody, Cape Colony (*Rev. J. O'Neil*).

A good many specimens of this species were kindly sent to me by the Rev. J. O'Neil, who seems to be an ardent entomologist and collector. The insect must come close to *P. rotundicollis* Chap., which is diagnosed in a three-line description, and which says nothing about the colour of the legs nor mentions a pubescence arranged in bands, which can be plainly seen in well-marked specimens; these bands are of uneven shape and the hairs composing them are long; the general colour is a dark cupreous.

PAUSIRIS FUSCITARSIS, sp. n.

Obscure æneous, clothed with white pubescence, the antennæ and the tibiæ fulvous; thorax very finely and closely punctured, with rows of closely arranged pubescence: tarsi fuscous.

Length 3 millim.

Head broad, closely punctured, and clothed with white pubescence, labrum and palpi fulvous; antennæ with the terminal five joints strongly thickened, fulvous, the second joint thicker but scarcely shorter than the third, this and the following three joints more elongate; thorax subglobulose, widened and thickened at the middle, rounded at the sides, the latter with a distinct margin, the surface finely and closely punctured, obscure cupreous, clothed with long whitish hairs; scutellum subquadrate; elytra wider at the base than the thorax, the shoulders prominent, the punctation slightly stronger than that of the thorax, and arranged in close and irregular rows, the interstices closely covered with white hairs, which are likewise arranged in closely approached rows; below and the legs similarly pubescent, the femora distantly placed at the base, unarmed; the tibiæ fulvous, the tarsi fuscous.

Hab. Salisbury, Mashonaland, also Malvern, Natal (*G. Marshall*).

I have seen four specimens of this species, kindly sent by Mr. G. Marshall. It differs from the other described species in the colour of the antennæ and tibiæ and other details.

CHRYSOMELINÆ.

CHRYSOMELA LIVINGSTONI, sp. n.

Below black, above greenish or purplish, head finely punctured; thorax sparingly punctured on the disc, more closely so at the sides; elytra extremely convex, semiglobose, irregularly punctured at the sides, the lateral margins purplish with a short row of deep punctures at the base.

Length 8 millim.

Of strongly convex, semicircular shape, the head very finely punctured; the clypeus nearly impunctate, feebly separated from the face; the antennæ black, the basal joint sometimes fulvous below, the terminal joints moderately thickened, distinctly longer

than broad ; thorax three times broader than long, the sides rounded anteriorly, straight at the base, the anterior margin deeply concave behind the eyes, the surface sparingly punctured at the disc, more strongly and closely so at the sides, purplish ; scutellum small ; elytra semiglobose, the disc metallic greenish, the suture and the sides purplish, the punctures scarcely stronger than those of the thorax, arranged in distant rows near the suture, larger and more irregular at the sides, the lateral margins with a single row of deep punctures to the middle, from there to the apex impunctate, the epipleuræ very broad, purplish ; legs triangularly compressed, the prosternum narrowed anteriorly in shape of a ridge.

Hab. Umkomaas Mts., Pt. Shepstone, Natal (*G. Marshall*).

This species must be closely allied to *C. badeni* Vogel, so far as a diagnosis of four lines will permit one to judge ; there are so many very closely allied species of *Chrysomela* to be found in Africa, that only a detailed description is of any use whatever. *C. badeni* is described as having the posterior thoracic angles obtuse, which is not the case here, where they are very distinct ; this species has also the underside and legs black and the colour of the upper surface is not very pronounced but rather subdued ; in some specimens the lower joints of the antennæ are more or less fulvous ; the sides of the thorax are somewhat strongly widened anteriorly and distinctly broader than the middle portion.

PSEUDOMELA NIGRIPENNIS, sp. n.

Fulvous, the apical joints of the antennæ, the sides of the breast, part of the abdomen, the legs, and the elytra black ; head and thorax minutely punctured ; elytra opaque, silky, with a few minute punctures.

Length 8 millim.

Head very broad, fulvous, sparingly and very finely punctured ; antennæ with strongly dilated apical joints, black, the lower four joints fulvous ; thorax twice as broad as long, the sides rounded, the angles distinct, the disc convex, very finely and remotely punctured ; scutellum broad, obscure fulvous ; elytra rather elongate, of entirely silky and opaque appearance, black, with some very fine punctures when seen under a strong lens, the suture and the epipleuræ with moderately long fulvous hairs ; below and the legs black, the metasternum partly and the last abdominal segment fulvous ; claws simple, the anterior coxal cavities open.

Hab. Cameroons.

This is a species of entirely different sculpturing and coloration than any of its allies, and must find its place in *Pseudomela* according to the arrangement of Weise.

LYGARIA TERMINATA, sp. n.

Below, the antennæ (the basal four joints excepted), the elytra, and the legs black ; head and thorax flavous, the latter very minutely punctured ; elytra finely and closely punctured, the interstices aciculate, the extreme apex flavous ; claws bifid.

Length 8 millim.

Head very finely and sparingly punctured, flavous; antennæ black, the lower four joints flavous, terminal joints strongly dilated; thorax rather more than twice as broad as long, strongly narrowed in front, the lateral margins very feebly, the posterior one very strongly rounded, the disc transversely convex, extremely minutely and rather sparingly punctured, the punctures more distinct at the sides and more closely placed; scutellum flavous, impunctate; elytra not wider at the base than the thorax, but slightly widened posteriorly, very closely and much more strongly punctured than the thorax, the punctures evenly distributed and the interstices aciculate, black, shining, the extreme apex flavous; below black, the prosternum, part of the metasternum, and the last abdominal segment flavous.

Hab. Cameroons.

Distinct in coloration from any of its allies.

Ceralces ornata Baly; *Ceralces spilota* Baly; *Ceralces walleri* Baly.—These three species, of which Mr. Gahan and I have examined the types in the British Museum, have bifid claws and closed anterior cavities, and must find their places in *Lygaria*. *L. mutabilis* Kolbe is identical with *L. spilota* and his variety *bimaculata* with *L. ornata* Baly; *Lygaria robusta* Weise is probably identical with Baly's *L. walleri*.

PLAGIODERA CONGOENSIS, sp. n.

Fulvous below, the antennæ and the legs black, above flavous; thorax with three longitudinal stripes and a spot at the sides piceous, closely punctured; elytra closely and strongly punctured, a transverse angular and interrupted band before and another one below the middle, as well as a spot near the apex, blackish.

Length 7 millim.

Evenly rounded and moderately convex, the head strongly punctured, fulvous at the vertex, with a flavous subquadrate spot between the eyes, the latter distinctly notched, the clypeus raised into a transverse ridge anteriorly; antennæ extending to the base of the thorax, black, the lower four joints more or less flavous below, terminal joints strongly transversely widened; thorax more than twice as broad as long, the anterior and posterior margins parallel, strongly curved, the sides nearly straight, narrowed towards the apex, the angles not produced but distinct, the surface irregularly and rather finely punctured, the punctures of different sizes, more closely placed and larger at the sides than on the disc, the ground-colour flavous, a medially strongly dilated or diamond shaped band at the middle, from base to apex, another narrower band at the sides, interrupted anteriorly, and a small spot near the anterior angles, piceous; scutellum broad, black; elytra evenly, strongly, and closely punctured, flavous, each elytron with an oblique stripe from the middle of the base towards the suture, of greatly angulate shape and connected with a spot at the sides, a somewhat similar band, strongly angulate or dentate, below the

middle, and a spot near the apex blackish, the suture likewise narrowly black; below fulvous, the legs black, the femora more or less fulvous at the base; prosternum narrow, mesosternum transversely subquadrate.

Hab. Zongo, Mokoanghay, Congo. (Coll. Belgian Mus. and my own.)

Of this singularly marked species I received two exactly similar specimens from the Belgian Museum. The eyes are more ovate, less reniform, and more deeply notched than is generally the case in *Plagiodera*, and the whole appearance of the insect resembles more *Chrysomela*, but the shape of the thorax and the short dilated antennæ as well as the prosternum agree with *Plagiodera*; the elytral bands scarcely justify this expression, as they consist of longitudinal irregular-shaped marks partly connected.

MELASOMA QUADRILINEATUM, sp. n.

Testaceous, head piceous, closely punctured; thorax with three longitudinal bands, very closely punctured; elytra strongly and irregularly punctate, the sutural and lateral margins, as well as two longitudinal stripes, black.

Length 6 millim.

Of elongate shape, somewhat depressed; the head very closely and finely punctured, piceous, the parts of the mouth paler; antennæ very short, testaceous, the apical joints darker, slightly thickened; thorax twice as broad as long, narrowed in front, the sides rounded, the surface punctured like the head, the sides with a small fovea, the middle of the disc with a broad longitudinal band, the sides with an elongate oblique spot, black; scutellum impunctate, black; elytra more strongly punctured than the thorax, the punctures here and there arranged in irregular rows, more closely placed and of larger size at the sides, these with a narrow longitudinal costa placed near the lateral margin, a narrow longitudinal stripe placed on the shoulders and nearly extending to the apex, preceded by a similar stripe, as well as the sutural and lateral margins narrowly, blackish; below and the legs testaceous.

Hab. Matabeleland, near Tati.

Of this well-marked species, quite distinct from any of its African congeners, a single specimen is contained in my collection.

HALTICINÆ.

PHYLLOTRETA CAPENSIS, sp. n.

Dark bluish or greenish æneous, the basal joints of the antennæ and the tibiæ and tarsi fulvous; head and thorax strongly and closely punctured; elytra semiregularly punctate-striate, the interstices sparingly and minutely punctured.

Length 2 millim.

Head very finely and closely punctured; the clypeus entirely contiguous with the face, rather convex and broad, punctured like the head; antennæ not extending to the middle of the elytra.

black, the lower five or six joints fulvous, third and fourth joint equal, slightly longer than the second, terminal four joints strongly thickened, about one-half longer than broad; thorax twice as broad as long, the sides moderately rounded, the anterior angles obliquely thickened, the surface minutely granulate, closely and rather strongly punctured; scutellum broader than long; elytra slightly widened towards the middle, the punctures slightly larger in size than those of the thorax, and arranged in somewhat irregular rows, intermixed with other minute punctures, the punctation more distinct anteriorly; underside shining, greenish æneous, the tibiæ and tarsi fulvous; the metatarsus of the posterior legs as long or slightly longer than the following joints together.

Hab. Dunbrody, Cape Colony (*Rev. J. O'Neil*).

From other African representatives of this genus the present species may be known by the arrangement of the punctures in distinct, although irregular and well-separated rows; the structure of the head, which is rather convex and without the slightest separation between the clypeus, will further assist in the recognition of the species, of which I received two specimens.

PHYLLOTRETA UNICOSTATA, sp. n.

Flavous, the breast and abdomen black; thorax minutely granulate, very finely and closely punctured; elytra greenish æneous, strongly and closely punctured in rows, the sides with a longitudinal costa.

Length 2 millim.

Head impunctate, the frontal elevations obsolete, clypeus broadly triangular; antennæ extending to the middle of the elytra, flavous, the terminal four joints fuscous, short, and slightly widened, second and third joint equal, the following four much more elongate; thorax one-half broader than long, distinctly narrowed anteriorly, the sides straight, anterior angles thickened, posterior margin slightly sinuate at each side, the disc very finely and closely punctured, the interstices very minutely granulate, opaque, pale flavous; scutellum broader than long, black; elytra much more strongly punctured than the thorax, the punctures arranged in closely approached, slightly geminate rows, with a single distinctly raised and acute costa extending from the shoulders nearly to the apex; below black; the legs flavous, the posterior femora strongly incrassate; prosternum very distinct.

Hab. Pt. Alfred, South Africa (*Rev. J. O'Neil*).

There will be no difficulty in recognizing the present species, on account of its coloration and the sculpturing of the elytra; the general shape of the species and that of the thorax is typical of the genus, and the terminal short joints of the antennæ are peculiar to the species, of which I have received several examples.

LONGITARSUS SALISBURIENSIS, sp. n.

Elongate-ovate, winged, the head and thorax obscure fulvous, opaque, closely punctured; elytra flavous, punctured like the thorax

in closely approached rows; legs and antennæ pale, the apex of the latter and that of the posterior femora, as well as the breast, black.

Length 2 millim.

Head impunctate, obscure dark fulvous, the frontal elevations absent; antennæ extending somewhat beyond the middle of the elytra, flavous, the terminal joints more or less fuscous, basal joint long and slender, the second slightly longer than the third, not thickened, terminal joints slightly dilated; thorax one-half broader than long, the sides straight, distinctly angulate before the middle, the surface closely and strongly punctured, slightly rugose, opaque, dark fulvous; scutellum piceous; elytra elongate, slightly widened below the middle, the apex rounded, covering the pygidium, the surface strongly punctured in closely approached rows, which are getting much finer towards the apex, the suture very narrowly infusate, the breast black; legs flavous, the tibiæ in the male rather dilated at the apex, the first joint of the anterior tarsi in the same sex greatly widened, the metatarsus of the posterior legs half the length of the tibia; the penis slender and curved, the sides near the apical portion with a distinct margin, the apex moderately pointed, preceded by an elongate cavity.

Hab. Salisbury, Mashonaland (*G. Marshall*).

This *Longitarsus* is so extremely closely allied to our *L. luridus* that I at first identified it with this species, but a close examination reveals some small but distinct and constant differences; these consist in the much longer basal joints of the antennæ in the present insect as well as the equally more elongate terminal joints; the male organ shows likewise differences in structure, inasmuch as there is no medial constriction as is the case in *L. luridus*, the sides also have a distinct thickened margin, and the anterior cavity is longer and larger; in all other respects the species agrees with the last-named species.

APHTHONA OVATIPENNIS, sp. n.

Short and ovate, winged, piceous below, apical joints of the antennæ black; head and thorax fulvous, impunctate; elytra pale testaceous, the suture blackish, the surface finely punctate-striate, the striæ widely placed, indistinct posteriorly.

Length $1\frac{3}{4}$ millim.

Head impunctate, fulvous, the frontal elevations narrowly transverse, the carina strongly raised; antennæ long and slender, black, the lower three joints flavous, the third joint but slightly longer than the second, terminal joints elongate, scarcely thickened; thorax subquadrate, one-half broader than long, convex, the sides straight, angulate before the middle, the disc entirely impunctate, fulvous; scutellum piceous; elytra wider at the base than the thorax, convex, narrowed towards the apex, the surface very finely punctured in somewhat irregular, rather distantly placed rows, which near the apex become obsolete, the interstices with some still finer punctures, a row of

deeper punctures is placed near the lateral margins; below and the posterior femora piceous; metatarsus of the posterior legs as long as the following joints together.

Hab. Salisbury, Mashonaland (*G. Marshall*).

Smaller than *A. durbanensis* Jac., the thorax less transverse, the punctuation of the elytra and the striæ more widely placed, and the whole insect of half the size only and much less robust.

APHTHONA BICOLOR, sp. n.

Below bluish black, the head, basal joints of the antennæ, the thorax, and the legs flavous; thorax transverse, microscopically punctured; elytra metallic blue, strongly punctured in closely approached rows; posterior femora dark blue; abdomen fulvous.

Length 3 millim.

Of elongate, nearly parallel shape; the head impunctate, the frontal elevations strongly raised; the clypeus broadly convex between the antennæ, these extending to about the middle of the elytra, black, the four or five lower joints flavous, the second joint scarcely shorter than the third, the following nearly equal; thorax one-half broader than long, the sides rounded, narrowed towards the apex, the posterior margin feebly rounded, the surface convex, flavous, with some extremely fine punctures, visible only under a strong lens; scutellum black; elytra wider at the base than the thorax, very convex, metallic blue or greenish, the shoulders prominent, the punctures rather strong and arranged in closely approached, somewhat irregular rows, the punctures much finer towards the apex, the interstices somewhat wrinkled; the breast and the posterior femora bluish black; the rest of the legs and the abdomen fulvous or flavous; posterior tibiæ strongly widened and deeply sulcate; the metatarsus as long as the following joints together.

Hab. Headlands, Mashonaland (*G. Marshall*).

Of the same coloration as *A. bohemani* Jac., likewise an African species, but of double the size, and with strong and very closely approached rows of elytral punctures.

APHTHONA MARGINATA, sp. n.

Fulvous, the thorax subquadrate, impunctate; elytra very closely and finely punctured, metallic blue, the lateral margins flavous; apex of the posterior femora piceous.

Length $2\frac{1}{2}$ millim.

Head impunctate, the frontal elevations feebly raised, broadly trigonate, the carina rather elongate, distinct; antennæ extending below the middle of the elytra, entirely fulvous, the second joint one-half shorter than the third, this and the fourth equal, the following joints more elongate and slender; thorax one-half broader than long, the sides feebly rounded, scarcely narrowed anteriorly, the angles distinct, the surface convex, fulvous, impunctate; scutellum black; elytra slightly wider at the base than the thorax, the shoulders prominent, the surface very closely and finely punctured,

metallic blue, the interstices slightly wrinkled, the space near the lateral margins deeply sulcate and flavous, this colour also extending to the apical margins; below and the legs fulvous, apex of the posterior femora piceous, posterior tibia with a distinct spine; the metatarsus as long as the following joints together.

Hab. Angola.

Two specimens of this very well-marked and distinct species are in my collection.

APHTHONA MINUTA, sp. n.

Winged, entirely pale flavous or testaceous, the apical joints of the antennæ black; thorax impunctate; elytra scarcely perceptibly punctured in irregular rows.

Length 1 millim.

Head impunctate, the frontal elevations distinct, bounded above by oblique grooves, carina acute and rather narrow; antennæ two-thirds the length of the body, the lower four joints flavous, the rest black, the second and third joints small, equal, the following slightly longer, terminal joint more elongate and feebly thickened; thorax one-half broader than long, slightly narrowed in front, the sides nearly straight, the surface somewhat depressed, with a very obsolete transverse depression near the base, entirely impunctate; elytra scarcely wider at the base than the thorax, parallel, the apex rounded, the surface with microscopically fine rows of punctures; posterior femora strongly incrassate, tibiæ dilated at the apex; the first joint of the posterior tarsi as long as the following joints together.

Hab. Dunbrody, Cape Colony (*Rev. J. O'Neil*). Many specimens.

One of the smallest species of the genus, perhaps most nearly allied to the European *A. pallida*, but of entirely uniform coloration with the exception of the antennæ; the penis is of parallel shape neither constricted nor widened, and with the apex broadly rounded, ending in a small point.

SERRAPHULA ELONGATA, sp. n.

Elongate, narrowed posteriorly, piceous below, above greenish æneous, the antennæ and the legs (the posterior femora excepted) fulvous; thorax coarsely and closely punctured; elytra closely punctate-striate, the interstices longitudinally costate.

Length 2 millim.

Head impunctate, the frontal elevations trigonate, undivided; the clypeus strongly raised into a triangular ridge, which extends upwards between the antennæ; palpi rather slender; antennæ extending to the apex of the elytra, fulvous, the basal joint moderately long and stout, the second and third short, equal, the following joints gradually elongate and slightly thickened; thorax subquadrate, one-half broader than long, all the margins straight, the angles not produced, the surface closely and strongly punctured; scutellum broader than long; elytra rather long and convex, slightly widened towards the middle, rather pointed towards the apex, the

latter itself rounded, æneous, the punctures strong and closely placed, the interstices, especially at the sides, longitudinally costate; posterior femora piceous, strongly incrassate, the rest of the legs fulvous; posterior tibiæ furnished at the apex with a long styliform process, the sides of which are strongly serrate.

Hab. Port Alfred, South Africa (*Rev. J. O'Neil*).

This is the second species of this interesting genus which I have received from Africa: like the typical form, the present species has the posterior tibiæ provided with a long, slightly curved and serrate prolongation, the tarsi being inserted much above the apex of the tibia, their first joint is extremely elongate and slender, the second one shorter, the claws are simple. (In my original description of the genus the claws are given as appendiculate, but another examination proves this to be incorrect, there is only a slight thickening of the base.) *S. elongata* is very closely allied to the type *S. ænea*, but is of more elongate shape, the antennæ are longer, the thorax is less transverse and the sides are not rounded, the surface is also much more strongly punctured and the elytra more distinctly costate. I received five specimens from the *Rev. J. O'Neil*.

HESPERA NATALENSIS, sp. n.

Black, finely pubescent, the basal joint of the antennæ fulvous; legs flavous; head and thorax finely granulate and punctured; elytra opaque, sculptured like the thorax; apex of the posterior femora piceous.

Length 2 millim.

Head minutely granulate, scarcely perceptibly punctured; frontal elevations and the carina strongly raised, shining, clypens in shape of a transverse ridge; antennæ extending nearly to the apex of the elytra, black, the basal joint more or less fulvous, second very short, third slightly shorter than the fourth, terminal joints elongate and rather thin; thorax twice as broad as long, the sides slightly constricted at the base, nearly straight, the surface sculptured like the head and finely pubescent; elytra very finely transversely wrinkled, clothed with short white pubescence, their base distinctly wider than the thorax; below black, more shining; legs flavous, all the tibiæ mucronate; posterior femora moderately incrassate, their apex black; the metatarsus of the posterior legs as long as the following joints together; prosternum extremely narrow, the anterior coxal cavities open.

Hab. Malvern, Natal (*G. Marshall*).

One of the smallest species of the genus and very closely allied to several Indian forms, at present undescribed. The general appearance of the insect is delicate and suggestive of *Luperus*, but the posterior femora are distinctly incrassate.

HESPERA INTERMEDIA, sp. n.

Entirely black, finely pubescent; thorax closely and finely rugose-

punctate; elytra sculptured like the thorax, clothed with very fine grey pubescence.

Length 3 millim.

Head minutely transversely granulate and sparingly punctured: frontal tubercles strongly marked, transverse; clypeus with an acutely raised central ridge; antennæ long and slender, the third joint twice the length of the second, very slightly shorter than the fourth joint: thorax one-half broader than long, the sides straight, the posterior margin rounded, the disc rather flat, finely rugosely punctured, sparingly pubescent; elytra wider at the base than the thorax, extremely closely rugose-punctate, of a rather finer texture than the thorax and clothed with short, silky, grey pubescence; posterior femora strongly incrassate, black as well as the under surface and the legs.

Hab. Dunbrody, Cape Colony (*Rev. J. O'Neil*).

This species is intermediate in size between *H. africanus* Jac. and *H. natalensis* just described; it differs from both in the entirely black antennæ and legs, also in the sculpturing of the thorax and that of the elytra, which is much more marked and rugose. I received two specimens from the *Rev. J. O'Neil*.

CHIRODICA PUNCTICOLLIS, sp. n.

Black, the head, basal joints of antennæ, and the thorax and legs fulvous; elytra dark blue, like the thorax, very finely and closely punctured and minutely granulate; posterior femora bluish black.

Length 4 millim.

Of elongate parallel shape, the head broad, impunctate, reddish fulvous, the frontal elevations broadly trigonate, divided by a narrow groove; clypeus strongly thickened, narrowly transverse; antennæ robust, extending slightly below the middle of the elytra, black, the lower two or three joints fulvous, basal joint curved and thickened at the apex, second joint short, the third one-half longer, the following more elongate and somewhat dilated; thorax subquadrate, one-half broader than long, all the margins nearly straight, the anterior angles slightly obliquely thickened, the surface somewhat depressed, minutely granulate and finely and closely punctured; scutellum broad, black: elytra dark blue, sculptured like the thorax; breast and abdomen black; legs robust, the anterior four fulvous, the posterior ones more or less piceous; posterior tibiæ with a strong spur, carinate, anterior tibiæ unarmed; the metatarsus of the posterior legs as long as the following joints together; prosternum extremely narrow, the anterior coxal cavities open.

Hab. Salisbury, Mashonaland (*G. Marshall*).

The genus *Chirodica* is of rather peculiar shape on account of the flattened and nearly quadrate thorax; the antennæ seem to vary rather in structure, as they are nearly moniliform and short in *C. chalcoptera* Germ., but much more elongate in the other species described by Baly. The present insect may be known from

C. chalcoptera by the finely punctured and granulate upper surface and the entirely unicolorous blue elytra. Mr. Marshall has sent me three specimens of it.

CHIRODICA FULVICORNIS, sp. n.

Narrowly elongate, black, the antennæ fulvous, the head, thorax, and legs flavous; thorax impunctate, the sides rounded; elytra closely and finely punctured, black.

Length $2\frac{1}{2}$ millim.

Head impunctate, strongly obliquely grooved above the eyes; frontal elevations broad and flattened, apex of the clypeus between the antennæ rather broad, palpi distinctly thickened; antennæ extending to the base of the elytra, entirely fulvous, all the joints, with the exception of the first, short, the terminal ones thickened; thorax one-half broader than long, the sides rounded, the angles distinct, very slightly thickened, the surface entirely impunctate; scutellum black, impunctate; elytra slightly wider at the base than the thorax, very feebly depressed below the base and the scutellum, black, shiny, finely, closely, and evenly punctured; legs rather robust, flavous; breast and abdomen black; the last abdominal segment with a round fovea (σ ?); prosternum very narrow, anterior coxal cavities open.

Hab. West Africa.

Closely allied to *C. wollastoni* Baly, but with the antennæ entirely fulvous and the sides of the thorax rounded, not straight.

JAMESONIA (*THRYMNES*) *FEMORALIS*, sp. n. (Plate XX. fig. 12.)

Oblong, the head, antennæ (excepting the basal joints), the breast and abdomen, and the posterior legs black; thorax fulvous, impunctate; elytra violaceous blue, very minutely and closely punctured; base of posterior femora fulvous.

Length 4 millim.

Head black, impunctate, the frontal elevations trigonate, oblique; clypeus with a long and acutely raised central ridge; palpi black; antennæ extending to about the middle of the elytra, black, the lower four joints fulvous, third and fourth joints equal, each one-half longer than the second, following joints more elongate; thorax one-half broader than long, slightly narrowed anteriorly, the sides and the posterior angles rounded, anterior angles oblique, the surface microscopically punctured, fulvous; scutellum triangular, black; elytra wider at the base than the thorax, elongate, convex, metallic bluish or violaceous, extremely finely and closely punctured; legs fulvous, the apex of the posterior femora, their tibiæ and the tarsi blackish, posterior tibiæ with a long spine; prosternum extremely narrow, anterior coxal cavities open.

Hab. Port Alfred, South Africa (*Rev. J. O'Neil*).

Differing entirely in coloration from the other species of the genus described by Weise and myself. I received eight specimens from the Rev. J. O'Neil.

JAMESONIA NIGRIPENNIS, sp. n.

Black, the lower portion of the face and the thorax reddish fulvous, the latter very minutely punctured; elytra opaque, black, closely and more distinctly punctured than the thorax; legs black.

Length 3 millim.

Head broad, impunctate, the vertex black, the lower portion in shape of a large subquadrate patch, fulvous, frontal elevations very broad; carina rather blunt, anterior edge of the clypeus straight; antennæ robust, extending to about the middle of the elytra, black, the second and third joint small, equal, third and following joints thickened, about twice as long as broad; thorax twice as broad as long, convex, the sides rounded, the posterior angles rather oblique, the surface extremely minutely punctured, reddish fulvous; scutellum black; elytra slightly broader at the base than the thorax, very slightly narrowed posteriorly, black, opaque, closely and finely punctured; below and the legs black, posterior femora strongly incrassate; the tibiæ with a long spine; the metatarsus as long as the following two joints together.

Hab. Dunbrody, Cape Colony (*Rev. J. O'Neil*).

Distinguished by the opaque black elytra, antennæ, and legs, and the colour of the head; the eyes in this species are, however, much more distantly placed than in the other members of the genus, and the posterior angles of the thorax are less rounded: all other characters agree with the typical species.

DECARIA OBSCURA, sp. n.

Below and the legs pale fulvous, above obscure dark fulvous, antennæ (the basal joints excepted) black; thorax extremely minutely, elytra more distinctly punctured, the punctures arranged in very close semiregular rows; antennæ ten-jointed.

Length 2 millim.

Head impunctate, obscure fulvous or piceous, frontal elevations transverse, broad; carina distinct; antennæ closely approached at the base, black, the lower two joints fulvous, second joint very small, third and following joints triangularly dilated, rather broad and robust; thorax scarcely twice as broad as long, the sides rounded, the anterior angles slightly obliquely thickened, basal margin distinctly concave in front of the scutellum, the disc obscure dark fulvous, with a few minute punctures; scutellum broad, impunctate; elytra distinctly wider at the base than the thorax, slightly widened towards the middle and gradually narrowed posteriorly, the apex rounded, the surface convex, subcylindrical, rather strongly punctured in closely approached semiregular rows; posterior femora strongly incrassate; posterior tibiæ with a long spine, their metatarsus as long as the following two joints together.

Hab. Rhobomp, Sierra Leone.

This cannot be *D. tricolor* Weise from the same locality, as the author describes the antennæ as yellowish brown and the elytra as

very finely punctured, with the anterior fourth portion black. Three specimens are before me, which do not differ from each other.

SPHÆRODERMA MASHONANA, sp. n.

Subglobulose, reddish fulvous, the apical joints of the antennæ and the tibiæ and tarsi black; thorax extremely minutely and rather closely punctured; elytra punctured like the thorax, the punctures irregularly placed.

Length 4 millim.

Head impunctate, the clypeus deflexed anteriorly, with a distinct central longitudinal carina; eyes very large; the antennæ extending to the base of the thorax only, flavous, the terminal five or six joints fuscous, subtriangularly dilated, the last strongly pointed; thorax nearly three times broader than long, the sides feebly rounded, with a very narrow margin, the anterior angles rather thickened and obtusely rounded, the posterior margin broadly produced at the middle, sinuate at the sides, the surface closely and very finely punctured; scutellum triangular, pointed; elytra subglobular, evenly and very strongly convex, the shoulders rounded and slightly prominent, the punctures not or scarcely larger than those of the thorax, irregularly distributed and here and there arranged in lines, those near the lateral margins nearly obsolete; elytral epipleuræ extremely broad and concave; legs and the underside fulvous, the coxæ and the tibiæ and tarsi blackish; prosternum elongate, constricted at the middle, strongly punctured.

Hab. Salisbury, Mashonaland, May and October (*G. Marshall*).

Resembling somewhat in size and shape the European *Argopus ahvensis* Gebl., but still more convex, the antennæ very short and dilated, and the punctuation of its upper surface very fine. The present species is the largest of the genus known to me from Africa.

BLEPHARIDA REGULARIS, sp. n.

Subquadrate ovate, fulvous; head and thorax flavous, the latter minutely punctured; elytra strongly punctate-striate, the interstices costate at the sides, with numerous closely placed flavous spots, the lateral margins broadly flavous, spotted with fulvous.

Length $5\frac{1}{2}$ millim.

Head very sparingly and finely punctured, flavous, with a deep semicircular groove in front of the eyes; clypeus broad and flat; antennæ not extending to the middle of the elytra, fulvous, the terminal six joints short and thick; thorax more than twice as broad as long, narrowed anteriorly, the sides nearly straight, the anterior angles thickened, the surface extremely finely punctured, only visible under a strong lens, with two small round depressions near the lateral margins; elytra with ten rows of deep and closely placed punctures, the subsutural one short, the punctures fulvous, the interstices varied at regular intervals with fulvous and flavous

spots, the last interstice near the margins broad, flavous, crossed from the middle downwards with fulvous stripes.

Hab. Africa.

Whether this is the species described by Thuuberg as *Podontia stolidia* I am not certain, the description is not detailed enough to be sure about it; the terminal joints of the antennæ are given as black and the thorax as impunctate; the position and number of the elytral spots are not mentioned. The present species differs from all its African congeners with which I am acquainted in the regular or semiregular numbers of the flavous spots, which form no bands or other pattern, but are distributed evenly and closely on every interstice; I possess three specimens, which show no differences in that respect, but have no exact localities.

DIBOLIA BIMACULATA, sp. n.

Bluish black, above metallic blue, the basal joints of the antennæ flavous; thorax closely semirugose-punctate; elytra finely and closely punctate-striate, each elytron with a fulvous spot near the apex.

Length $2\frac{1}{4}$ millim.

Of convex, subcylindrical shape; the head with a few fine punctures, metallic greenish; clypeus triangularly raised; eyes elongate and large; antennæ scarcely extending to the middle of the elytra, black, the lower five joints flavous, the basal joint stained with piceous above, elongate, slender, the second as long as the third joint, terminal joints gradually and moderately thickened; thorax about twice as broad as long, the sides nearly straight, obliquely narrowed towards the apex, the anterior angles very slightly thickened, the surface irregularly wrinkled, rather finely and closely punctured; scutellum small, triangular, black; elytra very closely and finely punctate-striate, the rows rather irregular here and there; each elytron with a large, subquadrate, slightly oblique fulvous patch near the apex; femora metallic blue; tibiæ and tarsi black, posterior tibiæ strongly widened towards the apex, the edges dentate, the apex with a robust, double-pointed fulvous spur; the metatarsus slender, as long as the following two joints together.

Hab. Malvern, Natal (G. Marshall).

I received a single specimen of this pretty little species from Mr. Marshall.

DIBOLIA AFRICANA, sp. n.

Dark metallic greenish, the antennæ black; thorax strongly and remotely punctured; elytra strongly and very closely punctured in irregular rows.

Length 3 millim.

Head finely and remotely punctured, the eyes widely separated, frontal elevations feebly raised; clypeus convex, triangular; antennæ extending to the base of the elytra, black, the lower three joints more or less stained with fulvous, the second, third, and fourth

joints equal, rather short, terminal joints rather thick; thorax more than twice as broad as long, narrowed in front, the sides feebly rounded, the surface remotely and strongly punctured; elytra widened towards the middle, the punctures about the same size as those on the thorax and arranged in irregular, very closely approached rows, distinct to the apex; below and the legs coloured like the upper surface; the posterior tibiæ strongly widened at the apex, with their edges serrate, the emarginate spur at the apex fulvous, as well as the claws.

Hab. Nairobi, 5500 ft., Kikuyu Forest, Brit. East Africa (Mr. Mackinder). (Type in the Oxford Mus. Collection.)

Of rather more robust appearance than *D. trimeni* Baly, and much more strongly punctured than that species. Differing from *D. intermedia* Baly in the metallic green legs and the black antennæ.

CHÆTOCNEMA SUBATERRIMA, sp. n.

Black, the antennæ, the anterior and posterior tibiæ and tarsi flavous; head impunctate, deeply foveolate near the eyes; thorax extremely finely and closely punctured; elytra deeply punctate-striate, the interstices longitudinally convex.

Length 2 millim.

Head entirely impunctate, blackish, opaque, with a deep longitudinal fovea near the eyes; clypeus separated from the face by a deep groove, very broad, nearly subquadrate, its lower portion furnished with some grey hairs; antennæ extending to the middle of the elytra, entirely flavous, the third to the sixth joints slender, the following joints slightly thickened but elongate, basal joint about one-half longer than the second; thorax about one-half broader than long, the sides slightly rounded, the anterior angles strongly thickened, the surface very minutely, evenly, and closely punctured, the basal margin not accompanied by an impressed line, but with some large punctures at each side; scutellum extremely short, transverse; elytra very convex, subcylindrical, strongly narrowed and pointed posteriorly, the punctures deep, closely placed and regular, distinct to the apex, the interstices convex, especially so near the sides and apex, impunctate, the fourth, fifth, and sixth interstices shortened and joined at the end, from thence to the apex continued into a single costa; the anterior legs flavous, as well as the rest of the tibiæ and tarsi; the femora blackish, the posterior ones very greatly incrassate; underside scarcely punctured; prosternum rugose-punctate.

Hab. Malvern, Natal (*G. Marshall*).

This is one of the few species which show no trace of a metallic gloss, being nearly entirely black; the very convex, posteriorly strongly pointed elytra and their costate interstices, together with the entirely impunctate head, will assist in the recognition of the species.

GALERUCINÆ.

ASBECESTA ORNATICOLLIS, sp. n.

Flavous, the head and the anterior half of the thorax black, the base of the latter fulvous, strongly punctured; elytra finely and closely punctured, testaceous, the base with a narrow, deeply emarginate blue band, another transverse narrow band or spot placed below the middle.

Length 5 millim.

This species, of which two specimens were received by Prof. Poulton from Mr. H. J. Mackinder, who obtained them at Nairobi, Kikuyu Forest, in East Africa, is so closely allied to the following one that it will only be necessary to point out the differences, which comprise the colour of the head and that of the thorax; the sides of the latter also are almost straight, not so strongly rounded anteriorly; the bands of the elytra are very narrow and the anterior one is deeply emarginate, the posterior band still narrower and not quite extending to the suture; lastly, the scutellum is black, not fulvous; the underside seems to be of the latter colour, but the specimens being glued to cards I am not quite certain as to this.

Type in the Oxford Museum Collection.

ASBECESTA ORNATA, sp. n. (Plate XX. fig. 11.)

Flavous, the head and thorax fulvous; elytra finely and closely punctured, flavous, a transverse band at the base and another near the apex dark blue.

Length 5 millim.

Head impunctate, frontal elevations very strongly raised, trigonate, bounded behind by a deep transverse groove; clypeus triangular, strongly swollen; antennæ flavous, the third and fourth joints equal, slightly longer than the second, the following joints gradually widened, robust; thorax nearly twice as broad as long, the sides strongly rounded before the middle, the disc with a deep transverse sulcus, sparingly punctured anteriorly, more closely so within the depression; scutellum fulvous; elytra finely and closely punctured, the punctuation indistinct near the apex, the ground-colour pale flavous, the base with a transverse, rather broad, dark blue band, extending a little way downwards at the sides, with its posterior margin rather deeply indented near the suture, near the apex another equally broad band extends from the lateral to the sutural margin; the sides of the elytra with a rather strongly marked longitudinal sulcation; below pale fulvous, the legs flavous.

Hab. Malvern, Natal (*Barker*); also Mozambique.

I received several specimens of this distinct species from Mr. Barker. A single specimen from Mozambique contained in my collection differs in the shape of the posterior elytral band, which surrounds the sides and apical margins, including a spot of the ground-colour; other differences I am unable to find.

MALACOSOMA VARIIPES, sp. n.

The antennæ, breast, and the legs black, the head and thorax rufous, the latter impunctate, subquadrate; elytra extremely finely punctured, rufous; base of the femora of the latter colour.

Length 6 millim.

Head rufous, impunctate, the frontal elevations transverse, the carina acutely raised, labrum black; antennæ extending below the middle of the elytra, black, the third joint one-half longer than the second, the following joints more elongate, slender; thorax one-half broader than long, the sides feebly rounded before the middle, the posterior angles strongly oblique, the posterior margin rounded, anterior angles thickened, the disc impunctate, or with some microscopically fine punctures, convex, rufous; scutellum obscure piceous; elytra widened posteriorly, convex, of the same colour as the thorax, extremely closely and finely punctured; the breast, the apex of the femora, and the tibiæ and tarsi black; the base of the femora and the abdomen rufous; tibiæ mucronate; prosternum very narrow, the anterior coxal cavities open.

Hab. Natal.

Distinct from every other species of the genus in its system of coloration. Quedenfeldt has described several species as *Malacosoma* from Central Africa; with one of them, *M. deformicorne*, the present insect agrees partly in coloration but not at all in structure; and as Quedenfeldt makes no mention of the state of the cavities nor the mucronate or non-mucronate tibiæ, it is doubtful whether he had a true *Malacosoma* before him; his description agrees far better with a species of *Megalognatha*.

LUPERUS MARSHALLI, sp. n.

Black, the antennæ and the legs flavous; thorax transverse, obsolete sulcate; elytra with a few minute punctures.

Length 4 millim.

Head extremely finely granulate and punctured, when seen under a strong lens, the frontal elevations very distinct, strongly oblique and joined at the apex; clypeus narrow, strongly thickened; antennæ nearly extending to the apex of the elytra, flavous, the second and third joints short, equal, the apical four joints much constricted at the extreme base; thorax nearly twice as broad as long, the sides straight at the base, feebly rounded anteriorly, the angles thickened, the disc with a shallow transverse sulcus, very finely punctured, black, shining; elytra slightly wider at the base than the thorax, punctured like the latter, the punctures scarcely perceptible; below black; the legs long and slender, all the tibiæ mucronate, the metatarsus of the posterior legs very long; prosternum invisible between the coxæ, the anterior cotyloid cavities open.

Hab. Estcourt, Natal, on acacia-trees (*G. Marshall*).

Somewhat resembling our *L. niger*, but with entirely flavous antennæ and legs and the thorax with a shallow sulcus.

SERMYLOIDES UNIFASCIATA, sp. n.

Elongate, fulvous, antennæ (the basal joints excepted) black; thorax transverse, narrowed anteriorly, extremely finely punctured; elytra very closely and distinctly punctured, flavous, the margins, a triangular spot surrounding the scutellum, and a transverse band below the middle black.

Length 5-6 millim.

Head impunctate, frontal elevations broadly transverse, labrum flavous, palpi piceous; antennæ long and slender, extending to about the middle of the elytra, black, the basal three joints fulvous, second joint small, the third, one-half longer, oblique at the apex, the following joints somewhat thickened, the terminal ones more slender; thorax transverse, the sides obliquely narrowed in front, nearly straight, the surface microscopically punctured, fulvous; scutellum fulvous, triangular; elytra convex, nearly parallel, very closely punctured, flavous, the lateral, sutural, and apical margins black, a triangular sutural black spot surrounds the scutellum, below the middle is a transverse band, widened at the suture and at the sides and connected with the black margins, this band encloses a round spot near the apex, of the ground colour; below and the legs flavous, all the tibiæ mucronate; anterior coxal cavities closed.

Hab. Salisbury, Mashonaland, on *Zizyphus* (*G. Marshall*).

This is the second African representative of this genus, the other species, *S. maculata* Jac., having been provisionally placed by me in the genus *Sermyla* (*Trans. Ent. Soc. London*, 1895, p. 333). The present species has lately been sent by Mr. Marshall, and another careful examination proves the two insects with far more right to be placed in *Sermylodes*, which is distinguished by filiform antennæ, incrassate penultimate joint of the palpi, a transverse non-impressed and anteriorly narrowed thorax, in having prolonged elytral epipleuræ, mucronate tibiæ, and an elongate posterior metatarsus, also by a very narrow and convex prosternum and closed anterior cavities; all these characters are present in the two African species, but the antennæ have no incrassate and elongate third joint as is the case with the male in the typical form *S. basalis*. This is, however, a sexual character only, and of no value in classification used by itself. All the species of the genus known until now are inhabitants of the Malayan islands.

MONOLEPTA STRIATIPENNIS, sp. n.

Oblong, very convex; below piceous, above testaceous, the antennæ (the basal joints excepted) black; thorax very short, remotely punctured; elytra with extremely close rows of deep punctures, the interstices slightly convex; legs testaceous.

Length $2\frac{1}{2}$ millim.

Head impunctate, the frontal elevations transverse; antennæ rather long and slender, black, the lower four joints more or less

testaceous, third joint very slightly longer than the second, the following more elongate, terminal joint widened at the middle but not longer than the preceding one; thorax very short, more than twice as broad as long, narrowed anteriorly, the sides straight, the surface rather remotely but distinctly punctured; scutellum proportionally large; elytra strongly convex towards the apex, strongly punctured in regular and very closely approached rows, distinct to the apex, the interstices slightly longitudinally convex, their epipleuræ entirely absent below the middle; underside piceous; legs slender, testaceous, the first joint of the posterior tarsi very long.

Hab. Kurazol, East Africa.

This small species is not difficult to recognize on account of its short thorax and the sculpturing of the elytra, which differs from any species with which I am acquainted.

MONOLEPTA NIGROCINCTA, sp. n.

Flavous, antennæ fuscous; thorax transverse, impunctate; elytra finely and closely punctured, very narrowly margined with black; lateral margins of the thorax obscure piceous.

Length 4 millim.

Head impunctate, the frontal elevations transverse, the clypeus broad; labrum black; antennæ extending slightly beyond the middle of the elytra, fuscous, the lower three joints flavous, second and third joints short, equal, the rest elongate; thorax twice as broad as long, the sides feebly rounded, the angles distinct, posterior margin moderately rounded, the surface convex, impunctate, flavous, the lateral margins piceous; scutellum fuscous; elytra subcylindrical, very finely and closely punctured, the interstices somewhat wrinkled, the extreme margins piceous or black; elytral epipleuræ entirely indistinct below the shoulders, margined with black; below flavous as well as the legs; the anterior tibiæ unarmed, the posterior tibiæ with a long spine, their metatarsus very long.

Hab. Sierra Leone.

Similar in colour to *Candezea dahlmanni* Jac., but the elytral epipleuræ indistinct below the shoulders, the antennæ and the underside of different coloration, and the general size smaller; *C. tenuicornis* Jac. is likewise nearly similarly coloured, but varies also in the same structural differences pointed out, the smaller size, more slender antennæ, pale labrum, and the absence of the thoracic black lateral margins; *C. nigrosuturalis* Jac. has the underside black.

MONOLEPTA EXCLAMATIONIS, sp. n. (Plate XX. fig. 9.)

Fulvous, the head and the intermediate joints of the antennæ black; thorax subquadrate, closely punctured; elytra widened posteriorly, punctured like the thorax, the lateral margins anteriorly, an interrupted longitudinal stripe (widened and abbreviated posteriorly), and a small spot at the apex black.

Length 5 millim.

Head black, opaque, the frontal elevations broad, trigonate, bounded by a transverse groove behind, clypeus with an oblique

row of deep punctures on each side; antennæ long and slender, the lower three joints flavous below, black above, the following five and the last joint of the latter colour, the ninth and tenth pale flavous, basal joint long and curved, club-shaped, second slightly shorter than the third; thorax nearly quadrate, the sides very feebly rounded at the middle, the anterior angles thickened, the posterior margin rounded, the surface crowded with punctures of different sizes, fulvous; scutellum small, trigonate; elytra widened towards the apex, of similar sculpture to the thorax, fulvous, the basal and lateral margins (the latter to below the middle), a short stripe at the middle of the base, followed by a longer stripe placed at the middle of the disc, curved and thickened at its apex, black, between these two stripes another indistinct black line is seen in some specimens as well as a minute black spot at the extreme apex of the elytra; below and the legs fulvous, the knees, base of the tibiæ, and the tarsi more or less piceous; the metatarsus of the posterior legs as long as the following joints together; elytral epipleuræ very broad at the base, indistinct below the middle.

Hab. Verulam, Natal (*G. Marshall*).

A well-marked species and resembling much *M. nigrolineata* Motsch., from Japan, but of different sculpture, the head black, and the colour of the antennæ and legs different.

MONOCIDA INORNATA, sp. n.

Below blackish, above flavous; antennæ black, the lower three joints fulvous; thorax with a few extremely minute punctures; elytra more distinctly but finely and very closely punctured; posterior tibiæ and tarsi black.

Length 5 millim.

Head fulvous, impunctate, the frontal tubercles strongly developed; clypeus in shape of a narrow transverse ridge; antennæ slender, black, the lower three joints fulvous or entirely of the first-named colour, third joint one half longer than the second, fourth twice the length of the third; thorax subquadrate, distinctly narrowed at the base, the sides rounded before the middle, the anterior angles slightly prominent, the surface with a few minute punctures; elytra wider at the base than the thorax, the shoulders prominent, the punctation very close and fine, the epipleuræ continued below the middle; breast and abdomen blackish, the last abdominal segments more or less flavous; femora fulvous; all the tibiæ mucronate, the four posterior ones (the base excepted) and the tarsi black; the metatarsus of the posterior legs as long as the following two joints together; claws appendiculate, the anterior coxal cavities closed.

Hab. Headlands, Mashonaland (*G. Marshall*).

This, the second species of the genus, may possibly be a local form of *M. suturata* Jac. (*P. Z. S.* 1899, p. 370), but the head is fulvous and the elytra have no sutural nor lateral black bands and are more strongly punctured; the constriction of the thorax at the

base, the mucronate tibiæ, and the closed anterior cavities are the principal characters by which the genus may be known.

ESTCOURTIANA, gen. nov.

Oblong, glabrous; the antennæ short, the joints submoniliform; thorax subquadrate, without depressions; elytra irregularly punctured, their epipleuræ continued below the middle; all the tibiæ with a spine at the apex; the first joint of the tarsi as long as the following two joints together; claws appendiculate; prosternum nearly invisible, the anterior coxal cavities closed.

Amongst the genera with closed anterior cavities, the present one seems most nearly allied to *Ergana* Chap., but the antennæ in that genus are filiform and the thorax much more transversely shaped. The only species of the genus here described, known to me, is a small insect of nearly subcylindrical shape which I have received from Natal and Mashonaland.

ESTCOURTIANA BIFASCIATA, sp. n.

Below black, above testaceous, the head partly black; thorax minutely punctured, with a central black band and a lateral spot; elytra nearly impunctate, each elytron with a broad longitudinal black band nearly extending to the apex.

Var. *a*. The elytral bands replaced by an anterior and posterior spot; head fulvous.

Var. *b*. Elytra without any markings.

Length 3 millim.

Head impunctate, black, obliquely grooved above the eyes, the frontal elevations obsolete, oblique; clypeus flavous, rather broad; palpi rather robust, the apical joint conical; antennæ very short, the lower five or six joints flavous, the others fuscous, the third joint about one-half longer than the second, the following joints widened, all very short; thorax one-half broader than long, the sides feebly rounded, the angles acute, the surface very finely and subremotely punctured, with a rather deep fovea near the anterior angles; elytra much wider at the base than the thorax, with some extremely fine punctures near the suture, the rest nearly impunctate, testaceous, a broad black band extends from the middle of the base nearly to the apex; the underside and the femora black, the tibiæ and tarsi flavous.

Hab. Estcourt, Natal, Salisbury, Mashonaland, obtained by sweeping (*G. Marshall*).

The specimens from Natal all belong to the varieties and it may just be possible that they represent a closely allied species, but I cannot find any differences of importance except those of coloration; the thorax is a trifle more transverse in shape and the extreme sutural margin is likewise black: in the variety *a* the elytra have an elongate black spot anteriorly and a rounded one below the middle, thus indicating the direction of the band; in the variety *b* all markings except those of the thorax are absent, these latter

represent a longitudinal central stripe, narrowed at the base, and a lateral small round black spot.

CANDEZEA CENTROMACULATA, sp. n. (Plate XX. fig. 10.)

Fulvous, antennæ and legs flavous; thorax minutely punctured, flavous, with a central black band; elytra extremely closely and finely punctured, flavous, with a broad transverse band at the base and another below the middle black.

Length 5 millim.

Of rather broad and robust shape, the head reddish fulvous, impunctate, the frontal elevations broad, trigonate, anterior margin of the clypeus straight; antennæ extending to the apex of the elytra, flavous, the last joint fuscous, the third joint but slightly longer than the second, the fourth as long as the basal joint; thorax one-half broader than long, the sides and the anterior margin straight, the basal one strongly rounded, the surface very minutely and closely punctured, the middle of the disc with a shallow transverse groove, flavous, with a central longitudinal black band, slightly widened anteriorly and extending from the base to the apex; scutellum black; elytra widened towards the middle, punctured like the thorax, flavous, with a transverse black band at the base, which gradually widens at the sides, to which it extends for about one-fourth of the length of the elytra, another band of more regular shape is placed below the middle, elytral epipleuræ extending below the middle; the breast and abdomen fulvous; the legs flavous; the first joint of the posterior tarsi longer than the following joints together.

Hab. Malvern, Natal (*Barker*).

Distinguished from all other African species placed in this genus and in *Monolepta* by the band of the thorax and the width of the elytral black bands.

CANDEZEA SULCICOLLIS, sp. n.

Entirely flavous, the terminal joints of the antennæ black only; thorax transverse, finely punctured, the disc obsoletely sulcate; elytra punctured like the thorax.

Length $5\frac{1}{2}$ millim.

Head impunctate, the frontal elevations broad and flat, divided by the rather broad posterior portion of the clypeus; antennæ extending to about the middle of the elytra, black, the lower four joints flavous, the second joint scarcely smaller than the third, the following joints elongate and slender; thorax rather more than twice as broad as long, the sides feebly rounded, the posterior margin oblique at the sides, the surface finely and closely punctured, with a transverse sulcus at the middle, more marked at the sides but not extending to the lateral margins, the anterior angles thickened, not produced; elytra wider at the base than the thorax, the shoulders not prominent, the punctation fine and close, the interstices slightly wrinkled, epipleuræ narrow but continued below

the middle; below and the legs flavous; the metatarsus of the posterior legs very elongate, its extreme base stained with black.

Hab. Salisbury, Mashonaland (*G. Marshall*), on *Zizyphus*.

Amongst the smaller uniformly coloured species of this genus there is none in which the thorax has a similar transverse sulcus; this character and the colour of the antennæ will help in the recognition of the species.

CANDEZEA MOLIROENSIS, sp. n.

Fulvous, the antennæ and the thorax flavous, the latter scarcely perceptibly punctured; elytra very closely and distinctly punctured, flavous, a sutural spot at the base, a broad transverse band at the middle, and the lateral and apical margins black.

Length 4 millim.

Of very convex and posteriorly widened shape; the head extremely finely punctured at the vertex, rather broad, the frontal elevations narrowly oblique, clypeus broad, triangular; antennæ fulvous (the last three joints wanting), the third joint double the length of the second; thorax short, more than twice as broad as long, narrowed anteriorly, the sides perfectly straight, the anterior angles oblique, the surface microscopically punctured, flavous, scutellum fulvous; elytra strongly convex, very distinctly, closely, and evenly punctured, their epipleuræ continued below the middle, black, the disc flavous, the suture at the base with an elongate black spot nearly connected with a very broad transverse band at the middle of triangular shape, its greatest width being at the suture, the margins of which it does not quite reach, the shoulders and the entire lateral and apical margins are likewise black; below and the legs fulvous; metatarsus of the posterior legs very long.

Hab. Moliro, Congo. (Coll. Belgian Mus. and my own.)

This *Candezea* much resembles in coloration and otherwise certain varieties of *C. variopennis* Jac. from Natal, but in that species the antennæ, with the exception of the basal joint and the underside, are nearly always black, the head is less broad, the base of the antennæ is more closely approached, and the thorax more distinctly punctured; but for all that the present species may only be another local variety of the very variable insect to which I have alluded.

CANDEZEA O'NEILI, sp. n.

Below and the tibiæ and tarsi black, above testaceous; antennæ fuscous; thorax impunctate; elytra scarcely perceptibly punctured.

Length 4 millim.

Head impunctate, flavous or pale fulvous, the frontal elevations strongly raised and broad, clypeus broad, triangular, with a slightly raised central ridge, labrum piceous; antennæ extending below the middle of the elytra, slender, the second joint short, the third, one-half longer, the following joints very elongate and equal; thorax scarcely one-half broader than long, slightly narrowed at the base and apex,

the sides feebly rounded at the middle, the angles distinct but not produced, the basal margin but slightly rounded, the surface entirely impunctate; scutellum triangular, fuscous; elytra with their greatest width below the middle, wider at the base than the thorax, the surface with some very minute punctures, only visible under a very strong lens; below black or piceous, the femora flavous, the tibiæ and tarsi black, all the tibiæ mucronate; the metatarsus of the posterior legs as long as the following three joints together; elytral epipleuræ continued below the middle.

Hab. Port Alfred, South Africa (*Rev. J. O'Neil*).

Amongst the unicolorous or for the most part flavous species of this genus known from Africa, the present one seems most nearly allied to *C. mashonana* Jac., but is only half the size of that species, which has also a flavous underside, and the metatarsus of the posterior legs much longer; *C. nigrotibialis* Jac. is likewise larger, and the lower joints of the antennæ as well as the underside are flavous and the elytra distinctly punctured; in several other species the tibiæ and tarsi are flavous. I dedicate this species to the *Rev. J. O'Neil*, in recognition of his constant endeavours to explore the entomological fauna of his district.

CANDEZEA LIVINGSTONII, sp. n.

Pale flavous or testaceous, the apical joints of the antennæ and the breast black; thorax finely punctured, obsoletely sulcate; elytra very finely and closely punctured.

Length 3 millim.

Head rather broad, impunctate; clypeus strongly thickened, bounded behind by a deep transverse groove; antennæ extending to the middle of the elytra, the lower four or five joints flavous, the rest black, the second and third joints equal, short, the fourth double the length and equal to the following joints; thorax transverse, twice as broad as long, the sides very feebly rounded at the middle, the posterior margin rounded, the surface with a shallow transverse sulcus at the middle, finely and closely punctured; elytra wider at the base than the thorax, extremely closely and finely punctured, the interstices somewhat wrinkled, their epipleuræ very narrow below the middle; legs flavous, all the tibiæ armed with a spine, the metatarsus of the posterior legs very elongate; the breast black.

Hab. Salisbury, Mashonaland, obtained by sweeping (*G. Marshall*).

One of the small species of the genus, distinguished by the transverse sulcus of the thorax and the black breast.

SARDOIDES NIGRICORNIS, sp. n.

Dark metallic blue, the antennæ black; thorax with a deep transverse sulcus; elytra flavous, finely punctured, the sutural and lateral margins metallic blue.

Length 5-6 millim.

♂. Elongate and parallel, dark metallic blue; the head impunctate, the frontal elevations strongly raised, trigonate, the carina

acute; antennæ extending nearly to the apex of the elytra, black, all the joints, with the exception of the second, elongate, the third joint shorter than the fourth, terminal joint thinner and more cylindrical in shape than the others; thorax about one-half broader than long, slightly constricted at the base, the angles tuberculiform, the sides nearly straight, the disc with a very deep and broad sulcus, metallic blue, the non-impressed parts very finely punctured, the anterior portion with another small depression; scutellum broad, metallic blue; elytra finely and closely punctured, with traces of longitudinal sulci, flavous, the margins narrowly metallic blue; below and the legs metallic blue.

Hab. Natal. (Coll. Mr. Andrewes and my own.)

At first sight this species entirely resembles the type of the genus, *S. viridicollis* Jac. (Trans. Ent. Soc. Lond. 1895, p. 333), but may be at once distinguished by the colour of the antennæ and that of the legs; but this is not the only difference. The male of the present insect differs from that of *S. viridicollis* in having the antennæ longer and more robust, with the intermediate joints slightly dilated; the thorax, instead of having two deep foveæ, has a continued broad sulcus, nearly extending to the sides: in the female the antennæ are much shorter, very robust, and the thorax has two foveæ as in the allied species; but in all the specimens the colour of the antennæ and that of the legs agrees with the male of the insect described here, the general size is also rather larger.

PLATYXANTHA BICINCTA, sp. n. (Plate XX. fig. 8.) *

Flavous, the head and thorax reddish fulvous, the latter impunctate, transversely sulcate; elytra extremely minutely punctured, flavous, a narrow transverse band at the base and another near the apex dark metallic blue.

Length 4 millim.

Head impunctate, frontal elevations very narrow, in the shape of a transverse ridge, clypeus strongly raised, narrowly triangular; antennæ extending to the middle of the elytra, flavous, the apical joint fuscous, the second joint small, the third and following joints equal, nearly subcylindrical; thorax scarcely twice as broad as long, of equal width, the sides feebly rounded, the angles acute, slightly tuberculiform, the surface impunctate, deeply transversely sulcate, the sulcus interrupted at the middle, scutellum fulvous; elytra slightly wider at the base than the thorax, extremely finely punctured, flavous, the base with a narrow transverse band, extending to the margins, the latter and another band near the apex metallic dark blue; below fulvous, legs flavous; tibiæ unarmed; the metatarsus of the posterior legs as long as the following joints together; anterior coxal cavities closed.

Hab. Salisbury, Mashonaland (*G. Marshall*).

A rather small species, possessing all the characters of the genus: it may be known by the colour of the antennæ, which have only the last joint dark, and by the two blue transverse bands of the elytra.

SYOPLIA AFRICANUS, sp. n.

Elongate, pubescent, testaceous; antennæ long and slender; thorax transverse, impunctate; elytra closely and strongly punctate-striate and pubescent.

Length 5 millim.

Head broad, impunctate, the frontal elevations short, strongly raised, the eyes large and round; the antennæ slender, extending beyond the middle of the elytra, testaceous, all the joints, with the exception of the second, elongate and pubescent; thorax about one-half broader than long, of equal width, the sides slightly constricted at the base, feebly rounded anteriorly, furnished with single long black hairs, posterior margin preceded by a strongly impressed groove, the surface impunctate and shining; scutellum triangular, rather broad; elytra elongate and parallel, wider at the base than the thorax, deeply and closely punctate-striate, the punctures large and round, but much finer near the apex, the interstices clothed with fine fulvous pubescence and longer single hairs; legs long and slender, the first joint of the posterior tarsi very elongate; the anterior coxal cavities closed.

Hab. Assynia, West Coast of Africa (*Ch. Alluaud*), and Cameroons (*Conrad*).

This is the only species of the genus known to me from Africa, the other members inhabiting Java and Sumatra. The present insect at first sight entirely resembles the type of the genus, *S. javanensis* Jac., but the punctation of the elytra is quite different, the punctures being larger, less closely placed, and the interstices flat. I received one specimen from M. Alluaud and another from Dr. Kraatz.

NOTES AND CORRECTIONS.

Pseudocolaspis puberula Marsh.

This species must find its place in *Macetes* Chap.

Diacantha divisa, Gerst. (sub *Aulacophora*).

This species and *Aulacophora conifera* Fairm. are of exactly similar coloration, and Mr. Gahan has expressed a doubt, in describing his species *D. mutica* (P. Z. S. 1893, p. 747), to which of these the female described by Gerstäcker may belong. I possess a female specimen which undoubtedly represents Gerstäcker's species, as it entirely agrees with the description. In the same sex in *A. conifera* the scutellum is always flavous, not black, the joints of the antennæ are more slender and elongate, and the thorax is much less strongly subangulate before the middle; all the females of *A. conifera* differ in these respects from *A. divisa*, and I have not much doubt that *D. mutica* represents the male sex of Gerstäcker's species.

Poëphila costatipennis Jac. (P. Z. S. 1899, p. 364).

This species and *P. fulvipes* Jac. of the same paper should find their places amongst the *Halticinae* instead of the *Galerucinae*.

Luperus scutellatus Jac. and *Malacosoma donkieri* (P. Z. S. 1897, pp. 568, 569).

The locality for both these species, which has been left out, is Madagascar.

Hemixantha piceipes Jac.

Fig. 6 in Plate xxi. of the P. Z. S. 1899 represents a variety of this species, not *H. terminata* as erroneously given.

Longitarsus africanus Jac. (P. Z. S. 1897, p. 555).

Of this species more specimens have kindly been sent by Mr. Marshall, which prove the insect to vary greatly in coloration; some of the specimens are piceous above, and others nearly black, with the apex of the elytra flavous; I may also add to my original description, that the last joint of the antennæ is in nearly every case fuscous.

Ædionychis natalensis Baly.

This species is identical with *Physodactyla africana* Dej.

Ædionychis rugicollis Jac.

Ædionychis africana Jac. : this species is an *Eutornus*, and the specific name must be altered to *clarki* on account of *Eutornus africanus* Clark.

Both these species, on account of their short and robust antennæ, should find their places in *Eutornus* Clark.

EXPLANATION OF PLATE XX.

- Fig. 1. *Damia capitata*, p. 207.
 2. „ „ *frontalis*, p. 208.
 3. *Peloptera apicata*, p. 210.
 4. *Pseudocolaspis cupreofemorata*, p. 225.
 5. *Scelodonta sexplagiata*, p. 226.
 6. *Odontomorpha minuta*, p. 239.
 7. *Microhermesia hirticollis*, p. 220.
 8. *Platyxantha bicincta*, p. 264.
 9. *Monolepta exclamationis*, p. 258.
 10. *Candezea centromaculata*, p. 261.
 11. *Asbecesta ornata*, p. 255.
 12. *Jamesonia femoralis*, p. 250.

March 20, 1900.

W. T. BLANFORD, Esq., LL.D., F.R.S., Vice-President,
 in the Chair.

Prof. Bell drew attention to a collection of Land-Planarians made by the Society's Corresponding Member, Dr. Goeldi of Para. These, like many other collections of Land-Planarians, had been confided for description to Prof. Graff, and some of them were the types of new species described by that author in his magnificent monograph. The collection before the Society had been sent to



W Purkis: del et lith.

West, Newman imp.



Mr. Sclater with the request that he would deposit them in the British Museum. Prof. Bell stated that to the already good collection there they would be a valuable and welcome addition.

Mr. G. A. Boulenger, F.R.S., exhibited a specimen of *Polypterus lapradii* Steindachner, with large external gills, which had been recently brought home from the Senegal by M. P. Delhez. This fish measured 390 millimetres, and was therefore the largest on record in which this larval character had been retained. In connection with this interesting example, Mr. Boulenger also exhibited a full-grown female of the Common Newt (*Molge vulgaris*), from the environs of Vienna, bearing well-developed external gills.

Mr. S. L. Hinde read a series of field-notes on the Mammals which he had met with during five years' residence in East Africa, and illustrated them with lantern-slides from photographs of the animals taken in their native surroundings.

Mr. Hinde made the following preliminary remarks:—

The B. E. A. Protectorate, for the purpose of description, may be divided into two parts, the inhabited and the uninhabited. The uninhabited ranges of hills are practically devoid of big game. The uninhabited country may be divided into two sections: regions of less than 3000 ft. above the sea-level, and regions more than 3000 ft. above the sea-level. The regions below 3000 ft. are, for the most part, densely covered with thorny jungle. The water-supply is small during the greater part of the year. In this dense jungle, eland, lesser kudu, oryx, impala, zebra, bushbuck, lions, and an occasional rhinoceros are to be found, but from the nature of the country and climate they are sufficiently protected from extermination by hunters without the necessity of legislation. Above 3000 ft. the game-country consists of rolling grass plains, interspersed in places with thin bush. In these plains the great herds of antelopes, zebras, &c. which now live and graze will soon be exterminated, unless the game-laws are enforced. One of the factors instrumental in aiding the escape of game is here absent. The ordinary hunter has to find his game, and this is often the most difficult part of the day's work. On large flat expanses the hunter can always see his quarry, and his whole time may therefore be given to stalking or killing it.

I should like to see animals from our Protectorate largely imported into the British Isles, and am convinced that they would both live and breed well in our parks, moors, and gardens, with little or no trouble about acclimatization. On the uplands of East Africa, the zebra, the white-bearded gnu, Coke's hartebeest, impala, waterbuck, Grant and Thomson's gazelles, the lesser reedbuck, and many other animals live in the open without any protection from the biting night-winds, rains, and intense heat. The temperature in the shade often varies from under 40° Fahrenheit at night, to over 80° in the daytime. During a very wet year at Fort Smith, in the Kikuyu district, waterbuck, Grant's and

Thomson's gazelles, and bushbucks lived healthily and well, though they were confined in the Fort Square, where for weeks together their feet and legs were never dry. Thomson's Gazelle bred for two generations in the Fort Square, and then all the animals died of rinderpest. This is a curious point, as none of these species suffer from rinderpest in their wild state.

From what I have seen of game, with the exception of elephant and rhinoceros, I am of opinion that they are not naturally timid. A railway train does not alarm the majority of animals, their curiosity at first draws them quite close to it; but within a few days of the establishment of a railway in a district, trains may pass noisily through a herd of game and few of them will even cease grazing. It would seem that animals, and antelopes in particular, are only afraid of what they have, in past experience, found to be dangerous. In most districts they have learnt that human beings represent danger, but in the country of the Masai, who do not hunt, the game take little or no notice of man. When horses were first brought to the country, in districts where game was constantly hunted, a mounted man could approach wild animals closely, but the moment he dismounted they fled. It is probable that antelopes only distinguish man under certain conditions; they apparently recognize him as an animal that walks erect, with a small head, and no neck or horns. In proof of this, it has been noticed that a man with a large load on his head can approach antelopes much nearer than a man without one; to their view, the man with the load, perhaps, seems to be a thick-necked animal whose head is out of all proportion to his body, and whom they have had no cause to fear. I have seen lions standing within 50 yards of a train, showing neither sign of fear nor intention of retreating, until the train pulled up and one or two men alighted. Seeing their well-known enemies close to them, the lions turned and trotted away.

The slides now exhibited are from photographs taken by me of animals in their natural surroundings. Those of the dead animals, with perhaps one exception, were taken without disturbing or arranging them in any way.

The following papers were read:—

1. On a Case of Homœosis in a Crustacean of the Genus *Asellus*—Antennule replaced by a Mandible. By W. BATESON, M.A., F.R.S., F.Z.S.

[Received March 20, 1900.]

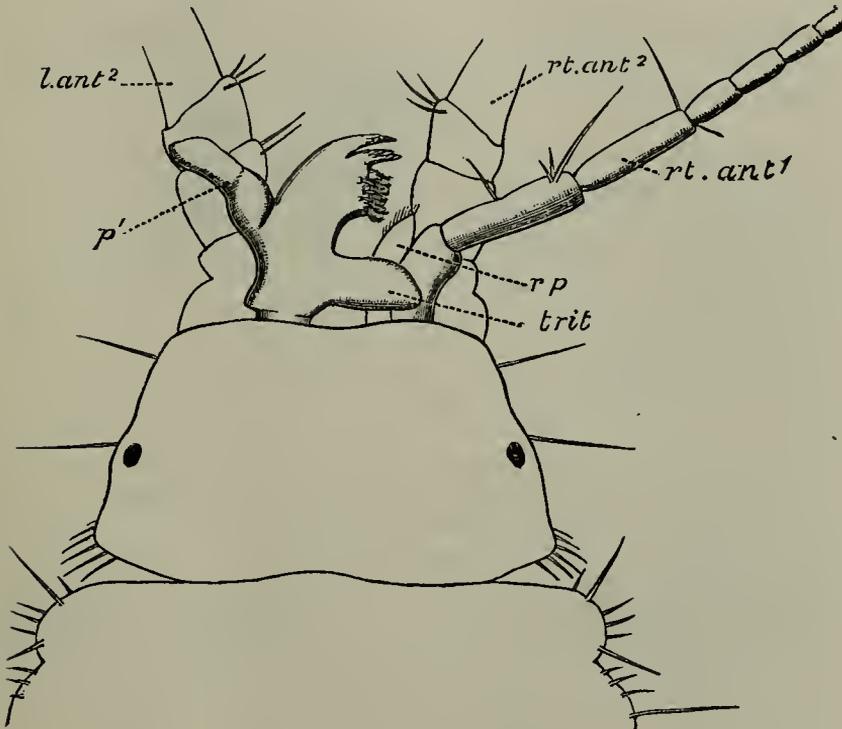
The subject of this note is a male specimen of *Asellus aquaticus* (an Isopod Crustacean) in which the left antennule is represented by a mandible.

The specimen was noticed when alive by Mr. J. J. Lister among

a number of *Aselli* taken from a large aquarium in the Cambridge Zoological Laboratory for examination by the students.

As the figure shows (fig. 1), the abnormal structure stands exactly as the left antennule should. Both antennæ and the right antennule are normal, as also are the mandibles, the other mouth-parts, and the rest of the body and its appendages, so far as they could be observed. The animal was of good size.

Fig. 1.



Head of *Asellus aquaticus*, seen from dorsal side.—*rt. ant.*¹, right antennule; *rt. ant.*², *l. ant.*², right and left antennæ; *rp*, palp of normal right mandible projecting from below; *p'*, palp of the abnormal mandible; *trit*, trituration process.

The abnormal appendage (fig. 2, p. 270) is a fairly well-formed mandible. The blade is complete, having two toothed processes and eleven plumose setæ. The latter are not quite regularly placed. The presence of *two* toothed processes proves that the appendage is a true *left* appendage, for the right mandible in *Asellus aquaticus* has only one toothed process, which bites between the two toothed processes of the left mandible¹.

The teeth on these processes are more numerous and less regular than in a normal mandible.

¹ Sars, G. O., *Crustacés d'Eau douce de Norvège*, p. 97, pl. viii. fig. 26..

The palp is misshapen and rudimentary. It consists merely of an irregular process with slight traces of segmentation.

The molar process is rather less than the normal in length. Its triturating end is ill-formed, and does not bear the elaborate structures found in the same place in the normal mandible, the apex being simply covered with a thick plate of chitin.

Fig. 2.



Apex of extra mandible of *Asellus aquaticus*, to show details.
p', palp of abnormal mandible.

This mandible was in life carried flat to the body, as shown in the drawing, but I have not succeeded in determining which morphological surface was upwards. It is not evident which this should be, but presumably it is the face, which in the normal mandible is next the mouth. I regret that I could find no feature sufficiently differentiating the two surfaces; but from the fact that, as shown in the figure, the diminishing series of teeth are on the exposed surface, it seems likely that the presumption referred to is correct. In a normal mandible this series is much less clearly defined.

The animal was approaching a moult, and the newly-formed skin, which could be seen through, showed that at the next ecdysis the appendage would not be noticeably changed.

In the details of the toothing and in the number of the plumose setæ (11 instead of 13), the animal departs slightly from Sars's type; but on examining other specimens I find that these characters vary a good deal, as might be expected.

Elsewhere¹ I have discussed the significance of cases of this sort,

¹ Especially 'Materials for the Study of Variation,' Chap. v., where an account of previously recorded cases is given. To these should be added a case of an *Astacus* having a somewhat antennuliform structure with two jointed filaments replacing one of the eyes: Hofer, B., Verh. d. deutsch. zool. Ges. iv. 1894, p. 82, fig.

in which an organ takes on the likeness of another organ with which it is in serial homology.

This phenomenon, which I have called *Homœosis*, plays a considerable part in the variations of Meristic series. In plants such variations are common, but in animals instances so striking as that now under consideration are among the greatest rarities in nature. Among Arthropods probably not a dozen examples comparable with the present one are on record. The conversion of antennule into mandible has not hitherto been observed in any form.

It should be noticed that the homœosis in the present instance does not transform the appendage into the likeness of the appendage next to it in series, for this is the antenna. The change is to the next but one.

Perhaps the cases hitherto known which most nearly approach this one are those of *Cimbex* and *Bombus*, having the club of an antenna in each case replaced by a foot.

Since the discussion of these cases in 'Materials for the Study of Variation' was written, the new fact has been discovered by Herbst¹ that when the eye is amputated in *Pulemon* an antenna-like structure may be formed in its place on regeneration. The question therefore arises whether some other Arthropod cases of homœosis may not be similarly connected with regeneration. On this point there is little positive evidence. It may be noted, however, that Przibran², who made some experiments on the subject, found that in *Asellus* both pairs of antennæ were regenerated as antennæ.³ The results of such experiments, however, are clearly very irregular. The regenerated part in Herbst's experiments was not always similar, and Przibran, on repeating Herbst's experiments, obtained only negative results. Here the matter at present rests.

2. On Echinoderms from Singapore and Malacca.

By F. P. BEDFORD, F.Z.S.

[Received March 8, 1900.]

(Plates XXI.—XXIV.)

The Echinoids and Asteroids described in this paper were collected during a residence of a little over a year in the neighbourhood of Singapore and Malacca by Mr. W. F. Lanchester and myself.

I am much indebted to the kind courtesy of the Hon. Sir J. A. Swettenham, Colonial Secretary of the Straits Settlements, and the Hon. W. Egerton, Resident-Councillor of Malacca, in allowing us to make use of the lighthouses under their jurisdiction as headquarters for our work; and I am under a still greater obligation to

¹ Arch. f. Entwickelungsmech. ii., 1896, p. 544.

² Zool. Anz. xix. 1896, p. 424.

³ P.S.—Since this paper was read Mr. L. Doncaster, of King's College, Cambridge, has repeated the experiment on *Asellus* with the same result.

Dr. R. Hanitsch, Curator of the Raffles Museum, for the great amount of trouble he took on our behalf, and for the readiness with which he placed his valuable experience of the local marine fauna at our disposal. I also wish to thank Mr. H. N. Ridley for his kind hospitality and advice.

Professor Bell has been good enough to allow me a room in the Natural History Museum, where I have had an opportunity of comparing our specimens with those in the National Collection; and Professor Minchin has kindly given me every facility for microscopical study at University College Laboratory.

From the point of view of the geographical distribution of the littoral fauna, this comparatively unworked district is a peculiarly interesting one: the sea rarely reaches a depth of more than 40 fathoms, and never, so far as I know, of more than 80, so that dredging from a small sailing-boat was always possible in calm weather; and although the collection of Echinoderms cannot be considered complete, yet I think specimens of all the commoner indigenous species have been collected either by ourselves or obtained from the natives.

Professor Bell has kindly looked through this paper and given me valuable suggestions.

I. ECHINOIDEA.

The region under consideration lies close to the Equator, between the Indian and Pacific Oceans, and might be regarded as a probable specific centre for many tropical forms whence migration took place in all directions—westwards to the Red Sea and East Coast of Africa; northwards to China and Japan; eastwards through the Pacific Islands towards the American Coast, and southwards in the direction of Australia and New Zealand. Plausible as such a view may appear *a priori*, the Echinoid evidence in its support is very meagre, and seems rather to point to a separate "centre" for each form-unit. The distribution of tropical Echinoids is as a rule very extensive: moreover, in the case of closely allied species their areas of distribution often overlap: *e. g.*, among Cidaridæ, *Rhabdocidaris annulifera* and *R. baculosa*; among Echinidæ, all the species of *Salmacis*; among Clypeastridæ, *Echinodiscus auritus* and *E. levis*; and among Spatangidæ, *Lovenia elongata* and *L. subcarinata*. In these cases, where there are no geographical barriers we should expect perhaps a physiological isolation to manifest itself in differences of mode of life and habitat, but such does not seem by any means an invariable rule: *Laganum depressum* and *Laganum decagonale* were frequently dredged together, and must have been subjected to almost identical environmental conditions, and the same is true of *Salmacis globator* and *S. sulcata*.

Considering the limited area, the Echinoid fauna is a fairly large one. This is no doubt partially to be accounted for by the great variety exhibited by the inorganic environment; near the

mouths of the rivers extensive deposits of silt mixed with vegetable débris occur, and here, as a rule, the reef is poorly, if at all, represented; in places, however, where the reef is flourishing its distance from the shore is very variable, rarely exceeding 500 yards, and the lagoon shore is of the most varied description—mangrove-swamps, tracts of hard sand, or gravel may occur, or volcanic rocks may come down to the water's edge and, being eroded by the action of the sea, form tide-pools and crevices when the tide recedes.

Each kind of environment was found to have its own peculiar Echinoid fauna, each species except the most abundant being restricted to one sort of habitat in its adult condition; and in this connection it is worth noting that, although this is constant throughout the district, yet in other localities, *e. g.*, Batavia, the same species will be found in a different environment. A good instance of this is afforded by *Diadema sawatile*, which was the only reef-Echinoid of the district, and was a conspicuous object among the masses of coral on nearly all the reefs; whereas at Batavia this species was apparently found by Dr. Sluiter (*cf.* also Studer¹) a short distance from coral on patches of sand, *Echinometra lucunter* being common among coral in that locality. It seems to me that, by a similar change of habitat, a certain amount of isolation might be caused which would enable variations in a direction favourable to that environment to become normal for the particular form-unit, and by a continuation of the process specific distinctions might become fixed. Without some such isolation it is difficult to imagine how any variations from the norm could become sufficiently stable to be perpetuated alongside of the type, or how any gradual modification could take place in the type itself², since the pelagic plutei that settle down in any given limited area can hardly be supposed to be the offspring of adults living within that same area, and there is no evidence, so far as I am aware, of discontinuous variation among Echinoids likely to lead to the formation of new races.

The species of which examples were obtained number sixteen, of which it may be worth remarking that four extend as far south as New Zealand; this is interesting in connection with the distribution of Asteroids and Holothurians, which appears to be much more limited.

Only a few Echinoids have been previously recorded from the locality, but of these there are two species which we have failed to find, and which are not represented in the Raffles Museum; they are *Salmacis dussumieri* and *Rhabdocidaris hispinosa*; there are specimens of the latter in the British Museum collected by Dr. Powell at Singapore, and I have satisfied myself of their distinctness from *Rhabdocidaris annulifera*. Only one new species is described, belonging to the morphologically interesting genus *Asthenosoma*, and we were fortunate in obtaining two young

¹ T. Studer, Monatsber. d. Ak. Wiss. Berlin, 1880, p. 868.

² *Cf.* A. E. Ortmann, Grundzüge d. mar. Tiergeographie, 1896, p. 31.

specimens which exhibit a number of points in the later development, and which I hope to describe in detail further on. The following is a list of the species of which examples were collected:—

1. *Rhabdocidaris annulifera* Lam.
2. *Diadema saxatile* Linn.
3. *Asthenosoma heteractis*, sp. nov.
4. *Temnopleurus toreumaticus* Ag.
5. *Temnopleurus reynaudi* Ag.?
6. *Salmacis sulcata* Ag.
7. *Salmacis globator* Bell.
8. *Salmacis rarispina* Ag. (fil.).
9. *Laganum depressum* de Blainv.
10. *Laganum decagonale* de Blainv.
11. *Laganum*, sp.
12. *Arachnoides placenta* Ag.
13. *Echinodiscus lævis* Ag. (fil.).
14. *Lovenia elongata* Gray.
15. *Metalia sternalis* Lam.
16. *Brissus carinatus* Gm.

1. RHABDOCIDARIS ANNULIFERA Lamarck. (Plate XXI. figs. 1 a-d.)

Cidarites annulifera, Lamarck, Hist. Nat. des Anim. sans Vert. t. iii. 1816, p. 57.

Phyllacanthus annulifera, Alex. Agassiz, Revision of Echini, pt. iii. 1872, p. 387.

Cidaris annulifera, P. de Loriol, Mém. Soc. Sc. Nat. Neuchâtel, t. iv. 1873, p. 25.

Cidaris lütkeni, P. de Loriol, Mém. Soc. Sc. Nat. Neuchâtel, t. iv. 1873, p. 29.

Schleinitzia crenularis, Th. Studer, Monatsb. Ak. Wiss. Berlin, 1880, p. 865.

Leiocidaris annulifera, L. Doederlein, Die Japanische Seeigel, i. 1887, p. 24.

References. H. Troschel, Sitzungsab. d. niederrhein. Ges. in Bonn, 1887, p. 335. Alexander Agassiz, 'Challenger' Reports, iii. Echinoidea (1881). P. de Loriol, Beiträge d. Geol. u. Pal. d. Libysche Wüste, Ab. 3, Hft. i., 1883. P. de Loriol, Mém. Soc. de Physique &c. de Genève, t. xxviii. No. 8 (1883). C. Ph. Sluiter, Natuurk. Tijd. v. Ned. Ind. D. xlviii. (1889). S. Lovén, Bih. till K. Sv. Vet.-Akad. Handl., Bd. 18 (1892). P. de Loriol, Rev. Suisse de Zool. t. i. (1893). R. Koehler, Mém. Soc. Zool. de France, t. viii. (1895).

Locality. Seven specimens from Singapore, one from Malacca.

Habitat. Spines of this species are extremely abundant in nearly all dredgings on a sandy or muddy bottom round Singapore; as Dr. Sluiter noticed in the Bay of Batavia, so here, the species seem to prefer a ground composed of comminuted fragments of shell,

coral, sand-grains, &c., but I have obtained it on the "tangles" from mud.

Distribution. The area of distribution is a somewhat anomalous one: it is fairly widely distributed over the Indo-Pacific circum-tropical zone, extending from the Coromandel Coast on the west through the Bay of Bengal and Malay Archipelago to the Prince of Wales Is.: in the east and southwards it extends into the Antarctic littoral zone, having been found in Tasmania as well as on the South-Australian coast, but it is not reported from as far north as Hongkong or the S. Japanese seas.

There seems little doubt that M. de Loriol is right in associating Studer's *Schleinitzia crenularis* from New Guinea with this species. Prof. Troschel and others have shown the inconstancy which the tubercles exhibit with regard to absence or presence of crenulation among recent Cidaridæ; and I have followed M. de Loriol (*loc. cit.* 1883, p. 1) in uniting Agassiz's species of *Phyllacanthus* and *Stephanocidaris bispinosa* in Desor's genus *Rhabdocidaris*.

The specimens brought home represent a series showing growth-changes from an individual 8 mm. in diameter to one 57 mm. in diameter. Considerable allowance has to be made for individual variations in drawing deductions from so few specimens; but it seems worth while to give a table of the principal measurements and also to figure the changes taking place in the spines during growth.

As is well known, new coronal plates are formed between the calyculs and the corona, the first-formed appearing as minute sectors between the oculars and genitals (*cf.* condition in *Asthenosoma*); and Prof. Lovén has described the process of formation of the perignathic girdle and peristomal radial and interradial plates by absorption from the coronal plates and redeposition on the buccal membrane. In this species, unlike *Dorocidaris papillata* examined by him, the peristomal plates do not increase in number after the animal has reached a diameter of 22 mm.; and judging from the relative positions of the plates and spines of the corona bordering on the peristome, I conclude that no entire coronal plates have been absorbed in that region subsequent to the stage represented by the smallest of our specimens (8 mm. in diameter). The formation of new coronal plates probably continues throughout life, and the spines evidently increase in length up to a quite late stage; but whether they keep pace with the growth of the test is not certain, as in the largest specimen they had apparently been injured during life. When first formed, the spines are always smooth and acquire the characteristic granulations and thorns later; but it is interesting to note that in the smaller specimens the spines acquire the typical characteristics long before they reach a length at which granulation begins to appear in the spines of larger individuals (*cf.* Plate XXI. figs. 1 *b*, 1 *d*). In some specimens all the tubercles are smooth, while in others many of the larger tubercles are very

TABLE OF MEASUREMENTS OF *RHABDOCIDARIS ANNULIFERA*.

Specimen.	Diam.	Height.	Interambulacral Spines.									Breadth of Ambulacrum at Equator.	Breadth of 1 A. at Equator.	Diameter of Calycinal Area.	No. of Peristomal Plates.						
			1st	2nd	3rd	4th	5th	6th	7th	8th	9th										
No. 1 ...	8	5	1.5	3.5	7.5	13.5	abs	abs	abs	abs	abs	abs	abs	abs	abs	4	3.0	1.0			
2 ...	10.5	5.5	2.0	6.0	10.0	3.5	2.0	3.0	4.0	9.0	14.0	5.5	abs	abs	abs	abs	abs	1.75	4.5		
3 ...	11.5	6.5	2.5	5.0	8.5	12.0	15.5	2.5	3.0	6.5	7.5	14.5	0.5	abs	abs	abs	abs	2.0	5.5	4.5	5
4 ...	14	9	2.5	4.0	8.0	9.0	25.5	1.0	3.0	4.0	8.5	17.5	16.0	abs	abs	abs	abs	2.0	6.0	6.5	6, 5?
5 ...	22	13	3.5	5.0	8.0	12.5	31.0	35.5	4.5	8.0	11.5	24.5	36.0	0.5	abs	abs	abs	3.0	10.5	10.5	8, 7
6 ...	25.5	14	6.0	8.0	8.5	25.0	42.5	33.5	7.0	8.5	19.0	31.5	50.0	4.0	abs	abs	abs	4.0	12.5	11.0	8, 7
7 ...	40	29	Longest spine 59 mm.																		
8 ...	57	37	Longest spine 59 mm.																		

No. 1. Longest spine = 17 x Diameter.
 2. " = 1.3 x " "
 3. " = 1.3 x " "
 4. " = 1.8 x " "
 No. 5. Longest spine = 1.6 x Diameter.
 6. " = 1.9 x " "
 7. " = 1.5 x " "
 8. " = 1.0 x " "
 All linear measurements in millimetres.

distinctly crenulated in their aboral half, as noticed by other observers; and, as pointed out by them, it is of interest in connection with the fossil species of the genus, e. g. *Rhabdocidaris nobilis* Desor, found in the Upper Jurassic strata of Europe.

2. DIADEMA SAXATILE Linn. (sp.).

For synonymy, *vide* S. Lovén, Bihang till Kongl. Sv. Vet.-Akad. Handl. Bd. xiii. Afd. 4, No. 5 (1887).

References. Th. Studer, Monatsber. d. k. Ak. Wiss. Berlin, Oct. 1880, p. 868. P. de Loriol, Mém. de la Soc. de Phys. &c. de Genève, t. xxviii. No. 8, 1883, p. 13. P. & F. Sarasin, Ergeb. naturw. Forsch. Ceylon, Bd. i. Hft. 1, 1887. C. Ph. Sluiter, Natuurk. Tijds. v. Ned. Ind. D. xlviii. 1889, pp. 285, 288. G. W. Field, Johns Hopkins Univ. Circ. vol. xi. No. 97 (1892).

Locality. Singapore and neighbouring islets.

Habitat. This species is abundant on the reefs wherever the coral is flourishing. In the daytime several individuals may often be seen congregating together under the shadow of projecting platforms of *Madrepora*, *Turbinaria*, or other coral. Unlike Drs. Sluiter and Studer, I have never observed it except in the immediate vicinity of living coral and usually on the outer edge of the reef (*cf.* Field). As the Drs. Sarasin point out, it is an extremely unpleasant creature to handle owing to the sharpness of its spines, the tips of which break off in the flesh, and when any attempt is made to hold it, it generally retreats to a place of greater security; when in its natural surroundings I have never noticed any indications of attack or defence unless touched. So far as I know, it is the only Echinoid which is used as an article of food by the Malays of the "Straits."

Distribution. The distribution is an extremely wide one throughout both the Atlantic and Indo-Pacific circumtropical zones; in the north it reaches up to Japan, the Mediterranean, and the Canary Is., and it has been found as far south as the Cape of Good Hope and N.E. Australia, but I cannot find any record of its occurrence from the west coast of America. The species is extremely variable both in form and colouring, but the varieties do not seem to be confined to separate localities.

In one young specimen the spines, as described by other observers, are banded with purple and white, the test being purplish black as in adult.

The coloration of this species is subject to a very considerable amount of modification, but whether there is really more than one species living in the district I am unable to state positively. The same uncertainty exists in my mind as to the Asteroid *Pentaceros* described later in this paper, and it would require a random selection of a large number of examples in order to settle the question.

3. *ASTHENOSOMA HETERACTIS*, sp. nov. (Plate XXI. fig. 2.)

References. Grube, 45es Jahresb. d. Schles. Gesell. f. nat. Cult. 1863 (*A. varium*). H. Ludwig, Zeitschr. f. wiss. Zool. Bd. 34, 1880, p. 70 (*A. varium*). A. Agassiz, 'Challenger' Reports, vol. iii. Echinoidea, 1880, p. 82 (*A. grubei*). P. & F. Sarasin, Ergeb. naturw. Forsch. Ceylon, Bd. i. Heft 3, 1888 (*A. urens*). S. Lovén, Bih. till K. Sv. Vet.-Ak. Handl. Bd. 18, 1892 (*A. varium*). F. J. Bell, Ann. & Mag. Nat. Hist. (6) vol. iv. 1889, pp. 436-438. P. de Loriol, Rev. Suisse de Zool. t. i. & iii. 1893 & 1896 (*A. varium*). S. Yoshiwara, Ann. Zool. Jap. vol. i. part 1, 1897 (*A. ijimai*). R. Koehler, Zool. Anz. xx. 1897, p. 307.

Locality & Habitat. This species occurs in some numbers in about 5 fathoms of water on a muddy bottom off the west of Pulo Brani, Singapore; a single specimen was dredged by Dr. Hanitsch in the New Harbour, Singapore; it lives in company with a species of *Haplodactyla*, specimens being frequently obtained together in the dredge.

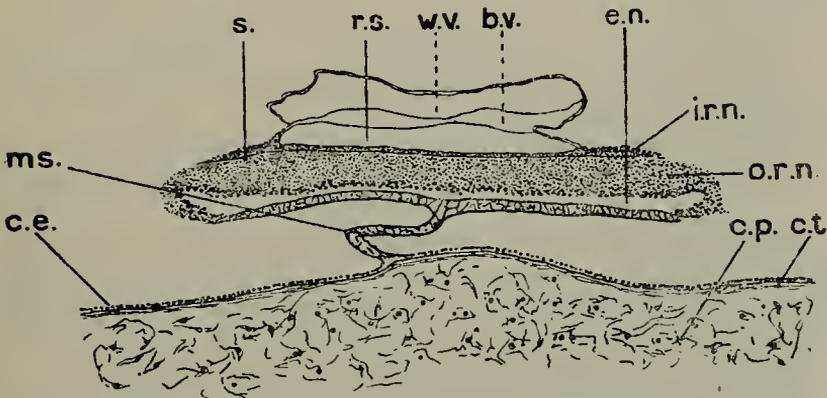
This form is very closely allied to the other three shallow-water species of *Asthenosoma*; its adult characters appear to be very constant, and although its differences from these species are very slight, it seems advisable to regard it as a distinct species. The nearest ally is perhaps *Asthenosoma urens*, collected by the Drs. Sarasin in the north of Ceylon, which it resembles in the possession of thorn-bearing spines in the neighbourhood of the ambitus, as well as poison-organs arranged along each side of the interambulacral space, and in the former respect it differs at once from *A. varium* and *A. grubei*. It is distinguished from *A. urens* by the very marked distinction in appearance between the ambulacral and interambulacral abactinal spines; the latter possess constricted connective-tissue sheaths as in all the abactinal spines of *A. urens*, which they also resemble in the possession of well developed poison-sacs, there is, however, very little pigment developed in their sheaths; the ambulacral spines are of equal length to the interambulacral, but have a very thin sheath which is unconstricted, and they are marked by very distinct and regular bands of purple pigment arranged transversely at intervals along the sheath; poison-sacs are also developed on these spines, but their tips are much more fragile than those of the other spines and in process of capture they are nearly always broken. The calycinal system resembles in the adult that of *A. urens* and *A. grubei*, and differs from *A. varium* in the separation of the genital pores from the genital plates, the pore being situated in a V-shaped incision on the outer margin of the plate. The madreporite differs from that of *A. grubei* in being quite flush with the rest of the calycinal system.

The peristomal plates, of which there are ten rows continuous with the ambulacral coronal plates (the interradial plates being

unrepresented in the peristome of *Echinothuridæ*), number in adults normally 9 in one row and 8 in the other row of the pair, although occasionally there may be 8 and 7 respectively. In *A. urens* there are 9 in each row (according to the Sarasins), and in *A. grubei* there are 12. The coronal plates, both ambulacral and interambulacral, are like those described by M. de Loriol for Amboina specimens of *A. varium*, but the ambulacral edge of the narrow interambulacral plates is devoid of tubercles. There are three distinct kinds of pedicellariæ.

Stewart's organs are very well-developed and of the same shape as in *A. urens*, and the muscular partitions are developed to the same extent as in that form.

The alimentary canal does not seem to have been described in detail in any species of the genus, so that I do not know if the condition occurring in this species is universal throughout the genus, or whether it forms a "specific character"; but in addition to the two loops of the alimentary canal occurring in other regular Echinoids (the adoral of the two being connected with the siphon), it makes two additional loops within the former before reaching the "siphonal intestinal loop," these additional loops being situated round the top of the lantern of Aristotle (the siphon appears to be absent).



Radius of *Asthenosoma heteractis* (transverse section).

This section passes *between* the branches to the ambulacral pores, and is thus slightly oblique.

w.v. = radial water-vessel.
b.v. = radial blood-vessel?
r.s. = radial sinus (pseudohæmal canal).
s. = septum between outer and inner radial nerves.
e.n. = epineural canal.

ms. = mesentery formed from the endothelium of the body-wall.
c.e. = endothelium lining body-wall.
c.p. = calcareous plate (decalcified).
ct. = connective tissue.
i.r.n. = inner radial nerve (ganglion).
o.r.n. = outer radial nerve.

Another character of some morphological interest which does not seem to have been noticed by the Drs. Sarasin in *A. urens*, or

by Agassiz in the 'Challenger' species of the genus, is the condition of the radial water-vessels; these, together with the nerves and associated canals, are slung up from the body-wall by a narrow mesenterial fold, so that the nervous system is farther removed from its primitive epithelial position than, so far as I know, occurs in any other Echinoid (see section figured). The division of the nerve-trunk into a deeper and a superficial layer is very obvious in sections, the deeper layer being swollen at intervals on each side to form ganglia: this condition is quite unique among Echinoids, the deeper nerve-layer being absent in the radii of all forms hitherto investigated in which it is said to be confined to the neighbourhood of the oral ring; its occurrence in the radii of this species recalls the condition in Holothurians.

In addition to adult examples, of which several were taken, two young stages were obtained which I hope to describe in a later communication in some detail, as they show some important differences in the calycinal system, coronal plates, poison-organs, pedicellariæ, &c. I hope also to give a more detailed account of the adult morphology than seemed advisable in a paper dealing chiefly with systematic features.

Adult examples seem to average about 83 mm. in diameter and have a height of about 24 mm.; they are thus smaller than the allied species.

4. TEMNOPLEURUS TOREUMATICUS Ag.

Temnopleurus toreumaticus Agassiz & Desor, Ann. Sci. Nat. 3^{me} sér. Zool. t. vi. 1846, p. 360.

References. Alexander Agassiz, Echini, pt. 3, 1873, p. 463.

J. E. Tenison-Woods, Proc. Linn. Soc. N. S. W. vol. iv. p. 159.

Locality. Common between tide-marks and up to 5 fathoms on the east of Singapore island; also common in from 1 to 3 fathoms of water at Tanjong Kling near Malacca, and several young specimens were dredged in 10 to 15 fathoms at C. Rachado.

Habitat. At Singapore they are found on *Zostera* on mud.

Distribution. Reported from the Indo-Pacific area between the Gulf of Persia on the west and New Caledonia on the east; it extends also into North China, and is recorded from N.E. Australia.

The Malacca specimens differ strikingly from those found at Singapore by reason of their much longer spines and somewhat different coloration. In some specimens the general colour-effect is a greenish grey, the spines being light-coloured with 6 to 12 dark transverse bands of the same tint, these bands are conspicuous towards the tip of each spine, but become gradually fainter towards the base; in other individuals the bands are claret-coloured, giving a reddish hue to the entire animal. Individuals do not seem to reach the same size as those recorded from other localities.

Measurements.

	Diam.	Height.	Calyx.	Peri- stome.	Longest spine.	Locality.	Percentage value D=100. Longest spine.
1.	24.5	15		8.0	28.5	Malacca	116.3
2.	26	15		7.5	32	"	123.1
3.	34	21		10.0	30	"	88.2
4.	35.5	21.5	8	10.0	33	"	92.9
5.	10.5	7		4	10	Singapore	95.2
6.	34	21		10.0	21	"	61.8
7.	37	21.5	7.5	10.0	21	"	56.8

5. TEMNOPLEURUS REYNAUDI Ag. (?).

Temnopleurus reynaudi, Agassiz & Desor, Ann. Sc. Nat. (3) vi. 1846, p. 360.

References. Alexander Agassiz, Revision of Echini, part 3, 1873.

H. Farquhar, Proc. Linn. Soc. N. S. W. xxiii. 1898, p. 318.

Distribution. Ceylon, China Seas, and New Zealand.

Locality. A single specimen only, in 6 fathoms on a bottom composed of sandy mud off the west of Singapore Island, appears to belong to this species.

Diameter 24 mm.; height 13 mm.

6. SALMACIS SULCATA Ag. (Plate XXII. fig. 3.)

Salmacis sulcata, Agassiz & Desor, Ann. Sc. Nat. (3) vi. 1846, p. 359.

Salmacis globator, Alex. Agassiz (not L. Ag.), Revision of Echini, part 3, p. 473, 1872.

Salmacis alexandri, Bell, Report of Zool. Coll. H.M.S. 'Alert,' 1884, p. 119.

References. J. E. Tenison-Woods, Proc. Linn. Soc. N. S. W. iv.

1878. F. J. Bell, Proc. Zool. Soc. 1880 (*S. globator a*). F. J.

Bell, Proc. Linn. Soc. N. S. W. ix. 1885. S. Lovén, Bih. K.

Sv. Vet.-Ak. Handl. Bd. 13, Afd. 4, No. 5, 1887. L.

Doederlein, Zool. Jahrb., Abth. Syst. Bd. 3, 1888, p. 836.

P. M. Duncan & W. P. Sladen, Journ. Linn. Soc., Zool. xxi.

1888. H. Farquhar, Proc. Linn. Soc. N. S. W. xxiii. 1898.

Locality & Habitat, vide *S. globator*, Bell. I believe that this species prefers a somewhat greater depth than *S. globator* (5-10 fathoms), but in any case they are found together in about 5 fathoms. A similar association together of two closely allied species of Echinoids within a limited area occurs in the case of *Echinus esculentus* and *Echinus acutus* at Plymouth (v. E. J. Allen, Journ. M. B. A. Plymouth, vol. xv. no. 4, 1889, p. 473). In this latter case the "specific centre" of the two forms appears, from Mr. Allen's

report, to differ considerably in depth, and the area in question appears to represent the shallow-water margin of the distributional area of *E. acutus* which overlaps the centre of distribution of *E. esculentus*.

Two of the specimens collected approach very close to "typical" *S. alexandri* in the more uniform character of their tuberculation, their deeper sutural furrowings, and their general facies; and it seems to me that the two forms represent extremes of a continuous series, the "norm" of which differs in different localities (*cf.* Lovén). Dr. Lovén places this species in the genus *Temnopleurus*, but I cannot see sufficient differences to warrant its generic separation from the other *Salmacis*; the bare median spaces containing the sutural pits, and referred to by Dr. Doederlein, are very obvious in the living animal. The colour of the spines is for the most part dark violet, with the base and tip often cream-coloured (*cf.* Duncan & Sladen).

Measurements.

Diam.	Height.	Calyx.	Peristome.	Percentage values: D=100.		
				H.	O.	P.
50	31	7.5	13.5	62.0	15.0	27.0
59	35	8.0	14.5	59.3	13.6	24.6
61	35	10.5	13.5	57.4	17.2	22.1

7. SALMACIS GLOBATOR Bell (? L. Ag.). (Plate XXII. figs. 4 a, b.)

Salmacis globator, F. J. Bell, Proc. Zool. Soc. 1880, p. 431 (*S. globator* β).

? *S. sulcatus*, Sladen, Journ. Linn. Soc., Zool. xiv. p. 439, 1879.

References. F. J. Bell, Proc. Linn. Soc. N.S.W. ix. 1885.

S. Lovén, Bih. K. Svensk. Vet.-Ak. Handl. Bd. 13, Afd. 4, No. 5, 1887.

Locality. Singapore.

Habitat. The test of this species together with those of *S. sulcata* are frequently found washed ashore on the east side of Singapore Island; unfortunately when collecting I did not recognize that the two species were distinct, so that I do not know in what proportions they occur; they live in considerable abundance from between tide-marks up to about 10 fathoms on a muddy bottom. The synonymy of this, as indeed of all the species of *Salmacis*, is in a state of the greatest confusion. Prof. Bell (*loc. cit.* 1880) described it as *Salmacis globator* (β); some years later (*loc. cit.* 1885) he expressed the opinion that it was identical with Louis Agassiz's *S. globator*, and he then renamed Alex. Agassiz's *S. globator*, *Salmacis alexandri*. Dr. Lovén does not admit that *S. globator* (β) Bell is Louis Agassiz's species, but, on the other hand, unites it with *S. varispina* of the latter author. It is quite impossible from the meagre description in Agassiz and Desor's 'Catalogue Raisonné' to arrive at any conclusion as to the species they intended; it seems better therefore, for the sake of

clearness, to ignore their definitions in the two cases, and to name it *S. globator* Bell. The species from the Korean Straits described by Mr. Sladen as *S. sulcatus* seems to me to be referable to this form. Owing to the uncertainty of identification of species of this genus, I have omitted their recorded distribution, but it is undoubtedly extensive.

The colour of the spines in the specimens collected was whitish yellow, with irregularly spaced, narrow, transverse purple bands; in one specimen the abactinal spines were all devoid of any purple pigment.

Measurements.

Diam.	Height.	Calyx.	Peristome.	Percentage values: D=100.		
				H.	C.	P.
30.5	20.0	..	8	65.6	..	26.2
53.5	40	9.0	13	74.8	16.8	24.3
58.5	34	10.5	15	58.1	17.5	25.6
75.0	49	..	16	65.3	..	21.3

8. *SALMACIS RARISPINA* Alex. Agass.

Salmacis rarispina, Alexander Agassiz, Revision of Echini, pt. 3, 1872, p. 475.

References. J. E. Tenison-Woods, Proc. Linn. Soc. N. S. W. vol. iv. 1878, p. 161. P. de Loriol, Rev. Suisse de Zool. t. i. 1893, p. 370.

Locality. Singapore; two specimens dredged in 10 fathoms on sand. The species does not appear to be very common at Singapore, although M. de Loriol mentions having examined several specimens from that locality.

The description given by Mr. Tenison-Woods of individuals from N.E. Australia accords exactly with those in the present collection; and I think there can be very little doubt that they are the same species as Alexander Agassiz's *S. rarispina*; the pale wedge-shaped sutural markings so characteristic of this species are very obvious in both specimens. So far as I can judge, this, as suggested by Lovén, is the *Echinus sphaeroides* of Linnæus, but I cannot agree with him in identifying it with *S. globator* (β) described by Prof. Bell (P. Z. S. 1880).

Measurements.

	Diam.	Height.	Calyx.	Peristome.	Percentage values: D=100.		
					H.	C.	P.
1....	39	24	7.0	11	61.5	17.9	28.3
2....	54.5	38	..	14.5	68.8	..	26.6

9. *LAGANUM DEPRESSUM* de Blainv. (Plate XXIII. figs. 5 a-e.)

Laganum depressum, L. Agassiz, Monograph. d'Échinod. ii. 184, p. 110, tab. 23.

References. Alexander Agassiz, Revision of Echini, pt. 3, 1873,

p. 518. P. de Loricl, Mém. Soc. Phys. &c. de Genève, t. xxviii. no. 8, 1883, p. 37. C. Ph. Sluiter, Natuurk. Tijds. Ned. Ind. xlviii. 1889, p. 293. P. de Loricl, Rev. Suisse de Zool. t. i. 1893, p. 375.

Locality & Habitat. Abundant in 5 to 10 fathoms on mud. Singapore.

Distribution. Extends from the East Coast of Africa to Fiji and Kingsmills Is.

Adults are easily distinguished from *L. decagonale* by the shape of the test; the young, however, approach each other rather closely (*v. figs.*); 5 genital pores usually visible.

Measurements.

1. Length	37 mm.	Diameter	33 mm.
2. „	37	„	33
3. „	36.5	„	31
4. „	36	„	32
5. „	36	„	31.5

10. LAGANUM DECAGONALE de Blainv. (Plate XXIII. figs. 6 a-e.)

Laganum decagonum, L. Agassiz, Monogr. d'Échinod. ii. 1841, p. 112, tab. 23. figs. 16-20.

References. Alexander Agassiz, Revision of Echini, pt. 3, 1873, p. 520. F. J. Bell, Zool. Coll. of H.M.S. 'Alert,' 1884, p. 122. F. J. Bell, Ann. & Mag. Nat. Hist. ser. 5, vol. xi. 1884, p. 130. F. J. Bell, Proc. Zool. Soc. 1894, p. 411.

Locality & Habitat. Very abundant in 3 to 10 fathoms on mud. Singapore and Malacca.

Distribution. Previously recorded from Japan, Prince of Wales' Channel and Thursday Is., New Caledonia, and Bay of Bengal.

The colour, when alive, is a dull red; in spirit this first becomes green, and ultimately disappears more or less completely. As shown in the figures, the test is somewhat variable in shape, the angles of the outline being somewhat less marked in young individuals. The size of the genital openings varies considerably; normally there are four present, although occasionally the posterior pore also occurs: in some specimens the genital openings are quite indistinguishable even in the denuded test; the extent to which the coronal sutures are visible is also extremely variable. This species is placed by Agassiz and others in the subgenus *Peronella*, but Professor Bell (*loc. cit.* 1883) has shown reasons for discontinuing this mode of subdivision of the genus.

Measurements.

1. Length	66.5 mm.	Diameter	63.5 mm.
2. „	57	„	51
3. „	54	„	49.5

11. LAGANUM, sp. ? (Plate XXIII. figs. 7 a, b.)

Four small specimens were found among a number of individuals of *Laganum depressum* and *decagonale* which I cannot ascribe to either of these species. It seems possible that they may be hybrid forms. The test is more swollen than in any specimens of either of the two species named; in shape they are quite orbicular and the four genital pores are very large (the posterior being absent): in the two smaller specimens the actinostome and anus are exceptionally large; the internal calcareous connections between the upper and lower surfaces are more complicated than in *L. depressum*, but do not extend to half the distance from the periphery to the centre as in normal *L. decagonale* (v. figs.).

12. ARACHNOIDES PLACENTA Agass.

Arachnoides placenta, L. Agassiz, Monogr. d'Échinod. ii. 1841, p. 94.

Reference. Alexander Agassiz, Revision of Echini, pt. 3, 1873, p. 530.

Locality. Singapore, one specimen between tide-marks.

Distribution. Mergui Archipelago, Burma, E. India Is., Australia, and New Zealand.

Transverse diameter 64 mm. Diameter in plane of odd ambulacrum 65 mm.

13. ECHINODISCUS LEVIS Agass.

Echinodiscus levis, Alexander Agassiz, Revision of Echini, pt. 3, 1873, p. 533.

Lobophora truncata, L. Agassiz, Monogr. d'Échinod. ii. 1841, p. 66.

Locality. Singapore, three specimens between tide-marks; at low tide they lie just covered by sand.

Distribution. S. Africa, E. India Is., New Caledonia, China Seas, and Japan.

In one specimen the lunule is incompletely formed on one side, the slit not being closed posteriorly; in the others both lunules are complete.

This species is very closely allied to *E. biforis*, from which it is distinguished by the shape of the test, which is relatively longer in the former, and the transverse line of greatest breadth passes close to the apex, being much more anterior in position than in *E. biforis*; the lunules, also, are shorter. Louis Agassiz's distinction, based on the absence of transverse grooves between the pore-pairs in *L. truncata*, does not hold good; in one specimen the pore-fields on the right side of the odd (ant.) ambulacrum and right posterior ambulacrum are devoid of continuous pore-grooves, while on the other pore-fields they are present; the characters first mentioned are also so variable, that it is quite possible that we are really dealing with a single species¹.

¹ Dr. Hanitsch has sent me an example of this species obtained at Malacca.

Measurements.

Trans. diam.	Other diam.	Distance of anus from post. edge.	Length of lunule on right side.
42	39·5	about 4	6
85	81	6	14
92·5	85·5	5·5	14

14. *LOVENIA ELONGATA* Gray.

Lovenia elongata, J. E. Gray, Catalogue of Echini in Brit. Mus. i. 1865, p. 45.

References. Alexander Agassiz, Revision of Echini, pt. 3, 1873, p. 575. Alexander Agassiz, 'Challenger' Reports, vol. iii. Echinoidea, 1880, p. 175. R. Koehler, Mém. Soc. Zool. de France, t. viii. 1895.

Locality. A single damaged specimen from 4 fathoms on mud. Singapore.

Distribution. Recorded from the Red Sea and Cape of Good Hope to the Philippines; it extends also into North and West Australia, and according to Agassiz it is found in the Gulf of California.

There is some doubt as to whether this species is correctly determined, on account of the broken condition of the posterior end of the test; but the arrangement of the long serrated abactinal spines and the shape of the actinostome resemble those parts in *L. elongata* more than in *L. subcarinata*, the only species with which it could be confounded: the colour also is characteristic of *L. elongata*, the large spines being yellow banded with violet as in the type.

15. *METALIA STERNALIS* Lamarck.

References. Alexander Agassiz, Revision of Echini, pt. 3, 1873, p. 600. P. de Loriol, Mém. Soc. de Phys. &c. de Genève, t. xxviii. p. 44, 1883.

Locality. Pulo Brani, Singapore.

Habitat. This species appears to burrow in fine sand between tide-marks in the same way as *Echinocardium cordatum* on our own coasts.

Distribution. Extends from the Red Sea to Sandwich Is. in the Indo-Pacific circumtropical littoral region; it is also recorded from Australia and New Zealand.

It is at once distinguished from *Brissus carinatus* by its cordiform subanal fasciole, narrower actinal plastron, and deep anterior groove.

Measurements.

Length.	Trans. diam.	Ant. petal.	Post. petal.	Height.	Act. plastron.
71·5	64	24·5	30·5	41	22

16. *BRISSUS CARINATUS* Gmelin.

Brissus carinatus, Gmelin, Linn. Syst. Nat. 1788, p. 3200.

Brissus scillæ, Ag., Agassiz & Desor, Ann. Sc. Nat. sér. 3, Zool. t. viii. 1847, p. 13.

Brissus columbarius, Gray, } J. E. Gray, Catalogue of Echinoidea
Brissus carinatus, Gray, } in Brit. Mus. pt. i. 1855, pp. 53, 54.

Brissus unicolor, Alex. Agass. (not Klein or Leske), Revision of Echini, pp. 97, 357, 598, 1872.

References. N. G. Leske, Addit. ad Kleinii Disp. Echin. 1778, tab. xlviii. figs. 4, 5. F. J. Bell, Proc. Zool. Soc. 1879, p. 349. P. de Loriol, Mém. Soc. de Phys. &c. de Genève, t. xxviii. 1883, p. 47. S. Lovén, Bih. K. Sv. Vet.-Ak. Handl. Bd. 13 (4), 1887, p. 165.

Locality. One denuded test dredged off Pulo Brani, Singapore: there is also another test of this species in the Raffles Museum collected at Singapore.

Distribution. Ranges over the entire circumtropical littoral zone, including the West Indies, Cape Verd Is., Mediterranean, and Indo-Pacific as far east as the Society and Sandwich Islands; it is not recorded from Australia.

M. de Loriol does not agree with Prof. Bell in uniting the *Brissus unicolor* and *carinatus* of Alexander Agassiz into one species; he bases his distinction on characters admittedly variable in different individuals of the same size and in the same individual at different stages of growth. I have therefore, with some hesitation, followed Professor Bell in this respect; but since Dr. Lovén has shown that Klein's *Brissus unicolor* is probably identical with *Metalia maculosa* and certainly not a true *Brissus* at all, it follows that the name of *B. carinatus* should be retained for this species, which is undoubtedly the same as that referred to by Leske as *Spatangus brissus latecarinatus* and renamed *carinatus* by Gmelin. In our example the peripetalous fasciole is normal for Eastern forms, having two re-entering angles in each anterior interambulacrum, and in the odd interambulacrum it forms a deep angle as in Leske's figure of *Spatangus brissus latecarinatus*. The subanal fasciole is reniform, and there are 5 pedicellar pores on each side of subanal area.

Measurements.

Length.	Trans. diam.	Ant. petal.	Post. petal.	Height.	Act. plastron.
70	52	22	28	39.5	21.5.

II. ASTEROIDEA.

Seventeen species of Asteroids were collected, several of which were, however, represented by single or few individuals; five species were found in the immediate neighbourhood of Malacca, but these were all specifically distinct from any found at Singapore and 3 out of the 5 were very abundant. This is worth noting, since the four species of Echinoids collected at Malacca were common

also at Singapore. The question of the extent to which the same species alters as it migrates from its specific-centre is one the solution of which must lead to a clearer idea of the mode of origin of new species (or rather perhaps new "form-units"). In many cases the same range of variation appears to occur throughout the whole area of distribution of the species, while in other cases we can speak of local varieties or local races; and in such, attempts have been made to trace a gradual progressive modification as we pass outwards from the supposed original "centre." This has been exemplified in some detail by Dr. Döderlein¹ for two species of *Culcita*. In this genus the form and distribution of the pore-areas over the abactinal surface vary considerably within the limits of the same species, and in the two species, *C. schmideliana* and *C. novæ-guineæ*, these pore-areas have a similar independent range of variation from forms with small disconnected areolæ to others in which the areolæ merge into one another, leaving small isolated spaces devoid of pores. *C. schmideliana* var. *ceylonica* and *C. novæ-guineæ* var. *plana* belong to the former type, while *C. schmideliana* var. *africana* and *C. novæ-guineæ* var. *arenosa* belong to the latter type. The distribution of the two species is as follows: *C. schmideliana* occurs in the western part of the Indian Ocean, while *C. novæ-guineæ* extends throughout the Malay Archipelago and Eastern Pacific. Dr. Döderlein points out that at Ceylon var. *ceylonica* occurs, while at Sumatra and Java, the most western points to which *C. novæ-guineæ* extends, var. *plana* is found; and from this he draws the conclusion that "wo die Verbreitungsgrenze beider Arten aneinanderstösst, finden sich Varietäten, die einander auffallend ähneln." From this it would appear that the two species originated from a form intermediate between var. *ceylonica* and var. *plana*, and that the specific-centre of this form would lie between Ceylon and Malaysia. This, however, is at once falsified by finding the opposite extreme of variation, viz. var. *arenosa*, at Singapore, a point nearer to Ceylon than the places at which var. *plana* has been collected. This merely shows how important it is to determine the distribution of varieties before questions of position of specific-centre can be solved, and it will serve, I hope, as an apology for what may be regarded as unnecessary detail in the descriptions I have given of specimens collected. In the case of *Astropecten javanicus* we appear to have a case of progressive modification as we pass from Java through the Straits of Malacca to the Mergui Archipelago, where *A. andersoni*, which I believe to be a variety of *A. javanicus*, is found; but it would be rash to assume this until the region is more fully worked out.

I have adopted in all cases the generic and specific notation employed by Professor Ludwig², as it seems to me preferable to attempt to impress some uniform scheme into systematic reports rather than to wage an incessant war of words in defence of doubtful claims to priority.

¹ Semon's Zool. Forsch. in Austr. &c. Bd. v. Lf. 3, 1896, pp. 310-316.

² Bronn's Thier-Reich, Bd. ii. Abth. 3, Asteroidea, 1899.

The following is a list of the species represented in the collection:—

1. *Archaster typicus* M. & T.
2. *Craspidaster glauconotus*, sp. nov.
3. *Astropecten javanicus* Ltk., var. *malaccanus* nov.
4. *Astropecten pleiacanthus*, sp. nov.
5. *Luidia longispina* Sladen.
6. *Luidia penangensis* de Lor.
7. *Luidia maculata* M. & T.
8. *Iconaster longimanus* Möb.
9. *Goniodiscus articulatus* de Lor.
10. *Stellaster incei* Gray.
11. *Anthenea flavescens* Perrier.
12. *Pentaceros turritus* M. & T.
13. *Culcita novaeguineæ*, var. *arenosa* Perrier.
14. *Palmipes rosaceus* M. & T.
15. *Retaster cribrosus* v. Mart.
16. *Patiria*, sp.
17. *Asterina*, sp.

The total absence of *Linckiadeæ* from the collection seems worthy of remark.

1. ARCHASTER TYPICUS.

Archaster typicus, Müller & Troschel, Archiv f. Naturg. 1840, p. 323.

References. Müller & Troschel, System der Asteriden, 1842, p. 65, Taf. 5. fig. 2. v. Martens, Archiv f. Naturg. 1866, p. 83. C. Ph. Sluiter, Natuurk. Tijds. v. Ned. Ind. xlviii. 1889, p. 309. P. de Loriol, Rev. Suisse de Zool. t. i. 1893, p. 378. L. Cuenot, Archives de Biologie, xi. 1891, p. 335. H. Ludwig, Bronn's Thier-Reich, Bd. ii. Abth. 3. Asteroidea, 1899.

$$R = 5.3 - 7.0 \times r.$$

Locality & Habitat. This species was very abundant on a sand-flat just exposed at low tide on Po Senang, Singapore; I did not meet with any examples elsewhere; its habitat appears to be identical on the islets of the Java Sea (*cf.* Sluiter).

Distribution. Extends from the Nicobars and Andamans through the Mergui Archipelago, Malay Archipelago, and N. Australia, as far as the Fiji and Tonga Is. It seems doubtful whether it occurs in Mauritius.

Out of five specimens brought back the superomarginals varied in number from 45 to 50 on each side of interbrachial arch (v. Martens gives 40-45, while Müller & Troschel give 36). There were no traces of superomarginal spines.

In one specimen at the base of one of the arms there is a constriction somewhat similar to that which occurs in *Linckia* before schizogony of the arm takes place; in the present case the

superomarginals meet across the abactinal surface, but the actinal plates are unaffected.

The anus is central, without any tendency towards Cuénot's interradius BC in any of the five specimens brought back: Prof. Ludwig, in his definition of the genus *Archaster*, says, "After central" (*loc. cit.* p. 667); whereas in the body of the work (p. 587) he corroborates Cuénot by stating that it lies "stets mehr oder weniger excentrisch in der Richtung einer interradialen Hauptebene," and he then continues to describe the particular interradius in agreement with Cuénot's notation BC, although he adopts a somewhat different mode of orientation.

Measurements of two extreme individuals:—

No. of marginals.	<i>R.</i>	<i>r.</i>	Arm-breadth.
46	64	12	13
46	71	10	13

2. CRASPIDASTER GLAUCONOTUS, sp. nov. (Plate XXIV. figs. 8 a, b.)

References. W. P. Sladen, 'Challenger' Reports, xxx. Asteroidea, 1889. H. Ludwig, Bronn's Thier-Reich, Bd. ii. Abth. 3, Buch 2, 1899. A. E. Verrill, Trans. Connect. Ac. vol. x. pt. 1, 1889, p. 213.

$$R=5 \times r.$$

Locality. Several specimens from 1 to 3 fathoms, Malacca.

Marginal plates very robust, superomarginals devoid of spines, granular; inferomarginals also granular with a variable number of spinelets; in some specimens there are two complete rows of 3 to 5 spinelets in each row on each plate, the abactinal ones being larger than the rest, but not standing out as a conspicuous fringe as they do in most *Astropecten*; in other specimens fewer spines are developed, in a few cases only one or two extra spinelets occurring in addition to those on the lateral line; the ventrolaterals also carry each several spinelets; as in *Craspidaster hesperus*, the ventrolaterals are few in number, not extending beyond the fourth inferomarginal. The abactinal surface is paxillose, each paxillus having a circular crown of about eight papillæ, the centre being usually smooth; as in *C. hesperus*, the plates are covered with a membrane which forms a serrated fringe on the edges of the marginals and dorsoventrals; superambulacrals are present between the ambulacrals and inferomarginals; the tube-feet are conical, without any sucking-disc; adambulacral armature is diplacanthid, arching over the furrow is a comb of six subequal spines, outside this on the aboral part of the ventral surface is a single rather stout spine, and on each of the three remaining edges of each plate is a vertical row of 3 to 5 rather short spines. Madreporite is small and circular, situated about halfway from outer edge to centre. In the youngest specimen obtained the spiculation of the ventrolaterals is already developed.

The colour, during life, is bluish green on the abactinal surface, the underside being white (in alcohol the colour rapidly bleaches to a dull grey).

This species is distinguished from *C. hesperus*, the only other known species of the genus, by the spinulation of the inferomarginals and ventrolaterals; the colour is also probably a constant distinguishing feature. As I hope to publish later some morphological details of this species, I will refrain from discussing here the systematic position of the genus, about which there appears to be much divergence of opinion (*cf.* Ludwig, Verrill, &c.).

	<i>R.</i>	<i>r.</i>	Arm- breadth.	No. of marginals.
Largest specimen . .	75	15	17	47
Smallest „ . .	18	6	6	23

3. *ASTROPECTEN JAVANICUS*, var. *MALACCANUS* NOV.

Astropecten javanicus, C. Lütken, Vidensk. Meddel. Naturhist. Foren. 1871, p. 234.

Astropecten andersoni, W. P. Sladen, Journ. Linn. Soc., Zool. xxi. 1889, p. 322, pl. 28. figs. 1-4.

Reference. C. Ph. Sluiter, Natuurk. Tijd. Ned. Ind. xlviii. 1889.

$$R=3.3 \times r.$$

Locality & Habitat. Abundant in about 2 fathoms on mud, Malacca: their food seems to consist principally of small Lamelli-branches.

Distribution. Previously recorded from Mergui Archipelago and Java.

This variety is intermediate between the type and *A. andersoni*. It differs from the former in the following particulars:—the lateral spines are always sharp; the ambulacral armature is triplacanthid in adult specimens, the outer series being composed of 2 or 3 small spines forming an oblique arc continuous with the small adoral spine of the middle series. It differs from *A. andersoni* in the spinulation of the inferomarginals, 3 or 4 spines being developed on each plate and forming a transverse row continuous with the lateral spines at the bases of the arms; the paxilli have a circular crown with 8 or 9 spines on the periphery and usually a single central spine. The colour is either chocolate-brown or grey in spirit, as in *A. andersoni*, which seems to me to be a variety of *A. javanicus*.

As in most species of *Astropecten*, there is a Polian vesicle on each side of the stone-canal and in each of the remaining 4 interradii; each is very long, with a large vesicular extremity, which comes to lie in one of the arms adjacent to the interradius in which the Polian vesicle originates.

<i>R.</i>	<i>r.</i>	Arm- breadth.	No. of marginals.
36	11	12	24 or 25

4. *ASTROPECTEN PLEIACANTHUS*, sp. nov. (Plate XXIV. figs. 9 a, b, c.)

Locality. Two specimens in 1 to 3 fathoms on mud on the east side of Singapore Island.

This species belongs to the division of the genus in which there are two series of spines on the superomarginals (Müller & Troschel's classification): the inner series is most strongly developed at the interbrachial angle and only extends a short distance along the arms; while the outer series disappears at their base, as in *A. aurantiacus*, *A. brevispinus*, and some S. American species. The adambulacral armature is triplacanthid; there are three furrow-spines, of which the middle is the longest; outside these on each plate there are two spines, of which the aboral is *much* larger than the adoral; the outer row is irregular, being usually composed of one or two small spines. The marginals are all covered with closely packed scale-like spinelets, the inferomarginals being provided in addition with several larger spines, which are not arranged in a single transverse row, but are situated somewhat irregularly, the abactinal lateral spine being the longest and most robust; paxillar crowns are very large and oval, with about 15 peripheral and 5 or 6 central spines, reminding one of *A. zebra* or *A. polyacanthus*.

This species is undoubtedly very closely allied to the Mediterranean species *A. aurantiacus*; its superomarginal spines are less prominent, the lateral spines are longer and narrower, the paxilli are provided with a larger crown, and the adambulacral armature is slightly different; in many respects also it is extremely like *A. polyacanthus*, from which it is, however, at once distinguished by the presence of bispinose superomarginals.

<i>R.</i>	<i>r.</i>	Arm-breadth.	No. of marginals.
51	12	14.5	27-30
32	9	11	24

5. *LUIDIA LONGISPINA*.

Luidia longispinis, W. P. Sladen, 'Challenger' Reports, xxx. Asteroidea, 1889, p. 254, pls. 43 & 45.

$$R = 5.75 \times r.$$

Locality. Two specimens dredged off Singapore in 10-15 fathoms on gravel in association with Gorgonians, &c.

<i>R.</i>	<i>r.</i>	Arm-breadth.
23	4	4.5

6. *LUIDIA PENANGENSIS*.

Luidia penangensis, de Loriol, Mém. Soc. Phys. &c. de Genève, suppl. vol. 1891, p. 25, pl. iii. fig. 2.

Locality. This species is very abundant off Malacca on mud in 2 to 10 fathoms of water, and reaches a much more considerable

size than any of the specimens examined by M. de Loriol. I have found small Lamellibranchs and an entire *Hoplodactyla* in the stomach. I do not remember to have seen any previous mention of Asteroids feeding upon Holothurians.

Distribution. Previously known from Penang.

The specimens appear to agree in all essential details with the original description: the general facies is, however, somewhat different, the arms, which are six in number in all individuals seen (about 30), being longer and narrower in the Malacca form. As M. de Loriol had received as many as fourteen specimens from Penang, this difference seems to be in some way correlated with the locality.

The large pedicellariæ on the adambulacrals mentioned by de Loriol as present in some cases appear to be constant in our specimens, and the anatomical details are subject to very little variation. Contrary to the general rule in long-armed starfish, the arms had not undergone regeneration in any of the specimens.

It is a striking fact that this species was not met with at Singapore, where an apparently similar habitat is available.

<i>R.</i>	<i>r.</i>	Arm-breadth.
125	21	
117	15	17
72	11	
51	10	11

At Professor Bell's request, M. de Loriol kindly sent two of his original dried specimens for comparison: these were much smaller than the average of our examples, but they seem to be similar in all essential respects, although, on account of the condition of M. de Loriol's specimens, it was impossible to carry out a very detailed investigation.

7. *LUIDIA MACULATA.*

Luidia maculata, Müller & Troschel, Syst. d. Ast. 1842, p. 77.

$$R = 7.6 \times r.$$

Locality. A single large 7-armed specimen from between tide-marks, Singapore. The arms had undergone a considerable amount of fracture and regeneration.

Distribution. Extends from Mozambique to Macclesfield Bank and northwards to South Japan.

<i>R.</i>	<i>r.</i>	Arm-breadth.
190	25	23

8. *ICONASTER LONGIMANUS.*

Astrogonium longimanum, K. Möbius, Neue Seesterne d. Hamb. u. Kiel. Mus. 1859, p. 7, Taf. i.

Dorigona longimana, F. J. Bell, Zool. Coll. of H.M.S. 'Alert,' p. 130, 1884.

References. J. O. E. Perrier, Révision des Stellérides, 1875, p. 229. Th. Studer, Abhandl. Akad. Wiss. Berlin, 1884. L. Doederlein, Semon's Zool. Forsch. in Austr. &c. Bd. v. Lf. 3, p. 31, Taf. xviii. fig. 3.

Locality. A single specimen dredged in 10 fathoms off Malacca.
Distribution. Malacca to Australia.

A single specimen was brought to Europe in 1837 from the Straits of Malacca by Eydoux and Souleyet (*v.* Perrier), but the authenticity of the locality has been since doubted; it is interesting therefore to have the opportunity of confirming the original statement.

This specimen appears to be identical with Australian examples in the British Museum; a minute, scanty granulation is present on the superomarginals, the inferomarginals being smooth; in three of the arms the superomarginals of each side alternate along the arm, especially towards its distal end (*cf.* Doederlein's figure and also Studer's *Dorigona moebii*).

<i>R.</i>	<i>r.</i>	Arm-breadth.	No. of marginals.
52·5	15	17·5	21

9. GONIODISCUS ARTICULATUS.

Pentaceros granulosus, J. E. Gray, Synopsis of Starfish, p. 6, tab. 6. f. iii. (1866).

Goniodiscus scaber, K. Möbius, Neue Seesterne d. Hamb. u. Kiel. Mus. 1859, p. 10, Taf. iii.

Goniodiscus articulatus (Linn.), P. de Loriol, Rec. Zool. Suisse, t. i. 1884, p. 638, Taf. xxxv.

References. W. P. Sladen, Journ. Linn. Soc., Zool. xxi. 1888, p. 328. R. Koehler, Mém. Soc. Zool. France, viii. 1895 p. 392.

$$R=2\cdot2 \times r.$$

Locality. Four specimens in 5 to 10 fathoms, Singapore (two are quite young).

Distribution Mergui, Singapore, Sunda Straits; Swan River and Fremantle, W. Australia. The species appears to be rare.

I can find no distinction between *Pentaceros granulosus* and this species.

<i>R.</i>	<i>r.</i>	Arm-breadth.	No. of marginals.
70·5	32	38	14-15.

10. STELLASTER INCEI.

Stellaster gracilis, K. Möbius, Neue Seesterne d. Hamb. u. Kiel. Mus. 1859, p. 12, Taf. i. figs. 3, 4.

Stellaster incei, J. E. Gray, Synopsis of Starfish in Brit. Mus. p. 7, 1866.

Stellaster belcheri, J. E. Gray, Synopsis of Starfish in Brit. Mus. p. 7, 1866.

Stellaster squamulosus, Th. Studer, Abhandl. Akad. Wiss. Berlin, 1884 iv. p. 33, Taf. iv. fig. 6.

References. L. Doederlein, Semon's Zool. Forsch. in Austr. &c. Bd. v. Lf. 3, 1896, p. 337. L. Doederlein, Semon's Zool. Forsch. in Austr. &c. Bd. v. Lf. 4, 1898.

Locality. This is perhaps the commonest Starfish in the district; it lives in 3 to 10 fathoms on mud or shelly gravel, Singapore. I found a specimen infested by two individuals of a species of *Thyca*, they were fixed close together on the abactinal side.

Distribution. Singapore to Australia, extends northwards to the Korean Straits.

		R.	r.	No. of marginals.	No. of tubercles :		No. of pigment-spots.
					rad.	interrad.	
1 ...	alc.	36.5	15.5	13	12	1	? (dissolved).
2 ...	"	29	10.5	13	3	0	? "
3 ...	"	21	8	12	5	0	? "
4 ...	"	14	5	9	0	0	? "
5 ...	"	12.5	4.5	9	0	0	? "
6 ...	formol	56	24	16	24	0	73
7 ...	"	55	23	15	?	?	21
8 ...	"	45	17	15	5	?	} 22+several small.
9 ...	"	41	16	15	?	?	
10 ...	"	38	14	15	5	0	27
11 ...	"	36	14	13	10	0	21
12 ...	"	27	10	13	11	1	23

Black pigment is developed on a variable number of the ventrolateral plates; this completely disappears in alcohol specimens, but is preserved with formol; there seem to be only a few cases in which the underside of starfish is pigmented; as in the case of the black pigment often found lining the body-cavity of Holothurians, its use is not in the least known.

11. ANTHENEA FLAVESCENS.

Hosea flavescens (part), J. E. Gray, Synopsis of Starfish, p. 9, 1866.

Anthenea flavescens, J. O. E. Perrier, Révision des Stellérides du Mus. de Paris, 1875, p. 276.

Locality. A single young specimen which appears to belong to this species was dredged between 5 and 10 fathoms off Tanjong Kling, Malacca.

Distribution. Previously recorded from Port Jackson and W. Australia.

R.	r.	Arm-breadth.	No. of marginals.
14	7.5	9	9

12. PENTACEROS TURRITUS.

Oreaster turritus, Müller & Troschel, System der Asteriden, 1842, p. 47.

Oreaster nodulosus, F. J. Bell, Proc. Zool. Soc. 1884, p. 66.

Reference. v. Martens, Archiv für Naturg. 1866, p. 77.

Locality. This species is found not uncommonly in about a fathom of water on the shore of the lagoon off the east side of Singapore Island.

Distribution. Indian Ocean, Eastern Archipelago, and N. Australia.

The systematic classification of the genus *Pentaceros* offers similar difficulties to those found in the Echinoid *Diadema*; in both cases we have exceedingly variable groups of individuals in which the norm of the variations is different in different localities. The four "species" *Pentaceros turritus* M. & T., *P. hiulcus* M. & T., *P. muricatus* Gray, and *P. alveolatus* Perrier, which Professor Bell describes as "apparently distinct," are based on characters which are admittedly subject to very great variation; and while Prof. Bell instances the presence or absence of marginal spines as a character by which "we can always safely discriminate between *O. lincki* (= *P. muricatus*) and *O. nodosus* (= *P. turritus*)" (*loc. cit.* p. 59), at the same time Dr. Martens had named two varieties of *P. muricatus* (var. *mutica* and var. *intermedia*) in which the marginal spines completely fail: this of course is entirely due to the fact that no two observers are agreed as to the best set of characters to select for specific diagnoses, and in consequence a totally different grouping of the same series of specimens would be resorted to by different systematists. Whether it is advisable in such a case to unite all the forms under one specific name, as has been suggested for the Pacific Diademas by Prof. Lovén, I do not feel in the least competent to express an opinion.

Specimens both with and without a central apical tubercle occur at Singapore as elsewhere, and in the former case the apical tubercles may be much longer and sharper than in the latter, in which they are usually mamilliform; I do not know if individuals with the marginal spines developed occur in the locality.

Two specimens gave the following measurements:—

R (act. side) = 116 mm., *r* = 46; arm-breadth = 54; no. of marg. plates = 23; 9 lophial tubercles, 3 or 4 interradials.

R (act. side) = 128 mm., *r* = 52; arm-breadth = 58; no. of marg. plates = 27; 7 or 8 lophial tubercles, 4 interradials.

13. *CULCITA* NOVÆ-GUINÆÆ, var. *ARENOSA*.

Culcita novæ-guinææ, Müller & Troschel, Syst. d. Ast. 1842, p. 38.

Culcita arenosa, J. O. E. Perrier, Révision des Stellérides, 1875, p. 264.

References. C. Ph. Sluiter, Natuurk. Tijd. v. Ned. Ind. xlviii. 1889, p. 305 (*C. schmideliana*). Cl. Hartlaub, Notes from the Leyden Museum, xiv. 1892, p. 65. R. Koehler, Mém. Soc. Zool. France, viii. 1895, p. 388. L. Doederlein, Semon's Zool. Forsch. in Austr. &c. Bd. v. Lf. 3, 1896.

Locality. This species is fairly common on Pulo Reugkam Singapore, between tide-marks on the reef; it lives in company with, and appears to have a mode of life similar to, the large tropical species of *Muelleria*.

Distribution. This variety has previously been recorded from Amboina, Ceram Laut, and the Sandwich Islands.

Unfortunately I have only examined one specimen with care, so that I do not know whether the other recorded varieties of the species also occur in the district. This specimen must certainly be regarded as the *C. arenosa* of Perrier: the pore-areas are not distinct from each other but tend to unite over the whole abactinal surface, leaving small, distinct islands which are devoid of pores and granular, the larger of these spaces being about the same size as the madreporite; they are devoid of large spines, thus differing from typical *arenosa* and approaching *C. coriacea* M. & T. The madreporite is an irregular oval structure, and is quite prominent, being bordered with a few large blunt spines; it measures 13 mm. \times 6.5 mm.

Dr. Doederlein has shown that *C. novæ-guinææ* differs from the Western species *C. schmideliana* in the character of granulation of the ventrolaterals, the larger granules not being divided up into distinct groups corresponding to the subjacent plates in the former. In the specimen now described this holds good, and parallel to the ambulacral furrow up to within a distance of about 7 mm. from it the granules enlarge gradually up to the furrow, where they form a conspicuous edging: in the adambulacral armature there are 3 to 6 furrow-spines (usually 5) on each plate, the outer row being extremely irregular and poorly developed, over a large part of the arms it seems to disappear completely.

Dr. Sluiter has pointed out how impossible it is in this genus to rely on shape for specific diagnosis; and in this species, at any rate, this character depends almost entirely on the mode of preservation. During life, especially when left dry on the reef at low-tide, the outline may alter considerably, and, if placed on a flat surface with the actinal side downwards, the upper side would flatten out over the edge, so that the ambulacral furrow would appear confined to the lower side (*cf. C. acutispinosa* Bell); also when specimens are placed in a basin and spirit is poured over them, the lower surface (abactinal or actinal) will often accommodate itself to the shape of the bottom of the vessel.

$$R + r = 195 \text{ mm.}$$

14. PALMIPES ROSACEUS.

Asteriscus rosaceus, Müller & Troschel, System d. Ast. 1842, p. 40

Distribution. Japan and Bay of Bengal.

Locality. One large and rather damaged specimen in 5 fathoms, Singapore.

This species, being the only 15-armed Asterinid, is easy to recognize; it appears to be rare.

$$R = 121.5 \text{ mm.}, r = 82 \text{ mm.}$$

15. *RETASTER CRIBROSUS*.

Pteraster cribrosus, von Martens, Arch. f. Naturg. 1867, p. 109, Taf. iii. fig. 2.

Retaster insignis, W. P. Sladen, 'Challenger' Reports, vol. xxx. Asteroidea, 1889, p. 482.

References. M. Sars, Öfv. af Norg. Ech. Christiania, 1861, tab. 4. J. O. E. Perrier, Révision des Stellérides, 1875, p. 383. L. Doederlein, Semon's Zool. Forsch. in Austr. &c. Bd. v. Lf. 3, 1896, p. 319.

Locality. Four specimens, two of which are quite young, in 10-15 fathoms, Singapore.

Distribution. Zanzibar, Mozambique, Ceylon, Philippines, Amboina, Samoa (*Doederlein*).

The largest specimen agrees with Dr. Doederlein's description of a specimen from Amboina. The colour, when alive, of all four specimens was bright brick-red, but they rapidly become colourless in spirit; when alive, the osculum can be seen to open and close with a fairly regular rhythm of about once every ten seconds. Sars has given an account in *Pteraster militaris* of the osculum bounded by five lappets and of the cavity into which it leads, situated between the dorsal membrane and the true abactinal surface of the body, and in direct communication with the exterior by a large number of short straight tubes in the former and lined by a columnar epithelium; it appears to function in both sexes as a respiratory chamber, and secondarily in the females as a brood-pouch; but my want of knowledge of Norwegian has prevented me from understanding Sars's paper as much as I should have wished, but the relations appear to be the same in this species. The reticular arrangement of muscle-fibres in the dorsal membrane is only apparent under a microscopical examination.

In addition to these 15 species there were two species of *Asterinidæ*, each represented by a single specimen. I cannot identify them as belonging to any known species; but as they both appear to be young forms, it seems advisable to defer description until a later date, when a fuller series may be obtainable: they belong to the genera *Patiria* and *Asterina* respectively.

EXPLANATION OF THE PLATES.

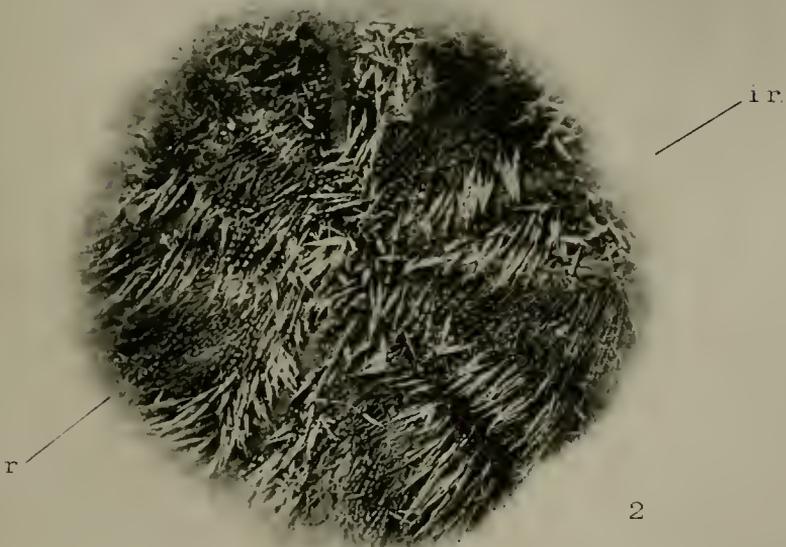
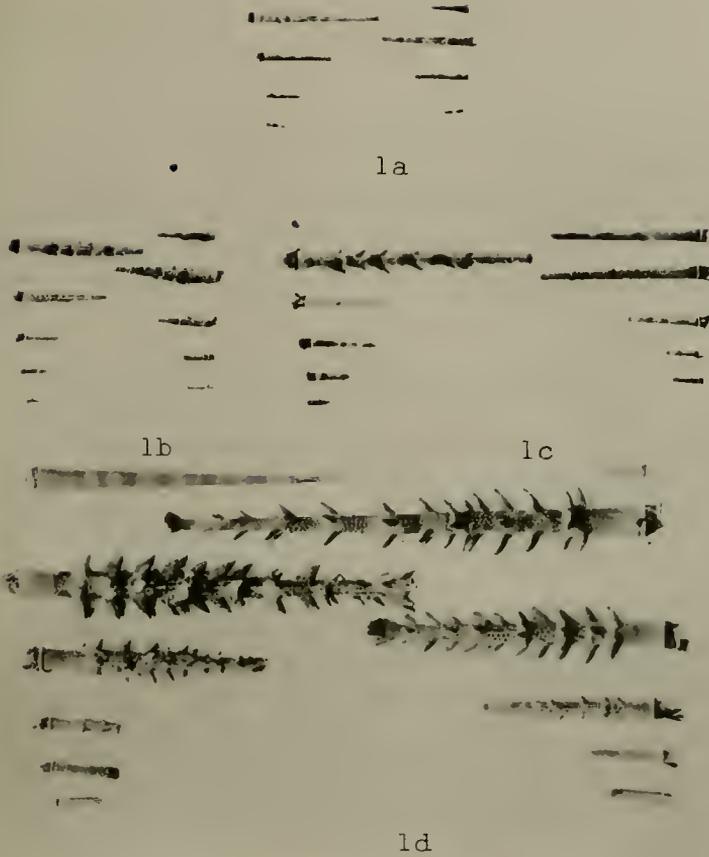
PLATE XXI.

Fig. 1. *Rhabdocidaris annulifera*, p. 274.

a.	Spines from an interambulacrum of specimen	No. 1.	Nat. size.
b.	"	"	No. 2. Nat. size.
c.	"	"	No. 4. Nat. size.
d.	"	"	No. 6. Nat. size.

(*Vide* table of measurements in text, p. 276.)

The spines are so arranged that the uppermost in each series is that which lies nearest to the calycinal system of the test, the lowermost being that which borders on the actinostome; they are also laid flat, so that their bases lie next to the adjacent ambulacrum, their points being directed towards the centre of the interambulacrum; no attempt has been made



G T Harris phot.

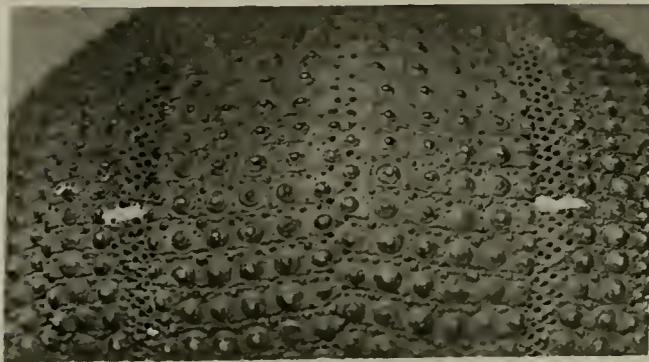
Morgan & Kidd, collect



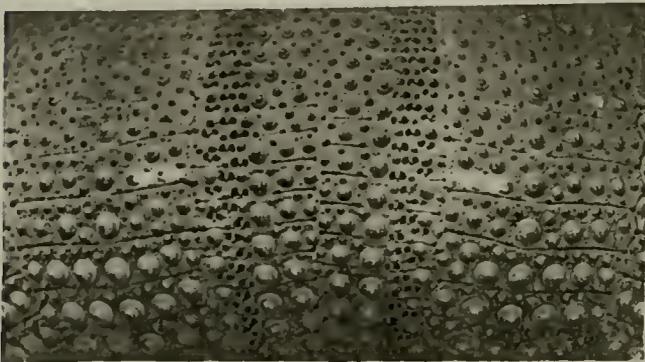




3 a



3 b



4 a



4 b

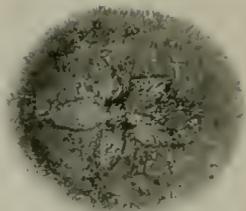
G T Harris, phot.

Morgan & Kidd, collot

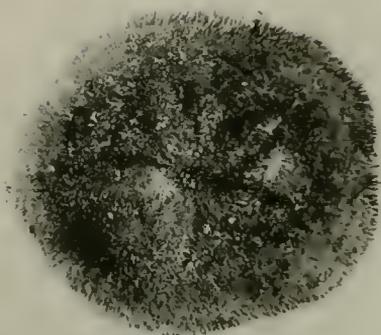




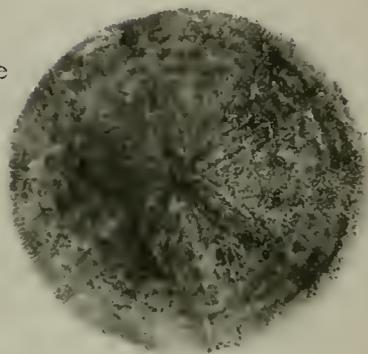
7a



7b



5c



6e



5d



6d



5c



6c



5b



6b



5a



6a

G T Harris, phot

Morgan & Kidd, collect

ECHINODERMS FROM SINGAPORE AND MALACCA



9a



9b



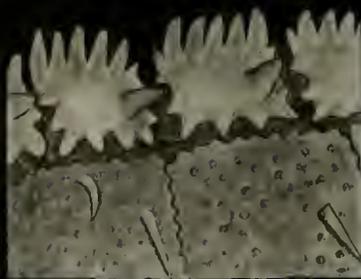
8a



9c



8b



G T Harris, phot

Morgan & Kidd, collect

ECHINODERMS FROM SINGAPORE AND MALACCA.

to reproduce the actual distance between the spines, but those on one side of the interambulacrum are shown in a respectively higher position than those on the other side, as is the case when in their natural position on the test (owing to the alternation of the coronal plates).

- Fig. 2. *Asthenosoma heteractis*, p. 278. Abactinal view (in spirit) Four-fifths nat. size.
r., radius; *ir.*, interradius.

PLATE XXII.

- Fig. 3. *Salmacis sulcata*, p. 281.
a. Ambulacrum, $\times 2$. *b.* Interambulacrum, $\times 2$.
 Fig. 4. *Salmacis globator*, p. 282.
a. Ambulacrum, $\times 2$. *b.* Interambulacrum, $\times 2$.
 The white lines indicate the position of the ambitus.

PLATE XXIII.

- Figs. 5 *a-e.* *Laganum depressum*, p. 283. Different stages of growth, nat. size.
 Figs. 6 *a-e.* *Laganum decagonale*, p. 284. Different stages of growth, nat. size.
 Figs. 7 *a, b.* *Laganum* sp. ? (possibly a hybrid between *L. depressum* and *L. decagonale*), p. 285.
 All the specimens are viewed from the abactinal side.

PLATE XXIV.

- Fig. 8. *Craspidaster glauconotus*, p. 290.
a. Actinal view, nat. size. *b.* Adambulacral armature (from drawing), $\times 15$.
 Fig. 9. *Astropecten pleiacanthus*, p. 292.
a. Abactinal view, nat. size. .
b. Actinal view, nat. size.
c. Adambulacral armature (from drawing), $\times 15$.

3. Notes on the Zoological Garden of Berlin.

By F. E. BLAAUW, C.M.Z.S.

[Received March 13, 1900.]

Having had the opportunity of visiting the Zoological Garden of Berlin in November last, I think it may be of interest to give you some particulars as to the collection of animals now to be seen there.

The Zoological Garden of Berlin, as is well known, owes its first great development to the late Dr. Bodinus, who succeeded in getting "a shower of gold," as the Berlin people call it, to descend on that part of the Thiergarten which is devoted to the zoological collection. This "shower of gold" enabled Bodinus to erect, amongst other buildings, the oriental palaces in which the Pachyderms and the Antelopes are kept. As time went on, however, this "shower of gold" unfortunately did not remain continuous; and those who visited the Garden towards the end of Dr. Bodinus's career received rather the impression that showers of rust, dust, and mud were of more frequent occurrence than those of the precious metal.

In 1884 Bodinus died, leaving the Garden in great disorder; the buildings were entirely out of repair, the fences were rusty and the animals were not properly kept. Other matters, moreover, did not make things easy for his successor. In 1885 Dr. Bodinus was succeeded by Dr. Max Schmidt, formerly Director of the Frankfurt Zoological Garden, who, during the short time of his Directorship (he died in 1888), had scarcely time to make many great reforms, though he did much in the way of improving the administration. Dr. Schmidt was succeeded in 1888 by Dr. L. Heck, then Director of the Zoological Garden of Cologne. On his arrival in Berlin Dr. Heck found matters much as described above, and it took him some years to get the difficulties put straight. This time of difficulties, however, seems now to have come to an end, and the "shower of gold" of the early years of Bodinus has apparently returned in a still more copious form.

During the last three or four years the greater number of the old unsuitable houses and yards have disappeared and have been replaced by new ones, in which the animals can be kept better in every way. Likewise the old "palaces" have been repaired, and the interior arrangements have been greatly improved.

The collection of animals is steadily increasing, and examples of a great number of species which are not to be found in any other continental garden are exhibited. In fact the number of species, which amounted to about 600 when Dr. Heck arrived at Berlin, has now been increased to double that number.

Dr. Heck takes a special interest in geographical forms, and many interesting series of varying species have been thus brought together. The large Cats' House contains a very beautiful set of Tigers of six geographical races, comprising specimens from Bengal, Singapore, Eastern Siberia (*Felis tigris longipilis*), Northern Persia (*F. t. virgata*), the Altai (*F. t. mongolica*), and Turkestan (*F. t. striata*). Of special interest amongst these is the family of Tigers from Eastern Siberia, as it comprises a splendid pair of adults in perfect condition, and three young ones born in the Garden. As the male is not kept separate from the female and young ones, the whole group is very striking. The Persian Tigers are very remarkable from their lion-like mane, which extends not only over the neck but all along the breast and belly. The Leopard (*Felis leopardus*) is represented by six different geographical forms, comprising specimens from the coast of German East Africa, from the interior, from Togo, from Persia (Askabad) (*Felis l. tulliana*), from Northern China (*F. l. fontanieri*), and from India. The *F. fontanieri* is a splendid animal of great size, with a remarkably long rough coat of greyish colour, on which the black marks, especially on the upper side, are much less clearly defined than is usual with other Leopards. This animal is said to have been presented, when quite a cub, to the daughter of an English merchant by the Empress of China. It was at first kept in the house as a pet, but when growing too large it was parted with to a dealer, who in his turn sold it to Dr. Heck. The Persian Leopard is also a very large, but at the same time a

very ferocious beast; it was obtained from the Kopet-dag Mountains, on the northern boundary of Persia. It has a long, rough tail and clearly-defined black marks on a very light yellow ground. Amongst the series of Lions I specially noticed a splendid male from Delagoa Bay and a pair from German East Africa. In the last-named pair the male showed a short light-coloured mane, whilst the female, although quite adult, was very much spotted on the legs and belly. Pumas were represented by large grey animals from Texas, and red-coloured ones from California and Missouri. There was also a hybrid between the Puma and the Indian Leopard. The small Cats included specimens of *F. geoffroyi*, *F. passerum*, *F. celidogaster*, *F. moormensis*, *F. caligata*, and *F. caffra*; whilst there was quite a large series of Lynxes. Amongst these I noticed *F. serval* from German East Africa, *F. servalina* from Liberia, *F. caracal* from India and Tunis, a large Lynx from North America, remarkable for its circular black spots as in the Leopard (*F. lynx fasciata*), and specimens of *F. tibetana* from Turkestan and *F. isabellina* from the Altai.

Wolves are represented in the Berlin Garden by *Canis chanco* from the Altai, *C. latrans* from North America, and the southern form *C. ochropus* (*C. occidentalis* Rchds.), *C. hadramauticus* (typical specimens from Southern Arabia), and *C. dalmaticus*, representing the South-European Jackal. There are also examples of several species of Foxes, and of special interest was a fine litter of young Corsacs (*C. corsac*). The Fennec Fox has bred in the Garden, and a specimen born there a few years ago looked in very good condition. Amongst the Hyænas was remarkable a Spotted Hyæna from Togo, which has been described by Dr. Matschie as *Hycæna togoensis*. It is distinguished from the East-African Spotted Hyænas by its pale grey ground-colour. The spots are coal-black, as are also the legs in their lower halves and the face.

In the Small Mammals' House was a specimen of *Cryptoprocta ferox* which had lived in the house since 1892; a specimen of the Indian Zibeth-Cat from Siam, which equals in size the African species; also a fine series of Genets from Tripoli (*Genetta bonapartei*), from German East Africa (*G. tigrina*), from Somaliland (*G. dongolana*), from German South-west Africa (*G. felina*), and from Togo (*G. genetoides*). I also noticed fine specimens of *Paradoxurus leucomystax* and of *P. tytleri*. Ichneumons were represented by five species—*Herpestes ichneumon*, *H. pluto*, *H. widdringtoni*, from Spain, *H. albicaudata* (in beautiful condition), and *H. caffer*, the last two named from German East Africa. Worthy of note are also specimens of *Mustela eversmanni* from the Altai, a Zorilla from Tripoli, a Glutton from the Altai (remarkable for its very lightly-coloured head), *Cercoleptes brachyotis* (of a greyish-yellow colour), *Ratelus leuconotus*, and *Meles ankuma*.

Amongst the Rodents at Berlin were fine specimens of *Sciurus varius*, *Eliomys munbyanus* (from Tripoli), *Arvicola nivalis*, the very curious *Aulacodus swindernianus*, and a pair of large maneless Porcupines from Siam, which Dr. Heck thought might, perhaps,

be referable to the Sumatran species described as *Hystrix longicauda*. In this same Small Mammals' House was also a fine specimen of *Perameles lagotis*, and a specimen of *Echidna hystrix* which had lived more than five years in the Garden.

In the large Bear-cages were, amongst other fine specimens of Bears of various species, a remarkably large example of a Brown Bear from Japan (Jesso), probably *Ursus behringianus*, and also specimens of a small black Bear from Japan both with and without a white collar. The all-black Bears have been described by Dr. Matschie as *U. rexi*, after the name of the donor.

The *Equidae* at Berlin are represented by six species, including *Equus hemionus*, *E. onager*, *E. africanus*, and *E. burchelli*, the typical form of which, with white unstriped legs, is getting extremely rare. Its place is now taken in most Zoological Gardens by the more northern form with striped legs (*E. chapmanni*), which is imported regularly by Reiche and other dealers. This form is also represented in the Berlin Garden, as also is the Mountain Zebra (*E. zebra*), by a fine female specimen.

In the repaired and re-decorated Elephant-house I found specimens of the Indian and African Elephants, and of the latter an example from West Africa (Cameroons). This animal, as Dr. Heck pointed out to me, differs in many respects from the generally imported East-African Elephant, of which also a specimen is exhibited. The most noticeable difference is that the ears in the West-African specimen are comparatively much smaller than in the East-African one, and also of a different shape. In the East-African animal the lower part of the ears is much elongated and projects forward along the lower jaw in a long pointed triangle. In the West-African specimen the ears are very much shorter and rounder, and do not project forward nearly so much. The skull of the West-African Elephant is also much smaller and flatter than the skull of the East-African one. As the West-African specimen is still young, it will be interesting to watch whether these peculiarities increase or decrease as the animal gets older. In the same house was a fine Indian Rhinoceros, and four varieties of the American Tapir, differing in size, colour, and coat. An Indian Tapir was also present.

The collection of Swine is a very good one. It comprises examples of the Wild Swine from the Caucasus, Morocco, and India; a fine specimen of *Sus philippinensis* with very remarkable long pointed white whiskers, and round white warts halfway between the eyes and the nose. Also of interest are examples of Wart-hogs (*Phacochoerus*) from Senegal, German East Africa, and South Africa.

The Deer, which in former times were a rather ill-arranged and badly-housed group of animals, have now got new houses and enclosures, and form one of the most interesting series of Ruminants. Amongst the very large number of species exhibited I specially noted the following—*Cariacus inornatus* from Colombia, remarkable for the yellow colour of its coat; *Cariacus*

macrurus, *C. savannarum* (from the Orinoco), and *C. mexicanus*; a very large, nearly unspotted, form of the Hog-deer from Siam, and the smaller spotted form (*Cervus minor*) from Assam; *Panolia eldi*; a male and two females of Père David's Deer; and a fine young male of *Cervus schomburgki* from Siam.

In the Antelope-house I noticed a fine specimen of *Bubalis lichtensteini* from the Zambesi, examples of *B. caama* and *B. buse-laphus*, a young male *Damaliscus albifrons*, a fine young male *Hippotragus bakeri* (brought by Menges from the Soudan), a pair of *Addax*, and examples of *Tragelaphus gratus*, *T. sylvaticus*, and the allied form *T. roualeyni* from German East Africa. In a newly-erected building with nice sunny enclosures some of the Duiker Antelopes were housed, and amongst them I recognized a fine female of the West-African *Cephalophus coronatus* with a calf, also specimens of *C. rufilatus* and *C. campbelli*.

In the Goat and Sheep collection I observed, together with a fine group of *Hemitragus jemlaicus*, a female specimen of the smaller *H. hylocrius* of the Nilgherries; also an adult male specimen of *Capra jerdoni* and examples of *Capra aegagrus* from the Caucasus and Persia (Luristan); likewise a pair of *Capra sibirica*, a pair of *C. ibex* (from the Grayian Alps), a *C. cylindri-cornis*, and specimens of *Ovis arkal*.

The *Bovidae* were represented in Berlin by a beautiful pair of *Bos sondaicus*, a fine young bull of *B. gaurus* and examples of *B. frontalis*, a pair of Anoa's with a calf, *Bos arni* and other Buffaloes and Bisons, both from Europe and America. The European Bisons had bred for many years in the Garden, but had rather come to a standstill in this respect. The old male was an invalid, and its offspring were so much bred in, that fresh blood is greatly wanted.

In the Monkey-house the part in which the animals are kept in large cages, with top-light and with palms and other tropical plants in the background, is separated from the part for visitors by large glass panes so that no draught nor unsuitable food can reach the animals. Several fine and rare species are exhibited here, as, for example, a fine pair of *Semnopithecus schistaceus* from the Himalayas, and a splendid adult pair of *S. entellus*. There are also specimens of *Cercopithecus ruber* (from Togo), *Cercocebus agilis* (from the Congo), *C. albigena*, *Macacus fusco-ater*, *Cynopithecus niger* (an enormous fully adult specimen), and *Cynocephalus langheldi* from German East Africa. In large outdoor cages are interesting families of *Macacus speciosus* and *M. inuus*.

The collection of birds is very extensive. A fine large building in Japanese style had not long ago been completed for the reception of the Cranes, Storks, and Herons. To keep away the offensive smell of the fish-eating birds, large glass panes are carried right along the row of compartments containing the Storks and Herons, so that the air in the large middle hall is quite sweet, and these birds can be examined in perfect comfort. The Crane-collection is very complete, and only *Grus antigone*

G. nigricollis, and *G. monachus* are deficient. I specially admired a fine pair of *Anthropoides leucauchen*. On the Stork-and-Heron side of the building I noticed amongst the former a splendid specimen of *Ciconia boyciana*, a *Tantalus loculator*; and amongst the latter a fine specimen of *Ardea sumatrana*, also *A. goliath*, *A. cocoi*, &c. In the same house were specimens of *Chunga burmeisteri* and of *Cariama cristata*.

In the neighbourhood of the Crane-house a new building for small birds, Parrots, &c., has been erected. For the present only one half of this building, which is eventually to consist of two houses with a large "flying aviary" between them, has been completed. In the above-mentioned aviary the background is formed by a nicely laid-out rockery, whilst large trees and a piece of water help to make it a favourite resort for the birds. It contains a large number of Waders of different species, some Mergansers, and quite a colony of Herons and Night-herons, which breed in the large trees. Of special interest were three hand-reared Ospreys (*Pandion haliaëtus*), which flew about the aviary without being noticed in the least by the numerous small Waders and Gulls and other birds. Dr. Heck told me that this had been the case from the beginning, the birds probably knowing that the fish-eating Ospreys have nothing in common with the dangerous Birds of Prey. It was rather a curious sight to see one of these Ospreys swim in the little pond between the Smews in a very duck-like fashion. Amongst the Waders was a pretty group of *Himantopus nigricollis*. In the house itself was a large collection of birds, mostly exhibited in small cages in long rows, one over the other. Some of the more delicate birds were kept in glass cages with tops of wire and with a special heating-apparatus under the cage, a system which seemed to answer extremely well. On the whole I think the cages were in most cases too small, but thanks to the cleanliness and to the great care bestowed on the birds, they appeared generally to be in extremely good health and plumage.

Amongst the Parrots exhibited I saw examples of seven species of *Palæornis*, including a splendid pair of the large *P. derbianus* from Southern China, which I have never seen elsewhere; examples of fourteen species of Cockatoos (amongst them a splendid *Microglossus aterrimus*); *Nestor notabilis* and *N. meridionalis*; ten species of Macaws, with *Ara hyacinthina*, *A. leari*, *A. glauca*, *A. spixi*, and the rare *A. ambigua* in the number; twelve species of *Platycercus* and its allies, including *P. multicolor*, *P. hæmatonotus*, *P. browni*, and *Polytelis alexandre*; also *Pyrrhulopsis personatus*. Besides I found such rare birds as *Henicognathus leptorhynchus*, *Pæocephalus versteri*, *Pionopsittacus pileatus*, *Pionias chalcopterus*, *Chrysotis hecki*, *C. xanthopteryx* (being the Paraguayan form of *C. æstiva*, with yellow wing-bend), and *Nymphicus uvæensis*. The whole collection of Parrots includes examples of 136 species.

The *Picarice* present many interesting species, including four Toucans, two Aracaris, and six Hornbills, also Touracous (*Turacus*

buffoni, *T. macrorhynchus*, and *T. porphyreolophus*) and four specimens of *Colius leucotis*.

The *Passeres* include examples of 260 species, and out of this large number I wish to draw attention to the following species:—*Paradisea apoda* and *P. papuana*, in fine condition, *Ptilonorhynchus smithi*, *Geocichla citrina*, *Turdus flavipes*, *T. mustelinus*, *Dicrurus splendens*, *Hypsipetes leucocephalus*, *Pycnonotus melanocephalus*, *Artamus sordidus* and *A. superciliosus*. There are here also specimens of the beautiful *Trochaloxyron erythrocephalum* and *T. rufigulare*. There are also examples of *Pitta bengalensis*, *Ruticilla leucocephala* (from India) and *Rhipidura tricolor* (both lovely birds and in splendid condition), and of *Meliphaga phrygia*, *Melithreptes lunulatus*, and *Ptilotis auricomus*. The Finches include *Emberiza flaviventris*, *Phrygilus gayi*, *Poospiza personata*, *Passer cinnamomeus*, *P. dentatus*, *P. swainsoni*, and *Coccothraustes melanura*. *Poephila acuticauda* was present in two different forms, of which one has a yellow and the other a nearly coral-red bill. A pair of *Textor alector* had begun to build the curious nest of twigs peculiar to this species; it was not finished, but resembled a magpie's nest on a small scale. Among the Tanagers I noted a fine *Pitylus capistratus*, from Brazil. In this same house were some small Birds of Prey, including *Tinnunculus cenchroides*, *T. vespertinus*, *Athene glaux*, *A. ferruginea*, and *Scops pennatus*.

The larger Birds of Prey are housed in a series of good-sized cages. Conspicuous amongst them is a beautiful adult *Haliaeetus pelagicus*, and examples of several species of *Spizaetus*. The smaller Birds of Prey, kept in a stone building, with lodges open in front, also presented some good specimens. Of special interest was an example of the curious Crane-hawk (*Geranospizias caerulescens*) from Argentina, a fine *Falco feldeggii*, and amongst the Owls good specimens of *Bubo ascalaphus* and *B. turcomanus*.

The Water-fowl included a pair of *Dendrocygna eytoni*. These birds were very conspicuous from the manner they carried their brightly-coloured elongated flank-feathers away from their body. They are certainly the most beautiful of all the *Dendrocygnae*. Noteworthy amongst the Geese was a specimen of the rare *Chen rossi*.

Amongst the *Cracidae* I noticed a specimen of the rare *Pipile cumanensis*, with its striking blue throat-wattle.

The *Struthionies* were represented by three species or forms of Ostriches—the Somaliland Ostrich with blue neck and thighs (*Struthio molybdophanes*), the South-African bird with light grey neck (*S. australis*), and a third form from the Tonga hinterland, with red neck and thighs, which has been described by Oscar Neumann as *S. massaicus*. This male bird, as well as the skins of other males from this same locality in German East Africa, present the peculiarity that the feathers which are black in the other Ostriches are brownish black in this form.

The collection of Cassowaries includes a fine specimen of the One-wattled Cassowary from German New Guinea, chiefly distin-

guished from the true *Casuarinus uniappendiculatus* by its rounded greenish casque (lately described by Mr. Walter Rothschild as *C. u. aurantiacus*).

The *Phasianidæ* include examples of *Phasianus scemmerringi* and a fine pair of *Gallus varius*. A singular hybrid may also be mentioned; it is stated to be the produce of a female *Platalea minor* from Japan and a male *Ibis melanocephala*. This curious bird somewhat exceeds in size both its parents; the head is feathered as in the Spoonbill, whilst the bill, in general form, nearly resembles the bill of the Ibis, having only the point somewhat flattened. The colour of this bird is white.

Amongst the Pigeons a fine specimen of the Double-crested Pigeon (*Lopholæmus antarcticus*) was remarkable.

But I could go on much longer if I wished to give an account of all the interesting animals seen in this best of all the Continental Zoological Gardens, and I will therefore end here, and only add that if everything is carried out as it has been planned many more improvements will be shortly accomplished, and the whole of the old inconvenient buildings will disappear and be replaced by new ones well adapted for their purposes. How this has been accomplished in so comparatively short a time is Dr. Heck's secret.

April 3, 1900.

Prof. G. B. HOWES, LL.D., F.R.S., V.P., in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of March 1900:—

The total number of registered additions to the Society's Menagerie during the month of March was 44, of which 29 were by presentation, 6 by purchase, and 9 were received on deposit. The total number of departures during the same period, by death and removals, was 128.

The following papers were read:—

1. On the Mammalia of Siam and the Malay Peninsula.

By STANLEY SMYTH FLOWER, F.Z.S., 5th Fusiliers.

[Received March 5, 1900.]

In order to write a complete account of the mammals of a country it seems necessary on the one hand to be able to examine the magnificent collection in the British Museum and to look up all the literature on the subject, which can only be done in a large library, and on the other hand to be able to see what specimens are represented in the local museums (where such exist) and

to have a certain knowledge, the more the better, of the animals alive in their own native wilds. The first of these things I have been unable to do, but having fortunately had opportunities of examining the mammals contained in the three museums which exist in the Malay Peninsula and the one in Siam, and having seen many alive, it may be useful to put these notes on record (as some account of the species occurring in these countries is much needed), hoping that they may help some more competent writer hereafter to compose a full catalogue.

The chief paper on the Mammals of the Malay Peninsula is Dr. Theodore Cantor's Catalogue, published in 1846, in the Journal of the Asiatic Society of Bengal (vol. xv. nos. 171 and 172), in which 93 species found wild in the Peninsula are enumerated. In the P. Z. S. 1886 Mr. Oldfield Thomas gave an account of the Mammals presented by Mr. A. O. Hume to the British Museum (Natural History); in this paper (pp. 72-79) 28 species are recorded from the Malay Peninsula, mostly from specimens collected by the late Mr. Davison.

Mr. H. J. Kelsall, R.A., in the Journal of the Straits Branch of the Royal Asiatic Society, no. 26, pp. 16 and 17, Jan. 1894, has recorded 13 species of mammals collected or observed during a journey from Kuala Indau to Batu Pahat, in Johore. And Mr. H. N. Ridley has published three papers on this subject:—(i.) "On the Dispersal of Seeds by Mammals," J. S. B. R. A. S. no. 25, 1894, pp. 11-32. (ii.) "List of Mammals recorded from Pahang," J. S. B. R. A. S. no. 25, 1894, pp. 57 to 60, in which 35 species are recorded. (iii.) "The Mammals of the Malay Peninsula," Nat. Science, vol. vi., nos. 35, 36, and 37, Jan., Feb., and March, 1895, in which about 46 species are mentioned by name.

In Dr. Jean Gerard Koenig's journal of his voyage to Siam (translation, J. S. B. R. A. S. no. 26, 1894) there are very few references to the mammals of the country; they are as follows:—

(P. 126) 8th Nov. 1778, at mouth of Bangkok River: "A squirrel was shot, whereupon the whole wood was filled with the screaming of the monkeys. The back, sides, and tail of this *Sciurus* were dark grey, and towards the surface of the hair yellow; the mouth and the round ears were black, the stomach rust-coloured brown; it was twice as big as the *Sciurus palmarum*."

(P. 145) 8th Dec. 1778, at Ayuthia: "In a bush I saw an Indian hare, with his half-naked neck, only covered with short, soft, black hair. The *Sciuri* are much rarer here than on the Coromandel Coast, and the Palm-Squirrel, which is generally so common, I have not seen at all here."

(P. 161) 4th Jan. 1779: "As I have mentioned the place where they found the gold (on the land-route from Mergui to Bangkok), I will add the tale of some Christians, who made this journey, concerning a class of creatures which are probably the *Homo lar*. This animal is said to walk erect, and to live principally on honey; and as the Siamese consider its skin and flesh to have some medical virtues, they kill it in the following manner:—Those

who go out for this purpose take two bamboo sticks, of about an arm's length, which they hold close to their arms. As soon as the animal sees the man it comes up to him and seizes one of his arms with signs of joy and as if it wanted to caress him. The man drops one of the bamboo sticks, which the animal keeps in his paws, and which it contemplates with joy and admiration; meanwhile the man seizes the other bamboo, and hits the animal over the head, until it is dead. The animal is said to be good-natured, but it only lives in the densest forests."

H.B.M. Vice-Consul, Mr. T. H. Lyle, has lately made an interesting collection of Siamese mammals: unfortunately I have had no chance of seeing these.

I have to acknowledge my sense of obligation to Mr. Oldfield Thomas, for his kindness in identifying specimens which I have sent home from time to time; also to the Curators of the local Museums, Dr. R. Hanitsch of Singapore, Mr. A. L. Butler of Kuala Lumpur, and Mr. L. Wray, junior, of Taiping; and also to Mr. H. N. Ridley, Director of the Singapore Gardens.

The classification and nomenclature in this paper are according to Mr. Blanford's volume on Mammals in the 'Fauna of British India'—an invaluable work which I carried everywhere with me and found a most interesting and charming companion. But in the division of *Sciurus* into several genera I have followed Mr. O. Thomas (A. M. N. H. ser. 7, vol. ii. no. 9, Sept. 1898, p. 249).

The following table shows the number of species of the ten Orders of Mammals represented in the Siamese and Malayan Fauna:—

Order.	No. of Species.	
Primates	15	(p. 312.)
Carnivora.....	37	(p. 322.)
Insectivora	7	(p. 336.)
Chiroptera	42	(p. 338.)
Rodentia	36	(p. 351.)
Proboscidea.....	1	(p. 365.)
Ungulata.....	15	(p. 366.)
Cetacea	5	(p. 376.)
Sirenia	1	(p. 377.)
Edentata	1	(p. 378.)

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Alphabetical List of Localities in the Malay Peninsula and Siam mentioned in this Paper.

Alma, a planter's estate in Province Wellesley.

Alor Star, the capital of Kedah, about 6° 8' N., called "Muang Seiburee" by the Siamese.

Anghin, a village near the head of the Gulf of Siam, anchorage for ships during N.W. monsoon.

Ayuthia, the former capital of Siam, about 60 miles (in a straight line) from the mouth of the Menam.

- Bakar Bata*, a suburb of Alor Star, formerly a brickfield, now containing the Sultan's Rest-house.
- Balik Pulo*, a village in the interior of Penang.
- Bamvasor*, a place mentioned by Finlayson (see *Rhizomys*); I have not identified it.
- Bangkok*, the present capital of Siam, about 17 miles (in a straight line) from the mouth of the Menam.
- Bangkok River*, a name for the branch of the Menam on which Bangkok is situated.
- Bangpakong*, a river entering the Gulf of Siam about 25 miles E. of Paknam Menam.
- Batang Padang*, a mountain in the south of Perak.
- Battambang*, the Cambodian province of Siam.
- Batu Caves*, a few miles from Kuala Lumpur, in Selangor.
- Batu Gajah*, a town in the Kinta district of Perak.
- Batu Pahat*, coffee-estate, on west side of Johore, about halfway between Malacca and Singapore.
- Bawtong Kabin*, the gold-mines of Kabin in Siam, up the Bangpakong River.
- Baw Yakar*, a gem-mine near Pailin, in the Battambang Province of Siam.
- Birman*, or *Bernam*, a river and district in the north of Selangor.
- Blaken Mati*, a fortified island on the south side of Singapore Island.
- Blanja*, a place in Perak.
- Bukit Gantang*, a hill in Perak.
- Bukit Timah*, a hill near the centre of Singapore Island, of which it forms the highest point.
- Changi*, a place near the east end of Singapore Island.
- Chantaboon*, an important town in South-east Siam, about 10 miles from the sea.
- Dindings*, the smallest of the five "Straits Settlements," situated on the coast of Perak.
- Dong Phya Fai* ("Forest of the Lord of Fire"), a hilly tract covered with jungle, about 50 miles across, between Ayuthia and Korat in Siam, abounding in animal life.
- Dumdruan*, an abandoned estate on the slopes of Gunung Pulai, in Johore.
- Genkoi*, a village in Siam on the Ayuthia side of the Dong Phya Fai.
- Georgetown*, the capital of Penang, founded by Capt. Francis Light.
- Girbee River*, Malay Peninsula, latitude 8° 0' N.
- Gunong Batu Putih* ("White Stone Mountain"), in interior of Malay Peninsula.
- Gunong Gajah* ("Elephant Mountain"), an isolated limestone mass in Kedah.
- Gunong Janeng*, a mountain in Johore.
- Gunong Jerai*, or "Kedah Peak," in Kedah, a prominent landmark north of Penang.
- Gunong Pulai*, a mountain in Johore, 2220 feet high, about 20 miles from Johor Bharu.

Indau, a river in Johore flowing into the China Sea.

"*Isles of Kullam, Straits of Malacca*" (Dobson, Cat. Chir. B. M. p. 49), possibly Kerimun.

Jaffaria, in Johore.

Jaram, Jelang, and Jerome, localities in Selangor.

Jenan, a shooting-box of the late Tunku Yacob of Kedah, on the road to Singora.

Johore, a Malay State at the southern end of the Malay Peninsula, protected but not administered by England. Capital, Johore Bahru.

Kabin, a town up the Bangpakong river in Siam, famed for gold-mines in the vicinity.

Kedah (spelt by Cantor "Keddah"), a Malay State on the west coast of the Peninsula, north of Province Wellesley, ruled by its own Sultan, nominally subject to Siam. Capital, Alor Star.

Kinta, a district in Perak.

Klang, a town in Selangor, the port for Kuala Lumpur.

Klong Morn, a canal running westward from Bangkok.

Korat, a town in Eastern Siam, about 15° N.

Ko-si-chang, an island near the head of the Gulf of Siam, abounding in Millipedes.

Kota Glanggi, Kota (=Fort), in Pahang.

Kota Tinggi, in Johore.

Kuala Indau, in Johore.

Kuala Kabang, in Johore.

Kuala Kangsar, in Perak, formerly the seat of Government.

Kuala Lambilong, in Pahang.

Kuala Lumpur, the capital of Selangor, with a Museum.

Kuala Muda, on the west coast of the Peninsula, boundary of Province Wellesley and Kedah.

Kuala Semantan, in Pahang.

Kuala Tahan, in Pahang.

Kussoom, in Junkceylon.

Lumbatuah, in Pahang.

Lancary, Lancavy, or Lancaurie, a large island off the coast of Kedah.

Laos, the country of the Laos in Northern Siam.

Larut, a district of Perak; the Larut Hills culminate in Gunong Higau, 4678 feet.

Lumut, in the Dindings.

Malacca, town and district, the third in importance of the five "Straits Settlements."

Matang, a town in Perak between Taiping and the Straits of Malacca.

Maxwell's Hill, in the Larut Hills, Perak.

Menam, the great river of Siam.

Muang Pran, in Siam.

Muar, a small State tributary to Johore, between Johore and Malacca.

Muok Lek, a village in the Dong Phya Fai, Siam, about 900 feet above the sea.

Negri Sembilan ("the Nine States"), a confederacy of small Malay States under British protection and administration between Malacca and Sungei Ujong.

Ophir, Mount, in Malacca.

Pachim, a town on the Bangpakong river in Siam, capital of the district.

Pahang, a large Malay State on the east of the Peninsula, protected and administered by England. Capital, Pekan.

Pailin, a mining centre in the Battambang province of Siam.

Pakchom, a village in Siam on the Korat side of the Dong Phya Fai.

Paknam Kabin, that part of Kabin where the two chief affluents of the Bangpakong meet.

Paknam Menam, a village near the mouth of the Menam.

Pakpreo, a village in Siam between Ayuthia and the Dong Phya Fai.

Passir Hitam, in Perak.

Patriew, a town on the Bangpakong river in Siam: great trade in rice.

Pekan, the capital of Pahang.

Penang, or Prince of Wales' Island, an island, the second in importance of the five "Straits Settlements." Capital, Georgetown.

Perak (pronounced Péra), a large Malay State on the west of the Peninsula, protected and administered by England. Capital, Taiping.

Petchaburi, a town in Siam.

Phrabat, a shrine in Siam.

Piah River, in Upper Perak.

P'ngkalan Repoh, in Johore.

Poongah, or *Pungah*, in Junkceylon.

Prachai, between Ayuthia and Korat in Siam.

Pramau, in Pahang.

Pulo Panjang, Gulf of Siam; an island which I have not identified, mentioned by W. L. Selater (Cat. Mamm. India Mus. ii. p. 20).

Pulo Tawar, a place which I have not identified, mentioned by Ridley (J. S. B. R. A. S. no. 25, 1894, p. 58).

Pulo Tikus, a village in Penang, also a small islet lying off Penang.

Pulo Tioman, a large mountainous island lying off the east coast of the Peninsula, latitude 2° 50' N.

Pulo Ubin, an island between Singapore and Johore.

Purlis, or *Perlis*, a small Malay State on the west coast of the Peninsula, tributary to Kedah.

Raheng, a town in Siam.

Rantan Panjang, in Selangor.

Ratburee, a town in Siam.

Salanga, Junkceylon.

Selangor, a Malay State on the west of the Peninsula, protected and administered by England. Capital, Kuala Lumpur.

Sembrong, a river in Johore, flowing into the Straits of Malacca near Batu Pahat.

Serendah, near Kuala Lumpur, Selangor.

Simpai, on the Batu Pahat, Sembrong, in Johore.

Simpang, in Perak.

Singapore, island and town, the capital of the Straits Settlements; with a Museum.

Singora, on the east coast of the Peninsula, tributary to Siam.

Sungei Pandang, a river in the south-west of Singapore Island.

Sungei Ujong, a Malay State on the west of the Peninsula, protected and administered by England.

Tahan River, in Pahang.

Tahkamen, a village on the Bangpakong river in Siam, between Pachim and Kabin.

Taiping, or *Taipeng*, the capital of Perak: with a Museum.

Tanjong Kopang, in Johore.

Tapah, a town in the south of Perak.

Taroar, in Junkeeylon.

Telok Anson, a port in the south of Perak.

Temerloh, in Pahang.

Tringgarru, a Malay State on the east of the Peninsula, nominally subject to Siam.

Ulu Langhat, in Selangor.

Ulu Pahang, Upper Pahang.

Wellesley Province, the 4th of the five "Straits Settlements," on the Peninsula opposite Penang. Capital, Butterworth.

Order PRIMATES.

Family SIMIIDÆ.

The Gibbons (exclusive of the Siamang) are collectively known to the English in the Straits Settlements as "Wawaas." The Malays generally use the same term (written "Wowwow" by Cantor, p. 2), and also "Ungka etam" for the dark-coloured and "Ungka puti" for the light-coloured forms. The Siamese call them "Chanee."

1. *HYLOBATES LAR* (Linn.). The White-handed Gibbon.

Hylobates lar, Blanf. Faun. Ind., Mamm. p. 7.

Cantor (p. 2) records this species from the "Malayan Peninsula," and says "the colour varies from blackish brown to light brown, yellowish or dirty white, sometimes uniform, sometimes mottled." The only Malayan specimen I have seen is one in the Selangor Museum, dark brown in colour, obtained near Kuala Lumpur in Selangor. In December 1897 a dead gibbon of this species was brought to me in Bangkok, where it had died apparently in captivity; unfortunately I was unable to ascertain where it had been originally caught. Mr. Kelsall (Journal Straits Branch Royal Asiatic Soc. no. 26, 1894, p. 16) says of the species in Johore: "*Hylobates albimanus*, Vig. & Horsf., the common black Wan Wau. This species was fairly plentiful everywhere on the Indau and Sembrong rivers. It always goes in small troops." And Ridley (J. S. B. R. A. S. no. 25, 1894, p. 57) writes it "is common in the Pahang jungles."

Dr. Hanitsch (Rep. Raffles Libr. & Mus. 1898, p. 8) mentions specimens of *H. lar* being in the Museum at Singapore from Tanjong Kopang and Kota Tinggi in Johore, and from Kuala Lambilong and Lambatuah in Pahang.

Distribution. Malay Peninsula, Tenasserim, and perhaps also Pegu and Arakan.

2. HYLOBATES AGILIS F. Cuvier. The Agile Gibbon.

Cantor (*op. cit.* p. 3) gives as its habitat "Malayan Peninsula (Malacca, Purlis, Kédah, Pungah), Sumatra:" he also says it appears to be less numerous on the Peninsula than *H. lar*, and that he has not seen the light-coloured variety. Ridley (Mammals Malay Pen. p. 26) writes it "is common in the Malay Peninsula as far south as Johore, but it is not wild in Singapore." In the Museum at Taiping there are specimens of both the black and light varieties from Larut, Perak. In April 1898, when I was in the Larut Hills, a party of these gibbons were to be seen daily in a group of high trees at about 3200 feet elevation; every morning they commenced calling at 6 A.M. and continued till about 10.30 A.M. They must come down almost to the foot of the hills, as I have frequently heard them in the morning from Taiping, which is but little above the sea-level.

At Paknam Kabin in Siam, in March 1897, there was a pet gibbon of the variety *pilatus* said to have been caught in the neighbourhood. Its colour was buffy white, except the hair on the top of the head, which was black, and on its chest, which was very dark grey. The skin of the face and palms of the hands and feet were black.

Distribution. Siam, Malay Peninsula, Sumatra.

3. HYLOBATES LEUCOGENYS Ogilby. The White-cheeked Gibbon.

Distribution. Siam (Forbes, 'Handbook Primates,' ii, p. 158).

4. HYLOBATES SYNDACTYLUS (Desm.). The Siamang.

In the Museum at Taiping there are specimens from Kinta and from Upper Perak. In September 1898, with the kind assistance of Mr. Ridley, I obtained a live Siamang, which had been caught in the Negri Sembilan, and which was successfully brought home alive to this Society's Gardens.

Mr. Wray (J. S. B. R. A. S. 1890, no. 21, p. 138) writes of this species:—"A fact which does not seem to be in conformity with the generally received ideas of the habits of the gibbons, is that on both of my ascents of the summit of Gunong Batu Puteh (in the interior of the Malay Peninsula) I heard the cries of Siamangs at between 6000 and 7000 feet altitude. One would have thought that the climate would be too cold and bleak for such delicate animals, but it appears that they can and do voluntarily stand a considerable degree of cold without any inconvenience."

Distribution. Malay Peninsula, Sumatra.

In reference to a quotation from a letter of mine in the P. Z. S. 1898, p. 924, "in Perak it (the Siamang) is found south of the Perak River, but not apparently anywhere north of it," Mr. A. L. Butler writes to me (dated Selangor, 30.5.99) saying: "Don't you get the Siamang on the (Larut) Perak Hills? I shot one large male on Maxwell's Hill at 3000 ft., unless I am much mistaken. I did not preserve it, as I was not then collecting monkeys. Oddly enough I shot it in mistake, taking its head, which alone I saw, for a black squirrel sitting bunched up. This was a very large gibbon, entirely black, much bigger than *Hylobates lar*."

No gibbons are found wild in the islands of Penang or Singapore, though they are evidently very generally distributed over the mainland; when met with in the jungle it is very hard to identify the species, and it is but little use and cruel to attempt to shoot them with a shot-gun; if a specimen be needed, kill it with a rifle-bullet. In September 1897, at the foot of Gunong Pulai in Johore, I saw both black and white gibbons of apparently the same species, but I cannot say which. In March 1897, near Takhamen, Siam, there were many in the high trees in the thick jungle; their call was loud and musical, "Pua, pua, pua, pua, pua, pua, pua, pua," beginning slowly and gradually getting faster. One morning we followed up an individual for a long time; it was a very large black gibbon, extremely agile. Occasionally it progressed by running along the boughs, but generally by swinging by its hands; every now and then it leaped down vertically to a great depth among the branches, as if falling, but it never actually came to the ground. In the forest of the Dong Phya Fai (between Ayuthia and Korat), at about 900 feet elevation, I have heard gibbons making a great noise in the early morning; judging from the cry, I should say it was the same species as at Takhamen.

In January 1898 I was shown a live black-faced white gibbon at Chantaboon, said to have been caught in the neighbourhood, which I could not identify. Consul T. ff. Carlisle, writing to me from the Pailin Mines, Battambang Province, Siam, in Feb. 1899, says: "I have seen lots of gibbons round here, and have heard of a reddish-coloured one, but have never seen it."

Very much remains to be done to get a definite knowledge of the species, varieties, and distribution in this region of these very interesting and attractive monkeys.

Family CERCOPITHECIDÆ.

5. *MACACUS ASSAMENSIS* McClell. The Himalayan Monkey.

Macacus assamensis, Blanf. Faun. Ind., Mamm. p. 15.

Blanford states there is in the British Museum a specimen, very probably of this species, from the Laos country in Upper Siam.

Distribution. Eastern Himalayas, Assam, Upper Burma, Siam probably), Sandarbuns (?)

6. *MACACUS ARCTOIDES* Is. Geoffr. The Brown Stump-tailed Monkey.

Macacus arctoides, Blanf. Faun. Ind., Mamm. p. 17.

Siamese. "Ling sayn."

There is a stuffed specimen in the Siamese Museum, of unknown locality.

Distribution. "Moupin in N.W. China, living on the snow-clad mountains; Upper Burma (Bhamo); Siam; the Cachar and Kachin hill-region on the western frontier of the Province of Yunnan, China; North-west Borneo, on the mainland opposite Labuan." (Forbes, 'Handbook Primates,' ii. p. 8.)

7. *MACACUS RUFESCENS* Anderson. The Rufous Stump-tailed Monkey.

Distribution. "Malay Peninsula."

In Bangkok I saw a live monkey, said to have been caught in the Laos country, which may have been *M. rufescens* or a variety of *M. arctoides*; the general colour of its hair was a conspicuous yellow, the face brilliant red. It was a very large and powerfully built male: its ferocity prevented a closer examination.

There is a short-tailed monkey called by the Siamese "Ling kabut." I did not succeed in finding out what it is: but villagers on the Bangpakong River, to whom I showed some pictures of animals, pointed out the figure of *Macacus leoninus* on p. 19 of Blanford's Indian Mammals as the "Ling kabut."

N.B.—*Macacus leoninus* (Blyth). Blanford, Faun. Ind., Mamm. p. 20, says that Anderson has referred to this species a young animal from Perak, but that the identification was very questionable.¹

Distribution. Burma, Andamans (introduced), Siam (?).

8. *MACACUS NEMESTRINUS* (Linn.). The Pig-tailed Monkey.

Papio nemestrinus, Cantor, p. 6.

Macacus nemestrinus, Blanf. Faun. Ind., Mamm. p. 20.

"Berok" (pronounced "Broh") of the Malays.

"Broh" or "Coco-nut Monkey" of the English in the Straits Settlements.

Cantor says the Broh is found in Penang and on the Peninsula; Ridley (Mamm. Malay Pen. p. 26) says it "is not really wild in Singapore, but it is frequently kept in captivity, and, often escaping, remains in a half-wild state, usually near the town. It is common in the Peninsula in the denser jungles." Ridley also records this species from Pahang (J. S. B. R. A. S. 1894, no. 25, p. 57). Kelsall records it from Gunong Janeng, Johore (J. S. B. R. A. S. 1894, no. 26, p. 16). In the Museum at Taiping there are several

¹ Selater (P. Z. S. 1898, p. 280) mentions a fine adult male *Macacus leoninus* living in the Marseilles Zoological Gardens, which is stated to have been brought from Siam.

specimens from Larut, Perak. In the Museum at Kuala Lumpur there are two specimens from Selangor.

I have never met with this monkey in a wild state, but it is very commonly to be seen in captivity in the Straits Settlements. The young are said to be intelligent. Three adult males I had alive were inclined to be savage; their strength compared to their size was extraordinary, and they were very destructive, requiring strongly built cages to keep them in.

Distribution. Southern Burma, Tenasserim, Malay Peninsula, Sumatra, Banka, Java, Borneo.

In the Museum at Singapore is a nearly mature embryo, a cross between a male *Macacus nemestrinus* and a female *Cynopithecus niger*, which paired in the Singapore Gardens (Rep. Raffles Libr. & Mus. 1896, p. 5).

9. *MACACUS CYNOMOLGUS* (Schreb.). Macaque or Crab-eating Monkey.

Cercopithecus cynomolgus, Cantor, p. 6.

Macacus cynomolgus, Blanf. Faun. Ind., Mamm. p. 21; Ridley, Mamm. Malay Pen. p. 24.

"Kra" of the English in the Straits Settlements and of the Malays. *Siamese*. "Ling."

Localities. The Kra or Mangrove Monkey is *par excellence* "the common monkey" of the Malay Peninsula; personally I have seen them wild in Penang (up to 2000 feet elevation), in Kedah and in Singapore (Sungei Pandang, Blaken Mati, Botanical Gardens, and Bukit Timah). In the Museum at Taiping are several specimens from the Larut and Kinta districts of Perak. Ridley (J. S. B. R. A. S. 1894, no. 25, p. 57) records it from Pahang, stating that it is "common along the coast and for some distance up the rivers." Kelsall (J. S. B. R. A. S. 1894, no. 26, p. 16) records it from Johore, in almost similar words: "common in the low lands near the coast and up the rivers for a considerable distance."

In the Siamese Museum there is a stuffed specimen labelled "Siam." I have not unfrequently seen these monkeys on rooftops and in trees in Bangkok, but believe they were all individuals escaped from captivity. In 1898 there was a white Kra, an extremely pretty monkey, living in the King's garden at Bangkok.

Habits. When travelling on the Malay rivers one generally sees the Kras in small parties of from 2 to 10 among the tree-branches at high tide, but at low water they take to the mud and hunt about for food. They usually take little notice of passing boats, and so can be easily observed. In captivity they become intelligent pets; though the adult male Broh becomes fierce and dangerous, I have known a very large male Kra to be remarkably tame. They delight in water, and (at any rate in their native climate) should be allowed a bath at least once a day.

Ridley (Mamm. Malay Pen. p. 26) says, "I have seen one leaping off the boughs of a tree into the water, climbing up and leaping off again and again." And I was told of one kept by some English

soldiers at Singapore that would dive into a deep tub of water and fetch out bananas that were thrown in for it.

The males of this species (as well as some other *Macaci*) seem to vary much in the size to which they attain.

Distribution. Burma, Nicobar Islands, Siam, Malay Peninsula, Sumatra, Pulo Nias, Banka, Java, Babi, Lombok, Timor, Natuna Islands, Borneo, Celebes (?), and the Philippines.

The Monkeys of the genus *Semnopithecus* are called by the Malays "Lutong," and by the Siamese "Ling karng"; of their species, varieties, and distribution in Siam and the Malay Peninsula we know but little, and their synonymy is very confusing, and must remain unsettled until much more material than is at present available has been collected. They seem very generally distributed throughout the big jungles both on the mountains and on the plains, but they are usually very shy. Cantor distinguished four species from the Peninsula, which he called *SS. obscurus*, *albocinereus*, *cristatus*, and *femoralis* respectively. Ridley says "there are several other species of *Semnopithecus* in the Malay Peninsula with apparently similar habits to *S. femoralis*, but it is not easy even to secure specimens, still less to observe their habits."

Personally I know of four distinct species from this region. Of three, *S. obscurus*, *S. femoralis*, and *S. germani*, I have shot specimens, which Mr. Oldfield Thomas has kindly identified; the fourth I only know from three stuffed specimens in the Museum at Taiping, two of which are from the Piah River in Upper Perak, and one from Tapah, Batang Padang, also in the State of Perak. It is a large species with unusually long limbs and tail (even for a *Semnopithecus*), and is coloured light rufous brown above and lemon-yellow below; the hair on the forehead, hands, feet, and tail is dark brown. Mr. Wray has labelled these specimens *S. siamensis*.

The Lutongs are but rarely seen in captivity, and are usually short-lived in that state, although it is possible to keep them. In June 1897, Mr. A. H. B. Denny wrote to me from Penang saying, "There is a very fine adult tame lutong here, a black one, which has been in captivity over three years, but I think it is a rare thing to get them tamed."

The Siamese believe these monkeys eat human flesh, and are greatly afraid of them. They say if you sleep out in the jungle they will kill you by sucking your blood.

10. SEMNOPITHECUS OBSCURUS Reid. The Dusky Leaf-Monkey.

Semnopithecus obscurus, Blanf. Faun. Ind., Mamm. p. 41.

"Lutong etam" (etam = black) of the Malays of the Peninsula. Cantor (p. 4) says this is the most common species in Penang and Singapore, and that it also occurs on the Peninsula. It is doubtful, however, whether it does occur at Singapore at the present time.

In April 1895 I found this species very common in Kedah, living in the highest trees along the banks of the Kedah River and

its tributaries, either solitary or in parties of about half a dozen; they were very active and wild.

In the Botanical Gardens, Penang, I have seen this species playing in the trees. On Penang Hill I have occasionally seen Lutongs which appeared to belong to this species; they are very shy, and it is difficult to see much of them before they disappear among the jungle trees.

In the Museum at Taiping there are specimens from the Larut Hills, Perak. In April 1898, at about 3500 feet elevation in the Larut Hills, I came on a party of from 10 to 20 *Semnopithec*i, of this or a closely allied species.

Ridley (J. S. B. R. A. S. 1894, no. 25, p. 57) says: "*S. obscurus*, Reid. The Grey Lotong. This monkey, which is common in Pahang, varies much in colour. Here it is of a dark grey, while further south, in Johore, it is almost black."

Kelsall (J. S. B. R. A. S. 1894, no. 26, p. 16) says: "*S. obscurus*, Reid. The Dusky Lotong. This species is very nearly black in Johore. Several specimens were obtained. Common everywhere in the inland districts."

There are two stuffed specimens in the Siamese Museum, labelled "Siam."

Colour. Specimens from Kedah. The very handsome fur is darkish grey above, paler below, with hands and feet black. The face is black except for the white nose and the distinctly defined white spaces or rings round the eyes. Iris brown.

Size. Specimens from Kedah:—

♂. Head and body 21½ in. (or 546 mm.); tail 26¾ in. (or 679 mm.).

♀. Head and body 22½ in. (or 571 mm.); tail 27 in. (or 685 mm.).

Distribution. Siam, Tenasserim, Malay Peninsula.

11. SEMNOPITHECUS FEMORALIS Horsf. The Banded Leaf-Monkey.

Semnopithecus femoralis, Blanf. Faun. Ind., Mamm. p. 42.

Cantor (p. 5) apparently obtained only one specimen—from Purlis (a small State on the west coast of the Malay Peninsula, north of Kedah), and says that the species does not appear to occur in either Penang or Singapore. Ridley (Mamm. Malay Pen. p. 26), however, says "it is not very common in Singapore, but a few occur in most of the larger jungles." Mr. Oldfield Thomas (P. Z. S. 1886, p. 72) mentions a specimen from Klang, Selangor, collected by Mr. Davison.

In September 1897, in the woods among the foothills of Gunong Pulai, Johore, were many Lutongs of this species going about in flocks; they were shy and difficult to see except for a glimpse of a black form disappearing from one high tree to another.

In the Museum at Taiping there are several stuffed monkeys which I feel inclined to refer to this species. Some from the Larut Hills are labelled by Mr. Wray *S. cristatus*, Horsf. & Raffl.,

and some from Tapah, Batang Padang, are labelled *S. albocinereus*, Schinz, or "Ka Ka."

Colour. Specimens from Johore. The beautifully soft fur is very dark grey, practically black, except on the chin and breast, where it is lighter, and on the inner side of the forearms, where it is light grey, and on the belly and inner side of the hind legs, where it is white. On the inner side of the thighs the two colours do not gradually blend, but there is a sharp line of demarcation between the black and white. The eyelids are whitish, the skin round the mouth pinkish, the rest of the naked face grey. The naked skin of the hands, feet, and callosities is dark grey.

Size. Specimens from Johore:—

♀. Head and body 21 in. (or 536 mm.); tail (with end hair) 26 $\frac{1}{4}$ in. (or 669 mm.).

♀. Head and body 21 $\frac{1}{2}$ in. (or 546 mm.); tail (with end hair) 27 in. (or 688 mm.).

Distribution. Tenasserim, Malay Peninsula, Sumatra, and Borneo.

N.B.—*Semnopithecus neglectus*, Schlegel, founded on a specimen from Singapore, is probably a variety of *S. femoralis*.

12. SEMNOPITHECUS MAURUS (Schreb.). The Negro Monkey.

? *Semnopithecus cristatus*, Cantor, p. 5.

Distribution. Cantor gives the habitat of his *S. cristatus* as "Pinang, Malayan Peninsula, Sumatra, Borneo, Banka."

H. O. Forbes, 'Handbook of Primates,' ii. p. 126, gives the distribution of *S. maurus* as "Malay Peninsula, Sumatra, Java, Billiton, Borneo."

13. SEMNOPITHECUS MITRATUS (Eschscholtz). The Mitred Leaf-Monkey.

? *Semnopithecus albocinereus*, Cantor, op. cit. p. 4.

Distribution. "Siam, Malay Peninsula, Sumatra." (Forbes, 'Handbook of Primates,' ii. p. 139.)

Mr. Oldfield Thomas (P. Z. S. 1896, p. 72) mentions a specimen of *Semnopithecus siamensis* Müll. & Schl., "from the interior of the Malay Peninsula, beyond Klang," collected by Mr. Davison, and says of it: "A curious whitish specimen, far paler than usual, but apparently not specifically different from Cantor's specimens of *S. albocinereus*, which Dr. Anderson has shown to be identical with *S. siamensis*."

14. SEMNOPITHECUS GERMAINI Milne-Edwards. Germain's Leaf-Monkey.

When on the Bangpakong River in Siam, in March 1897, we from time to time saw flocks of from 10 to 20 monkeys of this species in high trees in patches of jungle. The skin of the face is entirely black, the iris dark brown. A male I shot near Tahkamen measured:—Head and body 23 $\frac{1}{2}$ in. (or 587 mm.); tail, with end hair 33 in. (or 838 mm.), without end hair 31 $\frac{1}{2}$ in. (or 800 mm.).

On April 1st, 1897, I bought from a Siamese at Tahkamen a young monkey apparently of this species: it was evidently very young, and was weak and feeble. We tried feeding it at first with a bit of cotton-wool soaked in tinned milk and water (fresh milk was not to be had), but soon a young Siamese woman offered to suckle it, and she fed it with her own milk till we left Tahkamen on the 5th of April; then we had to feed the monkey on tinned milk and mashed bananas. It thrived very well; in a few weeks it could feed itself on a mess of banana, rice, porridge, and milk, and when we had had it about six weeks it took to eating a little grass on the lawn every day. It grew stronger and very active and was very fond of us (though it screamed at strangers and would not be touched by them); it also enjoyed romps with a Siamese kitten, and the two little animals would sleep curled up together—the monkey grasping the kitten's fur in its hands. When playing about and extra pleased this monkey had a comic little habit of jumping in the air vertically and coming down again on all fours. Its senses of sight and hearing were particularly acute, and it would follow my wife or myself about the house and compound.

Dimensions on April 1st:—Head and body 10 in. (or 254 mm.); tail (with end hair) $13\frac{1}{2}$ in. (or 343 mm.).

For two months this little animal was as well, happy, and active as could be; then it got a sudden attack of diarrhœa and a bad cold in the head, and, in spite of careful nursing, died on June 4th, 1897. Its dimensions then were:—

Head and body 11 in. (or 279 mm.); tail, with end hair $13\frac{3}{4}$ in. (or 350 mm.), without end hair $12\frac{3}{4}$ in. (or 324 mm.).

Colour. (Noted from life on 1.4.97.) Fur bright gold all over, except the long hair on the forehead, which is dark grey, and the hands and feet, which are also dark grey, and the hair on the cheeks and chin, which is white. Skin of face and ears dark brown. Iris dark brown. The skin of the abdomen and inner side of limbs is white, sparsely covered with golden fur.

Colour (of same individual, noted immediately after death, 5.6.97). Hair on forehead, crown, back of head, and neck black mixed with silvery grey. Lips, chin, long whiskers, and sides of head (both in front and behind ears) pure silvery white. Body, tail, and limbs golden orange, mixed with silvery and dark grey hairs, especially dark grey on the lumbar region, base of tail, forearm, and lower leg; the hinder portion of the forearm is almost entirely black, as is the hair on the hands and feet, but there are some silver hairs on the fingers, many on the toes, and many golden hairs on the "instep" of the hind feet. Naked skin of face, ears, hands, and feet entirely black. Iris dark brown. Callosities pale flesh-colour.

The hair of the crown does not radiate, but is directed backwards, forming a pointed crest over the occiput. Black supraorbital hairs well-developed, whiskers long, beard short.

Distribution. CochinChina, Siam.

In the Siamese Museum there was also a stuffed Lutong I never

identified, labelled "Siam;" it measured, head and body $24\frac{1}{2}$ in. (or 622 mm.); tail $31\frac{1}{2}$ in. (800 mm.). Mr. A. Balfour, Chief Engineer of the Siamese Navy, kindly gave me three skulls of *Semnopithecus* which he had shot near Ratburee, Siam; unfortunately I never had a chance of comparing them with skulls of known species, but they are still (or ought to be) in the Museum at Bangkok.

Family LEMURIDÆ.

15. NYCTICEBUS TARDIGRADUS (L.). The Slow Loris.

Nycticebus tardigradus, Blanf. Faun. Ind., Mamm. p. 44.

"Kúkang," "Kongkang," and "Kongka" of the Malays.

"Lemur" of the English in the Straits Settlements.

Siamese. Ling-lom = "Wind Monkey."

In Penang I got numerous specimens from natives, who said they had caught them in the hill forests; I also got two individuals in Kedah. In the Museum at Taiping there are many specimens from Larut, Perak; these resemble in head-markings and colour Penang specimens of the variety *javanicus*. In the Museum at Kuala Lumpor are two specimens, probably caught in Selangor. Mr. Oldfield Thomas (P. Z. S. 1886, p. 73) has recorded a specimen collected at "Salanga, Junkceylon," by Mr. J. Darling, and one from Malacca collected by Mr. Davison. Ridley records this animal from Pahang (J. S. B. R. A. S. 1894, no. 25, p. 57) and from Singapore (Mamm. Malay Pen. p. 26).¹ There are three Siamese specimens in the Museum at Bangkok.

Colour (of a Siamese specimen). Head, neck, lower parts and inner side of the limbs, lower parts of the fore limbs, and hands and feet very pale silvery grey, almost white. Remainder of fur light rufous brown, intermingled with many silver hairs. A bright reddish-brown vertebral line, which gets narrower anteriorly and terminates on the forehead (and does not join the ear-patches or the eyes as it does in eight specimens obtained in Penang). The patch round each ear is light reddish brown.

Size (of Siamese specimen noted above). ♂. Head and body $14\frac{3}{4}$ in. (or 375 mm.); tail (without end hair) $\frac{3}{4}$ in. (or 20 mm.).

Habits. In captivity these animals will live on bananas, mangoes, bread and milk, and live small birds, which they are singularly adroit at catching. At night, if left to themselves, they depart from their usual deliberate ways and climb about with considerable speed and activity. At one time I used to sleep in a hammock slung in a veranda close to a cage of Kongkangs, and when lying awake on moonlight nights had good opportunities of observing their habits. They could squeeze through the bars of the cage (though I never made out how they got their bodies through such narrow openings as they were) and roam about; usually they were back in the cage by daylight, sometimes they remained absent

¹ Three of the specimens on which M. Alphonse Milne-Edwards founded *Nycticebus cinereus* (Nouvelles Archives du Muséum, iii. 1867, p. 9, pl. iii.) were "pris aux environs de Bangkok."

a day or two, and on one occasion two individuals never returned to me. One kept by itself makes a nice and interesting pet, but when there were more than one I found they would resent being handled and bite; their bite may be very severe, as I know from painful experience, but the stories of its being dangerously poisonous to human beings are hard to believe. The young are carried under the mother's belly, holding on tight by all four hands, until they almost equal her in size.

Popular Beliefs. Many strange powers are attributed to this animal by the natives of the countries it inhabits; there is hardly an event in life to man, woman, or child, or even domestic animals, that may not be influenced for better or for worse by the Slow Loris, alive or dead, or by any separate part of it, and apparently one cannot usually tell at the time that one is under its supernatural power! Thus a Malay may commit a crime he did not premeditate, and then find that an enemy had buried a particular part of a Loris under his threshold, which had, unknown to him, compelled him to act to his own disadvantage. Its fur is used to cure wounds, and a sailing ship with a live Loris on board is said never to be becalmed. But its life is not a happy one, for it is continually seeing ghosts: that is why it hides its face in its hands!

A full account of the folk-lore connected with the Slow Loris would fill a small volume, but it would be of much interest. I am very glad to hear that Mr. H. N. Ridley is collecting stories about it from old Malay writings.

Distribution. Eastern Bengal, Assam, Burma, Siam, Cochinchina, Malay Peninsula, Sumatra, Java, Borneo, Philippines.

Order CARNIVORA.

Family FELIDÆ.

16. FELIS TIGRIS L. The Tiger.

Felis tigris, Blanf. Faun. Ind., Mamm. p. 58.

Siamese. "Seu-a."

Malay names for different varieties of tigers, Cantor, p. 35 (*apud* Low):—

1. "Rimau Sipai," reddish-coated, striped.
 2. "Rimau Ballu," darker coloured.
 3. "Daun Pinang," reddish-coated, without stripes.
 4. "Tuppu Kasau," darkish, without stripes, but with longer hairs than the others.
 5. "Puntong Prun," very dark, striped.
- "Rimau" is the common word for tiger; Cantor also gives "Harimau."

The tiger is numerous in suitable localities in the Malay Peninsula, and the island of Singapore, but seems to be entirely absent from Penang. In Kedah I was told no tigers inhabit the flat country around Alor Star, but are found in the hills; writing of the tiger in Pahang, however, Ridley (J. S. B. R. A. S. 1894,

no. 25, p. 57) says it "appears to be widely distributed, especially in the low country, disappearing in the hills." In Perak tigers occur from sea-level to the mountain jungles; Wray (J. S. B. R. A. S. 1890, no. 21, pp: 129, 138, 146) mentions them in the Larut Hills at over 4000 feet, and in the Batang Padang mountains at 6700 feet above sea-level. Round the town of Taiping, the capital of Perak, tigers are particularly numerous, living largely on the pigs kept by the Chinese. I have seen, a few hours after the occurrence, where a tiger burst through the wall of a house and carried off a pig, to the horror of a Chinaman who was in the room at the time. In Selangor also the tiger is over-plentiful. Kelsall (J. S. B. R. A. S. 1894, no. 26, p. 16) says they are "reported to be plentiful everywhere (in the State of Johore), especially on the Indau and at Batu Pahat." Dr. Wilson (Principal Medical Officer, Johore) informed me that about 1889 a tiger was caught at Muar which measured 12 feet from nose to tip of tail.

In Siam the tiger apparently is not found in the delta of the Menam, near Bangkok, nor in the valley of the Bangpakong, but from all accounts they are numerous in the Dong Phya Fai, especially at Pakchom on the Korat side.

Habits. Some idea of the Malay tiger and its ways may be gathered from the following well-written accounts:—

A. R. Wallace, 'Malay Archipelago,' p. 18 (1869).

H. N. Ridley, "Mammals Malay Peninsula," Nat. Science, vol. vi. pp. 89-91 (1895).

F. A. Swettenham, 'Malay Sketches,' pp. 12-18 (1896).

H. Clifford, 'East Coast Etchings,' pp. 142-154 (1896).

Distribution. Central and South-eastern Continental Asia and Sumatra and Java.

17. FELIS PARDUS L. The Leopard or Panther.

Felis leopardus, Cantor, p. 35.

Felis pardus, Blanf. Faun. Ind., Mamm. p. 67; Ridley, Mamm. Malay Pen., Nat. Science, vol. vi. 1895, p. 91.

Spotted Variety: "Rimau bintang" (Starred Tiger) of the Malays.

Black Variety:

"Rimau kumbang" (Black-beetle Tiger) of the Malays.

"Rimau akar" (Tiger of the Lianas) according to Ridley.

Cantor says: "The leopards of the Malayan Peninsula appear to attain to a larger size, and to be more ferocious, than is generally the case in India. Instances of their having killed and carried off Malays are on record." Ridley, on the other hand, states: "It is quite harmless to man unless wounded. . . . The more slender form, commonly called the leopard in opposition to the short thick panther, is said to occur in the Peninsula;" and also (J. S. B. R. A. S. 1894, no. 25, p. 57): "There are two distinct forms, one, which includes the black panther, being much more thick-set and heavy-looking than the typical leopard, and the spots are usually rings and not rosettes as in that animal."

Localities :—

Siam. The spotted leopard occurs ; while I was at the Museum in Bangkok two specimens were brought there in the flesh to be skinned, but neither had any history. Mr. St. Stephen, Manager of the Bawtong Mines, Kabin, told me he had once seen a panther near the mines.

Kelah. Both the spotted and black varieties occur—the latter appears to be most numerous—and are often trapped and exported to Penang, and thence sent to ménageries in Europe and America.

Penang. So far as I can ascertain, there are no wild leopards on the island, but individuals from Kedah have occasionally escaped of late years to my knowledge ; one attacked and wounded a native policeman on duty in Georgetown about 1896.

Province Wellesley. An English Officer of Police told me he had shot a black panther in the Province about 1896.

Perak. In the Museum at Taiping there is a spotted leopard from Larut, and black ones from Larut and from Kuala Kangsar. Ridley says the spotted form “appears to be fairly common in Perak and the northern part of the Peninsula.”

Selangor. Mr. A. L. Butler, Curator of the Museum at Kuala Lumpur, tells me 99 per cent. of the leopards in Selangor are black. Personally I have not heard of a spotted one from any State south of Perak.

Pahang. Occurrence recorded by Ridley (J. S. B. R. A. S. 1894, no. 25, p. 57).

Malacca. Cantor records a black male killed at Malacca, which “measured from the nose to the root of the tail 4 ft. 4½ in. (about 1333 mm.), the tail 2 ft. 10½ in. (about 886 mm.)”

Johore. Ridley says : “The Black Panther is abundant in Johore, and formerly occurred in Pulau Ubin, between Singapore and Johore.”

Singapore. Ridley says the Black Panther “is said to have occurred in Singapore, but this appears doubtful.”

Distribution. Africa and Asia in suitable places.

18. FELIS NEBULOSA Griffith. The Clouded Leopard.

Felis nebulosa, Blanf. Faun. Ind., Mamm. p. 72.

“Clouded Tiger” of the English in Siam.

This beautiful animal must be very rare in the Malay Peninsula ; and in Siam but little is known of it, except the handsome skins which are sometimes brought by natives from upcountry to be sold in Bangkok.

Distribution. South-eastern Himalayas, Assam, Burma, Siam, Malay Peninsula, Sumatra, Java, Borneo, and Formosa (*apud* Blanford).

Dr. Hanitsch (Rep. Raffles Libr. & Mus. 1898, p. 7) says he obtained “from a native a full-grown specimen of *Felis nebulosa* (body 36 in., tail 30 in.), said to have been killed at Changi, near Singapore.”

19. *FELIS MARMORATA* Martin. The Marbled Cat.

Felis marmorata, Blanf. Faun. Ind., Mamm. p. 74.

"Rimau dahan" of the Malays, according to Cantor and L. Wray.

Cantor (p. 36) records this species as numerous in the Malay Peninsula. In the Museum at Taiping there are two specimens from Kuala Kangsar, Perak. In the Museum at Kuala Lumpur there is a specimen caught at about 5 miles from that town.

W. L. Sclater (Cat. Mamm. Indian Mus. ii. 1891, p. 222) records two specimens from Malacca obtained in 1845.

Dr. Hanitsch (Rep. Raffles L. & M. 1898, p. 9) mentions a specimen of "*Felis marmorata* (= *diardi*)" from Malacca.

Distribution. Sikhim, Assam, Burma, Malay Peninsula, Sumatra, Java; Borneo (?).

20. *FELIS TEMMINCKI* Vig. & Horsf. The Golden Cat.

Felis temmincki, Blanf. Faun. Ind., Mamm. p. 75.

"Rimau Anjing" (Dog-cat) of the Malays of Perak, according to Mr. L. Wray.

In the Museum at Taiping there is a fine male from Kuala Kangsar, Perak; as stuffed it measures:—

Head and body 34 in. (or 854 mm.); tail 17 in. (or 432 mm.).

In the Museum at Kuala Lumpur there is one shot at Serendah, about 22 miles from Kuala Lumpur.

In the Museum at Singapore is a specimen from Malacca.

Ridley (Mamm. Malay Pen. p. 92) mentions this cat from Pahang.

Distribution. Nepal, Sikhim, Tenasserim, Malay Peninsula, Sumatra, Borneo.

W. L. Sclater (Cat. Mamm. Indian Mus. ii. 1891, p. 222) records a specimen from Malacca obtained in 1867.

21. *FELIS VIVERRINA* Benn. The Fishing Cat.

Felis viverrina, Blanf. Faun. Ind., Mamm. p. 76.

Siamese. Seu-a-pla = "Fish-cat."

This animal seems very well known in Siam; there were specimens of it in the Siamese Museum, but without exact locality. In March 1897, in the open country between Paknam Kabinu and Bawtong Kabin I saw by a pond footprints of a large cat, probably of this species. In Jan. 1898 I saw a skiu in a bazaar at Chantaboon.

Distribution. Parts of India, Ceylon, Burma, Siam, and Southern China. Mr. Blanford also gives the Malay Peninsula.

22. *FELIS BENGALENSIS* Kerr. The Leopard Cat.

Felis javanensis, Cantor, p. 36.

Felis bengalensis, Blanf. Faun. Ind., Mamm. p. 78.

"Rimau akar" of the Malays of the Peninsula, according to Cantor.

“Rimau aker” of the Malays of Perak, according to L. Wray.

“Seua-bong” and “Mow-pa” of the Siamese.

Cantor records this species from Penang and the Peninsula. Ridley (Nat. Science, vol. vi. 1895, p. 92) says this is “the commonest wild cat. . . . I have seen it in Singapore, and it appears to be abundant in the Peninsula.”

In the Museum at Taiping there are many specimens from Larut, Perak; and I was told it was common in the State of Selangor. In the Museum at Bangkok there are specimens from Pachim, Siam.

A wild cat caught near Balik-Pulo, Penang, in the spring of 1896 was, to the best of my recollection, of this species.

Distribution. India, Assam, Burma, Southern China, Siam, Malay Peninsula, Sumatra, Java, Borneo, and the Philippines.

23. FELIS PLANICEPS Vig. & Horsf. The Flat-headed Cat.

Felis planiceps, Blauf. Faun. Ind., Mamm. p. 83.

“Jalang” of the Malays of the Peninsula, according to Cantor.

Cantor also gives “Kúching útan” as the Malay name of this species, but this simply means “Cat of the woods” and is applied to any wild cat.

Cantor (p. 37) says of this apparently not numerous species that it is found on the Malay Peninsula and is “of most ferocious habits and untamable.”

In the Museum at Taiping there is a specimen said to have been obtained in Selangor.

In the Museum at Kuala Lumpur are two specimens, one from Klang, and the other from some other locality in the State of Selangor.

W. L. Selater (Cat. Mamm. Indian Mus. ii. 1891, p. 222) records a specimen from Malacca obtained in 1846.

Distribution. Malay Peninsula, Sumatra, Borneo.

24. FELIS CHAUS Güld. The Jungle Cat.

Felis chaus, Blanf. Faun. Ind., Mamm. p. 86.

In the Siamese Museum there is an old stuffed cat apparently of this species, labelled “Siam: January 1894.”

Distribution. Northern Africa, Western Asia, India, Ceylon, Burma, and perhaps Siam.

N.B.—Ridley (Nat. Science, vol. vi. 1895, p. 92) says “*Felis tristis* has been taken in Malacca.” Selater (P. Z. S. 1898, p. 281) mentions a beautiful small wild cat from Siam, living in the Jardin Zoologique d’Acclimatation, Paris, which was quite new to him.

25. FELIS DOMESTICA Briss. The Common Cat.

“Kúching” of the Malays.

“Mow” of the Siamese.

The ordinary domestic cat of the Malays has a very short

twisted or knotted tail, or else a mere bob. In Johore I have seen a very remarkably coloured variety of cat, somewhat like the English "tortoise-shell," but the different colours arranged more in spots than in blotches. The "Siamese" cat is fairly common in Siam, and not "reserved for royalty" (Lydekker, Royal Nat. Hist. i. p. 429, line 7). In Bangkok and the Straits Settlements it is not so much prized as a domestic pet as is the somewhat similar, but darker coloured, "Laos" cat from Northern Siam. In this region as elsewhere cats "frequently relapse from a state of domestication, resort to the jungle, and shun the presence of man" (Cantor, p. 38).

Family VIVERRIDÆ.

Subfamily VIVERRINÆ.

26. VIVERRA ZIBETHA L. The Large Indian Civet.

Viverra zibetha, Blanf. Faun. Ind., Mamm. p. 96.

"Tanggallong" of the Malays of the Peninsula (according to Cantor).

"Musang jebat" of the Malays of Perak (according to L. Wray).

Cantor (p. 27) records this species from Penang, Singapore, and the Peninsula, and considers it to be "far less numerous than the following" (i. e. *V. megaspila*). In the Museum at Taiping there are many specimens from Larut, Perak. In the Museum at Kuala Lumpur there are two civets from Selangor which I referred to this species, but Mr. A. L. Butler tells me he thinks they are *V. megaspila*.

Ridley (Nat. Science, vol. vi. 1895, p. 93) says: "The larger civets *V. zibetha* and *V. tangalunga*, the 'Musang jebat,' do not, I believe, occur wild in Singapore, but are common in the Peninsula, and are often trapped and brought for sale. They are never at all docile, and seldom live long in captivity."

Distribution. Bengal, Assam, Burma, Southern China, Siam, Malay Peninsula.

27. VIVERRA MEGASPILA Blyth. The Burmese Civet.

Viverra tangalunga, Cantor, p. 27.

Viverra megaspila, Blanf. Faun. Ind., Mamm. p. 99.

"Músang jebát" of the Malays.

Cantor records this species from Penang, Singapore, and the Peninsula, and says it is "exceedingly numerous." In the Museum at Taiping there are many specimens from Larut, Perak. In a deserted bungalow at Dumdruan, Gunong Pulai, Johore, I found a skin of this civet. The skin measured:—Head and body 29 in. (or 737 mm.); tail 11½ in. (or 292 mm.).

Distribution. Burma, Cochinchina, Malay Peninsula, Sumatra.

28. *VIVERRICULA MALACCENSIS* (Gmel.). The Small Indian Civet.

Viverricula malaccensis, Blanf. Faun. Ind., Mamm. p. 100.

“Cha-moot” of the Siamese.

There were in the Museum at Bangkok five specimens from Siam.

Cantor (p. 29) says: “On the Malayan Peninsula this species appears to be more numerous than *V. zibetha*; less so than *V. tangalunga*” (i. e. *V. megaspila*).

Ridley (Nat. Science, vol. vi. 1895, p. 92) gives a long and interesting account of “*Fiverra malaccensis*, the Musang”; with all due deference to his knowledge and experience, I would suggest that he is referring to (or at any rate has included under that name) some species of *Paradoxurus*.

Mr. J. L. Bonhote (A. & M. N. H. 7th series, vol. i. p. 120, 1898) writes: “Specimens from the Malay Peninsula representing the original *V. malaccensis* may be distinguished by having only seven dark rings on the tail instead of eight as in all other specimens, the tip being pure white.”

Distribution. India, Ceylon, Assam, Burma, Southern China, Siam, Malay Peninsula, Java, Philippines, Socotra, Comoro Islands, Madagascar (probably introduced).

29. *PRIONODON GRACILIS* Horsfield. The Graceful Tiger-Civet.

Cantor (*op. cit.* p. 29) records this species from Malacca; of which Blanford (Faun. Ind., Mamm. p. 105) says: “It was also reported from Malacca by Cantor (J. A. S. B. xv. p. 199); but, judging by the dimensions given, it is not improbable that the species obtained by him was *P. maculosus*.”

In the Museum at Taiping are three stuffed Tiger-civets from Larut, Perak: they agree in size and description with *P. pardicolor* (Blanf. Faun. Ind., Mamm. p. 103), but the spots tend to form broad longitudinal bands. In the Museum at Kuala Lumpur there is a Tiger-civet from Selangor, taken at about 5 miles from Kuala Lumpur: it seemed to me to be of the same species as the specimens at Taiping.

Distribution. Malay Peninsula, Sumatra, Banka, Borneo, Java.

30. *PARADOXURUS NIGER* (Desm.). The Indian Palm-Civet.

Paradoxurus niger, Blanf. Faun. Ind., Mamm. p. 106.

I include this species as an inhabitant of the Malay Peninsula on account of two specimens.

1st. One in the Museum at Taiping from Larut, Perak. It is very dark in colour, has no pale band on forehead, and the end of the tail white. It is labelled by Mr. Wray “*P. macrodus*, Gray.”

2nd. One that I saw in Penang was taken alive to England and presented to this Society: it was identified in London as *P. niger*.

Distribution. India, Ceylon, and (apparently) the Malay Peninsula.

31. *PARADOXURUS HERMAPHRODITUS* (Pall.). The Malay Palm-Civet.

Paradoxurus musanga, Cantor, p. 31.

Paradoxurus finlaysonii, Horsfield, Cat. Mamm. Mus. East-India Co. 1851, p. 65.

Paradoxurus hermaphroditus, Blanf. Faun. Ind., Mamm. p. 108.

"Músang" of the Malays, and the English in the Straits Settlements, also "Músang Pándan" and (when the tail is with white point) "Músang Búngkwang," Cantor. "Hen" of the Siamese.

Mr. Oldfield Thomas (P. Z. S. 1886, p. 73) records this species from Salanga (Jnnkceylon), and Klang (Selangor).

This Civet is abundant in the Malay Peninsula; personally I know of it from Kedah, Penang, Perak (many specimens from Larut in the Taiping Museum) Selangor, Malacca (specimens in Raffles Museum), Johore and Singapore. Sometimes it frequents inhabited houses, even in populous towns, but on account of its nocturnal habits is seldom seen.

Ridley's account (Nat. Science vol. vi. 1895, p. 92) of "*Viverra malaccensis*" applies excellently to this species.

Size. Adults seem to vary much in size. Cantor (p. 32) mentions one: head and body $24\frac{1}{2}$ in. (or 622 mm.); tail $16\frac{1}{2}$ in. (or 420 mm.).

Distribution. Burma, Siam, Malay Peninsula, Sumatra, Java, Borneo.

32. *PARADOXURUS MACRODUS* Gray. The Large-toothed Palm-Civet.

Paradoxurus macrodus, W. L. Sclater, Cat. Mamm. Indian Mus. ii. 1891, p. 246.

"In external characters this species does not differ appreciably from *Paradoxurus hermaphroditus*, but the skulls are at once distinguished by the large size of the teeth; upper sectorial .39 inch long by .33 inch wide" (Sclater, *op. cit.* p. 243).

Distribution. Malay Peninsula.

33. *PARADOXURUS LEUCOMYSTAX* Gray. The White-whiskered Palm-Civet.

Paguma leucomystax, Cantor, p. 30.

"Músang búlan" of the Malays of the Peninsula (according to Cantor).

In the Museum at Taiping there are several specimens from Larut, Perak. A male stuffed measures:—Head and body 27 in. (or 686 mm.); tail $21\frac{1}{2}$ in. (or 546 mm.).

In the Museum at Kuala Lumpur there is a single specimen. This species is said to be rare in Selangor.

In the Raffles Museum there are specimens from Singapore and Malacca.

W. L. Sclater (Cat. Mamm. Indian Mus. ii. 1891, p. 248) records specimens from Malacca.

Distribution. Malay Peninsula, Sumatra, Borneo.

34. *ARCTOGALE LEUCOTIS* (Blyth). The Small-toothed Palm-Civet.

Paguma trivirgata, Cantor, p. 31.

Arctogale leucotis, Blanf. Faun. Ind., Mamm. p. 115.

"Músang ákar" of the Malays of the Peninsula (according to Cantor).

"Hen-mi" of the Siamese.

In the Siamese Museum there is a male stuffed, obtained in the Dong Phya Fai by the late Dr. E. Haase.

W. L. Sclater (Cat. Mamm. Indian Mus. ii. p. 242) records two specimens from Malacca.

Mr. Oldfield Thomas (P. Z. S. 1886, p. 73) mentions a specimen from Selangor, collected by Mr. Syers.

Distribution. Assam, Burma, Siam, Malay Peninsula, Sumatra, Java, Borneo.

35. *HEMIGALEA HARDWICKII* (Gray). The Zebra Civet-Cat.

Paradoxurus derbyanus, Cantor, p. 32.

Hemigale hardwickei, Blanf. Faun. Ind., Mamm. p. 117.

"Músang batu" and "Sángah Prao" of the Malays of the Peninsula (according to Cantor).

Cantor gives this species from the Malay Peninsula, and says it "is apparently not numerous, and is celebrated among the Malays for its great agility." Ridley (Nat. Science, vol. vi. 1895, p. 166) says: "The only person whom I have met with who has seen one wild is Mr. H. L. Kelsall, who found one under a log in thick jungle by the Tahan River in Pahang."

In the Museum at Taiping there are three stuffed specimens from Larut, Perak. In the Museum at Kuala Lumpur there is an example caught about 4 miles from that place. In the Raffles Museum is a specimen labelled "Malacca: 1892."

Mr. Oldfield Thomas (P. Z. S. 1886, p. 73) records a specimen from Jaffaria, Johore, collected by Mr. Davison.

W. L. Sclater (Cat. Mamm. Indian Mus. ii. 1891, p. 241) records a specimen from Malacca obtained in 1843.

Distribution. Malay Peninsula, Borneo.

36. *ARCTICTIS BINTURONG* (Raffl.). The Bear-Cat or Binturong.

Arctictis binturong, Cantor, p. 22; Blanf. Faun. Ind., Mamm. p. 118; Ridley, Nat. Science, vol. vi. 1895, p. 93.

"Unturong" of the Malays of the Peninsula (according to Cantor).

"Bintūrōng" or "Menūrōng" of the Malays (according to Ridley).

This delightful animal is apparently not uncommon on the mainland, but I have not heard of it occurring wild in Penang or Singapore. In the Museum at Taiping are specimens from Larut and Kuala Kangsar, Perak. It is represented in the Museum at

Kuala Lumpor, and is said to be common in Selangor. In the Raffles Museum is a specimen from Malacca.

Mr. Ridley has kept for some years a very fine male Binturong alive, chained to a tree in his garden at Singapore: it is not of a gentle disposition; but a full-grown female belonging to Mr. A. H. B. Dennys, of Penang, is perfectly tame and delights in being petted.

Distribution. Assam, Burma, Siam, Malay Peninsula, Sumatra, Banka, Java, Borneo.

37. CYNOGALE BENNETTI Gray. The Otter-Civet.

Cantor (p. 33) says: "This animal appears to be of rare occurrence on the Malayan Peninsula, and the natives are consequently not acquainted with it." In the Raffles Museum there is a stuffed animal, supposed to be of this species, labelled "Malacca: 1889."

Distribution. Malay Peninsula, Sumatra, Borneo.

38. HERPESTES AUROPUNCTATUS (Hodgs.). The Small Indian Mongoose.

Herpestes auropunctatus, Blanf. Faun. Ind., Mamm. p. 121.

Cantor (p. 34) obtained a single specimen in the Malay Peninsula, which Blanford says was "possibly introduced."

Distribution. South Persia, Afghanistan, Baluchistan, Northern India, Lower Bengal, Assam, Chittagong, Upper Burma, and (possibly) Malay Peninsula.

39. HERPESTES MUNGO (Gmel.). The Common Indian Mongoose.

Herpestes griseus, Cantor, p. 34.

Herpestes mungo, Blanf. Faun. Ind., Mamm. p. 123.

"Bambun" of the Malays (according to L. Wray).

Cantor (p. 34) obtained a single specimen in the Malay Peninsula, which Blanford says "may very probably have been imported."

In the Museum at Taiping there are two specimens unlabelled. In the Museum at Kuala Lumpor there is one caught 4 miles from that place. Once in 1895 I saw a wild Mongoose near "Alma" Estate in Province Wellesley which appeared to be of this species; but I have been told that at one time mongooses were imported from India by the planters and turned loose in the Province, but when, and how many, and on which estates I do not know.

Distribution. Afghanistan, India, Ceylon, Malay Peninsula; introduced in Jamaica and other West Indian islands.

40. HERPESTES URVA (Hodgs.). The Crab-eating Mongoose.

Herpestes urva, Blanf. Faun. Ind., Mamm. p. 129.

"Hen-paaraa" of the Siamese.

In the Siamese Museum is a stuffed specimen from Prachai, Siam.

Distribution. South-eastern Himalayas, Assam, Burma, South China, Siam.

41. *HERPESTES JAVANICUS* (Desm.). The Javan Mongoose.

Sometimes called "Paang-pawn" by the Siamese.

Cantor (p. 33) records this species as being numerous in Penang and on the Peninsula.

On the 20th Jan. 1898 I was given a live mongoose, supposed to have been caught in or near Bangkok, and probably on the west side of the Menam. As it was the only mongoose I had seen from the neighbourhood, and also belonged to a species I was not acquainted with, I was particularly interested to add it to my small private menagerie. It soon became a general favourite under the name of "Riki-tiki;" it was a very intelligent animal, but not clean in its habits, and it generally had a disagreeable smell. Like *H. mungo* it was inquisitive and courageous, and extraordinarily clever in killing snakes. I have seen it kill a Dhamin (*Zamenis mucosus*) over seven feet long; when it had killed a snake, however large, it would drag the body to its cage and then commence eating it, head first, and continued eating till it got so distended that it could not move. The mongoose would then lie on its back, with all four legs stuck straight out, motionless for hours; as soon as it had room internally it continued its meal. On leaving Siam I brought this mongoose with me, hoping to present it to the Zoological Gardens in London, but unfortunately it died suddenly in the Red Sea; on board the steamer it soon became famous among the crew for its celerity in killing rats. Mr. Oldfield Thomas, to whom I sent the skin for identification, writes: "The mongoose is a form of *H. javanicus* for which the names of *exilis* Gerv. and *rutilus* Gray are available if it is distinct, as I believe to be the case. I think you might call it *exilis* for the present, if you need a name."

Distribution. Siam, Malay Peninsula, Java.

42. *HERPESTES BRACHYURUS* Gray. The Water Mongoose.

"Musang Túron" of the Malays of the Peninsula (according to Cantor).

"Musang Babi" (Pig-Civet) of the Malays (according to Ridley).

"Bambun" of the Malays of Perak (according to L. Wray).

Cantor (p. 35) records this species from the Malay Peninsula.

Ridley (Nat. Science, vol. vi. 1895, p. 93) records it from Tringganu. In the Museum at Taiping are four stuffed mongooses (two from Larut, Perak) which Mr. Wray considers to be *H. brachyurus*.

A large, dark mongoose in the Museum at Kuala Lumpur probably belongs to this species; as also, I think, does a large, very dark rufous-brown mongoose I have seen in the swamps near Jenan, Kedah.

Distribution. Malay Peninsula, Sumatra, Borneo.

Family HYÆNIDÆ.

Cantor (p. 27) says a Hyæna is reported to occur in the Malay Peninsula, but no Englishman nor native I have met has heard of it there or in Siam.

Family CANIDÆ.

43. CANIS FAMILIARIS L. The Dog.

Owing to the exertions of the Police authorities, pariah dogs are fortunately very scarce in the Straits Settlements nowadays. It is far otherwise in Siam; the miserable, maimed, and mangy pariahs which, together with pigs, vultures, and crows, are the scavengers of Bangkok, are a feature of the place. In the suburbs and country villages the dogs are less diseased, and I have two or three times seen specimens remarkably jackal-like in appearance, but have never seen or heard of true jackals in Siam. These ownerless dogs, or at any rate some of them, run about at night in packs, hunting for their food.

44. CYON RUTILANS (S. Müll.). The Malay Wild Dog.

Cyon primævus, Cantor, p. 26.

Cyon rutilans, Blanf. Faun. Ind., Mamm. p. 147; Ridley, Nat. Science, vol. vi. 1895, p. 94.

“Anjing utan” (Dogs of the woods) of the Malays.

“Srigalah” of the Malays of Perak (according to L. Wray).

The wild dog seems quite unknown in Penang and Singapore, but is distributed through the less settled parts of the Peninsula. In the Museum at Taiping there is a specimen from Kuala Kangsar, Perak; and in the Raffles Museum are specimens from Pahang and Mt. Ophir. Consul T. ff. Carlisle, writing to me from Pailin in the Battambang province of Siam in February 1899, says: “Wild dogs are said to be plentiful in parts of this province. I am trying to get one. I have been told there are two kinds.”

Distribution. Siam (?), Tenasserim, Malay Peninsula, Sumatra, Java, Borneo (?).

Family MUSTELIDÆ.

Subfamily MUSTELINÆ.

45. MUSTELA FLAVIGULA Bodd. The Indian Marten.

Mustela flavigula, Blanf. Faun. Ind., Mamm. p. 158.

“Anga Prao” of the Malays of the Peninsula (according to Cantor).

Cantor (p. 24) records this species from the Malay Peninsula. In the Museum at Kuala Lumpur there is a specimen caught on a coffee estate about seven miles from Kuala Lumpur.

Distribution. Himalayas from Hazara to Assam, hills of Southern India, Ceylon (?), Amurland, South China, Burma, Malay Peninsula, Sumatra, Java (?).

46. *PUTORIUS NUDIPES* F. Cuv. The Malay Weasel.

Putorius nudipes, Blanf. Faun. Ind., Mamm. p. 171.

"Pulásan" of the Malays of the Peninsula (according to Cantor).

Cantor (p. 24) records this species from the Malay Peninsula. In the Museum at Taiping there are specimens from Larut and from Kuala Kangsar, Perak.

Mr. Oldfield Thomas (P. Z. S. 1886, p. 73) mentions a specimen from Klang, collected by Mr. Davison.

Distribution. Malay Peninsula, Sumatra, Borneo.

Subfamily MELINÆ.

It is probable that some species of *Helictis* may be eventually found in Siam. I have not had such an animal described to me by the natives; but villagers on the Bangpakong seemed to recognize the figure of *Mellivora indica* in Blandford's Indian Mammals (p. 177) as a local animal under the name of "Mee-mu."

Subfamily LUTRINÆ.

47. *LUTRA VULGARIS* Erxl. The Common Otter.

Lutra vulgaris, Blanf. Faun. Ind., Mamm. p. 182.

In the Raffles Museum there are three Otters labelled *Lutra vulgaris*, from Singapore and Malacca, but I have not been able to examine the specimens myself. In the Siamese Museum there are two stuffed Otters, apparently of this species, obtained locally; they are very small, and pale in colour.

Distribution. Europe and Asia, in suitable localities.

48. *LUTRA MACRODUS* Gray. The Smooth Indian Otter.

Lutra nair, Cantor, p. 25.

Lutra ellioti, Blanf. Faun. Ind., Mamm. p. 185.

Lutra macrodus, Blanf. Fauna Ind., Mamm. Appendix, p. 602.

Recorded from the Malay Peninsula by Cantor. A specimen caught in Selangor is in the Museum at Kuala Lumpur.

Distribution. India, Burma, Malay Peninsula.

49. *LUTRA SUMATRANA* Gray. The Hairy-nosed Malay Otter.

Lutra barang, Cantor, p. 25.

Lutra sumatrana, Blanf. Faun. Ind., Mamm. p. 187.

Recorded from the Malay Peninsula by Cantor, and from Singapore by Ridley (Nat. Science, vol. vi. 1895, p. 94). A specimen caught in Selangor is in the Museum at Kuala Lumpur.

Distribution. Malay Peninsula and Islands.

50. *LUTRA CINEREA* Illiger. The Clawless Otter.

Aonyx leptonyx, Cantor, p. 25.

Lutra leptonyx, Blanf. Faun. Ind., Mamm. p. 187.

Lutra cinerea, Blanf. Faun. Ind., Mamm. Appendix, p. 602.

Recorded from the Malay Peninsula by Cantor, from Malacca

by W. L. Sclater (Cat. Mamm. Indian Mus. ii. 1891, p. 296), from the Tahan River in Pahang by Ridley (J. S. B. R. A. S. 1894, no. 25, p. 58), from Batu Pahat in Johore by Kelsall (J. S. B. R. A. S. 1894, no. 26, p. 16), from Singapore by Ridley (Nat. Science, vol. vi. 1895, p. 94) and by Hanitsch (Rep. Raffles Libr. & Mus. 1898, p. 9), and there is a specimen caught in Selangor in the Museum at Kuala Lumpur.

Distribution. South-eastern Asia.

In the Museum at Taiping I saw five stuffed Otters from Perak, but unfortunately had not time to examine them. Otters were not uncommon on the Bangpakong River in March 1897, but I do not know of what species; the only descriptive note in my diary is "Pachim, 10.3.97.—Young otter; well developed claws; colour of back and sides rich brown, of chin and throat lemon-yellow." In Jan. 1898 I saw the skin of a large Otter in the bazaar at Chantaboon.

Family URSIDÆ.

51. *URSUS MALAYANUS* Raffl. The Malay Sun- or Honey-Bear.

Helarctos malayanus, Cantor, p. 21.

Ursus malayanus, Blanf. Faun. Ind., Mamm. p. 199.

"Bruang" of the Malays.

"Mee" or "Mi" of the Siamese.

Ridley (J. S. B. R. A. S. no. 25, 1894, p. 58) records the Malayan Honey-Bear from the neighbourhood of the Tahan River in Pahang, and (Nat. Science, vol. vi. 1895, p. 93) says "it is tolerably common in the Peninsula, but is absent from Singapore. Formerly rewards were offered for its destruction, but it appears to be quite harmless to man unless wounded, when it becomes dangerous. It is, however, a troublesome enemy to fruit-growers near the jungles in which it lives." In the Museum at Taiping there are specimens from Larut, Perak. In the Museum at Kuala Lumpur there are specimens from Selangor, where it is said to be not uncommon. In the Raffles Museum there is a specimen from Malacca. In 1897 Mr. F. H. Malcolm Staples told me these bears are sometimes seen near Batu Pahat, Johore.

In the Museum at Bangkok there are two stuffed specimens, said to be from Siam; both were brought to the Museum in the flesh, so they probably died in captivity in Bangkok.

Distribution. Burma, Siam, Malay Peninsula (Perak, Selangor, Malacca, Pahang, Johore), Sumatra, Java, Borneo.

52. *MELURSUS URSINUS* (Shaw). The Sloth-Bear.

Melursus ursinus, Blanf. Faun. Ind., Mamm. p. 201.

If the Sloth-Bear be really found in Siam its range extends much farther east than is generally imagined. Several men told me there was a large black bear in the country, and the accounts of its unprovoked attacks on natives walking on jungle-paths accord with accounts of the habits of this species in Southern

India. Mr. St. Stephen, Manager of the Kabin Gold Mines, on the Bangpakong River, told me, when I was there, that in 1895 or 1896 a coolie was killed by a bear near the mines; he went out after the animal, but failed to find it. Some of the European engineers constructing the railway through the Dong Phya Fai said that bears were numerous in the hills of that forest, having their dens among the rocks.

In the Siamese Museum is a stuffed Sloth-Bear, obtained before I went there, labelled by one of my predecessors "Siam"; I made particular enquiries about it, and was assured by the Siamese that it came from the Laos country. But more evidence is wanted to prove that this species inhabits either the Laos States or Siam.

Distribution. India, Ceylon, Assam (?), Burma (?), Siam (?).

Order INSECTIVORA.

Family TUPAIIDÆ.

53. TUPAIA FERRUGINEA Raffl. The Malay Tree-Shrew.

Tupaia ferruginea, Cantor, p. 18; Blanf. Faun. Ind., Mamm. p. 210.

"*Tupaia tana*" of the Malays of Penang (*apud* Cantor).

"This singular little animal was first observed tame in the house of a gentleman at Penang, and afterwards found wild at Singapore and in the woods near Bencoolen" (Sir Stamford Raffles, *circa* 1819). Cantor records it from "Pinang, Singapore, Malayan Peninsula," and gives some account of its habits, as also does Ridley (*Nat. Science*, vol. vi. 1895, p. 28), who records it from Pahang (*J. S. B. R. A. S.* no. 25, Jan. 1894, p. 58). Oldfield Thomas (*P. Z. S.* 1886, p. 73) records it from Malacca and Jelang, Selangor. In the Museum at Taiping there is a specimen from the Waterfall Hill, Larut, labelled *T. tana*, but probably of this species. The Museum at Kuala Lumpor contains specimens from Selangor.

Distribution. Nepal, Assam, Burma, Malay Peninsula (Penang, Perak, Selangor, Pahang, Malacca, Singapore), Sumatra, Java, Borneo.

54. TUPAIA JAVANICA Horsf. The Javanese Tree-Shrew.

Discovered by Horsfield in Java in 1806. Recorded from Pahang (Ridley, *J. S. B. R. A. S.* no. 25, Jan. 1894, p. 58), and from Selangor and Johore (O. Thomas, *P. Z. S.* 1886, p. 73).

Distribution. Malay Peninsula (Selangor, Pahang, Johore), Sumatra, Java, Borneo.

N.B.—Dr. Anderson (*Cat. Mamm. Indian Mus.* part i. p. 156, 1881) records two specimens of *Tupaia malaccana* from Malacca.

I did not myself see a *Tupaia* in Siam, but there can be little doubt that at least one species occurs there. An English friend told me of an animal inhabiting his garden in Bangkok which was probably *T. ferruginea*, and the Siamese described it to me under the name of "Kra' chang."

Family ERINACEIDÆ.

55. GYMNURA RAFFLESI Vig. & Horsf. Raffles's Gymnura.

Gymnura rafflesi, Cantor, p. 20; Blanf. Faun. Ind., Mamm p. 220, fig. 57.

"Tikus ámbang búlan" of the Malays (*apud* Raffles).

"Munduk" of the Malays of Selangor, according to A. L. Butler.

"In a district not distant from Malacca, the animal is said to be numerous, though not to be seen in other localities" (Cantor). In the Museum at Taiping there is a stuffed specimen from Tapah, Perak, and there are two specimens from Kuala Lumpor in the Museum at that place.

Distribution. Tenasserim, Malay Peninsula (Perak, Selangor, Malacca), Sumatra, Borneo.

56. GYMNURA SUILLA (Müll. & Schleg.). The Smaller Gymnura.

Distribution. "Burma, Malay Peninsula, Sumatra, and Java." (Blanf. Faun. Ind., Mamm. p. 222.)

Family SORECIDÆ.

57. CROCIDURA MURINA (Linn.). The Brown Musk-Shrew.

Sorex murinus, Cantor, p. 21.

Crocidura murina, Blanf. Faun. Ind., Mamm. p. 233.

"Chinchorot" of the Malays of the Peninsula (*apud* Cantor).

"Nu-pee" or "Nu-ring" of the Siamese.

Cantor records this species from Penang and says: "The smell of musk, emitted by the adult animal, and which in the young is barely perceptible, is much less intense than that of the Bengal Musk-Shrew." O. Thomas (P. Z. S. 1886, p. 73) records a specimen from Singapore. Ridley (Nat. Science, vol. vi. 1895, p. 29) says the Musk-Shrew "is most abundant in gardens and near houses, and often perfumes the lower part of the house with its strong musky smell." Hanitsch (Rep. Raffles Libr. & Mus. 1897, p. 11) mentions specimens in the Museum at Singapore from Singapore and Pahang. In the Siamese Museum there is one specimen, in spirit, from Bangkok.

Distribution. South-east Asia, in suitable localities.

58. CROCIDURA CÆRULEA (Kerr). The Grey Musk-Shrew.

Crocidura cærulea, Blanf. Faun. Ind., Mamm. p. 236.

This so-called "Musk-Rat" is common in houses in Georgetown, Penang, and in Tanglin, Singapore; in both localities I have frequently caught individuals in rat-traps baited with toast.

Colour (a Penang specimen) bluish grey, paler below, hairs of back with slightly ferruginous brown tips. Skin of snout and feet flesh-coloured. Hair on backs of hands and feet white.

Distribution. South-east Asia, in suitable localities.

N.B.—A large Musk-Shrew occurs on the mainland of the Peninsula; I have seen specimens both in Kedah and in Taiping, Perak, but cannot say whether the species is *C. murina* or *C. cærulea*.

Family GALEOPITHECIDÆ.

59. GALEOPITHECUS VOLANS (Linn.). The Flying Lemur.

Galeopithecus temminckii, Cantor, p. 7.

Galeopithecus volans, Blanf. Faun. Ind., Mamm. p. 249, figs. 70 & 71.

“Kubong” or “Kurbong” of the Malays.

? “Bang” of the Siamese.

Cantor gives as the habitat of this species “Singapore, Pinang, and other Islands in the Straits of Malacca, Lancavy Islands, Malayan Peninsula, Java, Sumatra, Borneo, Pelew Islands, Siam.” Dr. Anderson (Cat. Mamm. Indian Mus. part i. p. 153, 1881) records a specimen from Perak: “skin of a young animal, much variegated with grey, brownish and black, interspersed with white spots,” and others from Malacca. O. Thomas (P. Z. S. 1886, p. 73) records specimens collected by Mr. Davison in the Dindings and in Malacca. Ridley (Nat. Science, vol. vi. 1895, p. 27) says it “is plentiful in some parts of Singapore,” and (J. S. B. R. A. S. no. 25, 1894, p. 58) records it from Kuala Tahan, Pahang. In the Taiping Museum there are several stuffed specimens from Larut, Perak; there are also specimens from Selangor in the Museum at Kuala Lumpur.

A specimen shot at the foot of Gunung Pulai, Johore, was found up a tree in the daytime. When disturbed it parachuted to a neighbouring tree, and started climbing up the trunk; it had a young one clinging to it.

A Penang example was obtained by moonlight, climbing on the trunk of a tree about 60 feet above the ground. The iris was dark brown, the ears pinky-red (this is very noticeable in life); the stomach was very full, its contents apparently all vegetable matter.

Distribution. Tenasserim, Siam, Malay Peninsula (Lancavy, Penang, Perak, Dindings, Selangor, Pahang, Malacca, Johore, Singapore), Sumatra, Java, Borneo.

Order CHIROPTERA.

Family PTEROPODIDÆ.

The species of *Pteropus*, Large Fruit-Bats or “Flying-Foxes,” are known to the Malays as “Kluang,” “Keluang” or “Kelawang,” and to the Siamese as “Käng-khaw maa-kai” or “Chankhoo maakai”; the meaning of this name I have not been able to make out for certain, but if it was originally composed of the four words that now compose it, would seem to suggest “The mother of the fowls that shield the stars,” a really poetic epithet for the largest known bats.

In some places in Siam the Buddhist priests consider these bats sacred. During my time in Siam I seldom saw any Fruit-Bats, but when they were seen they were invariably in large numbers, as the following extracts from my diary show:—

18.3.97. At Tahkamen, many *Pteropi* flying about in the moonlight.

19.3.97. At Tahkamen, at dusk see scores of *Pteropi* flying over the village wat (temple).

15.4.97. On the side of the Bangpakong River between Pachim and Patriew, see a tree covered with *Pteropi*, hanging up asleep; it was black with them, the branches bending under their weight.

12.8.97. At Bangkok, about 7 P.M., large Fruit-Bats kept flying over the compound, some very high in the air, others just high enough to clear the trees and roofs of the buildings; they were all going in the same direction, north-west.

These may have been either of the two following species.

60. *PTEROPUS MEDIUS* Temm. The Indian Fruit-Bat or Flying-Fox.

Pteropus medius, Blanf. Faun. Ind., Mamm. p. 257.

Blanford says this species "is not recorded east or south of Burma," but I believe it occurs in Siam. In the Siamese Museum there are two stuffed Fruit-Bats, one labelled "Bangkok," apparently of this species; and two that I shot on the Bangpakong River in March 1897 I should refer to this species; they were both males, length of forearm 152 mm. (or 6 inches), and the lower breast and abdomen were very dark brown. Unfortunately I did not keep their skins (owing to their very offensive smell, characteristic of these bats), for Mr. Oldfield Thomas writes to me (15.5.97), "I expect your *Pteropus* is not *P. medius* but *P. vampyrus* (*P. edulis* of Catalogue). . . . I do not think *P. medius* reaches Siam."

Distribution. India, Ceylon, and Burma, as far south as Amherst near Moulmein (O. Thomas, P. Z. S. 1886, p. 67); Siam (?).

61. *PTEROPUS EDULIS* Geoff. The Malay Flying-Fox.

Pteropus edulis, Cantor, p. 16; Blanf. Faun. Ind., Mamm. p. 259.

Pteropus vampirus, Ridley, Nat. Science, vi. 1895, p. 27.

Cantor records this species from "Pinang, Singapore, Malayan Peninsula and Islands." Horsfield (Cat. Mamm. Mus. East-India Co. 1851, p. 27) mentions a specimen from Siam obtained by Finlayson.

Dobson (Cat. Chir. B. M. p. 49) records specimens from "Isles of Kallam, Straits of Malacca." O. Thomas (P. Z. S. 1886, p. 73) records specimens from Klang.

Lieut. H. J. Kelsall, R.A., in a list of Mammals from Johore, (J. S. B. R. A. S. no. 26, 1894, p. 16), says: "*Pteropus edulis*, Gray. I only saw a single specimen of this large fruit-bat, at Kuala Kabang. It is probably common." Ridley (J. S. B. R. A. S. no. 25, 1894, p. 58) gives this species as common at Pekan, Pahang; and as regards those at Singapore (Nat. Sci. vi. 1895, p. 27) says: "The large fruit-bats are abundant at certain times, appearing in vast numbers and taking up their abode in some chosen spot, remaining there for some two or three months and then scattering again and

disappearing utterly. One year the [Botanical] Garden jungle was a favoured spot, and it was roughly calculated that seventy thousand roosted there every day. The reason for this flocking of the fruit-bats I cannot guess, as it appears to take place at no particular time of year, nor does it bear any relation to the fruit season."

In April 1895 I noticed this bat on Penang Hill, at 2500 feet above the sea. In the Museum at Taiping are specimens from Tapak, Perak; the Museum at Kuala Lumpur contains a specimen from Klang, and the Raffles Museum contains Singapore specimens.

Distribution. Mergui Archipelago, Tenasserim (?), Andamans (?), Nicobars (?), Siam (?), Malay Peninsula (Penang, Perak, Selangor, Pahang, Johore, Singapore), Sumatra, Java, Borneo, Philippines, Banda, Ternate, Timor.

62. *XANTHARPYIA AMPLEXICAUDATA* (Geoffr.). The Fulvous Fruit-Bat.

Xantharpyia amplexicaudata, Blanf. Faun. Ind., Mamm. p. 261.

Dobson (Cat. Chir. B. M. p. 73) records a specimen collected by M. Mouhot in the Laos Mountains.

Distribution. Persian Gulf, India, Ceylon, Burma, Siam, Sumatra, Philippines, Celebes, Amboyna, Timor, Flores, Aru Islands.

63. *CYNOPTERUS MARGINATUS* (Geoffr.). The Short-nosed Fruit-Bat.

Cynopterus marginatus, Cantor, p. 17; Blanf. Faun. Ind., Mamm. p. 263.

Cantor records this species from "Singapore, Pinang, Malayan Peninsula and Islands." Horsfield (Cat. Mamm. Mus. East-India Co. 1851, p. 30) mentions specimens from Malacca under the name of *Cynopterus titthæcheilus*.

Dobson (Cat. Chir. B. M. pp. 83, 84) records specimens from Penang and Malacca. Anderson (Cat. Mamm. Indian Mus. i. 1881, p. 106) records specimens from Penang.

Thomas (P. Z. S. 1886, p. 73) records specimens from "Jerome," Selangor, and from Singapore Island.

Ridley (Nat. Science, vi. 1895, p. 28) mentions this species as being the bat that most commonly flies into houses in Singapore at night, and says: "The fruit-bats, being clumsy and stupid, have much difficulty in finding their way out again, and are easily caught; but the insectivorous bats are much more clever, and fly in and out with ease."

In the Siamese Museum there was a specimen in spirit, labelled "Bangkok." I have met this species in Georgetown, Penang, and at various places in Singapore, where it seems numerous; it may be found by day in trees hanging up asleep.

Distribution. India, Ceylon, Burma, Andamans, Siam, Malay Peninsula (Penang, Selangor, Malacca, Singapore), Sumatra, Java, Billiton, Borneo, Philippines.

64. *CYNOPTERUS LUCASI* Dobs. Lucas's Fruit-Bat.

I understand Mr. Ridley has obtained this species both in Singapore Island (O. Thomas, A. M. N. H. ser. 7, i. p. 361, 1898) and in Selangor (Hanitsch, Rep. Raffles Libr. & Mus. 1897, p. 11).

Distribution. Malay Peninsula (Selangor and Singapore) and Borneo.

65. *CARPONYCTERIS MINIMA* (Geoffr.). The Small Long-tongued Fruit-Bat.

Carponycteris minima, Blanf. Faun. Ind., Mamm. p. 265.

Anderson (Cat. Mamm. Indian Mus. part i. 1881, p. 107) records a specimen from Siam collected by Dr. G. Finlayson, probably the same individual mentioned by Horsfield (Cat. Mamm. Mus. East-India Co. 1851, p. 29) "with a lengthened nose, perhaps a distinct species."

Distribution. Sikhim, Burma, Siam, Java, Philippines, Australia, New Ireland.

Another Fruit-Bat, *Eonycteris spelcea* (Dobs.), known from Burma, Cambodia, and Java, will probably be eventually found to occur in Siam and the Malay Peninsula.

Family RHINOLOPHIDÆ.

66. *RHINOLOPHUS LUCTUS* Temm. The Great Eastern Horse-shoe-Bat.

Rhinolophus luctus, Blanf. Faun. Ind., Mamm. p. 270.

Dobson (Cat. Chir. B. M. p. 106) records a specimen from Malacca.

Distribution. India, Ceylon, Burma, Malay Peninsula (Malacca), Java, Sumatra, Borneo, Philippines.

67. *RHINOLOPHUS CÆLOPHYLLUS* Peters. The Crosletted Horse-shoe-Bat.

Rhinolophus celophyllus, Blanf. Faun. Ind., Mamm. p. 272.

I caught a single male in Bakar Bata house, near Alor Star, Kedah, 1st June, 1898. Mr. O. Thomas, to whom the specimen was sent, has confirmed my identification of the species.

Distribution. Burma, and Malay Peninsula (Kedah).

68. *RHINOLOPHUS TRIFOLIATUS* Temm. The Three-foliated Horseshoe-Bat.

Rhinolophus trifolius, Blanf. Faun. Ind., Mamm. p. 272.

Hanitsch (Rep. Raffles Libr. & Mus. 1897, p. 11) mentions this species from Singapore.

Distribution. India, Assam, Mergui, Malay Peninsula (Singapore) Java, Borneo.

69. RHINOLOPHUS AFFINIS Horsf. The Allied Horseshoe-Bat.

Rhinolophus affinis, Cantor, p. 11; Blanf. Faun. Ind., Mamm. p. 274.

Cantor records two individuals from Penang.

Dobson (Cat. Chir. B. M. p. 112) records a specimen from Penang, from Cantor.

Ridley obtained this species in Selangor (O. Thomas, A. M. N. H. ser. 7, i. p. 361).

Dimensions of Penang specimens, after Cantor:—

Sex	♂.		♀.	
Entire length	64 mm.	2·5 in.	73 mm.	2·89 in.
Tail	13 mm.	·5 in.	16 mm.	·63 in.
Extent	11·25 in.		12·5 in.	

Distribution. India, Ceylon, Burma, Cochinchina, Malay Peninsula (Penang and Selangor), Sumatra, Java, Borneo.

70. RHINOLOPHUS MINOR Horsf. The Little Indian Horseshoe-Bat.

Rhinolophus minor, Blanf. Faun. Ind., Mamm. p. 276.

Dobson (Cat. Chir. B. M. p. 115) records a specimen from Siam. Ridley obtained this species in Selangor (O. Thomas, A. M. N. H. ser. 7, i. p. 361).

Distribution. India, Burma, Siam, Japan, Malay Peninsula (Selangor), Sumatra, Java, Borneo.

71. HIPPOSIDERUS ARMIGER (Hodgs.). The Great Himalayan Leaf-nosed Bat.

Hipposideros diadema, Gray?, Cantor, p. 11.

Hipposiderus armiger, Blanf. Faun. Ind., Mamm. p. 283.

Cantor records this species from Penang and the Malay Peninsula. Dobson (Cat. Chir. B. M. p. 136) mentions a specimen from Penang from Cantor.

In the Siamese Museum there was a specimen in spirit, apparently of this species, from Chantaboon.

Distribution. India (Himalayas, Khasi Hills), Burma?, China, Cochinchina, Siam, Malay Peninsula (Penang).

72. HIPPOSIDERUS DIADEMA (Geoffr.). The Large Malay Leaf-nosed Bat.

Hipposideros nobilis, Cantor, p. 12.

Hipposiderus diadema, Blanf. Faun. Ind., Mamm. p. 284.

Cantor records this species from Penang and the Peninsula, and says: "In the valley of Pinang single individuals of both species (i. e. *H. diadema* and *H. armiger*) are at night abroad at all seasons, but during the rains they are particularly numerous." Dobson

(Cat. Chir. B. M. p. 137) mentions a specimen from Penang; O. Thomas (P. Z. S. 1886, p. 73) a specimen from Gunong Pulai, Johore, collected by Davison. Hanitsch (Rep. Raffles Libr. & Mus. 1897, p. 11) records this species from Kuala Lumpur. In the Siamese Museum there is a specimen in spirit, apparently of this species, labelled "Bangkok."

Distribution. India (locally), Ceylon, Burma, Siam, Malay Peninsula (Penang, Selangor, Johore), Sumatra, Java, Borneo, Timor, Batchian, Amboyna, Philippines, Aru Islands.

73. HIPPOSIDERUS GALERITUS Cantor. Cantor's Leaf-nosed Bat.

Hipposideros galeritus, Cantor, p. 13.

Hipposideros galeritus, Blanf. Faun. Ind., Mamm. p. 287.

Cantor described this species from "a solitary male captured in the valley of Pinang." Dobson (Cat. Chir. B. M. p. 142) records a specimen from Singapore, collected by A. R. Wallace.

Distribution. India (near Bellary), Ceylon, Malay Peninsula (Penang and Singapore), Java and Borneo.

74. HIPPOSIDERUS LARVATUS (Horsf.). Horsfield's Leaf-nosed Bat.

Hipposideros vulgaris, Cantor, p. 13.

Hipposideros larvatus, Blanf. Faun. Ind., Mamm. p. 288.

Cantor records this species from Penang. Dobson (Cat. Chir. B. M. p. 145) records a specimen from Siam, collected by M. Mouhot.

Distribution. Assam, Sylhet, Burma, Siam, Malay Peninsula (Penang), Java, Borneo (Notes Leyd. Mus. xix. p. 52). Philippines?

75. HIPPOSIDERUS BICOLOR (Temm.). The Two-coloured Leaf-nosed Bat.

Hipposideros murinus, Cantor, p. 13

Hipposideros bicolor, Blanf. Faun. Ind., Mamm. p. 289.

Cantor records this species from Penang. Dobson (Cat. Chir. B. M. pp. 150, 151) records specimens of *H. bicolor* (typical variety, with ears as long as the head) from Penang and Singapore. O. Thomas (P. Z. S. 1886, p. 73) mentions a specimen from Klang, Selangor, collected by Davison—"♂, more pointed ears, a broader horizontal nose-leaf, and a much more largely developed projection between the nostrils than is usually the case in this species." Hanitsch (Rep. Raffles Libr. & Mus. 1897, p. 11) mentions *Phyllorhina bicolor*, var. *fulva*, from Kuala Lumpur.

I found *Hipposiderus bicolor fulvus* very numerous at Alor Star, Kedah, in May and June 1898, specimens flew into our house almost every night; and on the 26th June, 1898, I caught a single specimen in a house in Kuala Lumpur, Selangor, probably *fulvus*,

of which Mr. Oldfield Thomas remarks "rather different from others, but these *Hipposideri* want further working at."

Distribution. India, Ceylon, Assam, Burma, China, Nicobars, Malay Peninsula (Kedah, Penang, Selangor, Singapore), Java, Borneo, Philippines.

76. *HIPPOSIDERUS AMBOINENSIS* (Peters). The Little Leaf-nosed Bat.

Hipposiderus amboinensis, Blanf. Faun. Ind., Mamm. p. 290.

I caught two specimens on Penang Hill, 2400 feet, in March 1898.

Distribution. India (Himalayas and near Bellary), Malay Peninsula (Penang), Amboyna.

77. *HIPPOSIDERUS STOLICZKANUS* (Dobson). Stoliczka's Leaf-nosed Bat.

Phyllorhina stoliczkana, Dobs. Mon. As. Chir. p. 61, figs. *a, b*; and Cat. Chir. B. M. p. 132.

The type specimen was obtained by Dr. Stoliczka in Penang and presented by him to the Indian Museum, 1871.

Distribution. Malay Peninsula (Penang).

78. *CĒLOPS FRITHI*, Blyth. The Tailless Leaf-nosed Bat.

Celops frithi, Blanf. Faun. Ind., Mamm. p. 291, fig. 88.

Distribution. "Originally described from a Sundarban specimen, but has recently been discovered at Darjiling by Col. Kinloch. It has also been found in Siam and Java."

Family NYCTERIDIDÆ.

79. *MEGADERMA SPASMA* (Linn.). The Malay Vampire Bat.

Megaderma spasma, Cantor, p. 19.

Megaderma spasma, Blanf. Faun. Ind., Mamm. p. 294.

Cantor records this species from Penang and the Peninsula.

Dobson (Cat. Chir. B. M. p. 158) records specimens from Penang, Singapore, and Siam.

Anderson (Cat. Mamm. Indian Mus. part i. 1881, p. 121) mentions specimens from Malacca, presented by Mr. W. G. Moxon, 1850.

Hanitsch (Rep. Raffles Libr. & Mus. 1897, p. 11) mentions specimens from Penang and from Selangor.

Distribution. Southern India?, Ceylon?, Tenasserim, Siam, CochinChina, Malay Peninsula (Penang, Selangor, Malacca, and Singapore), Sumatra, Java, Borneo, Celebes, Philippines, Ternate.

80. *NYCTERIS JAVANICA* Geoff.

Nycteris javanica, Dobs. Mon. As. Chir. p. 81; and Cat. Chir. B. M. p. 164.

Anderson (Cat. Mamm. Indian Mus. part i. 1881, p. 122)

records a specimen from Malacca, presented by Mr. W. G. Moxon, 1851.

Distribution. Malay Peninsula (Malacca), Java.

Family VESPERTILIONIDÆ.

81. VESPERUGO NOCTULA (Schreb.). The Noctule Bat.

Vesperugo noctula, Blanf. Faun. Ind., Mamm. p. 308, fig. 93.

Dobson (Cat. Chir. B. M. p. 214) records a specimen from Singapore, called *Noctulina malaccensis* by Gray.

Distribution. Europe, Africa, Turkestan, India, Ceylon, China, Japan, Malay Peninsula (Singapore), Sumatra, Java.

82. VESPERUGO IMBRICATUS (Horsfield).

Vesperugo imbricatus, Dobson, Mon. As. Chir. p. 93, and Cat. Chir. B. M. p. 217.

Distribution. "Malay Peninsula (Malacca); Java" (Dobson).

83. VESPERUGO TENUIS (Temm.).

Kirivoula tenuis, Cantor, p. 15.

Vesperugo tenuis, Dobson, Cat. Chir. B. M. p. 226.

Cantor records this species from Penang.

Distribution. Malay Peninsula (Penang), "Sumatra, Java, Bo neo."

84. VESPERUGO ABRAMUS (Temm.). The Indian Pipistrelle.

Vesperugo abramus, Blanf. Faun. Ind., Mamm. p. 313.

Dobson (Cat. Chir. B. M. p. 228) records a specimen from Singapore. I caught specimens in the Officers' Mess, Sepoy Lines, Penang, in March, April, May, and June, 1895.

Distribution. Europe, India, Ceylon, Burma, Cambodia, China, Japan, Malay Peninsula (Penang and Singapore), Philippines, Celebes, New Guinea, Northern Australia.

85. VESPERUGO EIDLEYI (Thomas). Ridley's Pipistrelle.

Pipistrellus ridleyi, O. Thomas, A. M. N. H. ser. 7, i. p. 361 (1898).

Obtained by Mr. H. N. Ridley in Selangor, "caught under a railway arch."

Distribution. Malay Peninsula (Selangor).

86. VESPERUGO BLANFORDI Dobson. Limborg's Bat.

Vesperugo blanfordi, Blanf. Faun. Ind., Mamm. p. 317.

Anderson (Cat. Mamm. Indian Mus. part i. 1881, p. 133) mentions a specimen from Johore presented by Wood-Mason in 1873.

Distribution. Burma and Malay Peninsula (Johore).

87. *NYCTICEIUS KUHLI* (Leach). East Indian Yellow Bat.

Scotophilus temminckii, Cantor, p. 15.

Nycticejus kuhli, Blanf. Faun. Ind., Mamm. p. 320.

“Klávah” of the Malays of the Peninsula (Cantor).

Cantor records this species from “Singapore, Penang, Malayan Peninsula and Islands,” and says:—“This species is exceedingly numerous, forming large congregations in sheltered situations on the Malayan Peninsula, and in the caves on the numerous islands of limestone which stud the shores from Moulmein to Java, and in such localities large deposits of guano occur. The latter (‘Ty Klávah’ of the Malays, *i. e.* bats’ manure) has been tried by agriculturists at Penang, but has been found much less efficacious than the guano obtained from the swift (*Collocalia*) producing the edible nests.” Horsfield says: “This species is very abundant, collecting by companies of hundreds, in trunks and hollows of trees, and feeding chiefly on white ants.”

I caught a single specimen in the Officers’ Mess House, Sepoy Lines, Penang, 23rd May, 1895.

♂. Head and body 2·63 inches; forearm 1·92; tail 1·65; extent 13·5

Near Alor Star, in Kedah, I found this species very numerous in June, 1898; the Malay boys caught them in nets. Out of eleven individuals examined only two were males.

Colour. Fur very dark brown above, the basal portion of the hair yellowish brown, pale yellowish brown below; ears and wing-membranes very dark brown.

Of these specimens Mr. Oldfield Thomas writes to me: “The *Scotophilus kuhli* from Kedah is quite remarkably dark-coloured. Had it not been for the existence of *S. castaneus* Gray from Pinang, I might have been tempted to give it a subspecific name.”

Distribution. India, Ceylon, Assam, Burma, Malay Peninsula (Kedah, Penang, Singapore), Sumatra, Java, Borneo, Flores, Philippines.

88. *VESPERTILIO HASSELTII* Temm. Van Hasselt’s Bat.

Distribution. “Malay Peninsula, Siam, Sumatra, Java, &c. . . Burma” (Blanf. Faun. Ind., Mamm. p. 330).

89. *VESPERTILIO ADVERSUS* Horsfield.

Vespertilio adversus, Blanf. Faun. Ind., Mamm. p. 330.

Dobson (Cat. Chir. B. M. p. 293) records specimens from Siam presented by Mr. W. H. Newman. Hanitsch (Rep. Raffles Libr. & Mus. 1897, p. 11) mentions “*Vespertilio adversus*” from Singapore.

Distribution. Burma?, Siam, Java, Borneo, Celebes, Australia, Malay Peninsula (Singapore).

90. *VESPERTILIO OREIAS* Temm.

Distribution. Singapore (Dobson, Cat. Chir. B. M. p. 305).

91. *VESPERTILIO MURICOLA* Hodgs. The Mustachioed Bat.*Vespertilio adversus*, Horsfield?, Cantor, p. 14.*Vespertilio muricola*, Blanf. Faun. Ind., Mamm. p. 337, fig. 109.

Cantor records this species from Penang.

Dobson (Cat. Chir. B. M. p. 317) records specimens from Siam, collected by M. Mouhot, and from Singapore.

In a house at Kuala Lumpor, Selangor, 26th June 1898, I caught a young bat, probably of this species; and in Bangkok, 5th Aug 1898, an undoubted specimen, also caught in a house.

Distribution. India, Ceylon, Tibet, Burma, Siam, Mergui Archipelago, Malay Peninsula (Penang, Selangor, Singapore), Sumatra, Java, Borneo, Celebes, Amboyna.92. *VESPERTILIO TRALATITUS* Horsf.“*Trilatitus horsfieldi*, Gray,” Cantor, p. 15.

Cantor records this species from Penang.

Distribution. Malay Peninsula (Penang), Sumatra, Java.93. *CERIVOULA PICTA* (Pall.). The Painted Bat.*Kirivoula picta*, Cantor, p. 15.*Cerivoula picta*, Blanf. Faun. Ind., Mamm. p. 339.

Cantor records this species from Penang. The Siamese Museum contained one spirit specimen, a male, not labelled but evidently obtained locally; its dimensions were:—

Head and body	40 mm.	1.58 in.
Tail	40 „	1.58 „
Ear	12 „	.5 „
Forearm	34 „	1.24 „
Extent	240 „	about 8.5 „

Subsequently I obtained another Siamese specimen through the kindness of Phra Ong Chow Sye Sanitwongse, who sent it with this interesting note: “6th April 1898. Orange-coloured bat from a swamp called Bang Falari at the Rangsit Canal: it sleeps in the flower of the Cala Lilly.”

Distribution. India, Ceylon, Burma, Siam, Malay Peninsula (Penang), Sumatra, Java; Borneo?

Family EMBALLONURIDÆ.

94. *TAPHOZOUS MELANOPOGON* Temm. Black-bearded Sheath-tailed Bat.*Taphozous melanopogon*, Cantor, p. 10; Blanf. Faun. Ind., Mamm. p. 347.

Cantor records this bat from Pulo Tikus, Pulo Lancavy, and the

Peninsula. Dobson (Cat. Chir. B. M. p. 381) records specimens from Penang and Pulo Tikus (Dr. Cantor).

Habits. In Bangkok I found these bats very numerous at all times of the year, spending the daytime in the roofs of buildings; a score or more were generally to be seen in the kitchen of the somewhat ruinous house I lived in. In the evenings they used to hunt regularly for insects in the house, flying from room to room in turn, with occasional pauses for rest on the walls; the great pace at which they flew, their graceful circling swoops, and the unerring accuracy with which they passed at full speed through



Head of *Taphozous melanopogon*, ♂.

Three-quarter and profile views. (Slightly larger than life.)

the holes in the wooden partitions between the rooms, were a constant pleasure to watch on many a damp, stifling-hot night. Their voice is very shrill and ear-piercing. They are very active in climbing about, and it is very curious seeing a party of them (disturbed during the day) retreating *backwards* up a wall. They

generally rest suspended by their hind feet, with the head rather thrust up, and the big ears flat against their necks.

In April 1898 I found these bats fairly numerous on the little island of Pulo Tikus, near Penang. They were living in the small caves by the sea, which are only accessible (to human beings) at low tide; the way the bats crawl over the rocks is wonderful, the general effect being more that of a crab than a mammal. I have also received a specimen of this species from Chantaboon.

Colour. Five specimens (3 ♂, 2 ♀) caught on Pulo Tikus on the same day (9.4.98) showed great variations in colour:—

♂ (*a*). Pale mouse-colour, tinged with rufous, breast lighter, belly white, black patch on throat.

♂ (*b*). Very yellowish rufous.

♂ (*c*). Dark grey; this specimen was rather smaller than either *a* or *b*, which were subequal in size.

♀ (*d*). Pale mouse-colour, breast lighter, belly white.

♀ (*e*). Similar to *d*, but darker and browner above.

The illustration of the head of this species given by Dobson (P. Z. S. 1875, and Mon. As. Chir. p. 167), which has been used in subsequent books (Cassell's Nat. Hist. i. p. 316, and Blanf. Faun. Ind., Mamm. p. 347, fig. 114), is, I venture to think, not adequate in giving a good idea of the physiognomy of this bat. The appended sketches (see p. 348) of a male, from Bangkok, drawn from life, will be seen to differ from Dobson's figure in the profile of the nose, the form and serrations of the ear, and the bristles on the face. Also *T. melanopogon* has a bright, intelligent look, which is lost in Dobson's figure, apparently drawn from a spirit specimen.

Distribution. India, Burma, Siam, Cochinchina, Malay Peninsula (Lancavy, Penang), Java, Borneo, Philippines.

95. TAPHOZOUS LONGIMANUS Hardw. Long-armed Sheath-tailed Bat.

Taphozous longimanus, Blanf. Faun. Ind., Mamm. p. 348.

Dr. F. A. Jentink (Notes from the Leyden Museum, vol. xix. p. 54, January 1897) says of specimens of this bat from Sintang, Borneo:—"The wings are white, strikingly contrasting with the dark-coloured (in alcohol) rest of the animal." Mr. Oldfield Thomas (A. M. N. H. ser. 7, vol. ii. p. 246, Sept. 1898) describes these white-winged specimens as *Taphozous longimanus albipinnis*, with a female from Labuan, collected by the late Mr. A. H. Everett, as the type of the subspecies, and says: "Four other Bornean specimens are similarly white-winged, and there is also a white-winged specimen in the Museum collection from Malacca collected long ago by Mr. A. Charlton" (*vide* Dobson, Cat. Chir. B. M. p. 385). During a few days I spent in Labuan in Sept. and Oct. 1897 a white-winged *Taphozous* was very noticeable, flying at evening-time in large numbers over the road from Usher Market to the Post Office, but I do not know whether they belonged to this species

or to *T. affinis* (also recorded from Labuan), or both. This was the only locality where I observed any white-winged bats.

Distribution. India, Ceylon, Burma, Malay Peninsula (Malacca), Borneo.

96. *TAPHOZOUS SACCOLEMUS* Temm. Pouch-bearing Sheath-tailed Bat.

Taphozous saccoluimus, Cantor, p. 10.

Taphozous saccolemus, Blanf. Faun. Ind., Mamm. p. 350.

Cantor mentions "two males captured at Pinang in houses in the valley."

Dobson (Cat. Chir. B. M. p. 389) records a specimen from Singapore.

Distribution. Peninsula of India, Ceylon, Sylhet, Burma, Malay Peninsula (Penang and Singapore), Sumatra, Java.

97. *TAPHOZOUS AFFINIS* Dobson.

Taphozous affinis, Dobson, Cat. Chir. B. M. p. 389.

A male was caught by Mr. Robertson Glasgow in the Botanical Gardens, Singapore, on Nov. 19, 1897, and presented by him to the Raffles Museum (Ridley, J. S. B. R. A. S. no. 31, 1898, p. 104).

Distribution. Singapore, Sumatra, Labuan.

98. *RHINOPOMA MICROPHYLLUM* Geoffr. The Long-tailed Bat.

Rhinopoma hardwickii, Cantor, p. 8.

Rhinopoma microphyllum, Blanf. Faun. Ind., Mamm. p. 351, figs. 116 & 117.

Cantor says: "A single male, in no way differing from Bengal individuals, was obtained by Captain Congalton, H.C. Steamer 'Diana,' in a cave on an island in Girbee river, in latitude 8° 0', on the Malayan Peninsula."

Distribution. N.E. Africa, Syria, India, Burma, and Malay Peninsula (latitude of Junkceylon).

99. *CHIROMELES TORQUATUS* Horsf. The Hairless Bat.

Cheiromeles torquatus, Dobson, Cat. Chir. B. M. p. 405.

Recorded from Penang, Malacca, and Singapore by Dobson (*op. cit.*). Anderson (Cat. Mamm. Indian Mus., part i. 1881, p. 150) mentions a specimen from Siam collected by Finlayson, which is also mentioned by Horsfield (Cat. Mamm. Mus. East India Co. 1851, p. 42), who says: "Discovered by Mr. George Finlayson, while attached to the mission of John Crawford, Esq., to Siam and Cochin China. The precise locality is not known."

Ridley (Nat. Science, 1895, vol. vi. p. 28) says, in Singapore "this is not a rare species. When it comes into the house at night, unlike most insectivorous bats, it is confused by the light, and is easily caught."

The Raffles Museum contains specimens from Singapore and

Pahang. There is a specimen from the Batu Caves, Selangor, in the Museum at Kuala Lumpur.

Distribution. Siam, Malay Peninsula (Penang, Selangor, Pahang, Malacca, Singapore), Sumatra, Java, Borneo.

100. *NYCTINOMUS PLICATUS* (Buchanan). The Indian Wrinkled-lipped Bat.

Nyctinomus tenuis, Cantor, p. 9.

Nyctinomus plicatus, Blanf. Faun. Ind., Mamm. p. 354.

Cantor records this species from the Malay Peninsula.

Dobson (Cat. Chir. B. M. p. 425) records specimens from the Malay Peninsula and Singapore.

An interesting account of these bats at Hpagat, Salween, Burma, by Capt. A. R. S. Anderson, appeared in 'Natural Science,' 1899, p. 259, taken from the "Administration Report of the Marine Survey of India, 1897-98."

Distribution. India, Burma, Malay Peninsula, Sumatra, Java, Borneo, Philippines.

101. *NYCTINOMUS JOHORENSIS* Dobson. Dato Meldrum's Bat.

Nyctinomus johorensis, Dobson, Cat. Chir. B. M. p. 432.

The type specimen was obtained in Johore by Dato James Meldrum. He sent it to Wood-Mason, who presented it to the Indian Museum, 1872. So far as I am aware, this is the only specimen in any collection.

Distribution. Malay Peninsula (Johore).

Order RODENTIA.

Family SCIURIDÆ.

102. *PTEROMYS ORAL* Tick. The Large Brown Flying-Squirrel.

Pteromys oral, Blanf. Faun. Ind., Mamm. p. 361, fig. 122.

"Baang-let" of the Siamese.

While in Siam (Nov. 1898) I was shown the skin of a Flying-Squirrel shot at Prachei (a place between Ayuthia and Korat), which agreed exactly with Blanford's description of this species.

Distribution. India, Ceylon, Burma, Mergui Archipelago, Siam.

103. *PTEROMYS PETAURISTA*, Pallas. The Large Malay Flying-Squirrel.

Pteromys nitidus, Cantor, p. 44.

Pteromys nitidus, O. Thomas, P. Z. S. 1886, p. 73.

"Túpai Térbang" or "Kúbin" of the Malays of the Peninsula (Cantor).

"Tupai Belang" of the Malays (Ridley).

"Grabah" or "Kubin" of the Malays (L. Wray, jun.).

Cantor records this species from Penang, Singapore, and the Peninsula, and says it is "very numerous in the Malayan countries."

It is not strictly nocturnal, for it is frequently seen abroad during the day. It is particularly fond of the Durian, the fruit of *Durio zibethinus*. The Flying-Squirrel has this partiality in common with various other animals, as monkeys, Pteropi and Paradoxuri; nay, the Malays assert, that they have to watch this, their favourite fruit, against tigers."

Horsfield (Cat. Mamm. Mus. East India Co. 1851, p. 162) records a specimen, under the name of *Pteromys melanotis*, from Siam, collected by Dr. G. Finlayson; W. L. Sclater (Cat. Mamm. Indian Mus. part ii. 1891, p. 37) also mentions this specimen, and others from Malacca procured by the Rev. F. Lindstedt in 1845.

O. Thomas (P. Z. S. 1886, p. 73) records three specimens collected by Davison, from Klang (Salangor), Malacca, and Gunang Pulai (Johore) respectively, and says "these specimens all belong to the so-called species *Pt. melanotis*."

H. J. Kelsall (J. S. B. R. A. S. no. 26, Jan. 1894), in a list of Mammals from Johore, says presumably of this species:—" *Pteromys oral*, Tick. Red Flying-Squirrel. One specimen obtained at Simpai, on the Batu Pahat Sembrong."

Ridley (Nat. Science, vol. vi. 1895, p. 95) says:—"The red Flying-Squirrel, *Pteromys nitidus*, is still common in Singapore, inhabiting the thicker jungles. It remains quite quiet during the day, but at dusk begins to move about. It climbs with some clumsiness to a high point on a tree, and then dives off to the next, up which it climbs again, and again dives off, and so travels to its feeding ground. It appears to be very fond of coconuts, and will attack any that are near the jungles which it inhabits."

Hanitsch (Rep. Raffles Libr. & Mus. 1897, p. 10) records "*Pteromys petaurista* (= *oral*)" from Selangor, and "*Pteromys nitidus*" from Singapore.

In the Museum at Taiping I saw, in May 1898, six large Flying-Squirrels stuffed; two of these are very dark; Mr. Wray has labelled them *P. nitidus*, Malay name "Kubin," they are from Larut. The remaining specimens are very red; two are from Tapah, Batang Padang, and one from Larut; they are labelled *P. petaurista*, "The Taguan," Malay name "Grabah."

In the Museum at Kuala Lampor I saw, in June 1898, two stuffed specimens of *T. petaurista*, both obtained in Selangor; and Mr. A. L. Butler told me there was also a black *Pteromys* found in that neighbourhood, which he considered to be possibly a race of *P. oral*.

I have only once seen a *Pteromys* wild; it was apparently of this species, on Penang Hill, about 1800 feet elevation, on the 11th March, 1899. Just after sunset it passed near me, swooping down hill over the trees (which at this point were not high); we had a good view of it for about 100 yards, when it passed out of sight downhill; its parachute was kept quite steady, and its tail stiff straight out behind.

Distribution. Siam, Formosa, Malay Peninsula (apparently generally distributed), Sumatra, Java, Borneo.

104. *PTEROMYS PUNCTATUS* Gray. The Spotted Flying-Squirrel.

Distribution. Malacca and Burma (*vide* Blanf. Faun. Ind., Mamm. p. 366).

105. *PTEROMYS TEPHROMELAS* Günth.

O. Thomas (P. Z. S. 1886, p. 74) records two specimens collected by Davison, one from Klang, Selangor, and one from Jaffaria, Johore.

106. *SCIUROPTERUS ALBONIGER* Hodgs. The Parti-coloured Flying-Squirrel.

Distribution. "The Himalayas from Nepal eastward, at an elevation of 3000 to 5000 feet. Found also in the hills south of Assam, in Manipur, Yunnan, and Siam. Some skins in the British Museum from Borneo are also referred to this species." (Blanf. Faun. Ind., Mamm. p. 367.)

107. *SCIUROPTERUS SAGITTA* (Linn.). Horsfield's Flying-Squirrel.

Sciuropterus horsfieldii, Cantor, p. 45.

Sciuropterus sagitta, Blanf. Faun. Ind., Mamm. p. 367.

Of this species Cantor obtained a single skin, from Kedah.

In the Museum at Taiping I saw two specimens from Larut, Perak.

Distribution. Burma, Cambodia, Malay Peninsula (Kedah, Perak), Sumatra?, Bauka, Java.

Personally, the only place where I have seen *Sciuropterus* alive was on Penang Hill, at about 2200 feet elevation. On the 17th March, 1896, I noticed two grey ones going from tree to tree in bright daylight; and on the 29th March, 1898, I obtained a male specimen near the same spot; I do not know to which species it belongs, the large ears have no pencils of hair at the base.

Colour. Above dark grizzled brown, plentifully sprinkled with rich rufous yellow (underfur of back grey, hairs dark brown tipped with rufous yellow). Tail, upper surface nearly uniform dove-coloured brown. Below, very pale lemon-yellow under the head, neck, and body; pale rufous under the parachute; light red under the tail. A dark patch round eye. Cheeks rufous yellow. Nose, chin, and ears pale mouse-colour. The fringe of hair on the anterior margin and corner of the lateral flying-membrane is above rich rufous, and below buff turning to a warm reddish yellow at the edge.

Size :—

Head and body	188 mm.	about	$7\frac{1}{2}$ inches.
Tail, without hair	195 "	"	$7\frac{3}{4}$ "
Tail, with hair	220 "	"	$8\frac{3}{4}$ "
Hind-foot, without claw ..	34 "		
Ear	22 "		
Extent	305 "	"	12 "

108. *SCIUROPTERUS DAVISONI* Thomas. Davison's Flying-Squirrel.

O. Thomas (P. Z. S. 1886, p. 74, pl. vi.) described this species from a specimen collected in Malacca by Davison.

109. *SCIUROPTERUS LEPIDUS* Horsf.

In the Museum at Kuala Lumpur there is a Squirrel from Selangor, which Mr. A. L. Butler tells me is of this species.

110. *SCIUROPTERUS GENIBARBIS* (Horsf.).

Cantor (p. 45) records this species from the Malay Peninsula, and gives the following dimensions of a male :—

Head and body	191 mm.	7½ inches.
Tail	178 „	7 „

Distribution. Malay Peninsula, Java.

111. *RATUFA BICOLOR* Sparrm. The Large Malay Squirrel.

Sciurus bicolor, Cantor, p. 38; Blanford, Faun. Ind., Mamm. p. 373.

Cantor says the dark variety is called by the Malays of the Peninsula "Chingkrawah étam," and is very numerous in the forests and hills of Penang and the Malay Peninsula; the light variety is called "Chingkrawah" or "Chingkrawah puteh," and occurs in Penang.

O. Thomas (P. Z. S. 1886, p. 75) records twelve specimens from the Malay Peninsula, from the following localities :—two from Salanga, Junkceylon; one from the Dindings; four from Klang, Selangor; one from Malacca; one from Jaffaria, Johore; and three from Gunong Pulai, Johore. He says: "With the exception of three or four of the cream-coloured examples so common in this species, all these specimens represent the typical black and yellow *S. bicolor*."

W. L. Sclater (Cat. Mamm. Indian Mus. ii. 1891, p. 9) records specimens from Perak, Malacca, and Singapore.

Ridley (J. S. B. R. A. S. no. 25, Jan. 1894, p. 58) says: "*Sciurus bicolor* Sparr. This very variable Squirrel is, in Pahang, usually of a dirty yellowish-white colour, almost tawny on the back. Seen far up the Taban River, and at Pulau Tawar." Also (Nat. Science, vi. 1895, p. 95) he writes:—"*S. bicolor* is a strictly arboreal squirrel, which lives in the tops of the higher trees in the thick jungles. It is very variable in colour. The commonest form in Singapore is black with a cream-coloured belly. In the Peninsula it is usually entirely cream-coloured. It is remarkably docile, but much less active than the smaller species. When eating, this species sits transversely on a bough, grasping it with its hind feet, the head and body hanging down on one side and the tail on the other. It eats fruits of different kinds, and also buds and leaves."

H. J. Kelsall (J. S. B. R. A. S. no. 26, Jan. 1894, p. 16) says:— "This squirrel, which is common in Johor, is here of a dirty

yellowish-white colour, somewhat darker on the back. Specimens were obtained at Kuala Sembrong and Batu Pahat."

The Museum at Taiping contains a specimen of the dark race from Maxwell's Hill, Larut, Perak. Mr. L. Wray tells me this squirrel is known as "The Jeelrang Squirrel," "Chingkrawah Itam," or "Tupai Nanding."

The Museum at Kuala Lumpur contains one dark specimen from Selangor.

The Raffles Museum contains a specimen from Singapore.

In the Siamese Museum we had a specimen from Phrabat.

I saw the dark race of this species in some high jungle-trees near the waterfall, Botanical Gardens, Penang, 1st January, 1896. Also on the 28th March, 1897, a little downstream of Paknam Kabin on the Bangpakong River, Siam, I saw one in a very tall tree: it was black above, pale fawn-colour beneath, had a very big, bushy black tail, and, so far as we could make out with field-glasses, it had *tufted ears*.

Distribution. Nipal, Sikhim, Bhutan, Assam, Manipur, Burma, Siam, Malay Peninsula (Junkceylon, Penang, Perak, Dindings, Selangor, Malacca, Pahang, Johore, Singapore), Sumatra, Java, Borneo; Celebes?

112. SCIURUS FINLAYSONI Horsf. Finlayson's Squirrel.

Sciurus ferrugineus, Blanf. Faun. Ind., Mamm. p. 375.

"Krá rawk khow" (White Squirrel) of the Siamese.

Horsfield (Cat. Mamm. Mus. East India Co. 1851, p. 154) records a specimen from Siam collected by Dr. G. Finlayson.

This species is very numerous in parts of Siam; the Siamese Museum contained five specimens—a red one from Bangkok, October 1893; a red one from Chantaboon, July 1896; and three white ones without recorded localities. In March 1897 I saw six of the white race in various places on the Bangpakong River between Tahkamen and Kabin, they were all in trees, usually in the jungle. In January 1898 I saw one of the red race in trees in a mangrove swamp near the mouth of the Chantaboon River. In February 1898 we saw very many near Ayuthia, especially in a grove of trees a few miles north of the town; I did not see any on the ground, but always in the trees or clumps of tall bamboo. They were all engaged in love making, males were more numerous than females; they made a good deal of noise, a sort of clucking, rather like the cry of some species of woodpecker. The females have two pairs of mammae. These Ayuthia specimens varied greatly in colour (*v. O. Thomas, P. Z. S. 1898, p. 245*); in all the iris was dark brown, and the bare skin on hands and feet black. In August 1898 I saw one specimen on Klong Morn, a few miles from Bangkok. On the 28th August 1897, at Kosichang, I saw in the woods on Flagstaff Hill about 12 or 15 white squirrels, probably of this species, but apparently smaller and more buff (less pure white) than those I saw on the Bangpakong in March. On the 27th February, 1898, on revisiting the same woods, I saw

many of these squirrels; again they seemed to me smaller than *S. finlaysoni* of the mainland, but they looked pure white: perhaps they are a small island-race.

Distribution. Sikhim?, Burma, Siam.

113. *SCIURUS ERYTHRÆUS* Pallas. Pallas's Squirrel.

Sciurus erythræus, Blanford. Faun. Ind., Mamm. p. 377.

A stuffed specimen, apparently of this species, in the Siamese Museum, was said to have been obtained locally, which seemed probable, as the Siamese had a name for it—"Krarwak lai," that is, "The Variegated Squirrel."

Distribution. Assam, Burma, China?, Siam?

114. *SCIURUS HIPPURUS* Is. Geoffr.

Sciurus hippurus, Cantor, p. 41.

"Tupai Jinjang," "Ummu," or "Jau" of the Malays of the Peninsula (Cantor).

Cantor records this species from the Malay Peninsula.

Horsfield (Cat. Mamm. Mus. East Ind. Co. 1851, p. 154) records it from Malacca. O. Thomas (P. Z. S. 1886, p. 75) records three specimens from Klang, Selangor, collected by Davison, saying "This species seems to be the Malay representative of *S. erythræus* Pall., which does not, however, extend further south than Manipur, while Klang seems to be about as far north as *S. hippurus* has been found."

W. L. Sclater (Cat. Mamm. Indian Mus. part ii. 1891, p. 18) records two specimens from Malacca, from R. W. G. Frith, 1844.

In the Museum at Taiping there are several squirrels from the Larut Hills which Mr. Wray considers to be *S. hippurus*; they are about equal in size to *S. prevosti*, but have the back dark ferruginous instead of black, and have no white on the sides.

Distribution. Malay Peninsula (Perak?, Selangor, Malacca), Sumatra, Java, Borneo.

115. *SCIURUS CANICEPS* (Gray). The Golden-backed Squirrel.

Sciurus caniceps, O. Thomas, P. Z. S. 1886, pp. 68 & 76; Blanford. Faun. Ind., Mamm. p. 380.

O. Thomas (op. cit. p. 76) records seven specimens of *Sciurus caniceps concolor* from "Kussoom, Taroar, Poongah, and Salanga, Junkceylon," collected by Darling. W. L. Sclater (Cat. Mamm. Indian Mus. part ii. 1891, p. 14) records specimens from Perak which "have only a slight tinge of orange on the back, and no cheek-patches, and this form agrees very well with the specimen from Malacca (procured by G. Moxon, 1847), the type of *S. concolor*."

I shot a specimen, subsequently kindly identified by Mr. Thomas, near Gunong Gajah, Kedah, 13th April, 1895. ♂.

Distribution. Burma, Malay Peninsula (Junkceylon, Kedah, Perak, Malacca).

116. *SCIURUS GRISEIMANUS* M.-Edw. The Grey-footed Squirrel.

Ridley (J. S. B. R. A. S. no. 25, Jan. 1894, p. 59), in a "List of Mammals recorded from Pahang," includes "*Sciurus griseimanus*, A. M.-Edwards," but unfortunately gives no details about it.

Distribution. Cochinchina, Cambodia, Upper Burma (Blanf. Faun. Ind., Mamm. p. 381), Laos (O. Thomas, P. Z. S. 1886, p. 68), and Malay Peninsula?

N.B.—*SCIURUS ATRIDORSALIS* Gray. The Black-backed Squirrel.

Sciurus atridorsalis, Blanf. Faun. Ind., Mamm. p. 382.

O. Thomas (P. Z. S. 1886, p. 76) records a single specimen from Klang collected by Davison, but says:—"There is possibly some mistake in the labelling of this specimen, as the species is not otherwise known to occur south of Tavoy, Tenasserim, and the specimen exactly matches some of Mr. Davison's Moulmein skins."

Davison (J. S. B. R. A. S. no. 20, 1889, p. 84) says he "obtained one specimen of the common squirrel *Sciurus atrodorsalis*" on Pulo Tioman in August 1889!

Distribution. Burma.

117. *SCIURUS MACCLELLANDI* Horsfield. The Striped Himalayan Squirrel.

Sciurus macclellandi, Blanf. Faun. Ind., Mamm. p. 386.

In the Museum at Taiping, Perak, there is a stuffed specimen of *S. macclellandi barbei* from Taiping (it is labelled *S. tenuis* Horsf.).

In the Siamese Museum there are two specimens, also of the *barbei* race, from Petchaburi, Siam.

I obtained a single individual in a tree in a wood near Bortong Kabin, 26th March, 1897.

Distribution. Sikhim, Eastern Himalayas, Assam, Cachar, Manipur, China, Formosa, Cochinchina, Siam, Tenasserim, Malay Peninsula (Perak, Malacca).

N.B.—Mr. J. L. Bonhote (A. M. N. H. ser. 7, vol. v. p. 53, 1900) distinguishes specimens from Perak as *Sciurus macclellandi leucotis* (Temm.), differing from *S. barbei* in having the light stripes narrow and hair of ear white at base.

118. *SCIURUS TENUIS* Horsfield. The Slender Squirrel.

Sciurus tenuis, Cantor, p. 42.

Cantor records this species from Singapore and the Peninsula, and apparently found it rare, only observing two individuals. Horsfield (Cat. Mamm. Mus. East India Co. 1851, p. 154) mentions a specimen from Singapore, collected by Finlayson.

O. Thomas (P. Z. S. 1886, p. 76) records eleven specimens from the Malay Peninsula; they are from Klang and Ulu Langhat in Selangor, from Malacca, from Gunong Pulai in Johore, and from Singapore, and says "these specimens are all very similar, and precisely agree with Horsfield's type."

W. L. Sclater (Cat. Mamm. Indian Mus. ii. 1891, p. 20) records a specimen from Perak, and one from Malacca, collected by A. R. Wallace.

H. J. Kelsall (J. S. B. R. A. S. no. 26, Jan. 1894, p. 16), in a list of Mammals from Johore, says "*Sciurus tenuis*, Horsf. Fairly common. The smallest of the Malayan squirrels."

Ridley (Nat. Science, vol. vi. 1895, pp. 95 & 96) gives an account of the habits of this squirrel, and says it is very abundant and destructive in the Botanic Gardens, Singapore. Hanitsch (Rep. Raffles Libr. & Mus. 1897, p. 11) also records it from Singapore.

Distribution. Malay Peninsula (Perak, Selangor, Malacca, Johore, Singapore); "Pulo Panjang in the Gulf of Siam" (W. L. Sclater, *o. s. c.*), Java, Sumatra, Borneo.

119. *SCIURUS PREVOSTI* Desm. Raffles's Squirrel.

Sciurus rafflesii, Cantor, p. 40.

"Tupai B'lang" of the Malays (according to Messrs. Ridley and Wray). Cantor records this species as numerous on the Malay Peninsula.

O. Thomas (P. Z. S. 1886, p. 76) mentions specimens from Klang, Selangor, and Malacca. W. L. Sclater (Cat. Mamm. Ind. Mus. ii. 1891, p. 24) records specimens from Malacca. Ridley (J. S. B. R. A. S. no. 25, Jan. 1894, p. 59) mentions this species being common at Kuala Semantan, Pahang, and (Nat. Science, vol. vi. 1895, p. 95) says of it, "one of the most beautiful kinds in the world, is common in the Malay Peninsula, but I never saw it in Singapore." Hanitsch (Rep. Raffles Libr. & Mus. 1897, p. 11) records this species from Kuala Lumpor and from Pahang. In July 1898 I saw a specimen in the Raffles Museum labelled "*Sciurus rafflesii*, Singapore."

The Museum at Taiping contains specimens from Taiping and Blanja, Perak. Mr. A. L. Butler tells me this species is not uncommon in Selangor; there are several specimens in the Museum at Kuala Lumpor.

Distribution. Malay Peninsula (Perak, Selangor, Malacca, Pahang, Singapore?), Sumatra, Java, Borneo, Banka, Billiton, Celebes.

120. *SCIURUS NOTATUS* Bodd. The Malayan Squirrel.

Sciurus badging, O. Thomas, P. Z. S. 1886, p. 76.

Sciurus plantani of authors.

Sciurus vittatus, Cantor, p. 42.

Sciurus nigrovittatus, Cantor, p. 42.

? *Sciurus griseiventer*, L. Wray jun., label in Perak Museum.

Cantor records *S. vittatus* from Penang, Singapore, and the Peninsula, and says it is "the most numerous species in the Straits of Malacca," and *S. nigrovittatus* he records from the Peninsula and says it is "not numerous." O. Thomas (P. Z. S. 1886, p. 76) records specimens from Lumut in the Dindings; Jerome, Klang, and Birman in Selangor; Malacca; Gunong Pulai in Johore; and

Singapore ; and makes some very interesting remarks on the coloration of this species. W. L. Sclater (Cat. Mamm. Indian Mus. ii. 1891, p. 23) records specimens from Perak and Malacca. Ridley (J. S. B. R. A. S. no. 25, Jan. 1894, p. 59), in a "List of Mammals from Pahang," says: "*Sciurus notatus*, Bodd. This is perhaps the commonest of all the Malayan Squirrels. Common everywhere"; and mentions its habits in Nat. Science, vol. vi. 1895, p. 95.

H. J. Kelsall (J. S. B. R. A. S. no. 26, Jan. 1894, p. 16), in a list of Mammals from Johore, says "*Sciurus notatus*, Bodd. This pretty little squirrel is common everywhere." Hanitsch (Rep. Raffles Libr. & Mus. 1897, p. 11) records this species from Singapore, Johore, Kuala Lumpur, and Pahang.

This is the commonest species both about Taiping, Perak, and Kuala Lumpur, Selangor ; there are several specimens in the local museums at both towns. It also seems the commonest species on Penang Hill ; I obtained a specimen there at 2200 feet elevation.

Distribution. Malay Peninsula (Penang, Perak, Dindings, Selangor, Malacca, Pahang, Johore, Singapore), Sumatra, Java, Borneo.

121. *FUNAMBULUS BERDMOREI* (Blyth). Berdmore's Squirrel.

Sciurus berdmorei, Blanf. Faun. Ind., Mamm. p. 387.

During March 1897 I met this squirrel near Tahkamen, on the Bangpakong River, Siam ; three specimens undoubtedly of this species, one in the jungle, two near a village, were seen running on the ground ; two others, apparently of this species, were seen climbing in a clump of bamboo.

In the Siamese Museum there were two specimens labelled "M. Pran, Siam."

Distribution. Martaban, Tenasserim, Mergui Archipelago, Siam, Cambodia, Cochinchina.

122. *FUNAMBULUS LATICAUDATUS* (Diard). Long-nosed Squirrel.

Sciurus laticaudatus, Cantor, p. 43.

Rhinosciurus laticaudatus, W. L. Sclater, Cat. Mamm. Ind. Mus. ii. 1891, p. 30.

Cantor records this squirrel from the Malay Peninsula, gives a description of it, and says it is "apparently not numerous"; he examined five individuals. O. Thomas (P. Z. S. 1886, p. 78) records a specimen from Klang, Selangor. W. L. Sclater (Cat. Mamm. Ind. Mus. ii. 1891, p. 30) records a specimen from the Malay Peninsula procured by G. Moxon in 1851. Ridley (J. S. B. R. A. S. no. 25, Jan. 1894, p. 59), in a "List of Mammals recorded from Pahang," says "*Sciurus laticaudatus*, Diard. This appears to be a rare species. Kota Glanggi." Hanitsch (Rep. Raffles Libr. & Mus. 1897, p. 10) under the name of "*Xerus laticaudatus*" records a specimen from Pahang, probably the same as that mentioned by Ridley. A large pale rufous squirrel from Simpang, Perak, in the Museum at Taiping is considered by

Mr. Wray to belong to this species. Mr. A. L. Butler told me he shot two specimens in June 1898 near Kuala Lumpur, a female and a three-quarter-grown young one; the young one has dark rings on the tail, which are absent in the adult.

Distribution. Malay Peninsula (Perak, Selangor, Pahang), Borneo.

123. *FUNAMBULUS INSIGNIS* (F. Cuvier).

Sciurus insignis F. Cuv.

O. Thomas (P. Z. S. 1886, p. 78) records specimens from Klang in Selangor, and from Jaffaria in Johore. W. L. Sclater (Cat. Mamm. Ind. Mus. ii. 1891, p. 28) records a specimen from Malacca, presented by E. R. Alston. Ridley (J. S. B. R. A. S. no. 25, Jan. 1894, p. 59), in a "List of Mammals recorded from Pahang," says: "*Sciurus insignis*, F. Cuv. This is a pretty squirrel with three black stripes down the back. It appears to live almost entirely on the ground. Taban River." Hanitsch (Rep. Raffles Libr. & Mus. 1897, p. 10), under the name of *Xerus insignis*, mentions this species from Ulu Pahang.

Distribution. Malay Peninsula (Selangor, Malacca, Pahang, Johore), Sumatra, Java, Borneo.

124. *FUNAMBULUS LOCRIA* (Hodgs.). The Orange-bellied Himalayan Squirrel.

Sciurus subflaviventris, Horsfield, Cat. Mamm. East India Co. 1851, p. 152.

Sciurus locria, Blanf. Faun. Ind., Mamm. p. 376.

Horsfield (*l. s. c.*) mentions a specimen "from G. Finlayson's Collection during Crawford's Embassy to Siam."

Distribution. Nepal, Sikhim, Manipur, Arrakan, &c., and probably Siam.

Family MURIDÆ.

125. *HAPALOMYS LONGICAUDATUS* Blyth. Berdmore's Rat.

Hapalomys longicaudatus, Blanf. Faun. Ind., Mamm. p. 401.

Hanitsch (Rep. Raffles Libr. & Mus. 1897, p. 11) records a specimen from Patani.

Distribution. Burma and Malay Peninsula (Patani).

126. *VANDELEURIA OLERACEA* (Benn.). The Long-tailed Tree-Mouse.

Vandeleuria oleracea, Blanf. Faun. Ind., Mamm. p. 402.

One specimen, said to have been caught near Chantaboon, was given to me while in Siam; its dimensions in spirit were:—

Head and body	56 mm.	or	2.2 inches.
Tail	95 "		3.68 "
Hind foot	16 "		.63 inch.
Ear	11 "		.43 "

Distribution. India, Ceylon, Assam, Yunnan, Burma, Siam.

127. *CHIROPDOMYS GLIROIDES* (Blyth). The Pencil-tailed Tree-Mouse.

Chiropodomys gliroides, Blanf. Faun. Ind., Mamm. p. 403.

O. Thomas (P. Z. S. 1886, p. 78) records a mouse from Jaram, Selangor, collected by Darling, which probably belongs to this species.

Distribution. Burma, Malay Peninsula (Selangor), Java, Borneo.

128. *MUS RATTUS* Linn. The Common Brown Rat of the East Indies.

Mus rufescens, Cantor, p. 46.

Mus rattus, Blanf. Faun. Ind., Mamm. p. 406.

"Nu" of the Siamese (a term applied to all species of rats).

W. L. Sclater (Cat. Mamm. Indian Mus. ii. 1891, p. 67) records a specimen of *Mus rattus rufescens* from Malacca, and one from Penang from Cantor's collection. Hanitsch (Rep. Raffles Libr. & Mus. 1887, p. 11) records this species from Singapore.

I have caught this rat in Sepoy Lines, Penang (May 1895), on Penang Hill (Nov. 1896 and March 1898), in Bangkok (April, June, July, Aug., Nov. 1897, and Feb., Aug. 1898), and in Ayuthia (Feb. 1898).

Colour. Specimens from Penang Hill: Above reddish brown, with longer dark hairs; beneath pale yellowish, buff, or fawny grey; the two colours gradually shade into each other on the sides.

Specimens from Bangkok: Above reddish brown (varying from bright rufous to yellowish), many of the larger hairs having black tips (most noticeable in adult specimens), base of fur on back grey; beneath pure white (out of about 20 specimens examined, one was yellowish beneath, one male grey, one female rufous grey with a little white on the lower part of the abdomen, one young female rufous grey); the line of demarcation between the darker upper and white lower parts is very noticeable (except in a young female, where they gradually shade into each other); hands and feet flesh-coloured, with short white hairs on their upper surfaces, the white hairs on the last segment of the toes may be longer than the claws.

Females from Penang and from Bangkok had each 5 pairs of mammæ.

Distribution. Cosmopolitan.

129. *MUS CONCOLOR* Blyth. The Little Burmese Rat.

Mus concolor, Blanf. Faun. Ind., Mamm. p. 408.

W. L. Sclater (Cat. Mamm. Indian Mus. ii. 1891, p. 68) mentions a skin from Malacca, collected in 1846. Hanitsch (Rep. Raffles Libr. & Mus. 1897, p. 11) records this species from Singapore. The Siamese Museum contained three specimens from Bangkok.

Of this species I obtained three specimens from Penan

Hill, 2200 feet elevation, March 1896; two specimens from Tanglin, Singapore, April 1896; one specimen from Pachim, Siam, March 1897; one specimen from Paknam Menam, Siam, August 1898; and I saw what I believe to be this species at Pakpreo, Siam, in June 1897.

Colour of Paknam specimen:—Upper surfaces pale rufous brown, lower surfaces pure white, tail dark above and light below.

Distribution. Burma, Siam, Malay Peninsula.

130. *MUS DECUMANUS* Pall. “The Norway Rat.”

Mus decumanus, Cantor, p. 46; Blanf. Faun. Ind., Mamm. p. 408.

“Tikus” of the Malays (name applied to any species of rat).

Cantor records this species from Penang and the Peninsula; Hanitsch (Rep. Raffles Libr. & Mus. 1897, p. 11) records it from Singapore. In Siam I never saw this species alive or trapped it, but three times found dead rats (which appeared to be *M. decumanus*) in Bangkok, in each instance in that quarter of the town where the foreign shipping lies along the wharfs.

In Georgetown, Penang, this species is common; it is rufous brown above, buff below.

Distribution. Cosmopolitan.

131. *MUS MUSCULUS* Linn. The Common House-Mouse.

Mus musculus?, Cantor, p. 46; Blanf. Faun. Ind., Mamm. p. 413.

“*Tikus ruma*” (*i. e.* house-rat) of the Malays.

Cantor gives habitat “Pinang,” and says:—“In colour, this slightly differs from the European mouse, the upper parts being a mixture of shining grey and tawny. The separate hairs are leaden-grey at the base, then tawny with black apex; some are longer and uniformly dark brown. Beneath pale ash. The ears are large, more than one-half the length of the head, with very short hairs, rounded, blackish. Toes, palms, and soles whitish. Tail slender, dark-grey, with very short appressed brown hairs. Length of the head and body, two and five-eighth inches (67 mm.), tail two and four-eighth inches (64 mm.)”

Hanitsch (Rep. Raffles Libr. & Mus. 1897, p. 11) records this species from Singapore. I obtained only three specimens of the Common Mouse, two trapped in houses in Singapore (Jan. & Dec. 1896), and one picked up dead in the bazaar at Chantaboon (Jan. 1898). There were none in the houses in which we lived, in Bangkok, Kedah, or Penang.

Of the second specimen from Singapore, Mr. Oldfield Thomas writes to me:—“Very typical house specimen, with brown metapodials but white fingers and toes, a very characteristic coloration.”

Distribution. Cosmopolitan.

132. *NESOCIA* sp. inc. Bandicoot Rat.

At least one species of *Nesocia* occurs in the Malay Peninsula,

but what it is we cannot yet say for certain. Cantor seems to have observed two species: one (p. 45) he calls *Mus bandicota*, Bechstein, the other *Mus setifer*, Horsfield. Of the former he gives the Malay name as "Tikus besar" (*i. e.* big rat), and the habitat as "Pinang," and says:—"The larger of two individuals, captured in gardens, measured, head and body, ten and one-eighth inches (258 mm.); the tail seven and four-eighth inches (181 mm.)."

In May 1895 a species of *Nesocia* was common about out-buildings in the barracks in Penang.

Subsequently in April 1898 I trapped more Bandicoots in Georgetown, Penang; they were in colour:—above grey, with very long black hairs giving a very dark appearance; throat whitish buff, remainder of lower surfaces pale grey.

Three skulls and skins I sent to Mr. Oldfield Thomas, who kindly wrote to me they were "allied to *N. bengalensis*—perhaps *N. barclayana*, Anderson."

Family SPALACIDÆ.

133. RHIZOMYS BADIUS Hodgs. The Bay Bamboo-Rat.

Rhizomys minor, Horsfield, Cat. Mamm. Mus. East India Co. 1851, p. 165.

Rhizomys badius, Blanf. Faun. Ind., Mamm. p. 438.

Horsfield (*l. s. c.*) records a specimen from Siam obtained by Dr. G. Finlayson, who says it is called "Thúr" by the Siamese, and adds: "Our specimen is about 6 inches in length, and appears to be a young one. It readily submits to confinement, and is easily tamed. Like most animals of the genus, it is destructive to furniture, to grain, etc., and when suddenly surprised it throws itself upon the offensive, instead of making a precipitate retreat. Its principal food is unhusked rice or other grain, and it is fond of yams, pumpkins, etc., found in forests and woods near to Bamvasor."

Distribution. Nepal, Sikhim, Bhutan, Assam, Manipur, Burma, Siam.

134. RHIZOMYS SUMATRENSIS (Raffl.). The Large Bamboo-Rat.

Rhizomys sumatrensis, Cantor, p. 47; Blanf. Faun. Ind., Mamm. p. 439.

"Dekan" of the Malays (Wray).

"Woo'n" of the Siamese; also called "Tuu."

Cantor records this species from the Malay Peninsula, describes its colour, gives dimensions, and says "In confinement, it is very savage, scarcely tameable." W. L. Sclater (Cat. Mamm. Indian Mus. ii. 1891, p. 96) records specimens from Malacca and from Alma Estate, Province Wellesley. The Raffles Museum possesses specimens from Malacca. The Museum at Taiping contains specimens from Batu Gajah and from Bukit Gantang, Perak. The Museum at Kuala Lumpur contains several specimens caught in the neighbourhood of that town. There were in the Siamese

Museum three stuffed specimens from Siam of a species of Bamboo-Rat: they had been labelled (probably by the late Dr. E. Haase) *R. badius*, but they looked to me more like the young of *R. sumatrensis*.

Distribution. Parts of Burma, Siam, and Malay Peninsula.

Family HYSTRICIDÆ.

135. *HYSTRIX LONGICAUDA* Marsden. The Malay Porcupine.

Hystrix longicauda, Cantor, p. 48.

“Lándak” or “Bábi Lándak” (*i. e.* pig-porcupine) of the Malays.

Cantor records this species from the Malay Peninsula, and says it “is numerous, and, as it is considered a delicacy by the Chinese population, is frequently brought to market.” Ridley (*Nat. Science*, vi. 1895, p. 94) calls this species *Hystrix leucura*, and says of it:—“The Porcupine is still common in Singapore, but a number must be destroyed by the burning of the open country, in which they chiefly live. They are very destructive to the pine-apples.” The Museum at Taiping contains a specimen from Larut, Perak. The Museum at Kuala Lumpur contains one young porcupine, apparently of this species, locality unknown but probably from Selangor.

On the 14th Oct. 1897, I bought a live porcupine from a Malay in Singapore, who said it had been caught on Bukit Timah; it soon became tame and an interesting pet. (It is still alive with me, February 1900.)

Distribution. Malay Peninsula (Perak, Selangor, Singapore), Sumatra, Java?, Borneo?

In the Siamese Museum there were two stuffed Porcupines, both labelled “Siam,” representing apparently two species, but I do not know which: one with a pale brown forehead and a light crest had been labelled by some one “*H. bengalensis*,” the other had no crest, and had an old label “*H. hodgsoni*.”

The Siamese call a porcupine “menn.”

136. *ATHERURA MACRURA* (Linn.). The Asiatic Brush-tailed Porcupine.

Atherura fasciculata, Cantor, p. 49.

Atherura macrura, Blanf. Faun. Ind., Mamm. p. 446, fig. 146.

“Lándak” of the Malays.

“Landak-woobi” of the Malays of Selangor (A. L. Butler).

Diard and Duvaucel in 1821 (*Miscell. Papers Indo-China*, 2nd series, vol. ii. p. 208, 1887) speak of this species as “the porcupine of Queda” (*i. e.* Kedah), and say it “always carries its tail lifted up like a trumpet, and makes the tuft at the end tremble.” Cantor records this species from Penang and the Peninsula, and says it “is very numerous in the Malayan valleys and hills. In its fretful habits and in its food it resembles the preceding porcupine, like which, it is carried to the markets at Pinang and Malacca, where as

many as twenty to thirty may frequently be seen." W. L. Sclater (Cat. Mamm. Ind. Mus. ii. 1891, p. 104) records a specimen from Malacca. Ridley (Nat. Science, vi. 1895, p. 94) says:—"The Brush-tailed Porcupine (*Atherura macrura*) is not a native of Singapore, so far as is known; it inhabits the limestone caves in Pahang." This probably refers to the animals which Ridley (J. S. B. R. A. S. no. 25, Jan. 1894, p. 59), in his "List of Mammals recorded from Pahang," says were "caught in the Kota Glangga caves," but he then called them "*Hystrix longicauda*, Marsden." The Raffles Museum possesses a specimen from Malacca. The Museum at Taiping contains four stuffed individuals from Larut, Perak. The Museum at Kuala Lumpur contains one specimen without locality.

Distribution. Burma, Malay Peninsula (Kedah, Penang, Perak, Malacca, Pahang), Sumatra, Java; Borneo?

Family LEPORIDÆ.

137. LEPUS sp. inc. Hare.

A hare occurs in Siam, but I do not know of what species: I saw one caught alive at Genkoi (between Ayuthia and Korat), 21st November, 1897, and a leveret that had been caught near Chantaboon, January 1898.

Order PROBOSCIDEA.

Family ELEPHANTIDÆ.

138. ELEPHAS MAXIMUS L. The Indian Elephant.

Elephas indicus, Cantor, p. 52.

Elephas maximus, Blanf. Faun. Ind., Mamm. p. 463; S. Flower, Journ. Bombay N. H. S. vol. xi. no. 2, p. 335 (1897).

"Gajah" of the Malays.

"Chang" of the Siamese.

In the Royal Siamese Museum there was a life-size model of a male Siamese Elephant, and a most magnificent collection of about seventy tusks, all, so far as I could ascertain, from Siam; forty of these tusks are over 4 feet 8 inches (1420 mm.) in length.

The Selangor Museum contains six or seven skulls of local elephants.

Wild elephants do not occur in either Penang or Singapore, nor are tame ones employed there; but on the continent, both in Siam and the Malay Peninsula, elephants are found wild in suitable localities, and are trained for various purposes. Personally I only once came on wild elephants, a party of four, near the Bangpakong River, in March 1897; but in June 1897 we observed over a hundred wild ones caught in the Kraal at Ayuthia. I saw more or less trained elephants in Bangkok, Ayuthia, Chantaboon, Kedah, and Perak, but in the Southern Malay States the people do not seem to catch and tame them. H. J. Kelsall (J. S. B. R. A. S. no. 26,

Jan. 1894, p. 17) says: "The elephant appears to be common throughout Johore. Tracks were seen in many places on the Indau, and also on the Sembong, near P'ngkalan Repoh especially." Ridley (J. S. B. R. A. S. no. 25, Jan. 1894, p. 59) says: "The elephant, though common all through Pahang, is never caught and tamed. Abundant in the Tahan woods;" and (Nat. Science, vol. vi. 1895, p. 162) remarks that "it is not excessively abundant, but is plentiful in many parts of the Peninsula."

Distribution. India, Burma, Siam, Malay Peninsula, Sumatra, and Borneo.

Order UNGULATA.

Family RHINOCEROTIDÆ.

Malay name for Rhinoceros, "Badak" (the final "k" not pronounced in most parts of the Peninsula).

Siamese name for Rhinoceros, "Rat."

A good deal of uncertainty exists as to how many species of Rhinoceros inhabit this region, and which they are, and it is difficult to obtain information; they are poorly represented in the local Museums—partly because almost all parts of the rhinoceros are highly prized by various natives of Asia; and I have been told that it is more profitable for a Malay, if he happens to catch one of these animals in a pitfall, to kill it and sell the remains to the Chinese, than to sell the whole animal to a European.

The only specimens of Rhinoceros in the Perak Museum (May 1898) were three hornless skulls without localities labelled *R. lasiotis*, *R. sumatrensis*, and *R. sondaicus* respectively. In the Selangor Museum (July 1898) there was a single unlabelled skull. The Raffles Museum (1898) had only a skeleton, labelled *R. sumatrensis* without locality. In the Siamese Museum we had a splendid series of over sixty separate, detached horns of Rhinoceros, some of remarkable shapes, but unfortunately their localities are not known. In February 1897 we acquired a specimen of *R. sondaicus*, which we skinned and stuffed. As an instance of how rhinoceros products are valued, I may mention that to skin this animal we had any number of eager volunteers, mostly Siamese women, who in return for the work of removing the skin only wanted to have some of the blood. The rhinoceros was skinned in an old Palace Garden in Bangkok under my directions; it was an extraordinary sight as we hurried to get it done before dark—a crowd of women, mostly clad only in a "panung" (Siamese loin-cloth), smeared with blood from head to foot, working away at the carcass with knives and fingers, little children collecting the blood in cocoanut-shells and running off with it to their homes, and Siamese men hanging round trying to get any of the flesh they could; it was very difficult to save the skeleton, several of the bones being snatched up and nearly carried off by these loafers.

Cantor (p. 54) says that *Rhinoceros unicornis* and *R. sondaicus* "appear to be numerous on the Malayan Peninsula;" and adds

(p. 55) "a *two-horned* Rhinoceros is stated by the Malays to inhabit, but rarely to leave, the densest jungle," which he expects to be *R. sumatrensis*. Unfortunately he does not mention seeing any local specimens, or give any details of why he includes *R. unicornis* in his list.

Personally I have never seen even the tracks of a wild rhinoceros. At Alor Star, Kedah, the Malays told me no rhinoceros was known in that district, which is mostly flat; they looked on it as an animal only inhabiting the mountains. An Englishman once told me he had seen tracks of rhinoceros on Gunong Jerai (Kedah Peak) at several thousand feet above the sea. In Perak, English friends have told me, rhinoceroses were not uncommon till three or four years ago in the Larut Hills *above* four thousand feet. In the south of Perak, however, a friend told me he had once seen a rhinoceros in a swamp, it was reddish in colour. The 'Bangkok Times' for 11th Nov., 1897, mentions a rhinoceros being shot by Mr. C. Ephraums: unfortunately this account, as usual, does not say to what species the animal belonged and gives but few details—the rhinoceros was "seen at a sulphur spring within six miles of Ipoh," Perak: it "was an old male, stood 6 feet high at the shoulder and about 8 feet in length; his 'Sumbu,' or horn, measured 13 inches and weighed 3 lbs."

Mr. Ridley told me that in 1896 he saw a rhinoceros in the Dindings; and (J. S. B. R. A. S. no. 25, Jan. 1894, p. 59) he mentions having seen tracks of some species of rhinoceros in the Tahan River woods, Pahang, where he also heard the animal at night.

Mr. T. ff. Carlisle, H.B.M. Consular Service, writing to me from Baw Yakar, Pailin, Battambang Province of Siam, 4th Feb., 1899, says "I have met an old Shan hunter here who has shot both the one-horned and the two-horned rhinoceros."

139. RHINOCEROS SONDAICUS Cuv. The Smaller One-horned Rhinoceros.

Rhinoceros sondaicus, Blanf. Faun. Ind., Mamm. p. 474, fig. 155 (p. 475).

A young female, just dead, was brought to the Siamese Museum on the 10th Feb., 1897, which I was told had been brought from the Laos Country, and had died on reaching Bangkok. There was no horn. Colour uniform dusky grey. Only one pair of incisors showed through the gums in the lower jaw, they were tusk-like; none showed in the upper jaw, the gum forming a hard pad in the place where the incisors of a horse would be.

Ridley (Nat. Science, vi. 1895, p. 161) says *R. sondaicus* appears to be the common rhinoceros of the Malay Peninsula. "It frequents the hill-jungles, ascending to 4000 feet altitude, and seems usually to move about at night, though one may come upon it by day. It has a habit of constantly using the same track, and dropping its dung in the same place daily, a habit common also to the tapir. As the jungle gets cleared, it wanders often into the

low, open country, apparently losing its way. It is a quiet, inoffensive beast."

Distribution. Sundarbans, parts of Eastern Bengal, Sikhim Terai, Assam, Burma, Siam, Malay Peninsula, Sumatra, Java, Borneo.

140. RHINOCEROS SUMATRENSIS Cuv. The Asiatic Two-horned Rhinoceros.

Rhinoceros sumatrensis, Blanf. Faun. Ind., Mamm. p. 476.

The "Bada Api" or "Fire Rhinoceros" of the Malays is probably a red variety of this species.

Slater (Tr. Z. S. ix. p. 651, 1875) mentions a rhinoceros of this species "captured in the Sunghi-njong (presumably Sungei-Ujong) district of Malacca," and says other specimens "from the same district or the neighbouring territory of Johore were imported into Europe."

W. L. Slater (Cat. Mamm. Ind. Mus. ii. 1891, p. 205) records specimens from Malacca.

Mr. A. L. Butler in a letter to me, from Kuala Lumpur, dated 25th Oct., 1898, says:—"I went to see a big rhinoceros in a pitfall the other day at Rantan Panjang. A fine big female *R. sumatrensis*, a dark reddish-brown beast, 4 feet 3 inches at shoulder (measured with a standard) and about 8 feet to 9 feet in length (guessed). The great thing that struck me was her extraordinary tameness. She had only been caught three days, but fed readily from one's hand, and seemed to enjoy being scratched."

Distribution. Assam, Tenasserim, Siam, Malay Peninsula, Sumatra, Borneo.

Family TAPIRIDÆ.

141. TAPIRUS INDICUS Cuv. The Malay Tapir.

Tapirus malayanus, Cantor, p. 55.

Tapirus indicus, Blanf. Faun. Ind., Mamm. p. 478.

"Badak tampong" (*i.e.* Piebald Rhinoceros) of the Malays in Kedah and Perak.

Bádak," "Kúda Ayer," and "Tennú" of the Malays of the Peninsula, *apud* Cantor.

"Tenok" of the Malays, *apud* Ridley.

Cantor mentions specimens from Province Wellesley and Kedah. W. L. Slater (Cat. Mamm. Ind. Mus. ii. 1891, p. 198) records two specimens from Malacca, obtained in 1820 and 1848.

Ridley (J. S. B. R. A. S. no. 25, p. 59) says tracks of the Tapir were seen near Temerloh, Pahang, and (Nat. Science, vi. 1895 pp. 161, 162) mentions the supposed protective coloration of the young.

There are specimens from Larut in the Museum at Taiping, and from Malacca in the Raffles Museum.

H.H. the Rajah Mudah of Kedah told me (June 1898) that the Tapir is not uncommon in the swamps of Kedah, within a day's

journey of Alor Star. Mr. F. H. Malcolm Staples told me (Sept. 1897) that the Tapir is still sometimes met with about Batu Pahat, Johore.

On the 25th July, 1898, I saw a young Tapir alive in Bangkok : it had been brought from the Malay Peninsula, from between Kedah and Singora ; it was kept in the King of Siam's menagerie, and died about 6th August, 1898.

Distribution. Tenasserim, Lower Siam, Malay Peninsula, Sumatra.

Family BOVIDÆ.

142. BOS GAURUS Ham. Smith. The Gaur or S'ladang.

Bos gaur, Cantor, p. 64.

Bos gaurus, Blanf. Faun. Ind., Mamm. p. 484, fig. 159 (p. 488).

"Kating" of the Siamese (both *B. gaurus* and *B. sondaicus* seem included in this name).

"Sápi útan" (*i. e.* Cattle of the Woods) of the Malays of the Peninsula, *apud* Cantor.

"S'ladang" of the Malays.

W. L. Sclater (Cat. Mamm. Ind. Mus. 1891, p. 125) records a skull and horns from Malacca from Dr. Maingay, 1863. Ridley (J. S. B. R. A. S. no. 25, 1894, p. 59) says : "The S'ladang is to be met with all through the Pahang jungles, but, owing to its shy and retiring habits, is difficult of approach. Tahan woods and all down Pahang River."

In the Museum at Taiping there are horns from Batang Padang, Perak, and many fine heads from Pahang shot by Mr. C. F. W. Curtis. In the Museum at Kuala Lumpur there are a stuffed bull and numerous heads shot by the late Captain H. C. Syers in Selangor. The Raffles Museum contains a skull from Ulu Pahang presented by Mr. W. Bertrand Roberts.

Mr. W. Sinclair told me in Jan. 1898 that there are wild cattle, probably of this species, in the hill-jungle at the back of Anghin, Siam.

A pair of horns, apparently of this species, from near Raheng, Siam, measured in length 24 inches, and in circumference at the base 17 inches.

Mr. A. J. A. Jardine, Inspector General of Police, Bangkok, told me he had found a Gaur killed by wild dogs near Shagan Salween River, Burma.

Distribution. Parts of India, Assam, Burma, Siam, Malay Peninsula ; Cochinchina ?

143. BOS SONDAICUS Müll. & Schleg. The Banting or Tumbaadu.

Bos sondaicus, Blanf. Faun. Ind., Mamm. p. 489.

"Kating" of the Siamese.

"Sapi-utan" of the Malays.

In March 1897 I saw detached horns, apparently of this species,

in the Governor's house at Pachim, Siam ; they were said to have been obtained in that province.

The Banting is probably very rare in the Malay Peninsula : Mr. H. N. Ridley told me one was killed by Mr. Oxley at Muar about fifty years ago ; Mr. J. Rodger, C.M.G., has in his possession a single horn, apparently of this species, obtained from a Sakei ; and both Mr. Ridley and Mr. A. L. Butler tell me one was killed recently in Perak.

Distribution. Burma, Siam, Malay Peninsula, Java, Bali, Borneo, and Sumatra ?

144. *BOS BUBALUS* Linn. The Buffalo.

Bubalus arnee, Cantor, p. 65.

Bos bubalus, Blanf. Faun. Ind., Mamm. p. 491.

“ Khwai ” of the Siamese.

“ Karbau ” of the Malays.

Cantor says :—“ The wild Buffalo is reported, but apparently without proof, to be indigenous in the Malayan Peninsula. Domesticated it is very plentiful.” Ridley (J. S. B. R. A. S. no. 25, 1894, p. 59) says it is very doubtful if the Buffalo occurs in a wild state in Pahang.

I was told, on good authority, that there are Buffaloes near Pailin, in Siam, descendants of some that ran wild about fifty years ago.

Distribution. Wild in parts of India and Ceylon. Wild or feral in parts of Burma, Siam, and the Malay Peninsula. Domesticated in Egypt, Italy, Southern Asia, and the Malay Islands.

145. *NEMORHÆDUS SUMATRENSIS* (Shaw). Goat-Antelope.

Nemorhædus sumatrensis, Cantor, p. 64.

Nemorhædus sumatrensis, Blanf. Faun. Ind., Mamm. p. 514.

“ Lee'ngpah ” or “ Ooarpah ” of the Siamese.

“ Kambing útan ” or “ Kambing gran ” of the Malays.

“ Black Mountain-goat ” of the English in the Straits Settlements.

Cantor says “ it appears to be numerous on the Malayan Peninsula, but exceedingly difficult to obtain, as it frequents the steepest lilly localities, and is very shy and active.”

W. L. Sclater (Cat. Mamm. Indian Mus. ii. 1891, p. 151) records a skull from Province Wellesley.

Ridley, writing on the Mammals of Pahang (J. S. B. R. A. S. no. 25, 1894, p. 60), remarks : “ This wild goat is supposed to occur in the high mountains of the interior, but there is no record of its having been obtained ” ; and (Nat. Science, vi. 1895, p. 163) says it “ inhabits the isolated patches of limestone rocks which flank at intervals the main granite chain of the Peninsula. Though apparently not rare in these places, it has never been shot by any sportsman.”

In the Museum at Taiping there is a stuffed head from near

Kuala Kangsar, Perak, and a complete skeleton and two pairs of horns, all, I understand, from Perak. In the Museum at Kuala Lumpur there are several frontlets and horns, without locality.

Mr. A. L. Butler told me he saw a Goat-Antelope in March 1898 near "the Cottage" in the Larut Hills, Perak, at an elevation of about 4000 feet; and in a letter, dated 14th March, 1899, mentions Sir Frank Swettenham as having shot one in the Perak Hills. This is the first instance, to my knowledge, of one of these animals being shot by a European sportsman in the Peninsula, though many have tried. In another letter, dated 5th November, 1899, Mr. Butler tells me he has examined three specimens, and says "the *Nemorhœdus* of the Peninsula is not *N. sumatrensis*, having legs black instead of rufous."

The Siamese Museum possesses a stuffed female from the Laos country, each horn 7·8 inches (198 mm.) in length, and a frontlet without locality, each horn 7·4 inches in length. A frontlet from the hills between Raheng (Siam) and Burma was shown me by Mr. J. Harper: length of horns 7·75 inches, circumference of horns at base 5·25 inches; a horn in my possession from Perak is 6·15 inches in length, and 4·5 inches in circumference at base.

In July 1898, a live goat of this species was exhibited in Bangkok, but I was unable to find out where it had been caught; it was a very handsome animal, nearly black in colour.

Distribution. Eastern Himalayas, Moupin, Yunnan, Assam, Burma, Siam, Malay Peninsula, Sumatra.

Family CERVIDÆ.

146. *CERVULUS MUNTJAC* (Zimm.). The Kakar, or Barking Deer.

Styloceros muntjac, Cantor, p. 61.

Cervulus muntjac, Blanf. Faun. Ind., Mamm. p. 532, fig. 173.

"Kijang," "Kidjang" "Kidang," or of the Malays.

Recorded from Kuala Tahan, Pahang, by Ridley (J. S. B. R. A. S. no. 25 1894, p. 60), who (Nat. Science, vi. 1895, p. 164) says:—"The Kijang does not occur now in Singapore, if it ever did. It is abundant in many places, such as the slopes of Mount Ophir, and is often shot by planters and others in and about the coffee plantations." This species is kept in the Singapore Botanical Gardens, where it breeds.

There are specimens from Upper Perak in the Museum at Taiping, and from Selangor in the Museum at Kuala Lumpur.

Hanitsch (Rep. Raffles Libr. & Mus. 1898, p. 7) mentions a young *C. muntjac*, 24 hours old, "showing clearly the white longitudinal striations, which soon disappear in older animals."

The Kijang occurs in Siam. There is a pair of antlers in the Siamese Museum, presumably local, the length from burr to tip is 4·25 inches; and Mr. N. Kelly Passmore gave me the skull of one which had been shot by his overseer near Muok Lek, about

900 feet elevation, in the Dong Phya Fai: the right antler from burr to tip measured along the curve 6·5 inches, the left 6·75 inches (171 mm.). A deer we saw and heard on the Bangpakong River in March 1897 was probably of this species, though I failed to procure a specimen.

Distribution. India, Ceylon, Burma, Siam, Cambodia, Hainan, Malay Peninsula (Perak, Selangor, Malacca, Pahang), Sumatra, Java, Lombok, Borneo.

147. *CERVUS SCHOMBURGKI* Blyth. Schomburgk's Deer.

"Qua-an" of the Siamese.

Distribution. Parts of Siam.

148. *CERVUS ELDI* Guthrie. The Thameng.

Panolia acuticornis, Cantor, p. 64.

Cervus eldi, Blanf. Faun. Ind., Mamm. p. 541, fig. 176.

"Sam-an" of the Siamese.

Cantor says "A single skull of a stag, killed in Keddah, has the horns so like those of the Munneepore animal, that the species might be taken to be identical, but that the Malays assert theirs to be maned, and of a dark colour, with white spots, like the *Axis*. This stag is further described as being extremely wary, and therefore seldom seen but on heights inaccessible to man." H.H. the Rajah Mudah of Kedah, who is keen on shooting, told me the Thameng does not exist in Kedah; antlers are sometimes conveyed there from Siam, a pair of which probably were brought to Cantor, with imaginary details to enhance their value, the statement that they frequent "heights inaccessible to man" being alone suspicious in regard to this plain-dwelling species.

W. L. Selater (Cat. Mamm. Indian Mus. ii. 1891, p. 181) records a frontlet of this species supposed to have been "brought from Penang" in 1846; this may have been imported from Siam, *via* Singora and Kedah.

Mr. H. Warrington Smyth ('Five Years in Siam,' vol. ii. p. 217) says the plain round Battambang "is much frequented by herds of the *Lamang*, or *Eld's* Deer," and describes how the Cambodians capture them.

Distribution. Manipur, Burma, Siam, Cambodia, Hainan.

149. *CERVUS UNICOLOR* Bechstein. The Sámbar.

Rusa equina, Cantor, p. 63.

Cervus unicolor, Blanf. Faun. Ind., Mamm. p. 543, fig. 177 (p. 544).

"Nua" of the Siamese.

"Rusa" of the Malays.

Cantor records the *Rusa* from the Malay Peninsula and Penang; so far as I have been able to ascertain, it is now extinct in Penang, and has been so for the last 25 or 30 years. H. J. Kelsall

(J. S. B. R. A. S. no. 26, 1894, p. 17) says:—" *Cervus equinus*, Cuv. Tracks of the Sambhur were seen on Gunong Janeng. This deer is probably common in the Johore jungles, but owing to its shy nature is seldom seen." Ridley (J. S. B. R. A. S. no. 25, 1894, p. 60) records this species from Pahang, observing: "The Malayan Sambur, apparently the same as the Indian species, but the horns do not attain the same length"; and (Nat. Science, vi. 1895, p. 164) says:—"The *Cervus equinus* is common in the Peninsula, and a few still occur in Singapore; . . . the young are produced singly, and are coloured like the adult, but with much softer hair. There are, however, faint traces of light spots on the rump, which disappear after the first week"¹. Writing to me on 11th Sept., 1899, Ridley says: "Sambar breed regularly in the Singapore Gardens, and they also breed in Government House Park. The young usually have a couple of white spots on the sides near the rump, not very distinct. They are not fully spotted like *Axis*. I should say certainly that the Sumatran deer is a distinct animal, *Cervus hippelaphus*. It would not cross with the other deer" (*i. e.*, Peninsula Sambar). In the Museum at Taiping there is a stuffed female from Upper Perak, and antlers from Upper Perak, Batang Padang, and Larut. In December 1896 I saw a Sambar stag in a small patch of jungle within about a mile of the town of Taiping. In the Museum at Kuala Lumpur there are specimens from Selangor. The Sambar appears to be numerous in parts of Siam; we had a stuffed female and two pairs of antlers in the Siamese Museum.

Distribution. India, Ceylon, Assam, Burma, Siam, Hainan, Malay Peninsula; probably also parts of China, Formosa, Philippines, Borneo, and Sumatra.

N.B.—*CERVUS AXIS* Erxl. The Chital, or Spotted Deer.

Axis maculata, Cantor, p. 62.

Cervus axis, Blanf. Faun. Ind., Mamm. p. 546.

Cantor says this deer is called "Rúsa Búnga" by the Malays of the Peninsula, and "It is numerous in Keddah, and at present in Pinang. But it did not inhabit Prince of Wales' Island (*i. e.* Pinang) till one of the last Governors of the late Presidency took the trouble of importing from Bengal some pairs, which were kept in the park adjoining Government House (Suffolk House). When the Presidency of Prince of Wales' Island was abolished, the deer of the quondam Governor's park found their way into the jungle, where they have multiplied to a prodigious extent." Nowadays they have disappeared from Penang, and it seems Cantor must have been mistaken in recording them from Kedah; the local Malays assured me no spotted deer existed there.

¹ A Sambar born in 1899 in the Ghizeh Zoological Gardens (original locality of parents unknown) had at first a very distinct black vertebral line from between the ears to the tail.

150. *CERVUS PORCINUS* Zimm. The Para, or Hog-deer.

Cervus porcinus, Blanf. Faun. Ind., Mamm. p. 549, fig. 179 (p. 550).

The Siamese Museum contains two stuffed males, obtained in Siam, but the exact locality I was not able to discover.

Distribution. Parts of India, Ceylon, Burma, Siam, and Laos States of Cambodia (R. Ward, 'Records Big Game,' 1899, p. 71).

Family TRAGULIDÆ.

151. *TRAGULUS JAVANICUS* (Gmel.). The Smaller Malay Mouse-deer.

Tragulus kanchil, Cantor, p. 60; O. Thomas, P. Z. S. 1886, p. 17.

Tragulus javanicus, Blanf. Faun. Ind., Mamm. p. 556.

"Kra-chong" of the Siamese.

"Kanchil" or "Pelándok" (pronounced "Plando'") of the Malays.

Cantor says this "species is astonishingly numerous" and occurs in the Malay Peninsula, Penang, Singapore, and the Lancy Islands; he adds "In Prince of Wales' Island (*i.e.* Penang) any number may be procured within short notice, at the rate of one Spanish dollar per dozen."

Oldfield Thomas (*l. s. c.*) records specimens from Salanga, Junkceylon, from Taroar, from Klang, Selangor, and from Singapore Island.

Ridley (J. S. B. R. A. S. no. 25, 1894, p. 60) records this species from Pahang.

There are specimens from Larut in the Museum at Taiping, and from Selangor in the Museum at Kuala Lumpur. Hanitsch records it from Changi, Singapore (Rep. Raffles Libr. & Mus. 1898, p. 9).

This species occurs in Siam; there is a specimen from the Dong Phya Fai in the Siamese Museum; and A. Milne-Edwards ('Recherches Famille Chevrotains,' Paris, 1864, p. 78) says "en 1862, M. Bocourt en a rapporté au Muséum un individu du royaume de Siam, et le Musée britannique en possède un exemplaire provenant du Camboge."

Distribution. Tenasserim, Siam, Cambodia, Cochinchina, Malay Peninsula (Junkceylon, Lancy, Penang, Perak, Selangor, Pahang, Singapore), Sumatra, Java, Borneo.

152. *TRAGULUS NAPU* (F. Cuv.). The Larger Malay Mouse-deer.

Tragulus javanicus, Cantor, p. 61.

Tragulus napu, Blanf. Faun. Ind., Mamm. p. 557.

"Nápu" of the Malays.

Cantor records this species from the Malay Peninsula, where he says it "appears to be far less numerous than the preceding."

W. L. Sclater (Cat. Mamm. Ind. Mus. ii. 1891, p. 191) records two specimens from the Malay Peninsula, obtained in 1871 and 1872.

Ridley (J. S. B. R. A. S. no. 25, 1894, p. 60) records this species from Pahang, and (Nat. Science, vi. 1895, pp. 163, 164) says this is the commonest species of Mouse-deer in the Peninsula, and gives an interesting account of its habits in confinement and of native methods of catching it. There are specimens from Larut in the Museum at Taiping, and from Selangor in the Museum from Kuala Lumpur.

Distribution. Tenasserim, Malay Peninsula (Perak, Selangor, Pahang), Sumatra, Java, and Borneo.

N.B.—*TRAGULUS STANLEYANUS* Gray. Stanleyan Chevrotain.

W. L. Sclater (Cat. Mamm. Ind. Mus. part ii. 1891) records two specimens from the Malay Peninsula, obtained in 1870. This species is by some supposed to occur in Singapore, perhaps from a statement by A. Milne-Edwards: "Un individu né le 25 septembre 1862, à Singapore, de Chevrotains de Stanley achetés par M. Bocourt pour le Muséum" ('Recherches Famille Chevrotains,' p. 81, Paris, 1864). I do not know the real habitat of this species, but have been told that it occurs in the Dutch islands south and south-east of Singapore, and is imported into Singapore from Rhio.

Family SUIDÆ.

153. *SUS CRISTATUS* Wagner. The Indian Wild Boar.

Sus indicus, Cantor, p. 53.

Sus cristatus, Blanf. Faun. Ind., Mamm. p. 560.

"Mu" of the Siamese.

"Babi utan" of the Malays.

Cantor records wild swine from the Malay Peninsula, Penang, Singapore, and the Lancy Islands. Ridley (J. S. B. R. A. S. no. 25, 1894, p. 60) says wild pig are common in the low country of Pahang, and were also seen far up the Tahan; and (Nat. Science vi. 1895, p. 161) records them from the island of Singapore, where he says they are "far too abundant."

There are local specimens in the Museums at Taiping, Kuala Lumpur, and Singapore.

In 1896 wild pigs were still to be found in both Penang and Singapore. In 1897 I saw one that had been killed the day before near Gunong Pulai, Johore; I was doubtful whether it was *S. cristatus* or not, owing to the greatly elongated facial portion of the skull, which unfortunately I could not bring away, my companions being Mahomedans, and I having too many other things to carry myself. In June 1898 I saw two wild pigs in swamps beyond Jenan, Kedah; apparently the ordinary *S. cristatus*.

Distribution. India, Ceylon, Burma, Lower Siam, Malay Peninsula.

Order CETACEA.

Family BALÆNIDÆ.

154. MEGAPTERA BOOPS. Humpbacked Whale.

Hanitsch (Rep. Raffles Libr. & Mus. 1898, p. 9) says there is an incomplete skeleton of this species from Malacca in the Raffles Museum. I believe it was obtained in October 1891.

Family DELPHINIDÆ.

155. PHOCÆNA PHOCÆNOIDES (Cuv.). The Little Indian Porpoise.

Phocæna phocænoides, Blanf. Faun. Ind., Mamm. p. 574, fig. 187 (p. 575).

Hanitsch (Rep. Raffles Libr. & Mus. 1898, p. 9) records "*Neomeris phocænoides*" from Singapore. In the Museum at Taiping there is a stuffed specimen caught off Matang, Perak, about 46 inches (say 1168 mm.) in total length, apparently of this species.

Distribution. Indian Ocean, from Cape of Good Hope to Japan (Blanf. *op. cit.* p. 575).

156. ORCELLA BREVIROSTRIS (Owen). The Larger Indian Porpoise.

Orcella brevirostris, Blanf. Faun. Ind., Mamm. p. 571, fig. 189.

"Lomba-lomba" of the Malays.

The British Museum contains a stuffed specimen from Singapore (Flower, List of Cetacea, 1885, p. 17), from whence it is also recorded by Hanitsch (Rep. Raffles Libr. & Mus. 1898, p. 9). In the Museum at Taiping there is a stuffed specimen, caught off Matang, Perak, about 60 inches (say 1524 mm.) in total length, apparently of this species.

Distribution. Bay of Bengal, Singapore, North Borneo.

157. STENO PLUMBEUS (Dussam.). The Plumbeous Dolphin.

Steno plumbeus, Blanf. Faun. Ind., Mamm. p. 583.

Cantor (p. 66) says *Delphinus plumbeus* occurs on the coasts of Penang, is called "Parampúan Laut" by the Malays of the Peninsula, and "the species, although very numerous, and rather heavy in its movements, is rarely captured, except by chance in fishing stakes."

In the Museum at Taiping there are three stuffed specimens, from the coasts of Perak, probably of this species; the largest is about 78 inches (say 1980 mm.) in total length.

Distribution. Indian Ocean.

158. DELPHINUS DELPHIS L. The Common Dolphin.

Delphinus delphis, Blanf. Faun. Ind., Mamm. p. 587, fig. 182.

Recorded from Singapore by Hanitsch (Rep. Raffles Libr. & Mus. 1898, p. 9).

Distribution. "Probably all tropical and temperate seas" (Blanford).

Dolphins are numerous on both sides of the Malay Peninsula and in the Gulf of Siam. I have from time to time seen three, apparently different species, but have never managed to secure any specimens; one of these is *D. delphis*, one a smaller species, and one larger than *D. delphis*, with a very prominent dorsal fin.

Local sailors report seeing a "white porpoise" at Belawan Deli, on the east coast of Sumatra, and at the mouths of several rivers in the Straits of Malacca.

Order SIRENIA.

Family MANATIDÆ.

159. HALICORE DUGONG (Erxl.). The Dugong.

Halicore indicus, Cantor, p. 66.

Halicore dugong, Blanf. Faun. Ind., Mamm. p. 594, fig. 196.

"Dúyong" or "Parampúan Laut" of the Malays of the Peninsula, *apud* Cantor.

I have in my possession a beautifully finished pencil drawing of "A young male Dūyōng taken in the neighbourhood of Singapore in April 1837. Measuring in length from the tail to the nose on the back 7 ft. 4 in. A Commander of a Portuguese ship trading to China says that in Portuguese this Fish or Animal is called 'Pexi Mulher' (literally Woman Fish)—he had seen them at Palaos in the Pacific. The bones of the jaws, the top of the skull and the throat are much esteemed there, especially those of the jaws which are of value and used as ornaments by the Natives, who are Savages." This note and the drawing are unsigned, but are stamped "Pinang, 4 Ja. 1838, Post-Office."

Cantor says: "The Dugong appears not to be numerous at Singapore, still less so to the Northward, and has but in few instances been observed in Kwála Múda, the mouth of the river, which forms the northern boundary of Province Wellesley."

Horsfield (Cat. Mamm. Mus. East India Co. 1851, p. 139) records a Dugong's skull "from Finlayson's Collection, Siam."

Ridley (Nat. Science, vi. 1895, p. 165) says "The Dugong is tolerably common in the Strait between Johore and Singapore; but one does not often see it," and gives some information about it.

Hanitsch (Rep. Raffles Libr. & Mus. 1898, p. 9) records a specimen from Malacca. In July 1898 I saw one in the Raffles Museum labelled Singapore.

Mr. L. Wray told me in 1896 he believed the Dugong was not found on the coast of Perak, probably owing to the lack of seaweed.

Distribution. Shores of the Indian Ocean, Straits of Malacca, and coasts of Borneo.

Order **EDENTATA.**Family **MANIDÆ.**

160. **MANIS JAVANICA** Desm. The Malay Scaly Anteater.

Manis javanica, Cantor, p. 51; Blanf. Faun. Ind., Mamm. p. 599, fig. 199 (p. 600).

“Nim” of the Siamese.

“Pengóling” or “Pangolin” of the Malays, according to authors.

“Tangíling” of the Malays.

Cantor records the Manis from Penang and the Peninsula, and says:—“Although numerous in rocky situations, is not often captured, as it is seldom abroad till after sunset. The largest male measured from the apex of the nose to the root of tail one foot nine and a half inches (546 mm.); the tail one foot eight inches (508 mm.)” Ridley (J. S. B. R. A. S. no. 25, 1894, p. 60) records it from Pramau, Pekan, in Pahang; and (Nat. Science, vi. 1895, p. 165) says: “It is frequently found in open sandy country, making large burrows in the ground,” and remarks on its habits. In the Museum at Taiping there are several specimens from Larut, Perak, and in the Museum at Kuala Lumpor specimens from Selangor. Hanitsch (Rep. Raffles Libr. & Mus. 1898, p. 9) records this species from Singapore. There were three specimens from Siam in the Museum at Bangkok, the largest, as stuffed, was 3 feet 4½ inches (say 1028 mm.) in total length.

In April 1896 I saw a female and young one alive in Penang, said to have been just caught in the hills on the island. Mr. F. H. Malcolm Staples told me (Sept. 1897) that he once got an Anteater at Batu Pahat, Johore; they ate it and found it good. In June 1897 I saw the skin of a specimen that had been just killed at Ayuthia, Siam; this was in a flat alluvial plain, with no rocky hills within many miles. In January 1898 we got two specimens at Chantaboon, both caught by natives; one was brought in alive, but it died in nine days. In May 1898 we got a live one in Kedah, which also died in nine days. In each case we could not get them to feed; at night they were turned loose in the lower part of the house (where ants and innumerable other insects abounded), to forage for themselves, but I never observed them even attempting to eat. They were the least intelligent animals I have ever kept; they wandered about the house a great deal at night, and one we let walk in the garden so as to watch it in the moonlight: they showed no inclination to dig or search for food, but walked on till they came to an obstacle, when they proceeded to climb up it; if, for instance, it was a chair, they climbed on to it, then on to the back, and then fell off the other side, and continued walking as before. The prehensile tail is very difficult to detach once the animal has coiled up round one's arm.

Colour. Kedah specimen, ♂, uniform dark brown, except end of tail which is buff. Naked skin of feet pink.

This specimen had sixteen rows of scales round the middle of its body, and measured :—

	ft.	in.	mm.
Length, head and body	1	8	508
„ tail	1	3½	394
„ ear		¾	19
„ hind foot, without claws . .	3		76

Distribution. Sylhet to Burma, Siam, Cochinchina, Cambodia, Malay Peninsula (Penang, Kedah, Perak, Selangor, Pahang, Johore, Singapore), Sumatra, Java, Borneo, Celebes.

Popular beliefs. It is not surprising that strange stories are related about an animal like the Manis. One that I was told in Kedah is worth putting on record. It, says the Malays, is very clever catching ants; putting all its scales at right angles to its body, it lies perfectly motionless on the ground: ants, thinking it dead, swarm over it by thousands, then it suddenly shuts down all its scales, thus imprisoning the ants, and rushes into a pond: under water it again opens its scales, the ants float to the surface, and the wily Manis licks them up comfortably.

2. On a remarkable Piece of Skin from Cueva Eberhardt, Last Hope Inlet, Patagonia. By Dr. EINAR LÖNNBERG, University of Upsala.¹

[Received March 6, 1900.]

Last year Mr. Erland Nordenskjöld visited Last Hope Inlet, Patagonia, to make further explorations in the large cavern, Cueva Eberhardt, which has become famous for the interesting remains of animals found in the deposits covering its floor. He has recently published the results of his researches in a memoir read before the Royal Swedish Academy of Sciences²; but in addition to the remains of which he treats there is also a remarkable piece of skin of an unknown animal, which he has kindly entrusted to me for description. This specimen was found by Mr. Nordenskjöld in the oldest stratum on the floor of the cavern, which is chiefly formed of the excrement of the giant-sloth *Grypotherium*, and is sometimes covered with a thin layer of sulphate of magnesia 30 to 50 mm. in thickness. The discoverer informs me that it was found close to a scapula, a claw, and some other bones of *Grypotherium*, and also near a tooth of *Felis onca*. It is therefore probable that the animal to which the skin belonged was contemporaneous with *Grypotherium* and the other members of the Pampean fauna.

Mr. Nordenskjöld informs me that when the piece of skin was

¹ Communicated by A. SMITH WOODWARD, F.Z.S.

² E. Nordenskjöld, "Iakttagelser och Fynd i Grottor vid Ultima Esperanza i sydvestra Patagonien," K. Vetensk.-Akad. Handl. vol. xxxiii. no. 3 (1900).

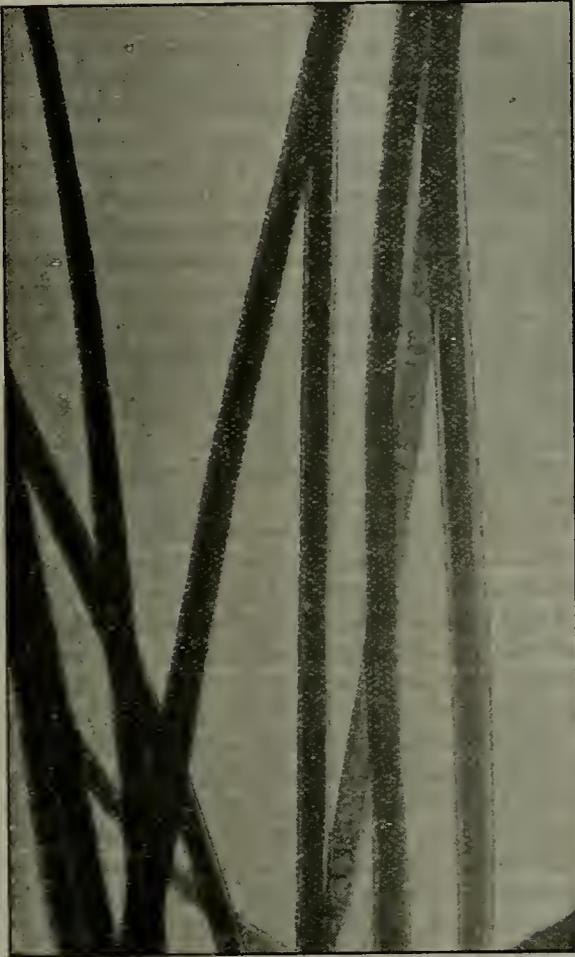
Fig. 1.



The piece of skin from Cueva Eberhardt.

found it was rolled up like a ball; but by moistening the specimen he was able to unwrap it and stretch it into the form shown in the accompanying photograph (see fig. 1, p. 380). It measures about 0·15 m. in length, but its breadth varies between 0·05 m. and 0·015 m. Its thickness, where stretched, is quite 0·002 m.: where contracted, somewhat greater. It is very densely covered with hair of a

Fig. 2.



Micrographic reproduction of some of the hairs of the piece of skin.

reddish-brown colour, redder than the coloration common in cattle and perhaps best described as fox-red. The hair seems to be a little more shiny than that of a fox, and occasionally it appears to be bleached to a pale yellow. It is, however, uncertain whether the paler spots are original or due to accident: it can only be said that they are probably original, because the paler tufts and single

hairs exhibit the same shade from their tips to their roots, and closely mingle with the completely red hairs. The length of this hair is different in different parts. Where it is longest it measures a little more than 0.045 m., but in some places 0.03 m. to 0.025 m. or even less. The hair is laid in different directions, as seen in the figure, and cannot have formed a smooth covering on the animal. The size of the individual hairs is variable, but there is no typical wool or underfur. The thickest hairs (fig. 2, p. 381) measure 80–100 μ in optical section, but taper gradually towards both ends. They are flattened and wavy. The medulla occupies the largest part of the hair, so that the cortex does not measure more than 10–13 μ in optical section; but towards the root the medulla becomes scantier and is finally completely broken up. The thinner hairs cannot be classified as wool or underfur. Their diameter in optical section varies from 45 to 55 μ . Their structure is exactly the same as that of the coarser hair. They are flattened and wavy, gradually tapering to a tip which has no medulla; but their stem exhibits a large medulla, so that the cortex of that part usually measures only 8–10 μ . The cortex is, as a rule, thicker on one side, and the cuticle covering it is scaly, so that the edge of the optical margin assumes a more or less distinct serrated appearance. The finer hairs are about ten times as numerous as the coarse hairs; and on the skin the coarser hair is not very conspicuous, the less so as intermediate sizes can also be seen.

In attempting to determine to what animal the piece of skin thus described may be referred, it is necessary first to consider the mammals of which remains have been found in the same stratum as this specimen. Of these, of course, *Grypotherium* is at once excluded, neither the structure of its skin nor that of its hair admitting of any comparison. The Guanaco may also be dismissed at the same time, since its fine wool or fleece bears no resemblance to the hair of this skin, as shown even by Guanaco remains associated with it. The large Cat of Cueva Eberhardt has been identified by Erland Nordenskjöld (with the concurrence of the eminent Danish zoologist, Herluf Winge) as a large variety of *Felis onca*¹. If this great extinct Jaguar had the same black-spotted appearance as the recent one, it is most improbable that so large a piece of skin should have been preserved without any black hairs remaining attached to it. If, however, the extinct Jaguar had a different fur-colour, it may be assumed, with a high degree of probability, that the structure of its furry covering was similar to that of the recent Jaguar. But the fur of the latter is distinguished from that of this piece of skin very readily by being shorter and having a fine underfur. This underfur of the Jaguar does not measure more than 15–30 μ in optical section, and has quite another structure, being completely devoid of a central

¹ This is the animal called by Santiago Roth "*Yemisch listai*" ("El Mamífero misterioso de la Patagonia *Grypotherium domesticum*," por Rodolfo Hauthal, Santiago Roth & Robert Lehmann-Nitsche, Revista Mus. La Plata, vol. ix. 1899 p. 441).

medulla, or at least with the medulla broken up in scattered minute portions. The coarse hair of the Jaguar is also different from that of the problematical piece of skin, in having a thicker cortex and a less developed medulla. Since all the present South-American cats (Jaguar, Puma, Ocelot, &c.) have an underfur, it may be assumed that the extinct Jaguar also had such an underfur, the more so as it lived further south in a region with a more inhospitable climate than that of the native country of most South-American cats. If such were the case, this piece of skin cannot have belonged to that extinct cat or to any other allied species. Similarly the species of *Canis*, probably a close ally of *C. magellanicus*, may be excluded from comparison, because, like other wolves and foxes, it must have been provided with an underfur. The skin is too thick to have possibly belonged to any of the rodents of which remains have been found in this or other layers of the cave. There thus remain only two kinds of animals of which fragments occur in the same layer as that in which the piece of skin was found, namely *Macrauchenia* and *Onohippidium*. The first of these, however, is very sparingly represented in Erland Nordenskjöld's collection, perhaps only by a phalangeal bone, and Dr. Hauthal has not found anything which could be referred to the same animal. *Onohippidium*, on the other hand, occurs abundantly. This peculiar horse, with its large fossa lachrymalis, which can be seen very well in one of Nordenskjöld's specimens, has thus in one way or the other been very often brought into the cave. It seems, therefore, quite probable that the piece of skin now described may have belonged to the now extinct *Onohippidium*.

To determine more precisely the mammal to which this piece of skin belonged, it is necessary to extend comparisons to other animals still living in the neighbourhood. For reasons already mentioned, the Puma, species of *Canis*, Guanaco, and the small rodents are at once excluded. The Viscacha (*Lagostomus*) has too soft a fur and too thin a skin to be taken into consideration. The characteristic structure of the hair of the deer (*Cervus chilensis*) makes every comparison with this animal impossible. In the same way, every mammal native to the South-American soil must be rejected. For the sake of completeness, however, the domesticated cattle and horses must also be included in the discussion, although it is extremely improbable that a piece of skin of either of these animals would find its way into the deepest layer of the cave-deposits. I have thus made a comparison of the hair with that of the domesticated ox and horse. The microscopical structure of the hair of cattle is different from that of the supposed *Onohippidium*. The cortex of the hair of the former is much thicker compared with the medulla than in the latter. At least in Scandinavia, it is also to be noted that the cattle have an underfur of fine hairs without medulla; and I suppose that the cattle of Patagonia, which run half wild without protection against the roughness of the climate, must be similarly provided. The hair of a horse is coarser and stiffer and does not show the same

scaly cuticle. It is also noteworthy that not even the winter-coat of a horse in Scandinavia approaches in denseness that of the supposed *Onohippidium*; while there are other differences more easily seen than described.

Taking all circumstances into consideration, I think we must return to the above suggested theory, that the specimen now under discussion is a piece of skin of an *Onohippidium*. If that be correct, it is of course very interesting to have a fragment of the soft parts of a second animal, long ago extinct, from the Cueva Eberhardt.

The detailed statements of Erland Nordenskjöld as to the extreme dryness of those parts of the cave where these remains were found, and the protecting layer of sulphate of magnesia, give a plausible explanation of the organic substances (even flesh on some bones) having been so excellently preserved for such a considerable time. I may add that Professor Lagerheim has also made attempts to find bacteria in the fæcal material, but failed to discover any¹.

3. On a remarkable Attid Spider from Borneo, *Mantisatta trucidans*, n. g. et sp. By CECIL WARBURTON, M.Á., Christ's College, Cambridge.

[Received March 31, 1900.]

By the courtesy of Dr. Sharp I am able to describe a very interesting new Spider found in a collection of insects, chiefly Termites, made by Dr. G. D. Haviland in Sarawak, Borneo. The Spider was overlooked on first going over the collection, and unfortunately no note was made of the particular insects with which it was associated, and nothing is certainly known with regard to its habits.

Fam. ATTIDÆ.

Subfam. LYSSOMANÆ.

Genus MANTISATTA, n. gen.

Body elongated and depressed. Eyes arranged as in *Lyssomanes*. Spinnerets *beneath* the posterior end of the abdomen, which is produced beyond them into a caudal process. Legs of the first pair much the most strongly developed, with strong forwardly directed spines under the tibia and *backwardly* directed spines

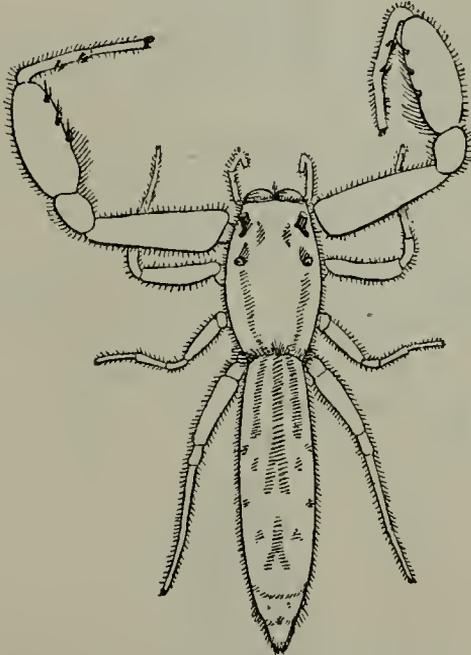
¹ After the reading of this paper, Dr. W. G. Ridewood remarked that he had examined the microscopic structure of the hair of the two equine hoofs found in association with *Grypothorium* by the La Plata Museum expedition. He had observed in the hairs attached to these hoofs the tapering of the hair at each end, the scaly cuticle, and the excentric position of the relatively large medulla, which had been described as characterizing the hair of the problematical skin found by E. Nordenskjöld.

under the metatarsus, forming a prehensile weapon when these joints are apposed.

MANTISATTA TRUCIDANS, n. sp. (Fig. 1.)

Female. Total length 4 mm. ; length of thorax $1\frac{1}{2}$ mm. ; length of abdomen $2\frac{1}{2}$ mm. Greatest breadth of thorax (about the level of the second pair of legs) about 1 mm. ; of the abdomen about .75 mm.

Fig. 1.



Mantisatta trucidans, ♀, much enlarged.

The cephalothorax is much depressed and is about half as long again as broad. The first pair of eyes are very large, occupying the whole breadth of the facies, and are mounted on short cylinders which project forward. The second and third pairs of eyes are on confluent dark-coloured eminences. The second eyes, which are pale-coloured, are about a quarter of the anterior eyes in diameter. The third eyes are very small and black. The fourth pair of eyes, somewhat farther behind the third pair than these are behind the second, are dark and moderately large, their diameter being about one third of that of the anterior eyes. The whole ocular area (fig. 2, p. 386) forms almost an exact square.

The abdomen is a depressed cylinder, more than three times as long as broad. The spinnerets are not visible from above, being hidden by a caudal process (fig. 3, p. 385).

The anterior legs are about as long as the whole animal, the femora, patellæ, and tibiæ being very strongly developed, and giving

the Spider a chelifer-like appearance. Beneath each tibia, towards its distal end, are three pairs of strong black spines, directed forward. The metatarsus, which can be closed upon the tibia, bears two pairs of shorter black spines directed backward. One pair is beneath the middle of the joint, and the other near its distal extremity.

Fig. 2.

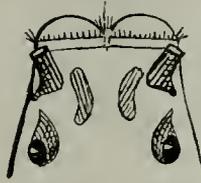
Ocular area of *Mantisatta trucidans*.

Fig. 3.

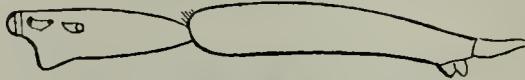
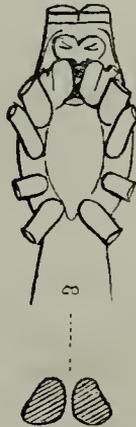
*Mantisatta trucidans* in profile.

Fig 4.

Under surface of anterior part of *Mantisatta trucidans*, with enlarged view of epigyne.

The other legs (4, 2, 3) are small and weak, and do not appear to be adapted for leaping.

The whole Spider is exceedingly pale—almost white—in colour, at all events as it appears after immersion in spirit. Dorsally it is variegated by a pattern marked out in faint dusky lines and dots. On the cephalothorax there are two dark patches between the third pair of eyes, and the second, third, and fourth pairs of eyes are on

black eminences. Behind the fourth pair commence two faint dusky lines, which converge slightly as they approach the abdomen, along which they are continued for nearly a third of its length. Along the first half of the abdomen there is a median line, forking posteriorly. This is succeeded by a shorter line which forks similarly, and behind this there is a transverse line. On each side of the central marking there are a series of dots, the distribution of which is shown in fig. 1. The body is thinly pubescent. The under surface of the body is whitish except the small yellow-brown epigyne (fig. 4).

The legs are similar in colour, and, except for the spines on the tibiæ and metatarsi of the first pair, are furnished only with a thin clothing of hairs. All exhibit black scopulæ on the tarsi.

Male unknown.

A single adult female was found among a collection of insects made by Dr. G. D. Haviland in Sarawak. Nothing is known of its habits, but from the nature of the collection it is probable that it was found inside a termites' nest. Its structure would suggest that it does not pounce upon its prey in the usual *Attid* fashion, but that it remains still and seizes passing insects with its predaceous front legs.

4. On Geographical and Individual Variation in *Mus sylvaticus* and its Allies. By G. E. H. BARRETT-HAMILTON, F.Z.S.

[Received March 2, 1900.]

(Plate XXV.)

This paper contains some account of the various local forms or subspecies of the Long-tailed Field-mouse, which can be recognized from the material at present available in the collections of the British Museum of Natural History.

The accusation has sometimes been brought against certain recent workers on Mammals that their papers are "scrappy." I fear that those who lightly make such assertions can have but little idea how insignificant is our present knowledge of the local variations of Old World mammals, and how numerous are the new facts constantly being brought before us with the consequent need for their permanent record. Even in the case of one of our commonest mammals, such as that here under consideration, a careful study of material, which is probably both greater in quantity and better in quality than that which has come before any other writer, chiefly impresses one by its inadequacy to afford the basis of anything like a full account of the variations of the animal even in such a small area as that of the British Isles.

It is a curious sign of the times that in this country, at all events, the naturalist who wishes to give some account of the local variations or subspecies of any particular mammal must commence

with an apology for the work in which he is engaged. So long as the field of enquiry be entomology, the attempt to describe and classify local variations, and to gain some knowledge of the guiding principles which underly them, is regarded with respect. If, on the other hand, a zoologist attempts to institute a similar inquiry respecting mammals, he is regarded with suspicion, or often as a mere species-monger who wishes to burden the compilers of local faunas with the names of a number of forms, the status and relationships of which only a long study will help them to thoroughly understand. Yet modern investigations have clearly shown the existence of a rich crop of local variations amongst the Mammalia, not less worthy of study than those found amongst the Lepidoptera or Mollusea, and which I hold it to be clearly the business of systematic zoology not only to describe and to arrange, but to name.

In treating a species well known and long recognized, such as *Mus sylvaticus*, I prefer to regard as subspecies all forms which can be identified as in any way phases or representative modifications of the original type as known to Linnæus. The method, so much in favour in America, whereby all forms which intergrade are looked upon as subspecies, and all those which do not are regarded as species, has much to recommend it; but the simple ascertainment of the fact that intergradation does, or does not, occur alone implies a greater knowledge and an ampler series of specimens than we, in the Old World, possess of many of the very commonest mammals. Further, by its unavoidable multiplication of species it obscures the relationship of kindred species and genera, and necessitates the formation of new genera or subgenera to include the various groups of new species and subspecies. Under this system many, if not all, of our time-honoured Old World species would be raised to the rank of full genera—a contingency which may be eventually necessary, but which it seems desirable to postpone to as late a date as possible.

On the other hand, the system used in this paper has the advantage of roughly indicating the relationship of the forms dealt with. We do not, however, thereby escape from the difficulty that these forms are of widely different degrees of distinctness. For instance, whereas some of our western subspecies approach each other closely, even in their extreme phases, and will probably be found to intergrade freely, there are others, such as *Mus sylvaticus princeps* or *M. s. draco*, which, even if they be proved to intergrade, are in their extreme phases highly distinct and at once recognizable. Some forms there are, however, which, having been long separated from the parent form, have become so differentiated that the most stubborn disregarder of local variations could not consider them to be identical with *M. s. typicus*. Such is *M. argenteus* of Japan. To it accordingly, lest my judgment should be found erring in allying it too closely with *M. sylvaticus*, I here accord full specific rank.

A further advantage may be claimed for the method which is

here advocated, namely, that it does not add to the difficulties of the student of the geographical distribution of mammals in its broadest and widest sense. The numerous modern species, although they may be of the greatest interest to the student of the fauna of a single or of a particular group of countries, cannot but be a source of perplexity to the naturalist, whose aim it is to regard the mammals of the world as a whole. To the latter the liberal and intelligent use of trinomials must be a boon, rendering possible as it does a ready comprehension of the origin and relationship of any particular local or representative form which he may have before him.

But, after all, the main object of our study should be the variations of the animal or group of animals dealt with. Provided that this be our aim, the exact method we employ is surely of subsidiary importance. No method that does or can exist, unless it be diagrammatic or pictorial, is capable of fully or satisfactorily exhibiting the variations which have to be dealt with.

Distribution.—The distribution of *Mus sylvaticus*, speaking of it in a broad sense as including all its subspecies, is, as I have already pointed out¹, almost coterminous with the limits of the Palearctic Region, in which it is probably as widely spread as most other mammals, since it seems to be comparatively regardless of the influence of temperature and is found far up the slopes of the mountains. Thus Dr. G. Radde² met with it almost everywhere in his journeys in South-western Siberia, and it is especially common on the middle Amoor. He remarks that there can be no doubt that it is found, at least locally, in the regions lying between wooded Dauria and Lake Baikal, at all events in the grassy country, but that it is absent from the high steppes of Mongolia. In these regions it avoids swampy and shaded localities, but loves sunny slopes with sparsely distributed high woods, where it gladly gathers the dry windfalls for its nest. With these exceptions, to which must be added the deserts and arctic tundras, it is equally at home in all the countries between the eastern coast-line of China and the Atlantic sea-board of Ireland or Portugal. It has reached nearly all the outlying portions of the Region, such as Morocco, Algeria, Palestine, Corsica, Sicily, the Balearics, the Channel Islands, Great Britain, the Isle of Man, Ireland, the Scotch Islands³ (such as the Inner Hebrides, where it is abundant on all the islands), the Outer Hebrides (including even remote St. Kilda⁴), the Shetlands, and Iceland, and in the last locality its local representative, if indigenous, is the only species of mammal that is so. On the other hand, I have seen no specimen from any of the Japanese islands, where, however, I believe, that on Nippon *Mus argenteus* is its modified

¹ Proc. Zool. Soc. Feb. 7, 1899, p. 82.

² 'Reisen im Süden von Ost-Sibirien in den Jahren 1855-1859 incl.' Band i. pp. 180-182 (1862).

³ J. A. Harvie-Brown & T. E. Buckley: 'Vertebrate Fauna of Argyll and the Inner Hebrides,' 1892, p. 38.

⁴ I have as yet seen no specimen from either the Orkneys or the Faroes. It doubtless occurs on the former; the case of the latter will be discussed below.

representative, and I could not hear of it in Kamchatka; but its absence from the latter country is not surprising when it is considered that the peninsula, as shown by its general fauna, has probably been isolated as an island until recent times, and further that we are not aware of the presence of *Mus sylvaticus* in the two main roads thither, in Chukchiland or the Kuril Islands.

In Asia Minor it was found by Ménétries amongst the mountains of Talyche, by Canon Tristram on the plains of Palestine, and Danford caught a specimen "while running about on the surface of the deep snow," considerably above the tree-growth¹. As a contrast to this, one has been trapped by Mr. G. H. Caton Haigh in Wales among the rocks on the shore near the mouth of an estuary, so that it seems equally at home in extremely varied localities.

In spite, however, of its wide distribution and comparative disregard of extremes of climate and environment, it is one of those mammals which do not seem to have reached Tunis, Tripoli, or Egypt.

The southern boundary of its range in Asia is uncertain. It has been reliably recorded from Wakhán on the Upper Oxus; from Kashgar, in Eastern Turkestan; from Gilgit in the Upper Indus Valley; from Cherra Punji, India; from Kashmir; and from Kuatun, in North-west Fokien, Eastern China. It thus reaches the confines of the Oriental Region at more than one locality.

Its presence in such isolated, yet widely separated, islands as Iceland and Corsica (if, indeed, it be native in the former), seems to mark it as a species which has for long maintained a wide area of distribution, and which is of sufficient age to have already occupied the greater part of its present geographical range when the British Islands and their appendages, at least as far as the Shetlands, Outer Hebrides, St. Kilda, and Ireland, still formed part of the Continent of Europe, and when there existed a free land-passage from Europe to North Africa by means of substantial land-bridges where now only islands remain. Japan alone seems to be old enough to have given it time for specific modification. This supposition gains support from the fact² that its bones have been found in numerous caves on the Continent as well as in the English Forest-Bed of Norfolk, and elsewhere, as in the Ightham Fissures of Kent, and that we have no trace of its ancestry, the Pleistocene species *Mus orthodon* Hensel and *Mus lewisi* E. T. Newton³ being at least as highly specialized as itself.

The question as to whether this Mouse could be indigenous to Iceland I left an open one, since it seems likely that the connection between that island and the Shetlands must have been of far more

¹ Proc. Zool. Soc. 1877, p. 279.

² See A. Nehring's "Uebersicht über vierundzwanzig mitteleuropäische Quartär-Faunen," Zeitschr. d. deutsch. geol. Gesellsch. Bd. xxxii. 1880, pp. 468-509; also Brandt & J. N. Woldrich's "Diluviale europäisch-nordasiatische Säugethierfauna und ihre Beziehungen zum Menschen," Mém. Acad. Imp. Sci. St. Pétersbourg, xxxv. I. p. 69 (1887).

³ Quart. Journ. Geol. Soc. vol. I. pt. 2, no. 198 (May 1, 1894).

remote date than that between the British Islands and the Continent, and, moreover, we do not know whether this Mouse occurs on the Faroes or not. Its occurrence in these intermediate localities would afford support to the presumption that it is native in Iceland; but I am indebted to Col. H. W. Feilden for the information that the existence of an indigenous mammal of any kind on the Faroes is very unlikely, since they have undergone an intense, although local, glaciation at a period long subsequent to their present condition as islands.

At all events, *Mus sylvaticus* is perhaps the species *par excellence* of all others inhabiting the Palæarctic Region which we should most expect to find in such an out-of-the-way island as Iceland.

Material examined.—The following is a summary of the material which I have been able to examine. Not only have I had before me the specimens included in my own collection, but the whole of those now in the British Museum have been generously placed at my disposal by the authorities. In addition to these Mr. Gerrit S. Miller, Junior, Assistant Curator of Mammals at the United States National Museum, Washington, D.C., has most kindly sent over for my examination 66 examples from the collection in that museum. I have thus had before me a series of, in all, about 580 specimens, many of them prepared in the best modern methods and having also attached to them carefully cleaned skulls.

From England and Wales I have seen 171 specimens¹: from Bedfordshire 2, Cambridgeshire 3, Carmarthenshire 6, Cheshire 9, Dorset 1, Glamorganshire 11, Gloucestershire 6, Herefordshire 33, Hertfordshire 3, Isle of Wight 8, Kent 4, Leicestershire 13, Lincolnshire 2, London District 13, Merionethshire 5, the New Forest 5, Northants 2, Northumberland 6, Oxfordshire 18, Staffordshire 3, Suffolk 4, Surrey 5, Sussex 5, Warwickshire 2, Worcestershire 1, Yorkshire 1.

Turning to Scotland and its Islands, I have seen 56 specimens: from Cromarty 11, Edinburgh 2, Elgin 17, Haddingtonshire 2, Lanarkshire 1, and Skye 1; while Mr. Robert Henderson of Dunrossness, Shetland, has sent me 8 obtained there; and Mr. W. E. de Winton has kindly placed at my disposal his fine series of 14 from the Islands of Lewis and Barra.

From Ireland I have had before me about 45 specimens: from Carlow 7, Clare 2, Galway 4, Kerry 6, Tipperary 3, and Wexford several; and have also, through the kindness of my friend Dr. R. F. Scharff, been permitted to examine those in the Dublin Museum of Science and Art, among which are included

¹ For these the British Museum and myself are indebted to a numerous band of collectors, of whom I may mention Messrs. O. V. Aplin, A. S. Austen, E. W. H. Blagg, J. L. Bonhote, G. H. Caton Haigh, T. A. Coward, R. J. Cuninghame, G. Denoon, W. Dodson, J. S. Elliott, W. Evans, C. H. B. Grant, S. F. Harmer, F. W. Headley, the late Lord Lilford, Messrs. J. O. Mansel-Pleydell, W. R. Ogilvie Grant, Oldfield Thomas, Miss D. Sharpe, Mr. W. Taylor, Col. J. W. Yerbury, while, last but not least, my friend Mr. W. E. de Winton has placed his whole collection from various localities at my entire disposal.

(besides several specimens in alcohol) 7 skins from Co. Dublin and the north of Co. Wicklow, 7 from Co. Louth, two without locality, and an immature skin from Co. Galway.

From the Channel Islands I have a set collected by Mr. W. Eagle Clarke on Alderney¹; while from the Continent of Europe, its Islands, and North Africa, I have seen 169 specimens (which form part either of my own collection or of that of the British Museum of Natural History) from the following countries:—Morocco 11, Portugal 9, Spain (various localities) 10, France (various localities) 18, Belgium 10, Holland 5, Denmark 5, Scandinavia 6, Germany 60 (from various localities), Lithuania 1, Slavonia 16, Switzerland 11, Italy 4, Corsica 2, Sicily 2, Algeria 1, Roumania 44, Montenegro 1, Russia 1, Iceland 1. Lastly, there is the series of 66 specimens kindly sent over for my examination by Mr. G. S. Miller, Junior, which comprises 16 from Brunswick, Germany: 9 from Bergen, Norway; 2 from Upsala, Sweden; 17 from Switzerland; 17 from Warene, Belgium; and 5 from Cadillac-sur-Garonne, France.

Of Asiatic material I have examined 25 specimens from a number of localities, the most eastern of which is Kuatun, in North-west Fokien, China, whence Messrs. C. B. Rickett & J. D. La Touche have recently sent a fine series to the Natural History Museum.

General Remarks.—It is extremely hard to deal satisfactorily with the various phases of *Mus sylvaticus*. Considerable as has been the material at my command, far more so probably than has fallen to the lot of any other naturalist to examine, it is still impossible to trace out with anything like completeness the variations of this species even in Western Europe. *Mus sylvaticus* occurs everywhere in such abundance and is so easily caught that it might be thought that no animal would be easier to work out; but this is not the case, for in proportion to the very facility with which it is captured, a great deal of the material is young and untrustworthy. At present, therefore, I do not see my way to catalogue with anything like completeness the various recognizable subspecies and individual variations. All that I can do is to describe a few of the more extreme forms, leaving the majority of the intermediates for further consideration.

In dealing with the variations of an animal, we have two distinct types to treat of, viz., those which are spasmodic and affect only the individual, and those which are geographical and characteristic of all, or of the majority of, the individuals of a particular region or locality. The former do not directly concern the student of geographical variation; the latter are the species and subspecies, according to the degree of difference which they show, of a paper like the present one. The occurrence of startling variations, either individual or geographical, seems almost foreign to the constitution of *Mus sylvaticus*, yet it is not deficient in equally interesting, although less conspicuous, developments. In this respect, what I stated in my previous paper on the subject may still, broadly

¹ See Proc. Zool. Soc. Feb. 7, 1899, p. 82, footnote.

speaking, be regarded as true, although now naturally modified by recent accessions of material, so that I am able to distinguish local forms, for the proper differentiation of which, although I believe them to be perfectly recognizable and distinct, there was needed the accumulation of a considerable number of specimens.

Mus sylvaticus appears in fact to be a form which, in its long-standing and successful struggle for existence, has attained to a height of specialization from which it has either very little power of variation, or else which is such as to fulfil all the needs of the species in almost any conditions with which it may be brought into contact. The possible range of its variations, whether individual or geographical, would seem to be narrow. Within this narrow range, however, variation is very evident and perplexing. The animal, indeed, while apparently having small power of varying, uses to the utmost the power which it possesses. Unlike some of our common mammals, such as the Squirrel, Rabbit, or Rat, it is not subject to either melanism or albinism. In the whole series of the 'Zoologist' and the volumes of the 'Field' for the last twenty years, there is not to be found a single recorded instance of a well-marked sport of this species—a result which would have been very widely different had the object of the search been *Sciurus vulgaris*, *Talpa europæa*, or *Mus musculus*. This, of course, does not prove that conspicuous sports do not occur, but it undoubtedly emphasizes their rarity¹. I have not thought it worth while to supplement this result by a search for information, all of which would probably be of a highly negative character, through any number of the works of foreign writers; but neither in those of Bell² nor of J. H. Blasius³ can any allusion to such sports be found. Dehne⁴, however, mentions a variety, which he calls "die isabellfarbige Waldmaus," and which he characterizes as very rare, since he had only seen one example, and that in the summer of 1833 in the district of Penig. He had never seen white or otherwise coloured varieties. De Selys-Longchamps⁵ records an "Isabelle albine" variety with pink eyes, and states that such occur "très accidentellement." Similar isabelline, white, or white-speckled varieties are noted as of extremely accidental occurrence by Bonaparte⁶, Fischer⁷, and Mina Palumbo⁸. *Mus sylvaticus* is then, it seems, a good instance in support of Mr. A. Sedgwick's remarks⁹ on the loss of variability in an old species.

¹ It must not be forgotten also that sports of *Mus sylvaticus* may have been occasionally credited to *Mus musculus*.

² 'British Quadrupeds,' ed. 2 (1874).

³ 'Säugethiere Deutschlands,' 1857.

⁴ Allgem. deut. naturh. Zeit. 1858, pp. 182-3.

⁵ 'Études de Micromammalogie,' 1839, p. 65.

⁶ 'Fauna Italica,' 1832-1841, art. on *Mus sylvaticus*.

⁷ "Säugethiere des St. Petersburger Gouvernements," Der Zoologische Garten 1869, p. 340.

⁸ Cat. dei Mamm. della Sicilia, 1838, p. 72. See E. Cantoni's "Elenco Generale dei Mammiferi soggetti ad albinismo," in Atti della Soc. Ital. di Sci. Nat. vol. xxiii., 1880.

⁹ Presidential Address to Section D of British Association: Dover, 1899.

Within its own limits, as has been stated above, the Long-tailed Field-mouse is subject to considerable variation, but the variations are usually more subtle than are those of some other mammals. Thus, putting aside the influence of age and season, I find a good deal of individual variation in the amount and intensity of the rufous coloration of the upper surface and of the purity of the underside, in the presence or absence of a spot or band upon the breast, and in the length of the tail. Size too, as in other mammals, contributes its share to individual differences; and my tables at the end of this paper show that, after allowing for individual differences amongst the various persons who have measured the specimens which I have had under examination, there yet remains a considerable variation above and below the mean for adults. I think it highly probable that such variation would have proved distinctly less had the series from which my averages have been compiled been collected in a locality smaller than that of Great Britain as a whole. It is, in fact, possible that there is an increase in size of *Mus sylvaticus* even in Great Britain from south to north, or, perhaps, from south-west to north-east.

As regards geographical or local variations, *Mus sylvaticus* is, on the whole, remarkably constant to a single well-marked type. Throughout the Palearctic Region it is distinguishable at a glance from every other mouse with which it might possibly be confounded by the possession of a combination of characters, amongst which its size, the pattern of its teeth, its long foot, large ears, and pure white belly, separated from the more or less rufous dorsal regions by a clearly marked line of demarcation, are predominant. Thus its local forms, though distinguishable, are not nearly so readily appreciable as, say, those of *Sciurus vulgaris*; and *Mus sylvaticus chevrieri* Milne-Edwards, of Tibet, is at first sight surprisingly like *Mus s. arianus* Blanford, of Persia and Afghanistan, or *Mus s. intermedius* Bellamy, of England, considering the enormous tracts of country by which these forms are separated. Yet there is variation and that distinctly geographical, consisting for the most part (as in the case of the individual variations) in differences of general size, tint, and thickness of the coat of the upperside, intensity of the white colour of the belly, presence or absence of a breast-band, length of tail, and size of ear.

Thus, in Europe, it is easy to divide *Mus sylvaticus* primarily into two very distinct—a larger long-tailed and a smaller short-tailed—subspecies. The larger reaches its maximum both of size and coloration in Eastern Europe (*M. s. princeps*), but towards the West becomes both smaller and duller. Colonies, however, persist right into Great Britain, where they are distinguishable by the presence of a remarkable breast-band of the same colour as the upper surface of the body (*M. s. wintoni*). In Denmark and Scandinavia there is a reduction in size (*M. s. typicus*), but, although the red of the upper surface remains fairly intense, the underside is much dulled; and this process has been carried to its fullest extent in the representatives of the species on the islands of Lewis

and Barra (*M. s. hebridensis*) and St. Kilda (*M. s. hirtensis*), where it is accompanied by a very interesting shortening of the ear and lengthening of the foot proportionately to the length of the body. A representative of the large form occurs also in the Shetlands; but my series is not sufficiently good to enable me to decide finally as to its affinities. The Iberian Peninsula and Morocco seem to be the habitat of a large dull-coloured form, with regard to the exact appearance and relationship of which, in default of more numerous specimens, I am a little uncertain, and for the present can merely allude to it under the name *Mus hayi* Waterhouse.

To turn to the smaller subspecies (*M. s. intermedius*), this is found mainly in the British Islands and in the neighbouring continental areas of Holland, Belgium, and North-west France; but the exact limits of its distribution are as yet uncertain, and it probably intergrades in all directions with other subspecies. It is extremely interesting to find that specimens from such damp western localities as Lewis and Skye in the Scotch Islands, Galway and Kerry in Ireland, and Oporto in Portugal indicate that in such situations the reduction of size and darkening of the colour of the upper surface reaches its maximum. It is not less interesting to find some evidence that there may be two ways of attaining to that greater dullness of coloration which seems to be fitted to a sojourn in the moderately warm, damp regions of Western Europe; and that, whereas in *M. s. hebridensis* and *M. s. hirtensis* this object is attained by rendering more uniform, although not darker, the colour of the upper surface, by the enlargement of the breast-band, the partial obliteration of the line of demarcation between the two surfaces of the body, and the extension of the yellow colour to the belly, the whole consistent with a retention of large size, in *M. s. celticus* the same result is brought about by an increase of the black-tipped hairs on the back, while the belly, although retaining its pure whiteness, is made less conspicuous by reduction of the size of the animal. The occurrence of representatives of each of these forms almost side by side on the small island of Lewis is perplexing; but Mr. de Winton informs me that the larger *M. s. hebridensis* keeps severely to itself on the western side of the island, and that he believes that the presence of the smaller form may here be due to accidental introduction.

As regards the remaining forms, such as *M. s. islandicus*, *arianus*, *pallipes*, *griseus*, *chevrieri*, *draco*, and *M. argenteus*, little is known and little can be said; but there is evidence to show that the representatives of *M. sylvaticus* are characterized in the north (according to Radde) by larger, and in the south by smaller size, and in the latter case by a proportionately smaller hind foot. The thick fur and light upperside of *M. s. pallipes* seem to indicate a development to suit great cold, combined perhaps with desert- or steppe-like conditions; but the curious differences between the manner in which the young grow up in extremes, such as *M. s. draco* and *M. s. intermedius*, are at present inexplicable.

The fact remains, however, that in these subspecies the young are more strikingly differentiated than the adults. In all, the young are duller than their respective adults, but in the East they seem to take a longer time to don the brighter hues of maturity and the manner of effecting the change is more patchy than that in vogue in the West. It may be that in regions where food is abundant and general bodily growth is rapid, the development of the genital organs cannot keep pace with that of the general size, and that with these organs the assumption of the external colours of the adult, which we know to have in many cases a most intimate connection with them, is retarded accordingly.

If it be true that the various stages of progress to maturity repeat in some degree the phylogeny of an animal, then we may, perhaps, assume that the brighter red hues of the adults of several of the subspecies¹ of *Mus sylvaticus* must be regarded as a modern acquirement, the original ancestor of the Long-tailed Field-mice having been a plain coloured, white-bellied House-mouse-like creature. Further, on the same supposition, the adult winter coat being the darker, is nearer to that of the young, and hence to that of the ancestor, whence perhaps it might be inferred that the immediate ancestor was an animal which inhabited a damp, only moderately warm, sunless country, and is most nearly represented in its colour by the subspecies of Western Europe of the present day.

The occurrence of a small dark form in such isolated localities as Lewis, Skye, Galway, and Kerry, and possibly in Portugal, seems to suggest some thoughts on our present views of distribution. We may look on the discontinuous distribution of such a form in two ways. We may regard it as evidence of the survival in isolated localities of an old subspecies, once of far wider distribution; and this is the view that would undoubtedly be adopted had we to deal in this case not with a subspecies, but with a genus or even with a very distinct species. An alternative view may, however, present itself, viz., that we may have here a case of the independent evolution of a similar form under the influence of similar conditions, which in fact one is tempted to regard as a similar reaction of the organism to the impetus of similar stimuli. To the latter view I am, I confess, myself very much inclined, and parallel cases can be found amongst other groups, as, for instance, in the case of the slug recently described by my friend Dr. R. F. Scharff² as *Limax marginatus*, var. nov. *niger*. This, a small dark form, was found by its describer and Mr. G. H. Carpenter "suddenly" appearing at a height of 2800 feet on Carrantuohill, in Co. Kerry, Ireland, and was certainly quite absent from the lower slopes of the mountain. According to Professor Simroth this form occurs also

¹ There are other Eastern *Muridæ* (e. g. *Mus confucianus*) of which the young are dully coloured and the adults red.

² 'Irish Naturalist,' Oct. 1899, p. 214.

in Transylvania, while it only differs from the var. *rupicola* in being unicoloured above. In fact the variety *rupicola* itself would seem to be another case in point, being found, as it is in Lessona and Pollinera, up to a height of 7000 feet in the Piedmontese Alps, as well as in the Mourne Mountains of Ireland, from which it has been recorded by Mr. W. D. Roebuck.

From whatever point of view we regard the numerous forms of *Mus sylvaticus*, it is of extreme interest to find that the changes and variations in different climates are paralleled, to a certain extent at least, not only by other mammals, but by birds and, in some cases, by invertebrates. In a recent paper¹ I showed that the brightening of the colours of certain birds according as they range southwards is paralleled by the Weasel, *Putorius nivulis* Linnæus and its subspecies. So, too, the most richly coloured subspecies of *Mus sylvaticus* which I have seen is *Mus s. draco* from Kuatun, a locality which must be near the extreme south-eastern limit of the range of the species, while in the south-west the deep, almost chocolate upperside of the single British Museum specimen of *M. s. algirus* of Algeria seems to be suggestive of a similar tendency.

It is also of interest to find that the bright, clearly coloured *Mus sylvaticus* of the cold drier regions of Central Europe is the counterpart of the corresponding form of Squirrel, *Sciurus vulgaris rufus* Kerr; whereas the duller subspecies of some of the damper Western regions are paralleled by *S. v. leucourus* Kerr and *S. v. typicus* Linnæus; and other parallels may be sought amongst the Red-backed Voles (*Evotomys*) and their subspecies. We are only just beginning to obtain any general light on the distribution of variation amongst European mammals, but the larger size of *Mus s. princeps* of Central Europe finds a parallel in at least one other species, viz. *Lepus europæus typicus* Pall., of which the Central European and Russian examples are distinctly larger than the Western, *L. e. occidentalis* de Winton². Indeed, it would be easy to quote a good many other instances, taken from birds as well as mammals, which seem to afford evidence of some law of decrease in size from cold and clear to warmer and duller regions. Finally, the occurrence of especially dark and often small forms in various isolated western localities of the British Islands finds an abundant counterpart in other groups. I may point to the Lepidoptera, amongst which so many dark western varieties have been recorded; to the dark Squirrels of damp mountainous continental regions; to our small dark breeds of cattle (Scotch, Irish, and Welsh); and to numerous instances amongst birds, as the Dippers (*Cinclus*) and the Long-tailed Titmice (*Acredula*). Perhaps the most interesting parallel of all is afforded by the Song-Thrush, *Turdus musicus*³, of which it is stated that individuals which inhabit the

¹ Ann. & Mag. Nat. Hist. (7) v. p. 42 (1900).

² See Mr. W. E. de Winton's paper, "On the Hares of Western Europe and North Africa," in Ann. & Mag. Nat. Hist. ser. 7, vol. i. February 1898.

³ Howard Saunders, 'Manual of British Birds,' ed. iv. p. 3.

Outer Hebrides are, like the Lepidoptera of the same islands, small and darkly coloured.

In many cases black forms of some common species of animals occur in the British Islands or in mountains, either in certain defined areas or sporadically, but are not yet in a status to be generally recognized subspecifically. Such are the black variety of the Water-Vole, *Microtus ater* (Macgillivray); the black varieties of the Common Rat, *Mus hibernicus* Thompson; the black variety of the Squirrel, *Sciurus alpinus* Cuvier, of the Pyrenees and Alps; and the dark variety of the Common Snipe, *Gallinago colesitis sabinii* (Vigors). Such forms, however, seem to be in many ways analogous, and it is strongly to be suspected that they owe their origin to some common cause, apparently not, in the ordinary sense, a protective one.

I recognize 19 subspecies or phases of *Mus sylvaticus*, which are as follows:—

1. *MUS SYLVATICUS INTERMEDIUS*.

Mus intermedius, C. J. Bellamy, Natural History of South Devon, pp. 195 & 329-330, with woodcut (1839).

Mus campestris, J. J. J. Holandre, Faune de la Moselle, p. 24 (1836), antedated by *M. campestris*, A. G. Desmarest, Mamm. Suppl. p. 543 (1822), which is a *Mus minutus*, Pall. subsp. incert.; see De Selys-Longchamps, 'Études de Micromammalogie: Revue des Musaraignes, des Rats et des Compagnons, suivie d'un Index méthodique des Mammifères d'Europe' (Paris, 1839), and Barrett-Hamilton, Ann. & Mag. Nat. Hist., April 1899, p. 345.

Mus sylvaticus fossilis, P. Gervais, Zool. et Pal. Fr. p. 43 (1859).

Mus sylvaticus auctororum.

Type locality. Devonshire, England.

Nomenclature & Synonymy. The discovery that the original application of the name *sylvaticus* by Linnaeus referred to a distinct subspecies, makes it necessary to search for a subspecific name which shall apply to the ordinary lesser subspecies of Britain and the neighbouring continental area. The name *intermedius* of Bellamy, although undoubtedly applied to a large example, seems to be suitable for this use. It is at all events appropriate to an animal which is distinctly intermediate in its characters between several surrounding subspecies.

Description. The colour of the basal two-thirds of all the hairs at all ages and seasons is slate-grey, but this is concealed by the terminal portions, about 2 or 3 mm. in length, which are coloured quite differently and to the tints of which the animal owes its general appearance. In adults the upperside is sandy reddish brown, not usually of rich or intense tints, the lower side pure white, with a very clear line of demarcation between the colours of the two surfaces passing along the flanks, inner surface of the thighs, fore limbs, and cheeks. Many hairs of the upperside are tipped with black, especially in the median dorsal region, and these black tips, becoming greatly increased in winter, constitute

the only seasonal difference which I can discover. The presence of the black-tipped hairs on the dorsal region gives the Mice the appearance of being more darkly coloured on the back and redder on the flanks; but there is a good deal of variation, even amongst individuals from the same locality, in regard to the comparative darkness, greyness, or redness of the upperside. As a general rule, very old specimens seem to be the reddest, but I have seen very large ones which were remarkably grey. In many there is present a breast-spot of variable extent, which may in some cases extend backwards along the median ventral surface, either as a thin rufous line or as a rather broad and diffused yellowish staining of the belly.

In old nursing females the underside often becomes very bare, and may lose its pure white colour.

In immature specimens the coloured tips to the hairs are not well developed; hence young mice are always duller and more House-mouse-like on the upper surface. In some cases, as in that of a specimen from the Island of Skye, the colour, both above and below, is identical with that of typical *Mus musculus*; others are slate-grey, and one from Shetland has the upperside like that of typical *musculus* and the underside white. Some very young specimens lack the line of demarcation between the colours of the upper and under surfaces and are dark-bellied, that is to say, the white-tipped hairs are absent and the dark underfur prominent; but this condition is not invariable, and many are comparatively brown or red, although not so much so as are the adults. My remarks respecting the colour of immature specimens are mainly based on the British series at the Natural History Museum and those in the collections of Mr. W. E. de Winton and myself, consisting chiefly of specimens taken in the months of May and July: later in the autumn a pelage which more nearly resembles that of the adults is assumed. In mild climates young are born until late in the year, since two females trapped by Mr. Oldfield Thomas near Calais, France, in September were nursing; other nursing females have been trapped as late as 10th September by Mr. W. R. Ogilvie Grant in Elginshire, Scotland, and on the 8th October at South Sutor, Cromarty, Scotland, and of the form *M. s. wintoni* on Dec. 7th, by Mons. A. Robert in Haute-Savoie. It would seem, then, that specimens in immature pelage may occasionally be trapped almost throughout the winter.

Moult. The rarity of the specimens showing a moult is worth noticing, and I can only suppose that the change from one coat to the other is made gradually and in an inconspicuous manner. One of Mr. Thomas's August specimens from Holland, a male (no. 98.2.1.18), is moulting from the rufous to a duller coat, and has just a patch of the former colour on the rump, whereas the rest of the body is of a dull colour.

Dimensions. The tables (p. 423) show that this subspecies is intermediate in size between giants of its race like *M. s. princeps* and pigmies like *M. s. celticus* or *M. s. tauricus*.

Skull. The skulls of adult British examples do not usually exceed 26 mm. in total length, the more usual length being 25 mm.

Distribution. Great Britain, Ireland, and the Scotch Islands (except the localities inhabited by other subspecies, such as St. Kilda, part of Lewis (Outer Hebrides), Barra, parts of the West of Ireland, probably Shetland, and the sporadic localities occupied by *M. s. wintoni*); the Channel Islands (Alderney), Holland, Belgium, Brittany, and North-west France, parts of Switzerland, and perhaps portions of South-western France; but the exact limits of the distribution of this form are uncertain, and it is not known whether its range is clearly marked off from, or whether it intergrades with, the larger forms.

General Remarks. Excluding examples of *M. s. wintoni*, I do not find amongst specimens from the mainland of Great Britain any tangible local differences; but to insure satisfactory results in this direction, a very carefully collected set of specimens from several selected localities would be necessary. The skins from Oxfordshire and Leicestershire (both those in Mr. de Winton's and those in the British Museum collection) certainly seem brightest and reddest, but they are summer skins, and there is no conclusive series from other localities of exactly the same date with which to compare them. Further, an old nursing female taken in Glamorganshire in July is as brightly coloured as any of them. Again, specimens from the London Parks are, like the birds and Lepidoptera, very dark and smoky. I am not, however, quite able to trace beyond dispute any local British variations, other than those already mentioned, but the subject is of great interest and well worthy of the attention of British naturalists. Certainly, if there be any reliable conclusions to be drawn from recent work on the colour of mammals, the mice of Central England should be on the whole brighter and redder than those of the surrounding districts; but a study of them should be based not upon individuals, but on averages, and would need very careful procedure. It is at least confirmatory of my supposition that amongst the more remarkable individual skins which I have examined are an old nursing female from Clifton, in which there was a thick median line of yellow on the belly, and a male from Northumberland (December), in which the belly is dirty white and exhibits also a buff median line. I have not been able to separate Scotch from other British specimens.

As regards continental forms, it is probable that the further accumulation of specimens will show the existence of hitherto undetected subspecies. Thus, while those both from Brunswick, Germany, and from Belgium belong to a type which, like *M. s. intermedius* generally, may be distinguished from most Scandinavian specimens by their clearer colour both above (grey) and below (white), I fancy that, of the two, the Belgians are the less clearly white-bellied. Swiss specimens, on the other hand, seem to agree with those from Upsala, Sweden, in having the central dorsal region darker and more accentuated, and the underside duller, while those from Bergen, Norway, are redder.

Monsieur F. Lataste seems to have got upon the track of some such subspecies when he wrote¹ that in the park of M. Foucassis, Department Gironde, France, he had taken individuals "dont les teintes foncées, même en dessous, se rapprochaient beaucoup de celles de la souris." This variety he contrasts with one from the dependencies of the observatory of Pic du Midi, at an altitude of nearly 3000 metres, "et dont la robe est d'un roux vif éclatant. Plusieurs sujets de cette dernière m'ont été envoyés par M. Vaussenat;" but I suspect that, in the case of the first of these varieties, M. Lataste had to deal with immature mice.

2. *MUS SYLVATICUS CELTICUS*, subsp. nov. (Plate XXV. fig. 2.)

Type. A female, No. 0.3.11.1 (British Museum Collection), from Caragh Lake, Co. Kerry, Ireland: collected by Colonel J. W. Yerbury, on Nov. 27, 1894.

Distinguishing Characteristics. A small-bodied Field-mouse, with a very dark upperside, caused by a great increase in the number of black-tipped hairs. The underside, unlike that of *M. s. hebridensis* and *M. s. hirtensis*, is clear white, although not so clear as in *M. s. wintoni*, and the line of demarcation between the coloration of the two surfaces is sharply defined. The dimensions of ear and hind foot seem to show that these are slightly larger in proportion to the general body-size than is the case with *M. s. intermedius*. This subspecies no doubt intergrades with Irish examples of *M. s. intermedius*. Thus Col. Yerbury's specimens are the most and Mr. Passingham's the least accentuated specimens which I have seen.

Skull as in *M. s. typicus*; total length about 25 mm.

Distribution. West of Britain, I have seen specimens from Caragh Lake, Co. Kerry (Col. J. W. Yerbury), from Fermoy, Castlegregory, in the same county (Mr. G. A. Passingham), as well as from Woodpark, Co. Galway (Mr. R. F. Hibbert). These specimens are matched exactly in colour and size by three from Eisken, in Lewis, Outer Hebrides (Major H. D. Thornycroft), and one from Skye (Mr. J. Steele Elliott). A similar one from Oporto, Portugal, collected by Mr. James Searle, may be an accidental variety or may indicate the occurrence of this small dark form in other parts of Western Europe.

General Remarks. So long ago as 1841 the late Rev. Leonard Jenyns (afterwards Blomefield) received from the County of Kerry, Ireland, some long-tailed Field-mice, one of which was taken at an altitude of 2500 feet. He at once noticed that they differed from the typical *Mus sylvaticus* "in being of a darker colour, smaller, and with some of the relative proportions rather less"², and suggested the occurrence of an interesting local race in these mountains. Not being, however, in possession of a satisfactory series, he wisely refrained from giving a name to his specimens.

Then followed the age of inexactness, during which Jenyns's mice,

¹ Act. Soc. Linn. de Bordeaux, xxxviii. p. 33 (1884).

² Ann. & Mag. Nat. Hist. vol. vii. p. 268, June 1841.

like so many other local forms, were put aside with the remark that they could be only regarded as "varieties of *Mus sylvaticus*"¹. Irish naturalists, however, well knowing the tendency of the elements of our fauna to become darker in the west of the country, have all along suspected that Jenyns's suggestion was well worthy of attention. Hence they have been gradually accumulating a series of Field-mice from Ireland, with the result that I think I may now say definitely that we have, in the west of Ireland, a small dark subspecies of Field-mouse, which nearly corresponds to Jenyns's description, and which is quite unlike the Field-mice of the greater part of Europe, of England, or, what is equally interesting, of the east and centre of Ireland. For this small subspecies I propose the name *Mus sylvaticus celticus*.

The first specimens of this Mouse received at the Museum were a series of six, collected by Col. J. W. Yerbury, at Caragh Lake, Co. Kerry, between Nov. 27th and Dec. 1st, 1894. These, although some allowance must be made for the winter coat, are darker and smaller than any English specimens which I have seen even of that season. In spite of these characters, I at first hesitated to regard the specimens as conclusive evidence of the truth of Jenyns's hypothesis. It was possible that in such a mild climate the mice might continue breeding to a late date in the year, so that examples showing the characteristics of immaturity might be obtainable even in December, and hence Col. Yerbury's specimens might possibly be regarded as not wholly adult. The colour of the underside, however, did not suggest immaturity, it being as white and as clearly marked off from that of the upperside as in any English examples, nor were the skulls those of immature specimens. Hence I felt sure that I should eventually obtain others like them from the west of Ireland. These were forthcoming in 1896, when Mr. R. F. Hibbert sent me four small dark Mice from Woodpark, Co. Galway. The date at which they had been taken (February and March) was such as to almost preclude the possibility of their being immature, and they were further supplemented by a third set of the small dark western Mouse sent by Mr. G. A. Passingham, from Fermoy, Castlegregory, in the very same county which had produced both Jenyns's and Colonel Yerbury's specimens.

The interest of these specimens was heightened when I found them exactly matched in colour and size by three collected at Eisken, in Lewis, in the Outer Hebrides, in October and November 1895, and by one sent to the British Museum of Natural History by Mr. J. Steele Elliott, from Skye, in the same year. These specimens seem to indicate that this small Western subspecies of *Mus sylvaticus* is not confined to the west of Ireland, but is found in similar localities in the Western Scotch Isles. The late date of capture (June 24th) of the Skye specimens shows that the dark colour is not characteristic of winter, but is retained throughout the year. It is remarkable that I should have seen a perfectly similar

¹ See Bell's 'British Quadrupeds,' ed. ii. p. 296 (1874).

specimen collected at Oporto, Portugal, by Mr. James Searle, on December 12th, 1896; but too much must not be inferred from a single specimen, which may possibly indicate the existence of *Mus s. celticus* in the west of Portugal, or may be only an accidental variety. Blasius, however, knew of the occurrence of dark Field-mice in the higher mountains of Europe¹. This single specimen from Oporto, whatever it may be, is certainly very unlike the ordinary Portuguese Field-mice.

A remarkable fact is the occurrence of this mouse on the same island (Lewis) as the very distinct *M. s. hebridensis*, which is one of the larger forms of Field-mice. I am informed by Mr. de Winton that the latter keeps to its own part of the island, and that probably the two do not intermingle. It is curious that while a big and little form of *Mus sylvaticus* occur here side by side, each finds a different method of fitting itself for the damp dull climate of the west.

It is interesting to find that the Field-mice of the centre and east of Ireland are normal, and, as far as I can make out, show neither any darkening of the colour of the upper surface nor any diminution of size. Among these normal Irish mice must be included specimens from Ballaghmoon, Co. Carlow (Mr. J. G. Symes), from Cashel, Co. Tipperary, and from the neighbourhood of Arthurstown, Co. Wexford, together with those in the Dublin Museum from Cos. Dublin, Wicklow, and Louth.

3. MUS SYLVATICUS HEBRIDENSIS.

Mus hebridensis, W. E. de Winton, Zoologist, Oct. 1895, p. 369.

Mus sylvaticus hebridensis, W. E. de Winton, Zoologist, Nov. 1895, p. 426.

Type. No. 95.10.25.1 (British Museum Collection), from Barra, Outer Hebrides (W. E. de Winton).

Distinguishing Characteristics. Resembles *Mus sylvaticus intermedius* in general form and colour, but is larger (about equal to *M. s. wintoni*), and has proportionately smaller ears, larger hind feet (especially stout in males), shorter and thicker tail, and generally stouter build. The colour of the upperside is more uniform and less bright than in *M. s. intermedius*; that of the underside is "generally dusky or sandy, with no distinct line between the upper and under parts" (de Winton); that of the tail is almost uniformly "brownish grey."

Skull large: total length of that of the type specimen 27 mm.

Distribution. The islands of Lewis and Barra in the Outer Hebrides.

General Remarks. This island-form was first obtained by Mr. J. Steele Elliott; but to Mr. de Winton is due the credit of having written the first published notice² of so interesting an addition to the British fauna.

¹ Säugethiere Deutsch. p. 324 (1857).

² Ann. Scott. Nat. Hist., Jan. 1895, p. 53.

This gentleman, to whose kindness I am indebted for permission to examine the whole of his interesting series of 14 specimens of this subspecies, has drawn my attention to the curious fact that the young males appear to lose the dull hues of immaturity of the upperside, and to don the reddish colour of maturity, at an earlier age than do the females, so that young males and females of the same age are actually distinguishable by their colour alone. If this be so, it would seem to be a quite unique case in the Rodentia, an order among the species of which, as I am informed by my friend Mr. Oldfield Thomas, sexual differences are excessively rare.

4. *MUS SYLVATICUS HIRTENSIS*.

Mus hirtensis, Barrett-Hamilton, Proc. Zool. Soc. 1899, p. 81.

Type. No. 94.7.16.1 (British Museum collection), a young male collected by Mr. J. Steele Elliott at St. Kilda.

Distinguishing Characteristics. Closely allied to *M. s. hebridensis*, from which, however, it differs in its slightly larger size, and also in the greater amount of buff or yellowish-brown coloration on the underside. Like *Mus s. hebridensis*, it differs from *M. s. intermedius*, apart from its greater size, in the more uniform coloration of the upper surface of the body, in the absence of the clearly defined white underside, and in the longer feet and shorter ears.

The *skull* is similar to that of *M. s. hebridensis*, but appears to be slightly larger, reaching a length of 29 mm., and equalling in size that of the largest specimen of *M. s. wintoni*.

Distribution. Known only from the island of St. Kilda.

General Remarks. This is another interesting insular development of *Mus sylvaticus*, the status of which has been already discussed (*op. cit.*). Like *M. s. hebridensis*, it seems to have been first obtained by Mr. J. Steele Elliott, who presented the type specimen¹ to the British Museum in 1894. This was supplemented by a series procured for me by my friend Mr. Henry Evans, of Jura, Scotland, in 1898. I have already suggested the possibility that this Mouse may be indigenous to St. Kilda, a suggestion which is heightened by the fact that, as Mr. Steele Elliott informs me, "there is no landing-place at St. Kilda, so rats and mice stand a poor chance of getting on the islands from any boats that call, especially as provisions taken on are also very limited"².

5. *MUS SYLVATICUS TYPICUS*, Linnæus, Syst. Nat. ed. 10, 1758, p. 62.

Mus flavicollis, H. B. Melchior, Den danske Stats og Norges

¹ Trapped in a hole in a loose stone wall at a height of about 6 feet from the ground.

² Mr. R. M. Barrington writes me that when he was at St. Kilda in 1881 he found a dead and dried specimen on the headland opposite the Doon, but, unfortunately, did not preserve it.

Pattedyr, p. 99, pl. i. (1834); *nec* A. Dehne, W. E. de Winton et aliorum (vide sub *M. s. wintoni*).

Type locality. Upsala, Sweden.

Nomenclature and Synonymy. Melchior's *M. flavicollis* must stand as a synonym of *M. s. typicus*, since I find that the Mice of Hilleröd, in Zealand (an almost toponymical locality for the former name), belong to the latter form, as shown by a collection made there by Mr. Oldfield Thomas. This is unfortunate, since the name *flavicollis* had, on the initiative of Mr. de Winton, been applied to its British representative, for which, therefore, a new name must now be instituted.

Distinguishing Characteristics. A greyish Mouse, with rather dark central dorsal region, resembling the subspecies *wintoni* in size, but slightly smaller, and with the white of the underside far less pure, the chest-band less prominent, and a slight tendency to display a washing of yellowish colour on the underside.

Distribution. Parts of Denmark, Norway, Sweden (I have seen specimens from Laaland, Denmark; Bergen, Norway, and Upsala, Sweden), and, possibly, the southern shores of the Baltic. Specimens from Brunswick, Germany, are intermediate between this and other subspecies.

General Remarks. Linnæus may possibly not have had an adult before him when he wrote his original description of *Mus sylvaticus*, which runs as follows:—"M. cauda mediocri, palmis tetradactylis, plantis pentadactylis, corpore griseo pilis nigris, abdomine albido." This would apply very well to a not quite mature animal. At all events the Long-tailed Field-mice of the localities given above are distinguishable from those of other parts of Europe. In size they are intermediate, being not so large as *M. s. wintoni*, but larger than *M. s. intermedius* from Ireland, England, and the neighbouring continental areas. The Mice of Brunswick seem to connect this subspecies and the larger *M. s. wintoni* and *M. s. princeps*. A series obtained there by Mr. J. A. Loring are smaller and less bright than other specimens which I have seen, notably a set procured by myself in 1894.

It is through the courtesy of Mr. G. S. Miller, Junior, who sent me over two specimens collected by Mr. J. A. Loring at Upsala, that I am enabled to know definitely what the Mouse which Linnæus described is really like. It seems to be a reduced and dulled edition of *M. s. wintoni*.

I strongly suspect, however, the existence of two subspecies in the Scandinavian Peninsula, but the material at my disposal is not yet sufficient for their proper differentiation. The skins which I have examined suggest the inference that those from Bergen are redder on the flanks, darker on the central dorsal line, and yellower beneath than those from Upsala, which latter agree with skins from Meiningen, Germany, and are not so red on the flanks, nor so dark on the central dorsal line; all the Scandinavian and Meiningen specimens possess a breast-band or spot, and in two or three individuals there is a wash of yellow continued right along the

median ventral line. But these differences, if real, are minute, and I should like to see them substantiated by the accumulation of far ampler material before recognizing them subspecifically.

6. *MUS SYLVATICUS CELLARIUS*.

Mus cellarius, J. F. Fischer, Zool. Gart. vii. p. 153 (1866), and xiii. pp. 223, 224 (1872).

Type locality. Cellars at or near St. Petersburg, Russia.

Nomenclature. The inappropriate name *cellarius* must unfortunately apply to the subspecies of the St. Petersburg district, since there can be no question that Fischer's *Mus cellarius* was simply a cellar-haunting individual of *Mus sylvaticus*, at first described by him as a variety, but later accorded full specific rank.

Distinguishing Characteristics. I am uncertain as to the appearance of this form, having never seen a skin of it. Mr. G. S. Miller, Junior, has, however, been good enough to send me over a single skull (No. 3616 of his own collection), which must be regarded as topotypical of the subspecies. The skull is a large one, differs radically from that of *M. s. typicus*, and has apparently its nearest relative in *M. s. princeps* of Roumania, a supposition which gains support from the fact that Mr. Miller writes of the skin, which he had unfortunately mislaid and therefore was unable to send to me, that it is simply a huge *sylvaticus*. The skull has a greatest length of 27 and a greatest breadth at the zygoma of 14 mm., so that while far larger than that of *M. s. typicus*, it is not so large as that of *M. s. princeps*, the largest skull of which has a total length of nearly 30 mm. It is a shorter-nosed and more compactly framed skull than is that of *M. s. princeps*, to which, however, it must be very closely allied.

Distribution uncertain, at present only known from the type locality. Probably the neighbourhood of St. Petersburg and the adjacent parts of Russia.

7. *MUS SYLVATICUS WINTONI*, subsp. nov.

Mus sylvaticus var. *flavicollis*, A. Dehne, Allgem. deut. naturh. Zeit. p. 182 (1855).

Mus flavicollis, W. E. de Winton, Zoologist, Dec. 1894, pp. 441-445; nec Melchior, Danske Stats og Norges Pattedyr, p. 99, pl. i. (1834).

Type. A male, No. 0.3.12.1 (British Museum Collection), Graftonbury, Herefordshire, 8th June, 1894 (W. E. de Winton).

Synonymy and Nomenclature. For the original description of this fine Mouse we are indebted to Mr. W. E. de Winton, who discovered it at Graftonbury, Herefordshire. In his anxiety to avoid the rash institution of a new name, he was led to identify it with Melchior's *Mus flavicollis*. Since, however, a series of Long-tailed Field-mice procured by Mr. Oldfield Thomas at Hilleröd, Zealand, Denmark—a locality almost topotypical of Melchior's

Mouse—prove to be different from the present form and identical with Mice from Scandinavia, it is unfortunately necessary that *Mus flavicollis* Melchior should stand as a synonym of *Mus sylvaticus typicus* Linn. Mr. de Winton's discovery, therefore, needs a new name, and I now take the opportunity of connecting it with its discoverer, to whose excellent field-work amongst British Mammals we owe our knowledge not only of this, but of the Hebridean subspecies. The use of the name *flavicollis* by other writers, such as Dehne, was probably in connection partly with *M. s. typicus* and partly with *M. s. princeps*, so that a certain amount of nomenclatural confusion cannot well be avoided.

Distinguishing Characteristics. Generally speaking, a remarkably finely developed *Mus sylvaticus*, in which the size is above the average, and the colours both of the upper and under sides are very pure and intense. Specimens of all ages usually, but by no means always, possess a well-defined breast-band, "about 8 mm. broad, passing along the chest, immediately in front of the fore legs, with a cross or longitudinal stripe in the centre extending forward about 5 mm., and back along the sternum about 10 mm., where it is entirely lost, unlike the slight dash of colour so frequently found on the chest of *Mus sylvaticus*, and which varies from the smallest spot on the breast to a decided yellow-brown tinge extending over the whole belly" (de Winton, *op. cit.*). The tail is longer than in *M. s. intermedius*; and Mr. de Winton gives the number of vertebræ as 30, as against 27 only in the latter subspecies. From *M. s. princeps* it may, perhaps, best be distinguished by its slightly duller colour and the more frequent occurrence and greater extent of the breast-band. Western specimens show the greatest development of the breast-band, which seems to become less conspicuous towards the east.

Skull larger and stronger than in *M. s. intermedius*, reaching a total length of 27 mm. and upwards.

Distribution. Sporadically distributed in colonies amongst *M. s. intermedius* in England, but replacing it eastwards. From England I have seen specimens from Graftonbury (de Winton) and Bishopstone, Herefordshire; Oundle, Northants (the late Lord Lilford); Sussex, Suffolk, and Northumberland. On the Continent it seems to become more dominant towards the east, until it must somewhere intergrade with its eastern representative, *M. s. princeps*, which appears to be the only form in Roumania, and perhaps also in S. Russia. Towards Denmark and in the neighbourhood of the South Baltic it is replaced by *M. s. typicus*, *M. s. cellarius*, or by intermediate forms, a set of which I have myself trapped at Brunswick. There are in the British Museum specimens from Tharand, Saxony; Magdeburg; Haida, Bohemia; Niesky, Silesia, and from Western Hungary. So long ago as 1855 A. Dehne (*op. cit.*) recognized a big Field-mouse with golden collar and long tail as not rare in the district of Pirna in Saxon Switzerland, while Prof. Nehring¹ states that there are specimens in the

¹ Katalog der Säugethiere, p. 13 (1886).

Berlin Museum from Rügen. Lastly, a set of eight males and three females collected by Mons. A. Robert at Lucinges, Haute-Savoie, in December 1899, at an altitude of 1100 metres, although, perhaps, slightly smaller and darker than the largest *M. s. wintoni*, and with the chest-spot less strongly developed, agree so closely with this form in the length of tail, coloration of the underparts, and general appearance, that I prefer to unite them with it, at least provisionally. This form doubtless occurs also in numerous other localities.

General Remarks. It cannot be denied that the treatment of *M. s. wintoni* at first presented a good many difficulties, at least as long as we knew it only from isolated localities. It seemed impossible that a large and small form of *Mus sylvaticus* could occur intermingled throughout the same area without interbreeding. Despite the assertion of Mr. de Winton, who has had such exceptional opportunities of studying these mice in Herefordshire, that the two forms keep quite separate, breed true, and show no intermediates, I was for a long time inclined to treat them as two parallel forms of one dimorphic animal. Even after colonies had been found on the Continent the difficulty remained, and was not dispelled until I had had the opportunity of working out a collection of small mammals taken by the late Mr. W. Dodson in Roumania, and which contained a fine series of the local form of *Mus sylvaticus* of all ages. These all proved to be very different from *M. s. typicus*, and are a bright Eastern representative of *M. wintoni*, which I have now no hesitation in regarding as the Western sporadic representative of the large East European Field-mouse (*M. s. princeps*).

8. *MUS SYLVATICUS PRINCEPS*, subsp. nov. (Plate XXV. fig. 1.)

Mus sylvaticus var. *flavicollis*, auctorum.

Type. Original no. 25, a female, Bustenari, Roumania, 13th April, 1899, collector the late W. Dodson: caught at foot of dead stump in oak-forest.

Distinguishing Characteristics. An extremely large Mouse apparently identical in size and proportions with *M. s. wintoni*, but adults are even brighter red in colour above and purer white on the underside. Many examples possess a breast-spot or band, but this character is not universal, and the band is not so extensive as in *M. s. wintoni*. Immature specimens are very blue, and resemble the young of *M. s. draco*; they frequently retain the dark colour of the upperside until they are fully as large as adults of *M. s. typicus*.

Skull. A large massive edition of that of *M. s. typicus*, reaching a total length of from 27 to nearly 30 mm.

Distribution. This was the only Long-tailed Field-mouse obtained by W. Dodson in Roumania, whether in the beech and oak forests of Bustenari, in the Carpathians N.W. of Bucarest, at a height of 480 metres; at Comana, south of Bucarest; under brushwood on a high plateau near Breba, a large and highly cultivated valley amongst

the Carpathians; or in the comparatively flat cultivated country at Gageni, at the foot of the Carpathians, north-west of Bucarest. Radde's description of the form found in the Caucasus, the Crimea, and in Western Siberia shows that a band of large *sylvaticus*-like Mice extends eastwards right into Siberia until in the East they meet the subspecies *M. s. chevrieri*; but, in the absence of specimens, it is impossible to lay down the exact relationships of these forms, or to state where one ends or the other begins. A single young specimen from Montenegro seems to belong to *M. s. princeps*, and, as has been stated above, a set from Haute-Savoie are in certain respects intermediate between this form and *M. s. wintoni*, with which form it must intergrade in various localities.

General Remarks. *M. s. princeps* is undoubtedly a bright East European representative of *M. s. wintoni*. For our knowledge of it we are indebted to the late Mr. W. Dodson, whom, through the liberality of the late Lord Lilford, I was enabled to send on a collecting trip to Roumania in the spring of 1899. Mr. Dodson brought back a fine series of 44 examples of all ages and sexes, showing that this form occurs in the regions which he visited to the apparent entire exclusion of the smaller forms of Long-tailed Field-mice.

This Mouse seems to breed in early spring, for amongst Mr. Dodson's specimens is a young one caught on April 15th, 1899, which, although attaining to a head and body length of 87 mm., was still in the slaty-coloured pelage of immaturity.

9. MUS SYLVATICUS ISLANDICUS.

Mus islandicus, F. A. L. Thienemann, Nat. Bemerk. ges. auf einer Reise im Norden von Europa, p. 153 (1824).

Type from Iceland? non existent; a co-type in Brit. Mus. of Nat. Hist., no. 45.11.15.17, received from Dr. Thienemann.

Description. "M. cauda corpore æquanti supra e fusco cinereus subtus albus." Seems to be smaller than ordinary *M. sylvaticus*.

Distribution. Iceland.

General Remarks. It has long been known that small rodents of some sort are found in Iceland, and there have been many discussions as to the exact nature of them. Some naturalists have supposed that they are Lemmings¹; but it is now certain that some forms both of *Mus sylvaticus* and of *Mus musculus* occur in the island. The Rev. H. H. Slater has been good enough to inform me that, while both species occur on the coast, the former is the House-mouse and the only species of the interior. Thienemann's description, although it gives no characters whereby *M. s. islandicus* may be distinguished from the Mice of other localities, and although he was himself of the opinion that his Mouse presented some of the characters both of *Mus sylvaticus* and of *Mus musculus*, clearly

¹ See the remarks of J. Steenstrup in 'Videnskabelige Meddelelser fra den Naturhistoriske Forening i Kjöbenhavn,' pp. 51-66 (1867), translated in the Ann. & Mag. Nat. Hist. ser. 4, iii. pp. 445 &c. (1869).

applies to some form of *Mus sylvaticus*¹. His description is certainly borne out by one of his specimens now in the British Museum of Natural History (no. 45.11.15.17), which, although an old and faded skin, and of little use for a careful and accurate examination of its characters, undoubtedly belonged to a *Mus sylvaticus*-like Mouse. I cannot distinguish the skull by any cranial or dental characters. The ears and feet of this specimen would appear to be rather shorter than in ordinary examples, as is also the case with the dimensions of two specimens in alcohol from the Gerbe collection as given by Mons. F. Lataste. Lastly, Herr Herluf Winge, to whom I wrote for information regarding the specimens in the Danish Museum at Copenhagen, has been good enough to inform² me that the Museum possesses four Icelandic specimens of *Mus sylvaticus*, "two skins and two spirit-specimens, all of them looking very ordinary, quite resembling Danish specimens." The measurements sent me by Herr Winge are not smaller than those of average *sylvaticus*.

There can be little doubt that the Field-mouse of Iceland is very close to that of Europe, and can only be regarded as subspecifically distinct.

10. *MUS SYLVATICUS* HAYI.

Mus hayi, G. R. Waterhouse, Proc. Zool. Soc. 1837, p. 76.

Type from Tangier, Morocco, no. 52.9.13.9 (British Museum Collection), in alcohol, from the collection of the Zoological Society of London.

Nomenclature. *Mus hayi* Waterhouse is simply *Mus sylvaticus* of Morocco.

Distinguishing Characteristics. This subspecies can only be described at present from its negative characters. It is not a large bright Mouse like *M. princeps*, but its size exceeds that of *M. s. intermedius* of England, and it has in addition the tail usually longer than the head and body.

The *skull* commonly reaches a length of 26 mm.

Distribution. For the present I am obliged to include under this name the Long-tailed Field-mice of Morocco, Spain, Portugal, and the neighbouring countries, including those of the Mediterranean islands. Of these I have seen specimens from Corsica and Sicily, the latter of which, however, have a name ready for them in *Mus dichrurus* Rafinesque.

Later investigations will probably show the existence of more than one subspecies in these regions. Thus some specimens from Villabra, Galicia, Spain, are small and very red; they come from a height of 1300 metres, and probably indicate the existence of more than one subspecies in Spain.

¹ Although Rüppell, who seems to have examined the original specimen of Thienemann, has declared it to be a *Mus musculus*, a piece of information for which I am indebted to Herr H. Winge.

² *In litt.* of 14th April, 1899.

[*Musculus dichrurus*, C. S. Rafinesque, Précis des Découvertes et Travaux somiologiques, p. 13 (1814).

Myoarus sicula, Lesson, Man. de Mam. p. 27 (1827).

Mus sylvaticus, J. H. Blasius, Säugethiere Deutschlands, p. 322 (1857); Barrett-Hamilton, Ann. & Mag. Nat. Hist. ser. 7, vol. ii. p. 426 (Nov. 1898).

Type locality. Sicily.

Synonymy and Nomenclature. The substitution of the generic name *Musculus* for that of *Mus* is explained by Rafinesque under heading of his *Musculus frugivorus* (= *alexandrinus*, Is. Geoffr.) in the same work. He simply writes "J'ai changé le nom trop court et équivoque de *Mus* en *Musculus*."

Description and General Remarks. In the absence of a series of the Long-tailed Field-mouse of Sicily I am as yet unable to decide whether it be distinct or not. Mr. J. I. S. Whitaker has sent over one or two specimens for identification, which, however, do not form material sufficient to enable me to make a thorough comparison. They seem to vary a good deal amongst themselves, one being very red in the colour of the upperside and another very much duller. The size seems to be larger than that of *M. s. intermedius*.]

11. MUS SYLVATICUS ALGIRUS.

Mus algerus, Pomel, Compt. Rend. Ac. Sc. Paris, xlii. p. 654 (1856); nec Loche, Rev. et Mag. de Zool. p. 49, pl. i. (1858), and Expl. de l'Algérie, sp. 78 (1867).

Type locality. Algeria.

Synonymy and Nomenclature. There can be no doubt that Pomel's name refers to the Long-tailed Field-mouse of Algeria, and, as this name exists, I propose to treat the form as subspecific, although, as in other cases, I have no series of specimens.

Distinguishing Characteristics. There is only one specimen of *Mus s. algerus* in the British Museum of Natural History, but that one, no. 52.5.27.62, although a very old French skin, is so peculiar in appearance that I think it very probably represents a distinguishable subspecies. The skin is a small one, but the coloration suggests that it is that of an adult, the underside being very white and the upperside almost chocolate in tint.

The original description ran as follows:—"Pelage d'un gris-brunâtre, teint de jaune ou de roussâtre, mêlé de quelques longs cils noirs; parties inférieures du corps, face interne des membres et pieds blanchâtres; parfois une tache rousse à la poitrine; talon brun; oreilles presque rondes, courtes, avec une petite touffe devant le méat; une tache blanchâtre derrière l'oreille; queue grise dessous, brunissant de plus en plus vers le bout. Le corps mesure 0m.,075; la queue 0m.,060.

"Habitat des terriers dans les cultures et les broussailles; quelquefois entre dans les maisons des campagnes."

Distribution. According to Lataste, the Long-tailed Field-mouse has been recorded for Barbary by Poiret, who states that he found

it in great quantities in the cultivated fields¹. Rozet has indicated its occurrence in the neighbourhood of Oran². Loche found it about Algiers; and, finally, Lataste³ himself took it in the plain of Mitidja, at Arba, near Algiers, and in the fields of Azesga, to the north-east of Fort National, "en Kabylie." Lataste did not find it so commonly as Rozet would have led him to expect, and he supposes that that author had confounded several other species with the present one.

This species is not included in Lataste's work on the Mammals of Tunis⁴, so that I presume that it does not occur in that country.

General Remarks. Lataste⁵ states that sometimes the back shows "d'un brun plus terne, et le gris domine sur les faces inférieures," which variation appears to be produced especially in the "pays méridionaux," and he has noted this variety also from Cardillac, Gironde, France, from Ciudad Real, Spain, and from Algeria. Side by side with this he states that he has met some individuals, generally young, which in coloration only were indistinguishable from common Mice. He adds (footnote) that these colours get clearer in alcohol, and after a time such specimens in alcohol are indistinguishable from the normal specimens.

12. *MUS SYLVATICUS TAURICUS*, subsp. nov.

Mus sylvaticus, C. G. Danford and E. R. Alston, P. Z. S. 1880, p. 62.

Type. No. 77.8.13.9 (in alcohol) (British Museum Collection), from the Zebil Bulgar Dagh, Asia Minor, collected by Mr. C. G. Danford, on the 5th January, 1876.

Distinguishing Characteristics. This single specimen from Asia Minor cannot be identified with any known form of Long-tailed Field-mouse. It cannot be placed either with the large Mice of Eastern Europe, or with the not very much smaller *M. s. arianus* of Asia. The skull, although the teeth are worn, has a total length of only 23 mm., and is thus smaller even than the smallest Western European subspecies.

Distribution. Uncertain: only known from the type specimen.

General Remarks. Perhaps the nearest ally of this little Mouse is *M. s. algirus*, another little known subspecies. It may be a parallel form to the small Weasel of the Caucasus and Asia Minor, to which I have recently given the subspecific name of *M. nivalis caucasicus*.

13. *MUS SYLVATICUS MAJOR*.

Mus sylvaticus var. *major*, G. Radde, Reis. Sib. i. p. 180, pl. v. figs. 3 & 4 a (1862).

¹ Voyage en Barbarie (1789).

² Voyage dans la Régence d'Alger (1833).

³ "Faune des Vertébrés de Barbarie," Actes Soc. Linn. Bordeaux, vol. xxxix. p. 135 (1885).

⁴ Catalogue critique des Mammifères apélagiques sauvages de la Tunisie (Paris, 1887).

⁵ "Note sur les Souris d'Algérie," Act. Soc. Linn. Bord. vol. xxxvii. pp. 17-18 (1883).

Antedates *Mus wagneri* var. *major*, N. Severtzoff, 1876 (see under *M. s. arianus*), and *Mus decumanus* var. *major*, B. Hoffmann, Abh. Zool. Mus. Dresden, 1887, p. 18.

Mus chevrieri, E. Büchner, Wiss. Res. der von N. M. Przewalski nach Central-Asien unternommenen Reisen &c., Säugethiere, p. 92 (1889).

Type: unknown (? in the Caucasian Museum at Tiflis).

Distinguishing Characteristics. I have no specimens of this Mouse at my disposal. Radde describes it as a large *sylvaticus*, resembling, but distinguishable from, the larger Eastern European Mice.

Distribution. Of the distribution of this, the Western Siberian representative of *M. s. princeps*, we have no exact knowledge, but we know that Herr Radde found *Mus sylvaticus*, of one form or another, wherever he journeyed in Western Siberia. With this form I must place, at least provisionally, Przewalski's specimens as described by Herr Büchner. Przewalski found *Mus sylvaticus* in the mountains of Ganssu, Ala-schan, to a height of 8000 metres, and it is recorded for the Muni-ula, where it lives in holes in meadow-lands.

14. MUS SYLVATICUS ARIANUS.

Mus sylvaticus, F. de Filippi, Viagg. Persia, p. 344 (1865); K. Satunin, Mammals of Caucasus, p. 305, &c.

Mus erythronotus, W. T. Blanford, Ann. & Mag. Nat. Hist. xvi. p. 311 (1875); Eastern Persia, Zool. & Geol. vol. ii. pp. 54-55, pl. v. fig. 3 (1876); Mammals of Yarkand Expedition, p. 54 (1879) (nec *Mus erythronotus*, C. J. Temminck, Fauna Japonica, Mamm. p. 50, 1850).

Mus arianus, W. T. Blanford, Ann. & Mag. Nat. Hist. vii. p. 162 (1881).

"*Mus wagneri*, var. *major* (*M. tokmak* n. sp.?)," Severtzoff, Proc. Mosc. Soc. Nat. vol. viii. p. 2 (1873), translated by J. Carl Craemers in Ann. & Mag. Nat. Hist. xviii. 1876 (see p. 53); Blanford, Mammals of Yarkand Mission, loc. cit.; E. Büchner, op. cit. p. 90; W. L. Sclater, P. Z. S. 1890, p. 528.

Typical series. Four specimens from Kohrúd, between Isfahan and Teheran, in Northern Persia, altitude 7000 feet (Indian Museum at Calcutta), and one, no. 74.11.21.22, anno 1872 (British Museum Collection).

Nomenclature and Synonymy. The name *erythronotus* Blanford, being preoccupied by *erythronotus* Temminck, the former naturalist renamed his species *arianus*, under which name I have to designate, for the present at least, the Mice from very widely separated localities and which probably include several distinct subspecies. Severtzoff's subspecific name is preoccupied by Radde's *Mus sylvaticus* var. *major*. *Mus wagneri* itself is a *Mus musculus*-like Mouse. Severtzoff's original description is, as Blanford has pointed out (Mamm. Yark. Mission, p. 54), insufficient to enable his species to be recognized, and it is far from clear whether "*M. tokmak*" is proposed as a name, Tokmak being "the name of a town between Vernoe and Auliáta, lying north-west of Lake Issik and nearly due

north of Káshgar." Further, the types seem to have been lost, being neither in the Museums of St. Petersburg or of Moscow. The usual course would, therefore, have been to have consigned Severtzoff's name to the list of those of unrecognizable species: and this I should have done, had not Herr Büchner, who had under his examination a large number of typical *Mus wagneri* from Turkestan, and who noticed that Severtzoff mentions no *sylvaticus*-like Mouse in his account of the Mammals of that region, bracketed *Mus wagneri major* with *Mus arianus*. I am, therefore, glad to follow Herr Büchner on that point. When, however, we do receive a series of the representative of *Mus sylvaticus* from Turkestan, I should not be surprised if it prove to be neither the subspecies *arianus* nor any other known subspecies.

Distinguishing Characteristics. Although there is no doubt that it is extremely close to *Mus s. intermedius*, like some other geographical forms of *Mus sylvaticus*, *M. s. arianus* was originally described as if it were something so distinct in itself as to need no comparison with any other species; hence no particular characters are laid down in the original description whereby the two may be separated. It agrees with *Mus s. intermedius* of England in general appearance and in the number of the mammæ, and Mr. Blanford's plate in 'Eastern Persia' would do very well for a specimen from Western Europe; but it appears to differ in the lesser size and length of the hind feet, and is said to be never of so intense a red-brown colour on the upper surface. Probably, had we a series from the distant regions where it is found, we should find other points of difference. The colour of the underside of the specimens examined by Herr Büchner was not, as in Mr. Blanford's examples, white, but golden grey (gelblichgrau), with a sprinkling of grey hairs, and there was no breast-spot; but, as has been said above, it is more than likely that several distinct subspecies have been confounded under the name of *arianus*.

I have no series of this Mouse before me, the only specimens at my disposal being no. 74.11.21.22 (1730 *a*), the skull of a female and one of Mr. Blanford's co-types; no. 96.11.2.1, a female in alcohol from Gulmerg, Cashmere, 5000 ft. (Dr. E. T. Aitchison); and a third specimen in alcohol, no. 91.93.20.15, with the mammæ as in *Mus sylvaticus*; so that I am quite unable to give a decided opinion as to the exact appearance of this form, but must follow Mr. Blanford and other naturalists in considering it distinct. Neither can I lay down any characters which will help to distinguish the skull from that of *M. s. typicus*. The skull certainly appears to be more massive and stronger than the skulls of Western European examples; but it is probable that the cranial characters given by Mr. Blanford¹ would not stand the test of

¹ It may perhaps be well to summarize these, as given by Mr. Blanford in the J. A. S. B. xlviii. pt. ii. (1879):—The occipital portion of the skull and the foramen magnum of European specimens is higher in proportion to its breadth than in *M. s. arianus*; the opening of the posterior nares is narrower, the breadth being less than that of the anterior upper molar, whereas in a skull

comparison with a series of specimens from Western Europe. It is very unfortunate that, whereas Mr. Blanford's original description was taken from the Kohrüd specimens, he afterwards obtained his cranial characters from a specimen from Wakhán, which may have belonged to quite a different subspecies. At all events the cranial characters as laid down by him, and in particular that of the size of the last upper molar, will not apply to his original specimens (skull no. 74.11.21.22, ♂, Persia).

Distribution. So far as our present information goes, and the name being used in the wider sense indicated above, it would appear that *Mus s. arianus* has a wide distribution. Mr. Blanford remarks¹ that "a species apparently identical with the Persian Mouse was collected by the late Dr. Stoliczka² in Wakhán, a province on the Upper Oxus belonging to Afghanistan, and at Kashgar, in Eastern Turkestan; and the same form has since been found by Major Biddulph and Dr. Scully at Gilgit, in the Upper Indus Valley." Blyth³ recorded it from Cherra Punji, India; while Herr Büchner⁴ identified with this Mouse the specimens brought by Przewalski from the rivers Zauma, Ssairam-mor, and Chapzagaigol, in Central Tian-schan, and from the southern slopes of the mountains of the latter name, to a height of 7500 feet.

It is found as a "steppe-inhabitant in the Ural, as well as on the Kirgies Steppes; but in Turkestan, where *M. musculus* is absent, *M. wagneri* is the house-mouse. It is numerous in the Chimkent and Tashkent houses, where it does not differ at all from the Kirgies-Steppe specimens."⁵

De Filippi⁶ identified the Persian House-mouse as *Mus sylvaticus*, and states that the same species was brought from Shiraz by Marquis Doria. Mr. Blanford, however, declares that a specimen which he obtained from Shiraz is certainly *M. bactrianus*. Mr. Blanford had seen no specimens from Northern Persia, and thought that "although the house-mouse there may be *M. sylvaticus*, it is quite as probable that it is *M. bactrianus*."

"Even if, however, *M. bactrianus* prove to be found in houses throughout Persia, *M. sylvaticus* must also be included in the fauna, as it was found by Ménétries common on the parts of the Tálísh Mountains not covered by trees, and it is said by Eichwald to be abundant in Georgia." "Eichwald includes *M. musculus* L.,

from Wakhán the breadth exceeds that of the molar; the third upper molar of *M. sylvaticus* is about one-fourth the size of the second, whereas in the Wakhán and Gilgit skulls the proportion is one half. It should be noted that Mr. Blanford had only one skull of European *M. sylvaticus* at his disposal, and only the figures of the types from which he had described *M. erythronotus*, the specimens themselves having been mislaid. See also pages 54 & 55 of Mr. Blanford's 'Mammals of the Yarkand Expedition' (1879).

¹ J. A. S. B. vol. xlviii. pt. ii. (1879).

² "At Panja in Wakhán"—Blanford, J. A. S. B. xlv. p. 108 (1875).

³ J. A. S. B. xxiv. p. 721, & xxxii. p. 348.

⁴ *Op. cit.* pp. 90-91.

⁵ Blanford, Mamm. Yarkand, p. 54.

⁶ *Op. cit.* p. 344.

and Ménétries *M. minutus* Pall. (*M. messorius*, Kerr), in the fauna of the Transcaucasian provinces. The latter probably may extend into Persia, but de Filippi particularly noticed the absence of *M. musculus* in the north-western part of the country, where he says it is replaced by *M. sylvaticus*.¹

Of the Caucasus, Rosikoff states² that *M. sylvaticus* is very common in the whole of the region; but in a second publication³ he alludes only to *M. arianus*, so that, as Satunin remarks, it is difficult to ascertain which species really occurs in Malkathales. Satunin himself supports Rosikoff's second opinion.

As regards the Transcaucasian Field-mouse, Satunin himself states that it is difficult to properly name the specimens, since they present characters of both species, but he thinks that on the whole they agree better with *M. sylvaticus*. He finds typical *sylvaticus* at Tiflis.

General Remarks. There can be little doubt that there has been a considerable confusion, perhaps of two or three separate forms, amongst the naturalists who have written of *M. s. arianus*; but for the present, and in the absence of an adequate series of specimens, I must follow Mr. Oldfield Thomas, and regard all the small-footed Central Asian individuals of *M. sylvaticus* as belonging to this form.

Even Mr. Blanford's belief in his own species seems to have become a little shaky, since he wrote⁴ in 1879 that "it is by no means certain that this form may not pass into the Eastern races of *M. sylvaticus*; and it requires comparison with *M. sylvaticus*, var. *major* of Radde; but . . . it appears to be a well-marked type, with a wide distribution in Central Asia."

The best remarks on this form are, I think, by Mr. Oldfield Thomas⁵, who notes the close, almost identical, proportions of *M. arianus* and *M. sylvaticus*, the shorter foot of *M. arianus* (as compared with English examples), the failure of Mr. Blanford's skull-characters for *M. arianus*, and finally adds that, "on the whole, I think that *M. arianus* will be found to represent a short-footed Eastern variety of *M. sylvaticus* worthy of a varietal name, but not enough to merit specific separation."

"De Filippi's '*Mus sylvaticus* L.' is no doubt this short-footed form, and not the true European *M. sylvaticus*."

15. *MUS SYLVATICUS* GRISEUS.

Mus arianus griseus, F. W. True, Proc. U.S. Nat. Mus. vol. xvii. p. 8 (1894).

Typical series (in U.S. Nat. Museum):—

20151 Male. Mountains of Central Kashmir, Sept. 13 1891.

35514 10,000 feet.

20139

35502 Female. Central Kashmir, Oct. 8, 1891. 8500 feet.

¹ East. Pers. pp. 57 & 58.

² 'Die Säugethiere des Malkathales,' p. 58.

³ 'In den Bergen des N.W. Kaukasus,' pp. 20, 31 & 51.

⁴ J. A. S. B. vol. xlvi. pt. ii. p. 97.

⁵ P. Z. S. 1881, pp. 548-550.

20144
35507. Male. Pir Panjal Pass, Aug. 31, 1891. 8500 feet.

Described from three specimens collected by Dr. W. L. Abbott "in pine forests at high elevations, two of them in Central Kashmir and the third in the Pir Panjal Pass."

Description. "Similar to typical *Mus arianus* Blanford in size and proportions, but having the upper surfaces ochraceous grey instead of rufous." An immature specimen "was especially grey above, and coincides in colour almost exactly with ordinary specimens of *M. musculus*." The two other specimens, a male and female, were "greyish, ochraceous brown above, which colour is produced by the mingling of hairs having ocher-coloured tips with others which are black." The dimensions of the feet, given in inches only, were in two of the dried specimens, after soaking in water, "slightly less than an average of measurements of *M. sylvaticus* given by Mr. Thomas."

Distribution. Known only from the type specimens.

General Remarks. Mr. True rightly draws attention to the extreme difficulty of ascertaining the real colour and appearance of *M. s. arianus* from descriptions only. That being so, it is doubly hard to determine in a similar manner the exact value of *M. griseus*; but, until specimens are available, we cannot do wrong, I think, in considering it a mountain form of *M. sylvaticus*. I cannot help suspecting, however, that Mr. True's description of his specimens reads uncommonly like that of an immature set of individuals.¹

16. MUS SYLVATICUS PALLIPES, subsp. nov.

Type. No. 75.S.17.6 (British Museum Collection), from Surhad Wahkán, Turkestan, April 28, 1874: collector, Capt. (now Colonel) Biddulph.

Distinguishing Characteristics. The size of the body is apparently similar to, or rather smaller than, that of *M. s. intermedius*, the length of the head and body, feet, and ears in the dried skin being about 85, 19 to 20, and 12 mm. respectively. The tail of the type specimen has been damaged, but is seemingly thicker than that of *M. s. intermedius*. The fur is very thick; the colour of the upper-side extremely light and that of the underside white, but with an ill-defined line of demarcation between the colours of the two surfaces.

Skull. Damaged, but closely resembles that of *M. s. intermedius* except in the size of the last upper molar, which is larger than usual.

Distribution. Known only from the type specimen.

General Remarks. The single skin on which I base this description, although not a good one and having attached to it no dimensions taken in the flesh, is so unlike that of any other specimens of *M. sylvaticus* which I have seen, that I have no doubt that it represents a distinct subspecies. The thick, almost rabbit-like

¹ Since this paper was read I have, through the courtesy of Mr. G. S. Miller, Junior, been able to examine Mr. True's specimens. They are certainly not highly remarkable and would almost pass muster as British, were it not for the slight peculiarity of tint which they show.

fur and the extremely light tints seem to mark this Mouse as a light northeru or mountain form of *Mus sylvaticus*.

17. *MUS SYLVATICUS CHEVRIERI*.

Mus chevrieri, A. Milne-Edwards, Rech. Mamm. pp. 288-9, pl. xl. fig. 2 (1868); E. Büchner, op. cit. supra, sub *Mus sylvaticus major* (p. 413).

Type from Moupin, Tibet (Paris Museum); collector Père David.

Distinguishing Characteristics, &c. This little-known Mouse was originally described as a species on the ground of its slightly greater size than that of *M. sylvaticus*, and agreement in colour with *M. confucianus* A. M.-Edw., as the young of which latter species Milne-Edwards was disposed to regard it until an examination of the skull convinced him of its distinctness.

The general colour is "d'un brun-fauve tiqueté de brun-foncé; les parties inférieurs sont d'un gris très-clair, presque blanches."

Mr. Oldfield Thomas has examined the types, which he thought come very near to *M. arianus* Blanford; their colour above is bright rufous, with the belly white or slate-colour; the fur on the back in some instances is almost spinous. Herr Büchner, who states that he also has seen the types, considers this subspecies identical with Herr Radde's *M. s. major* of Western Siberia, which is itself very close to and a constant Eastern representative of *M. sylvaticus*, while *M. arianus* Blanford represents the same species in the South. According to Herr Büchner's description of the typical series, the ground-colour of the upper-side is a rusty golden brown, tolerably strongly mixed with dusky brown or black. The whole underside is white. There is a somewhat strong line of demarcation between the colours of the two surfaces of the body.

Distribution. Not exactly known. I identify with this subspecies only the typical series from Moupin, Tibet, and (provisionally) a specimen (no. S2.6.16.7 of the British Museum Collection) collected by Père David at South Shensi, an inland province of China, in 1873. This locality, which lies considerably to the south-west of Peking, is so far to the north of Moupin that Père David's specimen may represent a new form; but it comes sufficiently near the original description of *M. chevrieri* to be at least provisionally assigned to it. The specimen, which is adult, is apparently of about the same size as my *M. s. draco*, but is brighter in its coloration. As in the Kuantun Field-mouse, the underside is white, but the skull is more massively formed.

18. *MUS SYLVATICUS DRACO*, subsp. nov.

Mus chevrieri, Oldfield Thomas, P. Z. S. Nov. 15, 1898, p. 773.

Type from Kuantun, N.W. Fokien, N.W. China (no. 98.11.1.20 of British Museum Collection); collector, Mr. J. D. La Touche.

Distinguishing Characteristics. In external appearance this Mouse resembles *M. s. typicus* Linnæus, but is slightly smaller and more brightly coloured on the upper-side.

The *skull* is narrower and slightly smaller than that of adult of the subspecies *intermedius*, reaching a length of only about 25 mm., and having the anterior portions of the frontals more attenuated, and the nasal region proportionately more slender than in the latter subspecies.

Distribution. At present known only from the typical series.

General Remarks. The Mice identified by Mr. Oldfield Thomas as *M. chevrieri* form quite a nice series of eleven specimens, with which may be considered eight specimens collected by Mr. C. B. Rickett in the same locality. Although obviously representing a subspecies of *M. sylvaticus*, I am unable to identify them with any known phase of that species. They cannot be *M. chevrieri*, for they are not larger, but rather smaller than the average; and the colour of the upperside, although brighter than that of *M. sylvaticus* from Western Europe, is not like that of *M. confucianus*. They cannot well be *M. s. arianus*, Blanford, the description of which certainly does not apply to them, while they differ in more than one obvious respect from *M. s. intermedius*.

The series represents individuals of very varied age, from quite young specimens to adults. The young seem to undergo very different changes of colour in their progress to maturity from those undergone by *M. s. intermedius*. When very young, they are of a darker slate-colour; and they appear to retain the dull slaty hues of immaturity until they reach a considerable, perhaps their full, size. Thus no. 97.6.6.11, a nursing female, with mammae 4+4, is in colour of the upperside very like an ordinary *M. musculus*, but, unlike this species, has a sharply defined white belly. Another nursing female, no. 98.11.1.22, is in process of losing her immature coat, and presents a three-coloured appearance, having the belly white, the central dorsal region clothed in the dusky immature tints, while the flanks show the red colours of an adult. Another specimen has progressed farther, and shows traces of the dark colour only on the rump. This patchy method of assumption of the adult coat seems to be quite unknown in *M. s. intermedius*, in which the process seems to be much more gradual; it would appear to be highly characteristic of this new subspecies. The white belly is present in specimens of all ages, and two or three show a breast-spot or band of more or less complete development.

The skulls of this subspecies are interesting, and are remarkable as compared with skulls of *M. s. intermedius* and even with the skull of the South Shensi specimen, as being very much narrower and more attenuated in the anterior frontal and nasal region. They are far less massive than in examples from Roumania, but almost equal in size those of medium-sized individuals from Western Europe. None of those which I have at my disposal are quite perfect, but the respective dimensions of total length and breadth would appear to be about 25 and 11 mm. The tubercles of the molar 1 are rather regularly arranged, and I think that the central tubercle of the last row (C'' of Hensel) is more prominent than in *M. s. intermedius*.

19. *MUS SYLVATICUS LEWISI.*

Mus abbotti, E. T. Newton, Quart. Journ. Geol. Soc. vol. vii. pt. 2, no. 198 (May 1, 1894).

Nec *Mus abbottii*, G. R. Waterhouse, P. Z. S. July 25, 1837, p. 77, which is a form of *M. musculus* Linnæus.

Mus lewisi, E. T. Newton, P. Z. S. 1899, p. 381.

Type. A skull, being one of those collected by Mr. Lewis Abbott in the ossiferous fissure at Ightham, Kent, and now in the Geological Museum, Jernyn Street, London, S.W.

Description (skull only). Similar to *M. sylvaticus*, but differs from it in the absence of the anterior pointed tubercle of the first lower molar.

Distribution. Known only from the typical series.

General Remarks. The absence of a small dental tubercle seems to be a very small point on which to base a species, especially as the skulls of *M. lewisi* were accompanied by others which were indistinguishable from those of *M. sylvaticus*. But the validity of the specific character must depend on its constancy or inconstancy in skulls of modern *sylvaticus*. I have examined 49 of these with a view to deciding this point, with the result that in 47 the tubercle in question is conspicuously present, while in two only (viz., no. 98.2.2.22, from Cintra, Portugal, and no. 95.10.25.1, from Lewis, Scotland, the type of *Mus s. hebridensis*) had the wearing down of the teeth made it indistinct. The specimens were of all ages, with the teeth both worn and unworn, and from widely different localities, yet in all the tubercle shows clearly, and must therefore, I think, be considered characteristic of present day *sylvaticus*.

We cannot tell what external features were present in *M. s. lewisi* in correlation with this slight peculiarity of dentition. These may have been conspicuous, or they may have been non-existent. The material in our hands permits us merely to examine the skulls, and from them alone, according to my treatment of *Mus sylvaticus*, I can only admit *M. lewisi* to subspecific rank as representing a side development of the *Mus sylvaticus* stock.

MUS ARGENTEUS.

Mus argenteus, C. J. Temminck, Fann. Jap. p. 51, pl. xv. fig. 1 (1845) (on the date of this work see Sherborn & Jentink, P. Z. S. Feb. 19, 1895, p. 149).

Type locality. Japan.

Distinguishing Characteristics. Resembles *Mus sylvaticus* in arrangement of colours, but has the upperside of a peculiar, deeper, more uniform *M. minutus*-like red, of a shade that I have never seen in *M. sylvaticus*. In the specimens at my disposal there is no breast-band and none of the black-tipped hairs of *M. sylvaticus*. The size is that of *M. musculus*. Temminck states that the general size and the ears of *M. argenteus* are as in *M. musculus*, and the tail is longer than the head and body. Of the colour he writes that "tout le dessus du corps, jusqu'à la

ligne médiane des flancs et des côtés du cou, d'un brun-roussâtre doré; la tête est d'une teinte brune et les longues moustaches sont d'un brun cendré. La couleur blanche de toutes les parties inférieurs s'étend jusqu'à la ligne médiane des flancs et des côtés du cou; les quatre extrémités sont aussi d'un blanc pur."

The *skull* is about equal in size to that of *M. sylvaticus* and with an identical tooth-pattern; the total length of skull of no. 88.9.25.6 (damaged) is slightly over 24 mm.

Distribution. Known only from Japan.

General Remarks. The only specimens of this Mouse at my disposal are nos. 88.9.25.6 and 88.9.25.7, collected by Mr. H. Pryer, and which bear on the labels the simple locality "Japan." The latter is a female with the mammæ arranged as in *M. sylvaticus*, and, since the general pattern of coloration and teeth, and skull, where not damaged, also agree with that species, I can have no hesitation in regarding this Mouse as very closely allied to *M. sylvaticus*. The dimensions of the dried skins, however, seem to show that the animals are considerably smaller than average *M. sylvaticus*.

Although Temminck gives no particulars as to the skull of his *M. argenteus*, and although his figure of that species is a miserable caricature of a dark brown *M. musculus*-like Mouse, with dark feet, long tail, and light underside, his description, which, it will be noted, contradicts his figure in several important respects, fits this Mouse so closely that I feel bound to identify it as *Mus argenteus*.

I can have little doubt that this Mouse is a local development from a *sylvaticus*-like stock, in which the skull has not altered from that of the type, but its peculiar red colour, its size and proportions mark it, as might perhaps have been expected, as the most distinct ally of *Mus sylvaticus* which I have seen.

MUS ORTHODON.

Mus orthodon, R. Hensel, Zeitschr. dents. geol. Gesellsch. 1856, p. 279, pl. xiii. figs. 6-10 (aff. *Muri sylvatico*, fide C. I. Forsyth Major, P.-verb. Soc. Tosc. 1888, p. 129).

Type (skull) from the Ossiferous Breccia of Mt. San Giovanni, Sardinia.

In dealing with *Mus sylvaticus*, I must allude also to *Mus orthodon*, which is believed to be very closely allied to it, and the skulls and teeth of which in the British Museum Collection I have examined. The teeth of this species are far more hypsodont in character, and in immaturity show very deep lateral grooving of the crowns, so that they are also more Vole-like than those of modern *Muridae*. The first upper molars of the youngest specimen show three internal and three less distinctly marked external convexities. The tubercles have been a good deal worn away, so that their exact disposition can only be guessed; but the teeth certainly give the impression of having had all the nine tubercles of Hensel's diagrams present and regularly arranged when quite

young and unworn. The first upper molar is more hypsodont than either of the next two.

In the next oldest set of teeth the lateral grooving is still evident, but is not nearly so deep as in the youngest; while in quite old and worn teeth the grooves are no longer visible. As they are worn down, the teeth get smaller and at length become separated from each other. The internal convexities of the first molar become less distinct, and the teeth-pattern of the crowns is gradually obliterated. Altogether, the upper teeth remind me very strongly of those of *M. agrarius* Pallas.

The under molars come very close to those of *M. sylvaticus*, but, like the upper, are more hypsodont in character. The tubercles of the first tooth were probably arranged as in *M. sylvaticus*, and the anterior unpaired tubercle is present. There is nothing to call for comment in the last two under molars, the tubercles of which, as in modern species, seem to have been 4 for molar 2, and 3 for molar 3.

The animal was larger than *M. sylvaticus*, and in its dentition shows resemblances both to that species and *M. agrarius*, so that it may, perhaps, have been a direct offshoot from a common stock from which both species have later sprung. In other respects, however, it seems to throw no light on the ancestry of Palearctic *Murida*, being even more specialized than the modern species.

TABLE OF DIMENSIONS.

The dimensions of the specimens examined during the preparation of this paper are included in a single table, so as to be more convenient for purposes of comparison. By the careful averaging of a large series of British examples, I have tried to give figures which shall be useful as a standard with which may be compared those of other subspecies. I am conscious that this standard would have been more satisfactory had it been taken from specimens from a single locality, instead of from those procured all over Great Britain. It may, for instance, be some day found that the average dimensions of specimens from North and South Britain are different; but I have had to make the best use of my material, and I think the figures given are a fair average for the ordinary *Mus sylvaticus* of the British Islands generally.

It is not easy to explain the large difference between the minimum and maximum dimensions given in the case of *M. s. intermedius*; but it should be borne in mind that as long as we have to deal with a series of specimens measured by a numerous band of collectors, so long will the individual factor tend to increase the gap between minima and maxima. I venture to think that the number of specimens which have been dealt with is sufficient to make the averages trustworthy and useful for purposes of comparison. It is to them that we must look for an idea as to the true appearance of an ordinary individual of a particular species dealt with, and they are not at all affected by the occasional occurrence of giants or pygmies, the measurements of which counterbalance one another.

Mus sylvaticus intermedius.

GREAT BRITAIN:

	Head and body.	Tail.	Hind foot.	Ear.	Skull, extreme length.
No. of items	62	61	60	26	} 25 to 26 mm.
	mm.	mm.	mm.	mm.	
♂ s. { Maximum	111	103	24.5	17.5	
{ Mean	92.6	88.2	22.7	15.4	
{ Minimum	83	67	20	14	
No. of items	31	31	30	12	
	mm.	mm.	mm.	mm.	
♀ s. { Maximum	110	98	24	17.5	
{ Mean	92	84.5	22.5	16	
{ Minimum	78	70	20	14	
Percentage of specimens in which length of head and body exceeds that of tail				♂ s. 70	♀ s. 74
Percentage of specimens in which length of tail equals or is less than head and body				30	26
Percentage of specimens in which length of head and body exceeds 90 mm.				63	67
Percentage of specimens in which length of head and body exceeds 100 mm.				13	23
Percentage of specimens in which length of feet reaches 24 mm.				7	3
Percentage of specimens in which length of feet does not reach 24 mm.				93	97

* *Immature Specimens.*

	Head and body.	Tail.	Hind foot.	Ear.	Skull, extreme length.
	mm.	mm.	mm.	mm.	mm.
♂. Lowestoft, Suffolk, Aug. 25, 1894, Oldfield Thomas.	85	79	23	...	23
♂. Rugby, Warwickshire, Jan. 2, 1894, A. S. Ansten.	78	85	21	...	25
♂. Lyndhurst Road, New Forest, Hants, July 12, 1894, Col. J. W. Yerbury.	81	83	22	...	25
♀. Chiswick, near London, Aug. 31, 1897, Miss D. Sharpe.	83	90	20	17	24
♀ (nursing). Hurlingham, near London, Aug. 31, 1897, R. I. Pocock.	90	71.5	20	...	23
♀. Cheadle, Staffs., Nov. 13, 1897, E. W. H. Blagg.	64	74	20	...	22.3
♀. Dunphail, Elginshire, Scotland, Sept. 19, 1893, W. R. Ogilvie Grant.	57	57	19	...	20

IRELAND:

5 ♂ s, 2 ♀ s. Ballaghmoon, Carlow, Jan. 20 to Mar. 6, 1896, J. G. Symes (e coll. Barrett-Hamilton). Measured by F. Metcalfe.	Max.	103	105	24
	Mean	93	85	22.6
	Min.	85	62	20

* The length of foot, apart from the coloration, distinguishes these from *Mus musculus*, of which I take at random the following dimensions for comparison, viz. :—

	Head and body.	Tail.	Hind foot.
♂	83	78	17
♀	79	72	16

	Head and body. mm.	Tail. mm.	Hind foot. mm.	Ear. mm.	Skull, extreme length. mm.
IRELAND:					
4 ♂s, 1 ♀. Co. Wexford, Ire- land, Jan., Mar., & Apr. } (e coll. Barrett-Hamilton). Measured by F. Metcalfe. } Max. 95 97 22 16					
	Mean 91	86.2	20.2		
	Min. 84	75	18	15	
2 ♂s and one unsexed. Ca- shel, Tipperary, Ireland, Jan. } 1895. } Max. 103 70 22.5 16					} 25
	Mean 92	74	22	15.5	
	Min. 87	87	23.5	15	
SHETLAND:					
Adult nursing ♀ (e coll. Barrett- Hamilton, no. 538). Recd. from } R. Henderson, Oct. 27, 1898 } ♂. Ditto, ditto } ♂ (juv.). Ditto, ditto }	102	100	22	15.5	26
	87	87	23	14.5	
	88	84	22	14	
CHANNEL ISLANDS:					
2 ♂s. Alderney, autumn 1898, W. } Eagle Clarke (e coll. Barrett- Hamilton, nos. 543 & 544)..... }	93	95	23	16	
	95	91	23	16	
BELGIUM:					
Liège, altitude 100 metres, Nov. 1894, H. Grönvold; of 10 specimens, all immature, although one was nursing, none exceed 88 mm. for head and body.					
11 ♂s and 6 ♀s. Warene, } Oct. 27-28, J. A. Loring, } from the collection of the } Smithsonian Institution, } Washington, D.C., U.S.A. }	Max. 100	100	25	...	} 24 to 25
	Mean 89.5	89.1	22.9	...	
	Min. 75	81	22	...	
HOLLAND:					
Oldest ♂ of 2 ♂s and 2 ♀s, collected } by Oldfield Thomas, Aug. & Sept. } 1895. }	94	83	21.5	16.1	{ 25 (teeth much worn).
SWITZERLAND:					
12 ♂s and 4 ♀s. Meiningen, } J. A. Loring, from the col- lection of the Smithsonian } Institution. }	Max. 107	99	25	...	} 25 to 26
	Mean 93.5	90	23.3	...	
	Min. 78	78	21	...	
BRITTANY:					
6 ♂s. Dinan, Dec. 25-28, 1897, } G. E. H. Barrett-Hamilton. }	Max. 94	89	24.5		
	Mean 86.5	80.6	22.5		
	Min. 83	75.5	20.5		
3 ♀s. Dec. 21, 1897, ditto ... }	Max. 88	83	24		
	Mean 83.41	76.5	23.41		
	Min. 75.35	67.5	22.25		
Combined average, after adding } one unsexed specimen. }	Max. 94	89	24.5		
	Mean 86.97	79.2	23.13		
	Min. 75.25	67.5	20.5		
FRANCE:					
♂. Cadillac-sur-Gironde, Mr. Young. } ♂. Manonville, Nov. 1895, Mons. } Lamont }	100	60	22	12	
	* 122	110	22	14	25

* Dimensions probably exaggerated.

	Head and body. mm.	Tail. mm.	Hind foot. mm.	Ear. mm.	Skull, extreme length. mm.
ITALY:					
2 ♂s, 2 ♀s. Apr. 9 & 10, 1895, A. H. Savage Landor. Apparently young, of which the largest (a ♂) measured	102	84	21	16	

Mus sylvaticus celticus.

2 ♂s, 4 ♀s. Caragh Lake, Kerry, Ireland, Nov. to Dec., Col. J. W. Yerbury.	Max. 90 Mean 85.3 Min. 80	84 80.8 75	25 22.3 20	15 14.6 14	
♂ & ♀. Femoyle, Castle Gregory, Co. Kerry, Ireland, various dates in winter, G. A. Passingham.	♂. 87 ♀. 88	87 84	23.5 21	15 16	25
1 ♂, 3 ♀s. Woodpark, Galway, Ireland, Feb. 13 to Mar. 19, 1896 R. F. Hibbert.	Max. 88 Mean 85.8 Min. 83	94 85.8 82	23 21.25 20	16 15.5 14	
♀. Skye, N.B., June 24, 1895, J. Steele Elliott.	... 83	84	21	13	

Mus sylvaticus hebridensis.

3 ♂s, 1 ♀. Lewis, Outer Hebrides, W. E. de Winton (from 'Zoologist,' op. cit.).	Max. 112 Mean 108 Min. 106	100 97.5 95	25 24.25 23.5	16 15.75 15	27
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Mus sylvaticus hirtensis.

St. Kilda:					
1 ♂. H. Evans, 1898 (e coll. Barrett-Hamilton, no. 556).	107	91	24.5	17	29
♀, in alcohol. Ditto	110	94	24	15	

Mus sylvaticus typicus.

Upsala, Sweden (e coll. Smithsonian Institution, Washington, D.C., U.S.A.).	♂. 95 ♀. 93	89 66	21 20		
Hilleröd, Zealand, Denmark, altitude 10 m., May-June 1898, Oldfield Thomas. Almost topotypical of <i>M. flavicollis</i> Melchior.	♂. 104 ♀. 103	111 114	25 24	17 17.5	26
					[One skull from this locality reached 27.]

Mus sylvaticus, subsp. incert.

Bergen, Norway:					
4 ♂s. (E Coll. Smithsonian Institution, Washington, D.C., U.S.A.)	88 93 89.5 95	125 110 62.5 99	*26 *26 *24.5 *23	...	†27
3 ♀s. (Ditto.)	93 83 92	89 98 103	*22.5 *24 *24.5	...	†25 (nursing)

* These measurements include the claws.

† Teeth partly worn.

‡ Teeth much worn.

Mus sylvaticus wintoni.

3 ♂s, 1 ♀. Graftonbury, Herefordshire, England. (E Coll. W. E. de Winton.)	Max. 108 Mean 110.75 Min. 115	108 111.75 112	23 23.75 24	18 18 18	29 28 27
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	Head and body. mm.	Tail. mm.	Hind foot. mm.	Ear. mm.	Skull, extreme length. mm.
3 ♂s. Haute-Savoie, France, Dec. 1899, A. Robert. (An intermediate form.)	♂. 95	108	25	17	27
	♂. 95	96	25	17	27·25
	♂. 98	99	26	20	28
4 ♂s. Strass b. Burgheim, Bavaria, March 1895, Lord Lilford.	♂. 110	80	22		
	♂. 110	108	25		
	♂. 100	96	22	...	28
	♂. 105	110	23	...	28
♂ & ♀. Haida, Bohemia	♂. 93	105	27	18	28
	♀. 110	95	25	16	28
Brunswick, Germany :	♂. 97	99	24	...	27
	♂. 96	95	25	...	27
5 ♂s. August. (More or less intermediate.)	♂ (juv.). 94	91	20	...	26
	♂. 112	110	23	...	27
	♂. 110	94	25		
13 ♂s. Aug. & Sept., J. A. Loring, from the collection of the Smithsonian Institution, Washington, D.C., U.S.A.	Max. 94	102	24	...	} 24 to 25
	Mean 84·8	90·7	22·5	...	
	Min. 73	79	21	...	
Niesky, Silesia : 2 ♂s, 1 ♀. Feb. & Nov. 1898, W. Baer.	♂. 97	83	22·5	19	
	♂. 115	120	24	17·5	
	♀ (juv.). 93	101·5	22·5	17·5	24

Mus sylvaticus princeps.

9 ♂s. Bustenari, Roumania, W. Dodson.	Max. 119	111	25·5	19·5	} 27·5 to 30 (nearly).
	Mean 110	110·7	24·5	17·94	
	Min. 102	97	24	15	
7 ♀s. Bustenari, Roumania, W. Dodson.	Max. 110	115	25	19	} 27 to 28
	Mean 105·28	105·85	23·21	17·85	
	Min. 101	98	22	16·5	
An obviously young specimen in slaty coat, from Roumania, taken April 15, 1899, measures as much as		87	81	22·5	14·5

Mus sylvaticus islandicus.

4 specimens in Copenhagen Museum, fide Herr H. Winge (2 in alcohol).	...	...	23·5	17
	...	...	21 (juv.)	13·5
2 skins, ditto. (Ear measured from lower border of ear opening.)	...	...	22	14
	...	...	23·5	15

Mus sylvaticus hayi.

Portugal :					
Cintra (altitude 230-330 m.), Jan., Feb., Mar. 1896, Oldfield Thomas.	Largest ♂.	100	107	24·8	17
	Largest ♀.	100	100	24	17
Estoril, ditto, ditto	♂.	101	103	23·3	16·2
(Five others are large, but immature.)					
Morocco :					
8 ♂s. Tangier, Mar. & Apr. (partim coll. Barrett-Hamilton, partim coll. by W. Dodson for J. I. S. Whitaker).	Max.	110	114	23	...
	Mean	95·62	98·25	22·12	...
	Min.	85	78	20	...
1 ♀. April 1, 1895 (G. B.-H.).		100	90	22	26

	Head and body. mm.	Tail. mm.	Hind foot. mm.	Ear. mm.	Skull, extreme length. mm.
<i>Mus sylvaticus</i> , subsp. incert.					
Spain :					
2 ♂s, 1 ♀, in alcohol. Nos. } 194.1.1.10 to 13, Villabra, } Gallicia, Prof. V. L. Seoane... }	Max. 91	97	23	15	
	Mean 82·6	88·3	22·23	14·25	
	Min. 77	82	22	13	
♂. Farrerdel Allo, near Coruna, Prof. V. L. Seoane.	80	91	23	14	
♂. Ditto. (Juv. ?)	81	72	20	11	
♂. Oindad Real, Spain, F. La- taste, 1883 (alcohol).	75	80	23	14·5	
♀. Ditto (skin).....	84	81	22	11·5	
Corsica :					
2 ♂s. Nos. 93.9.15.6 to 8, La Fue di Villarora (Beech Forest), altitude 3000 ft., Col. J. W. Yerbury.....	♂. 88 ♂. 78	92 71	23 24	15 } 16 }	26
[<i>Mus sylvaticus dichrurus</i> .					
Palermo, Sicily, e coll. J. { I. S. Whitaker, Aug. 6, (sex 1898, & Nov. 13, 1898. (stuffed). Ditto, Nov. 10, 1898 ♀ (nursing). Ditto, Nov. 18, 1898 ♂ (juv.). Ditto, Nov. 18, 1898 ♀ (juv.).	95 100 74 71	78 102 66 69	21 22 20 22	15 15 15]	
<i>Mus sylvaticus algerus</i> .					
Three specimens in alcohol (<i>fide</i> } Mons. F. Lataste, <i>op. cit.</i> 1883, } p. 12). } ♂. ♀. ♀.	... 72 ...	69 64 84	18·5 19 23		
<i>Mus sylvaticus tauricus</i> .					
Type specimen .....	...	...	...	...	{ Skull. 23×12
<i>Mus sylvaticus major</i> .					
Herr Radde's* specimen from the Bureja Mountains (? Trans- Baikalia). }	118	97	24	13·5	
* Radde gives total length, including tail, as 215 mm., and head and body as 118 mm., whence by subtraction I get tail 97 mm.					
<i>Mus sylvaticus arianus</i> .					
Type series (inches roughly re- duced to mm.), <i>fide</i> Blanford, East. Persia, p. 55. (Height of ear measured from orifice to tip.) }	♂. 102 ♀. 96 ♂. 97 ♀. 104	107 96 77 97	23 20·25 19 19	18 12·8	(Skull, Gulmerg, Persia, no. 96.11.2.1.) 28×14
<i>Mus sylvaticus chevrieri</i> .					
Type specimen (a quite adult ♀, <i>fide</i> Milne-Edwards). }	120	90			
One of Milne-Edwards's typical series as measured by Mr. Oldfield Thomas. }	100	90	21·5		

	Head and body. mm.	Tail. mm.	Hind foot. mm.	Ear. mm.	Skull, extreme length. mm.
Three of typical series as measured by Herr E. Büchner.	♂. 113	79	22		
	♂. 121	79	21		
	sex (?) 100	*65.5	22.5		
No. 82.6.16.7 of British Mus. coll., South Shensi, China, Père David. (Dimensions taken from dried skin.)	90	75	20.5	15	25

* Tail perhaps damaged.

Mus sylvaticus draco.

♂. No. 98.11.1.20, Kuatun, Bohea Mts., N.W. Fokien, S.E. China, April 18, 1898, J. D. La Touche.	91	95	*20	...	25
♀. No. 98.11.1.21, ditto, ditto, April 27, 1898.	83	91	...	...	25

* This item from dried skin only; those of head and body and tail are collector's measurements converted from inches.

Mus argenteus.

No. 88.9.25.6. Japan (H. Pryer).	88	70	*17.5	*10	24
No. 88.9.25.7, ♀. Ditto.	78	65	†17.5	†10	24

* Dimensions from the dried skin; these increase to 19.5 and 13 when the skin is wet.
† Collector's dimensions reduced from inches.

EXPLANATION OF PLATE XXV.

Geographical variation in *Mus sylvaticus*, as illustrated by (fig. 1) *M. s. princeps* (p. 408), the large light form of Roumania; (fig. 2) *M. s. celticus* (p. 401), the small dark form of Co. Kerry, Ireland.

12 AUG 1900



1

2

J. Smut del et lith.

Montern, Bros imp.

1. MUS SYLVATICUS PRINCEPS. 2. MUS SYLVATICUS CELTICUS.







J Smit del et lith

Mintern Bros. imp

CERVICAPRA THOMASINÆ.

May 8, 1900.

W. T. BLANFORD, Esq., LL.D., F.R.S., Vice-President,
in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of April 1900:—

The total number of registered additions to the Society's Menagerie during the month of April was 120, of which 41 were by presentation, 52 by purchase, 15 were received on deposit, and 12 were born in the Menagerie. The total number of departures during the same period, by death and removals, was 103.

Amongst the additions attention may be called to:—

1. A young Lyre-bird (*Menura superba*), presented by Messrs. Carrick and Fry on April 12th. Of this well-known Australian type no specimen has been received by the Society since 1876. The present example is immature, and may be either a female or a young male, the tail-feathers being not yet developed.

2. A Ural Owl (*Syrnium uralense*) obtained by purchase April 24th. This fine Owl of North-eastern Europe has not been previously represented in the Society's collection.

Mr. Sclater exhibited a specimen of a male Reedbuck (*Cervicapra*), which had been mounted by Messrs. Rowland Ward & Co., for Mr. Ewart S. Grogan, F.Z.S. It had been already exhibited as a skin to the Society by Mr. R. Lydekker, on May 2nd, 1899¹. The specimen was of about the same size and dimensions as the Common Reedbuck (*C. arundinum*)², but differed entirely in its pale grizzled grey colour above and white under surface, the anterior surface of all four limbs being of a dark rich brown. It had been supposed by Mr. Lydekker, and other good authorities who had examined this specimen, that the animal might be an albino or pale-coloured variety of the Common Reedbuck; but, after studying the specimen carefully, Mr. Sclater had come to a different conclusion, and considered it to be referable to a new species, which, at the request of Mr. Grogan, he proposed to call *Cervicapra thomasi*, with the following characters:—

CERVICAPRA THOMASINÆ, sp. nov. (Plate XXVI.)

C. quoad formam C. arundinum fere similis, sed colore albo, in dorso cineraceo et pedibus anticis fulvo-brunneis, ut videtur, satis diversa: alt. ad humeros 35 poll.

Hab. in ripis Laci Nyasæ, Afr. or.

The specimen exhibited had been obtained by Mr. Grogan on the Songwé River, about six miles from its entrance into Lake

¹ See P. Z. S. 1899, p. 555.

² Book of Ant. vol. ii. p. 157, pl. xliii.

Nyasa in December 1898, during the journey from the Cape to Cairo, of which Mr. Grogan had lately given an account to the Royal Geographical Society (see 'Geographical Journal,' xvi. p. 164). Mr. Grogan had been informed of the existence of a herd of four of these animals on the Songwé, and on proceeding to the spot indicated by his informant, had succeeded in shooting the present specimen, which he met with while grazing in a patch of grass near the river. Mr. Grogan had been told that a similar animal had been seen at Fort Johnston at the south end of the Lake, and that a specimen had likewise been met with on the shores of Lake Nyasa about 40 miles from its north end. Altogether Mr. Grogan had heard of eight specimens of this animal.

Mr. C. Davies Sherborn, F.Z.S., called attention to the progress of his 'Index Animalium,' commenced in 1889, which would contain an alphabetical list of all names used in Zoology from 1758 to 1900. The first portion, now approaching completion, was that for the years 1758 to 1800 inclusive. This part would contain about 60,000 entries; the whole of the slips were already in alphabetical order, and had had the duplicate entries eliminated. About six months' more work would be required to check the generic names. Mr. Sherborn, who is the Recorder under the British Association Committee, stated that he had been able to purchase no less than 250 volumes dealing with systematic zoology and dated before 1800, copies of which were not previously to be found in England. All of these volumes had now been incorporated in the Libraries of public institutions in this country. Some of these volumes were unique, and most of them of considerable rarity.

Mr. R. Lydekker called attention to the following misprint in the notice of his exhibition of the head of a Swamp-Deer (P. Z. S. 1899, p. 829), where the word 'Thameny' in the bottom line should read 'Thameng'; also to an error in the lettering of the plate in his paper on "The Dental Formula of the Marsupial and Placental Carnivora," where in fig. 4, "pp. 2" should be read "mp. 2."

A paper was read by Mr. J. S. Budgett, F.Z.S., "On some Points in the Anatomy of *Polypterus*," of which the following is an abstract:—

Having obtained a large amount of material of both the species of *Polypterus* found in the Gambia, in the spring of 1899, I thought it advisable to attempt to fill up some gaps in our knowledge of the anatomy of this most interesting of fishes.

Though much work has been done by many zoologists in this direction, there are many points in which the descriptions already

published of the anatomy of *Polypterus* are either deficient or inaccurate.

In the present paper, I have described in detail the urinogenital system of the male and female *Polypterus*, together with the later stages of the development of these organs. I have also added observations upon the vascular system, the external gills, the abdominal pores, the anal fin, and the skull.

In obtaining my material, I was aided by a grant of £50 from the Balfour Fund of the University of Cambridge. The work has been done in Mr. Adam Sedgwick's laboratory. To Mr. Sedgwick, Mr. Graham Kerr, and Prof. Howes my thanks are due for much help and advice.

The Male Organs.—In the adult male *Polypterus* a ridge of testicular tubules extends on either side the entire length of the body, but is only functional towards the anterior end of the ridge, where it swells out to form a conspicuous lobulated testis. A longitudinal duct lies at the base of the whole ridge ventral to and parallel with the ureter. Into this duct the tubules of the testis and of the testis-ridge open by very numerous short ducts.

The duct on either side leaves the testis-ridge as the "vas deferens," and running backwards in the same sheath of connective tissue as the ureter, opens upon a papilla into the urinogenital sinus just before the latter opens to the exterior. The spermatozoa are very small, about the length of the long axis of a red blood-corpusele, slightly swollen anteriorly, tapering posteriorly.

The duct of the testis-ridge is developed before the tubules of either the testis or testis-ridge, but in a specimen 9 cm. in length ends blindly in the wall of the ureter.

The Female Organs.—The funnel-like openings of the oviduct into the body-cavity were mentioned and figured by Joh. Müller and again by Hyrtl.

According to Hyrtl, the two oviducts unite to form a urinogenital sinus, into which the two ureters open by a common mid-dorsal aperture.

I find, however, that the ureters are dilated posteriorly, lying closely approximated to one another, but not communicating except immediately before opening to the exterior. Shortly before they open to the exterior, the oviducts open into their lateral walls precisely as do the vasa deferentia in the male.

Further, in the young female, 9 cm. in length, the course of these ducts has exactly the same relation to the ureter as in the male, only that the oviducts are considerably more dilated in the female. The ducts at this stage, like those of the male, end blindly in the lateral wall of the ureter. The peritoneal opening of the oviduct is already open at this early stage.

The *ovary* of *Polypterus* develops as a genital ridge lying on either side along the ventral surface of the kidney, from which it is separated posteriorly by the oviduct. The ovary becomes early divided into numerous compartments, on the external walls of which the ova are developed.

With increase in size of the ova, the external wall bulges out into great folds between the septa, while the internal wall remains a smooth sheet of peritoneum. As the ova develop, they become deeply pigmented upon the pole of the ovum, which is attached to the original outer wall of the ovary. It thus comes about that when ripe, through the smooth internal wall of the ovary only the colourless poles are seen, while through the external much-folded wall only the pigmented poles are seen. It has been stated that the outer wall of the ovary of *Polypterus* is without a covering of peritoneum; it will be seen from the description that this is not strictly correct.

General considerations on the Structure and Growth of the Urinogenital Organs.—I have shown that in the male *Polypterus* there are no connections between the testis and the kidney by which the latter could carry off the products of the testis, as is the case in *Lepidosteus* and perhaps some other Ganoids.

I have shown also that the arrangement of the ducts of the genital glands is very similar in male and female, and that in the larva this resemblance amounts almost to identity. From the early development of these ducts, and the similarity in the male and female, I regard the condition found in *Polypterus* as the primitive arrangement; and that in all cases where connections are found between the testis-tubules and the tubules of the kidney, they are either inherited along a divergent line of ascent, or, as in the case of *Lepidosteus*, secondarily acquired.

Abdominal Pores.—In both male and female, abdominal pores are present in *Polypterus*. These pores are acquired late in life, after the *Polypterus* is 9 cm. in length.

Anal Fin.—Traquair has already noted in *Calamoichthys* that the males have an enlarged anal fin. This difference is, in the breeding-season, one also of form as well as size. The anal-fin muscle in the male increases in size so much that the viscera in the posterior end of the cœlum are displaced. Fertilization is probably not internal, as has been suggested by Leydig.

External Gill.—The structure of the external gills is precisely that of larval Dipnoi and Amphibia.

Hyrtl supposed the external gill of *Polypterus* to be homologous with the endodermal pseudobranch of *Acipenser*. From a study of the blood-supply, I conclude that it is rather homologous with the external ectodermal gill of larval Dipnoi and Amphibia, which have properly an external and an internal gill to each visceral arch.

Vascular System.—In this preliminary abstract of my paper, I will merely state that my investigations lead me to agree with Pollard in regarding the arterial system of *Polypterus* as only comparable with the primitive *Chlamydoselachus* and embryo Selachians, where from each gill-arch a single efferent vessel unites with a median precardial aorta.

Cranium.—I find that there is an important specific difference in the form of the sphenoid of the two species *P. senegalus* and

P. lapradei, a difference which Bridge observed in two specimens of *Polypterus* and which he attributed to great range of variation.

This paper will be published in full in the Society's 'Transactions.'

The following papers were read:—

1. A List of the Batrachians and Reptiles of the Gaboon (French Congo), with Descriptions of new Genera and Species. By G. A. BOULENGER, F.R.S.

[Received March 20, 1900.]

(Plates XXVII.-XXXII.)

Mr. G. L. Bates, who has been stationed for some time on the Benito River, north of the Gaboon River, between 20 and 30 miles inland from the coast, has been so kind as to collect Batrachians and Reptiles for the British Museum, and so lucky as to discover, especially among the former, a number of new or interesting forms, on some of which I have already reported¹. Whilst describing the new forms of which an account is given in this paper, it appeared to me useful to compile a complete list of all the species on record from the Gaboon district—viz., the part of West Africa situated between Camaroons and Loango, in the French Congo². Such a stock-taking seemed to me particularly useful with reference to the work on the distribution of species in the Congo basin, with which I am now engaged. I must observe, however, that I am convinced that the list will have to be increased by the addition of a number of widely distributed species which are known both north and south of the Gaboon district, and which will, no doubt, be found when more extensive collections are made; but I have introduced the names of such species only of which I have seen examples from the district, or which have been recorded on reliable authority.

Only five contributions dealing specially with the Batrachians and Reptiles of the Gaboon district have been published so far:—

DUMÉRIL, A.—“Note sur les Reptiles du Gabon.” *Rev. et Mag. de Zool.* 1856, pp. 369-377, 417-424, 460-470, 553-562, pls. xx. & xxi.—The new species described in this paper have been redescribed and mostly figured in the same author's “Reptiles de l'Afrique occidentale,” *Arch. du Mus.* x. 1859, pp. 137-240, pls. xiii.-xviii.

¹ *Ann. & Mag. N. H.* (7) iii. 1899, pp. 274, 276, and iv. 1899, p. 122.

² The term Gaboon is here taken in the old sense. I do not know on what authority the Gold Coast is included in the Gaboon Country by Günther, *P. Z. S.* 1899, pp. 716 & 721.

- HALLOWELL, E.—“Notice of a Collection of Reptiles from the Gaboon County, West Africa, recently presented to the Academy of Natural Sciences of Philadelphia by Dr. Henry A. Ford.” Proc. Acad. Philad. 1857, pp. 48-72.
- PETERS, W., and BUCHHOLZ, R.—“Zweite Mittheilung über die in West Africa gesammelten Amphibien.” Mon. Berl. Ac. 1867, pp. 117-123. [Mostly from the Gaboon and Ogowe.]
- GÜNTHER, A.—“Report on a Collection of Reptiles and Fishes made by Miss M. H. Kingsley during her Travels on the Ogowe River and in Old Calabar.” Ann. & Mag. N. H. (6) xvii. 1896, pp. 261-285.
- MOCQUARD, F.—“Sur une Collection de Reptiles recueillie par M. Haug à Lambaréné.” Bull. Soc. Philom. (8) ix. 1897, pp. 5-20.

For the nomenclature and synonyms I must refer the reader to the British Museum Catalogues. I have added references to publications issued since the appearance of these general works.

Mr. Bates's discoveries have enriched herpetology with 5 new genera and 13 new species, some of which are of special morphological interest. The discovery of *Hymenochirus* and *Cardioglossa* has extended our knowledge of geographical distribution by adding African representatives to the families *Pipidae* and *Dendrobatidae*, the former having been based on the single South-American genus *Pipa*, the latter being hitherto regarded as characteristic of Tropical America and Madagascar.

I wish to record my thanks to the Board of Curators of the Philadelphia Academy of Natural Sciences for the loan of type specimens described in 1857 by the late Dr. Hallowell.

BATRACHIA.

APODA.

1. URÆOTYPHLUS SERAPHINI A. Dum.

Hab. Gaboon.

2. HERPELE SQUALOSTOMA Stutchbury.

Hab. Gaboon.

ECAUDATA.

DACTYLETHRIDÆ.

3. XENOPUS CALCARATUS Ptrs.

Hab. West Africa, from Liberia to the Congo.

One of the specimens collected by Mr. Bates on the Benito River has been prepared as a skeleton. There are only seven præcaudal vertebræ, the first being formed by the fusion of two (as is clearly proved by the large nerve-foramen in front of the diapophysis).

PIPIDÆ.

4. HYMENOCHIRUS BOETTGERI Tornier.

Xenopus boettgeri, Tornier, Kriechth. Deutsch-Ost-Afr. p. 163, fig. (1896).

Hymenochirus boettgeri, Bouleng. Ann. & Mag. N. H. (6) xviii. 1896, p. 420, and (7) iv. 1899, p. 122; Ridewood, Journ. Linn. Soc., Zool. xxvii. 1900, p. 454, pl. xxxi.

Hab. German East Africa; Gaboon.

In recently recording the occurrence of this extraordinary Batrachian on the Benito River, I have pointed out that the absence of teeth necessitates its removal from the *Dactylethridæ* to the *Pipidæ*. My notes on the skeleton have been corrected and supplemented by Dr. Ridewood in the paper quoted above, dealing with the hyoid and larynx and the carpus.

BUFONIDÆ.

5. BUFO TUBEROSUS Gthr.

Hab. Fernando Po, Camaroons, Gaboon.

Several specimens were obtained on the Benito River by Mr. Bates. The upper parts are not always uniformly coloured; they are sometimes handsomely spotted or marbled with darker brown, and a yellow or crimson vertebral line is often present.

6. BUFO REGULARIS Reuss.

Hab. The whole of Africa with the exception of Barbary. I have, however, not myself examined specimens from the Gaboon and there were none in the collection made by Mr. Bates.

7. BUFO LATIFRONS, sp. n. (Plate XXVII. fig. 1.)

Crown without bony ridges; snout short, blunt; interorbital space slightly concave, broader than the upper eyelid; tympanum distinct, three-fifths the diameter of the eye. First finger much longer than second; toes half-webbed, with single subarticular tubercles; two rather small metatarsal tubercles; a tarsal fold. The tarso-metatarsal articulation reaches the anterior border of the eye. Upper parts with irregular warts, some of which may be conical; parotoids elliptic, feebly prominent, rather indistinct. Olive-brown above, with or without a yellowish vertebral line, with more or less symmetrical black markings; limbs with dark cross-bars; bright pink spots on the back of the thighs; lower parts dirty white, throat greyish, breast with small greyish spots.

From snout to vent 73 millim.

Three specimens, females and young, from the Benito River (*G. L. Bates*).

This species stands very near to *B. regularis*. It is distinguished by the broader interorbital region, the smaller tympanum, and the feebly prominent parotoid glands.

8. *BUFO SUPERCILIARIS* Blgr.

Bufo superciliaris, Bouleng. Proc. Zool. Soc. 1887, p. 565.

Bufo laevis, Werner, Sitzb. Bayer. Ak. xxvii. 1897, p. 212, and Verh. zool.-bot. Ges. Wien, xlvi. 1898, p. 202, pl. ii. fig. 1.

This curious Toad was described from young specimens collected by Sir H. H. Johnston in the Rio del Rey district, Camaroons. Adult specimens have been redescribed by Werner under the name of *B. laevis*, from Camaroons. A young specimen is in Mr. Bates's collection from the Benito River. I have also examined a fine specimen, measuring about 120 millim. from snout to vent, from the Congo Free State.

9. *BUFO GRACILIPES* Blgr.

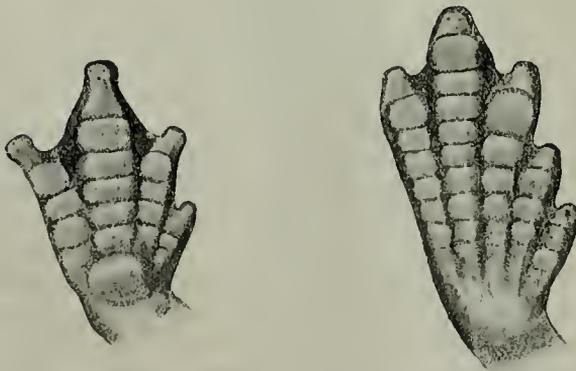
Bufo gracilipes, Blgr. Ann. & Mag. N. H. (7) iii. 1899, p. 276, pl. xii. fig. 2.

I have recently described this Toad from a single specimen from the Benito River, collected by Mr. Bates. I have now examined several specimens, and have to add that the tarso-metatarsal articulation may fail to reach beyond the anterior border of the eye, that the toes are one-third webbed in breeding specimens, that the parotoid glands may be more distinct than in the type specimen, narrow and shorter than the head, and that the male is provided with an internal subgular vocal sac and brown nuptial asperities on the inner side of the two inner fingers. Limbs with dark cross-bars. The largest male measures 30 millim. from snout to vent, the largest female 40.

10. *NECTOPHRYNE AFRA* Ptrs.

Originally described from Camaroons. Two specimens (σ f) are in Mr. Bates's collection from the Benito River.

Fig. 1.



Hand and foot of *Nectophryne afra*, showing the subarticular tubercles of the fingers and toes.

The subarticular tubercles of the fingers and of the toes are much developed, and flattened into overlapping pads which bear a

close resemblance and are no doubt functionally analogous with the subdigital lamellæ of the scansorial Geckos. Such a structure had not been observed before in any Batrachian. Buchholz and Peters have not alluded to it otherwise than by mentioning "dunkle Querlinien unter den Zehen," which I believe to be the result of an optical delusion caused by the lamellæ to which attention is now drawn.

The male, which is devoid of vocal sacs, measures only 17 millim. from snout to vent; the female measures 21.

RANIDÆ.

11. RANA CRASSIPES Ptrs.

This species is known from Camaroons and the Gaboon. I have examined 10 specimens collected by Mr. Bates on the Benito River, the largest measuring 63 millim. from snout to vent.

As pointed out by Günther (Ann. & Mag. N. H. [6] xvii. 1896, p. 266), the vomerine teeth are sometimes absent; this is the case in three of Mr. Bates's specimens. When present, they form two very small groups just behind the level of the choanæ. The tympanum is more or less distinct, measuring three-fourths or fourth-fifths the diameter of the eye. The colour of the upper parts varies from greyish olive or purplish brown to blackish, with or without very indistinct darker and lighter spots or marblings; dark cross-bars on limbs usually irregular, sometimes absent; lower parts white, throat often spotted or marbled with dark brown.

12. RANA SUBSIGILLATA A. Dum.

This species, which has been well figured by A. Duméril, is known from Old Calabar, Camaroons, and the Gaboon. Several specimens were collected by Mr. Bates on the Benito River, the largest measuring 88 millim. from snout to vent.

The species is remarkable for its long head without canthi rostrales, and its short limbs, the tibio-tarsal articulation reaching the tympanum; the diameter of the latter is two-thirds to three-fourths that of the eye. The upper parts are of a dark brown, but the sides of the head and body and the fore limbs are often tinged with bright carmine. The lower parts, in the young, are olive, with close-set round pale yellow spots on the throat and belly; with age, the dark colour between the spots becomes reduced to a network, which may even almost entirely disappear. Some specimens have a rather indistinct flat round gland under each thigh, as in most species of the genus *Mantidactylus*.

13. RANA ÆQUIPLICATA Werner.

Rana mascareniensis, var. *æquiplicata*, Werner, Verh. z.-b. Ges. Wien, xlviii. 1898, p. 192.

Vomerine teeth in two short oblique series commencing from the inner front edges of the choanæ. Head moderate, as long as broad or a little longer than broad; snout pointed, longer than the

diameter of the orbit; canthus rostralis distinct; loreal region deeply concave; nostril midway between the eye and the end of the snout; interorbital space nearly as broad as the upper eyelid; tympanum distinct, two-thirds or three-fourths the diameter of the eye. Fingers moderate, obtusely pointed, first not extending beyond second; toes broadly webbed, the web reaching the extremity of the third and fifth toes, but leaving two phalanges of the fourth toe free; subarticular tubercles moderate; a very small, oval, inner metatarsal tubercle, no outer tubercle. The tibio-tarsal articulation reaches far beyond the tip of the snout; tibia more than two-thirds the length of head and body. Skin more or less distinctly granular above, with numerous, interrupted, glandular, longitudinal folds on the back; a glandular fold from beneath the eye to the shoulder. Olive-brown above, with small dark spots, with or without a broad whitish or pink vertebral band; usually a dark cross-bar between the eye; a black canthal streak and a black temporal spot; tympanum reddish brown; limbs with dark cross-bars; hinder side of thighs black, spotted or marbled with white or pink; a series of black spots on the lower jaw; throat and belly yellow, immaculate. Male with two black external vocal vesicles projecting through two slits below the lower jaw.

From snout to vent 50 millim.

Five specimens from the Benito River are in Mr. Bates's collection. Dr. Werner's specimens were from Camaroons.

Closely allied to *R. mascareniensis*; differs in the more extensively webbed toes and the more numerous, interrupted folds along the back.

14. RANA MASCARENIENSIS D. & B.

Hab. Egypt, Tropical Africa, Seychelles, Madagascar, Mascarenes.

The Gaboon specimens belong to the var. *bibronii* Hallow. (*superciliaris* Gthr.), with longer snout and longer hind limbs. The head is longer than broad, and the tibio-tarsal articulation reaches beyond the end of the snout.

15. RANA ALBOLABRIS Hallow.

Hab. Fernando Po, Camaroons, Gaboon, Lower Congo.

Females grow to a length of 93 millim. from snout to vent. In such large specimens the dorso-lateral glandular fold becomes more indistinct, the tibio-tarsal articulation reaches the eye or between the eye and the end of the snout, the first finger does not extend beyond the second, and the white border to the upper lip, whence the species derives its name, disappears more or less completely.

SCOTBLEPS, g. n.

Pupil vertical. Tongue free and deeply notched behind. Vomerine teeth. Tympanum distinct. Fingers free; toes webbed. Outer metatarsals narrowly separated by web. Omo-

sternum and sternum with a bony style. Terminal phalanges simple, obtuse.

This genus may be defined as *Rana* with a vertical pupil.

16. SCOTOBLEPS GABONICUS, sp. n. (Plate XXVIII. fig. 1.)

Vomerine teeth in two small groups on a line with the posterior borders of the choanæ. Head rather large, as long as broad; snout obtusely pointed, with feeble canthus rostralis; loreal region slightly concave; nostril equally distant from the eye and the end of the snout; eye large; interorbital space narrower than the upper eyelid; tympanum not quite half the diameter of the eye. Fingers and toes moderately elongate, with slightly swollen tips and very strong subarticular tubercles; first finger extending as far as second; toes half-webbed; an oval inner metatarsal tubercle. The tibio-tarsal articulation reaches the nostril. Skin smooth, or with small flat warts on the back. Olive-brown above, with small blackish spots; a dark cross-band between the eyes; upper lip with blackish vertical bars, the one below the anterior third of the eye extending on the lower lip; limbs with dark cross-bars; lower parts white. Male with internal vocal sacs.

From snout to vent 57 millim.

Three specimens from the Benito River (*G. L. Bates*).

17. PETROPEDETES NEWTONI Bocage.

Tympanoceros newtonii, Bocage, Journ. Sc. Lisb. (2) iii. 1895, p. 270, and iv. 1895, p. 18, pl. —

Males differ from females in the larger tympanum, which is larger than the eye, and from the centre of which a horn-like dermal tubercle projects, in the presence of a long spine on the inner side of the first finger, and in the greater size of a large flat oval gland on the lower side of the thigh.

Several specimens were obtained on the Benito River by Mr. Bates. The specimens described by Barboza du Bocage are from Fernando Po.

The genus *Petropedetes* Reichenow (Arch. f. Nat. 1874, p. 290) is nearly related to *Cornufer*, but differs in the division of the dermal pad on the upper surface of the digital expansions by a short distal groove, giving it a cordiform appearance. The males are remarkable for the large glands under the thighs, which are absent or feebly developed in the females. In addition to the type species and the one now referred to, the genus embraces *Cornufer johnstoni* Boulenger, from the Rio del Rey, Camaroons. The three species may be distinguished as follows:—

P. cameronensis Reich. Toes half-webbed; tympanum half diameter of eye.

P. johnstoni, Blgr. Toes with a mere rudiment of web; tympanum half diameter of eye.

P. newtoni Bocage. Toes with a mere rudiment of web; tympanum more than half diameter of eye; male with a spine on the inner finger and a dermal tubercle on the tympanum.

18. *PHRYNOBATRACHUS AURITUS*, sp. n. (Plate XXVIII. fig. 2.)

Tongue with a free conical papilla in the middle. Habit slender. Head moderate, as long as broad; snout pointed, projecting beyond the mouth, with angular canthus and nearly vertical loreal region; nostril equally distant from the eye and the end of the snout; interorbital space narrower than the upper eyelid; tympanum distinct, measuring nearly half the diameter of the eye. First finger as long as second; toes two-thirds webbed; tips of fingers and toes dilated into small disks; subarticular tubercles small; two small metatarsal tubercles; a very small tubercle not far from the latter, on the inner side of the tarsus. The tibio-tarsal articulation reaches the tip of the snout. Skin smooth, or with very small warts above; a narrow glandular fold on each side of the back from the eyes to the sacral region, the two folds converging on the scapular region; a similar fold from the eye to the shoulder. Greyish or reddish brown above, darker on the middle of the back, with or without a filiform light vertebral line, which is continued along the middle of the upper surface of the thigh and the inner side of the leg; glandular folds edged with blackish; a few round black spots may be present on the pelvic region; limbs with rather indistinct darker cross-bars; hinder side of thighs blackish brown, edged with whitish above near the vent; inner side of legs also blackish brown; lower parts white, with small brownish spots on the throat and breast in the female; the throat blackish in the male. Male with an internal subgular vocal sac.

From snout to vent 37 millim.

Three specimens from the Benito River (*G. L. Bates*).

The distinct tympanum distinguishes this species from *P. plicatus* Gthr., to which it bears some resemblance.

19. *PHRYNOBATRACHUS LATIROSTRIS*, sp. n. (Plate XXVIII. fig. 3.)

Tongue with a free conical papilla in the middle. Habit moderately slender. Head moderate, as long as broad; snout short, rounded; canthus rostralis distinct; loreal region concave; nostril equally distant from the eye and the end of the snout; interorbital space as broad as the upper eyelid; tympanum distinct, measuring three-fifths the diameter of the eye. Fingers and toes moderate, the tips dilated into small disks; first finger not extending as far as second; toes half-webbed; a small, oval, inner metatarsal tubercle. The tibio-tarsal articulation reaches between the eye and the end of the snout. Skin smooth; a slight curved fold behind the eye, converging towards its fellow on the scapular region. Dark grey-brown above; a dark triangular spot between the eyes; glandular folds dark-edged; upper lip lighter, with dark vertical bars; lower lip dark brown in the male, with a series of small white spots; limbs with dark cross-bars; anal region blackish, edged with whitish above; throat grey in the male, white, spotted with brown, in the female; belly and lower surface of limbs white, breast spotted with brown. Male with an internal subgular vocal sac.

From snout to vent 30 millim.

A single male specimen from the Benito River (*G. L. Bates*).

A smaller female specimen from Lambarene, collected by Miss Kingsley, has been referred by Günther to *Cornufer johnstoni*.

20. *ARTHROLEPTIS AFRICANUS* Hallow.

Heteroglossa africana, Hallow. Proc. Ac. Philad. 1857, p. 64 ; Cope, Proc. Ac. Philad. 1862, p. 343.

Arthroleptis? africanus, Bouleng. Cat. Batr. Ecaud. p. 119 (1882).

Arthroleptis gabonensis, Mocquard, Bull. Soc. Philom. (8) ix. 1897, p. 17.

Thanks to the kindness of Dr. Chapman, Chairman of the Board of Curators of the Museum of the Academy of Sciences of Philadelphia, I have been able to examine the type specimen from the Gaboon, preserved in that Institution, and compare it with two specimens, male and female, collected by Mr. Bates on the Benito River.

Tongue with a free conical papilla in the middle. Head rather large, as long as broad ; snout obtusely pointed, with feeble canthus and concave loreal region ; interorbital space narrower than the upper eyelid ; tympanum distinct, two-thirds the diameter of the eye. Fingers and toes moderate, the tips swollen into small disks ; first finger not extending beyond second ; toes with a short but very distinct web ; two metatarsal tubercles, inner oval, outer round, subconical ; a small tubercle on the tarsus, near the inner metatarsal tubercle. The tibio-tarsal articulation reaches the nostril. Upper parts with small flat warts ; a feeble curved fold on each side of the scapular region. Dark brown above ; limbs with darker cross-bars ; blackish vertical bars on the sides of the head ; white beneath, limbs spotted with brown ; throat spotted with brown in the female, entirely black in the male, which is provided with an internal vocal sac.

From snout to vent 30 millim.

21. *ARTHROLEPTIS VARIABILIS* Matschie.

Arthroleptis dispar (*non* Peters, 1870), Peters, Mon. Berl. Ac. 1875, p. 210, pl. iii. figs. 1-3.

Arthroleptis variabilis, Matschie, Sitzb. Ges. nat. Fr. Berl. 1893, p. 173 ; Bocage, Jorn. Sc. Lisb. (2) iv. 1895, p. 18 ; Werner, Verh. zool.-bot. Ges. Wien, xlviii. 1898, p. 193.

Hab. Fernando Po, Camaroons, Gaboon.

22. *ARTHROLEPTIS MACRODACTYLUS* Blgr.

Arthroleptis macrodactylus, Bouleng. Cat. Batr. Ecaud. p. 117, pl. xi. fig. 5 (1882), and Zool. Rec. 1885, Rept. p. 23 ; Günth. Proc. Zool. Soc. 1893, p. 620.

Arthroleptis bivittatus, F. Müll. Verh. nat. Ges. Basel, vii. 1885, p. 671, pl. ix. figs. k-l.

Hab. Gaboon, Tumbo Id. (Gulf of Guinea), Nyassaland.

23. *ARTHROLEPTIS INGUINALIS*, sp. n. (Plate XXVII. fig. 2.)

Tongue without conical papilla. Head moderate, as long as broad; snout rounded; canthus rostralis obtuse; loreal region concave; interorbital space as broad as the upper eyelid; tympanum distinct, three-fifths to two-thirds the diameter of the eye. Fingers and toes rather elongate, slender, the tips merely swollen; subarticular tubercles very prominent; first finger not extending beyond second; toes practically free, the rudiment of web being very indistinct; a rather large, very prominent, oval, compressed inner metatarsal tubercle; no outer metatarsal tubercle; no tarsal tubercle. The tibio-tarsal articulation reaches the eye or between the eye and the end of the snout. Skin smooth. Coloration very variable: greyish or brownish above, uniform or spotted or freckled with darker, or with dark symmetrical markings; a black canthal and temporal streak; a more or less distinct dark spot or short oblique band on the groin; limbs with dark spots or bars; lower parts white, throat usually freckled with brown. Male with an internal vocal sac.

From snout to vent 30 millim.

Numerous specimens from the Benito River (*G. L. Bates*).

GAMPSOSTEONYX, g. n.

Pupil vertical. Tongue free and feebly notched behind. Vomerine teeth. Tympanum distinct. Fingers and toes free, the tips slightly swollen; terminal phalange of all but the inner toe a sharp curved claw, projecting through a slit on the lower surface of the extremity of the toe. Outer metatarsals bound together. Omosternum and sternum with a bony style.

The projecting, non-retractile bony claw, uncovered with a horny sheath, which arms the toes with the exception of the hallux, is a feature unique, so far, not only among Batrachians but among Vertebrates. The only other instance I know of bone being exposed through the skin in Vertebrates higher than Fishes is to be found in the ends of the ribs of *Molge (Pleurodeles) waltlii* Mich. and *Tylototriton andersonii* Blgr.

24. *GAMPSOSTEONYX BATESI*, sp. n. (Plate XXIX.)

Vomerine teeth in two small round groups between the choanæ. Head large, much broader than long; snout broadly rounded, with short canthi and very oblique, slightly concave lores; nostril equally distant from the eye and the end of the snout; eye large; interorbital space as broad as the upper eyelid; tympanum very distinct, oval, little smaller than the eye. First finger longer than second, nearly as long as third; subarticular tubercles of fingers and toes feeble; a small, oval, inner metatarsal tubercle. The tibio-tarsal articulation reaches the eye. Skin smooth and shiny; a glandular fold above the tympanum. Dark purplish brown above, white beneath; a black canthal and temporal streak; a black transverse line between the eyes; two dark bars on the upper lip,

the first under the nostril, the second below the anterior third of the eye; limbs with rather indistinct dark cross-bars; lower surface of crus and tarsus dark brown.

From snout to vent 70 millim.

A single specimen from the Benito River (*G. L. Bates*).

TRICHOBATRACHUS, g. n.

Pupil vertical. Tongue subcordiform, free and notched behind. Vomerine teeth. Tympanum distinct. Fingers free; toes webbed. Outer metatarsals bound together. Omosternum with a bony style; sternum a cartilaginous plate, without style. Terminal phalanges simple, obtuse.

To these characters might be added the villose dermal papillæ which cover some parts of the body, whence the name proposed for this new genus, were it not that I suspect it to be a mere seasonal peculiarity; far from being a nuptial attribute of the males, as one might have been inclined to suppose from analogy with various Fishes, the character is more strongly developed in the female than in the male.

25. TRICHOBATRACHUS ROBUSTUS, sp. n. (Plate XXX.)

General appearance suggestive of *Rana liebigi* Gthr. Vomerine teeth in two short transverse series between the rather large choanæ. Head larger, broader than long, much depressed; snout very short, rounded, with distinct canthi and very oblique, slightly concave lores; nostril slightly nearer the eye than the end of the snout; interorbital space a little broader than the upper eyelid; tympanum moderately distinct, half the diameter of the eye. Limbs robust; tips of digits slightly swollen; first finger much longer than second, as long as third; toes half-webbed; sub-articular tubercles large; a feebly prominent, elongate, inner metatarsal tubercle. The tibio-tarsal articulation reaches the eye. Skin smooth; sides of body, back of thighs, and a stripe along the upper surface of the latter with hair-like papillæ, more developed in the female than in the male. Olive-brown above; a darker, black-edged broad band along the back, fading away behind and sharply defined in front by a black cross-bar between the eyes; a black canthal and temporal streak; sides of body and limbs blackish; lower parts white, female with brown dots on the throat. Male with a pair of internal vocal sacs, and with three short ridges (two longitudinal and one transverse) of small horny black spines on the inner side of the first finger.

From snout to vent 110 millim.

Two specimens (♂ ♀) from the Benito River (*G. L. Bates*).

DILOBATES, g. n.

Pupil vertical. Tongue subcordiform, free and notched behind. Vomerine teeth. Tympanum distinct. Fingers free; toes nearly free, with a slight rudiment of web. Outer metatarsals bound

together. Omosternum and sternum small, cartilaginous. Terminal phalanges simple, obtuse.

26. *DILOBATES PLATYCEPHALUS*, sp. n. (Plate XXVII. fig. 3.)

Vomerine teeth in two small groups on a line with the posterior borders of the choanæ. Head very broad, much broader than the body, depressed, with very oblique lores and temples; snout rounded; canthus rostralis distinct; a loreal concavity; nostril equally distant from the eye and the end of the snout; interorbital space as broad as the upper eyelid; tympanum almost as large as the eye. Fingers and toes rather short, obtuse; first finger extending beyond second; subarticular tubercles moderate; a small, oval, inner metatarsal tubercle. Hind limb slender; the tibio-tarsal articulation reaches the anterior border of the eye. Skin smooth. Olive above, with small black spots; a dark cross-band between the eyes, preceded by a yellowish one; sides of head yellowish, with two dark bars, the first below the nostril, the second below the anterior half of the eye; fore limb yellowish; limbs with blackish transverse spots; lower parts white.

From snout to vent 26 millim.

A single specimen from the Benito River (*G. L. Bates*).

27. *RAPPIA FIMBRIOLATA* Buchh. & Ptrs.

Hyperolius fimbriolatus, Buchholz & Peters, Mon. Berl. Ac. 1876, p. 121.

Rappia fimbriolata, Boettg. Ber. Senck. Ges. 1887-88, p. 96.

Hab. Ogowe and Loango.

28. *RAPPIA MARMORATA* Rapp.

Hab. Tropical and South Africa.

29. *RAPPIA OCELLATA* Gthr.

Hab. Fernando Po to Angola.

30. *RAPPIA FUSCIGULA* Bocage.

Hab. Gaboon to Angola.

31. *RAPPIA TUBERCULATA* Mocq.

Rappia tuberculata, Mocquard, Bull. Soc. Philom. (8) ix. 1897, p. 18.

Hab. Ogowe.

32. *RAPPIA PHANTASTICA* Blgr.

Rappia phantastica, Bouleng. Ann. & Mag. N. H. (7) iii. 1899, p. 274, pl. xi. fig. 2.

Hab. Benito River (*G. L. Bates*).

33. *RAPPIA PLATYCEPS*, sp. n. (Plate XXVII. fig. 4.)

Head rather large, as long as broad, much depressed; snout rounded; loreal region oblique; interorbital space broader than

the upper eyelid; tympanum hidden. Outer fingers one-fourth webbed; toes two-thirds webbed; disks rather large. The tibio-tarsal articulation reaches the eye. Skin smooth, faintly areolate on the belly. Pale brownish above, with a large blackish-brown marking with indentations extending from between the eyes to the sacral region; sides of head and body and upper surface of legs blackish brown; a whitish spot on the leg above the tibio-tarsal articulation; upper surface of thigh whitish, with a narrow dark brown streak; lower parts white.

From snout to vent 29 millim.

Two specimens from the Benito River (*G. L. Bates*).

34. *RAPPIA PUSILLA* Cope.

Hab. Niger Delta to Gaboon.

35. *MEGALIXALUS FORNASINII* Bianc.

Megalixalus fornasinii, Werner, Verh. zool.-bot. Ges. Wien, xlviii. 1898, p. 195.

Hyperolius dorsalis, Peters, Mon. Berl. Ac. 1875, p. 206, pl. i. fig. 2.

Hyperolius leptosomus, Peters, op. cit. 1877, pl. 619, pl. —. fig. 5.

Megalixalus leptosomus, Mocq. Bull. Soc. Philom. (8) ix. 1897, p. 19.

Hab. Gold Coast to Congo, Nyassaland, East Africa from the Zanzibar Coast to Delagoa Bay.

36. *CHIROMANTIS RUFESCENS* Ptrs.

Hab. Camaroons, Gaboon.

37. *HYLAMBATES RUFUS* Reichen.

Hab. Fernando Po, Camaroons, Gaboon.

38. *HYLAMBATES BREVIROSTRIS* Werner.

Hylambates brevirostris, Werner, Verh. zool.-bot. Ges. Wien, xlviii. 1898, p. 199, pl. ii. figs. 5 & 6.

In addition to the characters given by Werner from Camaroons specimens, this well-marked species is easily distinguished from *H. rufus* by the more dorsal position of the tympanum. The only specimen obtained by Mr. Bates on the Benito River is uniform purplish above.

DENDROBATIDÆ.

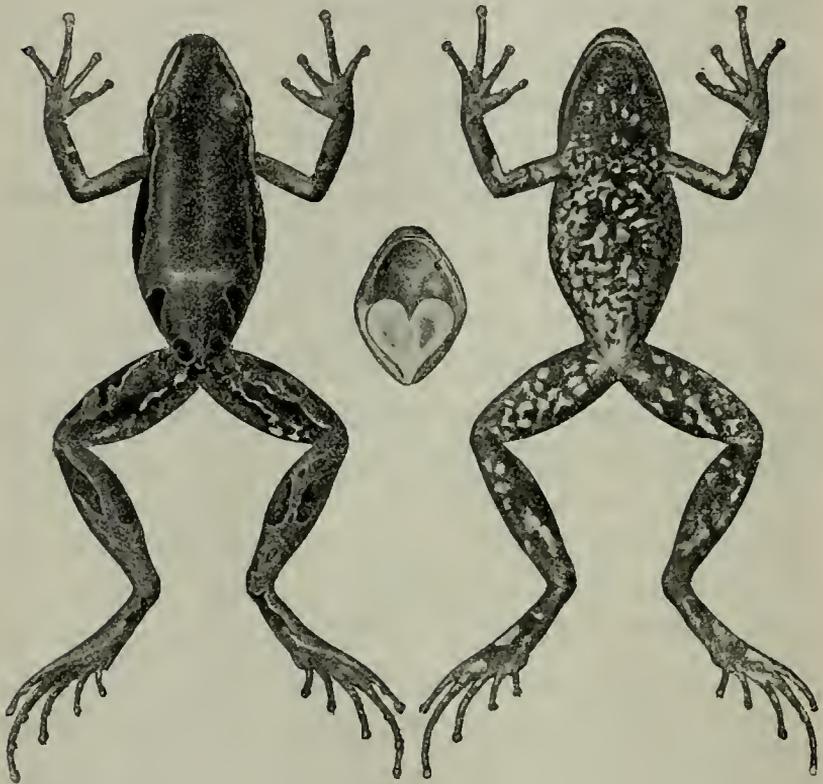
CARDIOGLOSSA, g. n.

Pupil horizontal. Tongue large, cordiform, deeply notched behind. Tympanum distinct. Fingers and toes free, the tips dilated into regular disks. Outer metatarsals united. Omosternum with a slender bony style; sternum a small cartilaginous plate, without bony style. Terminal phalanges T-shaped.

The family *Dendrobatidæ*, which may be defined as *Ranidæ* without teeth, was previously represented by two genera only: *Dendrobates*, from Tropical America, with the tongue elongate and entire and without bony style to the sternum; and *Mantella*, from Madagascar, with the tongue elongate and nicked behind and with a bony style to the sternum.

39. *CARDIOGLOSSA GRACILIS*, sp. n.

Fig. 2.



Cardioglossa gracilis.

Head much depressed, a little longer than broad; snout longer than the orbit, truncate at the end, scarcely projecting beyond the mouth; canthus rostralis distinct; loreal region concave; nostril near the end of the snout; eye rather small; interorbital space much broader than the upper eyelid; tympanum very distinct, two-thirds or three-fourths the diameter of the eye. Fingers and toes long and slender, the tips dilated into small disks; subarticular tubercles small but very prominent; first finger not extending quite as far as second; a rather prominent, moderately large, oval inner metatarsal tubercle. The tibio-tarsal articulation reaches the tip of the snout or a little beyond. Dark brown above and beneath; a black band, edged beneath with white, extends on each

side from the nostril to halfway down the side of the body, passing through the eye and tympanum, and widening behind; this band followed by a large black inguinal spot; dark symmetrical markings on the limbs, those on the front and back of the thighs black, edged with white; lower surfaces spotted or marbled with white. Male with internal vocal sacs.

From snout to vent 37 millim.

Several specimens from the Benito River (*G. L. Bates*).

REPTILIA.

CHELONIA.

PELOMEDUSIDÆ.

1. STERNOTHÆRUS GABONENSIS A. Dum.

Hab. Gaboon; Angola.

2. STERNOTHÆRUS DERBIANUS Gray.

Hab. Cape Verde to Angola.

TESTUDINIDÆ.

3. CINIXYS EROSA Schweigg.

Hab. Gold Coast to Gaboon.

4. CINIXYS HOMEANA Bell.

Hab. Cape Verde to Gaboon.

TRIONYCHIDÆ.

5. TRIONYX TRIUNGUIS Forsk.

Hab. Tropical Africa, Nile, Syria.

6. CYCLODERMA AUBRYI A. Dum.

Hab. Gaboon.

EMYDOSAURIA.

CROCODILIDÆ.

7. CROCODILUS CATAPHEACTUS Cuv.

Hab. Senegal to Congo.

8. CROCODILUS NILOTICUS Laur.

Hab. Nile and Senegal to Cape of Good Hope; Madagascar; Syria.

9. OSTEOLÆMUS TETRASPIS Cope.

Hab. Sierra Leone to Gaboon.

LACERTILIA.

GECKONIDÆ.

10. HEMIDACTYLUS MABUIA Moreau.

? *H. angulatus* Hallow.

Hab. Tropical Africa, Madagascar, South America.

11. HEMIDACTYLUS ECHINUS O'Shaugh.

Hab. Camaroons, Gaboon.

12. HEMIDACTYLUS FASCIATUS Gray.

Hab. Gold Coast to Gaboon.

Through an oversight, this species appears in Günther's list of the Reptiles collected by Miss Kingsley as *Gymnodactylus fasciatus*, which is the name of an American Gecko.

13. HEMIDACTYLUS BOCAGII Blgr.

Hab. Gaboon, Angola.

14. HEMIDACTYLUS RICHARDSONI Gray.

Hemidactylus richardsonii, J. G. Fischer, Jahrb. Hamb. wiss. Anst. v. 1888, p. 49, pl. iv. fig. 10.

Hab. Gaboon.

15. LYGODACTYLUS CAPENSIS Smith.

Hab. Gaboon (Benito River) and Lake Tanganyika to Natal.

AGAMIDÆ.

16. AGAMA COLONORUM Daud.

Hab. Senegambia to Angola, Somaliland, and Uganda.

VARANIDÆ.

17. VARANUS NILOTICUS L.

Hab. Tropical and South Africa, Egypt.

AMPHISEBENIDÆ.

18. MONOPELTIS DUMERILII Strauch.

Hab. Gaboon.

19. MONOPELTIS MAGNIPARTITA Ptrs.

Hab. Gaboon.

20. MONOPELTIS KOPPENFELSII Strauch.

Hab. Gaboon.

LACERTIDÆ.

21. POROMERA FORDI Hallow. (Plate XXXI. fig. 1.)

Tachydromus fordii, Hallow. Proc. Ac. Philad. 1857, p. 48.

Poromera fordii, Bouleng. Cat. Liz. iii. p. 6 (1887); Günth. Ann. & Mag. N. H. (6) xvii. 1896, p. 264.

Poromera haugi, Mocquard, Bull. Soc. Philom. (8) ix. 1896, p. 6.

Hallowell's description is faulty in several points, as I have been able to satisfy myself through inspection of the type specimen (♂) kindly sent to me from Philadelphia.

The ventral shields are in 10 longitudinal rows, not in 6. The large anal shield is bordered by a semicircle of keeled scales, a larger one on each side, connected by a series of 6. 12 femoral pores on one side, 13 on the other. In addition to this specimen, I have examined one from Lambarene, on the Ogowe, collected by Miss Kingsley and described by Dr. Günther, and seven procured by Mr. Bates on the Benito River. The dorsal shields are in 6 or 8 longitudinal, the ventrals in 8 or 10 longitudinal and 23 to 26 transverse series. The collar contains 12 to 14 shields. Males have a large, smooth præanal shield, bordered by a series of 6 or 8 keeled scales; females have the whole præanal region covered with keeled scales. 11- to 13 femoral pores on each side. Two superposed postnasals; 4 to 6 upper labials anterior to the subocular. Dark olive above, turning to bronze or copper-colour posteriorly; two light dorsal streaks, bright bluish white anteriorly; beneath greenish white in front, salmon-pink behind. The largest specimen measures 65 millim. from snout to vent.

Only known from the Gaboon district.

22. LACERTA ECHINATA Cope.

Hab. Liberia to Loango.

23. HOLASPIS GUENTHERI Gray.

Hab. Tropical Africa, from the Gold Coast and the coast of Zanzibar to Angola and the Zambesi.

GERRHOSAURIDÆ.

24. GERRHOSAURUS NIGROLINEATUS Hallow.

Hab. Gaboon to Angola.

SCINCIDÆ.

25. MABUIA RADDONII Gray.

Hab. Sierra Leone to Congo.

26. MABUIA BATESI, sp. n. (Plate XXXI. fig. 2.)

Snout short, obtuse, much depressed. Lower eyelid with a

large transparent disk. Nostril behind the suture between the rostral and the first labial; a post-nasal; anterior loreal not touching the first labial; supranasals widely separated from each other, the rostral forming a broad suture with the frontonasal; latter nearly twice as broad as long; prefrontals forming a short median suture; frontal as long as the fronto-parietals and interparietal together, in contact with the first and second supraoculars; four supraoculars, second largest; seven superciliaries, first largest; frontoparietals distinct, twice as long as the interparietal; parietals short, twice as broad as long, forming a suture behind the interparietal; no nuchals; fifth and sixth upper labials largest and below the eye. Ear-opening smaller than the transparent palpebral disk; two small obtuse lobules on its anterior border. Scales smooth, smallest on the sides, 32 round the middle of the body. The hind limb reaches the elbow of the adpressed fore limb. Digits short; subdigital lamellæ obtusely keeled. Tail slightly compressed, nearly once and a half the length of the head and body, Dark olive above, with widely separated bluish spots preceded by blackish ones, forming two longitudinal series on the back; a black canthal streak; sides of the neck and axilla lineolate black and white, with some black spots; lower parts white.

	millim.		millim.
Total length	140	Fore limb	18
Head	12	Hind limb	24
Width of head	9	Tail	84
Body	44		

A single specimen from the Benito River (*G. L. Bates*).

27. *LYGOSOMA REICHENOVII* Peters.

Lygosoma reichenovii, Mocquard, Bull. Soc. Philom. (8) ix. 1897, p. 8.

Hab. Camaroons; Lower Ogowe.

28. *LYGOSOMA FERNANDI* Burton.

Hab. Fernando Po to Congo.

ANELYTROPIDÆ.

29. *Feylinia currori* Gray.

Hab. Sierra Leone to Angola.

RHIPTOGLOSSA.

CHAMÆLEONTIDÆ.

30. *Chamæleon quilensis* Bocage.

Chamæleon parvilobus, Bouleng. Cat. Liz. iii. p. 449.

Hab. Camaroons to South Africa.

31. CHAMÆLEON GRACILIS Hallow.

Hab. Tropical Africa, from the Gold Coast and Somaliland to Angola and Lake Tanganyika.

32. CHAMÆLEON DILEPIS Leach.

Hab. Gaboon and Somaliland to Angola, Mashonaland, and Mozambique.

33. CHAMÆLEON OWENI Gray.

Hab. Camaroons to Gaboon.

34. CHAMÆLEON CRISTATUS Stutchb.

Hab. Calabar to Gaboon.

35. RHAMPHOLEON SPECTRUM Buchh.

Rhampholeon spectrum, Mocquard, Bull. Soc. Philom. (8) ix. 1897, p. 5.

Hab. Camaroons; Lower Ogowe.

OPHIDIA.

TYPHLOPIDÆ.

36. TYPHLOPS PUNCTATUS Leach.

Hab. West Africa, from the Gambia to Angola; Central Africa.

37. TYPHLOPS CÆCUS A. Dum.

Hab. Sierra Leone, Gaboon.

BOIDÆ.

38. PYTHON SEBÆ L.

Hab. Tropical and South Africa.

39. CALABARIA REINHARDTI Schleg.

Hab. Liberia to Congo.

COLUBRIDÆ.

40. TROPIDONOTUS FULIGINOIDES Gthr.

Hab. Gold Coast to Congo; Central Africa; Mozambique.

41. TROPIDONOTUS OLIVACEUS Ptrs.

Hab. Sudan to Congo and Mozambique.

42. HYDRÆTHIOPS MELANOGASTER Gthr.

Hab. Camaroons to Congo.

43. GONIONOTOPHIS BRUSSAUXI Mocq.
Gonionotophis brussauxi, Mocquard, Bull. Soc. Philom. (8) ix. 1897, p. 13.
Gonionotus vossii, Boettg. Zool. Anz. 1892, p. 418.
Hab. Camaroons to Congo.
44. BOTHROPHTHALMUS LINEATUS Ptrs.
Hab. Liberia to Congo; Central Africa.
45. BOODON VIRGATUS Hallow.
Hab. Gold Coast to Gaboon.
46. BOODON LINEATUS D. & B.
Hab. Tropical and South Africa.
47. BOODON OLIVACEUS A. Dum.
Hab. Niger to Congo.
48. LYCOPHIDIUM LATERALE Hallow.
Hab. Gold Coast to Gaboon.
49. LYCOPHIDIUM FASCIATUM Gthr.
Hab. Sierra Leone to Gaboon.
50. HORMONOTUS MODESTUS D. & B.
Hab. Gold Coast to Loango.
51. SIMOCEPHALUS CAPENSIS Smith.
Hab. Gaboon, Nyassaland, South-east Africa.
52. SIMOCEPHALUS GUIRALI Mocq.
Hab. Camaroons to Loango.
53. CHLOROPHIS IRREGULARIS Leach.
Hab. Tropical Africa from the Gambia and British East Africa to Angola and Mozambique.
54. CHLOROPHIS HETERODERMUS Hallow.
Hab. Sierra Leone to Congo.
55. PHILOTHAMNUS SEMIVARIEGATUS Smith.
Hab. Tropical and South Africa.
56. PHILOTHAMNUS DORSALIS Bocage.
Hab. Gaboon to Angola.
57. GASTROPYXIS SMARAGDINUS Schleg.
Hab. Liberia to Angola.

58. HAPSIDOPHRYS LINEATA Fisch.

Hab. Liberia to Congo.

59. RHAMNOPHIS ÆTHIOPS Gthr.

Hab. Liberia to Gaboon.

60. THRASOPS FLAVIGULARIS Hallow.

Hab. Sierra Leone to Congo.

61. GRAYIA SMYTHI Leach.

Hab. Liberia to Angola.

I have re-examined all the specimens in the British Museum in the light of the remarks recently made by Prof. Barboza du Bocage (Herp. d'Angola et du Congo, pp. 102 & 104) and by Dr. Mocquard (Bull. Soc. Philom. [8] ix. 1897, p. 9), and although I admit the possibility of several species being confounded under the name of *G. smythi*, I am unable to separate them into two by means of the characters pointed out by these authorities. This is obvious from the following tabulation of the shields and scales in the specimens examined by me:—

	Upper labials.	Scales.	Ventrals.	Caudals.
♂. Sierra Leone	8	17	148	97
♂. Oil River, Camarouss	7	17	154	99
♂. " "	7	17	161	89
♂. Camarouss, opposite Fernando Po	8	17	161	?
♂. Gaboon	8	19	147	?
Yg. "	8	17	147	82
Yg. Lambarene, Gaboon	8	19	153	80
Yg. Cette Cama, Gaboon	8	19	145	?
Yg. Mouth of the Loango	7	17	154	99
♂. Bona, Congo	7	17	147	93
♂. Monsembe, Congo	7	17	159	96
♂. Congo	7	17	147	98
Yg. "	7	17	155	95
Yg. "	7	17	152	91
Yg. "	7	17	148	74
♂. Central Africa	8	19	150	83
Hgr. — ?	7	17	149	101

Mocquard gives 19 as the number of scales in *G. ornata*=*fuscata*, but the types of both these supposed species are described as having only 17. A much larger material than was accessible to Bocage, Mocquard, and myself is required before the variations of the forms of this genus can be properly understood.

62. DIPSADOMORPHUS PULVERULENTUS Fisch.

Hab. Liberia to Angola.

63. *DIPSADOMORPHUS BLANDINGII* Hallow.

Hab. West Africa, from the Senegal to the Congo ; Zanzibar.

64. *DIPSADOBOA UNICOLOR* Gthr.

Hab. Sierra Leone to Gaboon.

A single specimen (♀, V. 192; C. 58) was sent by Mr. Bates from the Benito River. It is blackish above and white beneath, Eight upper labials, third and fourth entering the eye. A smaller specimen, collected by Miss Kingsley at Lambarene, noticed by Günther under the name of *D. assimilis* Matschie, is brown above with ill-defined darker cross-bars; eight upper labials, fourth and fifth entering the eye on the left side, third, fourth, and fifth on the left. The typical *D. unicolor* Gthr., green above, with nine upper labials, fifth and sixth entering the eye, is not confined to the island of Fernando Po, as Günther was inclined to believe; the British Museum has recently acquired a similar, but larger, specimen (total length 710 millim.; tail 145) from Sierra Leone. *Anoplodipsas viridis* Ptrs., of which *Heterurus bicolor* Jan is a strict synonym, is green above and has eight upper labials, fourth and fifth entering the eye. There is thus no correspondence between the colour and the number of the labials. I therefore do not think *D. assimilis* can be separated, as a species, from *D. unicolor*, however much extreme forms may differ. F. Werner (Verh. zool.-bot. Ges. Wien, xlvii. 1897, p. 399), after examination of 8 specimens from Togoland, has arrived at the same conclusion.

65. *PSAMMOPHIS SIBILANS* L.

Hab. Tropical Africa and Egypt.

66. *THELOTORNIS KIRTLANDI* Hallow.

Hub. Tropical and South Africa.

67. *MIODON COLLARIS* Ptrs.

Hab. Old Calabar to Angola.

68. *MIODON GABONENSIS* A. Dum.

Hab. Old Calabar to Congo.

69. *POLEMON BOCOURTI* Mocq.

Polemon bocourti, Mocquard, Bull. Soc. Philom. (8) ix. 1897, p. 13.

This species differs from *P. barthi* Jan in having two post-oculars and a lower number of ventral shields (178-202). A single specimen from Lambarene (V. 171; C. 24) in Miss Kingsley's collection has been referred by Günther to *P. barthi*.

70. *ELAPOPS MODESTUS* Gthr.

Hab. Liberia to Congo.

71. BOULENGERINA ANNULATA Buchh. & Ptrs. (Plate XXXII.)

Naja annulata, Buchh. & Peters, Mon. Berl. Ac. 1876, p. 419; Mocquard, Bull. Soc. Philom. (7) xi. 1887, p. 84; Bocage, Herp. Angola, p. 137 (1895).

Aspidelaps bocagii, Sauvage, Bull. Soc. Zool. France, 1884, p. 205, pl. vi. fig. 2.

Boulengerina annulata, Mocquard, Bull. Soc. Philom. (8) ix. 1897, p. 14.

Two perfectly typical young specimens (V. 227-230; C. 72, 70) were obtained on the Benito River by Mr. Bates. The only difference, apart from the markings, between this species and *B. stormsi* Dollo resides in the number of scales (23 instead of 21), and it is quite possible the two may have to be united when we become acquainted with a larger number of specimens.

Hab. Gaboon to Congo.

72. ELAPECHIS GUENTHERI Bocage.

Hab. Gaboon to Angola; Nyassaland.

73. NAIA MELANOLEUCA Hallow.

Hab. Tropical Africa, from the Gambia and British East Africa to Angola and the Zambesi.

74. NAIA GOLDII Blgr.

Pseudohaje nigra, Günth. Cat. Col. Sn. p. 222 (1858), nec *Naiia nigra*, Smith.

Naiia goldii, Bouleng. Ann. & Mag. N. H. (6) xvi. 1895, p. 34, and Cat. Sn. iii. p. 387, pl. xx. fig. 2 (1896).

Naiia guentheri, Bouleng. Cat. t. c. p. 388, pl. xxi., and Ann. & Mag. N. H. (6) xix. 1897, p. 154.

Naiia yakomæ, Mocquard, C. R. Congr. Intern. Zool. Leyden, 1895, p. 233 (1896).

Hab. Sierra Leone to Congo.

A large specimen was obtained by Mr. Bates on the Benito River. It has two præoculars on one side and one on the other; third and fourth upper labials entering the eye. Scales in 15 rows on the neck as well as on the body; ventrals 199; subcaudals 92. Uniform black above. I am now convinced that *N. guentheri* and *N. goldii* cannot be maintained as distinct species.

75. DENDRASPIS JAMESONI Traill.

Hab. Niger to Angola; Central Africa.

76. BITIS GABONICA D. & B.

Hab. Liberia to Damaraland; Zanzibar; Mozambique.

77. BITIS NASICORNIS Shaw.

Hab. Liberia to Gaboon.

78. *ATHERIS CHLORECHIS* Schleg.*Hab.* Liberia to Gaboon.79. *ATHERIS SQUAMIGER* Hallow.*Hab.* Camaroons to Angola.80. *ATRACTASPIS CORPULENTA* Hallow.*Hab.* Liberia to Gaboon.81. *ATRACTASPIS BOULENGERI* Mocq.*Atractaspis boulenyeri*, Mocq. Bull. Soc. Philom. (8) ix. 1897, p. 16.*Hab.* Lambarene, Ogowe.

EXPLANATION OF THE PLATES.

PLATE XXVII.

- Fig. 1. *Bufo latifrons*, p. 435.
 2. *Arthroleptis inguinalis*, p. 442, two specimens.
 3. *Dilobates platycephalus*, p. 444.
 4. *Rappia platyceps*, p. 444.

PLATE XXVIII.

- Fig. 1. *Scotobleps gabonicus*, p. 439.
 1 a. " " " Side view of head.
 1 b. " " " Open mouth.
 2. *Phrynobatrachus auritus*, p. 440.
 3. " " *latirostris*, p. 440.

PLATE XXIX.

Gampsosteonyx batesi, p. 442.

- | | |
|-----------------------|-------------------------------------|
| a. Upper view. | d. Side view of 4th toe, enlarged. |
| b. Side view of head. | e. Lower view of 4th toe, enlarged. |
| c. Open mouth. | f. Distal phalanges. |

PLATE XXX.

Trichobatrachus robustus, p. 443.

- | | |
|------------------------|---|
| a. Female, upper view. | c. Open mouth. |
| b. Side view of head. | d. Inner side of first finger of breeding male, enlarged. |

PLATE XXXI.

- Fig. 1. *Poromera fordi*, female, p. 449.
 1 a. " " " Side view of head, $\times 2$.
 1 b. " " " Lower view of head, $\times 2$.
 1 c. " " " Anal region, $\times 2$.
 1 d. " " " male. Anal region, $\times 2$.
 2. *Mabuia batesi*, p. 449.

PLATE XXXII.

Boulengerina annulata, p. 455, with upper and lower views of head.



P.J. Smit del et lith.

Mntern Bros. imp.

1. BUFO LATIFRONS. 2. ARTHROLEPTIS INGUINALIS
3. DILOBATES PLATYCEPHALUS. 4. RAPPIA PLATYCEPS.





P. J. Smit del. et lith.

Mintern Bros. imp.

1. SCOTOBLEPS GABONICUS. 2. PHRYNOBATRACHUS AURITUS.

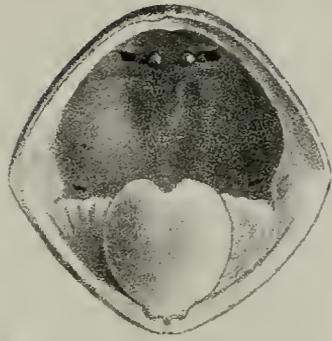
3. PHRYNOBATRACHUS LATIROSTRIS.







b.



c.

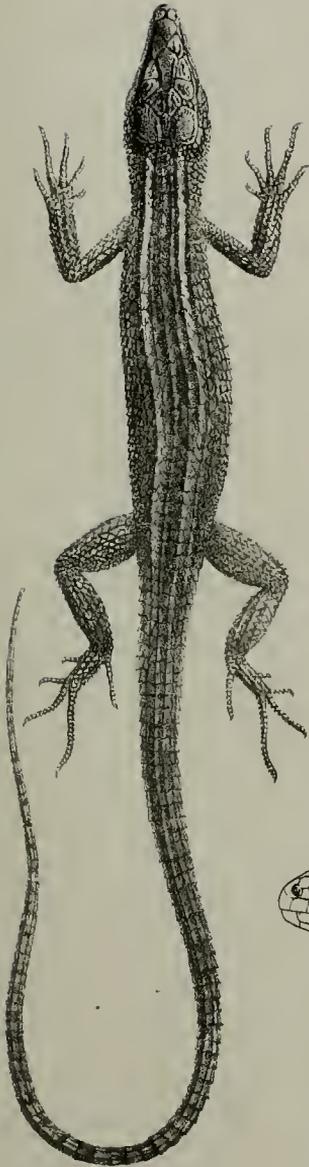


a.

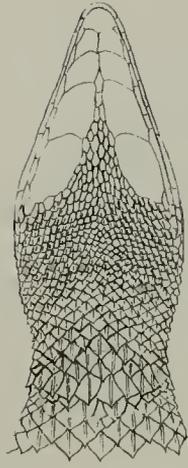


d.

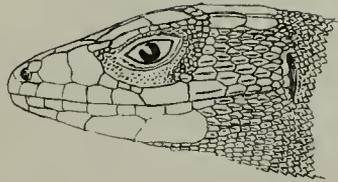




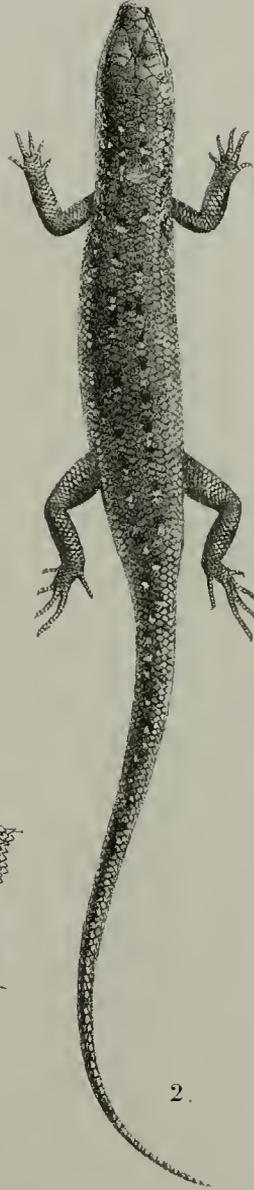
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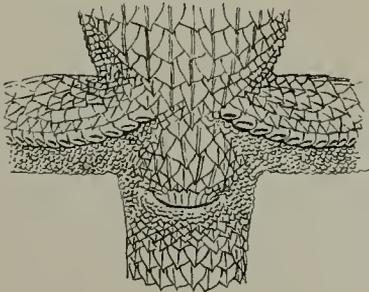
1b.



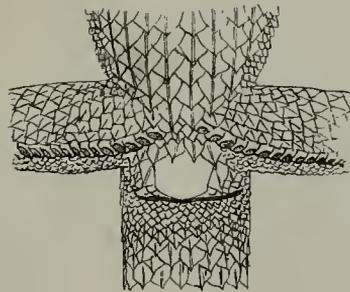
1a.



2.



1e.



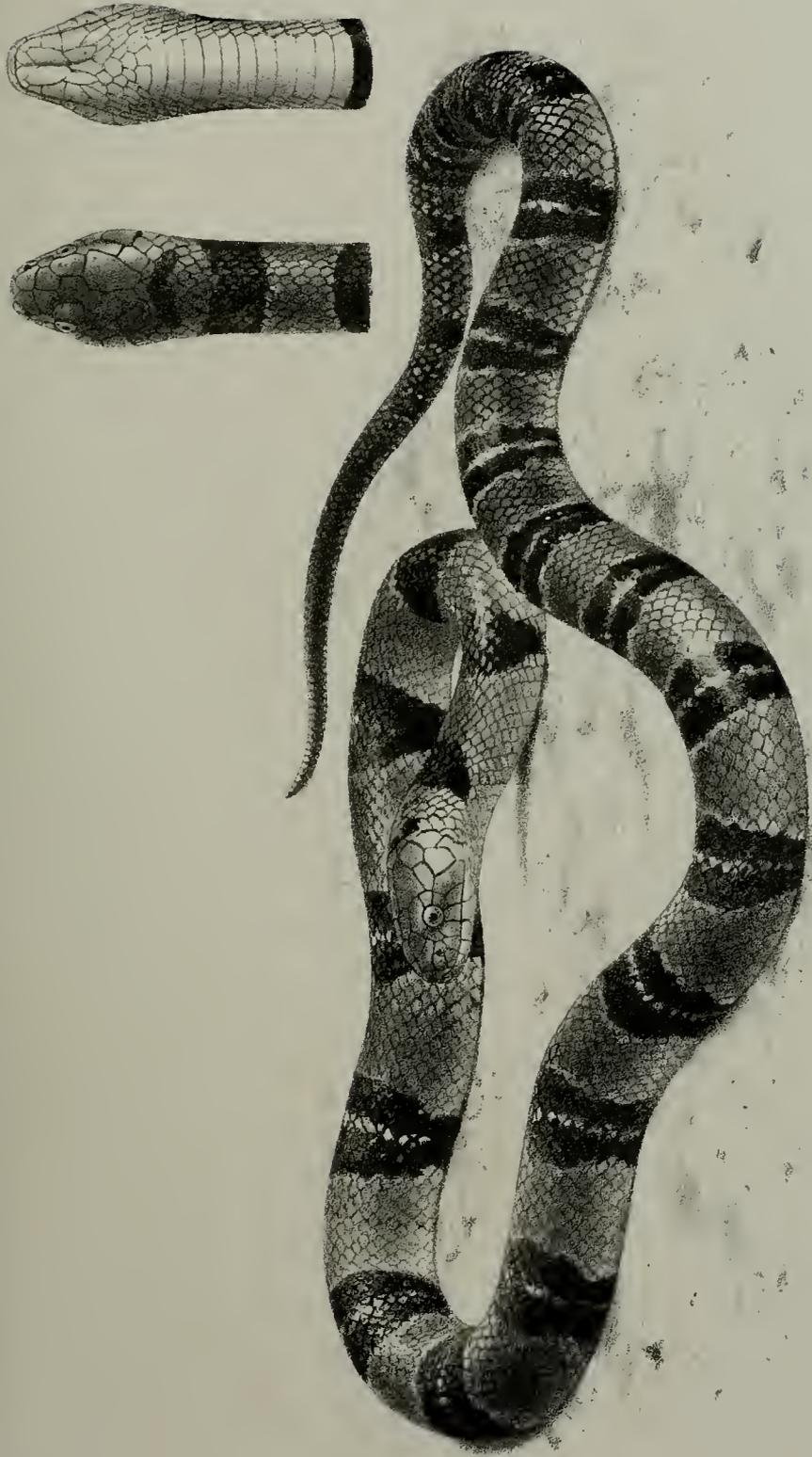
1d.

P. J. Smit del. et lith.

Mintern Bros. imp.

1. POROMERA FORDII. 2. MABUYA BATESII.





P. J. Smut del et lith.

BOULENGERINA ANNULATA.

Mintern, Bros. imp.



2. On the Birds of Hainan. By W. R. OGILVIE GRANT.

[Received March 4, 1900.]

(Plates XXXIII. & XXXIV.)

The present paper, which gives a complete list of all the species of Birds known to occur in the island of Hainan, is based on the collection made by the late Mr. John Whitehead in the so-called 'Five-Finger Mountains' (Ngau-tchi-lea) in the interior. During this expedition he unfortunately fell a victim to the terrible forest-fever, for which, it appears, the island is, at certain seasons, notorious.

I had arranged with Mr. Whitehead that he should again proceed to the Philippines and complete his work there by investigating the fauna of the highlands of Mindanao and other islands forming the southern part of the archipelago, which he had not been able to visit during his previous expedition. It was further agreed that he should, if possible, explore the highlands of Formosa and Hainan.

On the 10th February 1899 he arrived at Manila, but after remaining there two weeks, during which time fighting between the Americans and Philipinos (Tagalos) continued daily, he was reluctantly obliged to give up all idea of collecting in the Philippines, and, returning to Hong-Kong, made his way to Hainan.

While in Manila he engaged the services of four Philipinos, including two of his most valued collectors who had accompanied him during his former expedition in the Philippines. Through the kindness of the late Mr. Whitehead's relations, I have been permitted to make use of his diary giving an account of his journey in Hainan; and I feel sure that the following extracts, melancholy though they be, will prove to be of interest as the last record of how this brave man and unrivalled field-naturalist lost his life in the cause of science¹.

DIARY.

MARCH 5th. Leave Hong-Kong for Hainan. Voyage to Hoihow. Stranded in the 'Hatin' for four days on a sandbank; afraid of losing our baggage; an anxious time. Get taken off the steamer by the 'Hoihow.' Experience difficulties in reaching the shore at low water. Mud-flats covered with flocks of Waders: Dunlins, Greenshanks, Stilts, Golden Plover, Redskanks, Curlews, and Sand-plovers; also white-necked Crows.

On arriving in the town visit the Consul, and meet with great kindness from Mr. Jüdel, who puts me up. Baggage comes off in boats and arrives at daylight the next day.

¹ An account of the late Mr. John Whitehead's scientific career will be found in 'Country Life,' vol. vii. no. 159, pp. 72, 73, 20th January, 1900.

10th. Consulted the American missionaries, who are inclined to throw cold water on my visit to Nodia, their place inland, and can give no information! Determine not to ask their assistance any more. The Portuguese Padre Baptista promises to help me, and I hope to start in a few days. Mr. Jüedell rides with me to Kiung-chu, a walled city, with narrow streets, stinks, darkness and crowds of people, a terrible-looking place—my first visit to a Chinese town. Pass many lepers on the road begging, minus fingers and toes and at times feet and hands—an awful sight!

13th. Left Hoihow for Pak-siang, which is the riverside port of Kiung-chu. I left Hoihow at 1.30, and arrived at the Padre Baptista's house in about an hour, and subsequently we went to meet the boat which, with men and baggage, left Hoihow this morning at 10 A.M. The Chinamen had filled up the boat with rice and flour for their own food, so consequently we had to move some of it. The Chinese always do their best to score off the European, and as a rule succeed. One hour's walk over a narrow road paved with big stones brought us to Pak-siang. The river runs through a sandy barren country, almost treeless, and no good to the collector, so one must go on. The sides of the river, where they are high, are of red burnt clay of volcanic origin, underneath this clay is sand and here and there a stratum of sea-shells. The river is broad and very shallow, the boats requiring to be pulled along by the men for long distances.

We have passed a number of bamboo water-wheels for irrigating purposes, and where these occur the river is dammed with a bamboo fence. When this has been passed, navigation once more becomes easy.

We have seen numerous birds, Ospreys, Kites, Crows, Magpies, a Cormorant, a Grebe, numbers of Waders, more especially Greenshanks, Herons, and black Storks, as well as Kingfishers of two kinds. Our boat is a dirty barge and smells very strong, but one might be worse off.

The Chinese work naked and are without shame, the greatest savages I have met with.

15th. Still going up stream with a nice wind, and make good progress, though our mat sail is much destroyed.

16th. Still going up stream, but slowly. Arrive at Ting-au, a small walled Chinese town. We have got porters for Sieum-tin-san, where the Padre Baptista has a priest, and we remain for the night.

17th. Left this morning with twenty-eight porters; could not get off early as the Chinese talked so much, but at 9.30 A.M. they were on their way. The country is almost a sandy desert; there has been no rain for so long that the rice and potato crop will in all probability be a failure: all the trees have been cut down and burnt, and a more arid place it would be difficult to find. We stopped to-night at Teen-heng-si, in a most horrible squalid house with a foul open drain at the door; unfortunately we were too late to camp outside.

18th. After passing a horrible night, we started off at daylight for a 30-mile walk over the sandy arid country, a truly miserable spot. Camped at night by the side of a river at Nam-lu-as (I am fully determined, if possible, never to enter a Chinese house again), and passed a fairly good night.

19th. Walked twenty miles to-day and at 3 o'clock reached Leamui, another wretched place; in fact the whole country is horrible and almost entirely cleared of trees—the Chinese burning down the forest to keep back the Loïs or aborigines. I am afraid there are no birds, but fleas and other insects are everywhere.

20th. Went a long walk over the mountains to see if we could find collecting ground, but the place is very bare. I saw a Peregrine and several other birds.

21st. Getting baggage into small packs. I find my Chinese carriers a very great nuisance. Visited the Mandarin, and hope to start to-morrow.

22nd. Again visited Mandarin. His rifles are clean outside, but the rifling is eaten away with rust! Saw two Loi with their hair done up in front in a knob, like the horn of a unicorn.

23rd. Went for a walk over the bare mountain-sides, but caught a few nice butterflies on some flowering-plants. Saw a small red-coloured deer, two Peregrines, and, in the evening, some Nightjars, which settled on the tops of rocks on the summit of the hill. Their note is a curious shrill chirp, which, like that of a ventriloquist, seems to come from the ground near one's feet. Francolins are very common here. The porters say they will start to-morrow.

24th. The porters did not turn up till nearly 10 A.M.; then, as usual, went after their sticks; subsequently we had to visit the Mandarin, so did not leave until 12.30. After walking over some twelve or fifteen miles of the usual barren country, we reached a Chinese village, where we put up in the Joss-house, which was clean and well away from the stinks of the crowd.

25th. Started for the mountains again to-day, arriving at 5 P.M. at a small village, where we camped for the night. Saw a few birds, a *Henicurus* in the river, and a number of *Pericrocoti*, also a few *Palaornis javanicus*. I see neither the white Crow nor the Magpie so far inland. Francolins are still abundant. We meet every day Chinese carrying bundles of skins of deer, monkeys, and pangolins, so I am sure we are not far from some large forests.

26th. Our Chinese porters refuse to go any further to-day; they say they have no rice, but, the truth is, they are done up and want to rest. The Mandarin sent two soldiers with us, so that we should be looked after; they have proved most useful. Some Chinese wanted to prevent our going through their village yesterday: one of them was, I think, drunk and nearly had a row with us. The country is slightly less barren, but still a miserable place for collecting in. Rain all night. The hills have been so enveloped in clouds, that I have not yet been able to see the mountain-tops. I hope to reach our destination some time to-morrow.

27th. Instead of reaching our destination to-day, the Chinese

have taken us a day's journey further away from the mountains, as they say there is no road this (the north) side, so we have had to tramp over bare hills in a broiling sun. My old trouble dysentery is a great worry to me. The Lois or Lū, as the Chinese call them, are, so far as the men go, nearly like the Chinese. The hair is at times a pigtail tied in a knob, but more often a knob of hair tied in front, which looks like a unicorn's horn. Their villages are small, the houses of grass and sloped like an arch, and they live on the ground. The women are quite distinct from the Chinese, wearing very short skirts of blue, or blue with a red-and-white pattern.

28th. Still on the march. Arrived at Lū village in the evening, but the men seemed so disagreeable, that we went about half a mile away and camped. They then followed to see all they could, and were amazed at our guns. Bought half a big pig for \$1.50.

29th. Left early, as I wanted to camp near the mountain. Sent Andres and Juan off at 4 A.M. to look for a spot. Nearly had a row with our Chinese porters, but formed up in their rear so that they had to go on after using a good deal of bad language at us. Have struck a nice place for a camp, close to a fine rocky stream not far from the mountains. Hear lots of birds. Am very seedy with dysentery, Juan with fever. Busy building a house all day.

30th. Busy house-building. Caught some beautiful butterflies in the river. Saw a fine Kingfisher, I think *Alcedo euryzona*, also some monkeys.

31st. This being Good Friday, we have resolved not to begin collecting to-day—unlucky—but to finish off the house. It rained this morning and was very cold before daylight. A cloudy day, saw no butterflies. Begin collecting to-morrow.

APRIL 1st. At last we were able to go shooting. Andres brought in four birds. Hills very steep, sand and rocks; this is the reason why they are left alone by the natives. Sand-flies awful. Butterflies numerous in the river-bed. Saw a large Kingfisher and some squirrels.

Natives visit us daily: fowls 10 cts., ducks 25 cts., eggs $\frac{1}{2}$ ct.

2nd. Very seedy with dysentery. Juan shot a Silver Pheasant which may be new (see *Gennæus whiteheadi*, p. 503), and a fine Paradise Flycatcher. Heat and sand-flies awful.

3rd-19th. All ill with fever and dysentery.

19th-30th. The bird collection is going along slowly—my men being all ill one day or another, one or two have been ill every day with fever. I am perhaps in better health than I have been for some time. Lū women catching caterpillars for food. It rains heavily and thunders every afternoon, and our life here, owing to fever, is most miserable.

MAY 1st-6th. All my men ill with bad fever. The two Chinese and myself do not suffer much.

7th. I saw a Lū with some rat-traps identical with those made

by the Kina Balu Dusans. Changed into my new house. Very fine for the last few days, no rain. Men (Philipinos) hopelessly ill, and have done nothing for a fortnight. Sent the Chinese soldier out to shoot for me; want to see if he is worth anything.

9th. Three of my Manila men left me to-day of their own accord. I trust they will reach Hoihow safely. It makes me very sad all this illness. I gave them the option of going, as I should be very sorry to be the cause of the death of any one of them.

10th. To-day is very wet; the Manila men will have a sad time of it, I expect. My boy Juan is still with me, not because he cares about staying with me, but because he was too ill to start with the others. The Chinese soldier is doing my shooting and gets on very well.

11th-16th. Am trying to work on with one boy, who is not much use at bird-skinning. The Lū are beginning to bring things, which is a good job, so perhaps I shall get on after all.

20th. Attacked again by fever—very seedy—useless. John Afar also.

21st-23rd. Nearly dead with fever—no food—no depression of temperature.

24th May. (Diary ends.)

The faithful Chinese servants carried Mr. Whitehead's body and all his belongings to Hoihow, and his remains were interred in the cemetery by the sea. The journey from the interior was accomplished in 19 days.

Through the kindness of the Consul, Mr. Butler O'Brien, Whitehead's zoological collections were carefully packed and shipped to England, arriving safely in due course. The collection of birds, numbering about 250 skins, all in the most perfect condition, includes many striking novelties, the most remarkable being a very peculiar Jay (*Urocissa whiteheadi*), a splendid Silver Pheasant (*Gennæus whiteheadi*), and an equally fine Night-Heron (*Nycticorax magnifica*). The two last-named species have been well figured by Mr. H. Grönvold in the accompanying drawings.

That Mr. Whitehead should have succeeded, under the most adverse circumstances, in obtaining such splendid results in a comparatively short time, indicates that much still remains to be done in the highlands of the interior of Hainan, but, as his diary too clearly shows, the deadly climate of the forests will probably deter even the most hardy explorer from following in his footsteps.

[The species of which specimens were obtained in the Five-Finger Mountains are marked with an asterisk.]

1. CORVUS LEVAILLANTI.

Corvus sinensis, Moore; Swinhoe, Ibis, 1870, p. 348, fig. 1.

Corone levaillanti (Lesson); Sharpe, Cat. B. Brit. Mus. iii. p. 39 (1877).

Corvus leuallanti, Lesson ; Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 312 (1892).

Hainan birds of this species appear to belong to a slightly larger race.

Common about the towns of Hainan (*Swinhoe*).

2. CORVUS TORQUATUS.

Corvus torquatus, Less. ; Swinhoe, Ibis, 1870, p. 350 ; Sharpe, Cat. B. Brit. Mus. iii. p. 21 (1877) ; Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 312 (1892).

Common in the plains of North and North-west Hainan (*Swinhoe*).

3. PICA PICA.

Pica media, Blyth ; Swinhoe, Ibis, 1870, p. 350.

Pica pica (Linn.), Sharpe, Cat. B. Brit. Mus. iii. p. 62 (1877) ; Styan, Ibis, 1893, p. 431.

Pica caudata, Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 312 (1892), xiv. p. 366 (1898).

Abundant everywhere (*Swinhoe*).

4. UROCISSA ERYTHORHYNCHA.

Urocissa erythrorhyncha (Gmel.) ; Sharpe, Cat. B. Brit. Mus. iii. p. 71 (1877) ; Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 312 (1892).

An example of this species was procured in North Hainan by Tetsu, the late Mr. Schmacker's Japanese collector, and identified by Dr. Hartlaub.

5. *UROCISSA WHITEHEADI.

Urocissa whiteheadi, Grant, Bull. B. O. C. vol. x. p. xviii (1899).

This remarkable species may be characterized as follows:—Sexes similar one to another in plumage. Head, back, fore-neck, and chest dark earthy brown, darkest on the ear-coverts, and shading into grey on the sides and flanks, and into yellowish buff on the middle of the breast, belly, and under tail-coverts ; feathers of the crown rounded at the extremity and edged with whitish brown ; rump greyish brown ; upper tail-coverts black, tipped with white ; wings black, except the lesser and median wing-coverts, which are white save at the base ; tips of the primary-quills, margins of the terminal half of the outer webs of the secondaries, and the tips of the greater wing-coverts pure white ; middle tail-feathers grey, widely tipped with white and with a subterminal black band ; the outer feathers similarly marked, but with the white tips increasing in size and shaded with yellow ; axillaries and under wing-coverts clear yellowish white. “ Iris straw-colour ; bill red, shading into brownish yellow at the base ;

feet dark brown."—*J. W.* Total length about 18 inches; culmen 1.9; wing 8.2; tail 9.4; tarsus 1.95.

Mr. Whitehead was fortunate in obtaining a nest and eggs of this remarkable new species. The nest, a very slightly concave platform, is semitransparent, and formed of dry stems of creepers and roots, firmly interwoven.

The eggs, six in number, have the ground-colour pale greenish blue, sparingly spotted and dotted with light brown. The average measurements are 1.4 × 1 inch.

6. *DENDROCITTA SINENSIS.

Dendrocitta sinensis (Lath.); Swinhoe, *Ibis*, 1870, p. 351; Sharpe, *Cat. B. Brit. Mus.* iii. p. 81 (1877); Styan, *Ibis*, 1893, p. 431; Hartl. *Abh. nat. Ver. Bremen*, xiv. p. 366 (1898).

"Iris dull lake; bill black; feet dull brownish black."—*J. W.*

Not uncommon among the fine woods of Shuy-wei-sze, Central Hainan (*Swinhoe*).

Mountains of South-west Hainan (*Styan*).

7. *STURNIA SINENSIS.

Temenuchus sinensis (Gmel.); Swinhoe, *Ibis*, 1870, p. 352.

Sturnia sinensis, Sharpe, *Cat. B. Brit. Mus.* xiii. p. 68 (1890); Hartl. *Abh. nat. Ver. Brem.* xii. pp. 219, 314 (1892); Styan, *Ibis*, 1893, p. 431; Hartl. *Abh. nat. Ver. Bremen*, xiv. p. 365 (1898).

♀. "Iris greyish white; bill whitish blue, cobalt at base; feet whitish brown."—*J. W.*

Common on the coast of Hainan in March (*Swinhoe*).

Mountains of South-west Hainan (*Styan*).

8. *ACRIDOTHERES CRISTATELLUS.

Acridotheres philippensis, Bonap.; Swinhoe, *Ibis*, 1870, p. 352.

Acridotheres cristatellus (Gmel.); Sharpe, *Cat. B. Brit. Mus.* xiii. p. 92 (1890).

♂. "Iris orange-yellow; bill whitish green, base of lower mandible pinkish; feet yellowish brown."—*J. W.*

Abundant about all towns and villages (*Swinhoe*).

9. SPODIOPSAR CINERACEUS.

Sturnus cineraceus, Temm.; Swinhoe, *Ibis*, 1870, p. 352.

Spodiopsar cineraceus, Sharpe, *Cat. B. Brit. Mus.* xiii. pp. 41, 665 (1890).

Poliopsar cineraceus, Hartl. *Abh. nat. Ver. Bremen*, xii. pp. 299, 314 (1892).

Met with during February (*Swinhoe*).

10. SPODIOPSAR SERICEUS.

Spodiopsar sericeus (Gmel.); Sharpe, *Cat. B. Brit. Mus.* xiii. pp. 44, 665 (1890).

Poliopsar sericeus (Gmel.); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 314 (1892).

Adult and young were obtained by Mr. Schmacker's collector, Tetsu, in North Hainan (*Hartlaub*).

11. *TEMNURUS NIGER.

Crypsirhina nigra, Styan, Bull. B. O. C. vol. i. p. vi (1892); id. Ibis, 1893, p. 55.

Temnurus niger, Sharpe, Bull. B. O. C. vol. i. p. xix (1892); Styan, Ibis, 1893, p. 431.

Temnurus schmackeri, Styan, Ibis, 1893, p. 426 (descript. null.).

It is doubtful whether this species is really distinct from the type of *Temnurus truncatus*, which is said to have come from Cochin China and is preserved in the Paris Museum.

Obtained by Tetsu at Liuwowan, on the north slopes of the mountains of South-west Hainan.

12. *MAINATUS INTERMEDIUS.

Eulabes hainanus, Swinhoe, Ibis, 1870, p. 352.

Mainatus intermedius (A. Hay); Sharpe, Cat. B. Brit. Mus. xiii. p. 104 (1890).

"Iris brown; bill orange-red, tip and lappet orange-yellow; feet yellow."—*J. W.*

Though Swinhoe saw these Grackles in the cages in the towns of Hainan, he never met with them in a wild state.

Several birds were obtained by the late Mr. Whitehead in the Five-Finger Mountains.

13. *CHAPTIA AENEA.

Chaptia aenea (Vieill.); Sharpe, Cat. B. Brit. Mus. iii. p. 243, (1877).

♂. "Iris dark hazel; bill and feet black."—*J. W.*

This is the first time this species has been recorded from Hainan.

14. *BUCHANGA LEUCOGENYS.

Buchanga leucogenys, Wald.; Swinhoe, Ibis, 1870, p. 245; Sharpe, Cat. B. Brit. Mus. iii. p. 251 (1877); Styan, Ibis, 1893, p. 429.

♂. "Iris lake; bill and feet black."—*J. W.*

Not rare in the woods of Central Hainan (*Swinhoe*).

Mountains of South-west Hainan (*Styan*).

15. BUCHANGA ATRA.

Dicrurus macrocerus, Vieill.; Swinhoe, Ibis, 1870, p. 244.

Buchanga atra (Hermann); Sharpe, Cat. B. Brit. Mus. iii. p. 246 (1877); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 313 (1892); Styan, Ibis, 1893, p. 429; Hartl. Abh. nat. Ver. Bremen, xiv. p. 357 (1898).

Found in all cultivated parts of Hainan (*Swinhoe*).

16. BUCHANGA CINERACEA.

Buchanga mouhoti, Wald. ; Swinhoe, Ibis, 1870, p. 245.

Buchanga innexa, Swinhoe, Ibis, 1870, p. 246.

Buchanga cineracea (Horsf.) ; Sharpe, Cat. B. Brit. Mus. iii. p. 250 (1877) ; Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 313 (1892).

No reference is made in the 'Catalogue of Birds' to *Buchanga innexa* Swinhoe. The British Museum Collection now contains the female type of this species, which appears to be an immature example of *B. cineracea* ; the male type has apparently disappeared.

North-west and Central Hainan (*Swinhoe*).

17. *DISSEMURUS PARADISEUS.

Dissemurus paradiseus (Linn.) ; Sharpe, Cat. B. Brit. Mus. iii. p. 258 (1877).

In none of the specimens are the feathers on the back of the neck much elongated.

	Crest.	Culmen.	Wing.	Tail.	Tail to tip of racket.	Tarsus.
	in.	in.	in.	in.	in.	in.
♂ ..	1·8	1·5	6·3	6·9	16·5	1·1
♂ ..	2·0	1·5	6·5	6·3	14·1	1·2
♂ ..	2·2	1·4	6·3	6·1	14·4	1·1
♀ ..	1·85	1·4	6·1	6·8	14·4	1·1

This Drongo is recorded for the first time from Hainan.

18. *ORIOIUS DIFFUSUS.

Oriolus chinensis, Swinhoe (nec Linn.), Ibis, 1870, p. 342.

Oriolus diffusus, Sharpe, Cat. B. Brit. Mus. iii. p. 197 (1877) ; Styan, Ibis, 1893, p. 429 ; Hartl. Abh. nat. Ver. Bremen, xiv. p. 356 (1898).

Northern slopes of the mountains of South-west Hainan (*Styan*).
North-central Hainan (*Hartlaub*).

19. ORIOIUS NIGELLICAUDUS.

Psaropholus ardens, var. *nigellicauda*, Swinhoe, Ibis, 1870, p. 342.

Psaropholus nigellicauda, Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 313 (1892).

Oriolus nigellicaudus, Sharpe, Cat. B. Brit. Mus. iii. p. 221 (1877).

Tai-ping-sze, Central Hainan, and Yulinkan, South Hainan (*Swinhoe*).

North Hainan (*Hartlaub*).

20. MUNIA TOPELA.

Munia topela, Swinhoe, Ibis, 1870, p. 354 ; Sharpe, Cat. B. Brit. Mus. xiii. p. 351 (1890) ; Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 315 (1892) ; Styan, Ibis, 1893, p. 431 ; Hartl. Abh. nat. Ver. Bremen, xiv. p. 362 (1898).

Common in Hainan (*Swinhoe*).

Hoihow (*Hartlaub*).

Northern slope of the mountains of South-west Hainan (*Styan*).

21. **UROLONCHA SQUAMICOLLIS*.

Munia acuticauda, Swinhoe (nec Hodggs.), Ibis, 1870, p. 354.

Uroloncha squamicollis, Sharpe, Cat. B. Brit. Mus. xiii. p. 359 (1890).

♂. "Iris light hazel; upper mandible black, lower whitish blue; feet dull black."—*J. W.*

Common (*Swinhoe*).

22. *PASSER MONTANUS*.

Passer montanus (Linn.); Swinhoe, Ibis, 1870, p. 354; Sharpe, Cat. B. Brit. Mus. xii. p. 301 (1888).

This is the domestic Sparrow of Hainan (*Swinhoe*).

23. *EMBERIZA FUCATA*.

Emberiza fucata, Pall.; Swinhoe, Ibis, 1870, p. 354; Sharpe, Cat. B. Brit. Mus. xii. p. 493 (1888); Styan, Ibis, 1893, p. 431.

Lingmun, Central Hainan, 23rd February (*Swinhoe*).

Northern slopes of the mountains of South-west Hainan (*Styan*).

24. *EMBERIZA SPODOCEPHALA*.

Emberiza spodocephala, Pall.; Swinhoe, Ibis, 1870, p. 354; Sharpe, Cat. B. Brit. Mus. xii. p. 522 (1888).

Common about gardens in February (*Swinhoe*).

25. **EMBERIZA AUREOLA*.

Emberiza aureola, Pall.; Swinhoe, Ibis, 1870, p. 354; Sharpe, Cat. B. Brit. Mus. xii. p. 509 (1888); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 315 (1892).

"Iris dark brown; bill whitish brown on the culmen; feet light pinkish brown."—*J. W.*

Haosuy, West Hainan, 29th March (*Swinhoe*).

North Hainan, 19th March (*Hartlaub*).

The late Mr. Whitehead obtained an adult male on the Five-Finger Mountains, 8th May.

26. *ALAUDA GULGULA*.

Alauda celivox, Swinhoe, Ibis, 1870, p. 354.

Alauda sala, Swinhoe, Ibis, 1870, p. 354.

Alauda gulgula, var. *sala*, Sharpe, Cat. B. Brit. Mus. xiii. p. 575 (1890).

Alauda wattersi, Swinhoe; Styan, Ibis, 1893, p. 431.

The varieties *Alauda celivox* and *A. sala* are both found in Hainan.

The former is common in all cultivated parts of Hainan and even met with at Lingmun, Central Hainan (*Swinhoe*).

The latter was obtained at Hoi-tow, West Hainan (*Swinhoe*).

Northern slopes of the mountains of South-west Hainan (*Styan*).

27. MOTACILLA OCULARIS.

Motacilla ocularis, Swinhoe, Ibis, 1870, p. 346; Sharpe, Cat. B. Brit. Mus. x. p. 471, pl. iv. figs. 5, 6 (1885).

Tolerably common (*Swinhoe*).

The three specimens obtained by Swinhoe in Hainan are no longer to be found, they are not in the Seebohm Collection nor are they mentioned in the Catalogue of the Tristram Collection.

28. MOTACILLA LEUCOPSIS.

Motacilla francisi, Swinhoe, Ibis, 1870, p. 345.

Motacilla leucopsis, Gould; Sharpe, Cat. B. Brit. Mus. x. p. 482 (1885); Styan, Ibis, 1893, p. 428; Hartl. Abh. nat. Ver. Bremen, xiv. p. 354 (1898).

Two specimens were obtained by Swinhoe. It was recorded from Hoihow, North Hainan, by Hartlaub, and from South-western Hainan by Styan.

29. MOTACILLA MELANOPE.

Calobates boarula, Linn.; Swinhoe, Ibis, 1870, p. 346.

Motacilla melanope, Pall.; Sharpe, Cat. B. Brit. Mus. x. p. 497 (1885); Styan, Ibis, 1893, p. 428; Hartl. Abh. nat. Ver. Bremen, xiv. p. 354 (1898).

Not common (*Swinhoe*).

South-west Hainan (*Styan*).

Hoihow, North Hainan (*Hartlaub*).

30. MOTACILLA TAIVANA.

Budytes taivanus, Swinhoe, Ibis, 1870, p. 346.

Motacilla taivana, Sharpe, Cat. B. Brit. Mus. x. p. 514 (1885).

The bird collected by Swinhoe is now in the Liverpool Museum.

31. MOTACILLA BOREALIS.

Budytes cinereocapillus, Swinhoe (nec Savi), Ibis, 1870, p. 346.

Motacilla borealis, Sundev.; Sharpe, Cat. B. Brit. Mus. x. p. 522, pl. vii. figs. 1-3 (1885).

The example collected by Swinhoe on West Island, South Hainan, is now in the British Museum Collection.

32. ANTHUS MACULATUS.

Pipastes agilis (Sykes); Swinhoe, Ibis, 1870, p. 347.

Anthus maculatus, Hodgs.; Sharpe, Cat. B. Brit. Mus. x. p. 547 (1885); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 311 (1892).

The British Museum Collection possesses a young bird obtained by Swinhoe, who says that the species was to be found at most of the places he visited.

North Hainan (*Hartlaub*).

33. ANTHUS RICHARDI.

Corydalla richardi (Vieill.); Swinhoe, Ibis, 1870, p. 347.

Anthus richardi, Sharpe, Cat. B. Brit. Mus. x. p. 564 (1885); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 311 (1892); Styan, Ibis, 1893, p. 428; Hartl. Abh. nat. Ver. Bremen, xiv. p. 354 (1898).

Two specimens collected by Swinhoe are now in the British Museum Collection.

Common (*Swinhoe*).

Hoihow, North Hainan (*Hartlaub*).

South-west Hainan (*Styan*).

34. ANTHUS CERVINUS.

Anthus cervinus (Pall.); Swinhoe, Ibis, 1870, p. 347; Sharpe, Cat. B. Brit. Mus. x. p. 585 (1885); Styan, Ibis, 1893, p. 428; Hartl. Abh. nat. Ver. Bremen, xiv. p. 354 (1898).

Often met with in small parties (*Swinhoe*).

Hoihow, North Hainan (*Hartlaub*).

South-west Hainan (*Styan*).

35. ANTHUS ROSACEUS.

Anthus rosaceus, Hodgs.; Sharpe, Cat. B. Brit. Mus. x. p. 589 (1885); Hartl. Abh. nat. Ver. Bremen, xiv. p. 354 (1898).

Dr. Hartlaub records two males from Hoihow, North Hainan.

36. *ÆTHOPYGA CHRISTINÆ.

Æthopyga christinæ, Swinhoe, Ann. Mag. N. H. (4) iv. p. 436 (1869); id. Ibis, 1870, p. 236; Walden, Ibis, 1870, p. 36, pl. i. fig. 1; Gadow, Cat. B. Brit. Mus. ix. p. 30 (1884); Styan, Ibis, 1893, p. 430; Hartl. Abh. nat. Ver. Bremen, xiv. p. 361 (1898).

Urodrepanis christinæ (Swinh.); Shelley, Monogr. Nect. i. p. 79, pl. 26.

“♂. Eye and bill black; feet dark brown.”—*J. W.*

Shuy-wei-sze and Lingmun, Central Hainan (*Swinhoe*).

Liuwowan, northern slope of the mountains of South-west Hainan (*Styan*).

37. CINNYRIS RHIZOPHORÆ.

Cinnyris rhizophoræ (Swinhoe); Shelley, Monogr. Nect. i. p. 163, pl. 52; Gadow, Cat. B. Brit. Mus. ix. p. 89 (1884); Styan, Ibis, 1893, p. 430.

Arachnecythra rhizophoræ, Swinhoe, Ann. Mag. N. H. (4) iv. p. 436 (1869); id. Ibis, 1870, p. 237; Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 309 (1892), xiv. p. 361 (1898).

Plentiful throughout Hainan, except in the neighbourhood of the capital (*Swinhoe*).

Hoihow, North Hainan (*Hartlaub & Styan*).

38. DICCÆUM CRUENTATUM.

Diccæum cruentatum (Linn.); Swinhoe, Ibis, 1870, p. 239; Sharpe, Cat. B. Brit. Mus. x. p. 15 (1885); Hartl. Abh. nat. Ver. Bremen,

xii. pp. 299, 309 (1892); Styan, *Ibis*, 1893, p. 431; Hartl. *Abh. nat. Ver. Bremen*, xiv. p. 361 (1898).

Everywhere a common species (*Swinhoe*).

39. **DICÆUM MINULLUM*.

Dicæum minullum, Swinhoe, *Ibis*, 1870, p. 240; Sharpe, *Cat. B. Brit. Mus.* x. p. 47 (1885).

This species, hitherto known only from the unique type specimen which was dropped in the streets of London and lost (see Sharpe, *Cat. B. Brit. Mus.* x. p. 47, footnote), is represented by a male in the present collection.

40. **ZOSTEROPS PALPEBROSA*.

Zosterops palpebrosa (Temm.); Sharpe, *Cat. B. Brit. Mus.* ix. p. 165 (1884).

Zosterops simplex, Swinhoe, *Ibis*, 1861, p. 331 (S. China); id. *Ibis*, 1870, p. 348 (Hainan).

Zosterops neglecta, Seebohm, *Bull. B. O. C.* vol. i. p. xxvi (1893); id. *Ibis*, 1893, pp. 219, 258 (E. Java).

The Silver-eye from China and Hainan differs somewhat from typical *Z. palpebrosa* from India in having the sides of the breast and the flanks much less conspicuously washed with grey.

There is an example of *Z. palpebrosa* in the British Museum Collection, labelled "Laccadives, Hume Coll." This bird is perfectly similar in plumage to *Z. neglecta*, Seebohm, from East Java. The latter appears to me to be indistinguishable from examples of *Z. palpebrosa* from China and Hainan—that is to say, from *Z. simplex* of Swinhoe.

"Iris light brown, bill black, base of lower mandible pale blue, feet greyish green."—*J. W.*

Met with in all parts of the island (*Swinhoe*).

41. **PARUS CINEREUS*.

Parus cinereus, Vieill.; Swinhoe, *Ibis*, 1870, p. 348; Gadow, *Cat. B. Brit. Mus.* viii. p. 16 (1883).

Three Tits from the Five-Finger Mts., Hainan, differ slightly from typical *P. cinereus* in having the sides and flanks pure white, but this difference appears to me to be too slight to warrant their separation.

"Iris and bill black, feet greyish lead-colour."—*J. W.*

42. **LANIUS SCHACH*.

Lanius schach, Linn.: Swinhoe, *Ibis*, 1870, p. 240; Gadow, *Cat. B. Brit. Mus.* viii. p. 261 (1883); Hartl. *Abh. nat. Ver. Bremen*, xii. pp. 299, 312 (1892).

"♂. Iris brown, bill and feet black."—*J. W.*

Appears to be fairly common.

43. *LANIUS SUPERCILIOSUS*.

Lanius superciliosus, Lath.; Gadow, *Cat. B. Brit. Mus.* viii.

p. 273 (1883); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 312 (1892); Styan, Ibis, 1893, p. 429.

North Hainan (*Hartlaub*).

South-west Hainan (*Styan*).

44. *LANIUS FUSCATUS*.

Lanius fuscatus, Less.; Swinhoe, Ibis, 1870, p. 241; Gadow, Cat. B. Brit. Mus. viii. p. 263 (1883); Styan, Ibis, 1893, p. 429; Hartl. Abh. nat. Ver. Bremen, xiv. p. 358 (1898).

Central Hainan (*Swinhoe*).

Nodouha, North Central Hainan (*Styan*).

North Hainan (*Hartlaub*).

45. *LANIUS LUCIONENSIS*.

Lanius lucionensis, Linn.; Swinhoe, Ibis, 1870, p. 241; Gadow, Cat. B. Brit. Mus. viii. p. 274 (1883).

Lanius luzionensis, Linn.; Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 312 (1892).

Seen, but not procured, in North and West Hainan (*Swinhoe*).

North Hainan (*Hartlaub*).

46. **TEPHRODORNIS PELVICA*.

Tephrodornis pelvicus (Hodgs.); Swinhoe, Ibis, 1870, p. 241; Sharpe, Cat. B. Brit. Mus. iii. p. 376 (1877); Styan, Ibis, 1893, p. 429; Hartl. Abh. nat. Ver. Bremen, xiv. p. 358 (1898).

“♂. Iris brown; bill black; feet brown.”—*J. W.*

Central Hainan (*Swinhoe*).

Nodouha, North Central, and Liuwowan, northern slopes of the mountains of South-west Hainan (*Styan*).

North Hainan (*Hartlaub*).

47. *ARTAMUS FUSCUS*.

Artamus fuscus, Vieill.; Swinhoe, Ibis, 1870, p. 247; Sharpe, Cat. B. Brit. Mus. xiii. p. 11 (1890).

Yu-lin-kan Bay, South Hainan (*Swinhoe*).

48. *PHYLLOSCOPUS PLUMBEITARSUS*.

Phyllopneuste plumbeitarsus, Swinhoe, Ibis, 1870, p. 345.

Phylloscopus plumbeitarsus, Seebohm, Cat. B. Brit. Mus. v. p. 45 (1881).

West coast of Hainan towards the end of March (*Swinhoe*).

49. *PHYLLOSCOPUS SUPERCILIOSUS*.

Reguloides superciliosus (Gmel.); Swinhoe, Ibis, 1870, p. 345.

Phylloscopus superciliosus, Seebohm, Cat. B. Brit. Mus. v. p. 68 (1881); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 309 (1892).

Common in February (*Swinhoe*).

North Hainan (*Hartlaub*).

50. LUSCINIOLA FUSCATA.

Phylloperuste fuscata, Blyth; Swinhoe, Ibis, 1870, p. 345.

Lusciniola fuscata, Seebohm, Cat. B. Brit. Mus. v. p. 127 (1881); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 310 (1892).

Often met with in Hainan (*Swinhoe*).

North Hainan (*Hartlaub*).

51. CETTIA MINUTA.

Calamoherpe minuta, Swinhoe, Ibis, 1870, p. 345.

Cettia minuta, Seebohm, Cat. B. Brit. Mus. v. p. 141 (1881); Grant, Ibis, 1894, p. 508; Hartl. Abh. nat. Ver. Bremen, xiv. p. 352 (1898).

Frequently seen and heard in February about the gardens and villages near the capital, Kiung-chu (*Swinhoe*).

North Hainan (*Hartlaub*).

52. CETTIA CANTURIENS.

Calamoherpe canturians, Swinhoe, Ibis, 1870, p. 345.

Cettia canturiens, Seebohm, Cat. B. Brit. Mus. v. p. 141 (1881); Hartl. Abh. nat. Ver. Bremen, xiv. p. 352 (1898).

Common in February near Kiung-chu (*Swinhoe*).

North Hainan (*Hartlaub*).

53. PRINIA EXTENSICAUDA.

Drymœca extensicauda, Swinh. Ibis, 1870, p. 345.

Prinia inornata, Sykes; Sharpe, Cat. B. Brit. Mus. vii. p. 195 (1883); Styan, Ibis, 1893, p. 427; Hartl. Abh. nat. Ver. Bremen, xiv. p. 350 (1898).

Prinia extensicauda, Oates, Faun. Brit. Ind., Birds, i. p. 454 (1889).

Common (*Swinhoe*).

North Hainan (*Hartlaub*).

South-west Hainan (*Styan*).

54. *BURNESIA SONITANS.

Prinia sonitans, Swinhoe, Ibis, 1870, p. 345.

Burnesia sonitans, Sharpe, Cat. B. Brit. Mus. vii. p. 205 (1883); Styan, Ibis, 1893, p. 427; Hartl. Abh. nat. Ver. Bremen, xiv. p. 351 (1898).

"Iris brown; bill black; feet pinkish brown."—*J. W.*

Seen about the gardens at Kiung-chu, North Hainan, and Nychu, South Hainan (*Swinhoe*).

Interior of Hainan (*Hartlaub*).

South-west Hainan (*Styan*).

55. SUTORIA SUTORIA.

Sutoria sutoria (Forst.); Sharpe, Cat. B. Brit. Mus. vii. p. 215 (1883).

Orthotomus longicauda (Gmel.); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 310 (1892).

North Hainan (*Hartlaub*).

56. *GRAMINICOLA STRIATA.

Graminicola striata, Styan, Bull. B. O. C. vol. i. p. vi (1892); id. Ibis, 1893, p. 427; Hartl. Abh. nat. Ver. Bremen, xiv. p. 350 (1898).

A female specimen, collected by Whitehead, is in somewhat worn plumage; it appears to be very closely allied to *G. bengalensis*, if, indeed, it is really distinct; but the latter has the black on the head and back more pronounced and the rufous edges to the feathers less conspicuous. Many specimens of *G. bengalensis* have the feathers of the rump more or less narrowly streaked with black. I do not consider this character of much importance.

“Iris brown; bill dull pink, blackish along the culmen; feet pinkish white.”—*J. W.*

This species is new to the British Museum Collection.

Leimumon and Leimoi, northern slope of the mountains of South-west Hainan (*Styan & Hartlaub*).

57. CISTICOLA CISTICOLA.

Cisticola schcenicola, Bonap.; Swinhoe, Ibis, 1870, p. 345; Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 310 (1892).

Cisticola cisticola (Temm.); Sharpe, Cat. B. Brit. Mus. vii. p. 259 (1883).

Grassy hills of North Hainan (*Swinhoe & Hartlaub*).

58. TURDUS MUSICUS.

Turdus musicus, Linn.; Hartl. Abh. nat. Ver. Bremen, xiv. p. 346 (1898).

Hartlaub records a male from Hainan.

59. TURDUS CARDIS.

Turdus cardis, Temm.; Swinhoe, Ibis, 1870, p. 248; Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 303 (1892).

Merula cardis, Seebohm, Cat. B. Brit. Mus. v. p. 261 (1881); Styan, Ibis, 1893, p. 427.

Kiung-chu, North Hainan, February (*Swinhoe & Hartlaub*), and Tai-ping-sze, Central Hainan, 20th February (*Swinhoe*).

South-west Hainan (*Styan*).

60. TURDUS CHRYSOLAUS.

Turdus chrysolaus, Temm.; Swinhoe, Ibis, 1870, p. 248.

Merula chrysolaus, Seebohm, Cat. B. Brit. Mus. v. p. 275 (1881). Chinlan River, North-east Hainan, 6th March (*Swinhoe*).

61. TURDUS MANDARINUS.

Turdus mandarinus, Bonap.; Swinhoe, Ibis, 1870, p. 248.

Merula mandarina, Seebohm, Cat. B. Brit. Mus. v. p. 238 (1881).

Merula sinensis, Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 303 (1892).

North Hainan (*Swinhoe & Hartlaub*).

Occasionally seen in North-west and Central Hainan (*Swinhoe*).

62. **GEOCICHLA CITRINA*.

Geocichla citrina (Lath.); Swinhoe, Ibis, 1870, p. 248; Seebohm, Cat. B. Brit. Mus. v. p. 172 (1881).

An immature male obtained on 25th April, 1899, has the ear-coverts partially dusky brown.

"Iris dark brown; bill black; feet yellowish white."—*J. W.*

Observed by Swinhoe at Shuy-wei-sze, Central Hainan, but not obtained. Mr. Whitehead's specimen is the first that has actually been secured in Hainan.

63. *MONTICOLA SOLITARIUS*.

Petrocincla manilla (Bodd.); Swinhoe, Ibis, 1870, p. 248.

Monticola solitaria (P. L. S. Müller); Seebohm, Cat. B. Brit. Mus. v. p. 319 (1881); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 304 (1892); Styan, Ibis, 1893, p. 427.

Kiung-chu-fu and Hoihow, 27th December, North Hainan (*Swinhoe & Hartlaub*); February, Lingshuy, S.E. Hainan, 11th March, Haosuy, West Hainan, 29th March (*Swinhoe*); South-west Hainan (*Styan*).

64. *MONTICOLA CYANUS*.

Monticola cyanus (Linn.); Seebohm, Cat. B. Brit. Mus. v. p. 316 (1881); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 304 (1892), xiv. p. 348 (1898).

Hoihow, N. Hainan (*Hartlaub*).

65. *RUTICILLA AUREA*.

Ruticilla aurea (Gmel.); Swinhoe, Ibis, 1870, p. 344; Seebohm, Cat. B. Brit. Mus. v. p. 345 (1881).

Gardens of Kiung-chu, February (*Swinhoe*).

66. *RUTICILLA RUFIVENTRIS*.

Ruticilla rufiventris, Jerdon; Seebohm, Cat. B. Brit. Mus. v. p. 342 (1881); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 306 (1892).

Dr. Hartlaub has identified a female from Hainan as belonging to this species. *R. rufiventris* is a bird of North China and Mongolia, wintering in North and Central India, and it is somewhat surprising that it should turn up in Hainan; it is, however, very unlikely that any mistake could have been made in the identification.

67. *ERITHACUS CALLIOPE*.

Erithacus calliope (Pall.); Seebohm, Cat. B. Brit. Mus. v. p. 305 (1881); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 305 (1892); Styan, Ibis, 1893, p. 428.

North Hainan (*Hartlaub*).

South-west Hainan (*Styan*).

68. ERITHACUS SIBILANS.

Erithacus sibilans (Swinh.); Seebohm, Cat. B. Brit. Mus. v. p. 297, pl. xvii. (1881); Hartl. Abh. nat. Ver. Bremen, xii, pp. 299, 304 (1892).

North Hainan, 15th December (*Hartlaub*).

69. PRATINCOLA MAURA.

Pratincola indica, Swinhoe, Ibis, 1870, p. 344.

Pratincola maura, Pall.; Sharpe, Cat. B. Brit. Mus. iv. p. 188 (1879); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 305 (1892); Styan, Ibis, 1893, p. 428; Hartl. Abh. nat. Ver. Bremen, xiv. p. 351 (1898).

Near Kiung-chu and Hoihow, North Hainan, February (*Swinhoe* & *Hartlaub*).

South-west Hainan (*Styan*).

70. *COPSYCHUS SAULARIS.

Copsychus saularis (Linn.); Swinhoe, Ibis, 1870, p. 343; Sharpe, Cat. B. Brit. Mus. vii. p. 61 (1883); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 308 (1892); Styan, Ibis, 1893, p. 427.

“♂. Iris dark brown; bill black; feet brown.”—*J. W.*

Common in North and West Hainan (*Swinhoe*).

South-west Hainan (*Styan*).

71. *CITTOCINCLA MINOR.

Cittacincla macrura, var. *minor*, Swinhoe, Ibis, 1870, p. 345.

Cittacincla tricolor, Styan, Ibis, 1893, p. 427.

Kittacincla macroura?, Hartl. Abh. nat. Ver. Bremen, xiv. p. 348 (1898).

Cittocincla brevicauda, Grant, Ibis, 1899, p. 584.

The characters which distinguish this species from *C. tricolor* are its somewhat smaller size (wing 3·4 inches), the brownish edges to the outer webs of the primaries, the shorter middle pair of tail-feathers, not greatly exceeding the second pair in length, and the smaller white tips to the four outer pairs.

In addition to the male obtained by Whitehead, the British Museum possesses three birds collected by Swinhoe. These differ from the type in having the middle pair of tail-feathers longer than the following pair, but agree in having the outer webs of the primaries brownish and the white tips to the tail-feathers shorter.

Central Hainan (*Swinhoe*).

Nodouho, interior of North Hainan (*Styan* & *Hartlaub*).

72. *HENICURUS SINENSIS.

Henicurus sinensis, Gould; Sharpe, Cat. B. Brit. Mus. vii. p. 313 (1883).

♀. “Iris and bill black; feet pinkish white.”—*J. W.*

This species is recorded for the first time from Hainan.

Besides adults the collection contains a quite young bird, apparently just fledged, in an interesting stage of plumage.

73. *TROCHALOPTERON CANORUM.

Leucodipterum sinense (Gmel.); Swinhoe, Ibis, 1870, p. 250.

Trochalopecteron canorum (Linn.); Sharpe, Cat. B. Brit. Mus. vii. p. 376 (1883); Styan, Ibis, 1893, p. 427; Hartl. Abh. nat. Ver. Bremen, xiv. p. 348 (1898).

"Iris greenish yellow; bill yellow-red-brown; feet pinkish brown."—*J. W.*

Interior of Hainan (*Swinhoe*).

Interior of South-west Hainan (*Styan & Hartlaub*).

74. *GARRULAX SEMITORQUATA, sp. n.

Adult male. Most nearly allied to *G. pectoralis* (Gould), having the ear-coverts similarly striped. It is, however, much smaller and at once distinguished by the following characters:—the black band surrounding the throat is widely interrupted in the middle, the outer webs of the outer primary-quills are brownish buff instead of white, and the tips of the tail-feathers are fulvous buff.

Adult female. Differs from the male only in having the white streaks on the ear-coverts more strongly marked.

"Iris straw-colour to reddish brown; upper mandible lead-black, lower and feet lead-grey."—*J. W.*

Total length about 11·0 inches; culmen 1·25; wing 5·1; tail 4·8; tarsus 1·75.

Hab. Five-Finger Mts., interior of Hainan.

75. *GARRULAX SCHMACKERI.

Garrulax moniliger, Styan (nec Hodgs.), Ibis, 1893, p. 427.

Garrulax schmackeri, Hartl. Abh. nat. Ver. Bremen, xiv. p. 349 (1898).

This species evidently belongs to the more slender-billed group and is closely allied to *G. moniliger* (Hodgs.), having the ear-coverts similarly coloured. It is, however, an altogether smaller bird and may be at once distinguished by the wide bright fulvous tips to the tail-feathers. The adult has the base of the fore-neck tinged with buff, while in a quite young bird this part is pure white; in other respects the plumage of the young bird does not differ from that of the adult.

This species is new to the British Museum Collection.

G. schmackeri: culm. 1·05 in.; wing 4·2–4·3; tail 4·5; tarsus 1·5.

G. moniliger: „ 1·2 in.; „ 4·8–5·0; „ 4·9; „ 1·7.

Interior of South-west Hainan (*Styan & Hartlaub*).

76. *DRYONASTES CASTANOTIS.

Dryonastes castanotis, Grant, Ibis, 1899, p. 584.

This very distinct species is perhaps most nearly allied to *D. ruficollis* from India.

The general colour above is slate-grey, tinged with greenish on

the lower back and upper tail-coverts; the lores and feathers surrounding the eye and on the fore part of the cheek black; the hinder part of the cheek and ear-coverts with a large rounded patch of bright chestnut; the chin, throat, and upper part of the chest brownish black; and the rest of the underparts grey, tinged with greenish on the flanks, thighs, and under tail-coverts.

"Bill and eye black; legs and feet dark blackish brown."—*J. W.*
Total length 10·7 inches; wing 5·0; tail 5·0; tarsus 1·75.

Hab. Five-Finger Mts., interior of Hainan.

77. **DRYONASTES MONACHUS.*

Garrulax monachus, Swinhoe, *Ibis*, 1870, p. 248; Hartl. *Abh. nat. Ver. Bremen*, xii. pp. 299, 309 (1892).

Dryonastes monachus, Sharpe, *Cat. B. Brit. Mus.* vii. p. 457 (1883); Styan, *Ibis*, 1893, p. 427.

"Iris brown; bill black; legs and feet dusky black."—*J. W.*
Interior of Hainan (*Swinhoe*).
South-west Hainan (*Styan*).

78. **POMATORHINUS NIGROSTELLATUS.*

Pomatorhinus nigrostellatus, Swinhoe, *Ibis*, 1870, p. 250; Sharpe, *Cat. B. Brit. Mus.* vii. p. 425 (1883); Hartl. *Abh. nat. Ver. Bremen*, xii. pp. 299, 308 (1892); Styan, *Ibis*, 1893, p. 427.

Pomatorhinus musicus, Hartl. *Abh. nat. Ver. Bremen*, xiv. p. 348 (1898) (part., Hainan).

This species, though nearly allied to the Chinese form *P. stridulus*, Swinh., may be at once distinguished by the dark olive colour of the upper parts and the deep reddish-brown middles to the feathers of the fore-neck and chest.

"Tip of upper and lower mandible straw-yellow; iris pale brown; feet dark brown."—*J. W.*

Central Hainan (*Swinhoe*).
Interior of South-west Hainan (*Styan*).

79. **STACHYRIDOPSIS RUFICEPS.*

Stachyrhis praeognitus, Swinhoe, *Ibis*, 1866, p. 310 (Formosa).

Stachyridopsis ruficeps (Blyth); Sharpe, *Cat. B. Brit. Mus.* vii. p. 598 (1883).

This is the first time this species has been recorded from Hainan.

There appear to be three fairly well-marked races of *S. ruficeps* :—

a. Typical examples from India with the cap extending over the nape, and of the pale chestnut-colour characteristic of Chinese birds.

b. Chinese examples with the cap confined to the crown and generally of a pale chestnut-colour.

c. Birds from Formosa and Hainan with the cap of a deeper chestnut-colour and extending on to the nape. This is the form which has been described as *S. praeognitus* by Swinhoe.

"Iris deep lake; upper mandible black, lower white; legs greyish yellow."—*J. W.*

80. *ALCIPPE MORRISONIANA.

Alcippe morrisoniana, Swinh.; Sharpe, Cat. B. Brit. Mus. vii. p. 621 (1883).

Alcippe morrisonia, Swinh.; Styan, Ibis, 1893, p. 428; Hartl. Abh. nat. Ver. Bremen, xiv. p. 350 (1898).

"Iris lake-brown; bill black; feet brownish yellow."—*J. W.*
Interior of South-west Hainan (*Styan & Hartlaub*).

81. *HERPORNIS TYRANNULUS.

Herpornis tyrannulus, Swinhoe, Ibis, 1870, p. 347, pl. x.; Sharpe, Cat. B. Brit. Mus. vii. p. 637 (1883); Styan, Ibis, 1893, p. 428; Hartl. Abh. nat. Ver. Bremen, xiv. p. 353 (1898).

Cryptolopha bicolor, Styan, Bull. B. O. C. vol. i. p. vi (1892); id. Ibis, 1893, p. 55.

"Iris black; bill pink; ridge of culmen brown; feet pink."—*J. W.*

Central Hainan (*Swinhoe*).

Interior of South-west Hainan (*Styan*).

Hummocks, North Hainan (*Hartlaub*).

82. *PYCNONOTUS HAINANUS.

Ixus hainanus, Swinhoe, Ibis, 1870, p. 253; Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 308 (1892).

Pycnonotus hainanus, Swinhoe; Sharpe, Cat. B. Brit. Mus. vi. p. 150 (1881); Styan, Ibis, 1893, p. 428; Hartl. Abh. nat. Ver. Bremen, xiv. p. 355 (1898).

"Iris, bill, and feet black."—*J. W.*

Throughout Hainan and the adjacent island of Naochu (*Swinhoe*).

83. *HEMIXUS CASTANONOTUS.

Hemixus castanonotus, Swinhoe, Ibis, 1870, p. 251, pl. ix. fig. 1; Sharpe, Cat. B. Brit. Mus. vi. p. 51 (1881); Seebohm, P. Z. S. 1890, pl. xxvii. fig. 2 (breast wrongly coloured); Styan, Ibis, 1893, p. 428; Hartl. Abh. nat. Ver. Bremen, xiv. p. 355 (1898).

Swinhoe's type specimen, as figured by Seebohm, has had the breast stained with some brownish matter; hence the plate, as pointed out by Mr. Styan, is misleading.

♂. "Iris hazel; bill black; feet brownish black."—*J. W.*

Tai-ping-sze and Lingmun, Central Hainan (*Swinhoe*).

Interior of South-west Hainan (*Styan*).

84. SPIZIXUS CINEREICAPILLUS.

Spizixus cinereicapillus, Swinhoe; Sharpe, Cat. B. Brit. Mus. vi. p. 173 (1881); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 308 (1892).

Hartlaub records the occurrence of this species in Hainan.

85. *HYPSIPETES PERNIGER.

Hypsipetes perniger, Swinhoe, Ibis, 1870, p. 251, pl. ix. fig. 2; Sharpe, Cat. B. Brit. Mus. vi. p. 41 (1881); Hartl. Abh. nat. Ver. Bremen, xii. pp. 209, 307 (1892); Styan, Ibis, 1893, p. 429; Hartl. Abh. nat. Ver. Bremen, xiv. p. 355 (1898).

♂. "Iris brown; bill, legs, and feet vermilion."—*J. W.*
North Hainan (*Swinhoe*, *Styan*, & *Hartlaub*).
Central and South Hainan (*Swinhoe*).

86. *CRINIGER PALLIDUS.

Criniger pallidus, Swinhoe, Ibis, 1870, p. 252; Sharpe, Cat. B. Brit. Mus. vi. p. 81 (1881); Sharpe, Bull. B. O. C. vol. i. p. xix (1892); Styan, Ibis, 1893, p. 429; Hartl. Abh. nat. Ver. Bremen, xiv. p. 356 (1898).

Pinarocichla schmackeri, Styan, Bull. B. O. C. vol. i. p. vi (1892); id. Ibis, 1893, p. 54.

"Iris brown; upper mandible brown, lower blue-grey; feet pinkish brown."—*J. W.*

Central and South Hainan (*Swinhoe*).

Northern slopes of the mountains of South-west Hainan (*Styan*).

87. *CHLOROPSIS LAZULINA.

Phyllornis lazulina, Swinhoe, Ibis, 1870, p. 255; Hartl. Abh. nat. Ver. Bremen, xiv. p. 356 (1898).

Chloropsis lazulina (*Swinh.*); Sharpe, Cat. B. Brit. Mus. vi. p. 19 (1881); Styan, Ibis, 1893, p. 429.

♂. "Iris dark brown; bill black; feet lead-grey."—*J. W.*

Central and South Hainan (*Swinhoe*).

Northern slopes of the mountains of South-west Hainan (*Styan*).

88. *CAMPOPHAGA SATURATA.

Volucivora saturata, Swinhoe, Ibis, 1870, p. 242.

Campophaga saturata (*Swinh.*); Sharpe, Cat. B. Brit. Mus. iv. p. 66 (1879); Styan, Ibis, 1893, p. 429; Hartl. Abh. nat. Ver. Bremen, xiv. p. 357 (1898).

♂. "Iris brown; bill black; feet dusky black."—*J. W.*

Throughout Hainan (*Swinhoe*).

89. *GRAUCALUS MACII.

Graucalus macii, Lesson; Sharpe, Cat. B. Brit. Mus. iv. p. 34 (1879); Styan, Ibis, 1893, p. 429; Swinhoe (nec *Swinh.* 1863), Ibis, 1870, p. 242.

Graucalus rex pineti, Hartl. (nec *Swinh.*), Abh. nat. Ver. Bremen, xiv. p. 357 (1898).

♀ moulting. "Iris dark brown; bill and feet black."—*J. W.*

Tai-ping-sze, Central Hainan (*Swinhoe*).

Northern slope of the mountains of South-west Hainan (*Styan*).

90. PERICROCOTUS CANTONENSIS.

Pericrocotus cantonensis, Swinhoe, Ibis, 1870, p. 244 (Nao-chu); Sharpe, Cat. B. Brit. Mus. iv. p. 84 (1879).

This species, though found on the adjacent island of Nao-chu, has not yet been met with in Hainan.

91. *PERICROCOTUS FRATERCULUS.

Pericrocotus fraterculus, Swinhoe, Ibis, 1870, p. 244; Oates, Faun. Brit. India, Birds, i. p. 481 (1889).

Pericrocotus elegans, Sharpe (nec M'Clell.), Cat. B. Brit. Mus. iv. p. 73 (1879); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 307 (1892); Styan, Ibis, 1893, p. 429; Hartl. Abh. nat. Ver. Bremen, xiv. p. 358 (1898).

♂. "Iris, bill, and feet black."—*J. W.*

Common on all parts of the island (*Swinhoe*).

92. *PERICROCOTUS GRISEIGULARIS.

Pericrocotus griseigularis, Gould; Sharpe, Cat. B. Brit. Mus. iv. p. 83 (1879).

♂. "Iris, bill, and feet black."—*J. W.*

A male from Hainan appears to belong to the typical form from Formosa. Continental birds from China seem to differ from typical examples from Formosa in having the top of the head and back greyer, and they are, moreover, somewhat larger.

This is the first time this species has been recorded from Hainan.

93. PERICROCOTUS CINEREUS.

Pericrocotus cinereus, Lafr.; Swinhoe, Ibis, 1870, p. 244 (Nao-chu); Sharpe, Cat. B. Brit. Mus. iv. p. 83 (1879).

This species was procured by Swinhoe on the adjacent island of Nao-chu, but has not yet been found in Hainan itself.

94. HEMICHELIDON SIBIRICA.

Hemichelidon sibirica (Gmel.); Sharpe, Cat. B. Brit. Mus. iv. p. 120 (1879); Hartl. Abh. nat. Ver. Bremen, xiv. p. 359 (1898).

Hartlaub records a male from Hoihow, North Hainan.

95. HEMICHELIDON FERRUGINEUS.

Butalis ferruginea (Hodgs.); Swinhoe, Ibis, 1870, p. 247.

Hemichelidon ferrugineus, Sharpe, Cat. B. Brit. Mus. iv. p. 122 (1879).

West coast of Hainan, 29th and 30th March (*Swinhoe*).

96. ALSEONAX LATIROSTRIS.

Butalis cinerealba (T. & S.); Swinhoe, Ibis, 1870, p. 247.

Alseonax latirostris (Raffl.); Sharpe, Cat. B. Brit. Mus. iv. p. 127 (1879); Styan, Ibis, 1893, p. 430.

Gardens about Kiung-chu-fu, North Hainan, February (*Swinhoe*).
South-west Hainan (*Styan*).

97. MUSCICAPA ALBICILLA.

Erythrosterna leucura (Swains.); Swinhoe, Ibis, 1870, p. 247.

Muscicapa albicilla, Pall.; Sharpe, Cat. B. Brit. Mus. iv. p. 162 (1879); Styan, Ibis, 1893, p. 430; Hartl. Abh. nat. Ver. Bremen, xiv. p. 359 (1898).

Tai-ping-sze, Central Hainan, 19th February (*Swinhoe*).

South-west Hainan (*Styan*).

Hoihow, North Hainan (*Hartlaub*).

98. POLIOMYIAS LUTEOLA.

Erythrosterna mugimaki (Temm.); Swinhoe, Ibis, 1870, p. 247.

Poliomyias luteola (Pall.); Sharpe, Cat. B. Brit. Mus. iv. p. 201 (1879).

On the adjacent island of Nao-chu, 5th April (*Swinhoe*).

99. *XANTHOPYGIA NARCISSINA.

Xanthopygia narcissina (Temm.); Swinhoe, Ibis, 1870, p. 247; Sharpe, Cat. B. Brit. Mus. iv. p. 249 (1879).

Swinhoe records this species from the adjacent island of Nao-chu on the 5th April.

This is the first time this species has been procured on Hainan.

100. *XANTHOPYGIA CYANOMELÆNA.

Cyanoptila cyanomelæna (T. & S.); Swinhoe, Ibis, 1870, p. 247.

Xanthopygia cyanomelæna, Sharpe, Cat. B. Brit. Mus. iv. p. 251 (1879).

Niltava cyanomelæna, Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 306 (1892).

Haosuy, West Hainan, 29th March, and adjacent island of Nao-chu, 5th April (*Swinhoe*).

101. *XANTHOPYGIA FULIGINOSA.

Xanthopygia fuliginosa (Vig.); Sharpe, Cat. B. Brit. Mus. iv. p. 253 (1879).

♀. "Iris and feet dark brown; bill black."—*J. W.*

This is the first time this widely distributed Indo-Chinese species has been met with in Hainan, where it is evidently a resident and breeds. Young birds just able to fly were among those sent home.

102. *SIPHIA HAINANA.

Siphia pallidipes (Jerd.)?; Styan, Ibis, 1893, p. 430; Hartl. Abh. nat. Ver. Bremen, xiv. p. 359 (1898).

Siphia hainana, Grant, Bull. B. O. C. vol. x. p. xxxvi (1900).

Adult male. Allied to male of *S. pallidipes* (Jerd.), but much smaller. The blue on the upper parts darker and brighter; the forehead and superciliary stripes bright cobalt-blue; flanks and sides of belly grey, slightly washed with fulvous.

"Iris and bill black; feet dusky black."—*J. W.*

Adult female. Differs conspicuously from the female of *S. pallidipes* (Jerd.), the general colour of the head and upper parts being darker and more uniform, the upper tail-coverts and outer webs of the tail-feathers being olive-brown tinged with rufous instead of chestnut; but the most conspicuous difference is to be found in the colour of the throat, fore-neck, and chest, which are pale rust-colour instead of deep orange-rust.

	Total length.	Culmen.	Wing.	Tail.	Tarsus.
	in.	in.	in.	in.	in.
<i>S. pallidipes</i> , ♂ ad. . .	6·2	0·7	2·9	2·4	0·7
<i>S. hainana</i> , ♂ ad. . .	5	0·6	2·65	2·3	0·65
<i>S. pallidipes</i> , ♀ ad. .	5·9	0·65	2·9	2·25	0·72
<i>S. hainana</i> , ♀ ad. . .	5	0·6	2·6	2·15	0·65

Mr. Styan records examples from Leimumon on the northern slopes of the mountains of South-west Hainan and from Nodouha in the interior of Northern Hainan.

103. *HYPOTHYMIS AZUREA.

Myiagra azurea (Bodd.); Swinhoe, Ibis, 1870, p. 247.

Hypothymis azurea, Sharpe, Cat. B. Brit. Mus. iv. p. 274 (1879); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 307 (1892).

Hypothymis occipitalis (Vig.); Styan, Ibis, 1893, p. 430; Hartl. Abh. nat. Ver. Bremen, xiv. p. 360 (1898).

Common (*Swinhoe*).

104. RHIPIDURA ALBICOLLIS.

Rhipidura albicollis (Vieill.); Sharpe, Cat. B. Brit. Mus. iv. p. 317 (1879); Styan, Ibis, 1893, p. 430; Hartl. Abh. nat. Ver. Bremen, xiv. p. 360 (1898).

Styan records this species from Hainan.

105. *TERPSIPHONE PRINCEPS.

Terpsiphone princeps (Temm.); Sharpe, Cat. B. Brit. Mus. iv. p. 361 (1879); Styan, Ibis, 1893, p. 430.

♂. "Iris black; orbital skin and bill rich cobalt-blue, inclining to purple; feet cobalt."—*J. W.*

Hoihow, North Hainan, 10th October (*Styan*).

106. *CRYPTOLOPHA FULVIFACIES.

Cryptolopha fulvifacies, Swinh.; Sharpe, Cat. B. Brit. Mus. iv. p. 406 (1879).

♂. "Iris dark brown; upper mandible brown, lower dull yellow; feet brownish yellow."—*J. W.*

This is the first time this little Flycatcher has been recorded from Hainan.

107. HIRUNDO GUTTURALIS.

Hirundo gutturalis, Scop.; Swinhoe, Ibis, 1870, p. 240; Sharpe, Cat. B. Brit. Mus. x. p. 134 (1885).

Recorded by Swinhoe from all parts of the coast of Hainan.

108. **GECINUS HAINANUS*.

Gecinus hainanus, Grant, Ibis, 1899, p. 584.

This species is most nearly allied to *G. guerini* (Malh.) from China, but distinguished by the darker green colour of the upper and under parts; in *G. guerini* the general colour of the upper parts is dull greyish green and the underparts are similarly coloured, but paler, inclining to whitish grey tinged with green.

This species is also related to *G. occipitalis*, which it resembles in the dark green colour of the underparts; but the upper parts and wings are darker, the latter with very much less bronze-yellow wash on the outer webs, which are *indistinctly barred* with paler, while the tail-feathers are spotted, not barred; the present species is, moreover, considerably smaller than *G. occipitalis*, the bill especially being shorter and less stout.

	Culmen. in.	Wing. in.	Tail. in.
<i>G. hainanus</i> , ♂ adult (type)	1·5	5·3	3·8
<i>G. occipitalis</i> , ♂ adult	1·7	5·6-5·9	4·2-4·5

Hab. Five-Finger Mts., interior of Hainan.

“Iris white; bill grey-black, base greenish white; feet lead-grey.”—*J. W.*

109. **CHRYSOPHLEGMA STYANI*.

Chrysophlegma styani, Grant, Ibis, 1899, p. 585.

This species is most nearly allied to *C. wrayi* Sharpe and *C. ricketti* Styan. From the latter it differs in being much smaller and in having the terminal part of the outer primaries mostly uniform black, as in *C. wrayi*. From *C. wrayi* it may be at once distinguished by its larger size and by the dark brownish-chestnut crown, the pale (Californian) gold nuchal crest, and the dark smoke-grey underparts; in these respects it resembles *C. ricketti*.

The female of *C. styani* further differs from the female (type) of *C. wrayi* in having the feathers of the middle of the throat paler brown and margined with rufous instead of white.

	Wing. in.	Tail. in.
Type of <i>C. ricketti</i>	6·8	5·2
Type of <i>C. styani</i>	6·0	4·5
Type of <i>C. wrayi</i>	5·6	4·0

“Iris dark claret; bill dusky black, lower mandible green at base; feet olive-green.”—*J. W.*

Hab. Five-Finger Mts., interior of Hainan.

110. **DENDROCOPUS CABANISI*.

Picus cabanisi, Gould, B. Asia, vi. pl. xvii. (1857).

Dendrocopus cabanisi (Malh.); Hargitt, Cat. B. Brit. Mus. xviii. p. 218 (1890); Styan, Ibis, 1893, p. 431.

Picus mandarinus, Malh. ; Swinhoe, Ibis, 1870, p. 94 ; Hartl. Abh. nat. Ver. Bremen, xiv. p. 366 (1898).

“ Iris brown ; bill lead-black ; feet brownish black.”—*J. W.*

Yulinkan Bay, South Hainan (*Swinhoe*).

South-west Hainan (*Styan*).

Interior of North Hainan (*Hartlaub*).

111. *LEPOCESTES HAINANUS.

Lepocestes pyrrhotis, Styan (nec Hodg.), Ibis, 1893, p. 431.

Lepocestes hainanus, Grant, Ibis, 1899, p. 585.

This species is most nearly allied to *L. sinensis* Rickett, which it resembles in the darker colour of the mantle ; but the feathers of the lower back and rump are dark brown, indistinctly tipped with rufous, never barred with buff ; the chin and throat are more rufous ; the general colour of the underparts less dark ; and the flanks and under tail-coverts uniform without any traces of bars. The black bars on the wings and tail-feathers are wider apart and less numerous.

“ Iris brown ; bill straw-yellow ; legs dull blackish brown.”—*J. W.*

112. *YNGIPICUS KALEENSIS.

Picus kaleensis, Swinhoe, Ibis, 1870, p. 95.

Yngipicus kaleensis, Swinh. ; Hargitt, Cat. B. Brit. Mus. xviii. p. 315 (1890) ; Styan, Ibis, 1893, p. 431 ; Hartl. Abh. nat. Ver. Bremen, xiv. p. 366 (1898).

“ Iris dark brown ; bill slate-grey, whitish at base of lower mandible ; feet olive-green.”—*J. W.*

Central Hainan (*Swinhoe*).

Interior of South-west Hainan (*Styan*).

Interior of North Hainan (*Hartlaub*).

113. MICROPTERNUS HOLROYDI.

Micropternus holroydi, Swinhoe, Ibis, 1870, p. 95 ; Hargitt, Cat. B. Brit. Mus. xviii. p. 403 (1890) ; Styan, Ibis, 1893, p. 431 ; Hartl. Abh. nat. Ver. Bremen, xiv. p. 366 (1898).

Central Hainan (*Swinhoe*).

Nodouha, interior of North Hainan, May (*Styan & Hartlaub*).

114. *CYANOPS FABER.

Megalæma faber, Swinhoe, Ibis, 1870, p. 96, pl. iv. fig. 1 ; Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 317 (1892), xiv. p. 367 (1898).

Cyanops faber, Shelley, Cat. B. Brit. Mus. xix. p. 75 (1891) ; Styan, Ibis, 1893, p. 432.

♂. “ Iris brown ; upper mandible black, lower greyish at base, terminal half black ; feet green-olive.”—*J. W.*

Central Hainan (*Swinhoe*).

Nodouha, interior of North Hainan (*Styan & Hartlaub*).

115. *PALÆORNIS FASCIATA.

Palæornis javanica, Swinh. (nec Osb.), Ibis, 1870, p. 93.

Palæornis fasciata (Müll.); Salvad. Cat. B. Brit. Mus. xx. p. 464 (1891); Styan, Ibis, 1893, p. 433.

Palæornis lathamii, Finsch; Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 322 (1892), xiv. p. 368 (1898).

♀. "Iris pale straw-yellow; bill black; feet olive-green."—*J. W.*

Tai-ping-sze, Central Hainan, and near Hao-suy Harbour, North-west Hainan (*Swinhoe*).

Nam-fung, interior of North Hainan, 26th May; Ting-on, 13th January, and Leimumon, northern slope of the mountains of South-west Hainan (*Styan*).

116. *CUCULUS MICROPTERUS.

Cuculus micropterus, Gould; Shelley, Cat. B. Brit. Mus. xix. p. 241 (1891); Styan, Ibis, 1893, p. 433; Hartl. Abh. nat. Ver. Bremen, xiv. p. 368 (1898).

♂. "Iris dark brown; orbital skin, feet, and gape bright yellow; lower mandible greenish, upper blackish grey."—*J. W.*

Interior of South-west Hainan (*Styan*).

Interior of North Hainan (*Hartlaub*).

117. CACOMANTIS MERULINUS.

Polyphasia tenuirostris, Swinhoe, Ibis, 1870, p. 230.

Cacomantis merulinus (Scop.); Shelley, Cat. B. Brit. Mus. xix. p. 268 (1891); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 319 (1892).

Near Kiung-chu, North Hainan, February and March (*Swinhoe*).
North Hainan, December and March (*Hartlaub*).

118. *CHALCOCOCCYX MACULATUS.

Chalcococcyx maculatus (Gmel.); Shelley, Cat. B. Brit. Mus. xix. p. 291 (1891).

♂. "Iris red-brown; bill orange, tip black; feet brownish green."—*J. W.*

This species is new to Hainan.

119. EUDYNAMIS HONORATA.

Eudynamis malayana, Cab. & Heine; Swinhoe, Ibis, 1870, p. 231.

Eudynamis honorata (Linn.); Shelley, Cat. B. Brit. Mus. xix. p. 316 (1891); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 318 (1892); Styan, Ibis, 1893, p. 433.

Eudynamis maculatus (Gmel.); Hartl. Abh. nat. Ver. Bremen, xiv. p. 368 (1898).

Common throughout Hainan (*Swinhoe*).

120. *CENTROPUS SINENSIS.

Centropus viridis, Swinhoe (nec Scop.), Ibis, 1870, p. 235.

Centropus rufipennis, Swinhoe (nec Illiger), Ibis, 1870, p. 234.

Centropus sinensis (Steph.); Shelley, Cat. B. Brit. Mus. xix. p. 343 (1891); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 318 (1892), xiv. p. 368 (1898).

“Iris lake-red; bill and feet black.”—*J. W.*

Common throughout Hainan (*Swinhoe*).

121. CENTROPUS BENGALENSIS.

Centropus bengalensis (Gmel.); Shelley, Cat. B. Brit. Mus. xix. p. 352 (1891); Styan, Ibis, 1893, p. 433.

Interior of South-west Hainan (*Styan*).

122. *RHOPODYTES TRISTIS.

Rhopodytes tristis (Less.); Shelley, Cat. B. Brit. Mus. xix. p. 386 (1891); Styan, Ibis, 1893, p. 433.

Zanclotomus tristis, Swinhoe, Ibis, 1870, p. 234; Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 318 (1892), xiv. p. 367 (1898).

♂. “Iris dark brown; bill dull emerald-green; orbital skin dull scarlet; feet dull bluish olive-green.”—*J. W.*

Central, South-east, and South Hainan (*Swinhoe*).

Leimumon, northern slopes of the mountains of South-west Hainan (*Styan*).

123. *HARPACTES HAINANUS.

Harpactes erythrocephalus, Styan (nec Gould), Ibis, 1893, p. 433.

Harpactes hainanus, Grant, Bull. B. O. C. vol. x. p. xxxvii (1900).

Adult male. Differs from the male of *H. erythrocephalus* in having the head dull purplish crimson, not shading into crimson-scarlet on the nape; the upper parts much browner, especially the mantle and upper back, and with very little trace of chestnut on the lower back, rump, and upper tail-coverts, the latter being dark chestnut; the lower part of the chest, next the white band, dull crimson instead of scarlet-crimson. In addition to the above differences, the white tips to the outer tail-feathers are shorter, the longest scarcely exceeding 1.1 inch. From *H. yamakanensis* Rickett, from Fohkien, the Hainan bird may be at once distinguished by the colour of the upper parts.

Iris hazel; bill black, base and orbital skin dark purplish French blue; feet pinkish brown.

♂. Total length 12 inches; wing 5.5; tail 6.

Adult female. Differs from the female of *H. erythrocephalus* in having the general colour of the upper parts and chest much browner.

♀. Total length 12 inches; wing 5.3; tail 5.7.

This species has already been obtained by Mr. Schmaker's collector Tetsu at Leimumon, on the northern slopes of the mountains of South-west Hainan, but was identified by Mr. Styan with *H. erythrocephalus*, Gould.

124. CYPSELUS PACIFICUS.

Cypselus pacificus, Lath.; Swinhoe, Ibis, 1870, p. 89.

Micropus pacificus, Hartert, Cat. B. Brit. Mus. xvi. p. 448 (1892).

Apus pacificus, Hartert, Das Tierreich, Macropt. p. 86 (1897).

Observed in large numbers in Nychow Harbour, South Hainan (*Swinhoe*).

125. CYPSELUS SUBFURCATUS.

Cypselus subfurcatus, Blyth; Swinhoe, Ibis, 1870, p. 89; Hartl. Abh. nat. Ver. Bremen, xiv. p. 361 (1898).

Micropus subfurcatus, Hartert, Cat. B. Brit. Mus. xvi. p. 456 (1892).

Apus subfurcatus, Hartert, Das Tierreich, Macropt. p. 88 (1897).
North and South Hainan (*Swinhoe* & *Hartlaub*).

126. TACHORNIS INFUMATA.

Cypselus tinus, Swinhoe, Ibis, 1870, p. 90.

Tachornis infumatus (Sclat.); Hartert, Cat. B. Brit. Mus. xvi. p. 467 (1892).

Central, South-east, and South Hainan (*Swinhoe*).

127. *CAPRIMULGUS JOTAKA.

Caprimulgus jotaka, Temm. & Schleg.; Swinhoe, Ibis, 1870, p. 89 (Nao Chau); Hartert, Cat. B. Brit. Mus. xvi. p. 552 (1892).

Caprimulgus indicus jotaka, Hartert, Das Tierreich, Caprimulg. p. 61 (1897).

The two specimens collected by Whitehead, though considerably different one from another, agree in general characters with typical *C. jotaka*, but are somewhat smaller:—

a. Wing 7·1 inches; tail 4·4.

b. „ 7·8 „ ; „ 5·1.

The smaller bird has the general colour of the head, wing-coverts, and scapulars grey, and in this respect, as well as in the larger white markings on the four outer quills, differs considerably from *b*, the latter having many more of the feathers of the crown largely mixed with black, while the scapulars and wing-coverts are more conspicuously marked with black and rufous. Both Whitehead's birds belong to the smaller form obtained by Swinhoe on the adjacent island of Nao Chau.

128. MEROPS SUMATRANUS.

Merops sumatranus, Raffl.; Sharpe, Cat. B. Brit. Mus. xvii. p. 61 (1892); Styan, Ibis, 1893, p. 432.

Two immature birds from the Hummocks, North Hainan, 18th September (*Styan*).

129. *NYCTIORNIS ATHERTONI.

Nyctioris athertoni (Jard. & Selby); Sharpe, Cat. B. Brit. Mus. xvii. p. 88 (1892).

“Iris dark brown; bill black, base of lower mandible grey; feet dull yellow.”—*J. W.*

This is the first time this species has been recorded from Hainan.

130. *UPUPA INDICA.

Upupa indica, Reichenb.; Salvin, Cat. B. Brit. Mus. xvi. p. 10 (1892); Styan, Ibis, 1893, p. 432.

Upupa ceylonensis, Reichb.; Swinhoe, Ibis, 1870, p. 91; Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 318 (1892), xiv. p. 367 (1898).

“Iris black; bill dusky black, pinkish at base; feet dusky brown.”—*J. W.*

Common throughout Hainan (*Swinhoe*).

131. CERYLE VARIA.

Ceryle rudis, Swinhoe (nec Linn.), Ibis, 1870, p. 92; Styan, Ibis, 1893, p. 433; Hartl. Abh. nat. Ver. Bremen, xiv. p. 367 (1898).

Ceryle varia (Strickl.); Sharpe, Cat. B. Brit. Mus. xvii. p. 112 (1892); Hartl. Abh. nat. Ver. Brem. xii. pp. 299, 319 (1892).

Common throughout Hainan (*Swinhoe*).

132. *CERYLE LUGUBRIS.

Ceryle lugubris (Temm.); Sharpe, Cat. B. Brit. Mus. xvii. p. 115 (1892).

Ceryle guttata, Vigors; Styan, Ibis, 1893, p. 433.

“Bill lead-black; feet dark brown.”—*J. W.*

Interior of South-west Hainan (*Styan*).

133. *ALCEDO ISPIDA.

Alcedo bengalensis, Gmel.; Swinhoe, Ibis, 1870, p. 92.

Alcedo ispida, Linn.; Sharpe, Cat. B. Brit. Mus. xvii. p. 141 (1892).

♂ imm. “Iris brown; bill black; feet brown, soles yellow.”—*J. W.*

Common in all open country (*Swinhoe*).

134. *ALCEDO GRANDIS.

Alcedo grandis, Blyth; Sharpe, Cat. B. Brit. Mus. xvii. p. 156 (1892).

Adult ♀. “Iris dark brown; upper bill black, lower dull red; feet coral-red.”—*J. W.*

This is the first time that this very rare species has been met with outside Northern India.

135. *CEYX TRIDACTYLA.

Ceyx tridactyla (Pall.); Sharpe, Cat. B. Brit. Mus. xvii. p. 174 (1892).

This species has not previously been met with in Hainan.

136. *HALCYON SMYRNENSIS.

Halcyon smyrnensis (Linn.); Swinh. Ibis, 1870, p. 93; Sharpe, Cat. B. Brit. Mus. xvii. p. 222 (1892); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 319 (1892); Styan, Ibis, 1893, p. 433; Hartl. Abh. nat. Ver. Bremen, xiv. p. 367 (1898).

Once met with at Haosuy, North-west Hainan (*Swinhoe*).

Interior of South-west Hainan (*Styan*).

Hoihow, North Hainan (*Hartlaub*).

137. HALCYON PILEATUS.

Halcyon pileatus (Bodd.); Swinhoe, Ibis, 1870, p. 93; Sharpe, Cat. B. Brit. Mus. xvii. p. 229 (1892); Styan, Ibis, 1893, p. 433; Hartl. Abh. nat. Ver. Bremen, xiv. p. 367 (1898).

Entomobia pileata, Hartl. Abh. nat. Ver. Brem. xii. pp. 299, 319 (1892).

Haosuy, North-west Hainan, and the adjacent island of Nao-chu.

Interior of South-west Hainan (*Styan*).

Hoihow, North Hainan (*Hartlaub*).

138. *EURYSTOMUS CALONYX.

Eurystomus calonyx, Hodgs.; Sharpe, Cat. B. Brit. Mus. xvii. p. 38, pl. ii. fig. 2 (1892); Styan, Ibis, 1893, p. 432.

Eurystomus orientalis, Hartl. (nec Linn.), Abh. nat. Ver. Bremen, xiv. p. 367 (1898).

Hoihow, North Hainan, 29th Sept. (*Styan*).

139. SCOPS LEMPIJI.

Ephialtes lettia, Swinhoe (nec Hodgs.), Ibis, 1870, p. 88.

Ephialtes umbratilis, Swinhoe, Ibis, 1870, p. 342, footnote.

Scops lempiji, Blyth; Sharpe, Cat. B. Brit. Mus. ii. p. 91 (1875).

Scops umbratilis, Sharpe, Cat. B. Brit. Mus. ii. p. 93 (1875).

A male shot near Kiung-chu, North Hainan, February (*Swinhoe*).

The type of *E. umbratilis* Swinh. is now in the British Museum Collection. It resembles dark Indian examples of *S. lempiji* and is perfectly similar to specimens of *S. lempiji* from Sadia, Assam, collected by Colonel Godwin-Austen.

140. NINOX JAPONICA.

Ninox japonicus (T. & S.); Swinh. Ibis, 1870, p. 88; Grant, Ibis, 1896, p. 111.

Ninox scutulata, Sharpe (nec Raffl.), Cat. B. Brit. Mus. ii. p. 156 (1875).

Kiung-chu, North Hainan, 2nd April, and Haosuy, North-west Hainan, 29th March (*Swinhoe*).

The birds collected by Swinhoe are typical *N. japonica*.

141. *GLAUCIDIUM WHITELYI.

Glaucidium whitelyi (Blyth); Sharpe, Cat. B. Brit. Mus. ii. p. 222 (1875).

♂. "Iris straw-yellow; bill and feet greenish yellow."—*J. W.*
This is the first time this Chinese species has been procured in Hainan.

142. *ASIO ACCIPITRINUS.*

Asio accipitrinus (Pall.); Sharpe, Cat. B. Brit. Mus. ii. p. 234 (1875).

Otus brachyotus, Steph.; Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 320 (1892).

Hartlaub records a specimen from North Hainan.

143. *CIRCUS SPILONOTUS.*

Circus spilonotus, Kaup; Swinhoe, Ibis, 1870, p. 87; Sharpe, Cat. B. Brit. Mus. i. p. 58 (1874); Styan, Ibis, 1893, p. 433.

Swinhoe observed this species near the city of Ting-gan on the 15th of February and also in the neighbourhood of Kiung-chu in North Hainan.

Styan records it from the interior of South-west Hainan.

144. *CIRCUS MELANOLEUCUS.*

Circus melanoleucus (Forst.); Sharpe, Cat. B. Brit. Mus. i. p. 61 (1874); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 321 (1892).

Hartlaub records an adult male from North Hainan.

145. *CIRCUS MACRURUS.*

Circus macrurus (Gmel.); Sharpe, Cat. B. Brit. Mus. i. p. 67 (1874); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 322 (1892), xiv. p. 369 (1898).

Hoihow, North Hainan, 19th December (*Hartlaub*).

146. **LOPHOSPIZA TRIVIRGATA.*

Astur trivirgatus (Temm.); Sharpe, Cat. B. Brit. Mus. i. p. 105 (1874).

"Iris straw; cere greenish yellow; bill black, base of lower mandible bluish; feet dull yellow."—*J. W.*

I consider that Kaup is fully justified in distinguishing this bird from *Astur*, the long occipital crest and half-feathered tarsi being characters of importance.

This is the first time this species has been recorded from Hainan.

147. *CIRCUS ÆRUGINOSUS.*

Circus æruginosus (Linn.); Swinhoe, Ibis, 1870, p. 87; Sharpe, Cat. B. Brit. Mus. i. p. 69 (1874); Hartl. Abh. nat. Ver. Bremen, xiii. pp. 299, 321 (1892); Styan, Ibis, 1893, p. 433; Hartl. Abh. nat. Ver. Bremen, xiv. p. 369 (1898).

North Hainan, 15th February (*Swinhoe & Hartlaub*).

Leimumon, northern slope of the mountains of South-west Hainan (*Hartlaub & Styan*).

148. *ASTUR BADIUS.

Micronisus badius (Gmel.); Swinhoe, Ibis, 1870, p. 84.

Astur badius (Gmel.); Sharpe, Cat. B. Brit. Mus. i. p. 109 (1874).

Astur poliopsis, Hartl. (nec Hume), Abh. nat. Ver. Bremen, xii. pp. 299, 322 (1892).

"Iris straw-yellow; bill black, base bluish; feet light yellow."—*J. W.*

Examples from Hainan have the crown of the head darker and the cheeks greyer than is the case in the majority of Indian examples; there is, however, a female from Tipperah, in the British Museum Collection, which is absolutely indistinguishable from the two Hainan birds before me. The measurements are as follows:—Wing 8·8 to 8·9; tail 6·8 to 7·1 inches.

An adult male, Shuy-wei-sze, Central Hainan, 19th February (*Swinhoe*).

North Hainan (*Hartlaub*).

149. ACCIPITER NISUS.

Accipiter nisus (Linn.); Swinhoe, Ibis, 1870, p. 84; Sharpe, Cat. B. Brit. Mus. i. p. 132 (1874).

Swinhoe records the Common Sparrow-Hawk from Tai-ping-sze, Central Hainan, 20th February.

150. *ACCIPITER AFFINIS.

Accipiter virgatus (Temm.); Sharpe, Cat. B. Brit. Mus. i. p. 150 (1874) [part.].

Accipiter affinis, Hodgs.; Grant, Ibis, 1896, p. 107.

"Cere yellowish."—*J. W.*

Like Formosan examples, the Hainan Sparrow-Hawk belongs to the larger Himalayan form. Whitehead procured two adult females from the Five-Finger Mountains; this species had not previously been met with in Hainan.

151. BUTEO PLUMIPES.

Buteo japonicus, Swinhoe, Ibis, 1870, p. 87.

Buteo plumipes (Hodgs.); Sharpe, Cat. B. Brit. Mus. i. p. 180 pl. vii. fig. 1 (1874); Styan, Ibis, 1893, p. 433.

Buteo hemilasius (Temm. & Schl.); Sharpe, Cat. B. Brit. Mus. i. p. 182 (1874); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 322 (1892).

Island of Naochow, 2nd February; Ling-suy, South-east Hainan, 11th March; Heongpoo, West Hainan, 25th March (*Swinhoe*).

Interior of South-west Hainan (*Styan*).

North Hainan, 11th February (*Hartlaub*).

152. *SPIZAËTUS NIPALENSIS.

Spizaëtus nipalensis (Hodgs.); Sharpe, Cat. B. Brit. Mus. i. p. 267 (1874).

♀ imm. "Iris yellow; bill black, base blue; cere and feet dull yellow."—*J. W.*

Recorded from Hainan for the first time.

153. *SPILORNIS MELANOTIS.*

Spilornis rutherfordi, Swinhoe, Ibis, 1870, p. 85.

Spilornis melanotis (Jerdon); Sharpe, Cat. B. Brit. Mus. i. p. 289 (1874); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 322 (1892); Styan, Ibis, 1893, p. 433.

Spilornis cheela, Hartl. Abh. nat. Ver. Bremen, xiv. p. 369 (1898).

Forests of Central Hainan near Tai-ping-sze (*Swinhoe*).

North Hainan (*Hartlaub*).

Liu-wo-wan, northern slope of the mountains of South-west Hainan (*Styan*).

154. *MILVUS MELANOTIS.*

Milvus govinda, Swinhoe (nec Sykes), Ibis, 1870, p. 88.

Milvus melanotis, T. & S.; Sharpe, Cat. B. Brit. Mus. i. p. 324 (1874).

Abundant throughout Hainan (*Swinhoe*).

155. *FALCO COMMUNIS.*

Falco communis, Gmel.; Sharpe, Cat. B. Brit. Mus. i. p. 376 (1874); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 320 (1892).

Hartlaub records an adult male from North Hainan, 12th December.

156. *CERCHNEIS TINNUNCULUS.*

Tinnunculus alaudarius, Gray; Swinhoe, Ibis, 1870, p. 84.

Cerchneis tinnunculus (Linn.); Sharpe, Cat. B. Brit. Mus. i. p. 425 (1874).

Frequent throughout Hainan and in the small adjacent island of Nao-chu (*Swinhoe*).

157. *PANDION HALIAËTUS.*

Pandion haliaëtus (Linn.); Sharpe, Cat. B. Brit. Mus. i. p. 449 (1874); Swinhoe, Ibis, 1870, p. 86.

Harbours of Hainan (*Swinhoe*).

158. *POLIOAËTUS HUMILIS.*

Polioaëtus ichthyaëtus, Horsf.; Sharpe, Cat. B. Brit. Mus. i. p. 452 (1874) [part.].

Polioaëtus plumbeus (Hodgs.); Styan, Ibis, 1893, p. 434.

Polioaëtus humilis (Müll. & Schl.); Blanf. Faun. Brit. Ind., Birds, iii. p. 371 (1895).

Liuwowan, northern slope of the mountains of South-west Hainan, 15th December (*Styan*).

159. PELECANUS PHILIPPENSIS.

Pelecanus manillensis, Oates (nec Gmel.); Styan, Ibis, 1893, p. 434.

Pelecanus philippensis, Gmel.; Grant, Cat. B. Brit. Mus. xxvi. p. 471 (1898); Hartl. Abh. nat. Ver. Bremen, xiv. p. 380 (1898).
Hoihow, North Hainan (*Hartlaub*).

160. PHALACROCORAX CARBO.

Phalacrocorax carbo (Linn.); Styan, Ibis, 1893, p. 434; Grant, Cat. B. Brit. Mus. xxvi. p. 340 (1898); Hartl. Abh. nat. Ver. Bremen, xiv. p. 380 (1898).

Hoihow, North Hainan (*Hartlaub*).

161. SULA SULA.

Sula fusca, Vieill.; Swinhoe, Ibis, 1870, p. 367.

Sula sula (Linn.); Grant, Cat. B. Brit. Mus. xxvi. p. 436 (1898).

Seen by Swinhoe near Ting-gan, North Hainan.

162. NETTOPUS COROMANDELIANUS.

Nettopus coromandelianus (Gmel.); Styan, Ibis, 1893, p. 435; Salvad. Cat. B. Brit. Mus. xxvii. p. 68 (1895).

Nettopus coromandelicus, Hartl. Abh. nat. Ver. Bremen, xiv. p. 378 (1898).

Nodouho, interior of North Hainan (*Hartlaub*).

163. MARECA PENELOPE.

Anas penelope (Linn.); Swinhoe, Ibis, 1870, p. 366.

Mareca penelope, Salvad. Cat. B. Brit. Mus. xxvii. p. 227 (1895).

North Hainan (*Swinhoe*).

164. NETTION CRECCA.

Anas crecca, Linn.; Swinhoe, Ibis, 1870, p. 366.

Nettion crecca, Salvad. Cat. B. Brit. Mus. xxvii. p. 243 (1895).

North Hainan (*Swinhoe*).

165. QUERQUEDULA CIRCIA.

Querquedula circia (Linn.); Styan, Ibis, 1893, p. 435; Salvad. Cat. B. Brit. Mus. xxvii. p. 293 (1895); Hartl. Abh. nat. Ver. Bremen, xiv. p. 379 (1898).

Hoihow, North Hainan (*Styan & Hartlaub*).

166. IBIS MELANOCEPHALA.

Ibis melanocephala (Lath.); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 326 (1892); Styan, Ibis, 1893, p. 434; Sharpe, Cat. B. Brit. Mus. xxvi. p. 7 (1898); Hartl. Abh. nat. Ver. Bremen, xiv. p. 374 (1898).

Hoihow, North Hainan (*Styan & Hartlaub*).

167. LEPTOPTILUS JAVANICUS.

Leptoptilus javanicus (Horsf.); Swinhoe, Ibis, 1870, p. 364; Sharpe, Cat. B. Brit. Mus. xxvi. p. 317 (1898).

Swinhoe observed this bird on several occasions in Central Hainan.

168. PSEUDOTANTALUS LEUCOCEPHALUS.

Pseudotantalus leucocephalus (Forst.); Sharpe, Cat. B. Brit. Mus. xxvi. p. 323 (1898).

Tantalus leucocephalus, Hartl. Abh. nat. Ver. Bremen, xiv. p. 373 (1898).

Hoikow, North Hainan (*Hartlaub*).

169. ARDEA CINEREA, Linn.; Swinhoe, Ibis, 1870, p. 365; Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 324 (1892); Sharpe, Cat. B. Brit. Mus. xxvi. p. 74 (1898).

Seen in all parts of the island (*Swinhoe*).

170. HERODIAS TIMORIENSIS.

Herodias alba, Swinhoe (nec Linn.), Ibis, 1870, p. 365.

Herodias timoriensis (Cuv.); Sharpe, Cat. B. Brit. Mus. xxvi. p. 98 (1898).

Common (*Swinhoe*).

171. GARZETTA GARZETTA.

Herodias garzetta, (Linn.); Swinhoe, Ibis, 1870, p. 365.

Ardea garzetta, Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 325 (1892).

Garzetta garzetta, Sharpe, Cat. B. Brit. Mus. xxvi. p. 118 (1898).
Common (*Swinhoe*).

172. NYCTICORAX NYCTICORAX.

Nycticorax griseus, Linn.; Swinhoe, Ibis, 1870, p. 365; Styan, Ibis, 1893, p. 434; Hartl. Abh. nat. Ver. Bremen, xiv. p. 373 (1898).

Nycticorax nycticorax, Sharpe, Cat. B. Brit. Mus. xxvi. p. 146 (1898).

Often seen in large flocks (*Swinhoe*).

Hoihow, North Hainan (*Styan & Hartlaub*).

173. *NYCTICORAX MAGNIFICA. (Plate XXXIII.)

Nycticorax magnifica, Grant, Ibis, 1899, p. 586.

This species is most nearly allied to *N. leuconotus* (Wagl.), but differs chiefly in the following particulars:—The back is uniform brown like the wings; some of the concealed feathers of the lower back have a subterminal oval white spot at the extremity; a white band runs from behind the eye to the base of the long black crest (3 inches in length); the chin, throat, and fore part of the sides

of the neck are white; the hinder parts of the sides of the neck chestnut; the middle of the fore-neck reddish brown, widely edged on either side with black; some of the intermediate feathers with pale buff middles; the rest of the underparts white, with wide irregular margins of reddish brown; and the thighs are dark reddish brown on the outer and white on the inner aspect.

“Iris dark brown; skin round the eye and base of bill sulphur greenish yellow; rest of bill black; feet pea-green.”—*J. W.*

Total length about 20 inches; culmen 3·1; wing 11·9; tail 4·9; tarsus 2·95.

This magnificent Night-Heron is not very closely allied to any known form; the style of the coloration of the lower parts is most like that of *Gorsachius melanolophus*.

Hab. Five-Finger Mountains, interior of Hainan.

174. *ARDEOLA BACCHUS.

Ardeola prasinoscetes, Swinhoe, Ibis, 1870, p. 365; Styan, Ibis, 1893, p. 434.

Ardeola bacchus (Bonap.); Sharpe, Cat. B. Brit. Mus. xxvi. p. 211 (1898).

“A male in changing plumage has the iris straw-yellow; bill at base and skin round eye yellowish green, remainder of bill black; feet dull yellow.”—*J. W.*

Abundant about paddy-fields and moist places (*Swinhoe*).

175. ARDETTA SINENSIS.

Ardetta sinensis (Gmel.); Styan, Ibis, 1893, p. 434; Sharpe, Cat. B. Brit. Mus. xxvi. p. 227 (1898).

Recorded from Hainan by Styan.

176. DUPETOR FLAVICOLLIS.

Ardetta flavicollis (Lath.); Styan, Ibis, 1893, p. 434.

Dupetor flavicollis (Lath.); Sharpe, Cat. B. Brit. Mus. xxvi. p. 247 (1898).

Recorded by Styan from Hainan.

177. GRUS GRUS.

Grus cinerea, Meyer & Wolf; Swinhoe, Ibis, 1870, p. 362.

Grus lilfordi, Sharpe, Cat. B. Brit. Mus. xxiii. p. 252 (1894).

Common in plains and open country (*Swinhoe*).

178. ARENARIA INTERPRES.

Strepsilas interpres (Linn.); Swinhoe, Ibis, 1870, p. 361; Hartl. Abh. nat. Ver. Bremen, xii. pp. 300, 332 (1892); Styan, Ibis, 1893, p. 436; Hartl. Abh. nat. Ver. Bremen, xiv. p. 375 (1898).

Arenaria interpres (Linn.); Sharpe, Cat. B. Brit. Mus. xxiv. p. 92 (1896).

Common at Poochin River, North-west Hainan, 5th March (*Swinhoe*).

Hoihow, North Hainan (*Hartlaub*).

179. HOPLOPTERUS VENTRALIS.

Hoplopterus ventralis (Wagl.); Swinhoe, Ibis, 1870, p. 361; Sharpe, Cat. B. Brit. Mus. xxiv. p. 159 (1896).

Procured at Lingshuy, S.E. Hainan, 18th March (*Swinhoe*).

180. CHARADRIUS DOMINICUS.

Charadrius longipes, Temm.; Swinhoe, Ibis, 1870, p. 360.

Charadrius fulvus, Gmel.; Hartl. Abh. nat. Ver. Bremen, xii. pp. 300, 331 (1892); Styan, Ibis, 1893, p. 436; Hartl. Abh. nat. Ver. Bremen, xiv. p. 374 (1898).

Charadrius dominicus, P. L. S. Müll.; Sharpe, Cat. B. Brit. Mus. xxiv. p. 195 (1896).

West Hainan, 21st-23rd March, and Hoihow, North Hainan, 2nd April (*Swinhoe*).

Interior of North Hainan (*Hartlaub*).

181. OCHTHODROMUS GEOFFROYI.

Ægialitis geoffroyi, Wagl.; Swinhoe, Ibis, 1870, p. 360.

Charadrius geoffroyi, Styan, Ibis, 1893, p. 436.

Ochthodromus geoffroyi, Sharpe, Cat. B. Brit. Mus. xxiv. p. 217 (1896); Hartl. Abh. nat. Ver. Bremen, xiv. p. 374 (1898).

A specimen from Paklai, West Hainan (*Swinhoe*).

Hoihow, North Hainan, 11th December (*Hartlaub*).

182. OCHTHODROMUS MONGOLICUS.

Ægialitis mongolicus (Pall.); Swinhoe, Ibis, 1870, p. 360.

Charadrius mongolicus, Styan, Ibis, 1893, p. 436.

Ochthodromus mongolus, Sharpe, Cat. B. Brit. Mus. xxiv. p. 223 (1896).

Ochthodromus mongolicus, Hartl. Abh. nat. Ver. Bremen, xiv. p. 374 (1898).

Chillan River, N.E. Hainan, 7th March, and Hungpe, N.W. Hainan, 30th March (*Swinhoe*).

Hoihow, North Hainan, 10th December (*Hartlaub*).

183. ÆGIALITIS DUBIA.

Ægialitis intermedius (Ménétr.); Swinhoe, Ibis, 1870, p. 361.

Ægialitis dubia (Scop.); Sharpe, Cat. B. Brit. Mus. xxiv. p. 263 (1896).

Recorded from Hainan by Swinhoe.

184. ÆGIALITIS ALEXANDRINA.

Ægialitis dealbatus, Swinhoe, Ibis, 1870, p. 361.

Charadrius cantianus (Lath.); Styan, Ibis, 1893, p. 436.

Ægialitis alexandrina (Linn.); Sharpe, Cat. B. Brit. Mus. xxiv. p. 275 (1896).

Recorded from Hainan by Swinhoe.

185. NUMENIUS PHEOPUS.

Numenius pheopus (Linn.); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 327 (1892), xiv. p. 375 (1898); Sharpe, Cat. B. Brit. Mus. xxiv. p. 355 (1896).

Hoihow, North Hainan, 25th Nov. (*Hartlaub*).

186. NUMENIUS ARQUATUS.

Numenius major, Swinhoe, Ibis, 1870, p. 363.

Numenius arquatus (Linn.); Sharpe, Cat. B. Brit. Mus. xxiv. pp. 341, 753 (1896).

Lingshuy, South-east Hainan, 11th March (*Swinhoe*).

Hoihow, North Hainan, Feb.-April (*Swinhoe*).

187. NUMENIUS VARIEGATUS.

Numenius variegatus (Scop.); Styan, Ibis, 1893, p. 437; Sharpe, Cat. B. Brit. Mus. xxiv. p. 361 (1896); Hartl. Abh. nat. Ver. Bremen, xiv. p. 375 (1898).

Hoihow, North Hainan (*Hartlaub & Styan*).

188. LIMOSA NOVÆ ZEALANDIÆ.

Limosa uropygialis, Gould; Swinhoe, Ibis, 1870, p. 362.

Limosa novæ zealandiæ, Gray; Sharpe, Cat. B. Brit. Mus. xxiv. p. 377 (1896).

Limosa baueri, Naum.; Hartl. Abh. nat. Ver. Bremen, xiv. p. 376 (1898).

Hungpe, North-west Hainan, 30th March (*Swinhoe*).

Hoihow, North Hainan, Feb. and April (*Swinhoe & Hartlaub*).

189. LIMOSA LIMOSA.

Limosa melanuroides, Gould; Styan, Ibis, 1893, p. 437.

Limosa limosa (Linn.); Sharpe, Cat. B. Brit. Mus. xxiv. p. 381 (1896).

Limosa melunura (Leisl.); Hartl. Abh. nat. Ver. Bremen, xiv. p. 375 (1898).

Hoihow, North Hainan (*Styan & Hartlaub*).

190. TOTANUS FUSCUS.

Totanus fuscus (Linn.); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 328 (1892); Styan, Ibis, 1893, p. 437; Sharpe, Cat. B. Brit. Mus. xxiv. p. 409 (1896).

Hoihow, North Hainan, 31st January (*Hartlaub & Styan*).

191. TOTANUS CALIDRIS.

Totanus calidris (Linn.); Swinhoe, Ibis, 1870, p. 364; Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 328 (1892); Sharpe, Cat. B. Brit. Mus. xxiv. p. 414 (1896).

Hoihow, North Hainan, 5th February and 9th December (*Swinhoe & Hartlaub*).

192. TOTANUS STAGNATILIS.

Totanus stagnatilis, Bechst. ; Swinhoe, Ibis, 1870, p. 364 ; Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 328 (1892) ; Styán, Ibis, 1893, p. 437 ; Sharpe, Cat. B. Brit. Mus. xxiv. p. 422 (1896) ; Hartl. Abh. nat. Ver. Bremen, xiv. p. 376 (1898).

Hoihow, North Hainan, December, February, April (*Swinhoe & Hartlaub*).

193. TOTANUS GLAREOLA.

Totanus glareola (Gmel.) ; Swinhoe, Ibis, 1870, p. 363 ; Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 328 (1892).

Rhyacophilus glareola (Gm.) ; Sharpe, Cat. B. Brit. Mus. xxiv. p. 491 (1896).

Kiung-chu-fu, North Hainan, 2nd April (*Swinhoe*).

194. SQUATAROLA HELVETICA.

Squatarola helvetica (Linn.) ; Swinhoe, Ibis, 1870, p. 360 ; Hartl. Abh. nat. Ver. Bremen, xii. pp. 300, 331 (1892) ; Sharpe, Cat. B. Brit. Mus. xxiv. p. 436 (1896) ; Hartl. Abh. nat. Ver. Bremen, xiv. p. 374 (1898).

Charadrius helveticus, Linn. ; Styán, Ibis, 1893, p. 436.

Hungpe Lagoon, West Hainan, 30th March (*Swinhoe*).

Hoihow, North Hainan, 12th December (*Hartlaub*).

195. TRINGOIDES HYPOLEUCUS.

Tringoides hypoleucus (Linn.) ; Swinhoe, Ibis, 1870, p. 363 ; Sharpe, Cat. B. Brit. Mus. xxiv. p. 456 (1896).

Actitis hypoleucus (Linn.) ; Hartl. Abh. nat. Ver. Bremen, xii. pp. 299 (1892).

Totanus hypoleucus, Hartl. Abh. nat. Ver. Bremen, xii. p. 328 (1892).

Common everywhere (*Swinhoe*).

196. TEREKIA CINEREA.

Totanus terekius (Lath.) ; Hartl. Abh. nat. Ver. Bremen, xii. p. 328 (1892).

Terekia cinerea (Güld.) ; Hartl. Abh. nat. Ver. Bremen, xii. p. 299 (1892) ; Sharpe, Cat. B. Brit. Mus. xxiv. p. 474 (1896).

Hoihow, North Hainan, 17th December (*Swinhoe*).

197. GLOTTIS NEBULARIUS.

Totanus glottis (Lath.) ; Swinhoe, Ibis, 1870, p. 364 ; Styán, Ibis, 1893, p. 437 ; Hartl. Abh. nat. Ver. Bremen, xiv. p. 376 (1898).

Glottis nebularius (Gunner) ; Sharpe, Cat. B. Brit. Mus. xxiv. p. 481 (1896).

Very common about Hoihow, February (*Swinhoe & Hartlaub*).

198. CALIDRIS ARENARIA.

Calidris arenaria (Linn.); Swinhoe, Ibis, 1870, p. 363; Styan, Ibis, 1893, p. 437; Sharpe, Cat. B. Brit. Mus. xxiv. p. 526 (1896); Hartl. Abh. nat. Ver. Bremen, xiv. p. 375 (1898).

Hungpe, North-west Hainan (*Swinhoe*).

Hoihow, North Hainan (*Hartlaub*).

199. EURHYNORHYNCHUS PYGMÆUS.

Eurhynorhynchus pygmæus (Linn.); Hartl. Abh. nat. Ver. Bremen, xii. pp. 300, 330 (1892); Styan, Ibis, 1893, p. 437; Sharpe, Cat. B. Brit. Mus. xxiv. p. 535 (1896); Hartl. Abh. nat. Ver. Bremen, xiv. p. 377 (1898).

Hoihow, North Hainan (*Hartlaub*).

200. TRINGA RUFICOLLIS.

Tringa albescens, Temm.; Swinhoe, Ibis, 1870, p. 363.

Tringa ruficollis, Pall.; Styan, Ibis, 1893, p. 437.

Limonites ruficollis (Pall.); Sharpe, Cat. B. Brit. Mus. xxiv. p. 545 (1896).

Hungpe, North-west Hainan, 30th March (*Swinhoe*).

201. TRINGA TEMMINCKI.

Tringa temmincki, Leisl.; Hartl. Abh. nat. Ver. Bremen, xii. pp. 300, 329 (1892), xiv. p. 377 (1898).

Limonites temmincki (Leisl.); Sharpe, Cat. B. Brit. Mus. xxiv. p. 555 (1896).

Hoihow, North Hainan, 25th November (*Hartlaub*).

202. TRINGA SUBARQUATA.

Tringa subarquatus (Güld.); Styan, Ibis, 1893, p. 437.

Ancylochilus subarquatus (Güld.); Sharpe, Cat. B. Brit. Mus. xxiv. p. 586 (1896).

Tringa subarquata, Hartl. Abh. nat. Ver. Bremen, xii. pp. 300, 329 (1892), xiv. p. 376 (1898).

Hoihow, North Hainan, 17th December (*Hartlaub*).

203. TRINGA CANUTUS.

Tringa canutus, Linn.; Hartl. Abh. nat. Ver. Bremen, xii. pp. 300, 329 (1892); Sharpe, Cat. B. Brit. Mus. xxiv. p. 593 (1896).

North Hainan, 17th December.

204. TRINGA CRASSIROSTRIS.

Tringa crassirostris, Temm. & Schleg.; Hartl. Abh. nat. Ver. Bremen, xii. pp. 300, 329 (1892); Styan, Ibis, 1893, p. 436; Sharpe, Cat. B. Brit. Mus. xxiv. p. 600 (1896); Hartl. Abh. nat. Ver. Bremen, xiv. p. 376 (1898).

Hoihow, North Hainan, 24th November, 16th December, and 26th January (*Hartlaub*).

205. *TRINGA ALPINA*.

Tringa cinclus (Linn.); Hartl. Abh. nat. Ver. Bremen, xii. pp. 300, 329 (1892); Styan, Ibis, 1893, p. 437.

Tringa alpina (Linn.); Swinhoe, Ibis, 1870, p. 363; Hartl. Abh. nat. Ver. Bremen, xiv. p. 377 (1898).

Pelidna alpina, Sharpe, Cat. B. Brit. Mus. xxxiv. p. 602 (1896).

Hoihow, North Hainan, 11th December and 15th January (*Swinhoe & Hartlaub*).

206. *LIMICOLA PLATYRHYNCHA*.

Tringa platyrhyncha, Temm.; Swinhoe, Ibis, 1870, p. 363; Styan, Ibis, 1893, p. 437.

Limicola platyrhyncha (Temm.); Sharpe, Cat. B. Brit. Mus. xxiv. p. 612 (1896).

Hoihow, North Hainan, 5th February (*Swinhoe*).

207. *GALLINAGO STENURA*.

Gallinago stenura (Bonap.); Swinhoe, Ibis, 1870, p. 362; Hartl. Abh. nat. Ver. Bremen, xii. pp. 300, 330 (1892); Styan, Ibis, 1893, p. 436; Sharpe, Cat. B. Brit. Mus. xxiv. p. 619 (1896).

Common throughout Hainan (*Swinhoe*).

208. *GALLINAGO GALLINAGO*.

Gallinago scolopacina, Bonap.; Swinhoe, Ibis, 1870, p. 362.

Gallinago gallinago, Sharpe, Cat. B. Brit. Mus. xxiv. p. 633 (1896).

Common near Kiung-chu, North Hainan, February (*Swinhoe*).

209. *SCOLOPAX RUSTICULA*.

Scolopax rusticula (Linn.); Styan, Ibis, 1893, p. 671; Sharpe, Cat. B. Brit. Mus. xxiv. p. 671 (1896); Hartl. Abh. nat. Ver. Bremen, xiv. p. 375 (1898).

North Hainan (*Hartlaub*).

210. *ROSTRATULA CAPENSIS*.

Rhynchœa bengalensis (Linn.); Swinhoe, Ibis, 1870, p. 362.

Rhynchœa capensis (Linn.); Hartl. Abh. nat. Ver. Bremen, xii. pp. 300, 331 (1892); Styan, Ibis, 1893, p. 436; Hartl. Abh. nat. Ver. Bremen, xiv. p. 375 (1898).

Rostratula capensis (Linn.); Sharpe, Cat. B. Brit. Mus. xxiv. p. 683 (1896).

Hoihow, North Hainan (*Swinhoe & Hartlaub*).

211. *PHALAROPUS HYPERBOREUS*.

Lobipes hyperboreus (Linn.); Swinhoe, Ibis, 1870, p. 363.

Phalaropus hyperboreus, Sharpe, Cat. B. Brit. Mus. xxiv. p. 698 (1896).

Hungpe, North-west Hainan, 4th April (*Swinhoe*).

212. HYDROPROGNE CASPIA.

Sterna caspia, Pall.; Swinhoe, Ibis, 1870, p. 366; Hartl. Abh. nat. Ver. Bremen, xii. pp. 300, 334 (1892).

Hydroprogne caspia, Saunders, Cat. B. Brit. Mus. xxv. p. 32 (1896).

Plentiful at Hoihow, North Hainan, Feb. to April (*Swinhoe* & *Hartlaub*).

213. STERNA SINENSIS.

Sterna sinensis (Gmel.); Styan, Ibis, 1893, p. 437; Saunders, Cat. B. Brit. Mus. xxv. p. 113 (1896).

Sternula sinensis, Hartl. Abh. nat. Ver. Bremen, xiv. p. 380 (1898).

Hoihow, North Hainan (*Hartlaub*).

214. STERNA MELANAUCHEN.

Sterna melanauchen, Temm.; Swinhoe, Ibis, 1870, p. 367; Saunders, Cat. B. Brit. Mus. xxv. p. 126 (1896).

Hoihow Harbour, North Hainan (*Swinhoe*).

215. LARUS SAUNDERSI.

Larus saundersi, Swinhoe; Hartl. Abh. nat. Ver. Bremen, xii. pp. 300, 334 (1892); Styan, Ibis, 1893, p. 437; Saunders, Cat. B. Brit. Mus. xxv. p. 183 (1896).

North Hainan (*Hartlaub*).

216. LARUS RIDIBUNDUS.

Larus ridibundus, Linn.; Saunders, Cat. B. Brit. Mus. xxv. p. 207 (1896); Hartl. Abh. nat. Ver. Bremen, xiv. p. 379 (1898).

Hoihow, North Hainan (*Hartlaub*).

217. LARUS CANUS.

Larus niveus, Pall.; Swinhoe, Ibis, 1870, p. 366.

Larus canus, Linn.; Saunders, Cat. B. Brit. Mus. xxv. p. 277 (1896).

Hoihow Harbour, North Hainan, and Hungpe, North-west Hainan, February to April (*Swinhoe*).

218. PODICIPES PHILIPPENSIS.

Podiceps philippensis (Bonnat.); Swinhoe, Ibis, 1870, p. 366; Hartl. Abh. nat. Ver. Bremen, xii. pp. 300, 334 (1892).

Tachybates fluviatilis, Styan (nec Tunst.), Ibis, 1893, p. 437.

Podiceps philippensis, Grant, Cat. B. Brit. Mus. xxvi. p. 511 (1898).

Often seen (*Swinhoe*).

219. GALLINULA CHLOROPUS.

Gallinula chloropus (Linn.); Hartl. Abh. nat. Ver. Bremen,

xii. pp. 300, 332 (1892); Sharpe, Cat. B. Brit. Mus. xxiii. p. 169 (1894).

Recorded from North Hainan by Hartlaub.

220. *GALLICREX CINEREUS*.

Gallixrex cinereus (Gm.); Styan, Ibis, 1893, p. 436; Sharpe, Cat. B. Brit. Mus. xxiii. p. 183 (1894); Hartl. Abh. nat. Ver. Bremen, xiv. p. 378 (1898).

Hoihow, North Hainan (*Hartlaub*).

221. *FULICA ATRA*.

Fulica atra, Linn.; Hartl. Abh. nat. Ver. Bremen, xii. pp. 300, 332 (1892); Sharpe, Cat. B. Brit. Mus. xxiii. p. 210 (1894).

North Hainan (*Hartlaub*).

222. **TRETERON NIPALENSIS*.

Treron nipalensis (Hodgs.); Salvad. Cat. B. Brit. Mus. xxi. p. 34 (1893); Styan, Ibis, 1893, p. 435.

"Iris orange; bill pale yellow; base of bill and feet orange red."—*J. W.*

Interior of South-west Hainan (*Styan*).

223. *OSMOTRETERON BICINCTA*.

Osmotreron domvili, Swinhoe, Ibis, 1870, p. 354; Styan, Ibis, 1893, p. 435.

Osmotreron bicincta (Jerd.); Salvad. Cat. B. Brit. Mus. xxi. p. 57 (1893); Hartl. Abh. nat. Ver. Bremen, xiv. p. 370 (1898).

Interior of Hainan (*Swinhoe*).

224. *CARPOPHAGA AENA*.

Carpophaga sylvatica (Tick.); Swinhoe, Ibis, 1870, p. 355.

Carpophaga aena, Salvad. Cat. B. Brit. Mus. xxi. p. 190 (1893).

Shuy-wei-size, Central Hainan, 18th February, and Hungpe, West Hainan, 30th March (*Swinhoe*).

225. **CARPOPHAGA GRISEICAPILLA*.

Carpophaga griseicapilla, Wald.; Salvad. Cat. B. Brit. Mus. xxi. p. 217 (1893).

"Iris pale bluish white; bill and feet dull red; tip of bill dull grey."—*J. W.*

Recorded from Hainan for the first time.

226. *COLUMBA PUNICEA*.

Columba punicea (Tick.); Salvad. Cat. B. Brit. Mus. xxi. p. 306 (1893).

Alsocomus puniceus, Tick.; Styan, Ibis, 1893, p. 435; Hartl. Abh. nat. Ver. Bremen, xiv. p. 370 (1898).

Nam-fung, interior of North Hainan (*Styan & Hartlaub*).

227. *MACROPYGIA MINOR.

Macropygia tusalia, var. *minor*, Swinh. Ibis, 1870, p. 355.

Macropygia swinhoei, W. Ramsay, Ibis, 1890, p. 218; Salvad. Cat. B. Brit. Mus. xxi. p. 340 (1898); Styan, Ibis, 1893, p. 435; Hartl. Abh. nat. Ver. Bremen, xiv. p. 370 (1898).

Two specimens in the Whitehead collection have the somewhat smaller measurements of *M. minor*, but are identical in plumage with typical *M. tusalia*, the colour of the back, wings, and tail being absolutely similar. The female type of *M. minor* has the back unusually dark and almost devoid of all trace of rufous cross-bars. The pair of birds sent home by Whitehead are the first really fine specimens that have been brought to Europe, and they seem to show that though some examples of *M. minor* are darker than typical *M. tusalia*, others are indistinguishable in plumage, and only differ in their somewhat smaller size.

♂. Wing 7·1; tail 7·2 inches.

♀. „ 6·8; „ 6·8 „

“Iris narrow, pale yellow; bill dusky black; feet coral-red.”—

J. W.

Tai-ping-sze, Central Hainan, Nychow, South Hainan (*Swinhoe*).
Nam-fung, interior of North Hainan, May (*Styan* & *Hartlaub*).

228. TURTUR ORIENTALIS.

Turtur ruficollis (Pall.); Swinhoe, Ibis, 1870, p. 356; Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 323 (1892); Styan, Ibis, 1893, p. 435; Hartl. Abh. nat. Ver. Bremen, xiv. p. 370 (1898).

Turtur orientalis (Lath.); Salvad. Cat. B. Brit. Mus. xxi. p. 403 (1893).

A few near Kiung-chu, February (*Swinhoe*).

229. TURTUR HUMILIS.

Turtur humilis (Temm.); Swinhoe, Ibis, 1870, p. 356; Salvad. Cat. B. Brit. Mus. xxi. p. 434 (1893); Styan, Ibis, 1893, p. 435.

Obtained at Kiung-chu, 10th February, and occasionally seen in other parts of the island (*Swinhoe*).

230. *TURTUR CHINENSIS.

Turtur chinensis (Scop.); Swinhoe, Ibis, 1870, p. 356; Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 324 (1892); Salvad. Cat. B. Brit. Mus. xxi. p. 439 (1893).

“Iris pale brownish yellow; bill black; feet dull coral-red.”—

J. W.

Found everywhere (*Swinhoe*).

231. CHALCOPHAPS INDICA.

Chalcophaps indica (Linn.); Swinhoe, Ibis, 1870, p. 356; Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 323 (1892); Salvad. Cat. B. Brit. Mus. xxi. p. 514 (1893); Styan, Ibis, 1893, p. 435; Hartl. Abh. nat. Ver. Bremen, xiv. p. 370 (1898).

Once obtained at Shuy-wei-sze, Central Hainan, 27th February (*Swinhoe*).

Lui-wo-wan, northern slope of the mountains of South-west Hainan; Nodouha, interior of North Hainan, and the Hummocks, near the coast of North Hainan (*Styan & Hartlaub*).

232. *TURNIX DUSSUMIERI*.

Turnix dussumieri (Temm.); Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 324 (1892); Grant, Cat. B. Brit. Mus. xxii. p. 540 (1893).

Hartlaub records a specimen from North Hainan on the 24th March.

233. *CACCABIS CHUKAB*.

Caccabis chukar (Gray); Grant, Cat. B. Brit. Mus. xxii. p. 113 (1893); Hartl. Abh. nat. Ver. Bremen, xiv. p. 371 (1898).

Hartlaub records a pair from Hainan.

234. **FRANCOLINUS CHINENSIS*.

Francolinus sinensis, Swinhoe, Ibis, 1870, p. 359; Hartl. Abh. nat. Ver. Bremen, xiv. p. 372 (1898).

Francolinus chinensis (Osbeck); Hartl. Abh. nat. Ver. Brem. xii. pp. 299, 324 (1892); Grant, Cat. B. Brit. Mus. xxii. p. 136 (1893); Styan, Ibis, 1893, p. 435.

"Iris hazel; bill dusky black, base whitish; feet orange-yellow."—*J. W.*

Common everywhere (*Swinhoe*).

235. *ARBORICOLA ARDENS*.

Arboricola ardens, Styan, Ibis, 1893, p. 436, pl. xii.; Grant, Cat. B. Brit. Mus. xxii. p. 210 (1893).

The only specimen known of this remarkable Tree-Partridge was obtained at Lniwowan, on the northern slope of the mountains of South-west Hainan, in the month of December.

236. *COTURNIX COTURNIX*.

Coturnix communis, Bonn.; Hartl. Abh. nat. Ver. Bremen, xii. pp. 299, 324 (1892).

Coturnix coturnix (Linn.); Grant, Cat. B. Brit. Mus. xxii. p. 231 (1893).

¹ North Hainan, 29th January (*Hartlaub*).

237. *EXCALFACTORIA CHINENSIS*.

Excalfactoria chinensis, Swinhoe (nec Linn.), Ibis, 1870, p. 360; Grant, Cat. B. Brit. Mus. xxii. p. 250 (1893).

Seen by Swinhoe, but not obtained. It is quite possible that the Hainan bird should be referred to the subspecies *E. lineata*.

238. **GENNÆUS WHITEHEADI*. (Plate XXXIV.)

Gennæus whiteheadi, Grant, Ibis, 1899, p. 586.

The male of this remarkably fine species of Silver Pheasant

is most nearly allied to *G. nycthemerus*, but, as may be seen from the accompanying drawing (Plate XXXIV.), differs conspicuously in many important particulars.

Crown black with a slight blue gloss; nuchal crest rather long (2·5 inches) and similarly coloured, the longer feathers being decomposed.

Adult male. Nape and upper mantle pure white; each feather of the lower mantle, back, rump, and shorter upper tail-coverts with one black submarginal band on each web, forming an arrow-head black marking, which gradually increases in width towards the tail, most of the feathers being also narrowly fringed with black. Wing-coverts similar, but with the black markings much coarser. Longer upper tail-coverts and secondaries very boldly marked with successive black arrow-heads. Primary-quills black, with wide oblique white markings. Middle tail-feathers pure white; second and third pairs white, with wide (about 0·5 inch) oblique black bands on the outer web; the latter pair with some irregular black marking on the inner web also; remaining pairs white, with wide oblique black bands on both webs forming an irregular arrow-head pattern. Underparts black, some of the feathers of the sides with narrow white middles. Iris brownish yellow; naked wattle and skin on sides of face scarlet; bill greenish white; legs coral-red.

Total length 35 inches; wing 9·4; tail 20; tarsus 3·15.

Adult female. Most nearly resembles the female of *G. andersoni*, but is much darker. The feathers of the neck and mantle mostly black with wide white shaft-streaks; the underparts, including the under tail-coverts, similar, but with wider white middles. Outer tail-feathers uniform dark chestnut, with indistinct vermiculations of black. Iris light brown; upper mandible greenish brown, lower dull green; naked skin on face red; legs and feet bright scarlet.

Total length 21·5 inches; wing 8·1; tail 8·8; tarsus 2·9.

Mr. Whitehead secured three adult males and one female of this splendid Silver Pheasant.

Hab. Five-Finger Mountains, interior of Hainan.

239. GALLUS GALLUS.

Gallus ferrugineus (Gmel.); Swinhoe, Ibis, 1870, p. 357; Styan, Ibis, 1893, p. 435; Hartl. Abh. nat. Ver. Bremen, xiv. p. 371 (1898).

Gallus gallus (Linn.); Grant, Cat. B. Brit. Mus. xxii. p. 344 (1893).

Gallus bankiva, Temm.; Hartl. Abh. nat. Ver. Bremen, xii. p. 324.

Throughout Hainan (*Swinhoe*).

EXPLANATION OF THE PLATES.

PLATE XXXIII.

Nycticorax magnifica, p. 493.

PLATE XXXIV.

Gennæus whitcheadi, ♂ ♀, p. 503.



H. Gronvold del et lith

Mintern Bros. imp.

NYCTICORAX MAGNIFICA.





H. Gronvold del. et lith.

Mintern Bros. imp.

GENNÆUS WHITEHEADI ♂ & ♀.



3. On the Butterflies collected by the late Mr. John Whitehead in the Interior of the Island of Hainan. By PHILIP CROWLEY, F.L.S., F.Z.S.

[Received March 29, 1900.]

(Plate XXXV.)

In this collection, which was the last made by the late Mr. John Whitehead, there are representatives of 108 species, of which 8 are new, and many others have not been previously recorded from this island. I therefore append a list of those received. I can find only two previous lists of Butterflies from Hainan—that of Mr. F. Moore, in P. Z. S. 1878, and that of the Rev. W. F. Holland, Trans. Amer. Ent. Soc. 1887. I have marked with M. or H. all the species mentioned in these lists.

N Y M P H A L I D Æ.

E U P L Œ I N Æ.

TIRUMALA LIMNIAE Cram. ♀. M. & H.

SALATURA GENUTIA Cram. ♂, ♀. H.

CADUGA SWINHOEI Moore. ♂.

TREPSICHROIS LINNÆI Moore. ♂, ♀.

S A T Y R I N Æ.

E U P L Œ A M I M A H E N R I C I Holl. ♂. H.

O R S O T R I Æ N A M E D U S Fabr. ♀.

C A L Y S I S M E M A M E R T A Cram. ♂.

L E T H E R O H R I A Fabr. ♂.

T A N S I M A V E R M A Koll. ♂.

M E L A N I T I S A S W A Moore. ♂. H.

A M A T H U S I I N Æ.

N A N D O G E S H A I N A N A, sp. n.

Male. Resembles *N. diores* Doubl. Differs from the Indian form in being smaller, and in having the blue much restricted. Expanse $3\frac{4}{10}$ inches.

D I S C O P H O R A T U L L I A Cram. ♂.

NYMPHALINÆ.

EULEPIS EUDAMIPPUS WHITEHEADI, sp. n. (Plate XXXV. fig. 1.)

Male. Upperside—Fore wing: discal white area clearer and much broader than in *E. eud. rothschildi*, being in this respect not essentially different from *E. eud. nigrobasalis*, the marginal and submarginal spots having the same arrangement and direction as in its allies. Hind wing as in *E. eud. nigrobasalis*, but the black marginal band separated into rather smaller portions just touching each other, outer marginal interspaces much shaded with blue.

Underside—Fore wing: middle of costal margin black, discocellular portion of middle band black; two conjoined costal black spots midway between cell and postdiscal band; discal band similar to *E. eud. rothschildi*. Marginal band olive-brown. Hind wing: median band as in *E. eud. rothschildi*, but with the upper black bars more strongly developed. Series of double lunules with heavy bluish-white centres parallel to outer margin, as in *E. eudamippus*. Black submarginal spots, which are heavy and slightly transverse, especially 5–6, midway between lunules and margin of wing.

Expanse $3\frac{6}{10}$ inches.

HESTINA NAMA Doubl. ♂.

ADOLIAS ELEANOR Fruhs. ♂, ♀.

KIRONTISA WHITEHEADI, sp. n. (Plate XXXV. fig. 4.)

Male. Upperside deep olivescent brown. Fore wing with two paler olivescent marks within, one at the end, and another beyond the cell. Cilia white. A slight bluish-grey marginal band. Hind wing with a bluish-grey marginal band, narrow at the apex, widening to the anal angle; extreme edge black. Underside dark ochraceous umber-brown, cell and basal marks black. Both wings crossed by discal and submarginal sinuous blurred darker bands, most prominent on fore wing.

Female. Upperside paler than male. Fore wing: cell-markings as in male. Beyond the cell a series of five semidiaphanous whitish spots, the middle one indistinct, a subapical spot situate just below the base of the fifth subcostal; a bluish-grey marginal band beginning narrowly just below the apex, and widening to the posterior angle. Hind wing: basal marks obscure, a very wide bluish-grey outer marginal band enclosing six dentate black spots; blackish extreme outer edge. Underside brownish ochreous. Fore wing: cell-markings slender as in male; a series of prominent bluish-white black-edged semidiaphanous discal spots as on upper-side; a submarginal series of six black spots separated by the veins. Hind wing: basal marks obscure; a faint discal band; a series of diffused sinuous submarginal spots.

Expanse, ♂ $2\frac{8}{10}$, ♀, $3\frac{3}{10}$ inches.

- NOBA KESAVA Moore. ♂.
 DOPHLA DERMA Koll. ♂.
 NEPTIS HAINANA Moore. ♂, ♀. M.
 NEPTIS LEUCONOTA Butl. ♀.
 RAHINDA HORDONIA Stoll. ♀. H.
 YOMA VASUKI Doh. ♂.
 JUNONIA ASTERIE Linn. ♂. H.
 JUNONIA LEMONIAS Linn. ♂. M. & H.
 CYRESTIS THYODAMAS Boisd. ♂. M.
 PENTHEMA MICHALLATI Janet. ♂, ♀.
 CYNTHIA EBOTA Fabr. ♂. H.
 ATELLA SINHA Koll. ♂.
 ERGOLIS ALTERNUS Moore. ♂. M.

LEMONIIDÆ.

LIBYTHÆINÆ.

- LIBYTHEA MYRRHA Godt. ♂.

NEMEOBIINÆ.

- ZEMEROS CONFUCIUS Moore. ♂. M. & H.

LYCÆNIDÆ.

- PITHECOPS HYLAX Fabr. ♂.
 NEOPITHECOPS ZALMORA Butl. ♂, ♀.
 TARAKA HAMADA Druce. ♀.
 MEGISBA HAMPSONI Moore. ♂, ♀.
 CYANIRIS PUSPA Horsf. ♂, ♀.
 CYANIRIS DILECTUS Moore. ♂.
 CYANIRIS OBEAS Leech. ♂.
 LYCÆNESTHES LYCAMBES Hew. ♂.
 EVERES DIPOBA Moore. ♂.
 NACADUBA CÆLESTIS de Nicév. ♂.
 NACADUBA ARDATES Moore. ♂.
 NACADUBA KURAVA Moore. ♂.

CATOCHRYSOPS STRABO Fabr. ♂.

LAMPIDES ELPIS Godt. ♂.

LAMPIDES CELENO Godt. ♂, ♀. H.

TARUCUS PLINIUS Fabr. ♂.

CASTALIUS ELNA Hew. ♂.

POLYOMMATUS BÆTICUS Linn. ♂. M. & H.

AMBLYPODIA HAINANA, sp. n.

Male. Wings above dark purplish violet, with a dingy black marginal band; anal lobe and tail brown. Underside dark purple-brown, base of fore wing and entire hind wing sparsely speckled with grey scales; transverse line edged with grey near anal angle.

Expanse $2\frac{2}{10}$ inches.

CURETIS BULIS Doubl. & Hew. ♂.

CURETIS SPERTHIS Feld. ♂.

ILERDA EPICLES Godt. ♂, ♀.

APHNÆUS ZEBRINUS Moore. ♀.

LOXURA ATYMNUS Cram. ♂.

YASODA PITA Horsf. ♂.

RAPALA MANEA Hew. ♀.

PAPILIONIDÆ.

PIERINÆ.

PRIONERIS THESTYLIS Doubl. ♂.

PRIONERIS WATSONI Hew. ♂.

PRIONERIS CLEMANTHE Doubl. ♂.

TERIAS HARINA Horsf. ♂.

TERIAS SUAVA Boisd. ♂. H.

TERIAS ÆSIOPE Ménétr. ♂, ♀. M.

HEBOMOIA GLAUCIPPE Linn. ♂.

DERCAS VERHUELLI Hœv. ♂.

IXIAS EVIPPE Dru. ♂. M.

APPIAS GALBA Wall. ♂.

APPIAS HIPPO Cram. ♂, ♀.

CATOPSILIA PYRANTHE Linn. ♂.

HIPOSCRITIA LALAGE Doubl. ♂. H.

HIPOSCRITIA PSEUDOLALAGE Moore. ♂.

HIPOSCRITIA INDRA Moore. ♂.

HIPOSCRITIA LAGELOIDES, sp. n. (Plate XXXV. fig. 2.)

Male. Upperside white. Fore wing: base of costa greenish grey; a black streak shaded with bluish grey from base of cell to black discocellular spot, which is connected with the spur of the outer margin, thus cutting off a large white transverse elongated spot. Apical area and broad outer margin black, enclosing two subapical white spots, the lower indistinct; also a large white spot between first and second median nervules. Hind wing with a broad marginal black band, inner edge much suffused. Underside—Fore wing white, a distinct quadrate discocellular black spot, a black oblique band from costa beyond cell to just above posterior angle; a black spot between the median nervules connected with the band. Apex brownish yellow. Hind wing pale brownish yellow, crossed by two zigzag dark grey bands, a dot on the lower discocellular nervule.

Female. Upperside similar to male, with broader, more pronounced bands, and the white tinged with yellow. Underside as in male, but with apex and hind wing paler and tinted with faint lilac.

Expanse, ♂ $2\frac{1}{10}$ to $2\frac{5}{10}$, ♀ $2\frac{6}{10}$ inches.

CATOPHAGA ALBINA Bois. ♂.

HUPHINA NERISSA Fabr. ♂.

HUPINA NADINA Lucas. ♂.

PAPILIONINÆ.

TROIDES ABACUS Feld. ♀.

PAPILIO HELENUS Linn. ♂. M. & H.

PAPILIO CHAON Linn. ♂.

PAPILIO DEMOLEUS Linn. ♂, ♀. H.

PAPILIO AGENOR Linn. ♂, ♀. M. & H.

PAPILIO PROTENOR Cram. ♂.

PAPILIO HAMELA, sp. n. (Plate XXXV. fig. 3.)

Male. Upperside uniform intense brown, with vein- and cell-lines black. Minute internervular marginal white points. Hind wing with a discal band of seven pale primrose-coloured spots, second, third, and fourth being much the larger, sixth and seventh

tinged with yellow. Underside: general colour as above, but paler. Fore wing: faint white discocellular spot, traces of a series of submarginal internervular spots. Hind wing: an outer discal band of six, and traces of the seventh, white spots. A series of slight submarginal white spots.

Expanse $3\frac{1}{10}$ inches.

PAPILIO SLATERI Hew. ♂.

PAPILIO PARIS Linn. ♂. H.

PAPILIO ARISTOLOCHLÆ Fabr. ♀.

PAPILIO DODDSI Janet. ♂.

PAPILIO CONTINENTALIS Eimer. ♂, ♀. H.

PAPILIO AGETES Westw. ♂.

PAPILIO BATHYCLES Zink. ♂.

PAPILIO AXION Feld. ♂.

PAPILIO ACHERON, Moore. ♂.

PAPILIO SARPEDON Linn. ♂.

PAPILIO XENOCLES Doubl. ♂.

PAPILIO STRIATUS Lathy. ♂.

CAPILA HAINANA, sp. n.

Female. Upperside brown. Fore wing with a broad glistening hyaline white discal band, decreasing obliquely from middle of costa to above submedian nervure. Hind wing with two slightly defined parallel greyish streaks between the nervules. Underside dark brown. Hind wing without the greyish streaks. Body and legs brown. Palpi bright orange.

Expanse $2\frac{6}{10}$ inches.

TAGIADES MULTIPUNCTATUS, sp. n.

Male. Allied to *T. pralaja*. Upperside with the hyaline spots smaller and all entirely separated. Much less yellow on the hind wing. Underside—Fore-wing spots as above. Hind wing yellow, more restricted anally.

Expanse $1\frac{8}{10}$ inches.

TAGIADES ATTICUS Fabr. ♂.

SCOBURA, sp. n. ♂.

A single specimen of a new species in too bad condition to describe.

PADRAONA OIDES Butl. ♂.

PADRAONA PSEUDOMÆSA Moore. ♂.





Horace Knight ad. nat. lith

West, Newman chromo

BUTTERFLIES FROM HAINAN

TELICOTA BAMBUSÆ Moore. ♂. H.

CALTORIS TOONA Moore. ♀.

CALTORIS BADA Moore. ♂.

LAMBRIX SALSALA Moore. ♂.

UDASPES FOLUS Cram. ♂. H.

ASTICTOPTERUS OLIVASCENS Moore. ♂.

ISMENE ATAPHUS Watson. ♂.

EXPLANATION OF PLATE XXXV.

Fig. 1. *Eulepis eudamippus whiteheadi*, p. 506.

2. *Hiposcritia lageloides*, p. 509.

3. *Papilio hamela*, p. 509.

4. *Kirontisa whiteheadi*, p. 506.

4. List of the Fishes collected by Mr. J. S. Budgett in the River Gambia. By G. A. BOULENGER, F.R.S., F.Z.S. With Notes by J. S. BUDGETT, F.Z.S.

[Received May 8, 1900.]

The collection made by Mr. Budgett fills a gap in our knowledge of the African river-fishes. Extraordinary as it may appear, the fishes of the Gambia have been little collected as before, and it would have been impossible to draw up a list complete enough to compare with that of the Senegal. As might be expected, the fishes are very similar in the two rivers; I have nevertheless to describe as new two species, which are represented by several specimens in the collection. Mr. Budgett intends to present examples of these to the British Museum.

CROSSOPTERYGII.

POLYPTERIDÆ.

1. POLYPTERUS LAPRADII Stdr.
2. POLYPTERUS SENEGALUS Cuv.

DIPNOI.

LEPIDOSIRENIDÆ.

3. PROTOPTERUS ANNECTENS Ow.

[On this and the two preceding species, see Mr. Budgett's notes in Proc. Cambr. Philos. Soc. x. 1900, p. 236.]

TELEOSTEI.

ELOPIDÆ.

4. *ELOPS LACERTA* C. & V.

MORMYRIDÆ.

5. *MORMYROPS DELICIOSUS* Leach.

"Known as 'Suyi.' The natives are fond of all the Mormyridæ as food."

6. *GNATHONEMUS SENEGALENSIS* Stdr.

"Called by the natives 'Suyi-furu.' Brazen, blue and pink sheen."

7. *MORMYRUS JUBELINI* C. & V.

"Known as 'Suyi-nala.' All the Mormyridæ are easily caught with the trammel net, but with difficulty by other means."

8. *HYPEROPISUS BEBE* Lacép.

9. *GYMNARCHUS NILOTICUS* Cuv.

"Only caught in the Kunchow creek. Five specimens seen."

NOTOPTERIDÆ.

10. *NOTOPTERUS AFER* Gthr.

"This is not common. Its native name is 'Liffi lafo.' Two specimens only were taken near McCarthy's Island."

OSTEOGLOSSIDÆ.

11. *HETEROTIS NILOTICUS* Cuv.

"Native name 'Fanntanng.' Breeds in the swamps; the fish occurs also in the river. I have seen no specimen over 20 inches."

CHARACINIDÆ.

12. *SARCODACES ODOË* Bl.

"Known by the natives as 'Saunko.' It was taken several times at Nianimaru, 130 miles from the sea."

13. *HYDROCYON BREVIS* Gthr.

"Native name 'Sokkoro.' Very common; a specimen was found with a large *Alestes* in its gullet. Ventral lobe of caudal fin brilliant red. Used by the natives for food."

14. *ALESTES DENTEX* Hasselq.

15. *ALESTES SETHENTE* C. & V.

"Known as 'Ballauta.' Everywhere common, largely eaten and used as bait. The scales have a sky-blue tint, tail bright red."

16. *ALESTES LEUCISCUS* Gthr.17. *CITHARINUS GEOFFROYI* Cuv.

"Known as 'Tara.' Very common, 12 inches in length. The ventral lobe of the caudal fin and the ventral fins bright red, the rest silver grey."

CYPRINIDÆ.

18. *LABEO COUBIE* Rüpp.

"Known as 'Kulinumma.' The whole fish has a fine rosy tint; it is esteemed as food, and fairly common; the largest seen being about 18 inches in length."

19. *LABEO SELTI* C. & V.

"Known as 'Jotto.' Fairly common at McCarthy's Island. It is good eating. Silver white."

SILURIDÆ.

20. *CLARIAS BUDGETTI*, sp. n.

Vomerine teeth granular, forming a crescentic band which is as broad as or a little narrower than the præmaxillary band; the latter about 7 times as long as broad. Depth of body $6\frac{1}{2}$ or 7 times in total length; length of head (to extremity of occipital process) 3 or $3\frac{1}{4}$ times. Head $1\frac{1}{2}$ or $1\frac{1}{3}$ as long as broad, very feebly granulate; occipital process angular; frontal fontanelle 4 or 5 times as long as broad, its length about 4 times in length of head; occipital fontanelle small, in advance of occipital process; eye small, 3 or 4 times in length of snout, $5\frac{1}{2}$ to 7 times in interorbital width, which nearly equals width of mouth and is contained $2\frac{1}{3}$ or $2\frac{1}{2}$ in length of head; nasal barbel about $\frac{1}{2}$ length of head; maxillary barbel as long as or a little shorter than the head (a little longer in the young); outer mandibular barbel $1\frac{1}{4}$ or $1\frac{1}{3}$ as long as inner, which measures $\frac{1}{2}$ or $\frac{2}{3}$ length of head. Gill-rakers closely set, about 40 on first arch. Dorsal 68 to 73, its distance from the occipital process $\frac{1}{6}$ or $\frac{1}{7}$ length of head, its distance from the caudal fin greater than the diameter of the eye. Anal 46 to 50, narrowly separated from the caudal. Pectoral not quite $\frac{1}{2}$ length of head; the spine serrated on the outer border, about $\frac{2}{3}$ length of the fin. Ventrals midway between end of snout and caudal. Caudal $\frac{1}{2}$ length of head. Olive above, marbled with black, white beneath; anal with a light edge; a blackish streak from the angle of the mouth to the base of the pectoral.

Total length 330 millim.

Three specimens.

Very nearly allied to *C. senegalensis* C. & V.; with which it may ultimately have to be united. The less rugose head and the narrower frontal fontanelle are the characters which induce me to regard it, provisionally, as distinct.

"Called 'Connococono' by the natives. Often eaten by natives but not much esteemed. Lives chiefly in shallow swamps."

21. SCHILBE SENEGALENSIS C. & V.

22. ARIUS LATISCUTATUS Gthr.

"Known as 'Wollinyaba.' It is used as food. Seen two feet in length."

23. CHRYSICHTHYS CAMERONENSIS Gthr.

24. CHRYSICHTHYS NIGRODIGITATUS Lacép.

25. AUCHENOGLANIS BISCUTATUS Geoffr.

26. SYNODONTIS CLARIAS Hasselq.

"Not very common; taken several times at Nianimaru. Brilliant red tail and a little red near the head. Native name 'Konnkrikonng.' Not used as food."

27. SYNODONTIS GAMBIENSIS Gthr.

"Called by the natives 'Kosso.' Was very abundant in the river. Frequently when taken from the water made a faint cry. It is seldom eaten by the natives. Dull grey."

28. SYNODONTIS OCELLIFER, sp. n.

Præmaxillary teeth in several irregular series, forming a broad band; mandibular teeth 23 to 30, hooked, simple, measuring barely one sixth the diameter of the eye. Depth of body 3 times in total length, length of head $3\frac{1}{2}$ times. Head slightly longer than broad, convex on the occiput; snout obtusely conical, $\frac{1}{3}$ length of head; eye supero-lateral, its diameter 5 times in length of head, $1\frac{2}{3}$ to $1\frac{3}{4}$ in interorbital width; upper surface of head moderately granulate from between the eyes; frontal fontanelle narrow. Occipito-nuchal shield obtusely tectiform, longer than broad, granulate like the upper surface of the head, and terminating in two obtuse processes. Gill-cleft not extending below base of pectoral. Maxillary barbel without distinct fringe, longer than the head, reaching middle or posterior third of pectoral spine; mandibular barbels with long, slender, simple branches, inserted on a straight transverse line, outer nearly as long as the head, once and two thirds as long as inner. Lips rather feebly developed. Humeral process granulate, acutely pointed, extending nearly as far as occipito-nuchal shield. Dorsal II 7; spine strong, a little shorter than the head, curved, striated, with 12 or 13 feeble serræ behind in its upper half. Adipose fin 3 to $3\frac{1}{2}$ times as long as deep, a little longer than the head, 4 to 5 times as long as its distance from the dorsal. Anal IV 7-8. Pectoral spine slightly longer than dorsal, striated, feebly serrated on the outer edge, with 18 to 21 strong antrorse serræ on the inner edge. Ventral not reaching anal. Caudal deeply forked, with pointed lobes, upper longest. Caudal peduncle as long as deep. Skin of body smooth. Grey-brown above and on the sides, white beneath; body and adipose fin with large black-and-white ocellar spots

disposed with greater or less regularity at considerable intervals ; caudal fin with numerous small round blackish spots.

Total length 490 millim.

Three specimens.

This species is most nearly allied to *S. nigrita* C. & V., from the Senegal, from which it differs, however, in the larger adipose fin and the longer and more slender branches of the mandibular barbels, as well as in the presence of the ocellar spots on the body.

“Never found in main river; chiefly taken in the Kunchow Creek. Eye-spots very bright black with white centre. Upper parts brown.”

29. MALOPTERURUS ELECTRICUS Gm.

“Is known to the natives of the Gambia by the name of ‘Tingo.’ It is common. The largest specimen seen was 14 inches in length. Two small specimens 3 inches in length were kept alive for several weeks in an aquarium; they appeared to browse on the algæ, and were capable when even so small of giving a very considerable shock.”

MUGILIDÆ.

30. MUGIL FALCIPINNIS C. & V.

“Taken frequently in the Kunchow Creek. No fish in the river can compare with this as food, most of the river-fish being soft-fleshed and tasteless.”

POLYNEMIDÆ.

31. POLYNEMUS QUADRIFILIS C. & V.

SPHYRÆNIDÆ.

32. SPHYRÆNA GUACHANCHO C. & V.

OPHIOCEPHALIDÆ.

33. OPHIOCEPHALUS OBSCURUS Gthr.

“Called by the natives ‘Pattukoma’ or ‘sleeping-fish,’ from a curious habit it has when caught in shallow pools by draining the water: it does not attempt to get to the deeper parts of the pools but lies stranded as though dead. If placed in deep water it will suddenly dart away. In these pools it bears from above a striking resemblance to *Polypterus*, with which it is generally found.”

GOBIIDÆ.

34. ELEOTRIS SENEGALENSIS Sldr.

CARANGIDÆ.

35. TRACHYNOTUS OVATUS L.

SCIÆNIDÆ.

36. CORVINA NIGRITA C. & V.

CICHLIDÆ.

37. HEMICHRONIS FASCIATUS Pts.
 38. PELMATOCHROMIS JENTINKI Stdr.
 39. TILAPIA GALILÆA Gm.
 40. TILAPIA LATA Gthr.

“Known as ‘Furu.’ Much esteemed as food. Very common, the largest seen being 10 inches in length; great numbers taken with the seine-net. They are chiefly found in shallow water.”

PLEURONECTIDÆ.

41. CYNOGLOSSUS SENEGALENSIS Kaup.

“Native name ‘Juso’ (heart). Taken from above McCarthy’s Island.”

May 22, 1900.

Dr. ALBERT GÜNTHER, F.R.S., Vice-President, in the Chair.

The Secretary announced that Mr. J. S. Budgett, F.Z.S., had left Liverpool on Saturday the 19th inst., on a second expedition to the Gambia, where he was proceeding in order to complete his studies of the Fish-fauna of that Colony, and especially to investigate the life-history and development of the remarkable Fishes *Polypterus* and *Protopterus*. On reaching Bathurst Mr. Budgett would go up the river to his former quarters on McCarthy’s Island, in the neighbourhood of which he had already ascertained that these fishes breed during the rainy season.

A communication was read from Prof. G. B. Howes, F.R.S., and Mr. H. H. Swinnerton, B.Sc., on the development of the skeleton of the Tuatera, *Sphenodon (Hatteria) punctatus*, which was stated to be the outcome of 18 months’ work on material supplied to the authors by Prof. Dendy, of Christchurch, N.Z. An account was given of the egg, the hatching, and the habits of the hatched young, which the authors reared till four months old. Thus a stage (T) was added to Prof. Dendy’s series.

The main conclusions arrived at were stated to be as follows:—
 Two kinds of inter-centra are formed, of which one persists as the chevrons. The cartilaginous vertebral bodies arise as paired structures, and the intra-vertebral plates are chordal in origin. Inter-vertebral plates are formed in the tail, and the intra-vertebral plates have a special relation to the “splitting” process; also a series of central chordal vesicles is formed at the points of greatest flexibility. The “uncinates” are mostly separate in origin. The

brain-case is a product of the union of distinct ethmo- and otosphenoidal cartilages, and its fenestræ are primary. The trabeculæ represent a pair of pre-oral visceral arches, and the epipterygoid bone is an ossification of the ascending process of the pterygo-quadrate cartilage. The columella auris and stapedial processes are at all stages continuous with the hyoid arch, and that is attached only to the quadrate above. The meeting of the pterygoids and vomers is of an order leading to the Chelonia and Plesiosauria, and the pterygo-quadrate cartilage closely resembles that of *Ichthyophis*. The "abdominal ribs" arise by numerous calcifications and their median segment may be paired. There is no supra-temporal bone present at any stage. The hip-girdle is simpler than in the Lacertilians, and two types of pelvis are represented. There is no trace of the fifth *tarsale* in the ontogeny, and while a *centrale* is incorporated in the "*astragalus*," there are three *centralia carpi* represented during development.

Two types of cheek-teeth, and sustentacular ligaments which support the medulla and spinal cord, were also described.

This paper will be published in the Society's 'Transactions.'

The following papers were read:—

1. On some Crustaceans from the Falkland Islands collected by Mr. Rupert Vallentin. By the Rev. THOMAS R. R. STEBBING, M.A., F.R.S., F.L.S., F.Z.S.

[Received March 24, 1900.]

(Plates XXXVI.—XXXIX.)

The materials on which this paper is founded were collected by Mr. Rupert Vallentin, F.L.S., in Stanley Harbour and the adjacent district during the closing weeks of 1898 and the opening weeks of the following year. During the course of the present century this locality has been visited by several important scientific expeditions. It may be worth while to mention the voyage of 'La Coquille' under Duperrey in the years 1822–1825, the Crustacea of which were described by Guérin-Méneville between 1828 and 1838; the voyage of 'L'Astrolabe' and 'La Zélée' under Dumont d'Urville, 1837–1840, Crustacea by Jacquinot and Lucas, 1842–1853; the United States Exploring Expedition under Wilkes, 1838–1842, Crustacea by Dana, 1846–1855; Voyage of the 'Erebus' and 'Terror' under Sir J. C. Ross, 1839–1843, Crustacea by Miers, 1874; the 'Challenger' Expedition, 1873–1876, Crustacea by several writers, 1880–1888. Crustacea from the vicinity have also been described by R. O. Cunningham in 1871, by Targioni-Tozzetti in 1877, and by Professor Studer in 1884. Consequently the general features of the zoology of the Falklands are tolerably well known.

None the less, the specimens, in ample variety, which have rewarded Mr. Vallentin's assiduous and systematic researches, serve to throw new and much needed light on many interesting questions. At least in the single group of the Malacostraca I have found so much to say on a dozen species, of which only one is new, that the discussion and description of numerous other species must be left over to some future opportunity. It can scarcely be regarded as a reproach to the earlier naturalists that they had not prophetic eyes to make them acquainted with the requirements of modern classification. We are perhaps industriously preparing equivalent stumbling-blocks for a future age, which possibly will only care to distinguish species by the internal structure as seen working in the living animal under the Röntgen rays. But for the difficulty of identifying forms described by our predecessors, we ought not to lay all the blame on the imperfection of the original accounts. It should be shared by the naturalists who sometimes in a long succession are content to quote the name of a species, without using the means at their disposal of making it thoroughly well-known. There is a sort of superstition that a new species is worth publishing, but that to deal with one to which some other person's name and some ancient date is attached, is a poor affair, stale and unprofitable.

There are indeed some specimens in Mr. Vallentin's collection to which these remarks will not apply, such as *Scrolis paradoxa* (Fabricius), re-described by Beddard in his 'Challenger' Report on the Isopoda. Among the Amphipoda there is the well-marked *Talorchestia scutigera* (Dana), and there is Dana's *Iphimedia nodosa*, a beautiful species, easily identified with Dana's account specifically, though the genus remained doubtful till a specimen was available for dissection. These are mentioned to indicate that the interest of the specimens gathered is by no means exhausted in the present paper.

BRACHYURA.

CYCLOMETOPA.

Fam. ATELECYCLIDÆ.

1893. *Atelecyclidæ*, Ortmann, Zool. Jahrb. vol. vii. p. 421.
 1896. *Atelecyclidæ*, Ortmann, Zool. Jahrb. vol. ix. p. 444.
 1899. *Atelecyclinæ* (subfam. of Cancridæ), Alcock, J. Asiat. Soc. Bengal, vol. lxxviii. pt. 2, p. 96.

Ortmann defines this family as follows:—"Inner antennæ longitudinal. Outer antennæ occupying the interior hiatus of the orbits, their second joint cylindrical, just reaching the front, the third joint only a little smaller; flagellum hairy. Cephalothorax rounded, not widened, antero-lateral margin at least as long as the postero-lateral."

He places it among the Cancrini, his second subsection of the Cyclometopa, which in his system form the second section of the Cancroidea, these latter being the second subdivision of the

Brachyura proper. To the Atelecyclidæ he assigns the genera *Hypopeltarium* and *Atelecyclus*. Miers, who in 1886 placed *Hypopeltarium* together with *Gomezia* in a legion *Corystoidea*, recognized that *Hypopeltarium* was nearly allied to *Atelecyclus*, and that these approached the Cyclinea, while *Gomezia* was a typical *Corystoid*. Alcock includes in his subfamily *Atelecyclus* M.-Edw., *Erimacrus* Benedict, 1892, *Hypopeltarium* Miers, *Pliosoma* Stimpson, 1862, *Telmessus* White, 1846, *Trachycarcinus* Faxon, 1893, and *Trichopeltarium* A. M.-Edwards, 1880.

Genus PELTARION Jacquinot.

1843-1847¹. *Peltarion*, Jacquinot, D'Urville's Voy. au Pôle Sud, Atlas, Crustacés, pl. 8. fig. 1 (without definition).

1847. *Peltarion*, White, List of Crustacea in British Museum, p. 52.

1852. *Peltarion*, Dana, U.S. Expl. Exp. vol. xiii. p. 298.

1853. *Peltarion*, Lucas, D'Urville's Voy. au Pôle Sud, Zoologie, vol. iii. Crustacés, p. 80.

1871. *Peltarion*, Cunningham, Tr. Linn. Soc. London, vol. xxvii. p. 494.

1881. *Peltarion*, Miers, Pr. Zool. Soc. London, 1881, p. 68.

1886. *Hypopeltarium*, Miers, 'Challenger' Brachyura, Reports, vol. xvii. p. 210.

1893. *Hypopeltarium*, Ortmann, Zool. Jahrb. vol. vii. p. 421.

1897. *Hypopeltarium*, M. J. Rathbun, Pr. Biol. Soc. Washington, vol. xi. p. 165.

1899. *Hypopeltarium*, Alcock, J. Asiat. Soc. Bengal, vol. lxxviii. pt. 2, p. 96.

Miers considered that the name *Peltarion* was preoccupied, apparently because in 1844 Fischer de Waldheim had named a genus of Coleoptera, not *Peltarion* but *Peltarium*. He distinguishes the genus from *Atelecyclus* "by its narrower, three-spined front, the spinuliferous, not dentated, antero-lateral margins of the carapace, and the shorter, more truncated merus [fourth] joints of the exterior maxillipeds."

PELTARION SPINOSULUM White.

1843. *Atelecyclus spinosulus*, White, Ann. Mag. Nat. Hist. ser. 1, vol. xii. p. 345 (quoted by White in 1847 as '*Corystes spin.*').

1843-1847. *Peltarion magellanicus*, Jacquinot², Voy. au Pôle Sud, Atlas, Crust. pl. 8. figs. 1-3.

¹ The Atlas to the Voyage of the 'Astrolabe' and 'Zélée' au Pôle Sud et dans l'Océanie, 1837-1840, has a general titlepage dated 1842-1853. Of the Crustacea, plate 8 is quoted by White in 1847.

² The genus and species are sometimes assigned to Hombron and Jacquinot, who appear to have been both engaged in collecting the specimens obtained by the expedition; but as the figures of the Crustacea are attributed to Jacquinot by Lucas, who drew up the descriptions, there is nothing on which Hombron's claim to authorship can properly be founded.

1847. *Peltarion spinosulum*, White, List of Crustacea in British Museum, pp. 52, 139.

1852. *Peltarion spinulosum*, Dana, U.S. Expl. Exp. vol. xiii., Crustacea, p. 304, pl. 18. figs. 6 a b.

1853. *Peltarion magellanicus*, Lucas, Voy. au Pôle Sud, Zoologie, vol. iii. Crustacés, p. 83.

1871. *Peltarion spinulosum*, Cunningham, Tr. Linn. Soc. Lond. vol. xxvii. p. 494.

1881. *Peltarion spinulosum*, Miers, Pr. Zool. Soc. Lond. p. 68.

1886. *Hypopeltarium spinosulum*, Miers, 'Challenger' Brachyura, Reports, vol. xvii. p. 211.

1893. *Hypopeltarion spinulosum*, Ortmann, Zool. Jahrb. vol. vii. p. 421.

The carapace, except on the hind margin, is entirely begirt with little unequal teeth. Why they have been called spinules is not easy to explain. They are not movable, but continuous with the carapace which they fringe.

A single specimen, about $1\frac{1}{2}$ inch (34 mm.) in length and just the same in breadth, was "found during low-water in sandy bay, Port William," by Mr. Vallentin. Cunningham speaks of it as burrowing in sandy beaches, as well as of its being taken by dredging.

C A T O M E T O P A.

Fam. HYMENOSOMIDÆ.

1858. *Hymenosomidæ*, Stimpson, Pr. Acad. Philad. p. 108 (Prodromus, p. 54).

This family is more commonly regarded as a subfamily of the Pinnotheridæ, called Hymenicinæ by Dana, Targioni-Tozzetti, and Haswell, but Hymenosominæ by Milne-Edwards and Miers. Of the genera assigned to this group, *Hymenosoma* Leach is much older than Dana's *Hymenicus*. In the Hymenosomidæ the third joint of the third maxillipeds is not diminutive as in the Pinnotheridæ.

Professor Haswell considers the genera *Hymenosoma*, *Hymenicus*, and *Halicarcinus* to be synonyms, and inferentially unites with them *Elamena* Milne-Edwards. For in a note upon "*Hymenosoma planatum*" he says: "The *Elamena Mathaei* of Milne-Edwards (Ann. Sci. Nat. (3 sér.) xx. p. 223, pl. xi. fig. 4, and Hist. Nat. Crust. ii. p. 35) is probably the young male of this species. It is quite distinct from the *Hymenosoma Mathaei* of Desmarest (Consid. p. 163), which is described as having the form of an equilateral triangle, with the anterior angle (rostrum) a little rounded. As to which of these two species may be Rüppell's *Hymenosoma Mathaei*, I am unable to form an opinion—the 'Krabben des Rothen Meeres' not being here [Sydney] obtainable."

On this it must be remarked that practically there is no disagreement between the original account given by Milne-Edwards and that of Desmarest, since the former in his generic description uses the expression "il a la carapace à peu près triangulaire." Like

Desmarest he quotes the Museum name of the species, "*Hymenosoma Mathæi*, Latreille." Like Desmarest he refers to the Île-de-France as the place of origin, but adds the Red Sea, because he is able to refer to Rüppell. It is indeed reasonable to suppose that Desmarest and Milne-Edwards were describing identically the same specimen. It must be admitted that Desmarest says that it is 6 lines long, while in Milne-Edwards's 'Histoire' it is 4 lines in length. But to those who would lay any overwhelming weight on a discrepancy of that kind, it may be pointed out that Rüppell, at the outset of his description of this very species, says "This minute crustacean appears never to overstep a length (Längendurchmesser) of three lines," although at the close he says: "Comparisons in the Paris Museum convinced me of the identity of the species here described by me with that which M. Desmarest (Considérations sur les Crustacés, page 163) has published under the same name." It will be remembered that Desmarest gives the length not as three lines but as six. It seems clear that Paulson (Crustacea of the Red Sea, p. 71, 1875) is right in regarding the species described by Desmarest, Rüppell, and Milne-Edwards under the name *mathæi* (*mathei* Rüppell) as one and the same.

Nevertheless, Professor Haswell's suggestion is likely enough to be right with regard to the second account given by Milne-Edwards, in 1853, when he changes *Elamena* into *Elamene*, figures parts of a male specimen, which on the earlier occasion he had confessedly not had an opportunity of examining, and introduces into the generic character a tridentate rostrum which is conspicuous by its absence in the figure of his *Elamene quoyi*.

Gen. HALICARCINUS White.

1846. *Halicarcinus*, White, Ann. Mag. Nat. Hist. ser. 1, vol. xviii. p. 178.

1849. *Liriopsea*, Nicolet, Gay's Hist. Chile, Zool. vol. iii. p. 158.

1852. *Halicarcinus*, Dana, U.S. Expl. Exp. vol. xiii. Crust. pt. i. p. 379.

1853. *Halicarcinus*, Milne-Edwards, Ann. Sci. Nat. ser. 3, vol. xx. p. 222.

1876. *Halicarcinus*, Miers, Catal. Crust. New Zealand, p. 49.

1877. *Halicarcinus*, Targioni-Tozzetti, Crost. della Magenta, p. 172.

1882. *Hymenosoma* (part), Haswell, Catal. Australian Malacostraca, p. 114.

1886. *Halicarcinus*, Miers, 'Challenger' Brachyura, Reports, vol. xvii. p. 280.

White in 1846 placed this genus in the family Myctiridæ, as a subgenus distinguished from *Hymenosoma* "by the great size of the thickened fore-feet, by the carapace being generally wider than long, and having the edge of the strongly depressed upper surface with two teeth or angles on each side. The four last pairs of legs are cylindrical and free from hairs, while the claws are considerably

curved and compressed. The tail of the male is 6-jointed and deeply notched on each side about the middle. The outer pedipalps, as in *Hymenosoma*, are covered on the outside with short hairs."

It seems a fairly clear and innocent account, till you begin to work with it. White assigns to his subgenus two species, the second being *Hymenosoma depressum* Jacquinot, which in 1852 was referred to *Hymenicus* by Dana. Miers, however, in 1876 informs us that the specimens referred by White to Jacquinot's species are distinct from it, and he names them *Elamena whitei*. White's first species is *Halicarcinus planatus*, with the synonymy *Leucosia planata* Fabricius, *Hymenosoma leachii* Guérin, and *Hymenosoma tridentatum* Jacquinot. This last synonym is accepted without reserve by Milne-Edwards in 1853, by Heller in 1868, and Tozzetti in 1877, all of whom quote it accurately from Jacquinot's plate as *Hymenosoma tridentata*. It is accepted with doubt by Dana in 1852, by Miers in 1876, and by Haswell in 1882. Miers drops the query in 1879, and inferentially in 1886. Lucas in 1853 describes under the name "*Hymenosoma? tridentatum*," not Jacquinot's specimen, but Jacquinot's figures of it, adding the information that it was taken under stones at low-tide on the coasts of the Auckland Islands, and proposing to make it the type of a new genus *Hombronia*, most likely in total ignorance of White's *Halicarcinus*. In 1885 Filhol states that *Halicarcinus planatus* has been recorded from the Auckland Isles by Hombron and Jacquinot, and then proceeds to establish as a separate species *Halicarcinus tridentatus* (Jacquinot & Lucas), of which he gives a figure (pl. 50. fig. 3), having found the species, he says, in Cook's Straits. To the work in which Hombron and Jacquinot record *H. planatus* he gives no clue. He does not refer in his text to his figure of *H. tridentatus*, which has a much less comparative width of carapace and much more slender chelipeds than the figure on Jacquinot's plate. He speaks of the description of this species given by Jacquinot and Lucas as being incomplete, which it might well be, since Jacquinot did not describe it at all, and Lucas only described what Jacquinot figured. It is difficult to tell whether Lucas is quite serious about some of the details, but he had no specimen by which to control the drawings. M. Filhol tells us that the maxillipeds present very slight differences from those of *H. planatus*, but what those differences are he neither says nor shows, though Jacquinot's figure, with the last joint attached in the middle of the penultimate, absolutely excludes *Halicarcinus*. That the carapace is without lateral teeth M. Filhol does mention, and this may well be in agreement with Jacquinot's species, but it is contrary to the character of *Halicarcinus* given by White.

White's other synonym, *Hymenosoma leachii* Guérin, is not wholly free from difficulty, for though Dana, Miers, and Haswell accept it as identical with *A. planatus*, Milne-Edwards (1853) upholds it as an independent species, and Miers in 1886 regards *Halicarcinus ovatus* Stimpson as the representative on the Australian coast of

H. planatus. But Guérin's *H. leachii* came from the coasts of New Holland, and may therefore quite as well be *ovatus* as *planatus*.

Miers in 1876 observes that the abdomen of the male is concave, not "deeply notched" on each side as stated in White's description. This criticism certainly applies both to Falkland Islands and Australian forms, and raises a question whether White took his character, not from observation, but from the figure of the pleon in Guérin's 'Iconographie.' White also says that the claws of the last four legs are "considerably curved," which is in correspondence with Guérin's figure and with the term "crochu" applied to them by Guérin in the 'Voy. de la Coquille.' Dana, who is not over-satisfied with White's account of his new genus, describes this claw (or tarsus) in *H. planatus* from Tierra del Fuego as "nearly straight"; and though the difference in this respect between the Patagonian and Australian species is not really very great, yet, the limbs in the latter being more slender, the curvature of the claw is in them more effectively apparent. The massive chelipeds shown in White's figure, and alluded to in his generic account, may be those of an old male. They agree pretty well with the claws of Jacquinet's *Hymenosoma tridentata*, but not with those of Guérin's *H. leachii*, which are less inflated and very unequal, nor with those figured by Dana, which are small and equal, probably drawn from a female specimen.

Whatever may be the *Liriopea leachii* (Guérin) and *Liriopea lucasii*, both from Chile and both described by Nicolet, it is not improbable, as already observed, that the *Hymenosoma leachii* of Guérin is identical with *Halicarcinus ovatus* Stimpson. Professor Haswell makes them both synonyms of *Hymenosoma planatum*, the separation of *Halicarcinus* and *Hymenicus* from *Hymenosoma* seeming to him to rest "on extremely slight points of distinction"; and indeed the points are not of imposing magnitude as exhibited in species all of inconsiderable size. But whereas Haswell in 1882 thus unites *planatus* and *ovatus*, Miers, who in 1876 had done the same, in 1886 keeps them separate, apparently converted to this view by Tozzetti's work in 1877. For Tozzetti not only makes them separate species, but thinks that there are grounds for allotting *planatus* to a new genus, overlooking the fact that it is *ovatus*, as the later species, that would have to change its generic name, if a change were to be made.

Tozzetti, after discussing the facial structure in *Hymenosoma*, continues:—"In a second form the front broad at the base, continued outward by a supra-orbital margin, is inflected below by a distinct and acute tridentate epifrontal fold, produces with the free margin an interantennular septum which divides the antennary fossettes on one side and the other, closed further behind and below by a distinct epistome. This form (*Halicarcinus planatus*, see p. 178) seems to us a new type by the construction indicated.

"In the third form the front proceeds straight forward, covering with the base part of the orbital fossette, which has no proper

superior margin, and receives the eyes and the antennæ without intermediate division in front of the epistome, although that is present. This (*Halicarcinus ovatus*, see p. 173) belongs in our opinion to the genus *Halicarcinus*."

The emphasis which Tozzetti lays on the presence of the epistome is in criticism of Milne-Edwards, who had distinguished *Hymenosoma* and *Halicarcinus*, with the epistome less prominent, from *Elamena* and *Trigonoplax*, with the epistome more prominent.

After prolonged attention to Tozzetti's discussion, I cannot help feeling that he has made out but a feeble case for the generic distinction of his second and third forms, nor can I feel quite certain that his *Halicarcinus ovatus* is the same as that which I suppose to be Stimpson's. On this and many other points of Australian carcinology, precise and detailed investigations are needed.

HALICARCINUS PLANATUS (Fabricius). (Plate XXXVI B.)

1775. *Cancer planatus*, Fabricius, Syst. Ent. p. 403, 18.

1781. *Cancer planatus*, Fabricius, Spec. Ins. vol. i. p. 499, 19.

1783. *Cancer planatus*, Herbst, Krabben und Krebse, Heft. 2-5, p. 142.

1793. *Cancer planatus*, Fabricius, Ent. Syst. vol. ii. p. 446.

1798. *Leucosia planata*, Fabricius, Suppl. Ent. Syst. p. 350.

1846. *Halicarcinus planatus*, White, Ann. Mag. Nat. Hist. ser. 1, vol. xviii. p. 178, pl. 2. fig. 1.

1852. *Halicarcinus planatus*, Dana, U.S. Expl. Exp. vol. xiii., Crust. p. 385, pl. 24. figs. 7 a b.

1853. *Halicarcinus planatus*, Milne-Edwards, Ann. Sci. Nat. ser. 3, vol. xx. p. 222.

1868. *Halicarcinus planatus*, Heller, Reise der Novara, Crust. p. 66.

1871. *Halicarcinus planatus*, Cunningham, Tr. Linn. Soc. Lond. vol. xxvii. p. 492.

1876. *Halicarcinus planatus*, Miers, Catal. New Zealand Crust. p. 49.

1876. *Halicarcinus planatus*, S. I. Smith, Bull. U.S. Mus., Nat. Hist. Kerguelen, p. 57.

1877. *Halicarcinus planatus*, Targioni-Tozzetti, Crost. della Magenta, p. 176, pl. 10. figs. 4 a-f, pl. 11. ¹ figs. 2, 2 a [?].

1879. *Halicarcinus planatus*, Miers, Phil. Trans. vol. 168. p. 201.

1882. *Hymenosoma planatum*, Haswell, Catal. Australian Malacostraca, p. 114.

¹ At p. 173 under *Halicarcinus ovatus* we read "Tav. x. Fig. 5, a-d; Tav. xi. Fig. 3, 3 a"; on p. 178, under *Halicarcinus planatus*, "Tav. x. Fig. 4. a-f." On p. 255 the explanation of Tav. x. assigns *H. planatus* to fig. 4, and *H. ovatus* to fig. 5; but Tav. xi. has "Fig. 1, 1 a, 2 a" for *H. ovatus* with a reference to fig. 4 of the preceding plate, "Fig. 1, 2" for *H. planatus*, with a reference to fig. 5 of the preceding plate, and "Fig. 3, 3 a, 3 b, 3 c, 3 d, 3 e" for *Hymenosoma læve*.

1885. *Halicarcinus planatus*, Filhol, Recueil de Mém., Exp. pass. de Vénus, Zool. p. 396.

1886. *Halicarcinus planatus*, Miers, 'Challenger' Brachyura, Reports, vol. xvii. p. 281.

From what has been said on the genus it will be understood that the mere record of *H. planatus* is no very certain guarantee that precisely this species was obtained in the locality assigned. In the works of Fabricius and Herbst above mentioned, between 1775 and 1793, a species named *Cancer orbiculus* from New Zealand takes precedence of the Fuegian *Cancer planatus*.

Miers in 1876 says: "The type specimen of the *C. orbiculus* of Fabr. is in the Collection of the British Museum. It is very much injured, but I think it can be nothing but a specimen of *H. planatus* with the marginal teeth obsolete." He does not, however, endorse his opinion by substituting the name *orbiculus* for *planatus*, and this is prudent, unless the state of the specimen permits of its being distinguished, for example, from *Hymenicus varius* Dana, which also comes from New Zealand and is without teeth to the carapace.

In the following notes on specimens brought by Mr. Vallentin from the Falkland Islands, which specimens I take to be with little doubt *H. planatus*, I propose to compare with them specimens from Jervis Bay in Australia, sent to me by Prof. Haswell, unnamed, but agreeing in my opinion with *H. ovatus* Stimpson (Plate XXXVI A.).

In regard to the upper surface, there is a general agreement that in the latter species the frontal margin is narrower and the teeth of the tridentate depressed rostral projection more closely approximate than in the former. In both species the teeth are setiferous. Of the marginal teeth the hinder, which is much the more pronounced, is more setose in *H. planatus*; and in this species, as Miers notices, the carapace is much more hairy in some instances than in others, but that variability, for aught we know, may belong to other species of the genus, or even be an incident in the life of the individual. In front of the epistome there is, so far as I can make out, a similar median septum in both species. In both the eyes and antennæ agree, unless it may be that the eyes in *H. ovatus* are apically a little narrowed. The second antennæ have in both the narrow peduncle much shorter than the stout one of the first; while Guérin in his *Hymenosomaleachii* describes and figures them as being nearly equal in length.

The mouth-organs are practically the same in both species, and their characters are sufficiently shown by the figures. The external or third maxillipeds of *H. planatus* are on the outer surface of the third and fourth joints much more setose than those of *H. ovatus*, and there are small but trivial differences in the outline of the fourth joint. In the three terminal joints, both species have numerous finely pectinate spines on or projecting from the inner surface, which is shown in the figure. All three maxillipeds have a long narrow epipodal lamina, and the transversely placed

second joint of the exopod traversed by a muscle evidently adapted for moving the terminal fascicle of long setæ, about six in number.

From the chelipeds specific distinctions can scarcely be derived, since in well-developed males of *H. planatus* there appear to be greater differences than any which can be pointed out between the chelipeds of that species and those of *H. ovatus*. Nicolet's *Liriopea lucasi* from Chile is founded almost exclusively on the robust character of the chelipeds, "ending in a hand almost globose, much inflated and of dingy blackish colour," the movable finger having a strong dentiform tubercle near the proximal end of the inner margin. These, however, are characters which may be rather indicative of age than species.

The four following pairs of trunk-legs (or peræopods) are naturally stouter in *H. planatus*, that being much the larger species; but in the flattened terminal joint or finger there is also some difference of shape and armature, this joint in *H. planatus* being broader in comparison with its length, less curved, with the teeth of the inner margin not reverted, and implanted some on one side and some on the other of the border, whereas in *H. ovatus* they are in single file and provide the joint with a slightly backward directed serrature. In both species the two teeth nearest the acute nail are the largest, and the spaces between the spines have finely serrate setæ, of which there is a group at the base of the margin.

The broad, rounded pleon of the female and the terminally narrowed pleon of the male exhibit no characters for distinguishing the two species.

Breadth of *H. planatus* about 9 mm., length a little less; breadth of *H. ovatus* scarcely 7 mm., length a little less than the breadth.

Mr. Vallentin reports *H. planatus* as "common under stones and kelp, Stanley Harbour."

OXYRRHYNCHA.

Fam. INACHIDÆ.

1886. *Inachidæ*, Miers, 'Challenger' Brachyura, Reports, vol. xvii. pp. x, 2.

Dana in 1852 (U.S. Expl. Exp., Crust. p. 77) in the *Mainea* distinguished a family Eurypodidæ, as having eyes retractile to the sides of the carapace, but without concealment below it. To this he referred three genera, *Eurypodius*, *Oregonia*, and *Amathia*. Miers in 1886 refers the family to Stimpson, who adopted it in 1870 with an acceptation regarded by Miers as equivalent to his own subfamily Inachinæ (see J. Linn. Soc. Lond., vol. xv. p. 644, and 'Challenger' Report, p. 11). Alcock in 1895 divides the subfamily Inachinæ into two alliances, Leptopodioida and Inachoida, to the latter of which *Eurypodius* is assigned with a score of other genera (J. Asiat. Soc. Bengal, vol. lxiv. pt. 2, p. 164). If the genus *Leptopodia* has to relinquish its name, as Miss Rathbun argues that it ought to do, the alliance Leptopodioida would naturally, in conformity with her view, be called Macropodioida.

Genus EURYPODIUS Guérin.

1828. *Eurypodius*, Guérin, Mém. Mus. Hist. Nat. Paris, vol. xvi. pp. 349, 350.

1829. *Eurypode* (French), Latreille, Règne Anim., ed. 2, vol. iv. pp. 63, 583.

1829–1843. *Eurypodius*, Guérin, Iconographie, Crustacés, p. 10.

1834. *Eurypodius*, Milne-Edwards, Hist. Nat. Crust. vol. i. p. 283.

1838. *Eurypodius*, Guérin, Voy. de la Coquille, Zool. vol. ii. pt. 2, Crust. p. 23.

1839. *Eurypodius* (subgenus), de Haan, Fauna Japonica, Crust. pp. 79, 87.

It is unnecessary to carry the synonymy further, as both the name and the description of the genus by its author have been generally accepted, and the numerous references will be found prefixed to the account of the species given, by Miers in 1881. Guérin's dates are often perplexing, but his figure of *Eurypodius latreillii* in the 'Iconographie,' pl. 11. fig. 1, is referred to by Milne-Edwards in 1834. In the 'Voy. de la Coquille,' his text has a titlepage dated 1830, immediately followed by an 'Avant-propos' dated 1838, and signed Guérin-Méneville, after which comes the description of the Crustacea by Guérin, which was therefore printed and perhaps issued earlier than the preface, and before he had taken the addition to his name. The excellent figures in the Atlas to the Voyage, pl. 2. figs. 1–11, may have appeared in 1828; the date 1826 on the titlepage of the complete volume not testifying to anything except perhaps that the titlepage itself was printed in that year.

The name of the genus expressly alludes to the dilatation of the penultimate joint towards its distal extremity in the four pairs of walking-legs. The species *Eurypodius longirostris* Miers, 1886, differs from other forms in having the penultimate joint of the trunk-legs very little dilated, as also in having the rostrum bent upward with its two horns apically divergent, somewhat recalling Dana's genus *Oregonia*.

EURYPODIUS LATREILLII Guérin.

1828. *Eurypodius latreillii*, Guérin, Mém. Mus. Hist. Nat. Paris, vol. xvi. p. 354, pl. 14.

1828 (?). *Eurypodius latreillii*, Guérin, Voy. de la Coquille, Atlas, pl. 2. fig. 1.

1877. *Eurypodius latreillei*, Targioni-Tozzetti, Crost. della Magenta, p. 9, pl. 1. figs. 14–18, 20.

1881. *Eurypodius latreillei*, Miers, Pr. Zool. Soc. Lond. p. 64.

1886. *Eurypodius latreillei*, Miers, 'Challenger' Brachyura, Reports, vol. xvii. p. 22.

1898. *Eurypodius latreillii*, M. J. Rathbun, Pr. U. S. Nat. Mus. vol. xxi. p. 571.

In the Hist. Nat. Crust. vol. i. p. 284, 1834, Milne-Edwards is

made by the printer to call this species "*Erypodius Latreillia*." In a preliminary catalogue of the Crustacea of the 'Magenta,' 1870, Tozzetti inadvertently referred it to *Puramithrax peronii* Milne-Edwards. The synonymy given above is additional (except for the first item) to the list of authorities supplied by Miers in 1881. Miers considers that one specific name should suffice for *latreillii* Guérin, 1828, *tuberculatus* Eydoux & Souleyet, 1841, *audouinii* Milne-Edwards & Lucas, 1843, *septentrionalis* Dana, and *brevipes* Dana, both dating from 1851. He does not make any reference to "*Erypodius Cuvieri*, Audouin," the name attached by de Haan to figures of a first and a third maxilliped in plate H of his great work. Cunningham in 1871, as Miers notices, accepts four species of *Erypodius*, though the former is doubtful whether *septentrionalis* is distinct from *audouinii*, and not very sure about *brevipes*, nor does he name any character which he thinks trustworthy for separating any of the three from *latreillii*. Tozzetti unites *septentrionalis* with *audouinii*, neither he nor Dana himself making any remark on the fact that in the figure of *septentrionalis* in Dana's Atlas, pl. 2. fig. 6 a, the points of the rostral horns are divergent instead of convergent. From Guérin's *latreillii* Tozzetti thinks it necessary to distinguish not only Dana's *brevipes*, but also Dana's *latreillii*, for which he proposes a new name, *Erypodius dance*. But I am much disposed to regard this new species as founded on a misapprehension.

In an elaborate comparison of the characters, Tozzetti states that of Guérin's *latreillii* the length is more than three inches, the rostrum one-fifth of the length of the shield, the last segment of the pleon in the male rounded; that of Dana's *latreillii* the length is doubtful, the rostrum one-fourth of the length of the shield, the last segment of the pleon triangular. But this is by no means an accurate account of what Dana says. He speaks distinctly of "a specimen an inch in length;" in which he states that "the beak is about one-fourth the whole length of the carapace," and that the last segment of the pleon in the male is subtriangular. Between specimens respectively an inch and three inches in length it is obvious that there may be many differences, without any of them being specific. Still it must be admitted that even a "subtriangular" ending to the male pleon in *latreillii* would be very difficult to explain. It is very decidedly rounded in full-grown specimens. But we have to remember that the drawings for Dana's Atlas of Crustacea "were to a large extent made during the years 1838 to 1842, in the course of the cruise of the Expedition"; that after the engraving of the plates, and before their publication in 1855, a large part of the original drawings were destroyed by fire; and further, that before Dana's return to America many of the specimens had through ignorance been rendered to a great extent useless for scientific purposes. It is tolerably clear that, under these circumstances, in drawing up his descriptions he chose or was forced to rely, not on the specimens, but on his own drawings or the engravings from them. That this has happened in regard to

his *Eurypodius latreillii* seems almost certain, because he does not begin according to custom with a Latin, followed by an English description of it, but with the explanation of the figures in the plate, appending as usual more or less desultory descriptive observations. The explanation of the figures refers to plate 3. figs. 1 *a-c*, without any mention of fig. *d*, which appears three years later in the explanation of the Plates of the Atlas as representing the "abdomen, enlarged two diameters." On Plate 3 of the Atlas there is indeed an abdomen or pleon, enlarged two diameters, and its last segment is subtriangular, or one might fairly say triangular; but there is no letter or number on the plate to show that the figure belongs to *Eurypodius latreillii*, and it may, I think, be argued that Dana assigned it at a venture to his *latreillii* and then described the pleon of that species from it.

According to Dana, "the posterior margin of the inter-antennary cavity, next to the outer antennæ, is reflexed downward" in his *septentrionalis* and *brevipes*, but not so reflexed in his *latreillii*. Tozzetti does not take any notice of this distinction, in which Guérin's *latreillii* agrees with *septentrionalis*.

In *Eurypodius latreillii* from the Falkland Islands there is on the underside of the rostrum behind the cusps a groove ending in a strong forward pointing hook, as described by Guérin and indicated in Tozzetti's figures, pl. 1. fig. 18 (*latreillei*) and pl. 1. fig. 9 (*audouini*), as well as in Dana's pl. 2. fig. 7 *a* (*brevipes*), but not in his pl. 2. fig. 6 *a* (*septentrionalis*) nor yet in his pl. 3. fig. 1 *a* (*latreillii*).

The opinion of Miers that all the forms assigned to *Eurypodius* prior to 1886 belong to a single variable species is highly probable. It is unfortunate that he should have overlooked the discussion by Tozzetti, on which his judgment would have been so valuable.

Of two dried specimens brought home by Mr. Vallentin, the larger is 52 mm. long from tip of rostrum to end of the carapace, and 32.5 mm. broad at the widest part; the carapace, excluding the rostrum, is nearly $4\frac{1}{2}$ times as long as the rostrum.

Found clinging to the stems of *Macrocystis*. Mr. Vallentin says: "I have frequently detected one of these crustaceans slowly retiring to the root, as the stem of *Macrocystis* was being hauled into my boat for examination, and if the rate of hauling was suddenly quickened, one might possibly secure the specimen by making a frantic grab at it before it slipped off. All the four pairs of ambulatory appendages modified to enable the animal to cling to this weed." Guérin fancied that they were modified for swimming.

MACRURA.

A N O M A L A.

Section Lithodinea.

1849. *Lithodeacea*, de Haan, Fauna Japonica, Crustacea, pp. viii, xxii, 197, 213, etc.

1850. *Lithodina*, Brandt, Bull. phys.-math. Acad. St. Pétersbourg, vol. viii. p. 54.

1852. *Lithodea*, Dana, U.S. Expl. Exp. vol. xiii., Crust. pt. i. p. 426.
1858. *Lithodidea*, Stimpson, Pr. Acad. Philad. p. 244 (Prodromus, p. 68).
1859. *Lithodea*, Stimpson, Mem. Boston Soc. N. H. vol. vi. p. 472.
1877. *Lithodea*, Tozzetti, Crost. della Magenta, pp. 225, 227.
1882. *Lithodidea*, S. I. Smith, Bull. Mus. Comp. Zoöl. Harvard Coll. vol. x. p. 8.
1886. *Lithodoidea*, S. I. Smith, Ann. Rep. Fish & Fisheries for 1885, Crust. 'Albatross,' p. [34].
1888. *Lithodea*, Henderson, 'Challenger' Anomura, Reports, vol. xxvii. p. 41.
1893. *Lithodinea*, Stebbing, Hist. Crust., Internat. Sci. Ser. vol. lxxiv. p. 152.
1895. *Lithodinés*, Bouvier, Ann. Sci. Nat., Zool. ser. 7, vol. xviii. p. 157.
1896. *Lithodinés*, Bouvier, Ann. Sci. Nat., Zool. ser. 8, vol. i. p. 1.

This section, tribe, or legion contains at present the single family Lithodidæ. Henderson makes it section A of the Paguridea. Boas (Vidensk. Selsk. Skr., 6. Række Nat. og math. Afd. i. p. 110, 1880) includes in the 'Paguroiderne' *Pagurus*, *Cænobita*, *Birgus*, *Lithodes*, and the related forms. Bouvier divides the great family of the Paguridés into 3 subfamilies—the Pagurinés, Lithodinés, Lomisinés.

Fam. LITHODIDÆ.

1853. *Lithodidæ*, Dana, U.S. Expl. Exp. vol. xiii., Crust. pt. ii. p. 1430.
1888. *Lithodidæ*, Henderson, 'Challenger' Anomura, Reports, vol. xxvii. p. 42.
1892. *Lithodidæ*, Ortmann, Zool. Jahrb. vol. vi. pp. 271, 320.
1893. *Lithodidæ*, Stebbing, Hist. Crust., Internat. Sci. Ser. vol. lxxiv. p. 153.
1894. *Lithodidæ*, Benedict, Pr. U.S. Nat. Mus. vol. xvii. p. 479.
1895. *Lithodidæ*, Faxon, Mem. Mus. Comp. Zoöl. Harvard Coll. vol. xviii. p. 42 (Crust. 'Albatross').
1899. *Lithodidæ*, Alcock & Anderson, Ann. Mag. Nat. Hist. ser. 7, vol. iii. p. 15.

The genera and species now included in this family are numerous, and have recently been made the subject of important discussions by Benedict, Faxon, and others, but especially Professor Bouvier's essay on their classification, above cited, will be found to throw light upon them all. He bestows high praise on the work of Stimpson, 1859, and the papers which appeared between 1849 and 1853 by J. F. Brandt, from whom he adopts the division of the Lithodina into the Hapalogastrica and Ostracogastrica, though not accepting his view that the Lomina might be a link between those two divisions.

Gen. PARALOMIS White.

1856. *Paralomis*, White, Pr. Zool. Soc. Lond. vol. xxiv. p. 134.
 1858. *Paralomis*, Stimpson, Pr. Ac. Philad. p. 231 (Prodromus, p. 69).
 1871. *Lithodes*, Cunningham, Tr. Linn. Soc. Lond. vol. xxvii. p. 494.
 1881. *Paralomis*, Miers, Pr. Zool. Soc. Lond. p. 71.
 1888. *Paralomis*, Henderson, 'Challenger' Anomura, Reports, vol. xxvii. p. 44.
 1892. *Paralomis*, Ortmann, Zool. Jahrb. vol. vi. p. 321.
 1893. *Paralomis*, Stebbing, Hist. Crust., Internat. Sci. Ser. vol. lxxiv. p. 154.
 1894. *Echinocerus*, Benedict, Pr. U.S. Nat. Mus. vol. xvii. p. 484.
 1895. *Paralomis*, Bouvier, Ann. Sci. Nat. ser. 7, vol. xviii. p. 185.
 1895. *Paralomis*, Faxon, Mem. Mus. Comp. Zool. Harvard Coll. vol. xviii. p. 44 (Crust. 'Albatross').
 1896. *Paralomis*, Bouvier, Ann. Sci. Nat. ser. 8, vol. i. p. 25.
 1899. *Paralomis*, Alcock & Anderson, Ann. Mag. Nat. Hist. ser. 7, vol. iii. p. 15.

This genus was established by White for the species named *Lithodes granulosa* by Jacquinot in the Atlas of the 'Voy. au Pôle Sud.' It is strange that White should establish a genus, without any serious attempt at definition, on a figure which he pronounces to be "extremely bad." He does not explain how under the circumstances he was able to identify the specimen "in the British Museum" with the species in question. His observations that the species "has the beak scarcely projecting at all beyond the extra-orbital angle," that "the carapace and upper parts of its legs are thickly invested, as in some of the *Canceridae*, with close strawberry-surfaced granules, closely pressed together," and that it is a small species, "more allied to *Lomis*," are all the help he gives for distinguishing his new genus from *Lithodes*, not to speak of his own genera *Echinocerus* and *Petalocerus*.

Two or three years later Stimpson gave distinguishing characters for ten genera of Lithodidæ, in two groups. The second, with the body depressed, comprised *Lomis* of Milne-Edwards with Brandt's *Dermaturus* and *Hapalogaster*. Of these genera, Bouvier in 1894 gives reasons for removing *Lomis* entirely from the Lithodinea and founding upon it a separate section, the *Lomisinea* (answering to the *Lomina* suggested by Brandt in 1851); but the other two he retains with *Placetron* Schalfceew, 1892, as constituting one division of the Lithodinea, the *Hapalogastrica* of Brandt. Benedict's *Ædignathus* is made a synonym of *Dermaturus* and his *Lepeopus* of *Placetron*, de Haan's *Lomis dentata* falling into the genus *Hapalogaster* as arranged by Stimpson. The latter author's first group, with body convex, comprised *Lithodes*, *Echinocerus*, *Paralomis*, *Rhinolithodes*, *Acantholithus*, *Phyllolithodes*, and *Cryptolithodes*, the first established by Latreille, the next two by White, *Acantholithus* by Stimpson, and the remainder by Brandt,

White's *Petalocerus* being a synonym of *Phyllolithodes*. To these Bouvier in 1896 adds *Paralithodes* Brandt, and *Neolithodes* M.-Edwards and Bouvier, as constituting together the other division of the Lithodinea, Brandt's Ostracogastrica. De Haan's *Lithodes hystrix*, referred by Ortmann to *Paralomis*, is by Bouvier, in agreement with Stimpson, made the type of *Acantholithus*. The *Leptolithodes* and *Pristopus* of Benedict, 1894, are regarded as synonyms of White's *Paralomis*, to which eight species are assigned—*aculeata* and *formosa* of Henderson, *longipes* and *aspera* of Faxon, *multispina* and *papillata* from Benedict's *Leptolithodes*, *verrilli* from his *Pristopus*, and Dana's *verrucosa*, of which Jacquinot's *granulosa* is accepted as a synonym.

As characters common to all the Ostracogastrica, Bouvier gives "Lateral pieces of the pleon absolutely entire. Acicle spinulose or spinose, rarely laminar, simple, sometimes rudimentary." *Paralomis* he describes as agreeing with *Acantholithus* and *Rhinolithodes* in having "The habitus of *Lithodes*.—Carapace longitudinally oval, cordiform or triangular, very rarely a little broader than long, and not extending roof-like over base of walking-legs. Antepenultimate joint of first feet is very rarely provided with a salient internal crest, has no respiratory channel, and does not serve specially to protect the oral appendages. Median pieces of the pleon separated by a row of nodules more or less coalesced."

Paralomis, in common with *Rhinolithodes*, has the "acicle rather triangular, and ornamented with some spines, especially on its outer margin." From *Rhinolithodes* and *Acantholithus*, it is distinguished by the following characters:—"The marginal pieces of the third pleon-segment are fused with the corresponding lateral piece. Rostrum devoid of dorsal projection, but sometimes furnished below with a spinule or a tubercle."

PARALOMIS GRANULOSA (Jacquinot).

1843-1847¹. *Lithodes granulosa*, Jacquinot, Voy. au Pôle Sud, Atlas, Crustacés, pl. 8. figs. 15-21.

1852. *Lithodes verrucosa*, Dana, U.S. Expl. Exp. vol. xiii., Crust. pt. i. p. 428, pl. 26. fig. 16.

1853. *Lithodes granulata*, Lucas, Voy. au Pôle Sud, Zoologie, vol. iii. Crustacés, p. 94.

1856. *Paralomis granulosa*, White, Pr. Zool. Soc. Lond. vol. xxiv. p. 134.

1858. *Paralomis granulatus*, Stimpson, Pr. Ac. Philad. p. 231 (Prodromus, p. 69).

1858. *Paralomis verrucosus*, Stimpson, loc. cit.

1871. *Lithodes verrucosa* (? *L. granulosa*), Cunningham, Tr. Linn. Soc. Lond. vol. xxvii. p. 494.

1881. *Paralomis verrucosus*, Miers, Pr. Zool. Soc. Lond. p. 71.

1881. *Paralomis granulatus*, Miers, loc. cit. p. 72.

¹ See footnote on *Peltarion*, p. 519.

1888. *Paralomis granulosa*, Henderson, 'Challenger' Anomura, Reports, vol. xxvii. p. 45.

1894. *Echinocerus granulatus*, Benedict, Pr. U.S. Nat. Mus. vol. xvii. p. 484.

1895. *Paralomis granulosa*, Faxon, Mem. Mus. Comp. Zoöl. Harvard Coll. vol. xviii. p. 45.

1895. *Paralomis granulosa*, Bouvier, Ann. Sci. Nat. ser. 7, vol. xviii. p. 186, pl. 11. fig. 9, pl. 12. fig. 11.

1895. *Paralomis verrucosa*, Bouvier, loc. cit. p. 187, pl. 13. fig. 3.

1896. *Paralomis verrucosa*, Bouvier, Ann. Sci. Nat. ser. 8, vol. i. pp. 14, 26.

1899. *Paralomis verrucosa*, Alcock & Anderson, Ann. Mag. Nat. Hist. ser. 7, vol. iii. p. 15.

While M. E. L. Bouvier appears to be certainly right in identifying *granulosa* with *verrucosa*, as suggested with less confidence by various other authors, among whom Dana himself may almost be reckoned, it must, I think, be conceded that the name *granulosa* takes precedence. No doubt its priority depends on the figures in Jacquinot's Atlas, but they give much more information than many an accepted specific description. There are cases in which authors have evidently described species only from figures; Lucas in some instances acknowledges that he had only the figures in Jacquinot's Atlas, and not the corresponding specimens, to guide him. It would be an absurdity to allow authority to a description made from a figure, but to discredit the figure itself.

In his synoptic table of the eight species of *Paralomis* above mentioned, Bouvier separates *verrilli*, *granulosa*, *formosa*, and *aspera* from the other four, as having the rostrum without any rudiment of projection below. He unites *verrilli* and *granulosa* by the common characters: "Acicle long triangular, acute, armed outside with 3 or 4 spines [? teeth]; carapace covered with verrucosities or very low and very obtuse tubercles; chelipeds unequal; walking-legs very compressed." He separates *granulosa* by the distinctive characters: "The right cheliped reaches considerably beyond the base of the finger of the first walking-leg; it is furnished on the inner margin of the antepenultimate joint with a salient crest armed with 5 or 6 spines [teeth]. Carapace verrucose, except in the large adults, in which it becomes tuberculose. The fourth joint of the walking-legs is compressed from front to rear, the three following joints from above to below. No unpaired gastric spine [tooth]." The species *indica* and *investigatoris* of Alcock and Anderson, added to the genus in 1899, both have the walking-legs longer than the chelipeds, and in *indica* the latter have the wrist not expanded to a foliaceous lobe.

The distinction drawn between warts and tubercles is not very easy to appreciate. Of Jacquinot's specimen, only 12 mm. long by 10 broad, Lucas says that the carapace is "entirely covered with little, close-set tubercles, flattened and granular at the top." Miers says of a very young example in the British Museum, "the granulated and wart-like tubercles of the carapace are closely crowded

together, so that none of the smooth under-surface is visible." This is just the case with a perfect specimen from the Falkland Islands 36.5 mm. long by 36 mm. broad. A carapace, 62 mm. long by 62 broad, from which the radiating granules have been removed, shows the warts or tubercles solitary or in groups, with smooth intervening spaces.

Mr. Vallentin notes that this species was "Found during low-water amid a heap of rocks near Hooker's Point, Stanley, Falkland Islands. Mutilated specimens of this crab common on sands after S.E. gales. Only one perfect specimen seen."

PAGURINEA.

1888. *Pagurodea*, Henderson, 'Challenger' Anomura, Reports, vol. xxvii. p. 48 (with synonymy).

1893. *Pagurinea*, Stebbing, Hist. Crust., Internat. Sci. Ser. vol. lxxiv. p. 155.

Fam. PAGURIDÆ.

1852. *Paguridæ*, Dana, U.S. Expl. Exp. vol. xiii. Crust. pt. i. p. 435.

1858. *Paguridæ*, Stimpson, Pr. Ac. Philad., Prodr. p. 70.

1888. *Paguridæ*, Henderson, 'Challenger' Anomura, Reports, vol. xxvii. p. 52.

1893. *Paguridæ*, Stebbing, Hist. Crust., Internat. Sci. Ser. vol. lxxiv. p. 159.

1893. '*Paguriens*,' A. Milne-Edwards & Bouvier, Mem. Mus. Comp. Zoöl. Harvard Coll. vol. xiv. No. 3, 'Blake' Report.

1898. *Paguridæ*, G. M. Thomson, Tr. New Zeal. Inst. vol. xxxi. p. 171.

Gen. EUPAGURUS Brandt.

1851. *Eupagurus*, Brandt, Middendorff's Sibirische Reise, Zool. pt. i. p. 105.

1888. *Eupagurus*, Henderson, 'Challenger' Anomura, Reports, vol. xxvii. p. 62.

1892. *Eupagurus*, Benedict, Pr. U.S. Nat. Mus. vol. xv. p. 1.

1893. *Eupagurus*, Stebbing, Hist. Crust., Internat. Sci. Ser. vol. lxxiv. p. 160.

1893. *Eupagurus*, Milne-Edwards & Bouvier, Mem. Mus. Comp. Zoöl. Harvard Coll. vol. xiv. No. 3, p. 139.

1898. *Eupagurus*, Thomson, Tr. N. Zeal. Inst. vol. xxxi. p. 172.

For the present purpose it is unnecessary to give more extended references to the bibliography of this genus. Milne-Edwards and Bouvier, after quoting its characters as given by Henderson, write as follows:—

"To these characters we shall add, from the study of a great number of specimens, that the anterior maxillæ are without flagellum on the exopod (dépourvues de fouet sur la palpe), but that this appendage exists, clearly articulated on the anterior maxillipeds; that the external maxillipeds are separated at their base by a calcareous sternum; that the branchiæ have two rows of un-

divided lamellæ; lastly that the fifth pair of legs end in an imperfect chela, with very short fingers, and having on it a well-developed rasp. The rasp of the legs of the fourth pair is sometimes broad, sometimes formed of a single row of scales, but the first case is much the more frequent. The branchial formula is that of *Parapagurus*." The authors do not give the branchial formula of *Parapagurus*, but probably accept Professor S. I. Smith's statement that there are eleven pairs of branchiæ, "two each at the bases of the external maxillipeds and the three first pairs of cephalothoracic legs, and three at the bases of the fourth pair of thoracic legs,—as in *Eupagurus bernhardus*."

The first generic character given by Henderson is, "Front with a distinct rostral projection." This is modified by Thomson, who writes, "Front usually slightly rostrate." The change is obviously expedient, since Henderson says of his own *Eu. rubricatus* that the "frontal projections are scarcely indicated, the median being obtusely rounded;" Milne-Edwards and Bouvier make a similar remark in regard to their *Eu. stimpsoni*; and of *Eu. edwardsi* Filhol, Thomson declares that the front is "not at all produced on the median line." Thomson also omits the character that the basal scales of the ocular peduncles are "separated by a wide interval;" and this in fact seems little applicable to Dana's *Eu. novæ-zealandiæ*, while the two French authors just mentioned say of their *Eu. smithii*, that the ophthalmic scales are separated by a trifling interval ("intervalle médiocre").

Recently Miss Rathbun (Pr. U.S. Nat. Mus. vol. xxii. p. 302, 1900) has re-transferred *Eupagurus* Brandt to *Pagurus* Fabricius¹, and has given the name *Petrochirus* Stimpson to *Pagurus* as more commonly accepted. For this change there may be some subtle or simple explanation, but it is not supplied by the learned authoress, and without further discussion such an innovation should scarcely be accepted. If it be essential (as it may or may not be) to rescue the name *Pagurus* for one of the species originally assigned to it by Fabricius, it would be more correct and less confusing to sacrifice to it Dana's *Aniculus*, allowing Dana's own *Pagurus* to fall under Stimpson's *Petrochirus*, as Miss Rathbun proposes, but retaining Brandt's *Eupagurus*, with its numerous species, undisturbed.

EUPAGURUS COMPTUS (White).

1847. *Pagurus comptus*, White, Pr. Zool. Soc. vol. xv. p. 122.

1848. *Pagurus comptus*, White, Ann. Nat. Hist. ser. 2, vol. i. p. 224.

1858. *Eupagurus comptus*, Stimpson, Pr. Ac. Philad. p. 237 (Prodromus, p. 75).

1871. *Pagurus forceps*?, Cunningham, Tr. Linn. Soc. Lond. vol. xxvii. p. 495.

¹ So also S. J. Holmes (California Stalk-eyed Crustacea, p. 132, 1900), relying on J. E. Benedict (Ann. Nat. Hist. ser. 6, vol. xviii. p. 99, 1896), who relies on Latreille's Consid. gén. Crust. p. 421, 1810—a broken reed, as I have elsewhere ventured to maintain (Natural Science, vol. xii. no. 74, p. 239, 1898).

1874. *Eupagurus comptus*, Miers, Zool. Erebus and Terror, Crustacea, p. 3, pl. 2. figs. 5, 5 a (*Pagurus comptus* on plate).

1881. *Eupagurus comptus*, and var. *latimanus*, Miers, Pr. Zool. Soc. Lond. p. 72.

1888. *Eupagurus comptus*, var. *jugosa*, Henderson, 'Challenger' Anomura, Reports, vol. xxvii. p. 67, pl. 7. fig. 2.

1892. *Eupagurus comptus*, Ortmann, Zool. Jahrb. vol. vi. p. 298.

The *Pagurus forceps* of Milne-Edwards, to which this species is doubtfully referred by Cunningham, was originally described from Chile. Miers, in rejecting Cunningham's reference, says: "*E. forceps*, however, appears to be distinguished by the much shorter, broader, larger hand, and the much shorter and less slender fingers of the left anterior leg." Now, although Miers is probably right in his rejection of Cunningham's reference, it is difficult to understand the reasons he assigns for it. Milne-Edwards in his description of *forceps*, says that the right cheliped is very large, with the carpus much larger than the hand, and that the left cheliped has the fingers slender, long, and pointed, the movable finger almost filiform. In *Eu. comptus* the wrist of the right cheliped is not much larger than the hand, and the fingers of the left cheliped would have to be very thin to be more slender than those which are almost filiform.

Milne-Edwards describes the colour of his species as reddish violet, with the feet ringed; White describes his as "Whitish, the antennæ ringed with red, the legs with three or four broad red bands." The specimen here referred to *Eu. comptus*, as preserved in formalin, retains in many parts a violet hue, speckled with reddish points and lines, the distal half of the first antennæ is orange-coloured, the flagella of the second antennæ are brightly annulated with red and white, and the two pairs of walking-legs have three broad bands of brown, the uppermost bluish, the other two reddish.

The rostral point is well marked. The eye-stalks are slender. The ophthalmic scales are separated by no very wide interval. The flagella of the second antennæ, though not densely setuliferous, have numerous setules of various lengths. In the right cheliped the wrist is nearly or quite as broad and as long as the hand, the outer surface broadly triangular, a little convex, with sharp, granular or serrate margins, the lower surface two-sided; the hand and finger together form a broad oval, the outer edges of the fingers sharply serrate, the outer margin of the hand above the movable finger thickened, with two edges, meeting a slight expansion, rounded and serrate, of the wrist; the outer surface of the hand having a ridge from the movable finger to the wrist.

In the 'Voyage of the Erebus and Terror' some very rough figures are given of the type, the figures probably much older than the date of publication. They are left unexplained by Miers. They show a movable finger much shorter than the immovable one, which is produced to a sharp point. If they faithfully represent an actual specimen, the probability is that it was a deformed one. In the left cheliped, which is much smaller than the right,

the fingers are rather longer than the palm, and certainly not filiform.

The subchelate penultimate legs have the penultimate joint broad and flat, with a very narrow rasp.

Mr. Vallentin's specimen was obtained from "root of kelp, 3 fms., Stanley."

SCHIZOPODA.

1817. *Schizopoda*, Latreille, Règne Animal, vol. iii.

1827. *Schizopoda*, Latreille, Règne Animal, Nouv. éd., vol. iv. p. 99.

1867. *Schizopoda*, Sars, Crust. d'eau douce de Norvège, p. 11.

1885. *Schizopoda*, Sars, 'Challenger' Schizopoda, Reports, vol. xiii.

In 1883 Boas, Morphol. Jahrb. vol. viii. pp. 487, 569, in place of the Schizopoda, adopts two orders, the Euphausiacea and the Mysidacea. In this he is followed by Ortmann, 'Ergebnisse der Plankton-Expedition der Humboldt-Stiftung,' vol. ii. 1893, who explains that in using "Decapoden und Schizopoden" for the titular heading to his work, he is only making a concession to long established usage. The advantage gained by cancelling the name Schizopoda is not easy to perceive, with full allowance made for the importance of the differences between the two groups which it has long conveniently embraced.

Claus in 1863, Zeitschr. für wiss. Zool. vol. xiii. pt. 3, p. 442, suggests the names Thysanopodea or Euphausidea for a group to be distinguished from the Mysidea; but probably he only intended to give the names of families, which should rather be Thysanopodidæ or Euphausiidæ, and Mysidæ, respectively. His reason for proposing Thysanopodea is obvious, inasmuch as *Thysanopoda* Milne-Edwards is far older than its companion genus *Euphausia* Dana.

Fam. EUPHAUSIIDÆ.

1852. *Euphausiæ*, Dana, U.S. Expl. Exp. vol. xiii., Crust. p. 636.

1883. *Euphausiidæ*, Sars, Christiania Vidensk.-Selsk. Forh. no. 7, p. 11.

1885. *Euphausiidæ*, Sars, 'Challenger' Schizopoda, Reports, vol. xiii. pp. 10, 62.

1885. *Euphausiidæ*, Norman, Ann. Mag. Nat. Hist. ser. 6, vol. ix. p. 456.

1893. *Euphausiidæ*, Stebbing, Hist. Crust., Internat. Sci. Ser. vol. lxxiv. p. 261.

1893. *Euphausiidæ*, Ortmann, Decapoden u. Schizopoden, Plankton-Exp. vol. ii. p. 7.

To *Thysanopoda* Milne-Edwards, *Euphausia* Dana, and *Thysanoëssa* Brandt, Sars has added *Nyctiphanes*, *Nematoscelis*, *Stylocheiron*, and *Bentheuphausia*, and Calman in 1896 added *Nemato-dactylus*. The distinguishing feature of the family is found in the

wholly uncovered, digitiform-arborescent branchiæ, these being partially covered in the Lophogastridæ and Eucopiidæ, wanting in the Mysidæ, and not arborescent in *Anaspides*.

Gen. ΕΥΦΑΥΣΙΑ Dana.

1852. *Euphausia*, Dana, U.S. Expl. Exp. vol. xiii., Crust. pp. 637, 639.

1863. *Euphausia*, Claus, Zeitschr. für wiss. Zool. vol. xiii. pt. 3, p. 442.

1876. *Euphausia*, Claus, Genealog. Grundlage des Crustaceen-Systems, p. 7.

1883. *Euphausia*, Sars, Christiania Vidensk.-Selsk. Forh. no. 7, p. 11.

1885. *Euphausia*, Sars, 'Challenger' Schizopoda, Reports, vol. xiii. p. 63.

1893. *Euphausia*, Ortmann, Decapoden u. Schizopoden, Plankton-Exp. vol. ii. p. 10.

This genus is distinguished from others in the same family by having the last two pairs of trunk-legs (that is, the fourth and fifth peræopods) rudimentary, except in regard to the branchiæ, which are strongly developed.

The beautiful and elaborate figures with which Sars has illustrated this genus refer to a form which he calls *Euphausia pellucida* Dana. His reason for choosing the name is that so common a form cannot reasonably be supposed to have escaped the attention of Dana, and that of the four species described by Dana the one named *pellucida* seems to agree with it best. Against this reasoning there is much to be urged. Sars speaks of "the specimens examined by Dana;" but Dana's description would rather lead one to suppose that he had only at command a single specimen, of the female sex. A single specimen resulting from a four years' voyage may just as well belong to a rare species as to a common one. Dana's descriptions in some cases are, as Sars observes, anything but satisfactory. They are sometimes inconsistent one with another and with the figures to which they refer. In his account, for example, of *E. pellucida* he says that the last three joints of the feet are together nearly twice as short as the preceding joint. This is not borne out by his detail-figure even of the "posterior thoracic leg," and is still less likely to be true of the preceding feet. It is very far from true of any of the feet in the form described by Sars; but this is separated from Dana's by other characters. Dana describes each of his species as "brevissime rostratus," and it is difficult to suppose that he could have overlooked such a difference in the length of the rostrum as exists between the forms named by Sars respectively *E. pellucida* Dana and *E. splendens* Dana, the rostrum in the former reaching to the distal end of the eyes, and in the latter "scarcely projecting beyond the ocular segment." The *pellucida* of Sars is distinguished by the great length of the denticulate basal spine of the second antennæ, this spine being short in Dana's detail-figure. In *pel-*

lucida of Sars the second maxillæ "are distinguished more particularly by the short and broad form of the terminal joint," which is broader than long; whereas this appendage in the large and apparently careful figure given by Dana has the terminal joint considerably longer than broad. In Sars's figure the third peræopods have the last three joints together not shorter than the preceding joint; while in Dana's figure they are decidedly shorter, though not to so great an extent as in his description. Again, in Sars's *pellucida* the subapical processes of the telson are "finely denticulate along their inner edge," a character belonging also to *E. spinifera* Sars and *E. latifrons* Sars, but to none of the other species described in the 'Challenger' Report. A character of this minute kind might, it is true, easily have escaped observation by Dana, but it so happens that he expressly applies the epithet "naked" to these processes in *E. pellucida*. It follows therefore, I think, that for the *E. pellucida* of Sars some other name must be used, but this point will be considered to better advantage later on.

The identification of *E. splendens* Sars with the species so named by Dana is also, as Sars admits, beset with difficulties. Thus, in Sars's form the carapace has a denticle about the middle of each lower margin; but Dana says "carapace a little compressed, not toothed." As he does not show or speak of a toothed carapace in any of his four species, this particular negation remains rather mysterious. With another character it is different. Sars writes of *E. splendens*, "Antennular peduncle without any trace of dorsal lobes," having previously written in regard to the antennular peduncle of his *E. pellucida*, "it is more particularly distinguished by the basal joint having at the end above a conspicuous erect leaflet or membranous lobe." But Dana says of *E. pellucida*, "first basal joint of inner antenna not produced at apex," and of *E. splendens*, "first joint of inner antennæ oblong and produced at apex"; so that either this character is of no importance, or Dana's two species do not agree with the forms to which Sars has attributed their names. Rather curiously, too, Dana says of *E. pellucida*, "basal scale of outer antennæ a little longer than base," but of *E. splendens*, "basal scale of outer antennæ shorter than base" (or, in the Latin, "basin non superans"); whereas Sars states it is the basal scale of *E. splendens* that is decidedly longer than the base, that of his *E. pellucida* being scarcely at all longer, thus again inverting the relations as given by the two authors. According to Sars the inner plate of the uropods in *splendens* is a little shorter than the outer; in Dana's detail-figure it is fully as long. Sars says, "The length of the largest specimen reaches about 18 mm., and the species attains accordingly a somewhat larger size than *Euphausia pellucida*." Dana, on the other hand, who had some fifteen or twenty specimens at command, says: "Length about half an inch," half an inch being also the length which he gives for *E. pellucida*. The relative lengths of the joints in the thoracic legs appear to agree in the two forms; but later authors seem to have attached less specific importance to this character than Dana

did, though it was on his part done in a somewhat tentative manner. On the whole, the identification of the 'Challenger' specimens with Dana's *E. splendens* seems to rest on a rather insecure foundation.

A third form is described by Sars as without doubt the *Euphausia gracilis* of Dana, a decision for which there is strong support in the figure given by Dana of his single, somewhat damaged, specimen. Still, even here there is room for remark. Sars says: "Antennular peduncle without any dorsal lappet, basal joint shorter than the other two taken together;" but Dana says: "First joint of inner antennæ sparingly produced and acute at apex," and figures it as decidedly longer than the two other taken together. Sars says that the inner plate of the uropods is much longer than the outer. Dana, in a detail-figure, represents the outer fully as long as, if not slightly longer than, the inner. Dana says: "Feet very slender, last three joints subequal, and together but little shorter than preceding joint." As already intimated, Dana carelessly speaks of these proportions as though they applied to all the feet indiscriminately, instead of varying in each pair. There is, however, reason to believe that he bases his statements on the last (developed) pair. In his lateral view of the animal the three terminal joints of the last leg appear in fact subequal, but together much longer than the preceding joint. As there is no detail-figure of the limb, there is no need to insist on the inconsistency between the figure and the description. But in the lateral view given by Sars the last three joints of the undescribed last leg are very unequal. Also the detail-figure of the gill of the last (rudimentary) leg, which is given by both authors, may possibly represent the same structure, but twins would never be confused if they were as little alike as these two drawings.

Of the large and splendid *Euphausia superba* Dana, Sars, like Dana, had but a single specimen. The agreement between the figures and between the two accounts where they touch one another, though not absolute, is sufficient to make it probable that both authors are treating of the same species.

Next after the four forms originally included in the genus comes *Euphausia mülleri* Claus, 1863, from Messina. In regard to this it is curious and perplexing that, while Sars deems it unquestionably identical with what he considers to be *Euphausia pellucida* Dana, Claus himself declares that it stands nearest to, without being the same as Dana's, *Euphausia splendens*. In one notable particular it agrees better with *pellucida*, both of Sars and Dana, than with the *splendens* of either of these authors—namely, judging by the detail-figure, it has the inner branch of the uropods reaching decidedly beyond the outer. Claus, however, in the text makes no mention of this character. On the other hand, he distinguishes his own species from *splendens* as being longer (16–18 mm.), as having a longer rostral projection, and the sixth pleon-segment relatively much shorter. The two latter distinctions are not borne out by his figure as compared with Dana's. From *E. pellucida* of Sars one might say that *E. mülleri* is distinguished by a shorter

rostral projection, by having no lateral teeth on the margins of the carapace, and by having the subapical appendages of the telson smooth, not to speak of the evidently misrepresented mandible. To this it might be reasonably answered that the points in question are such as Claus might easily have overlooked while attending to features that were more striking or that seemed more important. But there is one feature to which both Sars and Claus have evidently paid exceptional attention—the metamorphosed first pleopods of the male. As each author gives a highly magnified drawing of the complicated inner branch of these organs, there is not the least reason to presume inattention or error, and yet the details are so different that, if such details have specific value, these must separate the forms described by Claus and Sars. In that case the *E. pellucida* of Sars (not Dana) will become *Euphausia bidentata* Sars, since that author had already described it in 1892 as *Thysanopoda bidentata*, from the Norwegian coast.

In 1883 seven species were added to the genus by Sars from the 'Challenger' gatherings, and three by Ortmann in 1893 from the Plankton Expedition. A new one is now contributed from the Falkland Islands, so that, if all be valid, there is a total of seventeen species, without reckoning the possibility that the name *splendens* may cover two distinct forms.

Since the keys for specific determination supplied by Sars and Ortmann will now require to be modified, it may be worth while, with reference to future as well as to past discoveries, to consider the characters which have been used or which are available for the distinguishing of species in this family. It should, however, be premised that in some instances the stability of a character within any particular species still awaits confirmation, and that characters which in words are the most clear, definite, and convenient are not always equally easy for observation. For example, the projecting tooth of the third pleon-segment may be so fine-drawn, so transparent, so closely adpressed to the following segment, as to beguile the observer into believing it to be absent, and the actual absence of so delicate a process might conceivably occur without transcending the limits of individual variation. It would be important also to learn whether the presence or absence, and position when present, of marginal teeth on the carapace can be depended on as specifically constant, and whether the sexual characters of the pleopods in the adult male are trustworthy for specific differentiation. Similar questions will readily occur at various points to the list which follows:—

1. *The size and shape of the rostral projection.*—The subquadrate form, distally truncate in *latifrons* Sars, produced to a median spike in *schotti* Ortmann, is peculiar to those two species. Ortmann's species in the pectinate margin of the rostral plate and the postero-dorsal spike of the carapace uniquely retains two larval characters. In all the other species the rostral projection is more or less triangular, though varying much in length, breadth, and acuteness of the apex. Dana says of *E. superba*, "carapace with a very short and acute beak;" whereas Sars says, "rostral projection

very small, and obtusely rounded." In Dana's detail-figure the beak in question is apically emarginate!

2. *Lateral denticles of carapace*.—Of these there may be on, or approximate to, each side margin two, or only one, or none. When present they are not easily perceived without separation of the delicate carapace from the body of the animal. They are not mentioned or figured by Dana in any of his four species, but attributed by Sars to three out of those four, Sars finding them in all species except *superba* Dana and his own *antarctica* and *latifrons*; Ortmann also finding them in his three new species described in 1893. Only one species has two denticles on each side, namely, *E. bidentata* Sars. In *E. milleri* Claus gives no clue to their presence. The single denticle is usually near the middle of the margin, but in *murrayi* Sars it is in front of the middle, and in *spinifera* Sars behind it.

3. *Third segment of pleon with a medio-dorsal backward projection*.—This character is common to *mucronata*, *gibba*, and *spinifera*, established by Sars, and to *gibboides*, *pseudogibba*, and *schotti*, established by Ortmann, and to the new species here described.

4. Length of sixth pleon-segment in relation to that of fifth, or of fifth plus fourth, or of the telson; the shape of the postero-lateral corners of the fifth segment; and the character of the postero-dorsal margin in this and the preceding segment.

5. *The compressed ventral tooth at distal end of sixth pleon-segment, called the pre-anal spine*.—This is unnoticed by Dana and Claus, but present in all the species described by Sars and Ortmann, except *murrayi* Sars, *superba* Dana, *mucronata* Sars, and *schotti* Ortmann. It is said to be simple in all the other species except *bidentata* Sars, in which it is tridentate; *spinifera* Sars, in which it is bidentate (as occasionally also in *gibba* Sars); and *pseudogibba* Ortmann, in which it is described as 2-4-dentate, rarely simple. In the new species of this paper it is tridentate, at least usually. The variability to which this character seems to be liable is very detrimental to its value.

6. *Dimensions of the eyes*.—The smallness of the eyes is characteristic only of *gracilis* Dana and Sars, *gibba* Sars, and *pseudogibba* Ortmann. Dana shows it in the figure of his species, without mentioning it in the text. Ortmann, who contrasts small eyes with eyes "tolerably large," makes the comment: "This distinction is apparently dubious; with some practice, however, the size of the eyes in relation to the body is easy to estimate and essentially determines the *habitus* of the species." One cannot help noticing that between *gibboides* Ortmann and *pseudogibba* Ortmann, both occurring in the same localities, there is scarcely any appreciable difference except in the size of the body and the size of the eyes. The smaller eyes pertain to the smaller species; and though the inferiority in the dimensions of the eyes is relative as well as absolute, some suspicion must still attach to the validity of Ortmann's *pseudogibba* until fuller details are given for separating it from *gibboides*.

7. *Apical lobes on basal joint of first antennæ.*—This feature is found wanting by Sars in the species he calls *splendens* and *gracilis*, as also in his own species *similis* and *mucronata*. Of his *antarctica* he says: "Anteunular peduncle slender, without any dorsal lobe, but with the outer corner of the basal joint produced into a sharp spine." Ortmann's species *schotti* agrees in this respect with *antarctica*, except that the sharp spine instead of being small is very elongate. As already mentioned, it is not at all certain that the true *splendens* and *gracilis* of Dana are without the lobe, or that the true *pellucida* of Dana has it. The value of this character is further somewhat impaired by its variability, since in his description of *bidentata* Sars says: "In most of the specimens this lobe is divided into two acuminate lappets (fig. 3); but in some specimens, though differing in no other respect from the typical form, these lappets are much more numerous, forming a dense fringe along the free edge of the leaflet (fig. 4)." Dr. Ortmann says of *gibboides*, "basal joint of the inner antennæ above with an oval, obliquely forward and outward pointed lobe;" and of *pseudogibba*, "basal joint of the inner antennæ above with a triangular lobe, whose point is directed forward and outward." But the triangular lobe is not figured, and the oval one is, in the figure, itself apically pointed and verging on the triangular.

There are also lobes occurring on the second and third joints of the first antennæ which are available, though they have not yet been found important for specific discrimination.

8. *The basal scale of the second antennæ and the attendant basal spine.*—The extent to which the scale reaches beyond the peduncle would be a useful character, but information on this point is rather deficient. Apparently *bidentata* is distinguished from all other species by the fact that its basal spine extends far beyond half the length of the scale.

9. *Mandibular palp.*—Unfortunately for several species the features of this palp are known imperfectly or not at all. Judging from Dana's figure of it in *Euphausia superba*, that species agrees in this particular with *antarctica* of Sars, in which the palp in question is very slender, its terminal joint being nearly as long as the median. This is not the case in *pellucida* Dana, *mülleri* Claus, *bidentata* Sars, *splendens* of Sars, or *gracilis* of Sars, the last having "the terminal joint very small and oval in form."

10. *Second maxilla.*—The shape, size, and armature of the apical joint seem to offer tangible characters for specific distinction, but such as can only be discovered by dissection.

11. *Proportionate length of the joints in the three pairs of maxillipeds and the three developed pairs of pereopods.*—The value that might attach to this character is strikingly illustrated by a comparison of the figures drawn by Sars of the last of these appendages in *bidentata* and *antarctica*. In the former species the third joint is shorter than the fourth, in the latter it is much longer than all the four succeeding joints combined. Unfortunately, beyond this one comparison, there is scarcely any definite and trustworthy

information available. Dana gives a detail-figure of the appendage in question for his *E. pellucida* and his *E. splendens*, but it is the latter rather than the former that agrees with the figure delineated by Sars for his *E. bidentata*. Of Dana's four species, as judged by the figures, it is only *superba* which has the third joint of the last (developed) leg longer than the fourth.

It has been already intimated that the limbs, in spite of their general resemblance, are by no means all of one pattern. It may be added that in the second maxillipeds there is an apical armature which may not be in all species identical.

12. *The branchiæ*.—The importance of differences in this apparatus is noticed both by Sars and Dana.

13. *First and second pleopods of the male*.—Characters derived from these organs appeal chiefly to highly skilled observers, and are not by any means always at their disposal.

14. *Uropods and telson*.—Characters, perhaps of not overwhelming importance, are derived from the lengths of the two branches of the uropods in relation one to the other and in relation to the telson, from the number and position of spinules on the telson, and from the smoothness or pectination of the telson's subapical processes.

So far, then, as at present known, the species will fall into two groups—the first, with the third pleon-segment not produced into a tooth, comprising *pellucida*, *splendens*, *gracilis*, *superba*, *mülleri*, *bidentata*, *similis*, *murrayi*, *antarctica*, *latifrons*; the second, with the third pleon-segment produced into a tooth, comprising *micronata*, *gibba*, *spinifera*, *gibboides*, *pseudogibba*, *schotti*, *vallentini*. In each group there are some well-marked species, but others to which the facilities of a synoptic arrangement cannot be very safely applied. Without attempting, therefore, here to formulate such a table, I will only offer some characters by which closely coupled forms may be distinguished one from the other, or by which particular species are distinctly ear-marked.

In the first group we observe:—

With subquadrate rostral projection	<i>E. latifrons</i> Sars.
With broadly triangular rostral projection	<i>E. antarctica</i> Sars.
With very small eyes	<i>E. gracilis</i> Dana.
With two teeth on each lateral margin of carapace	<i>E. bidentata</i> Sars.

E. similis Sars is obviously so named from its supposed likeness to *E. bidentata*, from which it is distinguished by the unidentate margins of carapace, and inner branch of uropods shorter than outer.

Lateral margin of carapace not dentate; uropods reaching beyond telson.....	<i>E. superba</i> Dana.
Lateral margin of carapace unidentate; uropods not reaching beyond telson	<i>E. murrayi</i> Sars.

In *E. pellucida* Dana and *E. mülleri* Claus the inner ramus of the uropods reaches beyond the outer, but not so in *E. splendens* Dana. In *E. pellucida* the last three joints of the third peræopod are much shorter than the preceding joint, but not so in *E. mülleri*.

In regard to that species he says that the second pair of maxillæ "have the terminal joint not very large, of a rather regular ovoid form, and but sparingly supplied with bristles." The shape appears from the figure to be rather similar to that in the present species, but the size and armature very different.

First maxillipeds to the third peræopods.—In all these appendages the penultimate joint is longer than the ultimate and, to a less extent, than the antepenultimate, but these three joints combined differ greatly in their relation to the preceding joints, being at least as long as both third and fourth joints in the first maxillipeds, but shorter than the fourth by itself in the third peræopods. In the second and third peræopods their length is absolutely as well as relatively shorter than in the preceding limbs; but also the length of the third and fourth joints successively increases from the first maxillipeds onwards, and whereas in the first maxillipeds and to a less extent in the second the fourth joint is shorter than the third, in the following appendages it is increasingly longer. The exopods of all these six pairs of appendages have a close general resemblance. Sars, in describing the genus, speaks of the articulation between the peduncle and the flagellum as very oblique, and figures the flagellum as unjointed. But, at least in the present species, it appears that the flagellum has transverse lines of a feeble and perhaps evanescent articulation, and that the junction with the peduncle is also transverse, a strongly marked oblique line on the peduncle following the course of a muscle but not constituting an articulation. Claus's figures of *E. mülleri* seem to be in agreement with this view of the matter.

The uropods.—The rami are equal in length, and scarcely reach beyond the insertion of the subapical processes of the telson.

The telson.—The subapical processes are quite smooth. The apical piece of the telson between them narrows above the middle, carrying at this point two minute spinules, and then widens, passing with convex margins to an acute apex. Below the middle of its entire length the telson has a pair of dorsal spinules.

Length. The specimen of which the parts are figured measured 16 mm. Another measured 18 mm., and a third 21 mm. None had sexually metamorphosed pleopods.

Locality. Stanley Harbour, Falkland Islands.

Gen. THYSANOESSA Brandt.

1851. *Thysanoessa* (subgen.), Brandt, Middendorff's Sibirische Reise, Krehse, p. 52.

1882. *Thysanoëssa*, Sars, Christiania Vidensk. Forh. no. 18, p. 52.

1883. *Thysanoëssa*, Sars, Christiania Vidensk. Forh. no. 7, p. 25.

1885. *Thysanoëssa*, Sars, 'Challenger' Schizopoda, Reports, vol. xiii. pp. 63, 119.

1887. *Thysanoëssa*, Hansen, Vid. Medd., Malac. mar. Groenl. occid. p. 54.

1892. *Thysanoessa*, Norman, Ann. Mag. Nat. Hist. ser. 6, vol. ix. p. 462.

1893. *Thysanoessa*, Stebbing, Hist. Crust., Internat. Sci. Ser. vol. lxxiv. p. 264.

1893. *Thysanoëssa*, Ortmann, Decap. u. Schizop., Plankton-Exp. p. 14.

1896. *Thysanessa*, Caullery, Ann. Univ. Lyon, 'Caudan' Crust., Schiz. et Decap. p. 367.

This genus is distinguished from the other Euphausiidae by having the second maxillipeds greatly produced, with their two terminal joints carrying spiniform setæ on both margins. In his preliminary notices of the 'Challenger' Schizopoda, Professor Sars speaks of the long second maxillipeds as the second pair of legs, but in the 'Challenger' Reports he calls them the first pair of legs—a vacillation which points to the ever-perplexing question whether an appendage ought to be named according to its undoubted homology or according to its actual structure, or according to some better but not yet invented method. It is, to say the least, very convenient to speak of three pairs of maxillipeds throughout the Malacostraca, with exception of the Isopoda and Amphipoda, in which the terms first and second gnathopods have won acceptance in place respectively of the second and third maxillipeds.

THYSANOESSA MACRURA Sars.

1883. *Thysanoëssa macrura*, Sars, Christiania Vidensk. Forh. no. 7, p. 26.

1885. *Thysanoëssa macrura*, Sars, 'Challenger' Schizopoda, Reports, vol. xiii. p. 125, pl. 23. figs. 1-4.

1893. *Thysanoëssa macrura*, Ortmann, Decap. u. Schizop., Plankton-Exp. p. 14.

This species, in common with *T. gregaria* Sars, is distinguished by a tooth on the lateral margin of the carapace from Krøyer's *neglecta* and *longicaudata*, the two other species of the genus, both of which are devoid of such a tooth. Krøyer's species also have a simple preanal spine, whereas that spine in *macrura* has from two to three teeth, and in *gregaria* may have a pectination of thirteen, though Ortmann reports a specimen in which it has only two teeth, thus undermining the value of this specific character.

The present species is distinguished from *T. gregaria* by the rostrum more broadly triangular and apically more acute, by the greater length of the sixth pleon-segment, and by the comparative length of the branches of the uropods, the inner being here considerably, instead of only slightly longer than the outer. Sars gives as a further distinction: "First pair of legs [second maxillipeds] much smaller than in last species [*gregaria*], meral [fourth] joint scarcely reaching beyond middle of antennal scale." He does not give a detail-figure of these appendages, but in the lateral view of the animal the three terminal joints combined are much shorter than the fourth joint of the appendage in question, and

the penultimate joint is fully two-thirds the length of the antepenultimate. On the other hand, the specimen here identified with *macrura* has the three terminal joints of its second maxillipeds together longer than the fourth joint, and the antepenultimate thrice as long as the penultimate. But as Sars considers that none of his specimens were full-grown, I abstain from regarding the differences mentioned as of specific value. Mr. Vallentin's specimen, of which unfortunately I cannot give the measurements, was certainly longer than the 13 mm. reached by Sars's specimen.

Locality. Stanley Harbour, Falkland Islands.

ISOPODA.

ASELLOTA.

1882. *Asellota*, Sars, Christiania Vidensk. Forh. no. 18, p. 58.

1885. *Asellota*, Sars, Den Norske Nordhavs-Exp. vol. xiv. pt. 1, p. 118.

1893. *Asellota*, Stebbing, Hist. Crust., Internat. Sci. Ser. vol. lxxiv. p. 376.

1895. *Asellota*, Hansen, Isop., Cumac. u. Stomat., Plankton-Exp., p. 4.

1897. *Asellota*, Sars, Crustacea of Norway, vol. ii. pt. 5, p. 94.

Fam. JANIRIDÆ.

1897: *Janiridæ*, Sars, Crustacea of Norway, vol. ii. pt. 5, p. 98.

The genus *Janira*, Leach, 1813-1814, established in the Supplement to his article "Crustaceology," was not spelt with an initial iota, but was trisyllabic.

Gen. IAIS Bovallius.

1886. *Iais*, Bovallius, Notes on Fam. Asellidæ, pp. 4 & 50, Bihang K. Svenska Vet.-Akad. Handl. vol. xi. no. 15.

1886. *Jæra* (part), Beddard, 'Challenger' Isopoda, Reports, vol. xvii. p. 19.

1887. *Iais* (*Janthe*), Pfeffer, Krebse von Süd-Georgien, p. 18.

This genus may be distinguished from its very near neighbour *Jæra* Leach, by the narrowness of the body, the smallness of the eyes, the triunguiculate fingers on all the limbs of the peræon, and by the uropods which are not adjacent, not inserted in a notch of the pleon, and in which the peduncle is not longer than the rami.

On the last only of these four characters can much dependence be placed. Sars, indeed, in his definition of *Jæra* includes the character "dactylar joint 3-unguiculate," but the reckoning of spines which justifies this would allow us to say that the dactylus in *Iais* was quadriunguiculate. It is, however, a somewhat unsubstantial character. Still more so are those depending on the breadth of the body and the size of the eye. In the mouth-organs

Jæra and *Iais* closely correspond; though the antepenultimate joint of the maxillipeds is rather less strongly developed in *Iais* than in *Jæra*, and, on the other hand, the inner plate of the first maxillæ is broader in *Iais*.

LAIS PUBESCENS (Dana). (Plate XXXVIII.)

1853. *Jæra pubescens*, Dana, U.S. Expl. Exp. vol. xiii., Crust. p. 744, pl. 49. figs. 9 a-d.

1876. *Jæra pubescens*, S. I. Smith, Bull. U.S. Nat. Mus., Contr. Nat. Hist. Kerguelen, p. 63.

1882. *Jæra novæ zealandiæ*, Chilton, Tr. New Zealand Inst. vol. xv. p. 189.

1886. *Iais hargerii*, Bovallius, Notes on Fam. Asellidæ, p. 50.

1886. *Iais pubescens*, Bovallius, ibidem, p. 51.

1886. *Jæra novæ-zealandiæ*, Bovallius, ibidem, p. 49.

1886. *Jæra neo-zealanica*, Thomson & Chilton, Tr. New Zealand Inst. vol. xviii. p. 157.

1886. *Jæra pubescens*, Beddard, 'Challenger' Isopoda, Reports, vol. xvii. p. 19, pl. 2. figs. 6-13.

1887. *Iais (Janthe) pubescens*, Pfeffer, Krebse von Süd-Georgien, p. 19.

1887. *Jæra antarctica*, Pfeffer, ibidem, pp. 19 & 94, pl. 7. figs. 1-4.

1888. *Iais neo-zealanica*, Chilton & Thomson, Tr. New Zealand Inst. vol. xxi. p. 265 (*Iais pubescens* evidently intended).

1891. *Iais pubescens*, Chilton, Trans. New Zealand Inst. vol. xxiv. p. 266.

1893. *Iais pubescens*, Thomson, P. R. Soc. Tasmania for 1892, p. 15 (*Iais* misprint for *Iais*).

The association of this minute species with *Sphæroma lanceolatum* (or *gigas*) is recorded by Dana for Tierra del Fuego, by Professor Smith and Mr. Beddard for Kerguelen Island. That they are all three applying the name to the same species is, therefore, highly probable. But Smith gives no description; and Beddard's description is accompanied by figures which do not in all respects agree with our specimens from the Falkland Islands, the segments of the body showing little or no lateral interval, and the head having its front and sides curiously serrate. From the text, however, it must be inferred, as Dr. Chilton has already pointed out, that at least the second of these differences is due only to an error on the part of the draughtsman; the first apparently depends on a very advanced stage of the brood-pouch in the female. That the rami of the uropods are in the figure distally clubbed instead of tapering, may well be due either to a casual variation or a slight inaccuracy in the drawing. *Iais hargerii* Bovallius, from the Strait of Magellan, differs in nothing from the Falkland Island specimens, unless in size ("3-4 mm.") and in one or two comparative measurements of parts, which can scarcely be trustworthy, since they vary with the bending or straightening and other accidental conditions of the specimen

measured. The distinction of *I. hargerii* from *I. pubescens* is only effected by attributing to Dana's description and figures a minute accuracy to which they have no claim, and which at the date of their production was scarcely ever accorded to small crustaceans. Dana, for example, says "Caudal stylets half as long as abdomen, three- or four-jointed," though his fig. 9 *d* shows the stylets with single-jointed rami and only about one-fourth as long as the pleon. That Pfeffer's *Jera antarctica* may be an additional synonym is of necessity conjectural. The solitary specimen was imperfect and could not be dissected. The length is given as 3.2 mm., and the greatest breadth as not much more than one-fourth of the length; just as Bovallius says of *Iais hargerii*, "the body is elongate, linear, four times longer than broad." This, it is likely, refers to the male. In *I. pubescens* the female loses something of her slenderness of shape as the marsupium becomes inflated. On the other hand, Pfeffer definitely states that the finger is biunguiculate and that the 3-unguiculate finger, which he, like Sars, attributes to *Jera*, was not to be found on any of the limbs of the peræon. He also gives the colour as brownish, whereas the Falkland Island specimens better agree with Bovallius's account of *I. hargerii*, as "greenish white, almost hyaline." Pfeffer's description of the damaged first antennæ and of the uropods tallies well with what is found in *I. pubescens*.

Mr. G. M. Thomson found Tasmanian specimens of *I. pubescens* in a tube with "*Sphæroma quoyana* M.-Edw.," but it may be noticed that he also brought with him from Tasmania specimens of *Sphæroma gigas*. Dr. Chilton found some of his New Zealand specimens free, but others "on a large *Sphæroma* (probably *S. obtusa* Dana) in Port Chalmers." The following description refers to the specimens found at the Falkland Islands on *Sphæroma gigas* (or *lanceolatum*). This association has been spoken of as parasitic or semiparasitic. Apparently the small isopod makes use of the large one as a kind of floating island, affixing its eggs to it, and in adult life still clinging on but doing no harm to its animated lodging, which occasionally accommodates some minute zoophytes on similar terms.

Body narrowly elliptical, peræon wider than head or pleon, but almost parallel-sided except under the influence of the developing ova, when also the sides of the segments become less widely separated than before. The sides on the upper part are fringed with small hairs. The pleon has a very small first segment, followed by a rounded shield, fringed with minute hairs and slightly projecting obtusely between the uropods. Head widest at the eyes, obtusely projecting between the first antennæ; in dorsal view the epistome obtusely prominent in advance of the rostral projection.

Eyes very small, wide apart, about at middle of the lateral margins of the head, each with only two crystalline cones set in dark pigment (see figure in Beddard's Report). First antennæ

6-jointed, shorter than peduncle of second, first joint nearly as broad as long, second shorter and much narrower, third about half as long as second; flagellum small, its middle joint longest.

Second antennæ apparently with a minute rudiment of a process on the third joint, carrying 2 spinules, sixth joint of peduncle a little longer than 5th; flagellum sometimes nearly twice as long as peduncle, attaining to 25 joints (20-30 are given for *I. hargeri*).

Upper lip with rounded or somewhat flattened apical margin.

Under lip with rather strong setules on the obtuse apices.

First maxillæ.—Inner plate not linear, its margins convex, the apex carrying 4-5 setæ; outer plate much broader, apex fringed with 11 spines in two series.

Second maxillæ.—Inner plate moderately broad, with numerous setæ on apex; outer plates narrow, each with 4 apical setæ, longer than those on inner plate.

Maxillipeds.—First joint short, the epipod irregularly oblong or oval, not reaching beyond first joint of the palp; second joint broad, its terminal plate nearly as long as the base and more than half as broad, with one or two coupling spines on inner margin, and several spinules fringing the apex; first joint of palp short, second rather broad, scarcely longer than broad, third much shorter and narrower, distally narrowed, fourth as long as second but narrower even than third, fifth much shorter than fourth.

Limbs of peræon all nearly alike. First pair (gnathopods) are a little shorter than the others, and, so far as I could discern, are without the triangular prolongation of the sixth joint seen on the other pairs. In all, the second joint is little broader than the fifth and little longer than the sixth, the fourth is shorter than the third, the fifth is decidedly broader than the sixth, but scarcely so long. The short finger has a broadly oval base, from which issues a strongly curved nail on the outer side of the apex, and on the inner side two similar but shorter nails; between these and the longer nail a curved spine may sometimes be seen protruding. The two smaller nails are placed so close together that they often look like a single two-pointed nail. Over the broad part of the finger the apex of the sixth joint is produced in a triangular process.

In the female, the operculum of the pleon is broadly rounded, with a produced obtuse apical point.

The uropods are rather more (or slightly less, Bovallius) than a fourth of the caudal shield. The outer ramus is as long as the peduncle, and has several setæ on the truncate but narrowed apex, with one or two setules near the middle; the inner has a basal part as long as, but broader than, the outer, with a narrower and much shorter apical portion, separated as it were by a fringe of spinules and tipped with long setæ.

The specimens were of various sizes (including young with the seventh pair of trunk-legs undeveloped). All the adults seemed to be females, the largest scarcely exceeding 2.5 mm.

Locality. Falkland Islands. On *Exosphæroma gigas*.

FLABELLIFERA.

1882. *Flabellifera*, Sars, Christiania Vidensk. Forh. no. 18, p. 58.

1897. *Flabellifera*, Sars, Crustacea of Norway, vol. ii. pt. 3, p. 43.

See also the references under the Tribe Asellota for other notices of the present tribe.

Fam. SPHÆROMIDÆ.

1840. '*Sphæromiens*,' Milne-Edwards, Hist. Nat. Crust. vol. iii. p. 197.

1847. *Sphæromidæ*, White, List of Crustacea in Brit. Mus. p. 102.

1853. *Spheromidæ*, Dana, U.S. Expl. Exped. vol. xiii., Crust. pt. ii. p. 748.

1857. *Sphæromidæ*, White, Popular Hist. British Crustacea, p. 244.

1867. *Sphæromidæ*, Bate & Westwood, Brit. Sessile-eyed Crust. vol. ii. p. 398.

1876. *Sphæromidæ*, Miers, Crustacea of New Zealand, p. 109.

1880. *Sphæromidæ*, Kossmann, Zool. Ergebn. einer Reise Rothen Meeres, p. 111.

1880. *Sphæromidæ*, Harger, Rep. U.S. Comm. Fisheries for 1878, pt. 6, p. 367.

1886. *Sphæromidæ*, Beddard, 'Challenger' Isopoda, Reports, vol. xvii. p. 145.

1893. *Sphæromidæ*, Stebbing, Hist. Crust., Internat. Sci. Ser. vol. lxxiv. p. 359.

1900. *Sphæromidæ*, H. Richardson, The American Naturalist, vol. xxxiv. p. 222.

By what must be regarded as a very unlucky accident this family is not at present represented in the fauna of Norway, so that we are without the light which would otherwise certainly have been shed upon it in the recently published work on Norwegian Isopoda by Professor G. O. Sars.

The genus *Sphæroma*, from which the family takes its name, was instituted by Bosc, or by Latreille in Bosc's Hist. nat. des Crustacés, vol. ii. p. 182, in the year 1802. As Guérin-Ménéville has pointed out in his 'Iconographie,' there was for long a great confusion as to the synonymy of the typical species. All that can now be determined is, that Bosc included in the genus the *Oniscus conglobator* of Pallas, 1766 (which Pallas himself identifies with *Oniscus asilus* Linn., 1758), and as a synonym of this the *Cymothou serrata* of Fabricius, 1793, earlier described as *Oniscus serratus* in the 'Mantissa,' 1787. Pallas had before this changed the name of his species to *globator*, and authors, in long succession, with the exception of Guérin-Ménéville, have united the species of Pallas with that of Fabricius and yet inconsistently adopted the name *serratum* in preference to the earlier *globator* or *conglobator*.

Guérin-Méneville makes of them two separate species. But the fact is, I think, that we cannot now with any certainty determine what species Pallas had before him, and must therefore accept *serratum* as the type of the genus.

The question now arises whether the genus ought to retain all those species which have been hitherto grouped within it on the ground of their very close external resemblance. My reply to this is that, at least in some instances, the grouping can scarcely outlast a careful comparison of the appendages in the different species. It is only fair to Bate and Westwood to say that, in their discussion of *Sphæroma prideauxianum* Leach, they state that "The foot-jaws differ from those of the typical species, in having each of the three intermediate joints dilated into an internal flattened lobe, a character which, in conjunction with that of the short plates of the lateral appendages of the terminal segment of the body, seems to indicate a more than specific distinction." They show in their figures the remarkable difference between the maxillipeds of *serratum* and *prideauxianum*; the latter being almost undoubtedly a synonym of Leach's *Sphæroma curtum*, which at any rate has maxillipeds and second maxillæ of the same pattern. In very near agreement with this pattern is that of the maxillipeds of *Sphæroma gigas* Leach, which I propose to place in a new genus, though without attempting here the arduous task of re-arranging the other species. Among them *Sphæroma rugicauda* Leach may be mentioned as having maxillipeds certainly very distinct from those of *serratum*, yet not in very perfect agreement with those of *Sphæroma curtum*. Dana says that his *Sphæroma calcarea* has the maxillipeds nearly as in *S. lanceolata*, but in the figure to which he refers they agree better with those of *S. curtum*, and with those which Kossmann represents for a seemingly immature specimen which he doubtfully names *Sphæroma obtusum* Dana.

EXOSPHEROMA, gen. n.

In general appearance agreeing with *Sphæroma*, but having the penultimate and two preceding joints of the maxillipeds lobed on the inner side, whereas in the type species of *Sphæroma* those joints are not lobed.

EXOSPHEROMA GIGAS (Leach). (Plate XXXIX.)

1818. *Sphæroma gigas*, Leach, Dict. Sci. Nat. vol. xii. p. 346.

1823-5. *Sphæroma gigas*, Desmarest, Consid. gén. Crust. p. 301.

1840. *Sphæroma gigas*, Milne-Edwards, Hist. Nat. Crust. vol. iii. p. 205.

1841. *Sphæroma gigas*, Guérin-Méneville, Iconographie du Règne Animal, Crust. p. 31.

1843. *Sphæroma gigas* (var. *lanceolata*), White, Ann. Mag. Nat. Hist. ser. 1, vol. xii. p. 345.

1847. *Sphæroma gigas*, White, List Crust. Brit. Mus. p. 102.

1847. *Spheroma lanceolatum*, White, List Crustacea Brit. Mus. p. 102.

1853. *Spheroma gigas*, Dana, U.S. Expl. Exp. vol. xiii., Crust. pt. ii. p. 775, pl. 52. fig. 1.

1853. *Spheroma lanceolata*, Dana, loc. cit. p. 775, pl. 52. figs. 1 a-f.

1871. *Spheroma lanceolatum*, Cunningham, Tr. Linn. Soc. Lond. vol. xxvii. p. 499.

1876. *Spheroma gigas*, Miers, Catal. Crust. New Zealand, p. 110.

1876. *Spheroma lanceolata*, Miers. loc. cit. p. 111.

1881. *Spheroma gigas*, Miers, Pr. Zool. Soc. Lond. p. 79.

1882. *Spheroma gigas*, Haswell, Catal. Australian Crust. p. 287.

1884. *Spheroma gigas*, Studer, Ak. Wiss. Berlin, Isopoden 'Gazelle,' p. 17.

1884. *Spheroma lanceolatum*, Studer, loc. cit. p. 18.

1886. *Spheroma gigas*, Beddard, 'Challenger' Isopoda, Reports, vol. xvii. p. 147.

1893. *Spheroma gigas*, G. M. Thomson, P. R. Soc. Tasmania, p. 14.

Leach very briefly describes this species as having "the body smooth; last segment of pleon narrowed to a point, apically rounded; length, an inch; habitat unknown" Of the only two specimens he had seen, one, given him by Lamarck, was in his own cabinet, the other in the museum of the Linnean Society. The latter is still, I think, where it was seen by Leach, but a dried marine isopod is in the position of Tithonus: its immortality does not carry with it the gift of perpetual youth.

Desmarest copies the brief description by Leach. Milne-Edwards adds that the rounded apical angle of the telson extends beyond ("dépasse notablement") the inner lamina of the uropods, and that the outer lamina or ramus is long, obtuse, not serrate.

White in 1843 describes his var. *lanccolata* thus:—"Body smooth; last joint of the abdomen considerably arched above, and having near the base a slight elevation grooved in the middle; the last joint is also in most of the specimens considerably pointed, and extends very slightly beyond the extremity of the inner plate of the last false legs; the outer plate of these appendices is narrow and lanceolate; both of the plates are minutely punctured with black." The habitat is the Falkland Islands; the size reaches three-fourths of an inch to a whole inch in length; and it is admitted that "this species comes very near the *S. gigas* Leach," "from which it principally differs in the more elongated and narrower outer plate, and in the grooved elevation at the base of the more arched last joint of the abdomen." In 1847 White adopts it as a separate species, but with the synonymy "var. *Sph. gigas* Leach?"

Dana gives a ventral view of the caudal shield and uropods of "*Spheroma gigas*" from New Zealand. For his specimens he reports surface of body smooth, but with microscopic appearance of granulation, caudal shield evenly convex, sides arcuate (not sinuous), apex rounded, moderately narrow, not quite reached by

lamellæ of uropods, the inner of which is "rounded at extremity, but subacute." The length of specimens was four to five lines, the colours brown to brownish black, with some irregular whitish spots. Of the "large" "*Spheroma lanceolata*" from Fuegia he figures and describes the mouth-organs. Further, he states that the peræon-segments fifth to seventh are scarcely shorter than the three preceding, that the caudal shield is evenly convex, its sides arcuate, its apex rather narrowly rounded, reached by the inner lamella of the uropods, which is equal to the outer lamella, and like it lanceolate, obtuse; the flagellum of the second antennæ 18-20 joints; "the texture of the shell corneous, as usual." Cunningham asks, as he well might, "Is this species truly distinct from *S. gigas* Leach?" Miers suggests that the differences may be only sexual. After describing specimens referred to the Aucklands, the Falklands, and Fuegia, he says that *S. lanceolata*, from the two latter localities, "differs only in the rami of the caudal appendages, which are narrower-lanceolate and acute at the extremity, and in the absence of the lateral marginal groove on the thoracic segments." In *S. gigas* he notes "inferior lateral margins of all the segments grooved," and "rami of the caudal appendages narrow-oval, rounded at the extremity." To these characters he adds that the front margin of the transversely oblong head has a very small lobe between the enlarged bases of the first antennæ, that the first segment of the peræon is rather the longest, "the rest short, subequal, slightly tending backward on the sides, and with the infero-posterior angle subacute," and that the colour is "light brown, margins of segments yellowish;" "length nearly 1 in." Haswell only repeats the description given by Miers; and Studer thinks the *lanceolatum* of Fuegia is distinguished from the *S. gigas* of Kerguelen by its slenderer body and the shape of the caudal shield. Beddard notices *S. gigas* as a species without prominent sexual dimorphism. Thomson records under this name a small Tasmanian and New Zealand form, which, he says, "differs in a few details from a large form" found in the Auckland Islands. What the details are he has at present left untold, though, like Guérin-Ménéville some fifty years earlier, bewailing the want of a monograph of the Sphæromidæ.

Guérin-Ménéville himself adds nothing to the knowledge then available of the adult *S. gigas*, but makes the following statements in regard to the young. He has found, he says, "under the ventral plates (feuilletts inférieurs) of a female a great number of eggs and some young individuals just hatched and still attached to the mother by a filament which issued from their anus, and he found that these individuals had seven segments [of the peræon] and seven pairs of feet. These young ones were scarcely a millimetre long, their body was narrow, elongate, with segments well marked and separated at the edges. The last pleon-segment was cordiform, rounded at the sides, pointed behind, and the lamellæ of the uropods were inserted far back on this tail-piece (fort en arrière de cette queue) and extended a little beyond it." He

reminds us that the young of *Porcellio* have at first only six peræon-segments and six pairs of legs.¹ It is rather provoking that he did not give fuller details, since in his account so far as it goes there are many points calculated to excite some surprise. The small size, the linear form, the anal filament, the heart-shaped caudal segment with uropods projecting to the rear, were little to be expected in the young of *Sphæroma gigas*. The truth appears to me to be that Guérin-Méneville was misled by the minute size and semi-pellucid hue of *Iais pubescens* (Dana) into supposing it to be the young of the *Sphæroma*, of which it is, so far as known, the invariable companion.

We now pass to the description of the adult *Evosphæroma gigas*.

The short but broad vertex of the head is separated from the occiput by a nearly straight ridge, the front line of the vertex being indented on either side of a short rostral point, its outer angles meeting the advanced points of the sides of the first peræon-segment a little in front of the eyes. All the segments of the peræon have the grooving described by Miers. The segments from the second to the seventh are almost parallel-sided, but the sixth and seventh slightly widen out. Again, the first division of the pleon is infinitesimally wider than the seventh segment of the peræon. This first part of the pleon is composite, a continuous line near the base, and for the most part usually concealed under the peræon, marking off the first segment, while from the broad second, the successively narrower third and fourth are marked off by lines which are interrupted at some distance from the middle. The second division probably consists of an obscure and concealed fifth segment, the sixth carrying the uropods and the telson. This division is so adjusted that in spirit-specimens the animal cannot be flattened out but has a crook in its back, which would appear to facilitate a doubling together of the body rather than the spherical form so readily assumed by *Sphæroma serratum*. The inflation of the caudal shield declines rather rapidly near the slightly sinuous sides and the rather narrow rounded apex.

The eyes are dark, small, irregularly oval, near the posterolateral corners of the head.

First antennæ.—First joint large, broad, with basal fold, second much smaller, third longer but much narrower than second; flagellum shorter than peduncle, 17-jointed, each joint except first and last carrying two hyaline filaments.

Second antennæ.—Longer than first, with stouter flagellum of about 16 short and stout joints.

Epistome widening much downward. Upper lip with distal margin almost straight, except at the angles.

Mandibles.—Cutting-edge tridentate, accessory plate stronger

¹ M. Louis Roule, "Études sur le Développement des Crustacés," Ann. Sci. Nat. ser. 7, vol. xviii. pp. 46, 57, 64 (1895), contravenes this long-accepted statement, though admitting the small comparative size of the seventh segment and its pair of appendages.

on the left than on the right mandible; molar cylindrical, with spines above, as well as the usual spine-row; spines on the second and third joints of the palp pectinate.

First maxillæ.—Inner plate narrow, with four plumose setæ at the apex, outer plate with a lobe below the middle, and on the apex nine stout, and three slender, somewhat denticulate spines.

Maxillipeds.—Second joint wide at the base, then narrow, its plate narrow at the base, then wide, the apical margin broad, carrying numerous plumose spines; third joint short; fourth narrow at base, the lobed distal end wide; fifth much shorter but about as wide distally; sixth longer than fifth or seventh, much narrower than fifth, with a short lobe at its widened distal end; seventh narrow, not unguiform. The fifth and sixth joints are not without armature of the inner margin, but it is far less conspicuous than the long setæ which those joints display in *Sphæroma serratum*.

Here, as in *Sphæroma curtum*, the fifth joint is decidedly smaller than the fourth, but in *Sphæroma rugicauda* the fifth joint is larger than the fourth, as in *Sphæroma serratum*.

Limbs of the peræon.—In these there is a gradual increase of length, so that the seventh pair is considerably longer than the first. In all, the third joint is elongate, without the long setæ displayed in *Sphæroma serratum*; the fourth, fifth, and sixth joints are thickly furred along the forward margin, the fourth and fifth having a group of small spines on the backward apex; the sixth has at the apex, on the inner side, as in various other Sphæromidæ, and in Isopoda of other families, a rounded plate overlapping the base of the finger; the finger is of the kind called bidentate, one tooth being the short, curved, horny-looking nail, the other a small spine near the base of the nail.

The appendages of the male on the seventh peræon-segment are rather long, about four times as long as broad.

Pleopods.—The first pair are smaller than the second. The male appendage of the second is considerably longer than the rami, apart from their long fringes of plumose setæ, and ends almost acutely, not being roundly expanded at the apex as in *Sphæroma rugicauda*. The covering ramus in the last three pairs has a transverse suture near the end; the under ramus of the fourth and fifth pairs is much plicated.

Uropods.—The lower outer branch is a little broader and apically a little more broadly rounded than the inner, which is sometimes spoken of as a prolongation of the peduncle, there being, in fact, no articulation between them.

One of Mr. Vallentin's specimens is distinguished from the rest as follows:—It has the sides of the peræon-segments abruptly down-bent, so as to form a sharp angle with the middle of the back; on the fourth pleon-segment are a pair of little median humps, such as are barely indicated in the other specimens; the pleon-shield has the median line occupied by a longitudinal groove between two elevations, and then by a carina of which the first part is divided between two tubercles, the remainder running to

the subacute apex; the uropods have their apices subacute, that of the outer ramus the sharper and turned slightly outward. It is light coloured, with two transverse narrow dark bands. This specimen ought perhaps to be called *Exosphæroma lanceolatum* (White); but one has to remark that Leach describes his species as having the "last segment of pleon narrowed to a point," so that the original *gigas* may have been the lanceolate form. Dana speaks of the lamellæ of the uropods in *lanceolatum* as "lanceolate, obtuse;" and if other distinctions are not more steadfast than those based on the apices of the telson and uropods appear to be, the two names *gigas* and *lanceolatum* may well stand in one synonymy.

Colour. In formol, the specimens are dark or light brown, the rows of whitish markings on the peræon being more conspicuous in dark than in light-coloured examples; the whole body is covered with minute blackish specks, the head and the peræon-segments, however, and parts of the pleon, having clear borders which are sometimes orange in hue.

Size. Length about 18 mm., breadth 11 mm.

Mr. Vallentin took this species in Stanley Harbour, where it abounds. He says: "This species is usually to be found during low water under stones; but during a calm, and especially if the sun is shining brightly, they come to the surface and swim about in an aimless manner, in an inverted position, the paired appendages of the telson standing out at right angles to the body. I frequently caught them swimming in this manner when in my boat, and when so captured they would immediately roll themselves up into a ball. On being replaced in the sea, an individual would sink a few inches, and mounting to the surface swim as vigorously as before. When swimming in this manner these crustaceans would always keep near the shore, where the water is not more than two fathoms in depth." Dr. Coppinger (*cf.* Miers, 1881) records small specimens from 9-10 fathoms at "Sandy Point."

Gen. CASSIDINA Milne-Edwards.

1840. *Cassidina*, Milne-Edwards, Hist. Nat. Crust. vol. iii. p. 223.

1843. *Cassidina*, Guérin-Méneville, Iconographie du Règne Animal, Crust., texte, p. 31.

1853. *Cassidina*, Dana, U. S. Expl. Exp. vol. xiii., Crust. p. 748.

1884. *Cassidina*, Studer, Isopoden Reise 'Gazelle,' p. 19.

1887. *Cassidina*, Pfeffer, Krebse von Süd-Georgien, p. 20.

1888. *Cassidina*, G. M. Thomson, Tr. New Zealand Inst. vol. xxi. p. 263.

1900. *Cassidena*, H. Richardson, The American Naturalist, vol. xxxiv. p. 222.

The origin of the name of this genus is indirectly explained by Milne-Edwards when he says that in the Sphæromidæ which

compose it the general form of the body, prolonged on each side much over the feet, resembles that of the insects known as *Cassides*, or rather a regularly oval and very inflated buckler. The species that have been successively assigned to the genus are *Cassidina typa* M.-Edwards, 1840, *C. emarginata* Guérin-Méneville, 1843, *C. latistylis* Dana, 1853, *C. maculata* Studer, 1884, and *C. neo-zealanica* Thomson, 1888. Of these five, *typa* and *latistylis* are under the double disadvantage that their place of origin is unknown and their colour undescribed; *maculata*, from Betsy Cove, Kerguelen Island, is described as black-brown with whitish flecks on both sides of the middle line; *neo-zealanica*, from the Bay of Islands, New Zealand, has the colour brownish-grey, covered with black spots and star-like markings; *emarginata* is reported from the Falkland Islands by Guérin-Méneville, from the Strait of Magellan and the west coast of Patagonia by Cunningham, from the same Strait and Punta Arenas by Studer, from Kerguelen Island by Miers, and from South Georgia by Pfeffer, the last-named writer describing the colour as a quite clear brown mixed with a little green-grey, the whole dorsal surface overspread with minute close-set points, which on the side-plates are somewhat larger and closer together. This species attains a length of 35 mm., while for the other four the length recorded ranges from 8 to 14 mm. But Studer and Pfeffer are no doubt right in accepting the opinion of Miers that the largest of the four, *C. latistylis* Dana, is only a junior form of *C. emarginata*.

The question next arises whether *C. emarginata* itself is distinct from all the other forms. *C. typa* is described as 4 lines long, thus very little exceeding in length the *C. neo-zealanica*, to which Thomson assigns "length 8 mm.; breadth 5 mm." It has been already stated that the colour of *C. typa* is not described; but in the Atlas to the 'Histoire Naturelle des Crustacés' there is a coloured figure of it, and the uniform light tint of this is out of agreement with any described colouring within the genus, except that of *C. emarginata*. It is rather curious, too, that the oval contour of this figure is very suggestive of a large, slightly bent specimen of *C. emarginata*. As opposed to any suspicions, however, that might arise of an identity between the two species, Guérin-Méneville points out that in his *C. emarginata* the body is moderately, not greatly, inflated; the head scarcely broader than long, while in Milne-Edwards's figure the head is very broad and very short with the eyes situated at a great distance one from the other; the last segment of the pleon triangular, truncate and a little emarginate at the apex, instead of having the apex narrowly rounded; the first antennæ reach a good deal, instead of scarcely at all, beyond the peduncle of the second; the fourth and fifth limbs of the peræon have the basal joint strongly bent, instead of straight; and the uropods have the inner lobe very broad, reaching clearly beyond the telson, with the distal margin obliquely truncate and a little emarginate, whereas in one

of the figures given by Milne-Edwards this lobe does not reach beyond the telson, and though described as very large is represented as comparatively long and narrow.

Unless the type specimen of *C. typa* could be recovered and examined, it would be impossible without rashness to ignore the distinctions which Guérin-Méneville has drawn between it and *C. emarginata*. But they are not quite so formidable as at first sight they appear. It is not very easy to induce specimens of *C. emarginata* to lie flat, and when not flattened they have that much inflated ("très-bombé") appearance which Milne-Edwards describes. Their eyes are in fact very wide apart, and though the breadth of the head in comparison with the length will not answer Milne-Edwards's figure or description, in his figure there is foreshortening to be considered, and in his description we cannot be sure between what points he measured the head-length. He gives both a dorsal and ventral view of the animal, in the latter of which the last segment of the pleon has its apex protruding rather sharply beyond the uropods, whereas in the former the apex is more broadly rounded and enclosed by the uropods. It is obvious, therefore, that no particular stress can be laid on figures so variable relating to the same object. In regard to the extension of the first antennæ beyond the peduncle of the second, it should be noted that this is much less considerable in small specimens of *C. emarginata* than in large ones. Of the remarkable bend in the basal joints of the second and third peræopods (4th and 5th limbs of the peræon), the ventral view of *C. typa* shows indeed no trace; but neither does Pfeffer in his careful and elaborate account of *C. emarginata* take any notice of this peculiarity, although he explains that in all the limbs of the peræon the first and second joints are more or less firmly coalesced, but, except in the first pair, plainly distinguishable. The feature to which Guérin-Méneville called attention is in reality not an arching of the first joint of the limb, but rather a geniculate connexion between the coalesced first and second joints; a detail much less likely to attract attention in a ventral view of a small specimen than in a lateral view of a large one. Against identifying *C. typa* with *C. emarginata* there still, however, remains a stumbling-block in the shape of the uropods. Of these Milne-Edwards gives a separate figure, in which the inner lobe is much longer than broad, with a narrowly rounded apex; whereas in *C. emarginata* this lobe is little broader than long, and has an oblique, slightly emarginate apical border, of which the inner angle does not reach the end of the pleo-telson, but the rounded outer angle reaches well beyond it. It is at least possible that we have here the explanation of the discrepancy in the two figures of *C. typa*, the artist in the ventral view observing the inner angle of the uropods, and the outer angle in the dorsal view. It is further possible that in the separate figure he had the uropod angularly placed, so that the long distal margin appeared as part of the outer side. That all this argues more carelessness in the figures than ought to be imputed to a work so high in reputation

and value as the 'Histoire Naturelle des Crustacés,' will be an obvious reflection. But there is no reason to suppose that the figures are by the distinguished author of that work, and it can easily be proved that their accuracy is not beyond impeachment. For example, in the figure of the maxillipeds of *C. typa* there is a joint missing; and if this corresponds with the reality, it would falsify the author's own statement that in this genus the mouth-organs correspond with those of the Sphæromidæ. It is most likely that Milne-Edwards had but one specimen, and that this one was dissected, and that the fragments, after they had been figured, were not thought worth preserving. In that case, the question here raised will perhaps never be answered with certainty.

C. maculata Studer, 11 mm. long, presents a different set of difficulties. Its colour has been already mentioned, together with the fact that it comes from Kerguelen, whence Miers records also *C. emarginata*. From this species, which was well known to Studer from South America, he distinguishes his Kerguelen species by the form of the pleo-telson, the narrowness of the inner branch of the uropods, and the length of the antennæ. Of these distinctions the last seems non-existent, but the other two make a rather close approach to what is shown in the ventral view of *C. typa*, the caudal shield being triangular, produced to a narrowly rounded point a little beyond the inner lobe of the uropods, this lobe being lanceolate with convex outer and concave inner margin, and prolonged much beyond the small outer ramus. A frontal view of the head shows a shape corresponding with that of *C. emarginata*, except that the rostrum (described in the text) is omitted in the drawing. But to this species Studer attributes "three free short pleon-segments" in front of the caudal shield, and figures them quite distinctly with unbroken lines running across the back, which cannot be reconciled with the statement of Milne-Edwards in his generic account, borne out by his dorsal view of *C. typa*, that "the pleon, as usual in this tribe, is composed of two portions, the anterior formed of several segments soldered together towards the middle of the body, but distant [?] distinct] laterally, the other posterior portion being shield-shaped." The front part of the pleon in *C. emarginata* is accurately described by Pfeffer. It clearly consists of four segments; the first much narrower than the rest, so short that it is apt to be concealed, but having its distal margin dorsally uninterrupted; the second rather remarkable, not only for its width, but for the fact that its sides are longer than any side-plates of the peræon and enclose the two following segments, with both of which it is in coalescence at the middle of the back; the third segment having its acute lateral apices bent round so as to rest on the front margin of the caudal shield; the fourth ending similarly within the third, but projecting a point on to the front margin of the caudal shield on each side at a short distance within its own lateral apex. Of such details the figure of *C. typa* is to a large extent innocent, showing, however, the last-mentioned projecting points, and three segments coalesced in the

middle of the back. But neither does Guérin-Méneville take any notice of the peculiar arrangement of the fore part of the pleon in his account of *C. emarginata*, and even Pfeffer's accurate description is very ill supported by the accompanying dorsal figure of that species.

It remains to consider the *C. neo-zealanica* Thomson, which agrees in its dimensions with *C. typa*, and is perhaps not particularly unlike in colouring—two characters, of which the second has but little importance, and the first, apart from other considerations, no importance at all. While quoting at length from Milne-Edwards's generic account of *Cassidina*, Mr. Thomson unfortunately does not call attention to any characters on which he relies for separating his own species from the typical one; and his specific description would, I think, justify an identification of one with the other, except for one peculiarity in *C. neo-zealanica*, namely, that the outer margin of the inner lobe of the uropods and the obtuse apex of the caudal shield are thickly ciliated. But the figure shows a pleon consisting of two broad, completely separated, segments, followed by the pleo-telson or caudal shield. By a comparison with the description, it appears as if the first of these segments had been regarded as the seventh of the peræon, the first peræon-segment being taken as a portion of the head, which is partially embedded in it. But the second pleon-segment is figured as quite simple, so that, if the figure is to be trusted, it is doubtful whether this species can stand in the genus *Cassidina*. The same doubt, for a similar reason, will apply to *C. maculata* Studer. But considering that the authors themselves have not attached any special importance to the characters discussed, there is still at least a possibility that, instead of needing new genera, all the named species of *Cassidina* may be one and the same. In that case, the ciliated apices in *C. neo-zealanica* would probably prove to be due to an adventitious growth. It would be very obliging on the part of the authors referred to, or any available representative, if they would re-examine their specimens and publish a decisive account of the required details.

CASSIDINA EMARGINATA Guérin-Méneville.

1843. *Cassidina emarginata*, Guérin-Méneville, Icon. Règne Animal, Crust., texte, p. 31.

1853. *Cassidina latistylis*, Dana, U.S. Expl. Exp. vol. xiii., Crust. p. 784, pl. 52. figs. 12 *a-e*.

1871. *Cassidina emarginata*, Cunningham, Tr. Linn. Soc. Lond. vol. xxvii. p. 499, pl. 59. fig. 4.

1879. *Cassidina emarginata*, Miers, Phil. Trans. vol. clxviii. p. 204.

1884. *Cassidina emarginata*, Studer, Isopoden Reise 'Gazelle,' p. 19.

1887. *Cassidina emarginata*, Pfeffer, Krebse von Süd-Georgien, pp. 63-69, pl. 2. figs. 9-10, pl. 5. figs. 23-30, pl. 6. figs. 1-10.

In the discussion of the genus many of the distinctive characters of this striking species have already been described. Moreover, a very full and satisfactory account of it has been given by Dr. Pfeffer, with a great number of excellent figures. In the earlier representations both Dana and Cunningham figure the fore part of the pleon as a simple solid segment. This is the more to be wondered at on Dana's part, as he, like Milne-Edwards, figures the corresponding and similar portion of *Amphoroidea typa* with all the requisite detail.

The specimens brought by Mr. Vallentin from the Falklands are preserved in formol and are all of a semi-pellucid orange colour, which under a lens shows a fine bordering to the segments and numerous dorsal markings of rather deeper tint, and is closely speckled about the dorso-lateral parts with minute greyish points.

It is only in large specimens that it is easy to make out the sinuous suture which marks off the side-plates of the second to the seventh segments of the peræon. The last of these segments is scarcely so wide as the second segment of the pleon.

In the fourth and fifth pleopods both rami are respiratory, consisting alike of plicated lamellæ, as contrasted with the corresponding appendages in some of the Sphæromidæ, in which the outer ramus or exopod is opercular. Mr. Beddard, in the 'Challenger' Isopoda, p. 147, calls attention to "a similar hypertrophy of the respiratory lamellæ" occurring in the two species of *Amphoroidea* and in his own *Cymodocea* [*Naesicopea*] *abyssorum*.

Two of Mr. Vallentin's specimens are of great size, the one measured being 36 mm. in length by 23 mm. in breadth, agreeing closely with the 3½ centimetres of Guérin-Méneville's description. With the large specimens were two others not more than 11 or 12 mm. long, and one 23 mm. in length.

Of his specimens Mr. Vallentin himself writes that the largest "was found holding on to a large drifting piece of *D'Urvillea harveyi* found in the harbour. The remaining specimens I secured on various occasions while collecting in my boat. During a calm I frequently observed specimens of this species mount to the surface of the sea, as if for a supply of air, and immediately return to the bottom. The depth of water where these crustacea were to be found was never less than two and half fathoms."

ONISCOIDEA.

1822. *Oniscoidea*, Sars, Christiania Vidensk. Forh. no. 18, p. 58.

1893. *Oniscoidea*, Stebbing, Hist. Crust., Internat. Sci. Ser. vol. lxxiv. p. 420.

1898. *Oniscoidea*, Sars, Crustacea of Norway, vol. ii. pt. 9, p. 153.

1900. *Oniscoidea*, H. Richardson, The American Naturalist, vol. xxxiv. p. 301.

Fam. TRICHONISCIDÆ.

1898. *Trichoniscidæ*, Sars, Crustacea of Norway, ii. p. 159.

1900. *Trichoniscidæ*, H. Richardson, Am. Nat. xxxiv. pp. 302, 306.

In separating this family from the Ligiidæ, Sars assigns to it the genera *Trichoniscus*, *Trichoniscoides*, *Haplophthalmus*, *Scyphacella*, and *Atoniscus*, while leaving to the Ligiidæ the genera *Ligia*, *Ligidium*, *Titanethes*, *Styloniscus*, and *Stymphalus*. In the latter family the first antennæ have the third joint minute, the second maxillæ have two plumose setæ on the inner margin, the maxillipeds have the terminal part distinctly five-jointed, and the uropods are described as freely projecting behind. In contradistinction to this, in the Trichoniscidæ the first antennæ have the third joint well developed, the second maxillæ are without plumose setæ on the inner margin, the maxillipeds have the terminal part generally imperfectly articulated, and the uropods have the peduncle broadly expanded inside and partly covered by the last caudal segment. There are other distinctions drawn by Sars, of more or less importance, to one of which it is specially needful to call attention. In the Ligiidæ the second antennæ have a "multiarticulate flagellum," whereas in the Trichoniscidæ they have a "flagellum composed of only a restricted number of articulations." The restricted number is not specified, but apparently it is not intended to exceed four or five, or seven at most. Now both species included by Dana in his genus *Styloniscus* at its institution have the multiarticulate flagellum, which is "seven to ten-jointed" in *magellanicus* and "about sixteen-jointed" in *longistylis*. But *magellanicus* by its maxillipeds and character in general clearly belongs to *Trichoniscus*. Therefore the distinction between the two families based on the number of joints in the flagellum of the second antennæ is no longer tenable. That *Styloniscus* may still belong to the Ligiidæ is possible. In the Californian species *gracilis*, added to the genus by Dana in 1856, the flagellum of the second antennæ has about fourteen joints and is nearly as long as the two preceding joints of the peduncle. The peduncle of the uropods is distinguished from that of *longistylis* by being scarcely twice as long as broad and on the outer side at the middle becoming suddenly narrower. This recalls the corresponding structure in *Ligidium hypnorum*. Unluckily Dana could not describe the rami because they were mutilated. He does not describe the mouth-organs either in this species or in *longistylis*, so that the genus remains obscure, covering two species which are very doubtfully congeneric. *Styloniscus gracilis* is mentioned by Stimpson in 1857, Budde-Lund in 1885, and Miss Harriet Richardson in 1899; but they neither quote nor supplement the meagre description given by Dana in the Pr. Ac. Philad. vol. vii. p. 176.

Sars makes the suggestion (Crustacea of Norway, vol. ii. p. 167) that the genus *Scyphacella* of S. I. Smith may perhaps turn out to be identical with *Haplophthalmus* of Schöbl. A distinguishing feature of *Haplophthalmus* is, however, as the name implies, that

the eyes are simple. Professor Smith, in describing his *Scyphacella arenicola*, says "eyes prominent, round," and "eyes black," a two-fold notice from which so important a character as "eyes simple" could scarcely have been omitted had it been applicable. The figure of the species by Harger (Rep. U.S. Comm. Fisheries for 1878, pt. 6, pl. 1. fig. 2) shows well-developed eyes with numerous components.

Gen. TRICHONISCUS J. F. Brandt.

1833. *Trichoniscus*, Brandt, Conspectus Crust. Oniscodorum, p. 12 (Bull. Soc. Moscou, vol. vi. p. 174).

1838. *Itea*, C. L. Koch, Deutschlands Crustaceen, 22 (162), no. 16.

1840. *Trichoniscus*, Milne-Edwards, Hist. Nat. Crust. vol. iii. p. 174.

1844. *Itea*, Zaddach, Synopseos Crust. Prussicorum Prodromus, p. 15.

1853. *Styloniscus* (part.), Dana, U.S. Expl. Exp. vol. xiii., Crust. p. 736.

1857. *Philougria*, Kinahan, Nat. Hist. Rev. vol. iv. p. 281.

1868. *Philougria*, Bate & Westwood, Brit. Sess.-eyed Crust. vol. ii. p. 454.

1870. *Trichoniscus*, Budde-Lund, Naturh. Tidsskr. ser. 3, vol. vii. p. 227.

1885. *Trichoniscus*, Budde-Lund, Crust. Isop. Terrestria, p. 243.

1886. *Philygria* (preocc. Diptera, 1844), Thomson & Chilton, Tr. New Zealand Inst. vol. xviii. p. 157.

1886. *Philygria*, Chilton, ibidem, p. 159.

1898. *Trichoniscus*, Sars, Crustacea of Norway, vol. ii. p. 160.

To this genus Budde-Lund in 1885 assigns nine species, one of them being *T. asper* Koch, found in amber, and another the *Scyphacella arenicola* of Smith, already referred to. He makes the *Trichoniscus leydigi* of Weber a synonym of his own *T. albidus*, but this decision is not admitted by Sars. Dollfus added to the genus the species *chavesi* in 1888, *insularis* in 1889, and with some doubt *murrayi* and *australis* in 1890. In 1898 Sars instituted a new genus, *Trichoniscoides*, to receive *Trichoniscus albidus* Budde-Lund, *T. leydigi* Weber, and perhaps *T. cavernicola* Budde-Lund. He does not mention *Trichoniscus vividus* Koch, but that species should probably be transferred, as it has simple eyes; and the most prominent, though not of necessity the most important, distinction of the new genus is that the eyes are simple or wholly wanting, whereas in *Trichoniscus* they are "small, but distinct, consisting of only 3 visual elements imbedded in a dark pigment." In 1885 Chilton described a marine species from New South Wales as *Philougria marina*, but the eyes apparently have numerous visual elements, the mandibles show no molar, and the other mouth-organs are undescribed; so that this species cannot be included in *Trichoniscus*. In 1886 the same author described *Philygria thomsoni* from New Zealand, and this appears to be a true *Trichoniscus*.

TRICHONISCUS MAGELLANICUS (Dana).

1853. *Styloniscus magellanicus*, Dana, U.S. Expl. Exp. vol. xiii., Crust. p. 736, pl. 48. figs. 7 a-g.

1881. *Styloniscus magellanicus*, Miers, Pr. Zool. Soc. Lond. p. 77.

1885. *Styloniscus magellanicus*, Budde-Lund, Crust. Isop. Terrestria, p. 271.

Body smooth, narrowly elliptical; front angles of first peræon-segment rounded, not greatly produced, hind angles of this and next segment rounded, of third subquadrate, of the rest successively a little more and more produced backwards and sharpened, but in none absolutely acute; first the longest, rather longer than the head, the others having the side-plates marked by a faint, obliquely sinuous suture. Pleon abruptly narrower than peræon, second segment very short. Telson with sides converging from insertion of uropods almost straight to broadly truncate apex.

Eyes dark, with three visual elements. First antennæ with second joint shorter than first or third. Second antennæ spinulose, with joints of peduncle successively longer, the last a little shorter than the 7-10-jointed flagellum (7-8-jointed in specimeus examined), last joint tipped with fascicle of setæ.

Upper lip apically rounded and furred. Mandibles with toothed cutting-edge narrow; a single seta on right mandible; molar cylindrical, prominent. First maxillæ: inner plate with three plumose setæ, the inner the longest; outer plate strap-shaped, surmounted by eight unequal spines. Maxillipeds as partially figured by Dana, and in near agreement with those of *T. pusillus* as figured by Sars, but the epipod longer and distally furred with closely-set, very short setules or spinules.

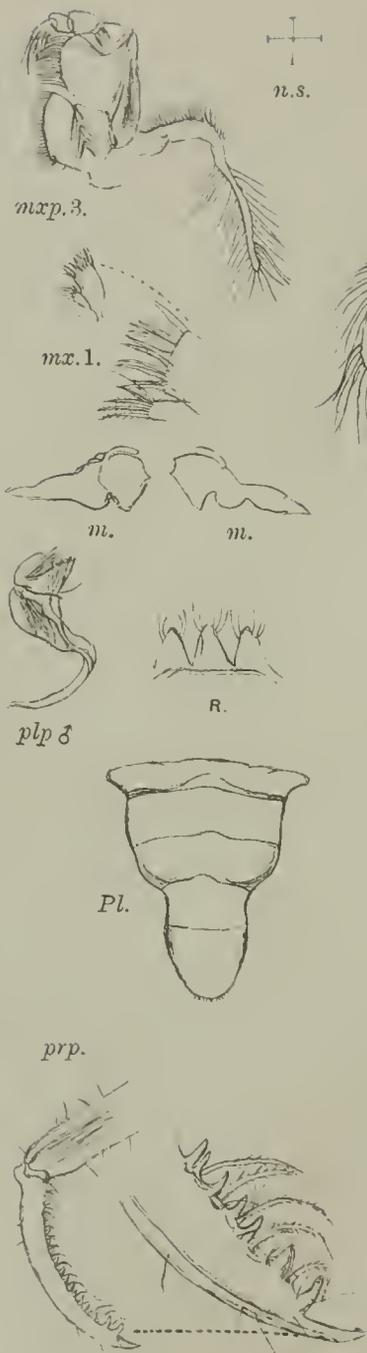
Hind trunk-legs longer than those in front, all very similar in structure; the fifth joint carrying the strongest and longest spines; the sixth fringed on the outer margin with transparent spinules, with little spines at intervals, also on the inner and part of the apical margin showing, especially in the hinder pairs, thin membranous expansions, as well as several spines; the small seventh joint is beset with various setules, among them a long one with split apex, and others with smoothly widened extremity (compare Chilton on *Philygria*, 1886). In the second pleopods of the male the long distal joint of the inner ramus is, till near the end, much more widened than the stiliform joint figured by Sars for this part of *T. pygmaeus*. The uropods are as Dana figures them, the inner ramus fully two-thirds as long as the outer, though in his description he says "longer branch nearly twice the length of the other."

Colour brown, mottled with yellowish white, especially a series of light patches just above the side-plates of the peræon. Length about a third of an inch, or 8 mm.

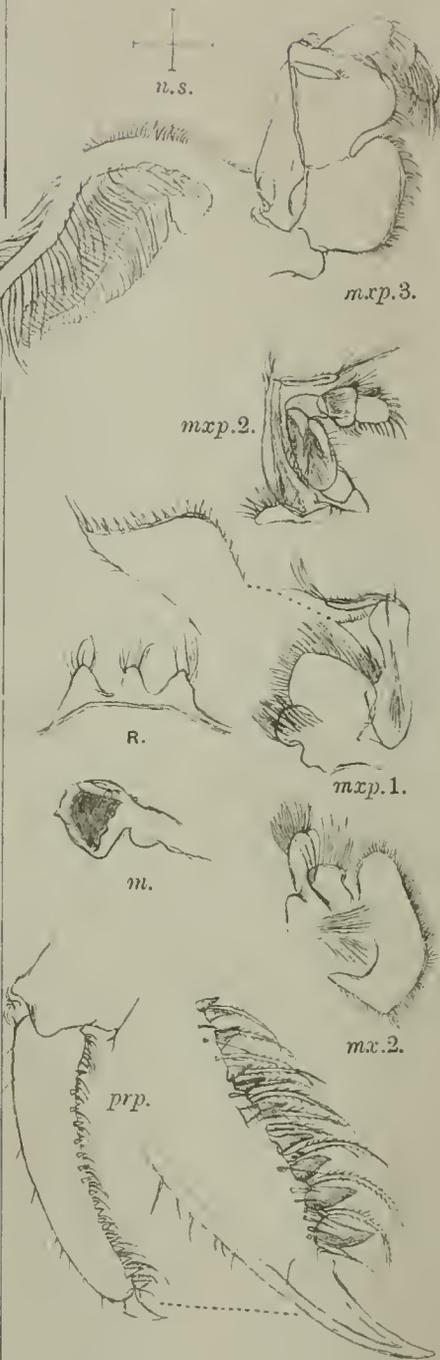
Mr. Vallentin's specimens were "found in a damp cave on the top of a hill 450 feet high. 2 miles distant from Stanley."



A



B



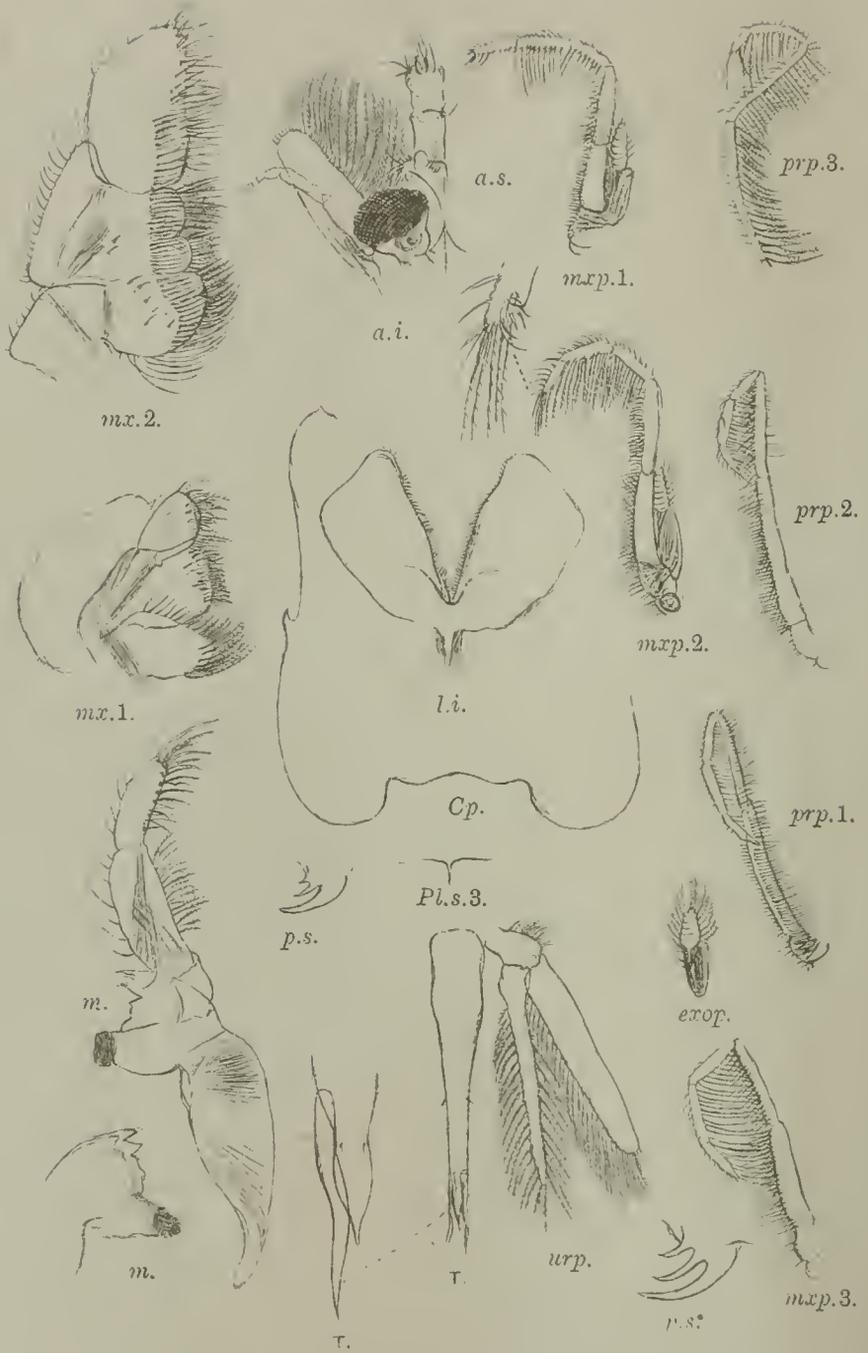
TRRS. del.

HALICARCINUS
OVATUS.

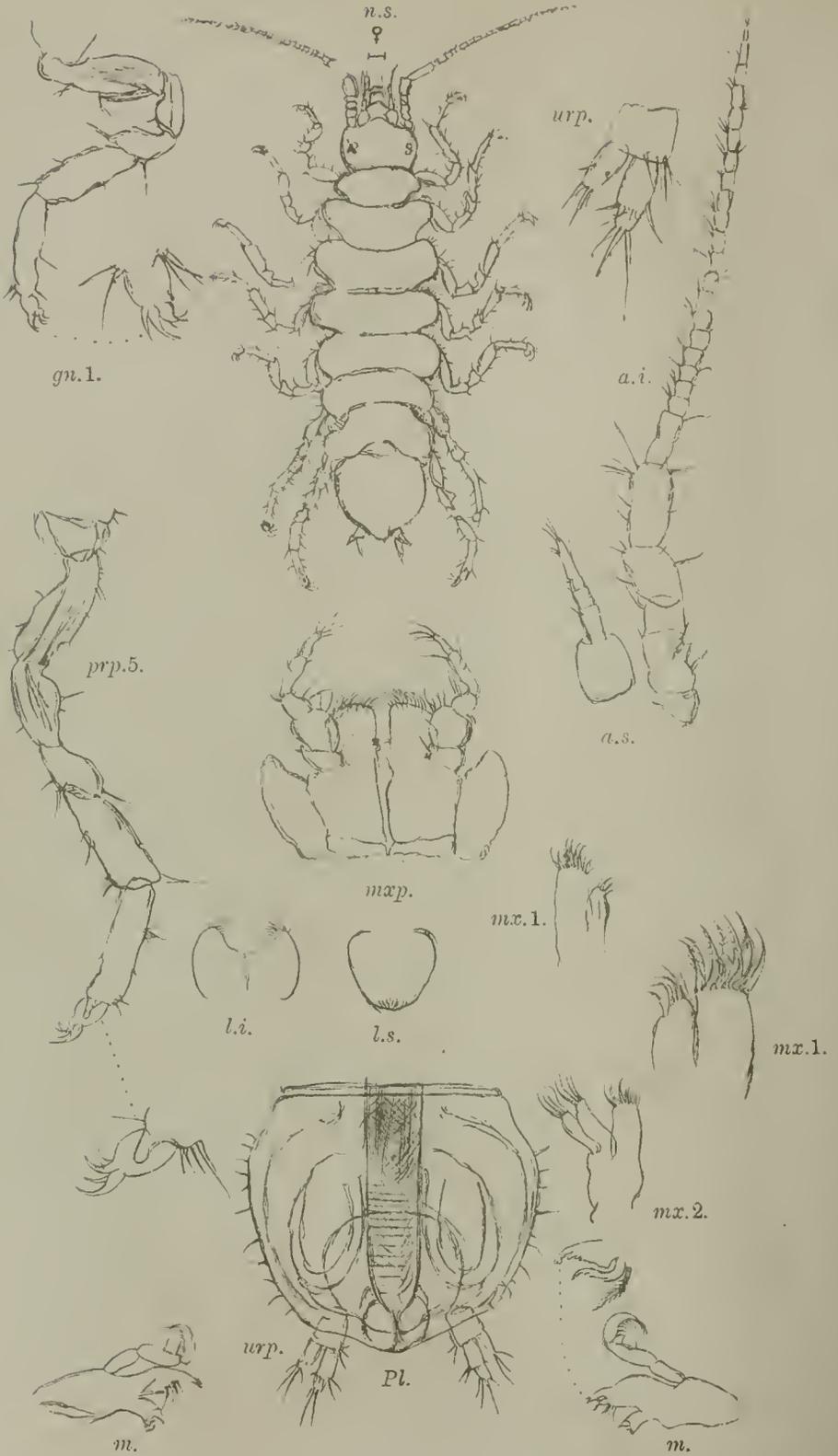
Gale & Danielsson. Ltd. Lith.

HALICARCINUS
PLANATUS.









T.R.S. del.

Bale & Danielsson, Ltd. Lith.

IAIS PUBESCENS.

EXPLANATION OF THE PLATES.

PLATE XXXVI.

A. *Halicarcinus ovatus*, p. 523.

n. s. Natural size of carapace, breadth measured at widest part of rim, length from middle rostral tooth to posterior margin.

R. Rostral teeth.

Pl. Pleon of male.

m., m. Mandibles, outer surface.

mx. 1. First maxilla, with spine-margins more highly magnified.

mxp. 3. Third or external maxilliped, inner surface.

prp. Terminal joint of a trunk-leg or peræopod, with apical part more highly magnified.

plp. ♂. Pleopod of male.

B. *Halicarcinus planatus*, p. 524.

n. s. Natural size of carapace, measured as in preceding species.

R. Rostral teeth.

m. Mandible, inner surface.

mx. 2. Second maxilla.

mxp. 1. First maxilliped, with apex of endopod more highly magnified.

mxp. 2. Second maxilliped.

mxp. 3. Third or external maxilliped, inner surface.

prp. Terminal joint of a trunk-leg or peræopod, with apical part more highly magnified.

PLATE XXXVII.

Euphausia vallentini, p. 545.

Cp. Lateral and hind margins of carapace.

Pl. s. 3. Postero-dorsal tooth of third pleon-segment.

p. s. Preanal spine. *p. s.** The same, from another specimen.

a. s., a. i. Eye, together with first antenna, second antenna, and rostral point.

m., m. Mandibles.

l. i. Lower lip.

mx. 1, mx. 2. First and second maxillæ.

mxp. 1, 2, 3. First, second, and third maxillipeds, without branchial appendages, the third also without exopod. Apex of second maxilliped more highly magnified.

prp. 1, 2, 3. First, second, and third peræopods, without exopods or branchiæ.

exop. A detached exopod.

urp. Uropod.

T. Telson. Apical portion and one subapical process more highly magnified.

The mandibles, lower lip, first and second maxillæ, preanal spines, apex of second maxilliped, and apex of telson are more highly magnified than the other figures, but the figures in each group are all to the same scale.

PLATE XXXVIII.

Iais pubescens, p. 549.

n. s. Line showing length of specimen figured.

a. s., a. i. First and second antennæ.

l. s. Upper lip.

m., m. Mandibles.

l. i. Lower lip.

mx. 1, mx. 2. First and second maxillæ.

mxp. Maxillipeds.

gn. 1, prp. 5. First gnathopod and fifth peræopod (first and seventh trunk-legs).

Pl. The semipellucid pleon.

urp. Uropod.

The mouth-parts, fingers of trunk-legs, and one uropod are magnified to the same scale, except the apices of *mx. 1*; the other details are less enlarged.

PLATE XXXIX.

Exospheroma gigas, p. 553.*n.s.* Lines showing actual length and breadth of specimen figured.*a.s., a.i.* First and second antennæ.*e.p., l.s.* Epistome and upper lip.*m., m.* Mandibles. The right mandible from the outer side; the left mandible from the inner side, without its palp.*l.i.* Lower lip.*m.x. 1, m.x. 2.* First and second maxillæ.*m.x.p.* Maxillipeds.*pp.p.* First peræopod (third trunk-leg).*Per.s. 7♂.* Appendages of male on ventral margin of seventh peræon-segment.*plp. 2♂.* Appendage of male on inner side of second pleopod.

The mouth-organs are all drawn to the same scale, but with higher magnification of the apical spines and setæ of the first maxilla, and of one setiform spine of the second maxilla. A uniform but lower scale applies to the two antennæ, the peræopod, and the male appendages.

2. On some Crustaceans from the South Pacific.—Part IV.
The Crabs. By L. A. BORRADAILE, M.A., F.Z.S.,
 Lecturer in Natural Sciences of Selwyn College, Cam-
 bridge.

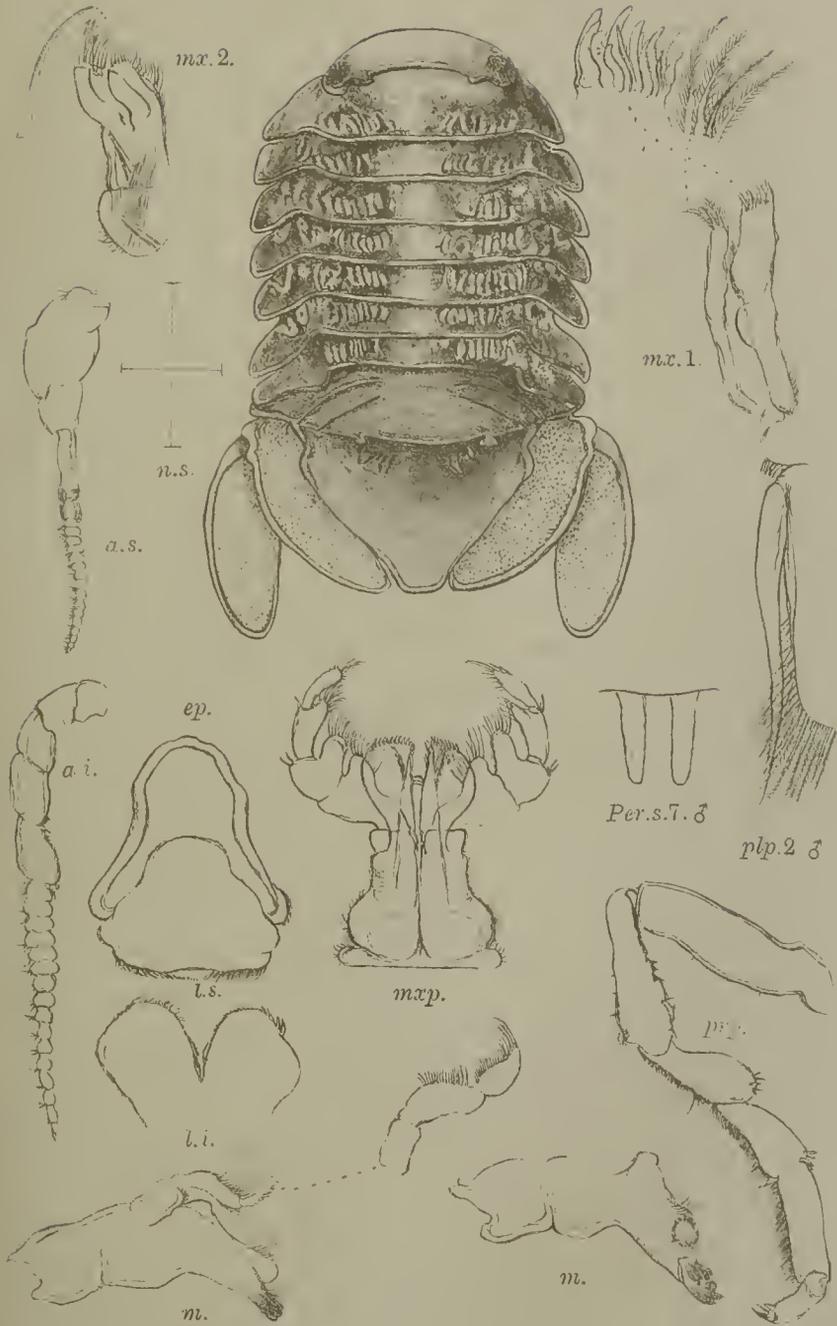
[Received March 31, 1900.]

(Plates XL.—XLII.)

The collections described in the following report were made in the islands of Funafuti (Ellice group), Rotuma, and Fiji by Mr. J. Stanley Gardiner, to whose kindness I am indebted for permission to examine them. They contain altogether examples of 77 species, of which seven appear to be new to science. All the known species have been already recorded from the Indo-Pacific region, and the new ones present no particularly remarkable features, although it has proved impossible to place one of them in any known genus, and a new division of that rank has been established for it.

The Funafuti collection contained examples of the following species:—

1. *Cryptodromia hilgendorfi* de Man.
2. *Ebalia erosa* (A. M.-Edw.).
3. *Calappa hepatica* (Linn.).
4. *Xenocarcinoides rostratus*, n. sp.
5. *Mencæthius monoceros* (Latr.).
6. *Goniocaphyra truncatifrons* de Man.
7. *Carupa læviuscula* Heller.
8. *Neptunus (Achelous) granulatus* (H. M.-Edw.).
9. *Thalamita admete* (Herbst), var. *edwardsi*, n. nom.
10. *Thalamita integra* Dana.
11. *Pseudozius inornatus* Dana.
12. *Pseudozius caystrus* (Ad. & Wh.).
13. *Pilumnus prunosus* Whitelegge.
14. *Cymo andreossi* (Aud.), var. *melanodactylus* Dana.
15. *Xanthius tamarckii* (H. M.-Edw.).





16. *Daira perlata* (Herbst).
17. *Atergatis floridus* (Rumph.).
18. *Chlorodius niger* (Forskål).
19. *Chlorodopsis spinipes* (Heller).
20. *Chlorodopsis* (*Cyclodius*) *ornata* Dana.
21. *Etisodes frontalis* Dana.
22. *Eriphia levimana* Latr.
23. *Eriphia scabricula* Dana.
24. *Trapezia ferruginea* Latr.
 - Var. *dentata* (Macleay).
 - Var. *areolata* Dana.
 - Var. *guttata* Rüppell.
25. *Trapezia digitalis* Latr.
 - Var. *speciosa* Dana.
26. *Trapezia cymodoce* Herbst.
27. *Tetralia glaberrina* (Herbst).
28. *Plagusia speciosa* Dana.
29. *Leiolophus planissimus* (Herbst).
30. *Grapsus maculatus* (Catesby).
31. *Pachygrapsus levis*, n. sp.
32. *Geograpsus grayi* (H. M.-Edw.).
33. *Sesarma gardineri*, n. sp.
34. *Cardiosoma hirtipes* Dana.
35. *Uca cultrimana* (White).
36. *Ocypode urvillei* Guérin.

The Rotuma collection contained:—

1. *Dromidiopsis australiensis* (Hasw.).
2. *Dromidia globosa* (Lam.).
3. *Calappa hepatica* (Linn.).
4. *Camposcia retusa* Latr.
5. *Hyastenus elegans* Miers, var. *tenuicornis*, nov.
6. *Tylocarcinus styx* (Herbst).
7. *Cyclax* (*Cyclomaia*) *suborbicularis* (Stimps.).
8. *Elamene truncata* A. M.-Edw.
9. *Kraussia rastripes* Müller.
10. *Thalamita admete* Herbst.
11. *Thalamita prymna* Herbst, var. *spiniimana* Dana.
 - Var. *pieta* Stimps.
 - Var. *stimpsoni* A. M.-Edw.
12. *Caphyra rotundifrons* A. M.-Edw.
13. *Pseudozius caystrus* (Ad. & Wh.).
14. *Melia tessellata* (Latr.).
15. *Pilumnus rotumanus*, n. sp.
16. *Cymo andreossyi* (Aud.).
 - Var. *melanodactylus* Dana.
17. *Xanthias notatus* (Dana).
18. *Xanthias lamarcki* (H. M.-Edw.).
19. *Xanthias parvus*, n. sp.
20. *Liomera richtersi* (de Man).
21. *Liomera levis* (Dana).

22. *Actæa tomentosa* (H. M.-Edw.).
23. *Actæa affinis* (Dana).
24. *Actæa hirtissima* (Rüppell).
25. *Actæa rufopunctata* (H. M.-Edw.).
26. *Actæa speciosa* (Dana).
27. *Actæa fossulata* (Girard).
28. *Zozimus æneus* (Linn.).
29. *Atergatus floridus* (Rumph.).
30. *Carpilius maculatus* (Linn.).
31. *Carpilius convexus* (Forskål).
32. *Carpiliodes tristis* Dana.
33. *Carpiliodes vuilliantianus* (A. M.-Edw.).
34. *Carpiliodes monticulosus* A. M.-Edw.
35. *Carpiliodes pallidus*, n. sp.
36. *Euxanthus melissa* (Herbst).
37. *Chlorodius niger* (Forskål).
38. *Chlorodius barbatus*, n. sp.
39. *Phymodius ungulatus* (H. M.-Edw.).
40. *Etisus lævimanus* Randall.
41. *Etisodes anaglyptus* (H. M.-Edw.).
42. *Etisodes frontalis* Dana.
43. *Chlorodopsis (Cyclodius) ornata* Dana.
44. *Euruppellia annulipes* (H. M.-Edw.).
45. *Eriphia lævimana* Latr.
46. *Eriphia scabricula* Dana.
47. *Trapezia ferruginea* Latr
 Var. *dentata* (Macleay).
 Var. *areolata* Dana.
 Var. *guttata* Rüppell.
 Var. *maculata* (Macleay).
48. *Trapezia digitalis* Latr., var. *speciosa* Dana.
49. *Trapezia cymodoce* (Herbst).
50. *Tetralia glaberrima* (Herbst).
51. *Plagusia speciosa* Dana.
52. *Leiolophus planissimus* (Herbst).
53. *Grapsus maculatus* (Catesby).
54. *Geograpsus grayi* (H. M.-Edw.).
55. *Sesarma aubryi* A. M.-Edw.
56. *Sesarma gardineri*, n. sp.
57. *Cardiosoma hirtipes* Dana.
58. *Cardiosoma carnifex* (Herbst).
59. *Uca cultrimana* (White).
60. *Ocypode ceratophthalma* (Pallas).

The Fiji collection :—

1. *Dromidiopsis australiensis* (Hasw.).
2. *Pilumnus hirsutus* Stimps.
3. *Actumnus setifer* de Haan.
4. *Actæa tomentosu* (H. M.-Edw.).
5. *Puchygrapsus minutus* A. M.-Edw.

The classification followed is that of Ortmann, in Bronn's 'Thier-reich.' In one or two points, however, slight deviations from this scheme will be found. The three tribes of Crabs seem still to have enough in common to justify us in keeping the old name of Brachyura in its full extent; and I have accordingly adopted de Haan's term Brachygnatha for the groups included by Ortmann in his restricted Brachyura. Following the latter writer's suggestion as to the inclusion of *Thia* Leach in the Ateleyclidæ, it is proposed to transfer Alcock's *Thiina*¹ bodily to that family, and *Kraussia* Dana is accordingly classed here. Lastly, under the heading Portunidæ, there will be found certain suggestions for an amplification of Ortmann's classification, notably the establishment of a new subfamily for the genus *Goniocaphyra* de Man.

Major Alcock's admirable series of papers on the Indian Crabs², containing as they do diagnoses and bibliographies for a large number of the species included in the present collection, make it unnecessary to give more than a very short list of references for these species. For the sake of convenience, however, a reference to the original description and, when possible, to a figure, is given, together with one to Major Alcock's work. In the case of species mentioned also in Whitelegge's report on the Funafuti Crustacea, I have included a reference to that writer's paper.

Suborder BRACHYURA.

Tribe DROMIIDEA.

Family DROMIIDÆ.

Genus CRYPTODROMIA Stimps., 1858.

1. CRYPTODROMIA HILGENDORFI de Man, 1887.

Cryptodromia hilgendorfi, de Man, Arch. Naturg. liii. 1, iii. p. 406, pl. xviii. fig. 4 (1887).

Three males from Funafuti, one dredged in the lagoon at a depth of 23 fathoms. This latter specimen carries a big sponge.

Genus DROMIDIA Stimps., 1858.

2. DROMIDIA GLOBOSA (Lam.), 1818.

Dromia globosa, Lamarck, Hist. An. sans vert. v. p. 264 (1818); H. M.-Edwards, H. N. Crust. ii. p. 177 (1837).

Dromidia globosa, de Man, Arch. Naturg. liii. 1, iii. p. 396 (footnote), pl. xviii. fig. 1 (1887).

One male from Rotuma, bearing an ascidian. The tooth at the side of the carapace is rather farther back than is indicated in de Man's figure. The locality of this species has hitherto been unknown.

¹ Journ. As. Soc. Bengal, lxviii. 2, i. p. 96 (1899).

² *Ibid.* lxiv., lxv., lxvii., lxviii.

Genus DROMIDIOPSIS, nov.

According to Ortmann (Bronn's 'Thier-reich,' v. 2, p. 1155) *Dromidia* has no epipodite on the first leg (cheliped). Examination of the specimens of *D. australiensis* Haswell shows that in this species the epipodite is present. It seems necessary, therefore, to make a new genus for this species, and such others as may agree with it in this particular. The name proposed is *Dromidiopsis*.

Characters of *Dromidiopsis*, n. gen. :—

1. Rostrum triangular, with the sides not distinctly lobed.
2. Carapace slightly longer than broad.
3. Sternal furrows in the female reach the chelipeds, converge, but do not join, and end in a single ill-marked tubercle.
4. Gills phyllobranchiate.
5. Cheliped with epipodite.
6. 4th and 5th legs (last two walking-legs) subchelate.
7. Uropods present and visible in dorsal view in the angle between the 6th segment and the telson.

3. DROMIDIOPSIS AUSTRALIENSIS (Hasw.), 1882.

Dromia australiensis, Haswell, Proc. Linn. Soc. N. S. W. vi. 4, p. 755 (1882); id. Cat. Austral. Crust. p. 139 (1882).

Dromidia australiensis, de Man, Arch. Naturg. liii. 1, iii. p. 396, pl. xvii. fig. 6 (1887).

Rotuma; one male bearing an ascidian.

Fiji; one male, one female.

Tribe OXYSTOMATA.

Family LEUCOSIIDÆ.

Subfamily LEUCOSIINÆ.

Genus EBALIA Leach, 1817.

4. EBALIA EROSA (A. M.-Edw.), 1873.

Phlyxia erosa, A. M.-Edwards, Journ. Mus. Godeffr. i. 4, p. 262 (1873); id. Nouv. Arch. Mus. x. p. 47, pl. iii. fig. 2 (1874).

Ebalia erosa, Miers, 'Challenger' Brachyura, p. 305 (1886); Alcock, J. As. Soc. Beng. lxxv. 2, p. 189 (1896).

Funafuti; one male.

Family CALAPPIDÆ.

Subfamily CALAPPINÆ.

Genus CALAPPA Fabr., 1798.

5. CALAPPA HEPATICA (Linn.), 1764.

Cancer hepaticus, Linnæus, Mus. Lud. Ulr. p. 448 (1764).

Calappa tuberculosa, Guérin, Icon. R. A., Crust. pl. xii. fig. 2.

Calappa hepatica, de Haan, Faun. Japon., Crust. p. 70 (1833); Alcock, J. As. Soc. Beng. lxx. 2, p. 142 (1896); Whitelegge, Mem. Austral. Mus. iii. 2, p. 139 (1897).

Funafuti; one male, one female.

Rotuma; one male, four females.

Tribe BRACHYGNATHA.

Subtribe OXYRHYNCHA.

Family MAIIDÆ.

Subfamily INACHINÆ.

Genus CAMPOSCIA Latr., 1829.

6. CAMPOSCIA RETUSA Latr., 1829.

Camposcia retusa, Latreille, Cuvier's R. An. (2) p. 60 (1829); A. M.-Edwards, H. N. Crust. i. p. 283, pl. xv. figs. 15, 16 (1834); Alcock, J. As. Soc. Beng. lxxiv. 2, p. 184 (1895).

Rotuma; one male.

Subfamily ACANTHONYCHINÆ.

Genus XENOCARCINOIDES, nov.

Characters of *Xenocarcinoides*, n. gen.:—

Rostrum long, compressed, above faintly grooved and notched at the tip, below hollowed and bearing on each side a thin wing.

Carapace elongate-triangular, bearing large tubercles.

Eyes moveable but not retractile, sunken in a pit formed by the side of the rostrum and the immoveable second joint of the second antenna. No pre- or postocular spines.

Antenna with 1st and 2nd joints fused, subtriangular. Flagellum hidden under rostrum.

Third maxilliped with the meropodite subquadrate, as broad as the ischiopodite, and bearing the carpopodite at its inner angle.

Chelipeds large; longer than either of the last three pairs of legs. (The second pair of legs are unfortunately wanting in the specimen.) The last three legs diminish gradually from before backwards. The dactyles are somewhat sickle-shaped, toothed below, and as long as the preceding joint.

The abdomen of the male is six-jointed, owing to fusion of joints 5 and 6, between which, however, a furrow can still be seen.

The genus differs from *Xenocarcinus* White in the shape of the carapace and rostrum, and in the larger size of the chelipeds.

7. XENOCARCINOIDES ROSTRATUS, n. sp. (Plate XL. fig. 1.)

Diagnosis: "A *Xenocarcinoides* with the carapace provided with ten tubercles arranged in an anterior and a posterior group of five each, those of the hinder group being larger and more acute than

those of the anterior; chelipeds much larger than the last three legs, nearly as long as the rostrum; fingers shorter than the palm, fairly stout, enclosing a space at the base, with interlocking teeth at the tip; moveable finger with an isolated blunt tooth near the proximal end; walking-legs with the joints irregularly swollen; dactyles somewhat sickle-shaped, bearing spines and a few hairs below."

The third maxilliped and the abdomen of the male are shown in figs. 1 *a* and 1 *b*.

Colour in spirit, white.

Total length 13.5 mm. Length of carapace to base of rostrum 8.5 mm. Greatest breadth 7 mm.

Funafuti; one male.

Genus MENÆTHIUS H. M.-Edw., 1834.

8. MENÆTHIUS MONOCEROS (Latr.), 1825.

Pisa monoceros, Latr. Encycl. x. p. 139 (1825).

Menæthius monoceros, H. M.-Edwards, H. N. Crust. i. p. 339 (1834); Alcock, J. As. Soc. Beng. lxiv. 2, p. 197 (1895).

Menæthius unguatus, *depressus*, *subserratus*, *tuberculatus*, *areolatus*, and *inornatus*, Dana, U.S. Expl. Exped., Crust. i. pp. 121-125, pl. iv. figs. 5-7 & pl. v. figs. 1-3 (1852).

Funafuti; two males.

The carapace in both specimens has the tubercles low and rounded but fairly numerous.

Subfamily PISINÆ.

Genus HYASTENUS White, 1847.

9. HYASTENUS ELEGANS Miers, 1836, var. (Plate XL. fig. 2.)

Hyastenus elegans, Miers, 'Challenger' Brachyura, p. 58, pl. vi. fig. 3 (1886).

The specimens differ from the type in the following particulars:—

1. The horns are more slender and set wider apart at the base.

2. The larger tubercles of the carapace are more rounded; not so sharp.

3. The arrangement of tubercles in the fore part of the carapace is somewhat different (see figure).

Should it be thought advisable to give this variety a name, that of *tenuicornis* would be suitable.

Rotuma; two males, one female.

Genus TYLOCARCINUS Miers, 1879.

10. TYLOCARCINUS STYX (Herbst), 1803.

Cancer styx, Herbst, Naturges. Krabb. u. Krebse, iii. 3, p. 53, pl. lviii. fig. 6 (1803).

Microphrys styx, A. M.-Edwards, Nouv. Arch. Mus. (1) viii. p. 247, pl. xi. fig. 4 (1872).

Tylocarcinus styx, Miers, Ann. Mag. Nat. Hist. (5) iv. p. 14 (1879); Alcock, Journ. As. Soc. Beng. lxiv. 2, p. 235 (1895).

Rotuma; eight males and eight females.

Two of the males have adult chelæ as in Milne-Edwards's figure. The length of these two is 20 and 18 mm. respectively, measured from the hinder end of the carapace to the tip of the rostral spines. Of the remaining six males, the two biggest were both exactly 16 mm. long; in one of these the two chelæ were both like those of the female and young male, in the other the left claw was that of the female and the right that of the grown male. All the other specimens had the chelæ of the female.

Subfamily MAIINÆ.

Genus CYCLAX Dana, 1852.

11. CYCLAX (CYCLOMAIA) SUBORBICULARIS (Stimps.), 1857.

Mithrax suborbicularis, Stimpson, Proc. Ac. Nat. Sci. Philad. 1857, p. 218.

Cyclomaia margaritata, A. M.-Edwards, Nouv. Arch. Mus. (1) viii. p. 236, pl. x. figs. 2, 3 (1872).

Cyclax (Cyclomaia) suborbicularis, Alcock, Journ. As. Soc. Beng. lxiv. 2, p. 245 (1895).

Rotuma; three males and three females.

Of the females one, 19 mm. long, had the sterna completely covered by the abdomen. The others, 17 and 18 mm. long respectively, showed a considerable stretch of the sterna bare on each side of the abdomen.

Family HYMENOSOMIDÆ.

Genus ELAMENE H. M.-Edw., 1837.

12. ELAMENE TRUNCATA A. M.-Edw., 1874.

Elamene truncata, A. M.-Edwards, Nouv. Arch. Mus. (1) x. p. 323 (1874).

Rotuma; one female.

Subtribe CYCLOMETOPA.

Family ATELECYCLIDÆ.

It seems best to follow Ortmann in keeping this family distinct from the Cancridæ, and to place in it the subfamilies Atelecyclinæ, Acanthocyclinæ, and Thiinæ.

Subfamily THINÆ.

Genus KRAUSSIA Dana, 1852.

13. KRAUSSIA RASTRIPES Müller, 1887.

Kraussia rastripes, Müller, Verh. Nat. Ges. Basel, viii, 2, p. 480, pl. iv. fig. 5 (1887).

The ridges on the moveable finger of the specimen are not so distinctly tuberculated as in Müller's figure.

Rotuma; one female.

Family CANCRIDÆ.

By the removal of the subfamilies of the Atelecyclidæ, the family Cancridæ becomes restricted to the Cancrinæ and Piri-melinæ, with perhaps also the Carcinidinæ (= Carcininæ). Thus narrowed it is essentially a circumpolar group, and it is not surprising that it is unrepresented in the present collection.

Family PORTUNIDÆ.

The following tables, showing the schemes of classification adopted by Ortmann¹ and Alcock² respectively, make it clear that there is a considerable difference of opinion between the authors in question, though in the main they may be said to be in accord.

<i>Subfamilies.</i>	Alcock.	<i>Alliances.</i>	Ortmann.
			<i>Subfamilies.</i>
Portumninæ.	{	Carcinoida.	Portumninæ.
		Portumnoida.	
Portuninæ.	{	Portunoida.	Portuninæ.
		Cœnophthalmoida.	
Caphyrinæ.	—————		
Lupinæ.	{	Lupocycloida.	Carupinæ.
		Lupoida.	Thalaminæ.
		Podophthalmoida.	Podophthalminæ.

Roughly speaking Ortmann's subfamilies correspond to alliances in Alcock's classification, but there is considerable divergence in detail.

Neither author refers to the somewhat remarkable genus *Goniocaphyra* de Man, which is not only impossible to place in any subfamily of either author as defined, but appears to have a distinct standing of its own, and to deserve a separate subfamily for its reception.

¹ Ortmann, Bronn's 'Thier-reich,' v. 2, p. 1170 (1899).

² Alcock, Journ. Soc. As. Beng. lxxviii, 2, i. p. 6 (1899).

Under the circumstances it is perhaps best to retain the whole of Ortmann's subfamilies with the addition of two, or three, others—the *Caphyrinæ* for the genera *Caphyra* Guérin 1832, and *Sphærocarcinus* Zehnter 1894; a new subfamily *Goniocaphyrinæ*, for the single genus *Goniocaphyra* de Man 1837; and the *Carcinidinæ*, if it be thought needful to retain this group in the *Portunidæ*.

The following key embodies the leading characters of the subfamilies as it is here proposed to limit them:—

- I. Eystalks and orbits normal.
- A. Basal joint of 2nd or outer antenna narrow. [Flagellum of 2nd antenna not shut out from orbit.]
- i. Inner antennæ sloping. Front with a median tooth. Generally at least one pair of walking-legs as long as chelipeds.
1. Last pair of legs not distinctly natatorial *Carcinidinæ*.
 2. Last pair of legs distinctly natatorial *Portumninæ*.
- ii. Inner antennæ transverse. Front with a median notch. Chelipeds longer than walking-legs.
1. 5th dactyles lanceolate *Goniocaphyrinæ*.
 2. 5th dactyles rounded *Carupinæ*.
- B. Basal joint of antenna broad. [Chelipeds larger than walking-legs.]
- i. Flagellum of 2nd antenna not shut out from the orbit by a process of the basal joint *Portuninæ*.
 ii. Flagellum of 2nd antenna shut out from the orbit by a process of the basal joint. [5th legs natatorial.]
1. Last joint of 5th legs sickle-shaped *Caphyrinæ*.
 2. Last joint of 5th legs flattened *Thalamitinæ*.
- II. Eystalks enormously long, orbits extend across the whole fore edge of the carapace. [5th legs natatory. Chelipeds longer than legs. Antennæ free; basal joint short; flagellum not shut out from orbit.] *Podophthalminæ*.

Subfamily GONIOCAPHYRINÆ.

Characters of *Goniocaphyrinæ*, n. subfam. :—

1. Carapace broad.
2. Antero-lateral edge with 5 teeth.
3. Front truncate, slightly notched in the middle.
4. Legs slender; chelipeds somewhat longer than walking-legs.
5. Last pair of legs with lanceolate dactyles.
6. Basal joint of antenna enters the orbital gap but does not wholly fill it. Flagellum not shut out from orbit by a process of the basal joint.
7. Antennules transverse.

Genus GONIOCAPHYRA de Man, 1887.

14. GONIOCAPHYRA TRUNCATIFRONS de Man, 1887.

Goniocaphyra truncatifrons, de Man, Arch. Naturg. liii. 1, iii. p. 339, pl. xiv. fig. 1 (1887).

Funafuti; one male.

Subfamily CARUPINÆ.

Genus CARUPA Dana, 1850.

15. CARUPA LÆVIUSCULA Heller, 1862.

Carupa læviuscula, Heller, Verh. zool.-bot. Ges. Wien, xii. p. 520 (1862); id. 'Novara' Crust. p. 27, pl. iii. fig. 2 (1868); Alcock, Journ. As. Soc. Beng. lxxviii. 2, i. p. 26 (1899).

Funafuti; one male.

Subfamily PORTUNINÆ.

Genus NEPTUNUS de Haan, 1833.

Neptunus, de Haan, Faun. Japon., Crust. p. 7 (1833); Alcock, Journ. As. Soc. Beng. lxxviii. 2, i. p. 28 (1899); Ortmann, Bronn's 'Thier-reich,' v. 2, p. 1171 (1899).

Portunus, Rathbun, Proc. Biol. Soc. Wash. xi. pp. 155 & 160 (1897); id. Proc. U.S. Nat. Mus. xxii. p. 289 (1900).

I am unable to agree with the alteration of the name of this genus proposed by Miss Rathbun. On the subject of Latreille's "types" I am in full agreement with the position taken up by Stebbing (Nat. Sci. xii. p. 239).

16. NEPTUNUS (ACHELOUS) GRANULATUS (H. M.-Edw.), 1834.

Lupea granulata, H. M.-Edwards, H. N. Crust. i. p. 454 (1834).

Amphitrite speciosa, Dana, Proc. Ac. Nat. Sci. Philad. 1852, p. 84; id. U.S. Expl. Exped., Crust. i. p. 276, pl. xvii. fig. 1 (1852).

Achelous granulatus, A. M.-Edwards, Arch. Mus. x. p. 344 (1861).

Neptunus (Achelous) granulatus, Miers, 'Challenger' Brachyura, p. 180 (1886); Alcock, Journ. As. Soc. Beng. lxxviii. 2, i. p. 45 (1899).

Funafuti; four males.

Subfamily THALAMITINÆ.

Genus THALAMITA Latr., 1829.

17. THALAMITA PRYMNA (Herbst), 1803.

Cancer prymna, Herbst, Naturges. Krabb. u. Krebse, iii. 3, p. 41, pl. lvii. fig. 2 (1803).

Thalamita prymna, H. M.-Edwards, H. N. Crust. i. p. 461 (1834); Alcock, Journ. As. Soc. Beng. lxxviii. 2, i. pp. 76, 78.

Alcock supports Kossman's view that all the forms of *Thalamita* with an eight-lobed front and a very broad basal joint to the antenna are but varieties of one species (*T. prymna*). The present collection contains no examples of the type, but three varieties are represented.

Var. *PICTA* Stimps., 1858.

Thalamita picta, Stimpson, Proc. Ac. N. Sci. Philad. 1858, p. 39; A. M.-Edwards, Nouv. Arch. Mus. (1) ix. p. 164, pl. iv. fig. 4 (1873); Alcock, Journ. As. Soc. Beng. lxxviii. 2, i. p. 79 (1899).

Rotuma; one male.

Var. *STIMPSONI* A. M.-Edw., 1861.

Thalamita stimpsoni, A. M.-Edwards, Arch. Mus. x. p. 362, pl. xxxv. fig. 4 (1861); Alcock, Journ. As. Soc. Beng. lxxviii. p. 79 (1899).

Var. *SPINIMANA* Dana, 1852.

Thalamita spinimana, Dana, U.S. Expl. Exped., Crust. i. p. 283, pl. xvii. fig. 8 (1852); A. M.-Edw. Arch. Mus. x. p. 364 (1861); id. Nouv. Arch. Mus. (1) ix. p. 165, pl. iv. fig. 5 (1873).

Rotuma; five males.

18. *THALAMITA ADMETE* (Herbst), 1803.

Cancer admete, Herbst, Naturges. Krabb. u. Krebse, iii. 3, p. 40, pl. lvii. fig. 1 (1803).

Thalamita admete, H. M.-Edw. H. N. Crust. i. p. 459 (1834); id. Cuvier's R. An. 2nd ed., Atlas Crust. pl. ix. fig. 2 (no date); Whitelegge, Mem. Austral. Mus. iii. 2, p. 138 (1897).

Thalamita admeta, Alcock, Journ. As. Soc. Beng. lxxviii. 2, i. p. 32 (1899).

Rotuma; three males.

Var. *EDWARDSI*, n. nom.

Thalamita admete, A. M.-Edwards, Arch. Mus. Paris, x. p. 356 (1861).

Alcock (J. As. Soc. Beng. lxxviii. p. 84) points out the existence of three varieties of this species. It is at present convenient to have a name for such forms, and accordingly it is here proposed to call Alcock's var. (2) *edwardsi*, after Prof. A. Milne-Edwards, who described it.

Funafuti; one male.

19. *THALAMITA INTEGR*A Dana, 1852.

Thalamita integra, Dana, Proc. Ac. N. Sci. Philad. 1852, p. 85; id. U.S. Expl. Exped., Crust. i. p. 281, pl. xvii. fig. 6 (1852); Whitelegge, Mem. Austral. Mus. iii. 2, p. 138 (1897); Alcock, Journ. As. Soc. Beng. lxxviii. 2, i. p. 85 (1899).

Funafuti; seven males, six females.

Subfamily CAPHYRINÆ.

Genus CAPHYRA Guérin, 1832.

20. *CAPHYRA ROTUNDIFRONS* (A. M.-Edw.), 1869.

Camptonyx rotundifrons, A. M.-Edwards, Nouv. Arch. Mus. (1) v. p. 156, pl. vii. figs 11 & 12 (1869).

Caphyra rotundifrons, A. M.-Edwards, *Nouv. Arch. Mus.* (1) ix. p. 174 (1873).

Rotuma; fourteen males, five females.

Family XANTHIDÆ.

Subfamily MENIPPINÆ.

Genus PSEUDOZIUS Dana, 1851.

21. PSEUDOZIUS INORNATUS Dana, 1852.

Pseudozius inornatus, Dana, U.S. Expl. Exped., *Crust.* i. p. 234, pl. xiii. fig. 7 (1852).

The colour of this species as preserved in spirit is brown of varying shades with three pale longitudinal stripes on the carapace, indicated in Dana's figure. It is, I think, quite distinct from *P. caystrus* (Ad. & Wh.).

Funafuti; eight males, six females.

22. PSEUDOZIUS CAYSTRUS (Ad. & Wh.), 1848.

Panopæus caystrus, Adams & White, 'Samarang,' *Crust.* p. 42, pl. ix. fig. 2 (1848).

Pseudozius caystrus, Miers, 'Challenger' *Brachyura*, p. 142 (1886); Alcock, *Journ. As. Soc. Beng.* lxxvii. 2, i. p. 181 (1898).

Rotuma; twenty-six males, thirty-eight females.

Funafuti; two males, six females.

Genus MELIA Latr., 1825.

23. MELIA TESSELATA (Latr.).

Grapsus tessellatus, Latreille, *Encycl. Méth.* pl. cccv. fig. 2.

Melia tessellata, Latreille, *Encycl.* x. p. 705 (1825); H. M.-Edwards, *Cuvier's R. An.* ed. 3, *Atlas Crust.* pl. xv. fig. 5 (no date); Dana, U.S. Expl. Exped., *Crust.* i. p. 242, pl. xiv. fig. 1 (1852).

Melia tresselata, H. M.-Edw. *Coll. Mus.* pl. xviii. fig. 8; id. *H. N. Crust.* i. p. 431, pl. xviii. figs. 8, 9 (1834).

Rotuma; two males, five females.

Genus ACTUMNUS Dana, 1851.

24. ACTUMNUS SETIFER (de Haan), 1835.

Cancer (Pilumnus) setifer, de Haan, *Faun. Japon.*, *Crust.* p. 50, pl. iii. fig. 3 (1835).

Actumnus setifer, A. M.-Edwards, *Nouv. Arch. Mus.* (1) i. p. 287, pl. xv. fig. 5 (1865); Alcock, *Journ. As. Soc. Beng.* lxxvii. 2, i. p. 202 (1898).

Fiji; one male.

Genus PILUMNUS Leach, 1815.

25. ? PILUMNUS HIRSUTUS Stimps., 1858. (Plate XLII. fig. 9.)

Pilumnus hirsutus, Stimpson, Proc. Ac. N. Sci. Philad. 1858, p. 37; Alcock, Journ. As. Soc. Beng. lxvii. 2, i. p. 197 (1898).

Owing to this species never having been figured, I am in some doubt as to whether the present specimens are rightly identified. The figure now given will, I hope, serve to clear up the difficulty.

Fiji; ten males, thirteen females.

26. PILUMNUS PRUNOSUS Whitelegge, 1897.

Pilumnus prunosus, Whitelegge, Mem. Austral. Mus. iii. 2, p. 133, pl. vi. fig. 1 (1897).

Funafuti; seven males, two females.

27. PILUMNUS ROTUMANUS, n. sp. (Plate XLI. fig. 6.)

Diagnosis: "A *Pilumnus* with the carapace smooth, the areas fairly well delimited, covered with a fine fur and long hairs; no tubercles on the carapace or limbs except a few obsolete ones on the outside of the wrist; antero-lateral edge with 3 sharp teeth, the first two procurved, the last shorter and straighter; the outer angle of the orbit sharp but not a tooth; the rim of the orbit with two distinct notches, above and below the outer angle, and also a distinct notch on the upper rim; no subhepatic spine; limbs slender, covered with long hair; chelipeds subequal; walking-legs with a spine at the end of the merus and one at a distance of about one third of the length of the joint from the end of its upper edge; hands slender, fingers grooved outside, a spine in front of the wrist and one on the upper edge of the arm."

Breadth of fronto-orbital border : greatest breadth :: 3 : 4.

Length on middle line somewhat less than greatest breadth.

Length, 17 mm.

Colour in spirit, white.

Rotuma; one female.

Subfamily XANTHINÆ.

Genus CYMO de Haan, 1833.

28. CYMO ANDREOSSYI (Aud.), 1826.

Pilumnus andreossyi, Audouin, Savigny's 'Egypte,' p. 86, pl. v. fig. 5 (1826).

Cancer (Cymo) andreossyi, de Haan, Faun. Japon., Crust. p. 22.

Cymo andreossyi, Dana, U.S. Expl. Exped., Crust. i. p. 225, pl. xiii. fig. 2 (1852); Alcock, Journ. As. Soc. Beng. lxvii. 2, i. p. 173 (1898).

Rotuma; one female.

Var. MELANODACTYLUS Dana, 1852.

Cancer (Cymo) melanodactylus, de Haan, Faun. Japon., Crust. p. 22 (1833).

Cymo melanodactylus, Dana, U.S. Expl. Exped., Crust. i. p. 225, pl. xiii. fig. 1 (1852); Alcock, Journ. As. Soc. Beng. lxvii. 2, i. p. 174 (1898).

Cymo andreossyi var. *melanodactylus*, Miers, Zool. 'Alert,' p. 557 (1884).

De Haan appears to have named this variety without describing it.

Funafuti; one male, one female.

Rotuma; one female.

Genus XANTHIAS Rathbun, 1897.

Xanthodes, Dana, Proc. Ac. N. Sci. Philad., May 1852, p. 75; Alcock, Journ. As. Soc. Beng. lxvii. 2, i. p. 156 (1898).

Xantho, Ortmann, Zool. Jahrb. vii. Syst. p. 443 (1893), in part.

Xanthias, Rathbun, Proc. Biol. Soc. Wash. xi. p. 165 (1897).

29. XANTHIAS LAMARCKI (H. M.-Edw.), 1834.

Xantho lamarckii, H. M.-Edwards, H. N. Crust. i. p. 391 (1834).

Xanthodes lamarckii, A. M.-Edwards, Nouv. Arch. Mus. ix. p. 200, pl. vii. fig. 3 (1873); Whitelegge, Mem. Austral. Mus. iii. 2, p. 130 (1897); Alcock, Journ. As. Soc. Beng. lxvii. 2, i. p. 157 (1898).

Funafuti; one female.

Rotuma; one male.

30. XANTHIAS NOTATUS (Dana), 1852.

Xanthodes notatus, Dana, Proc. Ac. N. Sci. Philad. 1852, p. 76; id. U.S. Expl. Exped., Crust. i. p. 178, pl. viii. fig. 12 (1852); Alcock, Journ. As. Soc. Beng. lxvii. 2, i. p. 158 (1898).

Rotuma; one female.

31. XANTHIAS PARVUS, n. sp. (Plate XLI. fig. 5.)

Diagnosis: "A *Xanthias* with the carapace minutely granular, clearly delimited into the areas characteristic of the genus; the antero-lateral edge on each side with four teeth, of which the first two are very low and blunt and the last two somewhat sharper; the front fairly straight, rather deeply notched in the middle line, and separated at its outer ends by shallow notches from the swollen orbital rims; chelipeds unequal, unlike, the larger with the hand more swollen and the fingers less gaping than the smaller, the wrist in both irregularly and coarsely rugose; the hand covered above and outside with fairly sharp conical tubercles, smooth below and inside; the cutting-edges of the fingers close set with bluntish rounded teeth, which in the large hand almost entirely fill up the gap between the fingers, but in the smaller leave a space towards the base of the fingers, the outside of the fingers grooved; the walking-legs stout, with a strong fringe of hairs on the upper edge, the last three joints hairy on the outside, the dactylopodite

rather longer than the propodite and ending in a long, slender, curved claw."

The third maxilliped is shown in fig. 5*a*, and the abdomen of the male in fig. 5*b*.

Colour in spirit brown, fingers darker.

Length 4.5 mm.

Rotuma; two males, four females.

Genus LIOMERA Dana, 1851.

32. LIOMERA RICHTERSI (de Man), 1889.

Actæodes richtersi, de Man, Zool. Jahrb. iv. Syst. p. 412, pl. ix. fig. 2 (1889).

Liomera richtersi, Ortmann, Zool. Jahrb. vii. Syst. p. 451 (1893).

Rotuma; one male.

33. LIOMERA LÆVIS (Dana), 1852.

Zozymus lævis, Dana, U.S. Expl. Exped., Crust. p. 191, pl. ix. fig. 5 (1852).

This species was placed by Dana in the genus *Zozymus*, but appears to belong to *Liomera* by all characters except the cristate form of the fore edge of the carapace.

Rotuma; one male.

Genus ACTÆA de Haan, 1833.

34. ACTÆA TOMENTOSA (H. M.-Edw.), 1834.

Zozymus tomentosus, H. M.-Edwards, H. N. Crust. p. 385 (1834); id. Cuvier's R. An. 3rd ed., Atlas Crust. pl. xi. *bis* fig. 2 (no date).

Actæa tomentosa, A. M.-Edwards, Nouv. Arch. Mus. (1) i. p. 262 (1865); Alcock, Journ. As. Soc. Beng. lxxvii. 2, i. p. 140 (1898).

Rotuma; seven males, seven females.

Fiji; one male.

35. ACTÆA AFFINIS (Dana), 1852.

Actæodes affinis, Dana, U.S. Expl. Exped., Crust. i. p. 197, pl. xi. fig. 3 (1852).

Actæa affinis, A. M.-Edwards, Nouv. Arch. Mus. (1) i. p. 263 (1865).

Rotuma; one male, five females.

36. ACTÆA HIRTISSIMA (Rüppell), 1830.

Xantho hirtissima, Rüppell, 24 Krabben, p. 26, pl. v. fig. 6 (1836).

Cancer (Actæa) hirtissima, de Haan, Faun. Japon., Crust. p. 18 (1833).

Actæa hirtissima, Alcock, Journ. As. Soc. Beng. lxxvii. 2, i. p. 141 (1898).

Rotuma; one male.

37. *ACTÆA RUFOPUNCTATA* (H. M.-Edw.), 1834.

Xantho rufopunctatus, H. M.-Edwards, H. N. Crust. i. p. 389 (1834).

Actæa rufopunctata, A. M.-Edwards, Nouv. Arch. Mus. (1) i. p. 268, pl. xviii. fig. 1 (1865); Alcock, Journ. As. Soc. Beng. lxvii. 2, i. p. 142 (1898).

Rotuma; one female.

38. *ACTÆA SPECIOSA* (Dana), 1852.

Actæodes speciosa, Dana, U.S. Expl. Exped., Crust. i. p. 198, pl. xi. fig. 4 (1852); Whitelegge, Mem. Austral. Mus. iii. 2, p. 136 (1897).

Actæa speciosa, A. M.-Edwards, Nouv. Arch. Mus. (1) i. p. 274 (1865); Alcock, Journ. As. Soc. Beng. lxvii. 2, i. p. 143 (1898).

Rotuma; one female.

39. *ACTÆA FOSSULATA* (Girard), 1859.

Cancer fossulata, Girard, Ann. Soc. Entom. France (3) vii. p. 149, pl. iv. fig. 2 (1859).

Actæa fossulata, A. M.-Edwards, Nouv. Arch. Mus. (1) i. p. 270 (1865); Alcock, Journ. As. Soc. Beng. lxvii. 2, i. p. 148 (1898).

Rotuma; one male.

Genus *DAIRA* de Haan (1833).40. *DAIRA PERLATA* (Herbst), 1790.

Cancer perlatus, Herbst, Naturges. Krabb. u. Krebse, i. viii. p. 265, pl. xxi. fig. 122 (1790).

Daira variolosa, Dana, U.S. Expl. Exped., Crust. i. p. 202, pl. x. fig. 4 (1852).

Daira perlata, Whitelegge, Mem. Austral. Mus. iii. 2, p. 131 (1897); Alcock, Journ. As. Soc. Beng. lxvii. 2, i. p. 155 (1898).

Funafuti; one male, two females.

Genus *ZOZIMUS* Leach, 1818.

On the spelling of the name of this genus, see Rathbun, Proc. Biol. Soc. Wash. xi. p. 167 (1897).

41. *ZOZIMUS ÆNEUS* (Linn.), 1764.

Cancer æneus, Linnæus, Mus. Lud. Ulr. p. 451 (1764).

Zozymus æneus, H. M.-Edwards, H. N. Crust. i. p. 385 (1834); Dana, U.S. Expl. Exped., Crust. i. p. 192, pl. x. fig. 3 (1852); Whitelegge, Mem. Austral. Mus. iii. 2, p. 134 (1877); Alcock, Journ. As. Soc. Beng. lxvii. 2, i. p. 104 (1898).

Rotuma; two males.

Genus ATERGATIS de Haan (1833).

42. ATERGATIS FLORIDUS (Rumph.).

Cancer florilus, Rumph. Amboinsch. Rariteitk. p. 16, pl. viii. fig. 5 (1705); Linnæus, Syst. Nat. 12th ed. p. 1041 (1766).

Cancer (Atergatis) floridus, de Haan, Faun. Japon., Crust. p. 40.
Atergatis floridus, Dana, U.S. Expl. Exped., Crust. i. p. 159, pl. vii. fig. 4 (1852); Whitelegge, Mem. Austral. Mus. iii. 2, p. 129 (1897); Alcock, Journ. As. Soc. Beng. lxvii. 2, i. p. 98 (1898).

Funafuti; one male, two females.

Rotuma; two males, two females.

Subfamily CARPILIINÆ.

Genus CARPILIUS Desmarest, 1825.

43. CARPILIUS MACULATUS (Linn.), 1764.

Cancer maculatus, Linnæus, Mus. Lud. Ulr. p. 433 (1764).

Carpilius maculatus, H. M.-Edwards, H. N. Crust. i. p. 382 (1834); id. Cuvier's R. An. 3rd ed., Atlas Crust. pl. xi. fig. 2 (no date); Alcock, Journ. As. Soc. Beng. lxvii. 2, i. p. 79 (1898).

Rotuma; one female.

44. CARPILIUS CONVEXUS (Forskål), 1775.

Cancer convexus, Forskål, Descr. Anim. p. 88 (1775).

Carpilius convexus, Rüppell, Krabben roth. Meer. p. 13, pl. iii. fig. 2, & pl. vi. fig. 6 (1830); Alcock, Journ. As. Soc. Beng. lxvii. 2, i. p. 80 (1898).

Rotuma; two males.

Genus CARPILIODES Dana, 1851.

45. CARPILIODES TRISTIS Dana, 1852.

Carpiliodes tristis, Dana, U.S. Expl. Exped., Crust. i. p. 193, pl. ix. fig. 7 (1852); Alcock, Journ. As. Soc. Beng. lxvii. 2, i. p. 82 (1898).

Rotuma; two males.

46. CARPILIODES VAILLIANTIANUS (A. M.-Edw.), 1862.

Carpilioxanthus vailliantianus, A. M.-Edwards, Mailliard's 'Réunion,' Annexe F, p. 3 (1862).

Carpiliodes vailliantianus, A. M.-Edwards, Nouv. Arch. Mus. (1) i. p. 231. pl. xi. fig. 3 (1865); Alcock, Journ. As. Soc. Beng. lxvii. 2, i. p. 85 (1898).

Rotuma; one male, two females.

47. CARPILIODES MONTICULOSUS A. M.-Edw., 1873.

Carpiliodes monticulosus, A. M.-Edwards, Nouv. Arch. Mus. (1)

ix. p. 181, pl. v. fig. 1 (1873); Alcock, Journ. As. Soc. Beng. lxxvii. 2, i. p. 86 (1898).

Rotuma; one male.

48. *CARPILIODES PALLIDUS*, n. sp. (Plate XL. fig. 3.)

Diagnosis: "A *Carpiliodes* the length of whose carapace is to the greatest breadth as 7: 11, with the carapace covered with vesiculous granules, lobulated as in *C. monticulosus*, but with the furrows not so deep; the front slightly sinuous, with a sharp, but not very deep, notch in the middle, extending at its outer ends in front of the orbital rims, from which it is separated by transverse grooves: the chelipeds equal, alike, above and outside granular like the rest of the body and limbs, below smooth; on the outside of the hands five more or less distinct grooves, of which the two lower run on to the immoveable finger and the upper one on to the moveable finger, while the middle two are less distinct than the others; the cutting-edges of the fingers with several blunt conical teeth, which are set closer together on the immoveable than on the moveable finger. The walking-legs granular, with a few scattered hairs; the propodites very short and broad; the dactylopodites about equal to the propodites in length, armed at the end with a rather short, almost straight claw."

The third maxilliped is shown in fig. 3*a*, and the abdomen of the male in fig. 3*b*.

Colours in spirit: carapace white; walking-legs pink, with the dactyle and half the propodite white; chelipeds pink, with the fingers white or pale brown with pink bases.

Length 3.5 mm.

The most characteristic feature of the species is its coloration; in most respects it shows a considerable resemblance to *C. monticulosus*.

Rotuma; three males, one female.

Genus *EUXANTHUS* Dana, 1851.

49. *EUXANTHUS MELISSA* (Herbst), 1801.

Cancer melissa, Herbst, Naturges. Krabb. u. Krebse, iii. 2. p. 7, pl. li. fig. 1 (1801).

Euxanthus melissa, Stimpson, Proc. Ac. Sci. Philad. 1858, p. 33; Alcock, Journ. As. Soc. Beng. lxxvii. 2, i. p. 110 (1898).

Euxanthus mamillatus, A. M.-Edwards, Nouv. Arch. Mus. (1) i. p. 193, pl. xv. fig. 2 (1865).

The fingers of this species are hollowed at the tip as stated by Alcock (p. 110). In his generic key (p. 75) the same author says that the fingers in this genus are pointed.

Rotuma; three males, two females.

Genus *CHLORODIUS* H. M.-Edw., 1834.

Chlorodius, Rüppell, Krabben roth. Meer. p. 20 (1830).

Chlorodius, H. M.-Edwards, H. N. Crust. i. p. 399 (1834); Alcock, Journ. As. Soc. Beng. lxxvii. 2, i. p. 159 (1898).

Chlorodiella, Rathbun, Proc. Biol. Soc. Wash. xi. p. 157 (1897);
Ortmann, Broun's 'Thier-reich,' v. 2, p. 1172 (1899).

Not *Clorodius* Desmarest, 1823; de Haan, 1833.

I am unable to agree with Rathbun and Ortmann as to the necessity for a new name for this genus, and prefer to follow Alcock in considering that Milne-Edwards's name holds good.

50. *CHLORODIUS NIGER* (Forskål), 1775.

Cancer niger, Forskål, Descr. Anim. p. 89 (1775).

Clorodius niger, Rüppell, Krabben roth. Meer. p. 20, pl. iv. fig. 7 & pl. vi. fig. 14.

Chlorodius niger, H. M.-Edwards, H. N. Crust. i. p. 401 (1834);
Alcock, Journ. As. Soc. Beng. lxxvii. 2, i. p. 160 (1898).

The lobes of the antero-lateral edge in all the specimens are low and rounded, and not procurved into spines.

Funafuti; one male, one female.

Rotuma; five males, four females.

51. *CHLORODIUS BARBATUS*, n. sp. (Plate XLI. fig. 4.)

Diagnosis: "A small *Chlorodius* with the areas of the carapace faintly demarked; chelipeds unequal; the fingers of the large hand widely gaping, less strongly toothed than in *C. lævissimus* Dana 1852, and more hollowed at the tip; the large hand bearing a tuft of hairs at the base of the fingers on the outside, hiding the proximal part of the fingers; the first tooth of the antero-lateral edge wanting altogether, and not, as in *C. lævissimus*, merely obsolescent."

The third maxilliped is shown in fig. 4*a*, and the abdomen of the male in fig. 4*b*.

Colour in spirit: white with brown fingers.

Measurements of largest specimen (a male): length 4.5 mm.; tip to tip of longest side-teeth 7 mm.; front 7 mm.; fronto-orbital breadth 6 mm.

The species is closely allied to *C. lævissimus* Dana, but differs from it in several points indicated in the definition.

Funafuti; thirty-five males and twenty-four females, all but one male from 15-25 fathoms.

Rotuma; eleven males, seven females.

Genus *PHYMODIUS* A. M.-Edw., 1863.

52. *PHYMODIUS UNGULATUS* (H. M.-Edw.), 1834.

Chlorodius unguatus, H. M.-Edwards, H. N. Crust. i. p. 400, pl. xvi. figs. 6-8 (1834).

Phymodius unguatus, A. M.-Edwards, Nouv. Arch. Mus. (1) ix. p. 218 (1873); Alcock, Journ. As. Soc. Beng. lxxvii. 2, i. p. 102 (1898).

Rotuma; two males.

Subfamily ETISINÆ.

Genus ETISUS, H. M.-Edw., 1834.

53. ETISUS LEVISSIMUS Randall, 1839.

Etisus levissimus, Randall, Journ. Ac. Nat. Sci. Philad. 1839, p. 115; Dana, U.S. Expl. Exped., Crust. i. p. 185, pl. x. fig. 1 (1852); Whitelegge, Mem. Austral. Mus. iii. 2, p. 131 (1897); Alcock, Journ. As. Soc. Beng. lxvii. 2, i. p. 131 (1898).

Rotuma; one male.

Genus ETISODES Dana, 1851.

54. ETISODES ANAGLYPTUS (H. M.-Edw.), 1834.

Etisus anaglyptus, H. M.-Edwards, H. N. Crust. i. p. 411 (1834).

Cancer anaglyptus, H. M.-Edwards, Cuvier's R. An. 3rd ed., Atlas Crust. pl. xi. fig. 4 (1849).

Etisodes anaglyptus, A. M.-Edwards, Nouv. Arch. Mus. (1) ix. p. 235 (1873); Alcock, Journ. As. Soc. Beng. lxvii. 2, i. p. 133 (1898).

Rotuma; one male.

55. ETISODES FRONTALIS Dana, 1852.

Etisodes frontalis, Dana, U.S. Expl. Exped., Crust. i. p. 187, pl. ix. fig. 3 (1852).

A small fifth tooth may be present or absent on the antero-lateral edge of the carapace in this species.

Rotuma; sixteen males, six females.

Genus CHLORODOPSIS A. M.-Edw., 1873.

56. CHLORODOPSIS SPINIPES (Heller), 1861.

Pilodius spinipes, Heller, Abh. zool.-bot. Ges. Wien, 1861, p. 11.

Chlorodopsis spinipes, A. M.-Edwards, Nouv. Arch. Mus. (1) ix. p. 230, pl. viii. fig. 6 (1873); Alcock, Journ. As. Soc. Beng. lxvii. 2, i. p. 169 (1898).

Funafuti; two males, dredged in the lagoon in 15-25 fathoms of water.

57. CHLORODOPSIS (CYCLODIUS) ORNATA (Dana), 1852.

Cyclodius ornatus, Dana, Proc. Ac. N. Sci. Philad. 1852, p. 30; id. U.S. Expl. Exped., Crust. i. p. 223, pl. xii. fig. 11 (1852).

Chlorodopsis (Cyclodius) ornata, Alcock, Journ. As. Soc. Beng. lxvii. 2, i. p. 171 (1893).

Funafuti; one male.

Rotuma; one male.

Subfamily OZIINÆ.

Genus EURUPPELLIA Dana, 1851.

58. EURUPPELLIA ANNULIPES (H. M.-Edw.), 1834.

Ruppellia annulipes, H. M.-Edwards, H. N. Crust. i. p. 422 (1834); Dana, U.S. Expl. Exped., Crust. i. p. 240, pl. xix. fig. 4 (1852); Whitelegge, Mem. Austral. Mus. iii. 2, p. 137 (1897).

Euruppellia annulipes, Miers, Zool. 'Alert,' p. 523 (1884).

Ozius (*Euruppellia*) *annulipes*, Alcock, Journ. As. Soc. Beng. lxvii. 2, i. p. 188 (1898).

Rotuma; five females.

Subfamily ERIPHIINÆ.

Genus ERIPHIA, Latr.

59. ERIPHIA LÆVIMANA Latr.

Eriphia lævimana, Latreille, Coll. Mus. (fide H. M.-Edw.); Dana, U.S. Expl. Exped., Crust. i. p. 249, pl. xiv. fig. 7 (1852); Whitelegge, Mem. Austral. Mus. iii. 2, p. 137 (1897); Alcock, Journ. As. Soc. Beng. lxvii. 2, i. p. 214 (1898).

Funafuti; two males, one female.

Rotuma; two males, three females.

60. ERIPHIA SCABRICULA Dana, 1852.

Eriphia scabricula, Dana, Proc. Ac. N. Sci. Philad. 1852, p. 82; id. U.S. Expl. Exped., Crust. i. p. 247, pl. xiv. fig. 5 (1852); Whitelegge, Mem. Austral. Mus. iii. 2, p. 137 (1897); Alcock, Journ. As. Soc. Beng. lxvii. 2, i. p. 216 (1898).

Funafuti; seven males, five females.

Rotuma; two males.

Subfamily TRAPEZIINÆ.

Ortmann's revision of this very difficult little group¹ is the authority followed in the present report.

Genus TRAPEZIA Latr., 1825.

61. TRAPEZIA FERRUGINEA Latr., 1825.

Trapezia ferruginea, Latreille, Encycl. Méth. x. p. 695 (1825); Ortmann, Zool. Jahrb. x. Syst. 2, p. 205 (1897); Alcock, Journ. As. Soc. Beng. lxvii. 2, i. p. 220 (1893).

Var. TYPICA Ortm. 1897.

Trapezia ferruginea, Latreille, Alcock, *ll. cit.*

Trapezia ferruginea typica, Ortmann, *loc. cit.* pp. 203, 205.

¹ Ortmann, Zool. Jahrb. x. Syst. 2, p. 201 (1897).

Trapezia cymodoce, Dana, U.S. Expl. Exped., Crust. i. p. 257, pl. xiv. fig. 5 (1852); Whitelegge, Mem. Austral. Mus. iii. 2, p. 137 (1897).

Funafuti; two males and one female. Of these one male and one female from 30 fathoms.

Rotuma; two males.

Var. *DENTATA* (Macleay), 1838.

Grapsillus dentatus, Macleay, Smith's Illustr. Zool. S. Afr., Annulosa, p. 67 (1838).

Trapezia ferruginea, Dana, U.S. Expl. Exped., Crust. i. p. 260, pl. xvi. fig. 1 (1852); Whitelegge, Mem. Austral. Mus. iii. 2, p. 137 (1897).

Trapezia dentata, Dana, U.S. Expl. Exped., Crust. i. p. 258, pl. xvi. fig. 6 (1852).

Trapezia ferruginea dentata, Ortmann, *loc. cit.* pp. 203, 204.

Funafuti; one male.

Rotuma; one male, two females.

Var. *AREOLATA* Dana, 1852.

Trapezia areolata, Dana, U.S. Expl. Exped., Crust. i. p. 259, pl. xv. fig. 8 (1852).

Trapezia ferruginea areolata, Ortmann, *loc. cit.* pp. 203, 206.

Funafuti; one male, one female, the latter from 15 fathoms.

Rotuma; five males, five females.

Var. *GUTTATA* Rüppell, 1830.

Trapezia guttata, Rüppell, Krabben roth. Meer. p. 27 (1830); Miers, 'Challenger' Brachyura, p. 166, pl. xii. fig. 1 (1886).

Trapezia ferruginea guttata, Ortmann, *loc. cit.* pp. 203, 205.

Funafuti; one male.

Rotuma; three males, two females.

Var. *MACULATA* (Macleay), 1838.

Grapsillus maculatus, Macleay, Smith's Illustr. Zool. S. Afr., Annulosa, p. 67 (1838).

Trapezia maculata, Dana, U.S. Expl. Exped., Crust. i. p. 256, pl. xv. fig. 4 (1852); Alcock, Journ. As. Soc. Beng. lxxvii. 2, i. p. 221 (1898).

Trapezia ferruginea maculata, Ortmann, *loc. cit.* pp. 203, 206.

Rotuma; one male.

62. *TRAPEZIA DIGITALIS* Latr., 1825.

Trapezia digitalis, Latreille, Encycl. Méth. x. p. 696 (1825); Ortmann, *loc. cit.* pp. 203, 208; Alcock, Journ. As. Soc. Beng. lxxvii. 2, i. p. 232 (1898).

According to Ortmann the typical form of this species has been found only off the East Coast of Africa, namely, in the Red Sea and at Mauritius. Those from more easterly localities differ in colour. What the difference is Ortmann does not state.

Alcock includes in his definition of *T. digitalis* the fact that it is of a blackish-brown colour. My examples are of precisely the same coloration as the type variety of *T. ferruginea*.

Funafuti; two males.

Var. SPECIOSA Dana, 1852.

Trapezia speciosa, Dana, U.S. Expl. Exped., Crust. i. p. 253, pl. xv. fig. 1 (1852).

Trapezia digitalis speciosa, Ortmann, *loc. cit.* pp. 203, 208.

Funafuti; two females.

Rotuma; one female.

63. TRAPEZIA CYMODOCE (Herbst), 1801.

Cancer cymodoce, Herbst, *Naturg. Krabb. u. Krebse*, iii. 2, p. 22, pl. li. fig. 5 (1801).

Trapezia hirtipes, Jacquinet and Lucas, *Crust. of 'Astrolabe'*, iii. p. 44, pl. iv. fig. 14 (1853).

Trapezia cymodoce, Gerstäcker, *Arch. Naturg.* xxii. 1, p. 125 (1856); Ortmann, *loc. cit.* p. 203; Alcock, *Journ. As. Soc. Beng.* lxvii. 2, i. p. 219 (1898).

Funafuti; four males, three females, from various depths up to 30 fathoms.

Rotuma; two males, two females.

Genus TETRALIA Dana, 1851.

64. TETRALIA GLABERRIMA (Herbst), 1790.

Cancer glaberrimus, Herbst, *Naturg. Krabb. u. Krebse*, i. 8, p. 262, pl. xx. fig. 15 (1790).

Tetralia nigrifrons and *glaberrima*, Dana, U.S. Expl. Exped., *Crust. i.* pp. 262, 263, pl. xvi. figs. 2, 3 (1852).

Tetralia cavimana, Heller, *S.B. Ak. Wiss. Wien*, xliii. p. 353, pl. iii. figs. 24, 25 (1861); Whitelegge, *Mem. Austral. Mus.* iii. 2, p. 138 (1897).

Tetralia glaberrima, Ortmann, *loc. cit.* p. 209; Alcock, *Journ. As. Soc. Beng.* lxvii. 2, i. p. 223 (1898).

Funafuti; twelve males, fourteen females. Only one specimen (a female) had not the coloration of Dana's *nigrifrons*. This one agreed with Dana's *glaberrima* in all respects.

Rotuma; three males, four females, all agreeing with Dana's *nigrifrons*.

Subtribe CATOMETOPA.

Family GRAPSIDÆ.

Subfamily PLAGUSIINÆ.

Genus PLAGUSIA Latr., 1806.

65. PLAGUSIA SPECIOSA Dana, 1851.

Plagusia speciosa, Dana, *Proc. Ac. N. Sci. Philad.* 1851, p. 252;
39*

id. U.S. Expl. Exped., Crust. i. p. 369, pl. xxiii. fig. 9 (1852); Miers, Ann. Mag. N. H. (5) i. p. 151 (1878); Kingsley, Proc. Ac. N. Sci. Philad. 1880, p. 223.

Funafuti; one male.

Rotuma; one male.

Genus LEIOLOPHUS Miers, 1876.

66. LEIOLOPHUS PLANISSIMUS (Herbst), 1804.

Cancer planissimus, Herbst, Naturg. Krabb. u. Krebse, iii. 4, pl. lix. fig. 3 (1804).

Plagusia serripes, Lamarck, An. sans Vert. p. 247 (1818).

Leiolophus planissimus, Miers, Cat. N. Z. Crust. p. 46 (1876); id. Ann. Mag. N. H. (5) i. p. 153 (1878); Whitelegge, Mem. Austral. Mus. iii. 2, p. 139 (1897).

Funafuti; two females.

Rotuma; three males, three females.

Subfamily GRAPSINÆ.

Genus GRAPSUS Lam., 1801.

67. GRAPSUS MACULATUS (Catesby), 1771.

Cancer grapsus, Linnæus, Syst. Nat. 18th ed. p. 630 (1758).

Pagurus maculatus, Catesby, Nat. Hist. Carolinas, 3rd ed., ii. pl. xxxvi. fig. 1 (1771).

Grapsus pictus, Latreille, Hist. Crust. Ins. vi. p. 69, pl. xlvii. fig. 2 (1803).

Grapsus maculatus, *webbi*, *ornatus*, and *pharaonis*, H. M.-Edw. Ann. Sci. Nat. (3) xx. pp. 167-8, pl. vi. fig. 1 (1853).

Grapsus maculatus, Kingsley, Proc. Ac. N. Sci. Philad. 1880, p. 192; Whitelegge, Mem. Austral. Mus. iii. 2, p. 139 (1897).

Rotuma; one male.

Genus PACHYGRAPSUS Randall, 1839.

68. PACHYGRAPSUS MINUTUS A. M.-Edw., 1873.

Pachygrapsus minutus, A. M.-Edwards, Nouv. Arch. Mus. (1) ix. p. 292, pl. xiv. fig. 2 (1873).

Fiji; five males, six females.

69. PACHYGRAPSUS LÆVIS, n. sp. (Plate XLII. fig. 7.)

Diagnosis: "A *Pachygrapsus* with the front almost straight, very slightly concave; the frontal lobes seven in number—the median small and triangular, the submedians large, square, and placed before those on either side of them, the sublaterals smaller, triangular, not so far forward, the laterals large, rounded, and the most forwardly placed of all; the carapace smooth, with linear

ridges on the branchial regions and faint transverse markings on the front; no tooth behind that forming the orbital angle; the chelipeds smaller than in *P. minutus*, the hands less swollen, a ridge running along the lower part of the hand and continued on to the finger; the fingers spoon-like at the ends, which are fringed with short stiff hairs, the arm bearing at its distal end on the inner side a crest of three teeth, the wrist with a spine on the outside at the distal end; the legs slender and almost hairless; the meropodite of the walking-legs with one tooth above and two below at the outer end; the propodite slenderer than in *P. minutus*."

The third maxilliped is shown in fig. 7 a.

Colour in spirit: greenish, banded on the legs with brown.

Length 6 mm. Front 5 mm.; tip to tip of orbital spines 7.5 mm.

This species belongs to the group with no tooth behind the orbital angle, including *P. corrugatus* Martens 1872, *P. aethiopicus* Hilg. 1869, *P. minutus* A. M.-Edw. 1873, *P. plicatus* H. M.-Edw. 1837, and *P. longipes* Rathbun 1893.

Funafuti; one female.

Genus GEOGRAPSUS Stimps., 1858.

70. GEOGRAPSUS GRAYI (H. M.-Edw.), 1853.

Grapsus grayi, H. M.-Edwards, Ann. Sci. Nat. (3) xx. p. 170 (1853).

Geograpsus rubidus, Stimpson, Proc. Ac. N. Sci. Philad. 1858, p. 103.

Geograpsus grayi, H. M.-Edwards, Nouv. Arch. Mus. (1) ix. p. 288 (1873); Kingsley, Proc. Ac. N. Sci. Philad. 1880, p. 196.

Funafuti; two males, four females.

Rotuma; one male, one female.

Subfamily SESARMINÆ.

Genus SESARMA Say, 1818.

71. SESARMA AUBRYI A. M.-Edw., 1819.

Sesarma (Holometopus) aubryi, A. M.-Edwards, Nouv. Arch. Mus. (1) v. Bull. p. 29 (1869); (1) ix. p. 307, pl. xvi. fig. 2 (1873).

Sesarma aubryi, de Man, Zool. Jahrb. ii. Syst. 3, p. 642 (1887).

Rotuma; one male.

72. SESARMA GARDINERI, n. sp. (Plate XLII. fig. 8.)

Diagnosis. "A *Sesarma* in which the front is half the fronto-orbital breadth, the latter rather less than the length of the carapace; the front hidden from above by the frontal lobes, the frontal edge divided into five shallow bights by four projections, not denticulate; the frontal lobes prominent, sharp, denticulate, the

inner pair much larger than the outer; the carapace irregularly granular, the granules largest just behind the frontal lobes, the branchial regions rugose; the sides with two teeth behind the orbital angle, the second tooth low and blunt; the walking-legs long and slender, their meropodites rugose with denticulate edges, bearing at the outer end two teeth above and none below and on the hinder side a low, rounded ridge, their carpopodites with two sharper ridges, their propodites long and flat, their dactylopodites broad and flat, diminishing gradually to a long straight spine, and having the edges hidden by a thick fur; the upper side of the hand in both sexes with two subparallel denticulate ridges, the inner less regular than the outer, and the two meeting at both ends so as to enclose an oval field, in which two or three tubercles may lie; the fingers rather shorter than the palm in the female, distinctly so in the male."

The third maxilliped and the abdomen of the male are shown in figs. 8 a and 8 b respectively.

Length 31 mm. Breadth of fronto-orbital border 27 mm.

The animal is described in Mr. Gardiner's notes as a "red tree-crab." The colour in spirit is an orange-yellow.

This species is not far from *S. oceanica* de Man, 1889, in Group II. of that author's classification of the genus [Zool. Jahrb. ii. Syst. 3, p. 639 (1887)], but differs in the ridges on the hand and in the more hairy dactyles.

Funafuti; three males, three females.

Rotuma; three males, one female.

Subfamily GECARCININÆ.

Genus CARDIOSOMA Latr., 1825.

73. *CARDIOSOMA HIRTIPES* Dana, 1852.

Cardiosoma hirtipes, Dana, U.S. Expl. Exped., Crust. i. p. 376, pl. xxiv. fig. 2 (1852); de Man, Arch. Naturg. liii. 1, p. 349, pl. xiv. fig. 3 (1887); Ortmann, Zool. Jahrb. vii. Syst. p. 737 (1894); Whitelegge, Mem. Austral. Mus. iii. 2, p. 138 (1897).

Funafuti; three males, five females.

Rotuma; one male, one female.

74. *CARDIOSOMA CARNIFEX* (Herbst), 1796.

Cancer carnifex, Herbst, Naturg. Krabb. u. Krebse, ii. 6, p. 163, pl. xli. fig. 7 (1796).

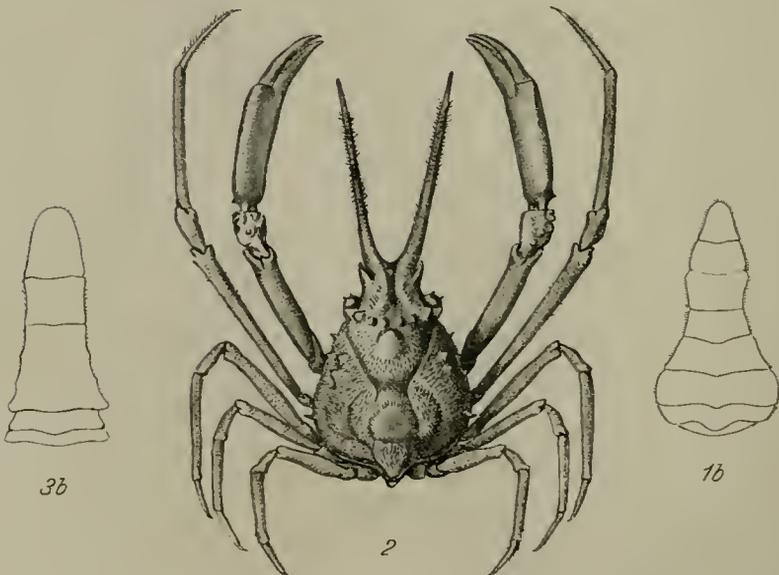
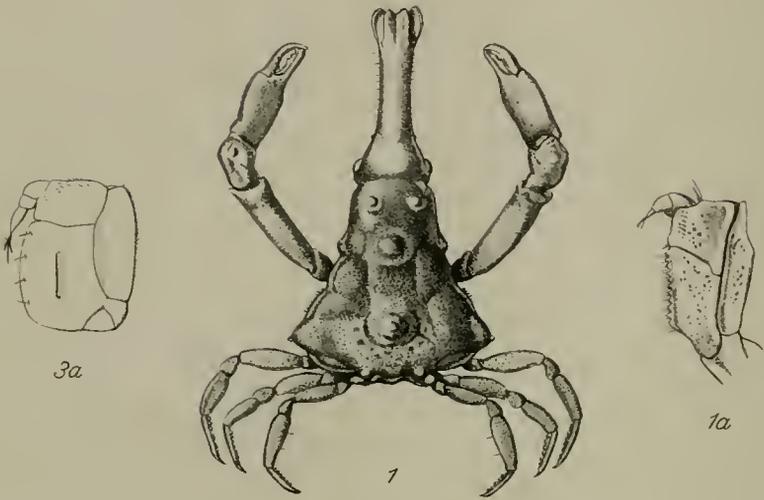
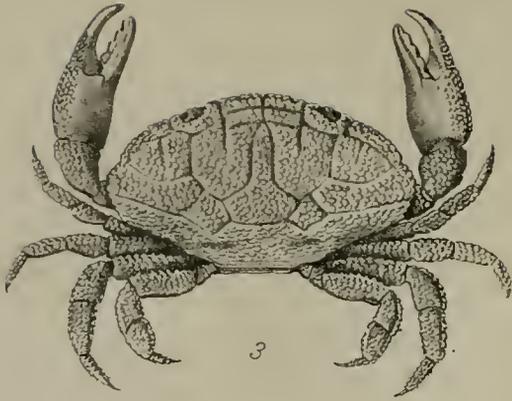
Cardiosoma carnifex, Latreille, Encycl. Méth. x. p. 685 (1825); Miers, 'Chall.' Brachyura, p. 220 (1886).

Cardiosoma guanhami, var. *carnifex*, Ortmann, Zool. Jahrb. vii. Syst. p. 735 (1894).

Cardiosoma obscura, Dana, U.S. Expl. Exped. p. 375, pl. xxiv. fig. 1 (1852).

Rotuma; one female.





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Family OCYPODIDÆ.

Subfamily OCYPODINÆ.

Genus UCA Leach, 1814.

Uca, Leach, Edin. Encycl. vii. 2 (1814); id. Tr. Linn. Soc. Lond. xi. p. 309 (1815); Say, Journ. Ac. N. Sci. Philad. i. p. 73 (1817); Rathbun, Proc. Biol. Soc. Wash. xi. p. 154 (1897); Ortmann, Zool. Jahrb. x. Syst. p. 346 (1897); id. in Bronn's 'Thier-reich,' v. 2, p. 1180 (1897).

Gelasimus, Latreille, Nouv. Dict. Hist. Nat. xii. p. 517 (1817).

Not *Uca* Latreille, 1817 = *Ucides* Rathbun, June 1897 = *Ædipleura* Ortmann, July 1897.

75. UCA CULTRIMANA (White), 1847.

Gelasimus cultrimanus, White, P. Z. S. Lond. 1847, p. 84; Kingsley, Proc. Ac. N. Sci. Philad. 1880, p. 140, pl. ix. fig. 7.

Gelasimus vocans, H. M.-Edwards, Ann. Sci. Nat. (3) xviii. p. 145, pl. iii. fig. 4 (1852).

Uca cultrimana, Ortmann, Zool. Jahrb. x. Syst. p. 348 (1897).

Funafuti; three females.

Rotuma; five males, four females.

Genus OCYPODE Fabr., 1798.

76. OCYPODE CERATOPHTHALMA (Pallas), 1772.

Cancer ceratophthalmus, Pallas, Spicilegia, p. 83, pl. v. fig. 17 (1772).

Ocypoda ceratophthalma, Fabricius, Ent. Syst. Suppl. p. 347 (1798); H. M.-Edwards, Cuvier's R. An., Atlas Crust. pl. xvii.; Whitelegge, Mem. Austral. Mus. iii. 2, p. 138 (1897); Ortmann, Zool. Jahrb. x. Syst. p. 365 (1899).

Rotuma; seven males, seven females.

77. OCYPODE URVILLEI Guérin, 1830.

Ocypoda urvillei, Guérin, Voy. 'Coquille,' Zool. ii. 2, p. 9, pl. i. fig. 1 (1830); Ortmann, Zool. Jahrb. x. Syst. p. 366, pl. xvii. fig. 10 (1897).

The fingers and the spine on the inner side of the wrist are both more slender and elongate in the present specimen than in Ortmann's figures.

Funafuti; one male.

EXPLANATION OF THE PLATES.

PLATE XL.

- Fig. 1. *Xenocarcinoides rostratus*, p. 573. ×3.
 1 a. " " 3rd maxilliped. ×8.
 1 b. " " Abdomen of male. ×6.
 2. *Hyastenus elegans* Miers, var., p. 574. ×1½.
 3. *Carpiliodes pallidus*, p. 586. ×5.
 3 a. " " 3rd maxilliped. ×10.
 3 b. " " Abdomen of male. ×10.

PLATE XLI.

- Fig. 4. *Chlorodius barbatus*, p. 587. $\times 6$.
 4 a. " " 3rd maxilliped. $\times 10$.
 4 b. " " Abdomen of male. $\times 10$.
 4 c. " " Big chela of male. $\times 6$.
 5. *Xanthias parvus*, p. 582. $\times 5$.
 5 a. " " 3rd maxilliped. $\times 6$.
 5 b. " " Abdomen of male. $\times 6$.
 6. *Pilumnus rotumanus*, p. 581. Nat. size.
 6 a. " " 3rd maxilliped. $\times 3$.

PLATE XLII.

- Fig. 7. *Pachygrapsus lævis*, p. 592. $\times 3$.
 7 a. " " 3rd maxilliped. $\times 5$.
 8. *Sesarma gardineri*, p. 593. Nat. size.
 8 a. " " 3rd maxilliped. $\times 2$.
 8 b. " " Abdomen of male. Nat. size.
 8 c. " " Chelæ of male. $\times 1\frac{1}{2}$.
 9. ? *Pilumnus hirsutus* Stimps., p. 581. $\times 3$.
 9 a. " " " 3rd maxilliped. $\times 5$.
 9 b. " " " Abdomen of male. $\times 3$.

3. On the Birds collected during the Mackinder Expedition to Mount Kenya. By R. BOWDLER SHARPE. With Notes by H. J. MACKINDER, ERNEST SAUNDERS, and C. CAMBURN.

[Received April 24, 1900.]

(Plate XLIII.)

[The birds here enumerated were shot by my colleagues Messrs. Campbell, B. Hausburg, Ernest Saunders, Claude Camburn, and César Ollier. They were most excellently preserved and packed by Messrs. Saunders and Camburn. For the position of the Camps referred to, see map in Geogr. Journal, vol. xv. p. 453 (1900).—H. J. M.]

1. FRANCOLINUS SCHUETTI.

Francolinus schuetti, Cab.: Ogilvie Grant, Cat. B. Brit. Mus. xxii. p. 170 (1893); Shelley, B. Africa, i. p. 180 (1896); Sharpe, Hand-l. B. i. p. 25 (1899).

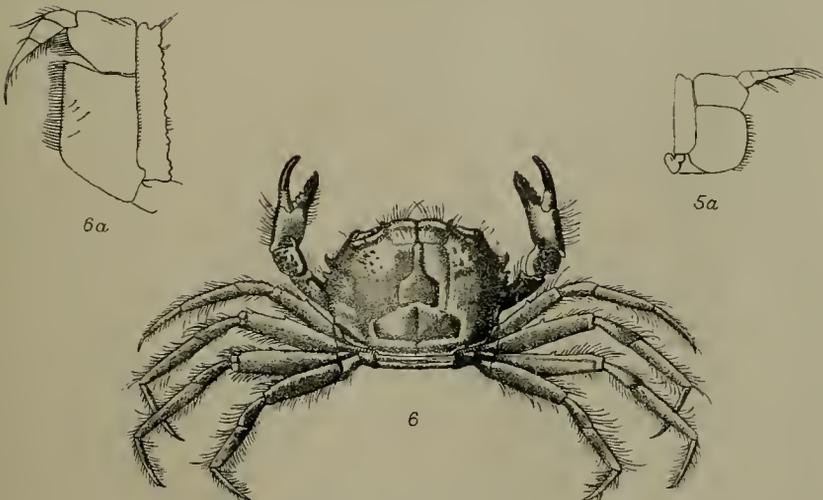
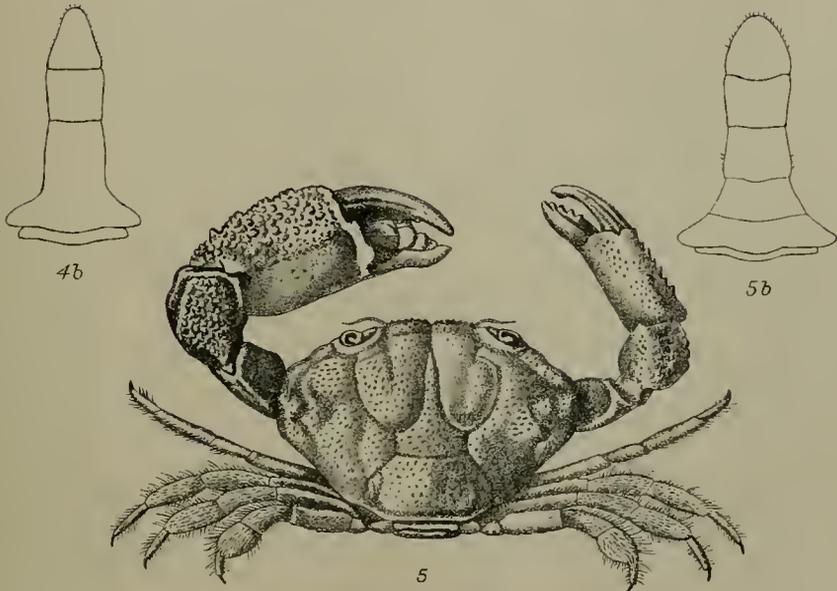
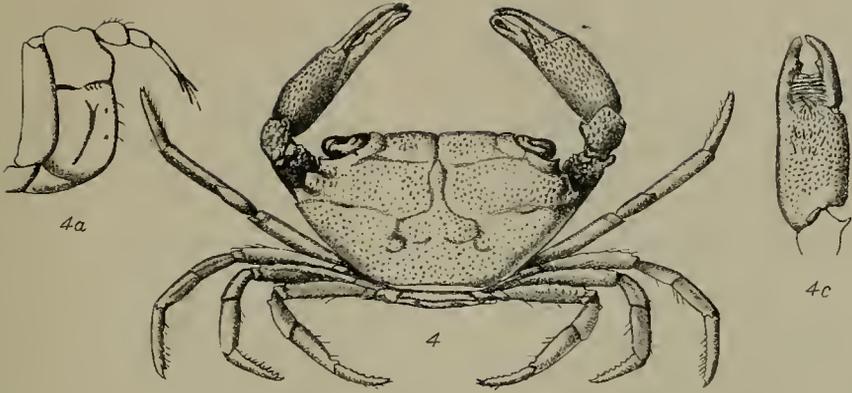
No. 9. ♀. Nairobi, 5500 feet, Sept. 13, 1899. Legs and feet bright red; bill bright red; eye hazel; fleshy parts around eye pale pink.

Uncommon, but known to Masai natives as "Lu-cu-ri."

2. FRANCOLINUS JACKSONI.

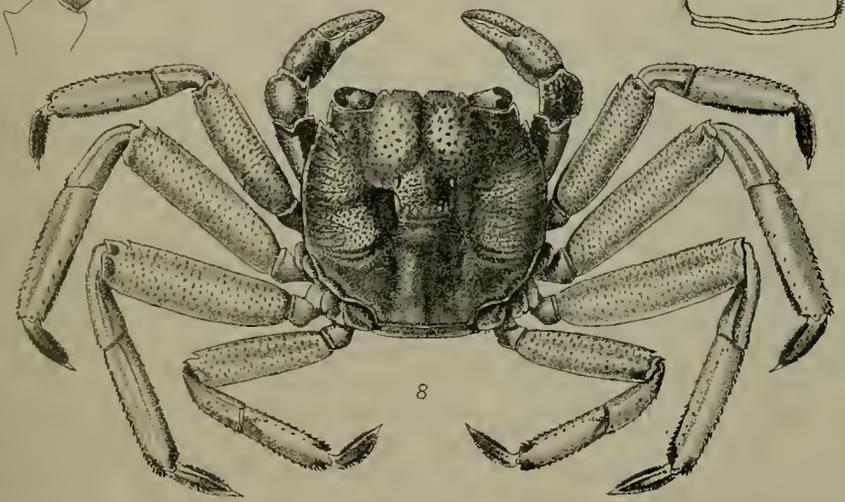
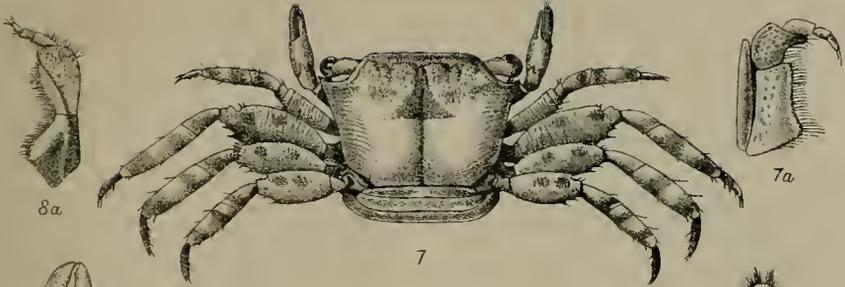
Francolinus jacksoni, Ogilvie Grant: Sharpe, Ibis, 1892, p. 552; id. Hand-l. B. i. p. 25 (1899); Shelley, B. Africa, i. p. 182 (1896).

No. 32. ♀. Foot of Mount Kenya, Aug. 16, 1899. Iris dark brown; bill and feet reddish brown.



E Wilson, Lith Cambridge











G. E. Lodge

G. E. Lodge del. et lith.

Mintern Bros. imp.

BUBO MACKINDERI

3. *PTERNISTES INFUSCATUS*.

Pternistes infuscatus, Cab.: Sharpe, Ibis, 1892, p. 552; id. Hand-l. B. i. p. 26 (1899); Shelley, B. Africa, i. p. 179 (1896).

No. 30. ♂. Shot on the march to Camp 12, Aug. 10, 1899. Eyes dark brown; bill dark brown; legs and feet black; fleshy parts around eyes and throat vermilion-red; neck bright yellow.

4. *NUMIDA REICHENOWI*.

Numida reichenowi, Ogilvie Grant, Ibis, 1894, p. 536, fig. 1; Shelley, B. Africa, i. p. 183 (1896); Sharpe, Hand-l. B. i. p. 41 (1899).

No. 111. ♀. Shot at Camp 29 on the Morendat River, Sept. 26, 1899. Alt. 7000 feet. Iris hazel; bill horn-colour; wattles and horn red; base of horn yellow-ochre; bare skin around eyes, chin, throat, nape, and neck cobalt-blue; legs and feet black.

Common, and to be seen in various sized flocks, and always near water. We saw these birds at an altitude of over 7000 feet; they were very nice-eating.

5. *HAPLOPELIA BRONZINA*.

Haplopelis bronzina (Rüpp.): Salvad. Cat. B. Brit. Mus. xxi. p. 540 (1893); Shelley, B. Africa, i. p. 136 (1896); Sharpe, Hand-l. B. i. p. 85 (1899).

No. 95. ♀ ad. Forest zone, Mount Kenya (8000 feet), Sept. 18, 1899. Bill black; legs, feet, and eyelids lake-red; iris hazel.

The only specimen of its kind seen during the eight days' stay in this camp.

6. *ARDEA MELANOCEPHALA*.

Ardea melanocephala, Vig. & Childr.: Sharpe, Cat. B. Brit. Mus. xxvi. p. 70 (1898); id. Hand-l. B. i. p. 194 (1899); Shelley, B. Africa, i. p. 157 (1896).

No. 28. ♂. Shot July 8, 1899, Camp 11, Sagana River. Eyes pale yellow; fleshy parts around eyes mottled greenish yellow; bill, legs, and feet black.

7. *ALOPOCHEN ÆGYPTIACUS*.

Chenalopex ægyptiacus, (Linn.): Salvad. Cat. B. Brit. Mus. xxvii. p. 167 (1895); Shelley, B. Africa, i. p. 171 (1896).

Alopochen ægyptiacus, Sharpe, Hand-l. B. i. p. 215 (1899).

No. 29. ♀. Camp 11, Sagana River, Aug. 7, 1899. Iris yellow-ochre; feet white; bill pale bluish white.

The Egyptian Goose was common on all the rivers in this district, and huge flocks were observed on Lake Naivasha.

8. *ANAS SPARSA*.

Anas sparsa, Smith: Salvad. Cat. B. Brit. Mus. xxvii. p. 213

(1895); Shelley, B. Africa, i. p. 172 (1896); Sharpe, Hand-l. B. i. p. 216 (1899).

Nos. 99, 100. ♂, ♀. Lake Höhnel, western slope of Mount Kenya, 13,000 feet, Sept. 20, 1899. Iris hazel; bill black with a yellow-ochre band at the base; legs and toes yellow-ochre; webs black.

The only two specimens seen at this altitude.

9. PELECANUS ROSEUS.

Pelecanus roseus, Gm.: Ogilvie Grant, Cat. B. Brit. Mus. xxvi. p. 466 (1899).

Pelecanus minor, Rüpp.: Shelley, B. Africa, i. p. 161 (1896).

Nos. 5 & 6. ♀ ad. Nairobi. Iris red; feet flesh-colour; fleshy parts round eye bluish pink; pouch yellowish.

These birds are considered rare in this part. They are known to the Masai natives as "Mur-turu."

10. NECROSYRITES MONACHUS.

Necrosyrtes monachus (Temm.): Sharpe, Hand-l. B. i. p. 243 (1899).

Neophron monachus, Shelley, B. Africa, i. p. 155 (1896).

No. 13. ♂. Nairobi Forest, July 15, 1899. Iris hazel with blue band on outer edge; legs and feet pale blue; bill dark brown; fleshy parts of neck bluish purple; head reddish purple; wattles in neck white.

These birds are common throughout this district and also in the intervening country to Mount Kenya up to an altitude of over 8000 feet.

11. BUTEO AUGURALIS.

Buteo auguralis, Salvad.: Sharpe, Cat. B. Brit. Mus. i. p. 175, note (1874); id. Hand-l. B. i. p. 255 (1899); Shelley, B. Africa, i. p. 150 (1896).

No. 90. Juv. Camp. 18a, western slope of Mount Kenya, 8000 feet. Iris white; bill dark blue, lighter at the base; cere, gape, and feet greenish yellow.

Rare and very hard to get at. We saw two other specimens during our stay at this camp.

12. MILVUS ÆGYPTIUS.

Milvus ægyptius (Gm.): Sharpe, Cat. B. Brit. Mus. i. p. 320 (1874); Shelley, B. Africa, i. p. 147 (1896); Sharpe, Hand-l. B. i. p. 268 (1899).

No. 64. ♀. Camp 20, western edge of Mount Kenya, 10,000 feet, Sept. 4, 1899. Iris hazel; bill, cere, and feet bright yellow.

13. *BUBO MACKINDERI*. (Plate XLIII.)

Bubo mackinderi, Sharpe, Bull. B. O. C. x. p. xxviii (Dec. 1899).

Nos. 69, 70. ♂. Teleki Valley, Mount Kenya, 13,000 feet, Sept. 3, 1899. Iris deep yellow; bill black.

No. 77. ♀. Teleki Valley, Sept. 11, 1899.

14. *SYRNIUM UMBRINUM*.

Syrnium umbrinum, Heugl.: Reichen. Mittl. hochl. N. Deutsch-Ost-Afr. p. 272 (1898); Sharpe, Hand-l. B. i. p. 294 (1900).

No. 25. ♂. Nairobi Forest, July 1898. Iris very dark brown; bill orange-yellow; legs and feet pale yellow.

[The various races of *Syrnium woodfordi* are very difficult to diagnose, but of those admitted by Dr. Reichenow, this specimen best agrees with the description of *Syrnium umbrinum* of Heuglin.—R. B. S.]

15. *PŒOCEPHALUS MASSAICUS*.

Pœocephalus massaicus, Fischer & Reichen.: Salvad. Cat. B. Brit. Mus. xx. p. 367 (1891); Shelley, B. Africa, i. p. 139 (1896); Sharpe, Hand-l. B. ii. p. 25 (1900).

Nos. 86 & 87. ♂, ♀. Sept. 15, 1899, at Camp. 18a, western slope of Mount Kenya, 8000 feet.

We did not notice these birds at a lower altitude than 7000 feet, but at the above camp it was a common sight to see flocks of them in the early morn flying in a north-easterly direction and returning again just before sundown, doubtless from their favourite feeding-grounds.

16. *THIRIPIAS SCHOENSIS*.

Thiripias schoensis (Rüpp.): Hargitt, Cat. B. Brit. Mus. xviii. p. 308 (1890); Shelley, B. Africa, i. p. 133 (1896); Sharpe, Hand-l. B. ii. p. 219 (1900).

No. 2. ♀. July 7, 1899, Nairobi Forest. Iris red; legs and feet olive-green.

The only specimen we saw in this locality, and it was shot in the most wooded parts of the forest.

17. *CAMPOTHERA HAUSBURGI*.

Campothera hausburgi, Sharpe, Bull. B. O. C. x. p. xxxvi (Jan. 1900).

No. 1. ♂ ad. Nairobi, 6000 feet, July 11, 1899. Feet olive-green; iris red.

No. 98. ♂. Camp 18a; forest zone, Mt. Kenya, 6000 feet, Sept. 18, 1892. Iris red; feet ashen-green.

[Compared with a specimen of *C. tenuiolæma* in Mr. Jackson's collection from Mau, there is very little difference in the colour of the upper surface of the two species; but the lower surface is distinct enough, the coarse and dusky nature of the cross-barring

of *C. tenuicollis* being quite different from the fine and paler barring of *C. hausburgi*.

There is another specimen in the Rothschild collection at Tring which agrees with Mr. Jackson's bird; it was collected by Dr. Ansorge at the Eldoma Ravine.—R. B. S.]

18. CAPRIMULGUS TRIMACULATUS.

Caprimulgus trimaculatus (Swains.): Hartert, *Tierr.*, *Caprimulgidae*, p. 55 (1899).

Caprimulgus lentiginosus, Smith: Hartert, *Cat. B. Brit. Mus.* xvi. p. 536 (1892); Shelley, *B. Africa*, i. p. 106 (1896).

No. 24. ♂. July 20, 1899. Eyes very dark blue; bill brownish black; legs and feet brown.

We found this bird chiefly on the banks of the small running creeks which intersect the forest. The general coloration of the species is beautifully adapted to its surroundings, making it most difficult at all times to discover where the bird has actually alighted.

19. CAPRIMULGUS FRÆNATUS.

Caprimulgus frænatus, *Salvad. Ann. Mus. Genov.* xxi. p. 118 (1884); Sharpe, *Ibis*, 1892, p. 322; Hartert, *Cat. B. Brit. Mus.* xvi. p. 533 (1892); Shelley, *B. Africa*, i. p. 106 (1896); Hartert, *Tierr.*, *Caprimulgidae*, p. 59 (1899).

No. 68. ♀ imm. Western slope of Mount Kenya, 10,000 feet, Sept. 4, 1899. Bill black; legs and feet pinkish brown; iris dark hazel.

20. CORACIAS CAUDATUS.

Coracias caudatus (Linn.): Sharpe, *Cat. B. Brit. Mus.* xvii. p. 21 (1892); Shelley, *B. Africa*, i. p. 109 (1896); Sharpe, *Hand-l. B.* ii. p. 46 (1900).

No. 23. ♀. Nairobi Forest, July 20, 1899. Eyes bright reddish brown; bill black; legs and feet greenish yellow.

Single specimens only were noticed, and invariably in the open glades and banana shambas.

21. COLIUS AFFINIS.

Colius affinis, Shelley, *Ibis*, 1885, p. 312; id. *B. Africa*, i. p. 118 (1896).

No. 4. ♀. Nairobi Forest, 6000 feet. Iris hazel; legs and feet pale coral; bill dark brown; lower mandible yellowish.

[This specimen is much darker than the majority of the others in the British Museum from various localities, but there seems to be such a decided graduation in tint in a large series from light to dark brown, that I have been unable to draw any definite line of demarcation. Some of Mr. Jackson's specimens from the Ravine seem to be quite as dark as the Nairobi bird, but others from Nandi and Njemps are lighter again.—R. B. S.]

These birds travel about in various sized flocks; and on the lower slopes of Mt. Kenya I have noticed fully 80 or 90 at a time; they present a curious sight when on the wing, their exceedingly long tails causing a most peculiar motion. Their flight is somewhat slow.

22. *TURACUS HARTLAUBI*.

Turacus hartlaubi (Fischer & Reichen.): Sharpe, Ibis, 1892, p. 312; Shelley, B. Africa, i. p. 120 (1896).

No. 3. ♀ ad. Nairobi Forest (5500 feet), July 11, 1899. Iris hazel; feet black; bill dark green, tip orange.

No. 10. ♂ ad. Nairobi Forest (5500 feet), July 15, 1899.

No. 19. ♂ ad. Nairobi Forest (5500 feet), July 18, 1899.

These birds are common in this locality and are also to be met with on Mount Kenya at an altitude of 9000 feet. They utter a cry not unlike the Francolin which is to be found there. Masai native name: "Kal-ler-wa."

23. *HAPALODERMA NARINA*.

Hapaloderma narina (V.): Sharpe, Ibis, 1892, p. 321; Shelley, B. Africa, i. p. 108 (1896).

No. 20. ♂. Nairobi Forest, 5500 feet, July 19, 1899. Iris red; bill yellow at base, darkening to grey at the tip; feet pinkish brown.

No. 20. ♀. Camp 18, western slope of Mount Kenya, 8000 feet, Sept. 15, 1899. Iris reddish brown; bill yellow at base, shading to green at tip; feet pale pinkish brown.

Uncommon.

24. *BYCANISTES CRISTATUS*.

Bycanistes cristatus (Rüpp.): Grant, Cat. B. Brit. Mus. xvii. p. 417 (1892); Shelley, B. Africa, i. p. 114 (1896).

Nos. 11, 12. ♂ ♀ ad. Nairobi Forest, July 14, 1899. Bill brown, casque white; iris dark brown; feet black, with white between the scales.

These birds were mostly found in pairs, and are very wary. Alighting on the most lofty (usually dead) trees, they would be off at the slightest noise, or at the sight of anything moving beneath. Common.

25. *IRRISOR JACKSONI*.

Irrisor jacksoni, Sharpe, Ann. Mag. Nat. Hist. [6] vi. 1890, p. 503; Salvin, Cat. B. Brit. Mus. xvi. p. 21, pl. iii. fig. 1; Sharpe, Ibis, 1892, p. 319; Shelley, B. Africa, i. p. 112 (1896).

Nos. 85, 91, 93, 94. Three females and one male were shot at Camp 18 a, Kenya Forest, alt. 8000 feet. Iris reddish brown; bill, legs, feet, and eyelids lake-red.

These birds were found in small flocks of about twenty. They

are very active, travelling from tree-top to tree-top, and apparently feeding on small fruit with which some of the trees abounded.

26. MELITTOPHAGUS SHARPEI.

Melittophagus sharpei, Hartert, Bull. B. O. C. x. p. xxvii (Dec. 1899).

Melittophagus cyanostictus (nec Cab.): Sharpe, Cat. B. Brit. Mus. xvii. p. 48, pl. i. fig. 3 (1892); id. Ibis, 1892, p. 319; Shelley B. Africa, i. p. 110 (1896).

Nos. 26, 27. ♂, ♀. Camp 11, Sagana River, Aug. 7, 1899. Eyes crimson; bill, legs, and feet black.

Single specimens only were noticed, which mostly frequented the banks of the river.

27. MELITTOPHAGUS OREOBATES.

Melittophagus oreobates, Sharpe, Ibis, 1892, p. 320; id. Cat. B. Brit. Mus. xvii. p. 498 (1892); Shelley, B. Africa, i. p. 110 (1896).

No. 22. ♀. Nairobi Forest, July 19, 1899. Eyes dark red; bill black; legs pale slate-colour; feet darker.

This bird chiefly inhabits the banana shambas in the Nairobi district.

28. CORVULTUR ALBICOLLIS.

Corvultur albicollis (Lath.): Sharpe, Cat. B. Brit. Mus. iii. p. 24 (1877); Shelley, B. Africa, i. p. 46 (1896).

No. 41. ♂. Bamboo zone, western slope of Mount Kenya, 8000 feet, Aug. 26, 1899.

Nos. 88, 89. ♂, ♀. Camp 18, western slope of Mt. Kenya, 8000 feet, Sept. 16, 1899. Bill black, with white tip; feet black; iris hazel.

These birds were obtained also at Nairobi, and were noticed throughout the intervening country and up to an altitude of 10,000 feet on Mount Kenya itself.

29. CINNAMOPTERUS TENUIROSTRIS.

Cinnamopterus tenuirostris (Rüpp.): Sharpe, Cat. B. Brit. Mus. xiii. p. 166 (1890); Shelley, B. Africa, i. p. 45 (1896).

No. 51. ♂ ad. Camp 21, Höhnel Valley, western slope of Mt. Kenya, 12,000 feet, Aug. 30, 1899. Among rocks and caves. Iris hazel; bill and feet black.

Nos. 55, ♂; 56, 57, ♀. Camp 21, Aug. 30, 1899.

[These specimens agree with others in the British Museum from Shoa and Abyssinia, and there is another specimen in Mr. Jackson's collection from Ruwenzori. It should be noticed that both the female birds have the grey edges to the feathers which I formerly considered to be characteristic of the young of this species.—R. B. S.]

Although fairly common among the crags at the head of the Höhnel Valley, this species was not observed in any other locality.

30. LAMPROCOLIUS CHALYBEUS.

Lamprocolius chalybeus (Ehr.): Sharpe, Ibis, 1891, p. 242; Shelley, B. Africa, i. p. 43 (1896).

No. 110. ♂ ad. Morendat River (7000 ft.), Sept. 1899. Iris bright yellow; bill, legs, and feet black.

This species was not observed at a higher altitude than that mentioned above. It was not found in the hilly districts, but seemed confined to the reed-beds of the rivers traversing the plains, and was observed on the Nairobi River as well as at the Morendat.

31. DREPANOPECTES JACKSONI.

Drepanoplectes jacksoni, Sharpe: Jackson, Ibis, 1899, p. 599.

Coliipasser jacksoni, Shelley, B. Africa, i. p. 24 (1896).

No. 101. ♂ ad. Western foot of Mount Settima range (7000 ft.), Sept. 26, 1899. Bill, base and lower mandible black, upper part pale green; legs and feet very dark brown; iris hazel.

No. 102. ♀ ad. Western foot of Mount Settima range (7000 ft.), Sept. 26, 1899. Bill, legs, and feet pinkish horn-colour.

These birds travel about in flocks of thirty or forty together, and seem to be common along these ranges.

32. HYPHANTORNIS CAMBURNI.

Hyphantornis camburni, Sharpe, Bull. B. O. C. x. p. xxxv (Jan. 1900).

No. 16. ♂ ad. Nairobi Forest, 5500 feet, July 17, 1899. Bill dark brown; feet pale brownish; iris hazel.

Common; observed in small flocks; known to Masai natives as "Ging-yangiki."

[Although sexed a male, I think this bird must be a female, as it agrees so well with the hens of *Hyphantornis vanthops*. It is of a brighter yellow below, has a somewhat more distinct yellow eyebrow, but is principally distinguished by its very small bill.—R. B.S.]

33. AMBLYOSPIZA UNICOLOR.

Amblyospiza unicolor, Fisch. & Reichen.: Shelley, B. Africa, i. p. 33 (1896).

No. 31. ♀ imm. Aug. 10, 1898. Bill, upper mandible dark brown, lower mandible yellowish; legs and feet dark brown; iris dark brown.

Collected on the march; the only specimen observed of this species.

34. DREPANORHYNCHUS REICHENOWI.

Drepanorhynchus reichenowi, Fischer: Jackson, Ibis, 1899, p. 630.

Nectarinia reichenowi, Shelley, B. Africa, ii. p. 29 (1900).

No. 105. ♂. Camp 27, foot of Settima Range, 7000 feet, Sept. 25, 1899. Bill and feet black; iris hazel.

Somewhat common on both the eastern and western slopes of Mount Settima, but was not observed elsewhere.

[The specimen is moulting, and shows a curious metallic green shade on the median wing-coverts which is not seen in any of the series in the Jackson collection. I fancy that this is not a difference of specific value, but is due to the wearing of the metallic plumage through exposure.—R. B. S.]

35. NECTARINIA ÆNEIGULARIS.

Nectarinia æneigularis, Sharpe : Jackson, Ibis, 1889, p. 631.

Nectarinia cupreonitens, Shelley, B. Africa, ii. p. 21 (1900).

No. 107. ♂. Western foot of Mount Settima, 7000 feet, Sept. 20, 1899. Bill and feet black; iris hazel.

[This specimen differs from the type of *N. æneigularis* in having a reddish-coppery crown, thereby approaching *N. cupreonitens*. As, however, there is considerable variation in the green or reddish colour of the upper surface in the common *N. famosa*, I do not think it advisable to separate the Kenya specimen.—R. B. S.]

36. NECTARINIA JOHNSTONI.

Nectarinia johnstoni, Shelley, P. Z. S. 1885, p. 227, pl. xiv.; id. B. Africa, ii. p. 22 (1900).

Nectarinia deckeni, Höhnel in Teleki's Exped. Lake Rudolph, p. 374.

Nos. 47, 48. ♂ ♀ ad. Höhnel Valley, western slope of Mount Kenya (12,000 ft.), Aug. 28, 1899. Bill, feet, and legs black; iris hazel. Shot amongst groundsel and lobelia.

Nos. 54, 52, ♂ ad.; 53, ♀ ad. Höhnel Valley (12,000 ft.), Aug. 30, 1899.

No. 58. ♂ ad. Höhnel Valley (12,000 ft.), Aug. 31, 1899.

No. 60. ♀ ad. Höhnel Valley (12,000 ft.), Sept. 1, 1899.

No. 63. ♂ ad. Teleki Valley (13,000 ft.), Sept. 2, 1899.

Common in Höhnel and Teleki Valleys, but apparently limited to the alpine zone. A nest, presumably of this species, was observed built in tree-heath only just below the ice zone. It contained young birds.

[*Nectarinia johnstoni* was obtained by Count Teleki's expedition on Mt. Kenya, and Dr. Gregory also met with the species.—R. B. S.]

37. NECTARINIA TACAZZE.

Nectarinia tacazze (Stanley): Sharpe, Ibis, 1891, p. 591; Shelley, B. Africa, ii. p. 26 (1900).

No. 37. ♂ ad. Western slope of Mount Kenya (10,000 ft.), Aug. 20, 1899. Bill, legs, and feet dark black; iris dark brown.

No. 38, 39. ♂ ad. W. slope of Mt. Kenya (10,000 ft.), Aug. 23, 1899.

Nos. 43, ♂ ad.; 49, ♀ ad. W. slope of Mt. Kenya (10,000 ft.), Aug. 27, 1899.

Observed only at Camp 20, in a densely wooded valley immediately above bamboo zone. It was in the habit of frequenting the tops of the highest trees.

38. CINNYRIS MEDIOCRIS.

Cinnyris mediocris, Shelley: Sharpe, Ibis, 1891, p. 593; Shelley, B. Africa, ii. p. 79 (1900).

No. 42. ♂ ad. Western slope of Mount Kenya (10,000 ft.), Aug. 27, 1899. Bill, legs, and feet black; iris dark brown.

Shot among bamboo and low trees.

No. 75. ♂ ad. Western slope of Mount Kenya (10,000 ft.), Sept. 11, 1899. Iris hazel.

No. 109. ♂ ad. North-western foot of Mount Settima (7000 ft.), Sept. 25, 1899.

These birds are not common, but it will be noticed that a specimen was obtained on Settima, in addition to the two from Mount Kenya.

39. CINNYRIS KIRKI.

Chalcomitra kirki (Shelley): Shelley, B. Africa, ii. p. 107 (1900).

No. 21. ♀ ad. Nairobi Forest, July 19, 1899. Bill, feet, and legs black; iris dark brown.

Decidedly uncommon; the only specimen noticed on the whole trip.

40. ZOSTEROPS KIKUYUENSIS.

Zosterops kikuyuensis, Sharpe, Ibis, 1891, pp. 444, 594, pl. xii. fig. 1; Shelley, B. Africa, i. p. 7 (1896).

No. 67. ♂. Camp 20, western slope of Mt. Kenya, 10,000 feet, Sept. 4, 1899. Bill black; iris light hazel; feet greenish grey. Plentiful.

Nos. 71, 72, ♂; 73, ♂. Camp, Sept. 10, 1899.

Occurs in small flocks, fluttering from bush to bush above bamboo zone. The blossom of bushes frequented are a bright yellow, like the birds. Early morning and evening they are most in evidence.

41. LANIARIUS ABBOTTI.

Laniarius abboti, Richmond, Auk, xiv. p. 161 (1897).

No. 33. ♂ ad. Foot of Mount Kenya (alt. about 7000 feet), Aug. 16, 1899. Bill, legs, and feet black; iris dark red.

This was the only specimen I saw of its kind during our stay at this camp (17). I shot it in a very thick part of the forest surrounding the camp.

[The single specimen obtained by the expedition is very similar to the type of *Malaconotus manningi* of Shelley (Ibis, 1899, p. 369,

pl. v.), but is not quite so fiery-orange below. Judging from the limited material at my command, it seems probable that the birds from Nyika, Kilimanjaro, and Kenya will be found to be inseparable.—R. B. S.]

42. DRYOSCOPIUS ÆTHIOPICUS.

Laniarius æthiopicus, Gm.: Shelley, B. Africa, i. p. 53 (1896); Neum. J. f. O. 1899, p. 406.

Nos. 78, ♂ ad.; 81, ♀ imm. Western slope, Mount Kenya (8000 feet), Sept. 10, 14, 1899. Bill black; legs and feet bluish grey; iris hazel.

These birds were shot at the junction of the lower forest and bamboo zones.

43. LANIUS HUMERALIS.

Lanius humeralis, Stanl.: Sharpe, Ibis, 1891, p. 597.

Fiscus collaris (Linn.): Shelley, B. Africa, i. p. 51 (1896).

No. 17. ♂ ad. Nairobi Forest (5500 feet), July 17, 1899. Bill, legs, and feet black; iris dark brown.

Chiefly met with in the native banana shambas. Known to the Masai natives as "Ndare-tiki."

44. GEOCICHLA PIAGGIÆ.

Geocichla piaggiæ, Seeböhm, Cat. B. v. p. 171, pl. xi. (1881) Sharpe in Seeböhm Monogr. Turdidæ, p. 41, pl. xiii. (1898).

Turdus piaggi, Shelley, B. Africa, i. p. 88 (1896).

No. 82. Camp 18, western edge of Mount Kenya, 8000 feet, Sept. 14, 1899. Bill black; feet pale pinkish brown; iris hazel.

Shot at extreme lower edge of bamboo zone. Rare: the only specimen observed.

45. PINAROCHROA ERNESTI.

Pinarochroa ernesti, Sharpe, Bull. B. O. C. x. p. xxxvi (Jan. 1900).

Nos. 35, 36. ♂ ♀ ad. Western slope, Mount Kenya (10,000 feet), Aug. 20, 1899. Bill, legs, and feet black; iris hazel.

Nos. 61, 62. ♂ ad. Teleki Valley (13,000 feet), Sept. 2, 1899.

Nos. 65, 66. ♂ ad. Western slope, Mount Kenya (10,000 feet), Sept. 3, 1899.

Occurs in numbers among tree-heath and low scrub; found up to alt. of 13,000 feet from immediately above bamboo zone.

[This species, which is identical with the *Pinarochroa* of Mt. Elgon, is certainly distinct from *P. hypospodia* of Kilimanjaro. The latter is grey underneath, the throat and breast being of the same tint, and the under wing-coverts and axillaries are also greyish. In the other two species, *P. sordida* and *P. ernesti*, the under wing-coverts and axillaries are rufous; the lower surface of the body is also rufescent, with an indication to a grey throat. *P. ernesti*

is much darker than *P. sordida*, and has blackish-brown ear-coverts.—R. B. S.]

46. BRADYPTERUS CINNAMOMEUS.

Bradypterus cinnamomeus (Rüpp.): Sharpe, Ibis, 1892, p. 154; Shelley, B. Africa, i. p. 77 (1896).

No. 76. ♂ ad. Western slope, Mount Kenya (10,000 feet), Sept. 11, 1899. Bill, legs, and feet horn-brown; iris hazel.

Nos. 96, 97. ♂ ad. Forest zone, Mount Kenya (8000 feet), Sept. 18, 1899.

No. 108. ♂ ad. Foot of Settima range (7000 feet), Sept. 25, 1899.

Somewhat common in districts above named. Found flitting about among undergrowth.

47. CISTICOLA TERRESTRIS.

Cisticola terrestris (Smith): Shelley, B. Africa, i. p. 74 (1896).

No. 50. ♀ ad. Höhnel Valley, western slope of Mount Kenya (12,000 feet), Aug. 28, 1899. Bill pinkish brown; legs and feet ochreous flesh-colour; iris yellowish brown.

Shot among the tree-heath.

Two other specimens only were observed. Utters a piercing little song while on the wing.

48. CISTICOLA PROCERA.

Cisticola procera, Peters: Sharpe, Ibis, 1892, p. 168; Shelley, B. Africa, i. p. 75 (1896).

No. 104. ♀ ad. Western end of Settima, 9000 feet, Sept. 25, 1899. Bill black; feet light brown; iris hazel.

No. 105. ♂ ad. Camp 27, foot of Settima Range, 7000 feet, Sept. 25, 1899.

Found in grass, undergrowth, and low scrub.

49. CISTICOLA HUNTERI.

Cisticola hunteri, Shelley: Sharpe, Ibis, 1892, p. 157; Shelley, B. Africa, i. p. 75 (1896).

Nos. 44, 45, 46. ♂ ♀ ad. Western slope of Mount Kenya (10,000 feet), Aug. 27, 1899. Bill blackish brown; legs and feet flesh-colour; iris hazel.

No. 103. ♂ ad. Foot of Mount Settima range (7000 feet), Sept. 25, 1899. Bill black; legs and feet brown.

This locality is devoid of all heavy timber, and is very swampy in parts; the vegetation consists mostly of long grasses and small shrubs. We noticed several Snipe, also some Quail, but could not get a shot.

This species habitually frequented tops of bamboo; it was also discovered creeping about among branches of low shrubs.

50. *PYCNONOTUS LAYARDI*.

Pycnonotus layardi, Gurney : Sharpe, Cat. B. Brit. Mus. vi. p. 132 (1881); Shelley, B. Africa, i. p. 60 (1896).

Ad. [label lost].

51. *XENOCICHLA KIKUYUENSIS*.

Xenocichla kikuyuensis, Sharpe, Ibis, 1891, p. 118; 1892, p. 299.
Criniger kikuyuensis, Shelley, B. Africa, i. p. 63 (1896).

No. 92. ♂ ad. Western slope of Mount Kenya (8000 feet), Sept. 18, 1899. Bill black; legs and feet greenish ash; iris hazel.

The only specimen noticed during our stay of eight days at this camp (18 a).

52. *GRAUCALUS PURUS*.

Graucalus purus, Sharpe, Ibis, 1891, p. 121, 1892, p. 299; Shelley, B. Africa, i. p. 50 (1896).

No. 15. ♂. Nairobi Forest, 5500 feet, July 17, 1899. Bill and feet black; iris dark brown.

No. 34. Camp 17. Aug. 16, 1899. Bill black; feet slate-colour; iris very dark blue.

No. 83, ♀. Camp 18 a, western slope of Mt. Kenya, 8000 feet, Sept. 15, 1899. Bill black; feet black, powdered with white; iris hazel.

Somewhat common at Nairobi and throughout the intervening country to Camp 18 a on Mt. Kenya, at an altitude of 8000 feet.

53. *TARSIGER ORIENTALIS*.

Tarsiger orientalis, Fischer & Reichen.: Sharpe, Ibis, 1892, p. 302; Shelley, B. Africa, i. p. 86 (1896).

Nos. 79, 80. ♂, ♀. Camp 18 a, forest zone, western slope of Mt. Kenya, 8000 feet, Sept. 14, 1899. Bill black; feet yellowish grey; iris hazel.

Somewhat common at this camp, which is situated at the junction of the bamboo and forest zones.

54. *DIOPTRORNIS FISCHERI*.

Dioptrornis fischeri, Reichen.: Sharpe, Ibis, 1892, p. 300.

Muscicapa fischeri, Shelley, B. Africa, i. p. 94 (1896).

No. 14. ♂ ad. Nairobi Forest, July 17, 1899. Bill slate-colour, darkening towards the tip; feet almost black; iris hazel.

55. *CHLOROPETA ICTERINA*.

Chloropeta icterina, Sundev.: Sharpe, Cat. B. iv. p. 273 (1879); Shelley, B. Africa, i. p. 96 (1896).

No. 40. Camp 20, western slope of Mount Kenya, 10,000 feet, Aug. 23, 1899. Bill dark brown; feet slate-colour; iris hazel.

We noticed several of these birds at this camp, but owing to the dense undergrowth which they frequent could obtain no more specimens during our short stay.

[I have identified the single specimen with Sundevall's *Chloropeta icterina*, a species about which very little is known. It differs from *C. natalensis* in its more slender bill and greener plumage, in which the head is like the back. It is much smaller than *C. masaica*, and has not the dusky-brown head of the latter. —R. B. S.]

56. *TERPSIPHONE CRISTATA*.

Terpsiphone cristata (Gm.): Sharpe, Ibis, 1892, p. 304; Shelley, B. Africa, i. p. 99 (1896).

No. 8. ♂ ad. Nairobi, July 12, 1899. Bill and eyelids cobalt-blue; feet leaden blue.

Somewhat common, and found frequenting the forest shambas near Nairobi.

4. A Revision of the Earthworms of the Genus *Amyntas* (*Perichæta*). By FRANK E. BEDDARD, M.A., F.R.S., &c.

[Received May 9, 1900.]

There can be no doubt that this "difficult and extensive genus" urgently requires revision. There has been no comprehensive essay upon the whole series of species comprised in the genus (which I will attempt to define presently) save in my 'Monograph of the Oligochæta.' Since the appearance of that work a very large number of new species have been described, or at least a large number of new names given to members of this genus. In view of recent investigations, the 79 species described in my Monograph should probably be reduced to not more than 56. Some 50 new species may now be added.

I have lately gone through my very large collection of *Perichæta*—or *Amyntas* as it should unfortunately be called¹; and in doing so have noted a number of small facts of systematic, rather than of anatomical, interest which are new. As these concern a considerable number of species and refer to several hundreds of individuals, I was compelled to make for my own use a list of the species of the genus as I defined them. It has appeared to me that the best way of recording these new facts would be in the shape of a revision of the entire genus: this will doubtless be criticised; but I believe that it will at least serve as a means of determining a supposed new form more easily than can be done at present with the scattered literature.

¹ Michaelsen ("Terricolen von verschiedenen Gebieten der Erde," Jahrb. Hamb. wiss. Anst. xvi.) has pointed out that the name *Perichæta*, having been used for a genus of Diptera, must be dropped, and that the name *Amyntas*, formerly dropped on account of its being merely a synonym of *Perichæta*, must be reinstated. Dr. Horst (Zool. Anz. 1900) traverses this conclusion, and would retain *Perichæta* for the worm, since it is not a valid dipteran genus.

It seems to me impossible to avoid the conclusion that a name once used cannot be used again for another genus.

The large number of reputed species of this genus is due to two principal causes. In the first place, it has been tacitly assumed that a *Perichæta* coming from the New World would be certainly different from an Eastern form. We now know that this is not the case, and that in all probability there are no indigenous species outside of the Malayan Archipelago and the adjacent parts of the Asiatic mainland. In the second place, sufficient attention has not been paid in the past to the great variability which is found among the species of this genus. I direct particular attention as regards this matter to the large series of variations seen in such a protean species as *Amyntas hawayanus* or *A. stelleri*. Gradated specimens connect the extreme forms which, when described singly, have been referred to different species, a quite necessary conclusion in view of the facts then known.

I have naturally, therefore, found great difficulty in deciding upon the value of specific characters in the following survey of the species of the genus. There are some characters which seem to be of first class importance and to be not subject to variation. Those characters are:—(1) The setæ on the clitellum, when these are present on every segment and form continuous rows. Otherwise, in those cases, such as *A. hawayanus*, where the setæ are at best but few, they vary in number and in the segments upon which they occur. In such forms as *A. violaceus*, *A. taprobancæ*, there is no variation. (2) The presence or absence of a rounded muscular sac, often containing a protrusible penis, into which the duct of the spermiducal gland opens. This is either present or absent in a given species, definitely present or absent. (3) The cæca again seem to be always either present (in the majority of cases) or absent, with the apparent exception (?) of *A. merabahensis*. (4) The spermathecæ again are, with not many exceptions, constant in number of pairs and position of segments. In one or two instances (*A. dyeri*) their very dorsal position seems to be a valid specific difference. (5) The close approximation of the male pores in a few species (e. g., *A. iris*, *A. halmahercæ*) is a good character. But a slight difference in the remoteness of the two pores must be used with the greatest care, if at all. I have not made use of it here, as I am not convinced that it is possible to eliminate from such slight differences the effects of differing degree of contraction. (6) The position of the last "heart"; this is always in segment xii. (*A. taprobancæ*) or in xiii. (the vast majority of species). The only species which varies at all is *A. stelleri*. (7) The presence or absence of septa in the segments occupied by the gizzard. As a rule those septa (viii./ix., ix./x.) appear to be absent. But in some species, one or both are present and even quite thick. In other cases, there is one very thin septum or not more than traces. The character must therefore be used with great care: its use is marred by the fact that there are not always exact observations upon the point on record. (8) Rarely, e. g. *A. neoguineensis*, the testes, funnels, and sperm-sacs are present to the number of one pair only. This seems to be a non-variable characteristic of those species in which it is met with. (9) The

presence of additional sperm-sacs in segment xiii., and even in x., seems to be distinctive of a few species; but here it is not certain that variations do not occur.

There are next to be considered a number of characters which will probably be of use when they are better known. At present they have to be used with great caution, and cannot be much respected unless they are based upon the examination of a large number of individuals.

(1) The Genital Papillæ.—It does seem that there are species (e. g. *A. padasensis*) in which these structures are entirely absent. But they appear likewise to be occasionally absent from specimens of species which normally possess them. In a few forms they are very constant in number and arrangement. In *A. posthumus*, for example, there are two pairs always (except in obvious asymmetrical monsters) in the same place. But elsewhere they vary enormously. To give one instance: I have examined many specimens of the common *A. heterochætus*, and only once have I found a pair of small papillæ in front of and behind the spermathecal pores, a common enough position for such papillæ in other species.

(2) The relations of the Spermatheca to its Muscular Duct.—Sometimes, as in *A. forbesi* and *A. impudens*, it is easy enough to distinguish the relatively large thick duct from a duct which is practically absent, the pouch being almost sessile. But other cases come so near to each other, and the amount of contraction may be so different, that the character is not always of practical value. The same is the case with the diverticulum. The long spirally-wound accessory pouch of *A. musicus* cannot be confounded with the rudimentary knob of *A. iris*; but the middle examples of the series cannot be so easily defined, and in most cases cannot be distinguished at all. The occasional existence of accessory diverticula upon the main diverticulum does not appear to be constant. Rarely (*A. ijimæ*) there is no diverticulum; but it would be more satisfactory to be assured on the results of section-cutting that the absence is real and not merely apparent.

(3) The length, thickness, and degree of curvature of the muscular duct of the glandular appendage of the sperm-duct is apparently a character of value; but, again, it has to be used with caution, chiefly because the descriptions extant are not always clear upon the point. Also the shape of the gland itself. This, however, does appear to vary considerably in degree of lobation and in size in the same species.

(4) A fourth character which must be used with caution is the extent of the clitellum. Not indeed those cases where it extends beyond the normal segments, but its actual line of commencement and ending upon the xivth and xvth segments. It certainly varies a little in the same species.

(5) It is quite possible, when more is known about the facts, that the point at which the sperm-duct becomes confluent with the duct of its terminal gland will prove to be a character of importance.

(6) An ornamentation of the setæ has been observed in *A. hetero-*

chaetus and in a few other species. Here, again, there are not data to enable the character to be made very wide use of.

In the following pages I have made use of some or all of the characters formulated in the two lists just given. I have also directed attention to size, because it is inconvenient to describe a species without giving some notion of its dimensions. As a matter of fact, size seems to be of practically no importance in the discrimination of species. Neither has colour any *practical* importance. For, in the first place, the colours of earthworms do not as a rule show easily describable variations from species to species; in the second place, there is no doubt that actual variations do occur from individual to individual; and, finally, the bulk of the existing species are known from spirit-preserved specimens, from which in many cases all, and in others some, of the colour-markings have been lost.

Nor does it seem to be very profitable to dwell strongly upon the number of setæ in each segment; at any rate the value of this character has been distinctly exaggerated. The form and extent of the buccal lobe shows only such slight differences from species to species, if any at all, that I have ignored it.

In the following survey of the species I have arranged them in a number of groups for purposes of easier reference. It should be noted that in all the descriptions—unless any remark be made—the following characters are to be added:—Clitellum occupying segments xiv.–xvi. Male pores on xviii. Oviducal pore on xiv. Dorsal pores commencing about xi./xii. Gizzard in viii. Cæca present in xxvi. Last heart in xiii. Testes in x., xi. Ovaries in xiii. Sperm-sacs in xi., xii.

Genus **AMYNTAS**, Kinberg.

Syn. *Rhodope*, *Nitocris*, *Pheretima*, Kinberg. *Perichæta*, Schmarda. *Megascolex*, Baird.

Large (4 feet) to small (1 inch) earthworms. Segments of body comparatively few, often corresponding with length in millimetres. Prostomium never continued by grooves to end of the first segment of the body. Setæ (sometimes ornamented with faint ridges) forming a continuous circle, occasionally interrupted in the ventral and dorsal mid-line, or in either the dorsal or ventral mid-line. Setæ vary in number from about 20 to over 100 on a segment; sometimes stronger on the anterior segments, and at times two or three longer on each side of ventral median line. The setæ are sometimes more crowded ventrally or laterally than dorsally. Clitellum as a rule occupying segments xiv.–xvi., often beginning in the middle of the first and ending at the middle of the last of these segments; rarely extending beyond the xvth. Clitellum developed all round the body, with or without setæ. Only in *A. houletti* are the clitellar setæ different from those on other segments. Dorsal pores as a rule not commencing before segments xi./xii., always present. Male pores on xviii. Oviduca

pore (rarely paired) on xiv. Male pores always separated by some setæ, their degree of approximation varying. Genital papillæ commonly, but not always, present; they are developed in the neighbourhood of the male pores or spermathecal pores, or both. There are apparently two kinds, which may coexist: sucker-like depressions and projecting or flattened areas of modified epidermis. Septa viii./ix. and ix./x. usually, but not always, missing. Gizzard always in segment viii. No calciferous glands. Intestine commences invariably (?) in xv. Intestine nearly always provided with a pair of forwardly-directed cæca of limited (up to five segments) extent. Cæca occasionally divided into not more than 6 cæca. Typhlosole small. The last heart either in xiii., or, much more rarely, in xii. Nephridia "micronephridia" only. Sperm-sacs usually in xi., xii., sometimes extending to x. & xiii. Sperm-reservoirs always present, enveloping sperm-duct funnels in x., xi. Egg-sacs commonly present in xiii. or xiii., xiv. Spermathecae one to six pairs in some, or all, of segments iv.-ix.; occasionally numerous (2-14) in one, or two, segments. Spermathecae always provided with a diverticulum (in which alone the sperm is stored), to which are rarely appended secondary diverticula. Sperm-ducts open in common with a lobate spermiducal gland which varies in size and is rarely absent. The muscular duct of this gland opens directly on to the exterior or through a terminal dilated sac, which may be provided with an exsertile penis. Penial setæ are not present. Glands correspond in many cases to the genital papillæ.

Distribution. Oriental Region, especially Malay Archipelago, but found also (introduced?) in Australia, Africa, America, Europe.

- (1) *Setæ on all segments of clitellum; gizzard-septa absent; spermiducal gland-duct with terminal bulb.*

A. Spermathecae 3 pairs in vii.-ix.

1. *Amyntas houlleti* Perrier.

Perichæta houlleti, Perrier, *Nouv. Arch. Mus.* viii. p. 99.

P. houlleti, Beddard, *Ann. Nat. Hist.* (5) xvii. p. 93; id. *P. Z. S.* 1887, p. 389; id. *Zool. Anz.* 1888, p. 91; id. *P. Z. S.* 1890, p. 61; id. *Quart. Journ. Micr. Sci.* xxx. p. 459.

P. houlleti, Rosa, *Ann. R. Accad. Torino*, xxix. p. 16; id. *Ann. Mus. Civ. Genova*, (2) xvi. p. 515.

P. houlleti, Michaelsen, *Abh. Senck. nat. Ges.* xxi. p. 234; id. *Jahrb. Hamb. wiss. Anst.* xvi. p. 12 & p. 92; id. *Zool. Jahrb.*, *Abth. f. Syst.* xii. p. 139.

P. houlleti, Bourne, *Journ. Asiat. Soc. Bengal*, lviii. p. 110.

P. houlleti, Horst in *Weber's Zool. Ergebn.* ii. p. 64.

Megascolex houlleti, Vaillant, *Annelés*, 1889, p. 75.

Perichæta campanulata, Rosa, *Ann. Mus. Civ. Genova*, (2) x. p. 115.

Perichæta ulekemi, Michaelsen, Arch. f. Naturg. 1892, p. 240.

Perichæta gulielmi, id. Abh. Gebiete Naturw. xiii. No. 2, p. 32.

200 mm. Setæ 52; those of clitellum shorter and bifid at end. Spermathecæ with longish, often zigzag diverticulum: with it open one or more glands.

Hab. Sumatra, and the East generally; Bahamas; Madagascar¹.

The last three synonyms are not absolutely certain. The shape and occurrence of the clitellar setæ is not noted by Michaelsen. At any rate this is the case with his original descriptions. But as he himself includes them as synonyms of *A. houlleti* in a recent paper, it is to be presumed that that point has been verified. The chief distinction between this species and the next is the peculiar form of the clitellar setæ, which were originally figured by myself.

2. *Amyntas travancorensis* Fedarb.

Perichæta travancorensis, Fedarb, Journ. Bombay Nat. Hist. Soc. xi. p. 435.

Perichæta crescentica, id. P. Z. S. 1898, p. 447.

80 mm., 101 segments. Setæ upon clitellum not modified. 10-12 setæ between male pores. Stalked glands associated with spermathecæ, which latter have a zigzag diverticulum. Spermiducal glands much broken up in xvi.-xx.

Hab. Dehra Dun and Travancore, in India; Sumatra(?).

I think that there can be no doubt as to the identity of these two forms, which are among the few species of true *Amyntas* living in the Indian Peninsula. It may be that Horst's "*Perichæta dubia*"² is this species. He describes it as generally like *houlleti*, but without any clitellar setæ. In this case, the name will have to be altered.

(2) *Setæ totally absent from clitellum; gizzard-septa usually absent; terminal bulbus present.*

A. Spermathecæ 5 pairs in v.-ix.

3. *Amyntas pentacystis* Rosa.

Perichæta pentacystis, Rosa, Ann. k.-k. Hofmus. Wien, vi. p. 400.

Amyntas pentacystis, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 95.

135-110 mm., 112-82 segments. Papillæ on segments viii., xvii., xviii. paired. Setæ 100 on viii. Both gizzard-septa present. Cæca absent. Spermiducal glands extend through three segments, with short bent duct. Spermathecæ flattened "tomato-shaped,"

¹ Here as elsewhere I give a list of localities from which the several species have been obtained. I believe, however (with Michaelsen), that the occurrence of the genus outside of the Oriental Region and Japan is accidental and due to man.

² Zool. Ergebn. Max Weber, Bd. xi. p. 69; and Vermes in 'Midden-Sumatra,' p. 7.

with not long diverticulum ; dorsal in position. Sperm-sacs with long dorsal process.¹

Hab. Mahe Island ; Madagascar.

B. Spermatheca 4 pairs in vi.-ix.

4. *Amyntas cingulatus* Vaillant.

Perichæta cingulata, Vaillant, Ann. Sci. Nat. (5) x. p. 228 (in part), and Mém. Soc. Montpellier, vii. p. 146 (in part).

P. darnleiensis, Fletcher, Proc. Linn. Soc. N. S. W. (2) i. p. 966.

P. vaillanti, Beddard, P. Z. S. 1890, p. 66.

P. martensi, Michaelsen, Arch. f. Naturg. 1892, p. 242 ; id. Abh. Senck. nat. Ges. xxiii. p. 240, and *Oligochæta* in Semon's Forsch. Reise, v. Lief. i. p. 99.

P. indica, Horst, Vermes in 'Midden-Sumatra,' p. 4.

P. eoa, Rosa, Ann. Mus. Civ. Genova, (2) xvi. p. 528 & p. 609.

P. martensi, Horst, Notes Leyd. Mus. xv. p. 324.

P. madelinæ, Benham, Journ. Linn. Soc., Zool. xxvi. p. 219.

Amyntas padasensis, var. *lokonensis*, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 78.

Perichæta belli, Rosa, Ann. Nat. Hist. (7) ii. p. 286.

Megascolex cingulatus, Vaillant, Annelés, 1889, p. 72² (in part).

45-180 mm., 70-125 segments. Setæ up to 66 in a segment, 10-16 between male pores. Sperm-sacs often with dorsal processes. Spermiducal glands xvi.-xviii., with straight or S-shaped duct. Diverticula of spermatheca not long, often with one or more secondary diverticula. Septum viii./ix. occasionally present, but thin.

Hab. Java, Sumatra, Celebes, Mentawai, Philippines, Torres Straits.

It seems to me to be impossible to separate specifically these forms. I point out later that *Perichæta indica* of Horst (as figured in his account of the worms in 'Midden-Sumatra') cannot be *Perichæta indica* of subsequent authors, since it has a large terminal sac to the duct of the spermiducal gland. As far as can be judged, it is, as Horst supposed, the same species as Vaillant's *Perichæta cingulata* figured in his plate. From these I cannot differentiate my *Perichæta vaillanti* in the light of fuller knowledge. The characters of the latter offer no differences from *P. madelinæ*, with which Michaelsen, as I think, rightly unites his "*Amyntas padasensis*, var." As to *martensi* and *eo*a, they are doubtless identical with each other. The accessory diverticulum reminds us

¹ It is often the case that the dorsal ends of the sperm-sacs have a narrow knob-like projection. It seems to me to be merely a part of the sperm-sac which has not become fully expanded with semen. In the meantime, however, I mention the character where it has been noted.

² *Perichæta cingulata* of Schmarda is of course a *Megascolex*, as now defined.

of that of Fletcher's *P. darnleiensis*. The peculiar investment of nephridial tubules to the spermatheca of *martensi* has not been described in the other forms with which I believe it to be identical: it remains the only difference, and that not perfectly certain. *P. belli* is difficult to separate. The diverticula of the spermathecæ seem to be longer. Only one specimen, however, was examined. Michaelsen has described a var. *javana*.

5. *Amyntas quadripapillatus* Mich.

Amyntas quadripapillatus, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 93.

125 mm., 89 segments. Setæ with slight dorsal gaps, closer ventrally, 40 on v., 52 on xxvi. Large papillæ on xvii., xix. on line with male pores. Spermiducal glands xvii.-xix.; terminal sac small. Diverticulum half the length of spermatheca.

Hab. Sumatra.

The arrangement of the genital papillæ in this species strongly recalls that of *A. posthumus*. There can be no danger of confusing the two species.

C. Spermathecæ 3 pairs in vii.-ix.

6. *Amyntas impudens* Mich.

Amyntas impudens, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 84.

120 mm. (about). Setæ with slight dorsal gaps, closer ventrally; 39 on vi., 58 on xxv.; those on anterior segments enlarged. Paired papillæ on spermathecal segments. Terminal sac of spermiducal gland with extensive penis. Diverticulum of spermatheca longer than sessile pouch, slightly spiral, ending distally after narrow neck in a rounded seminal chamber.

Hab. S.E. Borneo.

Only a single specimen was studied. This appears to differ from the next species chiefly in the spermatheca which are sessile, and in the presence of papillæ.

7. *Amyntas philippinus* Rosa.

Perichæta philippina, Rosa, Ann. k.-k. Hofmus. Wien, vi. p. 397.

Amyntas bindjeyensis, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 94.

240 mm., 125 segments. Setæ 44 on viii., 70 on xii. Sperm-sacs with narrow dorsal prolongations. Spermiducal glands not large, kidney-shaped, with short straight duct.

Hab. Island of Cebu, Sumatra.

I do not see any noteworthy differences in the descriptions of the two forms here united. I follow Rosa's description. Michaelsen figures the spermathecal appendix as coiled and probably longer than pouch.

D. Spermathecæ 2 pairs in vii., viii.

8. *Amyntas ferdinandi* Mich.

Perichæta ferdinandi, Michaelsen, Jahrb. Hamb. wiss. Anst. viii. p. 336.

190 mm., 116 segments. Setæ 55 in middle of body. Male pores somewhat approximated, one-sixth of circumference apart. Spermiducal gland in xvii.-xix., duct bent. Spermathecæ with two shortish diverticula.

Hab. Sangir.

This species seems to differ from its allies by the position of the spermathecæ. The presence of an additional diverticulum suggests a gland such as that of *A. houlleti*. Only two examples were examined.

9. *Amyntas purus* Rosa.

Perichæta pura, Rosa, Ann. Nat. Hist. (7) ii. p. 285.

250 mm., 92 segments. Setæ 54 on v., 96 on xxv., 14 between male pores. Sperm-sacs with dorsal appendages. Spermiducal glands enclosed in xviii., with short duct. Spermathecæ with long diverticulum, the duct of which is thicker at its lower half, as in *A. stelleri*.

Hab. Lombok.

Of this species but one specimen is known.

E. Spermathecæ 3 pairs in vi.-viii.

10. *Amyntas merabahensis* Beddard & Fedarb.

Perichæta merabahensis, Beddard & Fedarb, Ann. Nat. Hist. (6) xvi. p. 72.

200 mm., 146 segments. Male pores rather close. Cæca small. Sperm-sacs x.-xii. Spermathecæ with long diverticulum closely coiled, ending in a globular sac. Spermiducal glands xix.-xxii.

Hab. N. Borneo.

This species has diverticula like those of *A. peguanus*. The duct is much contorted, but cannot be dissected out. It has the appearance of being contained within a sheath. The spermiducal glands are unusual in the fact that they lie entirely behind their duct and of course the terminal bursa. They are much broken up into lobules.

F. Spermathecæ 2 pairs in viii., ix.

11. *Amyntas capensis* Horst.

Megascolex capensis, Horst, Notes Leyd. Mus. v. p. 195.

Perichæta capensis, Horst, in Max Weber's Zool. Ergebn. ii. p. 62; id. Notes Leyd. Mus. xv. p. 322.

Perichæta capensis, Michaelsen, Abh. Senck. nat. Ges. xxiii. p. 229; and *Oligochæta* in Semon's Forsch. Reise, v. Lief. i. p. 99.

Amyntas capensis, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 92.

Perichæta capensis, Ude, Zeitschr. wiss. Zool. lvii. p. 61.

? *P. operculata*, Rosa, Ann. k.-k. Hofmus. Wien, vi. p. 398.

P. tenkatei, Horst, Notes Leyd. Mus. xv. p. 321.

P. tjibodæ, id. ibid. p. 326.

P. inflata, id. ibid. p. 327.

P. falcata, id. ibid. p. 316.

P. variabilis, id. ibid. p. 319.

P. sexta, Benham, Ann. Nat. Hist. (6) xvi. p. 44.

Megascolea sumatranus, Horst, Notes Leyd. Mus. v. p. 189.

Perichæta sumatranus, Horst, Vermes in 'Midden-Sumatra,' p. 5; and Zool. Ergebn. ii. p. 69.

P. sumatranus, Beddard, P. Z. S. 1892, p. 155.

P. capensis, Rosa, Ann. Mus. Civ. Genov. (2) xix. p. 65.

130 mm., 110 segments. Setæ 40 on viii., 60 on xxv.; 12 setæ between male pores. Dorsal pores from vi. Spermiducal glands xv.-xxiv., much broken up. Diverticulum of spermathecæ very long and often coiled like a sheep's horns.

Hab. Java, Engano, Soemba, Sumatra, Timor Cupang, Hong-Kong, Cape of Good Hope, Barbados.

The above list of synonyms is largely in accordance with Dr. Michaelsen's views. I do not, however, follow him in including Benham's *Perichæta willeyi*, since that species has no terminal sac to the duct of the spermiducal gland. I am also of opinion that Rosa's species *P. fasciata* is not rightly included, as the describer says nothing about a sac. In any case, it cannot be doubted that the worms here included in one species are at least exceedingly near to each other in structure. The peculiar ram's-horn appearance of the long diverticulum of the spermathecæ is not apparent in all the individuals, to judge from the published illustrations. But that is very possibly a matter of contraction. It should be observed that it is not clear from Rosa's description that his *operculata* has a terminal muscular sac. Nor does Ude mention this structure in identifying *operculata* with *capensis*. Rosa, indeed, says the duct of the spermiducal gland "führt direct nach aussen." But the sac looks as if it had been extruded in his specimen.

12. *Amyntas caducichætus* Benham.

Perichæta caducichæta, Benham, Ann. Nat. Hist. (6) xvi. p. 47.

133 mm., 105 segments. Setæ 20 on iv., 38 on xxiii., totally absent on x. Spermiducal gland small in xvii.-xix. Diverticulum of spermathecæ long.

Hab. Java.

Were it not for the fact that the setæ are absent in this species from segment x., it would be impossible to avoid placing it with that which has just been described.

13. *Amyntas schmardæ* Horst.

Megascolex schmardæ, Horst, Notes Leyd. Mus. v. p. 194.

Perichæta schmardæ, Michaelsen, Arch. f. Naturg. 1892, p. 235 ;
id. Zool. Jahrb. xii. p. 224.

P. trityphla, Beddard, P. Z. S. 1896, p. 205.

P. vesiculata, Goto & Hatai, Ann. Zool. Jap. iii. p. 21.

80 mm., 93 segments. Anterior setæ slightly larger ; 38 on vi., 49 on xvii. No papillæ. Cæca trifid or even with five divisions. Sperm-sacs with dorsal constricted portion. Spermiducal glands xvii.-xxi., much incised. Diverticulum of spermathecæ long and coiled.

Hab. Japan, Barbados, Honolulu, Oahu, China.

I think that Michaelsen is fully justified in uniting the species referred in the above synonymy ; though it must be remembered that the trifid or multifid cæcum of my *trityphla* was not described by Horst in the type of his *schmardæ*. If it were not for this feature, the species could hardly be separated from *A. capensis*.

P. vesiculata of Goto and Hatai seems to me to be probably this species. The complex cæca agree with this identification, as do other points. The only difference in the descriptions of the two Japanese authors is in the position of the spermathecæ, which are said to be vii., viii. To a Chinese variety with rather fewer setæ per segment, closer packed ventrals, Michaelsen gives the name var. *macrochæta*.

G. Spermathecæ 1 pair in vi.

14. *Amyntas urceolatus* Horst.

Perichæta urceolata, Horst, Notes Leyd. Mus. xv. p. 322 ; Rosa, Ann. Mus. Civ. Genova, (2) xix. p. 65.

110 mm. Setæ 30-40. 12 setæ on v. between male pores. Sperm-sacs with dorsal median process. Spermathecæ (occasionally a second pair in vii. present) with not coiled, not very long, diverticulum.

Hab. Sumatra, Timor Cupang.

H. Spermathecæ 1 pair in viii.

15. *Amyntas montanus* Kinberg.

Pheretima montana, Kinberg, Öfv. K. Svensk. Ak. Förh. 1866, p. 101.

Amyntas montanus, Michaelsen, *ibid.* 1899, p. 437.

Perichæta taitensis, Grube, in Reise der Fregatte Novara, Annel. ii. p. 36 (in part).

Perichæta novaræ, Rosa, Ann. k.-k. Hofmus. Wien, vi. p. 396.

Amyntas novaræ, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 17.

Perichæta pulchra, Michaelsen, Arch. f. Naturg. 1892, p. 233.

- Amyntas pulcher*, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 16.
Perichaeta sangirensis, Michaelsen, Jahrb. Hamb. wiss. Anst. viii.
 p. 334; id. *ibid.* xvi. p. 76.
P. vitiensis, Beddard, Ann. Nat. Hist. (6) ix. p. 131.
P. crassicystis, Michaelsen, Abh. Senck. nat. Ges. xxiii. p. 204.
P. malamaniensis, Benham, Journ. Linn. Soc., Zool. xxvi.
 p. 213.
P. arturi, id. *ibid.* p. 205; Beddard, Willey's Zool. Res.
 p. 184.
P. atheca, Rosa, Ann. Mus. Civ. Genova, (2) xvi. p. 520.
P. zonoporus, Rosa, Ann. Nat. Hist. (7) ii. p. 288.
 ? *Perichaeta sangirensis*, Horst, Notes Leyd. Mus. xv. p. 317; and
 Zool. Ergebn. p. 68.

Megascolex montanus, Vaillant, Annelés, 1889, p. 69.

90–150 mm., 110–113 segments. Setæ larger on anterior segments, with slight dorsal gap. 30 on v., 60 on xxvi. Sperm-sacs often with dorsal process. Septum viii./ix. often present. Spermiducal glands usually divided completely into two halves. Duct much bent, terminal sac with a penis. Spermathecal diverticulum nearly as long as or as long as pouch.

Hab. Celebes, Sumatra, Sangir, Halmahera, Ternate, Malaman, New Britain, Viti, Upolu, Tahiti.

I cannot see how the forms in the above list can be separated. They have, for the most part, a rich violet colour, often showing bandings. As a rule the worms are fairly stout, and the measurements and the number of setæ agree, except in minutiae, in the various descriptions. It may be that it will be necessary to distinguish those forms in which the spermiducal gland is not divided into two from the others. It is not clear, for example, whether this is or is not the case with *zonoporus*. The alleged greater complexity of the penial apparatus in some individuals from others seems to me to be not quite certain from the data.

I have been able to dissect (through the kindness of Dr. Michaelsen) two individuals labelled by him *Perichaeta sangirensis*. They differ from such examples of *arturi* (very badly preserved) as I have seen by the fact that the terminal muscular bursa, appended to the spermiducal gland, is relatively small and rounded, and without a projecting penial sac. However, this sac was distinctly less obvious in some specimens. And there is a further reduction of it, as shown by Benham's figure of the corresponding parts of *malamaniensis*. *Perichaeta novaræ* as described by Michaelsen seems to have a larger and rather more complex terminal bursa, like those of *arturi* and *malamaniensis*, and not like the smaller bursa of my *vitiensis*, which is more after the fashion of *sangirensis*.

If a line of division is to be made at all, I should unite *arturi*, *malamaniensis*, and *novaræ*, leaving the others to form a second group.

16. *Amyntas densipapillatus* Mich.

Perichaeta densipapillata, Michaelsen, Abh. Senck. nat. Ges. xxiii. p. 227.

75 mm., 113 segments. Setæ 48 on ix., 57 on xix. Numerous papillæ in neighbourhood of both male pores and spermathecal pores. Sperm-sacs one pair in xi.; testes and funnels also one pair (in x.). Spermiducal glands small, in two segments. Spermathecae very peculiar, pear-shaped, and of a muscular appearance, with, in that of the left side, a small sac distally.

Hab. Batjan.

This species is one of the few in which the sexual organs are reduced to one pair. The spermathecae are highly peculiar, and Dr. Michaelsen is inclined to suppose that the main pouch is represented by the small sac, and that the storage of the sperm is undertaken by the muscular duct, the diverticulum being absent. They obviously require further study. Only a single example is known, and therefore it is unnecessary to give an accurate account of those highly variable bodies, the genital papillæ, of which, in the single individual, there were 14 pairs and two unpaired.

I. Spermathecae 1 pair in ix.

17. *Amyntas racemosus* Rosa.

Perichaeta racemosa, Rosa, Ann. k.-k. Hofm. Wien, vi. p. 399.

110 mm., 100 segments. Setæ closer ventrally, 46 on segment ix. Spermiducal glands small. Spermathecae with short diverticulum, which is divided distally into three to five chambers.

Hab. Borneo, Java.

I am not quite certain from Rosa's description where to place this species. He observes that the clitellum extends from the seta-rows of segments xiv. to xvi. But whether this means that the setæ are present upon those segments or not, is not quite clear. In any case, it does not seem that this species can be confused with any other.

(3) *Setæ totally absent from clitellum; gizzard-septa usually absent; no bulbous at end of spermiducal gland-duct.*

A. Spermathecae 6 pairs in iv.-ix.

18. *Amyntas hexatheca* Benham.

Perichaeta hexatheca, Benham, Ann. Nat. Hist. (6) xviii. p. 440.

138 mm., 74 segments, stout in form. Setæ 70 on vi., more than 100 behind clitellum. Papillæ on xvii. (2), xix. (3), xx. (3). Spermiducal gland small, with compact structure. First four spermathecae very small.

Hab. Celebes.

Only one example of this species has been studied.

B. Spermathecæ 5 pairs in v.-ix.

19. *Amyntas megascolidioides* Goto & Hatai.

Perichæta megascolidioides, Goto & Hatai, Ann. Zool. Japon. iii. p. 21.

240 mm., 118 segments. Setæ 48, 13 between male pores. Male pores on xix. Papillæ paired on xvii., xviii., xx. Spermiducal glands large. Diverticulum of spermathecæ long.

Hab. Japan.

This species is absolutely unique in the genus, by reason of the fact that the male pores open on to the sixth segment. It may be, of course, that in those species, such as *A. hilgendorfi*, in which the position has not been ascertained, owing to the entire absence of a terminal apparatus, it may also open on to that segment.

C. Spermathecæ 4 pairs in vi.-ix.

20. *Amyntas heterochætus* Mich.

Perichæta heterochæta, Michaelsen, Abh. naturwiss. Ver. Hamb. xi. Heft ii. No. 2, p. 6.

Perichæta indica, auctorum¹.

Non *Perichæta indica*, Horst, Vermes in 'Midden-Sumatra,' p. 4.

Perichæta perkinsi, Beddard, P. Z. S. 1896, p. 198.

Perichæta modigliani, Rosa, Ann. Mus. Civ. Genova, (2) vii. p. 134.

Perichæta nipponica, Beddard, Zool. Jahrb. vi. p. 760.

Perichæta mirabilis, Bourne, P. Z. S. 1886, p. 668.

Amyntas heterochæta, Beddard in 'Fauna Hawaiiensis,' 1900, p. 416.

60-190 mm., 110 &c. segments. Anterior setæ larger, 31 on v., 46 on xvi.; they are ornamented. Papillæ paired on vii.-ix., also often two or three quite close to male pore. Spermiducal gland often absent altogether.

Hab. Everywhere, including Europe.

I have already pointed out² that *Perichæta indica* figured by Horst cannot be the same species as that to which the name of *P. indica* has been also given by myself and others, since in the former there is a large end-sac, through which the duct of the spermiducal gland opens on to the exterior; and I agree with Michaelsen in this identification. *P. perkinsi* is at most a variety of the type examples. *Pheretima californica* (see p. 627) of Kinberg is partly identical. *Perichæta modigliani* of Rosa must also be included, since it appears to have the same papillæ near to the male pores. *P. nipponica* has numerous or few secondary diverticula to the spermathecal appendix, apparently resembling *P. darnleiensis* in this. As I only have one specimen of the former, I (in the meantime at least) follow Michaelsen in including it among the synonyms of *A. heterochætus*.

¹ It is not always possible to know what is meant by "*Perichæta indica*."

² Earthworms from Hawaii, in 'Fauna Hawaiiensis,' Cambridge.

21. *Amyntas enganensis* Rosa.

Perichæta enganensis, Rosa, Ann. Mus. Civ. Genova, (2) xii. p. 546.

170 mm., 140 segments. Stoutish worm. Setæ 80 on ix. Spermiducal glands small. Apertures of spermathecæ close together in middle line (2 mm. apart); diverticulum longer than spermathecæ.

Hab. Engano.

Of this form, which is obviously near to *A. heterochætus*, but different by reason of the close approximation of the spermathecal orifices and of the male pores, Dr. Rosa has described a dark-coloured variety, *tetra*.

22. *Amyntas pictus* Mich.

Megascolex pictus, Michaelsen, Arch. f. Naturg. 1892, p. 246.

Amyntas pictus, id. Jahrb. Hamb. wiss. Anst. xvi. p. 83.

240 mm., 137 segments. Setæ slightly larger anteriorly, 66 on v., 79 on xxv. Clitellum xiii.-xviii. Spermiducal glands hardly extend beyond xviii. Diverticula of spermathecæ bifid.

Hab. Borneo.

This species was originally placed in the genus *Megascolex* on account of the slight dorsal gaps in the seta-rows, and, I presume, the form of the spermathecal appendix. The gizzard, however, is like that of *Amyntas* in position. Another very noteworthy feature in the species is the long clitellum. As only one specimen of this worm has been seen, it is unnecessary to comment at length upon its characteristics.

23. *Amyntas dyeri* Beddard.

Perichæta dyeri, Beddard, P. Z. S. 1892, p. 157.

Perichæta sinensis, id. *ibid.* p. 158.

Perichæta monilicystis, Michaelsen, Arch. f. Naturg. 1892, p. 251.

Perichæta dyeri, Michaelsen, Abh. Senck. nat. Ges. xxi. p. 230.

Perichæta shimäensis, Goto & Hatai, Ann. Zool. Jap. iii. p. 15.

126 mm., 104 segments. Setæ larger anteriorly, those setæ being ornamented; 35 on v., 50 on xxi. One or two pairs of large concave genital papillæ behind or also in front of male pores. Spermathecæ opening very dorsally in position. Diverticulum often moniliform.

Hab. Japan, China, West Africa, British Guiana, West Indies, Madagascar, Europe.

There is no manner of doubt as to the inclusion of the three species, *sinensis*, *dyeri*, and *monilicystis*, under one head. It was mainly the colour that led me to differentiate the two which bear my authorization. The moniliform diverticulum is not a specific character, but an occasional condition. The existence of one pair of papillæ is commoner than two pairs. I found individuals with only one pair, with two pairs, and some in which there was an asymmetry, only one of the anterior pair being present. The

position of the spermathecal orifices is unusual, but is paralleled in *A. trinitatis*.

24. *Amyntas vordermanni* Horst.

Perichæta vordermanni, Horst, Notes Leyd. Mus. xii. p. 231.

315 mm., 175 segments. Setæ 80-90 behind clitellum. Sucker-like papillæ paired on xvii., xviii.; besides these, prominent papillæ on same segments in line of setæ, in front of that of xvii. and behind that of xviii. on each side. Also papillæ on vii., viii. Spermiducal glands xvii.-xxii. Large gland corresponding to papillæ in this region of body. Spermathecæ with diverticulum half their length.

Hab. Billiton.

25. *Amyntas padasensis* Beddard & Fedarb.

Perichæta padasensis, Beddard & Fedarb, Ann. Nat. Hist. (6) xvi. p. 73.

- Non *Amyntas padasensis*, Michaelsen, Jahrb. Hamb. wiss. Aust. xvi. p. 74.

280 mm., 96 segments. Setæ slightly larger anteriorly; occasionally more closely crowded ventrally, especially on xvii., xviii. Male pores divided by 10 setæ. Spermiducal glands with thick straight duct. Diverticula of spermathecæ with accessory sperm-chambers. Sperm-sacs in x.-xiii., those of xi., xii. with a small apical lobe, as in many other species.

Hab. Borneo.

In this species the difference in size between individuals is great. Two examples from Padas Valley were respectively 280 and 187 mm. Those from Merabah about 120 mm. or so. The spermathecæ have a remarkably strong duct, nearly as wide, and quite as long, as the pouch. The diverticula are not always provided with additional swellings; but they are often so. The arrangement is like that of the Japanese worm I called *Perichæta nipponica*, *Amyntas daruleiensis*, and also *A. martensi*, where the same occurrence and non-occurrence of the supplementary diverticula is met with. I have seen five specimens of this species, the two large ones from Padas and the smaller ones from Merabah.

26. *Amyntas trinitatis* Beddard.

Perichæta trinitatis, Beddard, P. Z. S. 1896, p. 206.

150 mm., 100 segments. Setæ on vi.-ix. larger, 45 on xvii.; 19 setæ between male pores. Spermiducal glands in xvii.-xxi., with horseshoe-shaped duct. Spermathecæ open near to dorsal middle line, with diverticulum longer than pouch.

Hab. Trinidad.

This species appears to be distinct. It differs from *A. heterochætus* mainly in dorsal position of spermathecal pores, in larger number of setæ between male pores, and in larger diverticulum of spermathecæ. It has egg-sacs in xiii., xiv.

27. *Amyntas divergens* Mich.

Perichæta divergens, Michaelsen, Arch. f. Naturg. 1892, p. 243.

Amyntus divergens, id. Jahrb. Hamb. wiss. Anst. xvi. p. 8.

P. fuscata, *P. heteropoda*, *P. obscura*, *P. scholastica*, *P. micronaria*, *P. grossa*, Goto & Hatai, Ann. Zool. Jap. ii. p. 66, &c.

120 mm., 120 segments. Setæ of anterior segments stronger, 33 on v., 48 on xxv. Paired papillæ on vii.-ix. near spermathecal pores, to which correspond internally stalked glands; also on xvii.-xx. Sperm-sacs with dorsal process. Spermiducal gland totally absent.

Hab. Japan.

I take the above description entirely from Michaelsen. He is of opinion that the species described by Messrs. Goto and Hatai enumerated above are to be looked upon as mere variations. To these, indeed, he adds some few others which I partly identify with other known forms of Japanese *Amyntas*. This arrangement, however, cannot but be regarded as quite preliminary. A renewed investigation of the Japanese species is to be desired.

In the meantime it may be mentioned that in *P. fuscata*, *P. scholastica*, *P. grossa*, and *P. micronaria* there is a spermiducal gland. But this of course is no reason against the identification of the various forms here grouped together as one species.

28. *Amyntas izukai* Goto & Hatai.

Perichæta izukai, Goto & Hatai, Ann. Zool. Jap. iii. p. 14.

235 mm., 137 segments. Setæ 40 on v., 60 posteriorly, longer on anterior segments. Paired papillæ on xix.-xxiii. in line with male pores. Cæca absent. Spermiducal glands confined to xviii. Spermathecæ with long duct and equally long appendix.

Hab. Japan.

The disposition of the genital papillæ in this species is like that of *A. forbesi* and *A. biserialis*. But the four pairs of spermathecæ distinguish the present species from either of those.

29. *Amyntas bosschæ* Horst.

Perichæta bosschæ, Horst, Notes Leyd. Mus. xv. p. 324.

Perichæta bosschæ, Michaelsen, Abh. Senck. nat. Ges. xxiii. p. 238.

170 mm., 125 segments. Setæ ornamented; 37 on v., 40 on xxiv.; 8 setæ between male pores. Sperm-sacs in x.-xii. Spermiducal glands not large. Spermathecæ with short diverticulum.

Hab. Borneo.

D. Spermathecæ 3 pairs in vii.-ix.

30. *Amyntas carinensis* Rosa.

Perichæta carinensis, Rosa, Ann. Mus. Civ. Genova, (2) x. p. 107.

200 mm., 150 segments. Setæ closer ventrally, 60 on viii. Papillæ one pair on xviii. between male pores. Sperm-sacs very

large, extending backwards to spermiducal gland. Spermiducal glands in three segments. Spermathecæ very large, posterior pair reaching the anterior sperm-sac, with slender diverticulum nearly as long.

Hab. Mt. Carin (Buruna).

31. *Amyntas ælianus* Rosa.

Perichæta æliana, Rosa, Ann. Mus. Civ. Genova, (2) xii. p. 545.

100 mm., 120 segments. Setæ 74 on xiii. Male pores closely approximated, only 2 mm. apart. Spermiducal glands with short straight duct. Spermathecæ opening as close together as male pores, with very long diverticulum wound into a mass larger than pouch.

Hab. Engano.

32. *Amyntas minahassæ* Mich.

Perichæta minahassæ, Michaelsen, Abh. Senck. nat. Ges. xxiii. p. 235.

Amyntas minahassæ, id. Jahrb. Hamb. wiss. Anst. xvi. p. 51.

48-105 mm., 92-113 segments; stoutly built worm. Setæ with dorsal gaps closer ventrally, 60 on x., 74 on xxvi. Deep suckers in front and behind each male pore on xvii./xviii., xviii./xix.; also small papillæ on xviii. and xix., and less constantly on xvii. Sperm-sacs in x.-xii. Duct of spermiducal gland short and straight. Diverticulum of spermathecæ longer than, or as long as, pouch.

Hab. Celebes.

The fact that ripe individuals of this species sometimes only reach a length of 48 mm. shows how careful it is necessary to be in founding specific differences upon size.

33. *Amyntas castaneus* Mich.

Amyntas castaneus, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 56.

50 mm., 95 segments. Setæ with slight dorsal gaps, a little closer ventrally, 40 on vi. and xxvi. In front of and behind male pores a furrow. Papillæ paired on xvii.-xx. near middle line, and a fifth pair on xvii. still more ventral. Spermiducal gland in four segments, with thick straight duct. Diverticulum of spermatheca a little shorter than pouch.

Hab. Celebes.

34. *Amyntas kalaenensis* Mich.

Amyntas kalaenensis, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 68.

50 mm., 93 segments. Setæ with slight dorsal gaps, 44 on xii., 49 on xxvi. A slit-like depression in front of and behind each male pore. Spermiducal gland small, with short straight duct. Diverticulum longer than spermatheca.

Hab. Celebes.

As this species is distinguished from the last by Michaelsen, who

has described both, I separate them here. But the present form is known only from one specimen, and may prove to be not different from *A. castaneus*. It has, it will be observed, the slit-like suckers by the male pores, found, however, in other forms, such as *A. novæ-britanniæ*.

35. *Amyntas burchardi* Mich.

Amyntas burchardi, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 88.

270 mm., 126 segments. Setæ ornamented, larger anteriorly and also dorsally on all segments, with slight dorsal gaps; 34 on v., 62 on xxvi. 40 small papillæ between male pores. The sperm-sacs have a dorsal appendix. Spermiducal glands from xvii.–xxi., broken up into minute lobules, almost granular. Diverticulum slightly longer than spermatheca.

Hab. Sumatra.

The papillæ suggest those of *A. papulosus*, with which, however, the present species (known by a single example only) is not to be confounded.

36. *Amyntas ocellatus* Mich.

Amyntas ocellatus, Michaelsen, loc. cit. p. 89.

175 mm., 150 segments. Setæ ornamented, larger on anterior segments; 28 on vi., 49 on xxvi. Papillæ in two rows of 3–6 behind and before seta-line of xviii.; two in front of each spermathecal pore; there are others varying in the same segments. Sperm-sacs with appendices. Spermiducal gland in four segments. Diverticulum hardly so long as spermatheca.

Hab. Sumatra.

37. *Amyntas tobaensis* Mich.

Amyntas tobaensis, Michaelsen, loc. cit. p. 91.

105 mm., 112 segments. Setæ with slight dorsal gaps, closer ventrally; 54 on v., 47 on xxvi. Three small papillæ by each male pore, and two or three pairs close to orifices of spermathecæ. Sperm-sacs with an appendix. Spermiducal glands in xvii.–xx. Diverticulum coiled, half as long as spermatheca.

Hab. Sumatra.

38. *Amyntas californicus* Kinberg.

Pheretima californica, Kinberg, Cefv. K. Svensk. Ak. Förh. 1866, p. 102 (in part.).

Amyntas californicus, Michaelsen, ibid. 1899, p. 438.

Megascolex californicus, Vaillant, Annelés, 1889, p. 70.

Perichæta ringeana, Michaelsen, Jahrb. Hamb. wiss. Anst. vii. p. 60.

Perichæta guarini, Rosa, Atti R. Accad. Torino, xxix. p. 13.

Amyntas ringeanus, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 116 & p. 120.

50–125 mm., 55–110 segments. Setæ larger ventrally and on

the anterior segments; those of segment x. very small; 34 on v., 60 on xxv. Setæ ornamented. Spermathecæ with long duct.

Hab. Mexico, Madeira, Egypt, California.

This species is placed among those with three pairs of spermathecæ on account of the fact that one specimen had three pairs of these organs. But two pairs in viii. and ix. seems to be the more usual condition. It is not an easily definable species and may not be distinct. Its chief character (but this has not been looked for in many other species) is a series of vesicular bodies attached to the nephridia after segment xxx.

39. *Amyntas udei* Rosa.

Perichæta udei, Rosa, Ann. Mus. Civ. Genova, (2) xvi. p. 521.

Amyntas udei, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 87.

66 mm., 90 segments. Setæ closer ventrally; 40 on vii., 39 on xxvi. 8 setæ between male pores. Septum vii./ix. rudimentary. Spermiducal glands limited to xviii., with short slightly curved (S-shaped) duct. Diverticulum of spermatheca half the length of pouch.

Hab. Sumatra.

40. *Amyntas juloides* Mich.

Amyntas juloides, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 53.

145 mm., 119 segments. Setæ with slight dorsal gaps, closer ventrally; 60 on vi., 86 on xxv. Papillæ one in front of and one behind each male pore; five median on xviii.; one on xvii., xix. Septum viii./ix. thin. Sperm-sacs with a median process. Spermiducal glands with slightly bent duct. Diverticulum of spermathecæ less than pouch.

Hab. Celebes.

41. *Amyntas peguanus* Rosa.

Perichæta peguana, Rosa, Ann. Mus. Civ. Genova, (2) x. p. 113.

Perichæta peguana, id. Ann. Nat. Hist. (7) ii. p. 289.

170 mm., 120 segments. Setæ 56 on viii. Papillæ on xvii./xviii., xviii./xix., paired in front of and behind male pores. Septum viii./ix. present. Spermiducal glands in three segments, with curved duct. Diverticula of spermathecæ long but coiled into a tight coil, which cannot be separated. Round sacs of muscular appearance corresponding internally to papillæ.

Hab. Burma, Penang, Siam.

I do not agree with Rosa as to the absence of the septum viii./ix. I found it to be distinctly present in individuals examined by myself.

42. *Amyntas flavescens* Goto & Hatai.

Perichæta flavescens, Goto & Hatai, Ann. Zool. Japon. ii. p. 72.

Perichæta producta, iid. ibid. p. 73.

140 mm., 120 segments. Setæ 30-50; 8 between male pores.

Papillæ paired on vii.-ix., and three or four surrounding male pore. Spermiducal gland sometimes wanting. Spermathecæ either without or with but minute diverticulum.

Hab. Japan.

This species, which Michaelsen merges with his *A. divergens*, has, I think, claim to distinction on account of the three pairs of spermathecæ in segments vii.-ix., with absent diverticula or with (in the case of the variety *flavescens*) only minute diverticula to the pair of spermathecæ in segment viii.

E. Spermathecæ 2 pairs in viii., ix.

43. *Amyntas semifasciatus* Mich.

Amyntas semifasciatus, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 49.

110 mm., 88 segments. Setæ 45 on v., 62 on xxiv. Small papillæ, one or two pairs on xvii., xix. Both gizzard-septa present but thin. Spermiducal glands in xvii., xviii., with bent duct. Diverticulum of spermatheca very short.

Hab. Celebes.

Only a single specimen has been described.

44. *Amyntas æruginosus* Kinberg.

Amyntas æruginosus, Kinberg, Öfv. K. Svensk. Ak. Förh. 1886, p. 101.

Amyntas æruginosus, Michaelsen, Öfv. K. Svensk. Ak. Förh. 1899, p. 434; id. Jahrb. Hamb. wiss. Anst. xvi. p. 4.

Megascolex æruginosus, Vaillant, Annelés, 1889, p. 82.

Perichæta musica, Michaelsen, Oligochæta in Semon's Forsch. Reise, v. Lief. i. p. 99.

Megascolex musicus, Horst, Notes Leyd. Mus. v. p. 193.

Perichæta musica, Horst, Notes Leyd. Mus. xii. p. 236; id. ibid. xv. p. 338; id. Zool. Ergebn. Max Weber, Bd. ii. p. 59.

Perichæta musica, Vordermann, Natuurk. Tijdschr. Ned. Indië, xli. p. 1, & xliv. p. 1.

Perichæta fasciata, Rosa, Ann. Mus. Civ. Genova, (2) xii. p. 543, & xvi. p. 609.

Perichæta longa, Horst, Notes Leyd. Mus. xv. p. 325.

Perichæta musica, Ude, Zeitschr. wiss. Zool. lxvii. p. 63.

Perichæta musica, Michaelsen, Arch. f. Naturg. 1892, p. 238.

Perichæta musica, Rosa, Atti R. Accad. Torino, xxix. p. 8.

Perichæta longa, Michaelsen, Arch. f. Naturg. 1892, p. 239.

Perichæta willeyi, Benham, Ann. Nat. Hist. (6) xvi. p. 41.

180-570 mm., 100-166 segments. Setæ from 50-100. 17 setæ between male pores. Spermiducal glands in xviii. only; duct short and straight. Diverticulum of spermatheca very long and much coiled.

Hab. Java, Sunatra, Guam.

This, the largest of all species of *Amyntas*, and one of the largest

of earthworms, should obviously include the specific names given above, which really only differ in size. Its characters, save those of size, are by no means salient, and with difficulty can it be separated from the next species. I also place here *A. willeyi*, which cannot be, as is suggested by Michaelsen, a synonym of *capensis* since the latter has a terminal bursa. I am rather inclined to think that *operculata* (see p. 618) should come here.

45. *Amyntas upoluensis* Beddard.

Perichæta upoluensis, Beddard, Proc. Roy. Soc. Edinb. xiv. p. 174, and Willey's Zoological Results, part ii. p. 185.

Perichæta recta, Rosa, Ann. Nat. Hist. (7) xi. p. 284.

166 mm., 110 segments. Setæ 46 on x., 54 on xxv. 7 setæ between male pores. Papillæ one median on x., and a variable number of also unpaired papillæ on xvii.–xxi. (xxii). Two or three minute papillæ close to each male pore. Spermiducal gland in xvi.–xviii.; duct short and straight. Diverticulum of spermathecæ very long.

Hab. Upolu, Esafate.

46. *Amyntas sluiteri* Horst.

Perichæta sluiteri, Horst, Notes Leyd. Mus. xii. p. 234.

190 mm., 135 segments. Setæ 60–75, more closely packed ventrally. Sperm-sacs x.–xii. Spermiducal gland nearly divided into two, of loose structure, its duct sinuous. Spermathecæ with zigzag diverticulum as long as pouch.

Hab. Billiton.

47. *Amyntas halmaheræ* Mich.

Perichæta halmaheræ, Michaelsen, Abh. Senck. nat. Ges. xxiii. p. 208.

Perichæta jampeana, Benham, Ann. Nat. Hist. (6) xviii. p. 430.

Amyntas jampeanus, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 61.

Perichæta bonthainensis, Benham, loc. cit. p. 437.

Perichæta digitata, Benham, loc. cit. p. 432.

Perichæta purpurea, Benham, loc. cit. p. 445.

? *Amyntas fissiger*, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 67.

95–420 mm., 116–148 segments. Setæ 70–130 on xxvi.; they are ornamented. Male pores rather close together. Papillæ very variable in neighbourhood of male pores and spermathecal pores. Spermiducal gland not very large. Diverticulum longer than pouch.

Hab. Celebes, Halmahera, Batjan.

Dr. Michaelsen has indicated the close likeness which all the forms here brought together exhibit. He, however, would allow three species, viz., *A. halmaheræ*, *A. jampeanus*, *A. purpureus*. The reasons for uniting all must now be dealt with. *A. halmaheræ* (with varieties *gamsungi*, *batjanensis*, *cæcilia*, *kauensis*, *galelensis*,

imparicystis) agrees with *A. jampeanus*, as described by Benham, in size: the extremes are different, viz. 130 & 420 mm.; but the following measurements unite these extremes to some extent:—170, 220 of *halmaheræ*, and 370, 280, 240, & 225 of *jampeanus*. The genital papillæ differ enormously in the varieties of *halmaheræ*: in one there are but a single pair on xvii., at the other extreme we have something like twelve pairs in the neighbourhood of the spermathecal orifices and eleven pairs posteriorly.

From this to *A. jampeanus* with no papillæ is not a wide jump; and it must be remembered that Benham described only three examples of the species. In any case *P. bonthainensis* has rows of three such papillæ on xvii., xix., xx. The number of setæ is certainly smaller in the typical *halmaheræ* from what is found in the typical *jampeanus*, i. e. 80 on xxv. to 130 on the same segment. But this discrepancy is reduced in significance by Dr. Michaelsen's description of a variety of *jampeanus* in which that segment had but 86. To this and to another variety the names of *tigrina* and *fumigata* were given by Michaelsen. In all of these forms the male pores are more closely approximated than is the rule in *Amyntas*. A difference shown by *digitata* is the "digitate" condition of the cæca. But this is shown to nearly the same extent in *halmaheræ*. In the former, again, the spermiducal glands are small, and actually confined to the xviiiith segment. We find, however, here again a series of stages: in specimens of *bonthainensis* examined by Michaelsen those glands only occupied two segments; the rule for the species, as it appears, is for them to fill three segments. It would seem at first sight more unreasonable to include the small species *A. purpureus*. The species is as small as 72 mm. in length, which contrasts with the 420 mm. of *A. jampeanus*. But the largest individual of *purpurea* described by Dr. Benham measures 95 mm., which is after all not so great a difference from the smallest of *halmaheræ*. I include it in the present form in agreement with Dr. Michaelsen, who however did not actually place the name as a synonym of the rest. The male pores are close together as in the other varieties. The setæ are however fewer, not more than 70 upon the xxvth segment. That the diverticulum of the spermatheca is straight and not coiled does not appear to me to be at all a valid distinction.

48. *Amyntas aspergillum* Perrier.

Perichaeta aspergillum, Perrier, Nouv. Arch. Mus. Paris, viii. p. 118.

Perichaeta aspergillum, Rosa, Ann. k.-k. Hofm. Wien, vi. p. 403.

Amyntas aspergillum, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 10.

Perichaeta takatorii, Goto & Hatai, Ann. Zool. Japon. ii. p. 76.

Megascolex aspergillum, Vaillant, Annelés, 1889, p. 76.

180–375 mm., 150 segments. Setæ 48 on v., 97 on xxvi. Setæ ornamented, ventral larger than dorsal on many segments. Male pores surrounded by ten papillary pores; spermathecal apertures

by rather fewer. Duct of spermiducal gland bent. Diverticulum of spermathecæ the length of pouch.

Hab. South China, Japan.

49. *Amyntas sarasinorum* Mich.

Amyntas sarasinorum, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 71.

165 mm., 95 segments. Setæ 45 on v., 56 on xxvi. Male pores rather close. Spermiducal gland limited to xviii. Diverticulum of spermathecæ not long, with an accessory diverticulum.

Hab. Celebes.

This species clearly approaches *Amyntas halmaheræ*. The male pores, rather close, are not quite so nearly approximated as in that species; the cæca show the commencement of the digitation so pronounced in "*digitata*." This latter form moreover has the spermiducal gland confined to segment xviii., as is the case with *A. sarasinorum*.

50. *Amyntas esafatæ* Beddard.

Perichæta esafatæ, Beddard, Willey's Zool. Results, part ii. p. 187.

115 mm., 105 segments. About 8 pairs of papillæ on segments xvii.-xix. Four setæ between male pores, but orifices not closely approximated. Diverticulum of spermatheca longer than pouch.

Hab. Esafate, New Hebrides.

51. *Amyntas masatakæ* Beddard.

Perichæta masatakæ, Beddard, Zool. Jahrb., Syst. Abth. vi. p. 761.

Perichæta campestris, Goto & Hatai, Ann. Zool. Japon. ii. p. 67.

125 mm., 90 segments, of stout build. 11-15 setæ between male pores. Anterior setæ larger. Three small papillæ surrounding male pore; anteriorly a pair lying to inside of, and before, and in front of each spermathecal aperture. To all these correspond stalked glands. Spermiducal glands absent, only duct represented, which is curved. Diverticulum of spermatheca long and straight, longer than pouch.

Hab. Japan.

I regard *Perichæta campestris* as synonymous with my species. It has two pairs of spermathecæ in the same segments, which appear however to have shorter diverticula. The presence of a spermiducal gland in *campestris* does not invalidate the comparison, since we have cases like *A. heterochætus*, where this gland may be absent or present. The papillæ too are slightly different in the two forms. Still *campestris* appears to be more like *masatakæ* than *divergens*, where it was placed by Michaelsen.

52. *Amyntas novæ britannicæ* Benham.

Perichæta novæ britannicæ, Benham, Journ. Linn. Soc., Zool. xxvi. p. 199.

Perichæta novæ britannicæ, Beddard, Willey's Zool. Results, pt. ii. p. 183.

130 mm., 120 segments. Setæ 56 on vi., 74 on xxvi. Papillæ, two deep pits on xvii., xviii. Spermiducal gland in xvi.–xviii., with straight duct; orifices, as of the spermathecæ, close. Diverticulum as long as pouch.

Hab. New Britain.

f. *Spermathecæ* 2 pairs in vii., viii.

53. *Amyntas tokioensis* Beddard.

Perichæta tokioensis, Beddard, Zool. Jahrb., Syst. Abth. vi. p. 762.

Perichæta candida, Goto & Hatai, Ann. Zool. Japon. ii. p. 77.

Perichæta parvicystis, Goto & Hatai, *ibid.* iii. p. 18.

70–150 mm., 67–95 segments. Setæ 40. Papillæ two to three near male pores and paired on vi.–viii., with stalked glands. Spermiducal glands (sometimes absent) xvii.–xx., with curved duct. Spermathecal diverticulum long and straight.

Hab. Japan.

I think that there can be hardly a question as to the justice of uniting the forms which have received the three names quoted above. The fact that the spermiducal gland is absent in the form termed by Goto and Hatai "*candida*" is not necessarily an objection to this proceeding.

54. *Amyntas hesperidum* Beddard.

Perichæta hesperidum, Beddard, P. Z. S. 1892, p. 169, and *Fauua Hawaiiensis*, 1900.

Perichæta sandvicensis, Beddard, P. Z. S. 1896, p. 203.

Amyntas lohri, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 12.

100 mm., 105 segments. Setæ stronger on anterior segments; 33 on v., 53 on xvi. 18 setæ between male pores. Septum viii./ix. occasionally present, but thin. Spermiducal glands in three segments. Diverticulum of spermatheca coiled, not long. Sperm sacs with dorsal diverticula.

Hab. Hong Kong; Hawaii; Barbados.

It is only the comparative shortness of the spermathecal appendix that differentiates this species from *æruginosus*; the two are close.

55. *Amyntas hilgendorfi* Mich.

Perichæta hilgendorfi, Michaelsen, Arch. f. Naturg. 1892, p. 235, and Jahrb. Hamb. wiss. Anst. xvi. p. 9.

Perichæta rokugo, Beddard, Zool. Jahrb., Syst. Abth. vi. p. 76.

Perichæta irregularis, Goto & Hatai, Ann. Zool. Japon. iii. p. 13.

Perichæta schizopora, Goto & Hatai, *ibid.* ii. p. 76.

150 mm., 120 segments. Setæ 40–60. Group of pores on viii. in front of ring of setæ on to which open a number of stalked

glands. Cæca 6-8. Spermiducal gland and duct entirely absent. Spermathecæ with long straight diverticulum.

Hab. Japan.

The above synonymy is partly due to the fact that my description and that of Michaelsen were published at about the same time. I follow Michaelsen in regarding *P. schizopora* of Goto & Hatai as a synonym. It has moreover but one pair of spermathecæ in viii. It is possible that the present species is the same as *P. glandularis* of the two authors referred to. But in the meantime I keep that species separate. *P. irregularis* of the same authors has no spermathecæ and no gland-patches, but perhaps is the same.

56. *Amyntas annulatus* Horst.

Megascolex annulatus, Horst, Notes Leyd. Mus. v. p. 186.

Perichæta annulata, id. ibid. xii. p. 236.

195 mm., 130 segments. Setæ 60 on viii. Male pores separated by 30 setæ, thus, as are the spermathecal pores, dorsal in position. Papillæ seven pairs on xvii.-xix. Spermiducal gland in xvii.-xix. Spermatheca with diverticulum about half its length.

Hab. Malay Archipelago.

I am indebted to Dr. Horst for some further details concerning this species, which are embodied in the above description.

57. *Amyntas japonicus* Horst.

Megascolex japonicus, Horst, Notes Leyd. Mus. v. p. 192.

220 mm. Male pores on a long J-shaped groove, extending over xviii. and part of xvii. Setæ 66. Spermiducal glands in xvii.-xix., much lobate, with horseshoe-shaped duct. Diverticulum of spermatheca straight and slender, not so long as pouch.

Hab. Japan.

58. *Amyntas glandularis* Goto & Hatai.

Perichæta glandularis, Goto & Hatai, Ann. Zool. Japon. iii. p. 18.

150 mm., 104 segments. Setæ 60 in vii. 19 setæ between male pores. Cæca six pairs. Median glandular area on vii. and xviii., through which open masses of stalked glands; also three or four isolated stalked glands in neighbourhood of spermathecal and of male pores. Only duct of spermiducal gland present. Spermathecæ with long diverticulum.

Hab. Japan.

This species comes near to *A. hilgendorfi* in the masses of white glands opening on to the exterior by a median perforated area. But it seems to be a different species.

59. *Amyntas levis* Goto & Hatai.

Perichæta levis, Goto & Hatai, Ann. Zool. Japon. iii. p. 20.

85 mm., 88 segments. Setæ 45-48. Papillæ near to spermathecal pores, on to which open stalked glands. Cæca five pairs.

Spermiducal gland entirely absent. Diverticulum of spermatheca long.

Hab. Japan.

60. *Amyntas vittatus* Goto & Hatai.

Perichæta vittata, Goto & Hatai, Ann. Zool. Japon. ii. p. 74.

100 mm., 68 segments. Setæ 57 on vii., 60 on xviii. Cæca six pairs. Spermiducal glands entirely absent. Spermathecae three pairs in each of their two segments.

Hab. Japan.

G. Spermathecae 3 pairs in vi.-viii.

61. *Amyntas bournei* Rosa.

Perichæta bournei, Rosa, Ann. Mus. Civ. Genova, (2) x. p. 110.

150 mm., 130 segments. Setæ 60. Papillæ, two by each male pore and one close to each spermathecal orifice, provided with glands. Spermiducal gland not very large, its duct curved. Diverticulum of spermatheca as long as pouch.

Hab. Burma.

I am much disposed to think that this species is really *hawayanus*.

62. *Amyntas proporus* Rosa.

Perichæta propora, Rosa, Ann. Mus. Civ. Genova, (2) xvi. p. 522.

60 mm., 62 segments. Setæ more crowded below, 44 on vii., 40 on xvii. Two or three minute papillæ behind each spermathecal pore. Spermiducal gland in xvi.-xxi., with curved duct. Diverticulum of spermathecae longer than pouch and zigzag above.

Hab. Sumatra.

Perhaps the same remark may be made about this species as about the last.

63. *Amyntas sieboldi* Horst.

Megascolex sieboldi, Horst, Notes Leyd. Mus. v. p. 191.

Perichæta sieboldi, Michaelsen, Arch. f. Naturg. 1892, p. 235.

Perichæta sieboldi, Beddard, Zool. Jahrb., Syst. Abth. vi. p. 759; Horst, Notes Leyd. Mus. xx. p. 240; Goto & Hatai, Ann. Zool. Jap. ii. p. 65.

Perichæta sieboldi, Rosa, Ann. k.-k. Hofm. Wien, vi. p. 401.

Perichæta communissima, Goto & Hatai, Ann. Zool. Jap. iii. p. 23.

Amyntas sieboldi, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 9.

145-270 mm., 91-145 segments. Setæ 80 on viii. No papillæ. Septum ix./x. present. Cæca 6-7 arising in same segment one above the other. Spermiducal gland in xvi.-xviii., with straight or curved short duct. Spermathecae (? usually in vii.-ix.) with long coiled diverticulum.

Hab. Japan.

Some confusion has arisen concerning this species owing to the fact that the examples studied by Goto & Hatai showed the

spermathecae in vi.-viii., instead of vii.-ix. as described by Horst, Rosa, and Michaelsen. The latter has now solved the difficulty by finding that in some specimens, which he distinguishes as a variety *lenzi*, the spermathecae have that position. Moreover these worms are smaller than the type, 90-145 mm., and have rather fewer setae. The gizzard-septa are entirely absent, and the sperm-sacs have a small "Anhangsblase" such as occurs in many worms, but (as is also sometimes the case elsewhere) sunk into the proper sperm-sac. The example studied by myself belongs to this variety, and has the spermathecal pores between v./vi.-vii./viii. It is smallish, and has a bent instead of a straight duct to the spermiducal glands. I observed the same accessory lobe to the sperm-sacs that Michaelsen refers to.

64. *Amyntas ijimæ* Rosa.

Perichæta ijimæ, Rosa, Ann. k.-k. Hofm. Wien, vi. p. 402.

Perichæta kamakurensis, Goto & Hatai, Ann. Zool. Japon. ii. p. 68.

Perichæta parvula, iid. ibid. p. 68.

Perichæta decimpapillata, iid. ibid. p. 71.

110-150 mm., 115 segments. 60 setae on viii. Papillae paired on vi.-viii. and on xvii.-xix., as many as two pairs to each segment. Spermiducal gland extensive, in xv.-xx.; sometimes absent. Spermathecae with minute diverticula or without any.

Hab. Japan.

I unite the three species described as separate by Messrs. Goto & Hatai with Dr. Rosa's *Perichæta ijimæ* on account of the missing or small spermathecal diverticula. Rosa's species only differs in the greater number of setae in the spermathecal region (60 as against 36) and in the absence of papillae. But these latter are so inconstant that the fact is not necessarily fatal to the collocation of these forms. *P. parvula* is very minute, only 32 mm., with 48 segments, and has no genital papilla or spermiducal gland. To this form it may be necessary to assign a separate specific name. But I do not do this for the present. It has no diverticula, while *decimpapillata* has "very small diverticula."

65. *Amyntas acrophilus* Rosa.

Perichæta acrophila, Rosa, Ann. Mus. Civ. Genova, (2) xvi. p. 527.

73 mm., 110 segments. Setae closer ventrally, 30 on vii., 40 on xxv. 14 setae between male pores. Septum viii./ix. feeble. Spermiducal glands occupying five segments, with short duct. Diverticulum of spermatheca zigzag, longer than pouch.

Hab. Sumatra.

66. *Amyntas brevis* Rosa.

Perichæta brevis, Rosa, Ann. Nat. Hist. (7) ii. p. 283.

20 mm., 80 segments. Setae 50 on xxv. 14 setae between male

pores. Gizzard-septa both present. Sperm-sacs x.-xii. Spermiducal gland occupying 6 segments. Spermathecæ almost globular, with duct not so long as pouch.

Hab. Christmas Island.

67. *Amyntas agrestis* Goto & Hatai.

Perichæta agrestis, Goto & Hatai, Ann. Zool. Japon. iii. p. 17.

160 mm., 96 segments. Setæ 36-40. Papillæ to inside of spermathecæ on vii., viii. Cæca seven pairs. Spermiducal glands entirely absent. Diverticulum of spermathecæ long.

Hab. Japan.

In some specimens there are a pair of papillæ upon xviii.

68. *Amyntas birmanicus* Rosa.

Perichæta birmanica, Rosa, Ann. Mus. Civ. Genova, (2) vi. p. 164.

130 mm., 112 segments. Setæ 70 on each segment, 15 between male pores. Spermiducal glands in three segments, with bent duct. Spermathecal diverticulum coiled.

Hab. Bhamo (Irrawaddi).

H. Spermathecæ 1 pair in viii.

69. *Amyntas zebra* Benham.

Perichæta zebra, Benham, Ann. Nat. Hist. (6) xviii. p. 442.

Amyntas zebra, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 73.

200 mm., 146 segments. Setæ 62 on vi., 78 on xxvi.; 10 setæ between male pores. Papillæ, one pair between male pores. Spermiducal gland in xvi.-xviii., with curved duct. Diverticulum shorter than pouch, coiled.

Hab. Celebes.

I. Spermathecæ 1 pair in ix.

70. *Amyntas pataniensis* Mich.

Perichæta pataniensis, Michaelsen, Abh. Senck. nat. Ges. xxiii. p. 222.

40-110 mm., 78-120 segments. Setæ 40 on v., 54 on xxvi. Male pores and spermathecal pores close together. Papillæ present anteriorly as well as posteriorly. Sperm-sacs in xi.

Hab. Batjan, Patam, Halmahera.

Michaelsen divides this species into two subspecies, of which the first has the species name, the second he terms *labuensis*. The former has really two pairs of spermathecæ, but the anterior pair are small and in process of disappearance. The resemblance of this species to *A. halmaheræ* is considerable, especially in the approximation of generative pores and in the papillæ.

71. *Amyntas supuensis* Mich.

Perichæta supuensis, Michaelsen, Abh. Senck. nat. Ges. xxiii. p. 225.

115 mm., 145 segments. Setæ very numerous and small, 132 on vi., 154 on vii., 106 on xxvi. Papillæ on xviii., xix., several pairs, and on viii., ix., one pair each. Spermiducal gland not large, embracing a thick short duct.

Hab. Halmahera, Supu.

Here again, as in *A. halmahera*, the generative orifices are closely approximated to each other.

K. Spermathecæ 2 pairs in vi., vii.

72. *Amyntas biserialis* Perrier.

Perichæta biserialis, Perrier, Comptes Rend. lxxxi. p. 1044; Beddard, P. Z. S. 1890, p. 63.

Perichæta biserialis, Michaelsen, Abh. Senck. nat. Ges. xxiii. p. 226; Horst, Notes Leyd. Mus. xx. p. 201; Beddard & Fedarb, P. Z. S. 1899, p. 803.

Perichæta acystis, Beddard, Monograph Oligochæta, p. 423.

Megascolex biserialis, Vaillant, Annelés, 1889, p. 76.

135 mm., 167–220 segments. Setæ on each side of ventral line much enlarged; those of anterior segments also enlarged; 81 on v., 90 on x., 70 on xxvi. 14 setæ between male pores. Papillæ paired on xix.–xxv. (maximum number). No cæca. Spermisacs in xi–xiii. Spermiducal glands in xvi.–xix., with curved duct. Spermathecæ paired, 3–6 in each segment, often asymmetrical, sometimes entirely absent.

Hab. Philippines, Madagascar, Guiana.

There can be no doubt as to the identity of the two species included in the present. The number of setæ on the segments varies considerably. The numbers given above are those of Michaelsen. The prevalent number of papillæ is 3 to 5 pairs. Perrier found 7, a number which has not been found by other observers. Out of the 33 examples of the species which have been studied, 12 had no spermathecæ. Generally there are no setæ upon the clitellum; but in one individual at any rate there were a pair upon segment xvi.

73. *Amyntas hasselti* Horst.

Megascolex hasselti, Horst, Notes Leyd. Mus. v. p. 190.

Perichæta hasseltii, id. Vermes in 'Midden-Sumatra,' p. 5.

70 mm., 100 segments. Setæ 70–75, those of ventral surface crowded together. Spermiducal glands much divided, with short straight duct. Spermathecæ with diverticulum half the length of pouch.

Hab. Lebong.

74. *Amyntas nanus* Rosa.

Perichaeta nana, Rosa, Ann. Mus. Civ. Genova, (2) xvi. p. 519.

30 mm., 95 segments. Setæ with slight dorsal and ventral gaps, 36 on xii., 32 on xxv. 6 setæ between male pores. Dorsal pores from vii./viii. Spermiducal glands in xvii.-xxi., with slightly bent duct. Diverticulum longer than spermatheca.

Hab. Sumatra.

L. Spermathecae numerous in vi., vii.

75. *Amyntas stelleri* Mich.

Perichaeta stelleri, Michaelsen, Jahrb. Hamb. wiss. Anst. viii. p. 337.

Perichaeta barami, Michaelsen, Abh. Senck. nat. Ges. xxiii. p. 203.

Perichaeta stelleri, Horst, Notes Leyd. Mus. xx. p. 205; Michaelsen, Abh. Senck. nat. Ges. xxiii. p. 202.

Perichaeta everetti, *P. papillata*, *P. sarawacensis*, *P. kinabaluensis*, Beddard, Mon. Olig. p. 428.

Perichaeta everetti, *P. papillata*, *P. sarawacensis*, *P. kinabaluensis*, Beddard & Fedarb, Ann. Nat. Hist. (6) xvi. p. 69 etc.

Amyntas stelleri, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 36.

115-300 mm., 160 segments. Setæ with slight dorsal gaps, those of anterior segments stronger, 42 on v., 55 on xxiv. Paired papillæ to some or all of xix.-xxx. No cæca. Sperm-sacs in x.-xiii. Spermathecae 2-20 pairs.

Hab. Celebes, Sangir, Borneo.

The question of the identity or the non-identity of the various species here grouped together in deference with the arrangement of Drs. Horst and Michaelsen does not appear to me to be quite settled.

Horst found that in numerous examples studied by him, the number of papillæ ranged in number from a single pair through two, three, four, five, eight, nine, and ten pairs, there being occasionally an asymmetry. This seems to dispose of at any rate one alleged specific difference between the four species described by myself and *stelleri* of Michaelsen. A renewed study of my own material and the dissection of many more individuals than those which formed the basis of my original description, has led to the following results.

In 32 individuals from Merabah there were never more than two pairs of papillæ upon segments xix., xx. Occasionally an asymmetry showed itself, there being only one of one pair present, and occasionally papillæ were totally absent. In all of these same specimens the spermathecae were small in number, not more than two in segment vi. and not more than four pairs in segment vii.

The sperm-sacs of this series are four pairs in x.-xiii. The last

heart is in segment xii. This assemblage of characters does not correspond exactly with any of the forms described by myself; nor does it fit in with any of the varieties described by Michaelsen.

In two individuals examined by myself and belonging to another series, I find the following characters:—The papillæ three pairs on xix.–xxi.; the last heart is in xii.; the sperm-sacs in x.–xiii.; the spermathecæ are more numerous, in one specimen 7 and 6 in vi., 8 and 9 in vii.; in the other 11 and 12 in vi. and 14 in vii. A third individual came nearer to the first described variety in that it had not more than three spermathecæ on each side of each of the segments vi., vii. (the actual numbers were 1-2, 3-3). There are no papillæ; the last heart is in xii., the sperm-sacs in xi.–xiii.

This form seems to come nearest to Michaelsen's variety *klabattensis*, in which the last heart is also in xii., the spermathecæ 8-11 pairs, but which has no papillæ.

Another individual agreeing with the last in having three papillæ (those of one side of body were missing) has also sperm-sacs in x.–xiii., 5 to 10 spermathecæ on each side of the body in their respective segment, but has the last heart in xiii.

Three specimens had five pairs of papillæ, sperm-sacs in x.–xii. or xiii., last heart in xiii., spermathecæ varying from four to twelve on each side of their respective segment. In one of these there were setæ on the last segment of the clitellum, a feature which is not present in other specimens that have been examined. This group seems to agree with the variety *seriata* of Michaelsen, but differs in some small points. I confess that there seems to me to be no way out of merging all these specimens with those I have described previously and with those of Michaelsen and Horst into one species, *Amyntas stelleri*. But the variation in such features as the position of the last heart, which is usually so well marked a character, is very curious.

This species it is quite clear comes near to the next. It is, however, as far as our present information goes, to be distinguished by the absence of specially enlarged ventral setæ. In other respects, however, it is very near, and it may be necessary ultimately to merge to two.

M. Spermathecæ numerous in vi.

76. *Amyntas phacellotheca* Mich.

A. phacellotheca, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 47.

130 mm., 115 segments. Setæ with dorsal gaps, those of anterior segments larger, 25 on v., 75 on xxvi. Male pores closely approximated. No cæca. Last heart in xii. Sperm-sacs in xi.–xiii. Spermiducal gland with S-shaped duct. Spermathecæ, three pairs asymmetrical.

Hab. Celebes.

Only a single example known.

4. *Setæ* present on *clitellum*; *gizzard-septa* sometimes represented; no *terminal bulbus*.

A. *Spermathecæ* 5 pairs in v.-ix.

77. *Amyntas loriæ* Rosa.

Perichæta loriæ, Rosa, Ann. Mus. Civ. Genova, (2) xix. p. 61.

Perichæta loriæ, Beddard, Willey's Zool. Results, pt. ii. p. 185.

130 mm., 99 segments. *Setæ*, 60 on v., 70 on xxv. *Setæ* present on all segments of *clitellum* or on xv., xvi., or on xvi. Male pores with 10 *setæ* between. *Papillæ* on xvii., xix., xx., on line with male pores. *Septum* viii./ix. present. No *cæca*. *Sperm-sacs* in xii. *Spermiducal gland* in xviii. only. *Diverticulum* as long as duct of *spermatheca*.

Hab. British New Guinea; Solomon Is.

The female pore is at least sometimes paired.

78. *Amyntas solomonis* Beddard.

Perichæta solomonis, Beddard, Willey's Zool. Results, pt. ii. p. 188.

140 mm., 90 segments; a stout worm. *Setæ* present at least on xvi. of *clitellar* segments. 15 *setæ* between male pores. Rows of 3-6 *papillæ* on x., xi., xx.-xxiii. *Septum* viii./ix. present. Last hearts in xii. *Sperm-sacs* x.-xii. *Spermiducal glands* xviii.-xx., with curved duct. *Diverticulum* of *spermatheca* half the length of pouch.

Hab. Solomon Is.

79. *Amyntas subulatus* Mich.

A. subulatus, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 29.

70 mm., 116 segments. *Setæ* closer ventrally, with slight dorsal gap. Dorsal pores from vi./vii. *Setæ* on all segments of *clitellum*. 26 *setæ* between male pores. *Papillæ* paired on x., xi., xvii., xix., xx. No *cæca*; *gizzard-septa* present. *Spermiducal glands* in xviii., xix., with straight duct. *Spermathecal diverticulum* half the length of pouch.

Hab. Celebes.

80. *Amyntas violaceus* Beddard.

Perichæta violacea, Beddard, Monograph Oligochæta, p. 407.

80 mm., 89 segments; slender worm. *Setæ* 44 on v., 40 on xvi.; on all segments of *clitellum*. *Papillæ* one pair on xviii.-xix., large. Last heart in xii. *Spermiducal glands* xvi.-xx., with long and bent duct. *Spermathecal diverticula* nearly as long as pouch.

Hab. Penang; West Indies.

B. *Spermathecæ* 4 pairs in vi.-ix.

81. *Amyntas posthumus* Vaillant.

Perichæta posthuma, Vaillant, Ann. Sci. Nat. (5) x. p. 228, and Mém. Ac. Montpellier, vii. p. 146.

Perichæta affinis, Perrier, Nouv. Arch. Mus. Paris, viii. p. 106.

Perichæta posthuma, Horst, Notes Leyd. Mus. v. p. 106; xv. p. 318.

Megascolex affinis, Beddard, Ann. Nat. Hist. (5) xii. p. 214.

Perichæta posthuma, Beddard, *ibid.* (5) xvii. p. 93.

Perichæta affinis, Beddard, P. Z. S. 1887, p. 389.

Perichæta posthuma, Horst, Zool. Ergebn. Max Weber, ii. p. 61.

Amyntas posthumus, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 74.

Perichæta posthuma, Michaelsen, Abh. Senck. nat. Ges. xxiii. p. 201.

Perichæta posthuma, Rosa, Ann. Nat. Hist. (7) ii. p. 289.

Megascolex posthumus, Vaillant, Annelés, 1889, p. 72.

95 mm., 70 segments; stoutish worm. Setæ 140 on viii., 90 on xvii. Setæ on all segments of clitellum. Papillæ on xvii., xix. corresponding in position with male pores. Septum viii./ix. present. Spermiducal gland in three segments, with curved duct. Spermathecae with diverticulum less than pouch.

Hab. Java, Celebes, Christmas Is., Philippines, Cochin China, Bahamas, Europe.

The cæca appear to be sometimes absent.

82. *Amyntas neoguinensis* Mich.

Perichæta neoguinensis, Michaelsen, Arch. f. Naturg. 1892, p. 229.

Perichæta neoguinensis, Rosa, Ann. Mus. Civ. Genova, (2) xix. p. 60.

140–220 mm., 94–130 segments. Setæ 85 on v., 100 on xxv. Setæ on all clitellar segments, 14, 16, 20 in number. 20 setæ between male pores. Papillæ paired on xix.–xxv., or xxvi., corresponding in position to male pores. Septum viii./ix. rudimentary. Sperm-sacs in xii. only, with dorsal narrow constricted sac. Spermiducal glands confined to segment xviii., with short straight duct. Spermathecal pores approximated, with very short sessile diverticulum.

Hab. New Guinea.

To a slight variation Rosa gives the name of var. *spectabilis*.

83. *Amyntas pacificus* Beddard.

Perichæta pacifica, Beddard, Willey's Zool. Results, pt. ii. p. 190.

38–56 mm., 90 segments. Setæ 37 on viii., 46 on xvii. 10 setæ between male pores. Papillæ large and median, upon xvii.–xxii., and xii., xiii. Setæ upon xvi. and often other clitellar segments. Both septa. Last hearts in xii. Sperm-sacs in xii.; testes &c., only one pair. Spermiducal gland xvii.–xix., with short straight duct.

Hab. New Britain.

84. *Amyntas celebensis* Mich.

A. celebensis, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 32.

60 mm., 90 segments. Setæ 49 on vi., 44 on xxvi., with slight

dorsal gaps. Dorsal pores from vi./vii. Clitellum begins in xiii.; it has setæ on all segments. Papillæ paired on xvii./xviii., xviii./xix., corresponding with male pores, and three pairs on xix.-xxi. within line of male pores. Also anterior papillæ upon viii. No cæca. Both septa present. Spermiducal glands in three segments, with short straight duct. Diverticulum of spermatheca $\frac{2}{3}$ length of pouch.

Hab. Celebes.

Only a single specimen is known.

85. *Amyntas feæ* Rosa.

Perichaeta feæ, Rosa, Ann. Mus. Civ. Genova, (2) vi. p. 161.

360 mm., 160 segments. Clitellum reaching to xvii. Setæ 100 on vii. Spermiducal gland with very long duct. Diverticulum of spermatheca zigzag.

Hab. Tenasserim.

86. *Amyntas glandulosus* Rosa.

Perichaeta glandulosus, Rosa, Ann. Mus. Civ. Genova, (2) xvi. p. 607.

Perichaeta hippocrepis, id. ibid. p. 524.

110 mm., 130 segments. Setæ 80 on viii., 70 on xxv. Setæ on xvi. or all of clitellar segments. Male pores surrounded by many small papillæ. Similar papillæ in front of and behind each spermathecal pore. Spermiducal gland in xvii.-xx., with curved duct. Spermathecal diverticulum zigzag, $\frac{2}{3}$ length of pouch.

Hab. Sumatra, Mentawai.

I think there can be no doubt about the identity of these forms. The number of setæ is stated to be different in the two; but this does not appear to be always a reliable character. The absence of papillæ anteriorly in the form *hippocrepis* is again not necessarily a matter calling for specific rank.

87. *Amyntas queenslandicus* Fletcher.

Perichaeta queenslandica, Fletcher, Proc. Linn. Soc. N. S. W. (2) i. p. 962.

120 mm., 120 segments. Setæ on all clitellar segments. Setæ 60. 14 setæ between male pores. Papillæ paired on ix.-xi. and xvii.-xxii. Sperm-sacs with dorsal appendices. Spermiducal glands large, in xviii.-xxi., with short duct. Diverticulum of spermatheca very short.

Hab. Queensland.

Mr. Fletcher is evidently not accurate in the enumeration of the segments in some of the organs. He states that the spermatheca are in v.-viii., which does not seem likely, especially as he states that the cæca are given off in xxv. Therefore I have some hesitation in copying his statement that the last pair of hearts is in xii., as this is, when certainly stated, rather an important specific character.

88. *Amyntas mazarredi* Rosa.

Megascolex mazarredi, Rosa, Atti R. Acc. Torino, xxix. p. 6.

200 mm., 105 segments. Setæ interrupted dorsally and ventrally, 100 on xxv. Clitellum xiii.–xiv., with setæ on all segments. A depression, square in outline, occupies segments xvii.–xx. Papillæ paired on xvii. and xix. Gizzard-septa present. No cæca. Spermiducal glands limited to xviii. Spermathecæ with very short sessile diverticulum.

Hab. Marinduque in Philippines.

Dr. Michaelsen has called attention to the fact that this species, referred by Rosa to the genus *Megascolex* on account of certain obvious characters mentioned above, should be placed in *Amyntas* on account of the position of the gizzard in viii.

89. *Amyntas papua* Rosa.

Perichaeta papua, Rosa, Ann. Mus. Civ. Genova, (2) xix. p. 63.

84 mm., 84 segments. Setæ 44 on v., 66 on xxv. Setæ on all clitellar segments. Male pores very close, with 4 setæ between. Two or three papillæ on viii., ix. Sperm-sacs one pair in xii.; they extend through three segments and have a small median narrow prolongation. Spermiducal glands in xvii.–xix. Diverticulum of spermatheca shortish.

Hab. British New Guinea.

90. *Amyntas peregrinus* Fletcher.

Perichaeta molokaiensis, Beddard, P. Z. S. 1896, p. 201.

Perichaeta floweri, Benham, Journ. Linn. Soc., Zool. xxvi. p. 217.

Perichaeta peregrina, Fletcher, Proc. Linn. Soc. N. S. W. (2) i. p. 969.

Perichaeta peregrina, Rosa, Ann. Mus. Civ. Genova, (2) xvi. p. 515.

Amyntas peregrinus, Beddard in 'Fauna Hawaiensis,' 1900, p. 414.

120 mm., 116 segments. 10 setæ between male pores. Setæ 40 on xiii., 45 on xxvi. Setæ on xvi. Spermiducal gland with short curved duct. Diverticulum straight, as long as spermatheca.

Hab. Singapore, Sumatra, Hawaii, S. Australia.

I agree with Michaelsen as to the identity of my "*molokaiensis*" with "*peregrinus*," and I think there can be no question as to "*floweri*" being a synonym.

C. Spermathecæ 3 pairs in vi.–viii.

91. *Amyntas papulosus* Rosa.

Perichaeta papulosa, Rosa, Ann. Mus. Civ. Genova, (2) xvi. p. 525.

50 mm., 115 segments. Setæ 54 on v., 60 on xxv. Setæ on all or some of clitellar segments. About 100 papillæ on xvii.,

xviii., between male pores. Spermiducal gland xvi.-xxi., with short horseshoe-shaped duct. Spermathecæ long pouches, with coiled duct about half their length.

Hab. Sumatra.

92. *Amyntas hawayanus* Rosa.

Perichæta hawayana, Rosa, Ann. k.-k. Hofmus. Wien, vi. p. 396.

Perichæta hawayana, Michaelsen, Zool. Jahrb., Syst. Abth. xii. p. 224.

Amyntas hawayanus, Beddard, in 'Fauna Hawaiiensis,' 1900, p. 420.

Perichæta pallida, Michaelsen, Arch. f. Naturg. 1892, p. 227.

Perichæta mandhorensis, id. ibid. p. 241, & Jahrb. Hamb. wiss. Anst. xvi. p. 86.

Perichæta bermudensis, Beddard, P. Z. S. 1892, p. 160.

Perichæta morrisi, id. ibid. p. 166.

Perichæta morrisi, Rosa, Ann. Mus. Civ. Genova, (2) xvi. p. 516.

Perichæta barbadensis, Beddard, P. Z. S. 1892, p. 167.

Perichæta mauritiana, id. ibid. p. 170.

Perichæta mauritiana, Michaelsen, Abh. Senck. nat. Ges. xxi. p. 235.

Perichæta amazonica, Rosa, Atti R. Accad. Torino, p. 14.

Perichæta sancti jacobii, Beddard, P. Z. S. 1895, p. 239, and Hamb. Magall. Reise, p. 61.

Perichæta carnosa, Goto & Hatai, Ann. Zool. Jap. iii. p. 16.

Perichæta insulæ, Beddard, P. Z. S. 1896, p. 204.

Perichæta cupulifera, Fedarb, P. Z. S. 1898, p. 445.

60-140 mm. Setæ larger on anterior segments, up to 60 or 'so in number per segment. Papillæ in neighbourhood of male pores, and also paired on some of segments which contain spermathecæ. Sperm-sacs often with median process. Spermiducal gland in several segments, with not long, curved or straight duct. Spermathecæ (occasionally two pairs only) with diverticulum of about same length.

Hab. Borneo, China, Mauritius, Hawaii, Bermudas, Barbados, South America, Teneriffe.

In my account of the earthworms of Hawaii, published in the 'Fauna Hawaiiensis,' I have stated in full my reasons for uniting the five reputed species enumerated in the above synonymy. I condense from that a sufficient abstract for my present purpose. *A. hawayanus* does not, as I have suggested, differ from *A. bermudensis* in the absence of setæ upon the clitellum; but this occasionally occurs in *hawayanus*. Both of these forms may have anterior papillæ on the viith segment near to the spermathecal pores. They are by no means always present in either. The two forms have sometimes simple cæca without the series of rounded processes inferiorly, which have been mentioned as a characteristic.

The form *hawayanus* must be also united with *barbadensis*; the

latter, however, may have setæ (in addition to those upon xiv.) on xvi. & xv. The papillæ may be anterior as well as posterior as in *hawayanus*; the setæ of some of the anterior segments are enlarged as in that form. The spermathecæ are occasionally reduced to two pairs, in vi., vii.; but as the usual three are to be found, no specific difference can be made upon this point. *P. morrissi* differs only in the fact that the spermathecæ are in vi., vii., or in vii., viii. There are anterior and posterior papillæ. In *P. mauritiana* there are three pairs of spermathecæ in vi.-viii.; in one individual I found a fourth pouch on one side of the body in ix. The setæ on segments iii.-vii. are larger than those on other segments. Thus there are clearly no marked differences to say the least from the other forms which I here unite into a single species. *P. pallida* of Michaelsen cannot be plainly distinguished from the present series. Michaelsen mentions the absence of the larger setæ upon the anterior segments, and the closer approximation of the male pores as reasons for not confusing it with *hawayanus*. As to the former matter, it would be necessary for me to separate one of the individuals which I have referred to *barbadensis*, if this were to be considered a sufficient reason. As to the latter point, I do not understand from Michaelsen's description that the male pores are really close; he speaks of them as "ziemlich weit von einander." I think that there is every reason to accept Michaelsen's identification of *amazonica* with his *pallida*. And my own form *sancti jacobii* can hardly be separated. Of both of these latter only a single example has been examined. Of *mandhorensis* again only a single example is known. But Dr. Michaelsen's description of this specimen leaves no great doubt of its likeness to the worms of the present series. It has larger setæ on segments ii.-ix., as in *hawayanus*; the cæca have the crenated appearance of those of the latter form; the spermathecæ occupy the same segments and are of similar form. No anterior papillæ appear to exist; but as only a single example was described, this cannot be considered a reason for specific separation.

D. Spermathecæ 3 pairs in segments vii.-ix.

93. *Amyntas hupeiensis* Mich.

Perichata hupeiensis, Michaelsen, Abh. Ver. Hamb. xiii. No. 2, p. 35.

Amyntas hupeiensis, id. Jahrb. Hamb. wiss. Anst. xvi. p. 6.

55 mm., 132 segments. Setæ closer ventrally, and larger ventrally on anterior segment, 95 on x., 72 on xxvi. Setæ ventrally on all segments of clitellum. Male pores rather close together. Papillæ before and behind each male pore and two pairs on xvii./xviii., xviii./xix. Septa viii./ix., ix./x., very thick. Spermiducal glands in xvii.-xx., with thin winding duct. Spermathecal diverticulum longer than pouch.

Hab. China, Japan.

E. Spermathecæ 3 pairs in vi.-viii.

94. *Amyntas sedgwicki* Benham.

Perichaeta sedgwickii, Benham, Journ. Linn. Soc., Zool. xxvi. p. 201.

Perichaeta sedgwickii, Beddard, Willey's Zool. Results, pt. ii. p. 183.

110 mm., 86 segments. Setæ 29 on vi., 50 on xii.; complete circles of setæ on all clitellar segments. Male pores separated by 8 setæ. Papillæ paired on x.-xiii., xvii., xix.-xxi., with pairs on xvi., xix., xx. outside of these. A single unpaired ventral cæcum arising in xxii. Last heart in xii. Spermiducal gland in xvii.-xix., with short straight duct. Diverticulum of spermatheca short, nearly sessile sac.

Hab. New Britain.

95. *Amyntas iris* Mich.

Megascolex iris, Michaelsen, Arch. f. Naturg. 1892, p. 244.

Amyntas iris, id. Jahrb. Hamb. wiss. Anst. xvi. p. 15.

240 mm., 240 segments. Setæ with dorsal and ventral gaps, closer ventrally, 32 on vi., 42 on xxvi. Males pores 1 mm. apart, as are spermathecæ. Clitellum xiii.-xvii. Papillæ paired on xix./xx., xx./xxi., close to median line. Septum viii./ix. present. No cæca. Spermiducal glands with almost straight duct. Spermathecæ with very small diverticulum.

Hab. Philippines.

96. *Amyntas margaritaceus* Mich.

Megascolex margaritaceus, Michaelsen, Arch. f. Naturg. 1892, p. 245.

Amyntas margaritaceus, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 16.

90 mm., 103 segments. Setæ with dorsal and ventral gaps, 24 on vi., 20 on xxvi. Male pores 1.3 mm. apart. Clitellum xiii.-xvii. Groups of pores on segments x./xi., xviii./xix., xix./xx. Spermathecæ with longer diverticulum than last species.

Hab. Philippines.

These two species were first referred to the genus *Megascolex*, to which they have clearly many points of likeness. There are regular or irregular lines upon the dorsal and ventral surfaces which are unoccupied by setæ. In any case these two species cannot be confounded with any others. There are no penial setæ. For this reason and the position of the gizzard, the two forms appear to be rightly placed in the present genus.

F. Spermathecæ 2 pairs in vii., viii.

97. *Amyntas godeffroyi* Mich.

A. godeffroyi, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 17.

105 mm., 95 segments. Setæ on iv.-viii., enlarged especially

ventrally, with slight dorsal gaps; 27 on v., 48 on xxvi. Setæ on xvi. and (fewer) on xiv. Papillæ on xvi., xvii. in line with male pores. Septum viii./ix. thin, next absent. Spermiducal gland-duct almost straight. Diverticulum of spermatheca half the length of pouch.

Hab. Viti.

G. Spermathecæ 2 pairs in viii., ix.

98. *Amyntas forbesi* Beddard.

Perichæta forbesi, Beddard, P. Z. S. 1890, p. 65.

220 mm. Setæ on ventral side of all clitellar segments. Papillæ paired and corresponding in position with male pores on xvii., xix.–xxi. Sperm-sacs in xii. Rudiments of septum viii./ix. Spermiducal glands with short, very thick duct. Spermathecæ with very short duct into which opens very short diverticulum.

Hab. New Guinea.

The anterior spermathecæ were doubled on one side (the side differing) in the two specimens which I have examined.

99. *Amyntas robustus* Perrier.

Perichæta robusta, Perrier, Nouv. Arch. Mus. Paris, viii. p. 112.

Perichæta robusta, Michaelsen, Abh. Senck. nat. Ges. xxi. p. 234.

Perichætu cingulata, Vaillant, Ann. Sci. Nat. (5) x. p. 228 (in part), & Mém. Ac. Montpellier, vii. p. 146 (in part).

Megascoleæ robustus, Vaillant, Annelés, 1889, p. 76.

180 mm.; setæ 45. A pair of papillæ between male pores and a pair on each of segments viii., ix. Sperm-sacs with dorsal process. Spermiducal glands with coiled duct. Diverticulum of spermatheca longer than pouch and moniliform at end.

Hab. Ile de France; Philippines.

H. Spermathecæ 1 pair in viii.

100. *Amyntas taprobanæ*.

Perichæta taprobanæ, Beddard, P. Z. S. 1892, p. 163.

Perichæta pauli, Michaelsen, Jahrb. Hamb. wiss. Anst. xiv. p. 87; id. Zool. Jahrb., Abh. Syst. xii. p. 140.

145 mm., 95–122 segments. Setæ 70 on v., 54 on xxvi. Complete rings on all clitellar segments. Papillæ large, paired on vi.–xi. and xviii.–xxi. Septæ viii./ix. present. No cæca. Spermiducal glands small in xviii. only, with U-shaped duct. Spermathecæ small, with equally sized diverticulum.

Hab. Ceylon.

There is no doubt about the identity of these two species, accepted by Michaelsen. A re-examination of the original specimens has shown the presence of the large faint papillæ. A characteristic of the species is the very small size of the generative apparatus.

I. Spermathecæ 1 pair in vi.

101. *Amyntas lompobatagensis* Mich.

Amyntas lompobatagensis, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 33.

55 mm., 95 segments. Setæ of v.-vii. rather larger, slight dorsal gaps; 33 on vi., 42 on xxvi. Dorsal pores from v./vi. Papillæ on xvii./xviii., xviii./xix. Duct of spermiducal gland long, divided into a proximal thinner and a distal spindle-shaped portion. Diverticulum of spermatheca small.

Hab. Celebes.

102. *Amyntas pusillus* Ude.

Perichaeta pusilla, Ude, Zeitschr. wiss. Zool. lvii. p. 63.

16 mm., 60 segments. Setæ 40-50. 10 setæ between male pores. Papillæ on xvii. and xix., corresponding in position to male pore, also a median papilla on xx. Spermathecal diverticulum small and spherical.

Hab. Buitenzorg.

Only a single example was examined; but it appears to differ from the last.

K. Spermathecæ 1 pair in segment vii.

103. *Amyntas minimus* Horst.

Perichaeta minima, Horst, Zool. Ergebn. Max Weber, ii. p. 66.

25 mm., 80 segments. Setæ 44 behind clitellum, 60 on vii. Duct of spermiducal gland curved. Diverticulum of spermatheca long. Papillæ on vii.

Hab. Java.

Species which cannot be classified by the above characters entirely.

AMYNTAS CULMINIS, Michaelsen, Jahrb. Hamb. wiss. Anst. xvi. p. 58.

50 mm., 75 segments. Setæ closer ventrally, 48 on v., 46 on xxvi. Clitellum not developed. Three papillæ in middle of 18th segment. Gizzard-septa? Spermiducal glands lying in four segments, with short duct and no terminal sac. Spermathecæ one pair in viii., with very strong muscular duct as long as pouch and diverticulum, of which the duct is much coiled, longer than spermatheca.—Celebes.

AMYNTAS QUADRAGENARIUS, Perrier; *Perichaeta quadragenaria*, Perrier, Nouv. Arch. Mus. Paris, viii. p. 122.

210 mm. (exaggerated through softening); 40 setæ in segments in front of clitellum. Sperm-sacs in xi., xii. Spermathecæ one

pair in viii., with very long diverticulum which is much folded. Intestinal cæca? Spermiducal gland much lobed. Terminal sacs?

Although Perrier's definition is not adequate so far as our present knowledge is concerned, this species does not seem to be identical with any subsequently described form with one pair of spermathecae in segment viii. or vii., or ix.

AMYNTAS ELONGATUS, Perrier; *Perichæta elongata*, Perrier, *ibid.* p. 124.

Length? (stated to be 355 mm.; but this length is too great for the diameter of 4 mm.). Sperm-sacs in xi., xii. Spermiducal gland loosely lobate, with bent duct and no terminal sac. Spermathecae in vi. without (?) diverticula.—Peru.

Here again it is impossible to state with even probability that the present species is identical with any subsequently described species.

AMYNTAS TAITENSIS, Grube (in part) in 'Reise der Novara,' Anneliden, 1868, p. 36.

This species, from which one individual of the two described by Grube must be removed and placed in a second species already treated of as *Amyntas novaræ*, has been termed "*Perichæta grubei*" by Rosa (Ann. k.-k. Hofm. Wien, vi. p. 395). It is 90 mm. long and has 120 segments. Four papillæ between male pores. Setæ 60 on viii. Spermathecae open on intersegmental furrows vii./viii., viii./ix.

AMYNTAS PARVUS (Ude, Zeitschr. wiss. Zool. lvii. p. 64) is a small worm 25 mm. long, with 85 segments. Setæ 40-44, 12 between male pores. Spermathecae in viii., ix. with very long and coiled diverticulum. Duct of spermiducal gland broad and short.

I place this species in this place because the author of it says nothing about setæ upon the clitellum and papillæ. As he examined three specimens, it is possible that they were absent. In this case the species seems to be at least very near to *A. æruginosus* or *A. hesperidum*. But I have not been able to make up my mind to include a pygmy like the present form with the giant "*Perichæta musica*," and the spermathecal diverticulum seems to be too long for *A. hesperidum*.

AMYNTAS ACINCTUS Goto & Hatai (Annot. Zool. Jap. iii. p. 16), is a doubtful species so named—and not aptly—because of the undeveloped clitellum. Its characters are:—

130 mm., 113 segments. Setæ 50 to 60, 7 between male pores. Spermiducal glands xvii.-xix. Spermathecae in vi.-viii., with diverticulum twice the length of pouch.

Species which belong to the genus Amyntas, but which cannot be defined.

I shall content myself with giving a bare list of these species, as our information concerning them is entirely limited to a few external characters which are not sufficient to place them with

even approximate accuracy, or to the number only of the spermathecæ.

Amyntas diffringens, Baird, Proc. Zool. Soc. 1869, p. 40 & p. 387.

Amyntas javanicus, Kinberg, Öfv. K. Svensk. Ak. Förh. 1866, p. 439.

Amyntas gracilis, id. ibid. p. 112.

Perichæta corticis, id. ibid. p. 439.

Amyntas subquadrangula, Grube, in 'Reise der Novara,' Annalen, 1868, p. 36.

Amyntas rodericensis, Grube, Phil. Trans. clxviii. p. 554; id. Monatsber. Ak. Berlin, 1877, p. 355.

Amyntas juliani, Perrier, Compt. Rendus, lxxx. p. 1045.

Amyntas bicinctus, id. ibid. p. 1044.

Amyntas tricystis, id. Bull. Soc. Zool. France, ii. p. 243.

Amyntas dicystis, id. ibid. p. 243.

A few other species, such as "*Megascolex sanctæ helene*" of Baird, may belong to this genus. A number of forms described by Schmarda¹ as *Perichæta* have been shown by subsequent investigators not to belong to that genus as now defined but to *Megascolex*. Prof. Spencer² and Mr. Fletcher³ described under the name of "*Perichæta*" worms which belong to other genera and were only provisionally placed in *Perichæta*. The same may be said of several species described by Prof. Bourne.⁴

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¹ Neue wirbellose Thiere beobachtet und gesammelt auf einer Reise um die Erde, 1853, Pt. ii.

² Proc. Roy. Soc. Victoria, v. p. 16 *et seq.*

³ Proc. Linn. Soc. N. S. W. vols. i.-iv.

⁴ P. Z. S. 1886, p. 663.

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heteropoda	625	novaræ	619	subquadrangula	651
hexatheca	621	obscurus	625	subulatus	641
hilgendorfi	633	ocellatus	627	sumatranus	618
hippocrepis	643	operculata	618	supuncensis	638
houletti	613	pacificus	642	taitensis	619
hupeiensis	646	padasensis	624	takatorji	631
ijimæ	636	pallida	645	taprobanæ	648
imparicystis	630	papillata	639	tenkatei	618
impudens	616	papua	644	tetra	623
indica	615	papulosus	644	tigrina	631
inflata	618	parvicystis	633	tjibodæ	618
insulæ	645	parvula	636	tobaensis	627
iris	647	parvus	650	tokioensis	633
irregularis	633	pataniensis	637	travancorensis	614
izukai	625	pauli	648	tricystis	651
janpeanus	630	peguanus	628	trinitatis	624
japonicus	634	pentacystis	614	trityphla	619
javanicus	651	peregrinus	644	udei	628
javanus	616	perkinsi	622	udekemi	614
juliani	651	phacellotheca	640	upoluensis	630
juloides	628	philippinus	616	urceolatus	619
kalaenensis	626	pictus	623	vaillantii	615
kamakurensis	636	posthumus	641	variabilis	618
kaensis	630	prodnctus	623	vesiculata	619
kinabaluensis	639	proporus	635	violaceus	641
klabatensis	640	pulcher	619	vitiensis	620
labuensis	637	purpureus	630	vittatus	635
levis	634	purus	617	vordermanni	624
löhri	633	pusillus	649	willeyi	629
lokonensis	615	quadragenarius	649	zebra	637
lompotatagensis	649	quadripapillatus	616	zonoporus	620
longa	629				

5. On the Structure of a new Species of Earthworm of the genus *Benhamia*. By FRANK E. BEDDARD, M.A., F.R.S., &c.

[Received May 9, 1900.]

Two specimens of a species of *Benhamia* have been kindly placed in my hands by Mr. Budgett, of Trinity College, Cambridge. They were collected by him on McCarthy Island on the Gambia, and prove to be in an excellent state of preservation for anatomical purposes. I believe them to be referable to a new species, of which I propose to associate the name with that of Mr. Budgett. The following is a description of *Benhamia budgetti*:—

External characters.

The length of one individual (the two were fairly equal in size) was 116 mm., by 5 or 6 mm. in breadth.

The *buccal lobe* cannot be described with accuracy as it was almost entirely withdrawn into the buccal cavity. In correspondence perhaps with this withdrawal, the first segment of the body was deeply grooved dorsally and before backwards.

The setæ, as usual, are closely paired. All the four pairs are about equidistant, and the area occupied by them collectively is about $\frac{1}{3}$ of the circumference of the body. They do not appear to be wanting upon any of the segments of the clitellum except the ventral pair upon the xviiith and xixth segments, where they are of course replaced by the penial setæ, and, I think, the corresponding pair upon the xviiiith segment. These setæ are generally, but not always, absent in *Benhamia*.

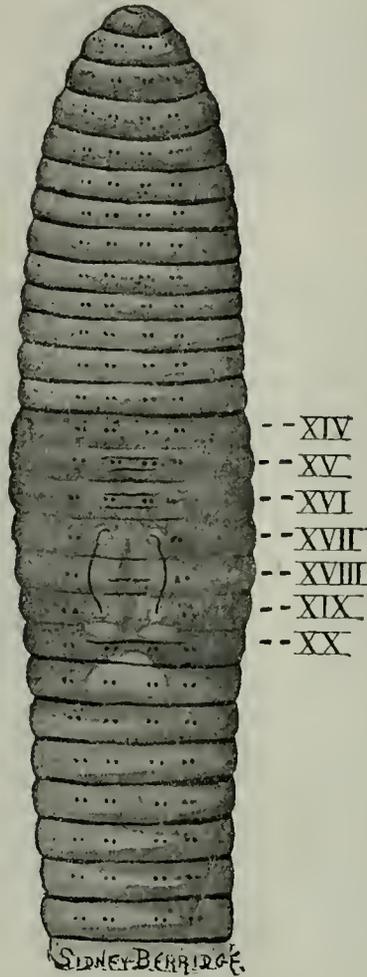
The *clitellum* occupies entirely segments xiv.–xx. inclusive, and also, at least in one specimen, the latter half of segment xiii. It is incomplete along a narrow ventral line which corresponds to the area occupied by the ventral pairs of setæ and their interspace. This area forms almost a gutter owing to the bulging of the integument along each side, which however does not commence until the xvth segment.

Dorsal pores are present, and are especially conspicuous at the tail end of the body.

The *genital papillæ* of this species are not numerous. There are a pair upon segment xx. which extend on to xix., and are in line with the orifices of the spermiducal glands. A median papilla lies upon the end of segment xx., whose area is rather less than that of the two anterior papillæ and their interspace. This papilla was only obvious in one specimen. Finally there is a larger median papilla upon the twenty-second segment, whose area extends beyond the ventral setæ. It is hardly to be separated from the papilla in front. These papillæ are all conspicuous from their white colour.

The *orifices of the oviducts* appear to be upon the fourteenth segment. On this segment and between the ventral setæ is a small convex quadrangular area with rounded angles. I believe that the actual pores are placed at the sides of this convexity in the valley which separates it from the surrounding integument, but I have not seen them.

Fig. 1.



Ventral surface of *Benhamia budgetti*. The clitellar segments are numbered.

The *orifices of the spermiducal glands* are upon the xviith and xixth segments. The usual furrow connects the two pores of each side. This furrow is on both sides bowed outwards; it passes outside of the position of the ventral setæ of the xviith segment; but the setæ themselves I have not succeeded in seeing, nor the apertures of the sperm-duct.

Structure of the body-wall.—Very few examples of this genus

have been examined microscopically; our knowledge of the more minute structure of the genus is indeed limited to that of the smaller forms. I have investigated the structure of the body-wall in the present species, which shows certain features worthy of note.

The first point to which I direct attention is the vascularity of the epidermis. This structural peculiarity occurs, but is not common, among earthworms. I was myself the first to announce that certain *Oligochæta* resemble the Leeches (in which group the fact had been previously ascertained by Lankester) in having a vascular epidermis.¹ This character, however, has not been found in many earthworms. It seems to me therefore to be worth recording the fact that the *Benhamia* which forms the subject of the present communication has a vascular epidermis. It appeared to me moreover to be more abundantly vascular than I have observed to be the case elsewhere. The capillaries are very readily seen owing to their being injected with their own blood; they penetrate the actual epidermis as loops which reach perhaps halfway through the thickness of the epidermic layer. I could find no trace of their opening on to the exterior, which has been asserted by the Messrs. Sarasin in the case of *Perichæta*.

It is also to be noted that in the anterior region of the body, at any rate in the neighbourhood of the spermathecæ, intra-epidermic capillaries are so rare as to be practically absent. I only saw one or two loops in a large number of sections. They can be of but little functional importance in this part of the body; but they are clearly of great functional importance towards the hinder end of the body. As a matter of fact these capillaries do not apparently penetrate the epidermis at the very end of the body; but this may conceivably be due to fresh growth in this region. That the epidermis should be especially vascular posteriorly is interesting when we reflect that it is in this situation that gills are chiefly developed in branchiate *Oligochæta*.

A second point of interest concerning the body-wall of this species is that the longitudinal muscles have the bipinnate arrangement, first described by Claparède in *Lumbricus*, but not by any means universal among earthworms.

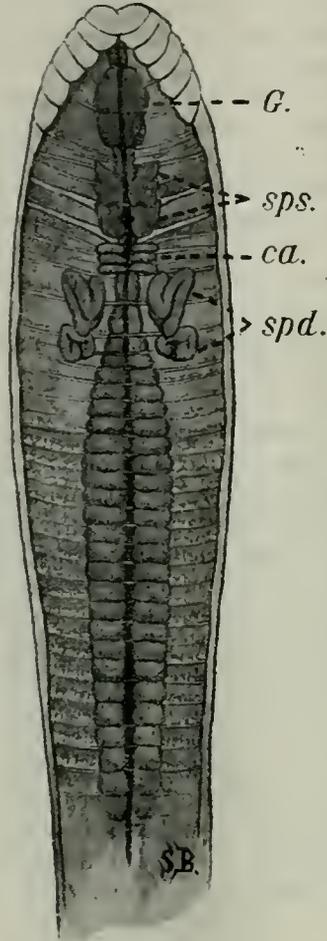
Internal Structure.

The accompanying drawing (fig. 2, p. 656) illustrates a general view of the internal viscera, and expresses at the same time some of the specific peculiarities of the species. The anterior portion of the two gizzards (which completely hide the underlying spermathecæ) is to be noticed. The position of the calciferous glands (*ca*), the last pair of which are situated in the xvith segment, is important; and also the fact that the large intestine may be said to commence in the xxist segment, as it does not attain to its greatest

¹ "On the Anatomy and Histology of *Pleurochæta moselcyi*," Trans. Roy. Soc. Edinb. 1880, and "On the Structure of the Body-wall in certain Earthworms," Proc. Roy. Phys. Soc. Edinb. 1881.

width until that segment. The difference in size between the anterior and posterior pairs of the spermiducal glands is clear (*spd.*). The sperm-sacs (*sps.*) are to be seen in the xith and xiith segments, a quite usual place for them.

Fig. 2.

General dissection of *Benhamia budgetti*.

G., gizzard; *sps.*, sperm-sacs; *ca.*, calciferous glands; *spd.*, spermiducal glands.

The *intersegmental septa* of this worm have the following arrangement:—

The first septum, which is fairly thick, marks the anterior end of the anterior gizzard; the next, also thick, the posterior end; then follows an excessively thin one. Another thin septum marks the posterior boundary of the second gizzard. After this are four closely crowded and also fairly thick septa. The two next, which lie on the posterior boundaries of the xith and xiith segments, are

also thickened. The next septum is thin and delicate, but curved forwards like those in front. After this the septa are all thin but run straight across the body-cavity. A few strands of muscle bind together some of the thickened septa, but they are not very strongly marked.

The *alimentary canal* is, as in other *Benhamiæ*, furnished with two *gizzards*. The last of these undoubtedly lies in the sixth segment. The first appears to occupy the fourth segment, two septa intervening between the two gizzards. The gizzards, which are very stout, are pushed back and really overlie and absolutely conceal the spermathecæ. Hence the crowding of the septa which immediately follow them. There seems in fact to be more independence between the position of the septa and the intersegmental furrows than is usually the case. The *calciferous glands* lie in a position which they do not invariably occupy in this genus, *i. e.* in segments xiv., xv., xvi. They are of a bronzy yellow colour. The *intestine* does not assume its greatest width until segment xxi. I could find no intestinal cæca such as are sometimes present in the species of this genus. There is a typhlosole in the anterior part of the gut but not posteriorly.

Besides a difference in position, that is to say of the segments occupied by these glands, the calciferous pouches differ in certain other points of structure among the species of this large genus. In the present species the surface of the glands is fairly smooth; the furrowing, seen to so marked a degree for example in *Benhamia cæcifera*, being practically absent. In transverse sections of the glands they are seen to be somewhat bean-shaped, with a hilum where the duct leaves the gland. On the opposite side there is but one distinct furrow not far from the lower end of the gland, *i. e.* that side which is nearest to the œsophagus. The three glands open into the œsophagus by only a single duct on each side. This duct is of considerable calibre, and is ciliated like the œsophagus; it has also muscular walls and is formed of three branches, one from each gland. The glands lie dorsally to the œsophagus for the greater part.

The *nephridia* of all species of *Benhamia* are of the "diffuse," "plectonephric," or "micronephric" type. Very generally in the description of species this statement has been made without any further additions. In others (as for instance *B. octonephra*) the more exact arrangement of the nephridial tufts has been noted and has afforded systematic characters. In the present species, there are 10 or 12 nephridial tufts on either side of the nerve-cord, which are rather more conspicuous from the 27th segment or so backwards than they are anteriorly. This is often the case with earthworms, and seems to be due to the peritoneal covering. The micronephridia of this species have a curiously squarish outline.

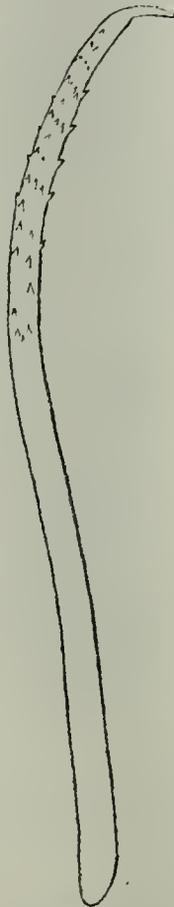
As to the *vascular system*, I have only to observe that the dorsal vessel is single throughout its course and that the last pair of hearts are in segment xiii.

Reproductive Organs. The sperm-sacs are large and rather

racemose in form; they lie in segments xi. and xii. I am inclined to think that delicate sacs involve the funnels of the sperm-ducts which are situated in segments x., xi. I detected the ovaries, attached as usual to the anterior wall of segment xiii.

The spermiducal glands are limited to their respective segments (*i. e.* xvii. and xix.) by being coiled. They are stout but not long; the muscular duct is also short and is about one fifth of the length of the gland. The posterior pair of spermiducal glands are distinctly smaller than the anterior pair. The structure of the penial setæ is shown in the accompanying drawing (fig. 3).

Fig. 3.



Penial seta of *Benhamia budgetti* greatly magnified.

There are the usual two pairs of *spermathecae*, which are completely hidden by the gizzards, and affect therefore to lie in a much more anterior position than is really the case. Viewed from above after removal of the gizzards, the four spermathecae are seen to be closely pressed together in the middle line, all of them in fact

touching. The posterior are elongated and quite twice the size of the anterior pair. They thus exactly match the spermiducal glands. On a dissection no diverticula are visible; but in longitudinal sections it is plain that a considerable number of tubular diverticula open into the duct part of the spermatheca which are enclosed within the same sheath. The arrangement in fact is very like that of *Benhamia beddardi* as figured by Horst¹, only that the region occupied by the diverticula is relatively shorter.

From the account of the anatomy given above, the following definition of the species has been compiled:—

BENHAMIA BUDGETTI, n. sp.

Length 116 mm. × 5 or 6 mm. diameter. Clitellum xiii.–xx. Genital papillæ paired on xx., unpaired and median on xxi., xxii. Dorsal pores present. Furrows uniting spermiducal gland-pores convex outwards, passing to outside of ventral setæ of xviii. (which are absent?). Gizzards in v. and vi.; calciferous glands in xiv.–xvi.; large intestine begins in xxi., and has a typhlosole for part of its course. Spermathecæ globular, with short duct and no external diverticulum; anterior pair smaller. Spermiducal glands not long, stout and coiled; posterior pair shorter. Penial setæ small, with spinelets on anterior fourth.

Hab. McCarthy Island, Gambia.

June 19, 1900.

Prof. G. B. HOWES, LL.D., F.R.S., Vice-President, in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of May 1900:—

The registered additions to the Society's Menagerie during the month of May 1900 were 330 in number. Of these 38 were acquired by presentation and 56 by purchase, 16 were born in the Gardens, and 220 were received on deposit. The total number of departures during the same period, by death and removals, was 151.

Among the additions attention may be specially called to:—

1. A young female Cape Hunting-dog (*Lycæon pictus*), obtained by purchase on May 4th. This is a rather rare and delicate canine animal, the present specimen of which seems likely to do well.

2. An Allen's Porphyrio (*Hydrornia alleni*), captured at sea and presented by Capt. J. C. Robinson, of the mail steam-ship 'Kildonan Castle,' on May 15th, who kindly sends me the following note on the subject:—

"On the 1st of May, when the ship was in 8° South latitude and

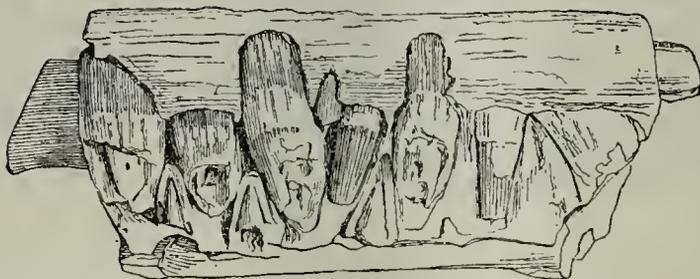
¹ Notes Leyd. Mus. xvii. pl. i. fig. 6.

5° West longitude, a bird flew on board, and being absolutely exhausted was unresistingly picked up, and is alive and well up to date.

“The strange thing about it is, that the point in question is about 400 miles from Ascension, 500 from St. Helena, 700 from the Gold Coast.”

The Secretary exhibited a cast of a portion of the jaw of an *Ichthyosaurus* (taken from a specimen obtained at Flinders River in Queensland) transmitted to the Society by Mr. J. Lane Huxley, of the Land's Department, Brisbane, Queensland, and read the following note upon it prepared by Dr. C. W. Andrews, F.Z.S. :—

“The specimen sent is a cast of a fragment of the snout of an *Ichthyosaurus* related to *Ichthyosaurus campylodon*.



Fragment of Jaw of *Ichthyosaurus*.
Lower Cretaceous, Flinders River, Queensland.

“It is probably referable to the species *Ichthyosaurus australis*, described by McCoy in ‘Annals and Magazine of Natural History,’ 1876, vols. xix. & xx., and the specimens noticed by him are from the same locality, viz. Flinders River, Queensland. The horizon from which they came is, as stated by McCoy, the Lower Cretaceous, although, for some reason or other, Moore states (see Quart. Journ. Geol. Soc. 1870) that McCoy regards it as Liassic.

“Another species, *Ichthyosaurus marathonensis*, from the same horizon and a neighbouring locality, has been described by R. Etheridge, Jun. (Proc. Linn. Soc. N. S. W. 1888, iii. [2]), but he admits that it is not improbably identical with *Ichthyosaurus australis*. *Plesiosaurus* is also recorded from the same horizon and locality.

“In the present specimen the bases of about seven teeth in the upper jaw, and the crowns of four or five in the lower, are preserved on the right side; while on the left only traces of teeth are present.

“The teeth appear to have the subquadrate base and coarsely ridged crown of the *Campylodon* group of *Ichthyosaurus*.”

The Secretary called the attention of the Meeting to an article by Mr. E. C. Stuart Baker (of Dibrughur), F.Z.S., which had lately appeared in the 'Asian,' February 1900, concerning the Gaur (*Bos gaurus*) and the Gayal (*Bos frontalis*). After a careful study of the subject for several years, Mr. Stuart Baker had come to the conclusion that the Gayal was simply a domestic form of the Gaur, and that the differences between them were produced by domestication. A copy of Mr. Stuart Baker's paper upon this subject had been deposited in the Society's Library.

Mr. G. A. Boulenger exhibited a remarkably large specimen of a Bornean Tortoise, recently described by him under the name of *Liemys inornata*. The specimen, obtained by Mr. C. Hose in Lake Majang, had a carapace length of 64 centimetres. Mr. Boulenger at the same time pointed out that the name proposed by him would have to give way to the prior one of *Brookia baileyi*, which had been proposed by Mr. E. Bartlett, although the description given by that gentleman could not be regarded as a satisfactory one. Dr. Siebenrock, of Vienna, had already shown that the skull described by the late Dr. G. Baur as *Adelochelys crassa* belonged to *Liemys inornata*. The synonymy of *Brookia baileyi* would stand as follows:—

Hardella baileyi, E. Bartlett, Sarawak Gazette, May 1, 1895.

Brookeia baileyi, E. Bartlett, Sarawak Gazette, June 1, 1896, and Note-book Sarawak, No. 2, 1896, p. 81; Bouleng. Zool. Rec. 1897, Rept. p. 26.

Adelochelys crassa, Baur, Anat. Anz. xii. 1896, p. 314, fig.

Liemys inornata, Bouleng. Ann. & Mag. N. H. (6) xix. 1897, p. 469; Siebenrock, Sitzb. Ak. Wien, cvi. 1, 1897, p. 248.

The following papers were read:—

1. On the Anatomy of *Bassaricyon alleni*. By FRANK E. BEDDARD, M.A., F.R.S., Prosector and Vice-Secretary of the Society.

[Received May 1, 1900.]

A specimen of this rare American Carnivore, which was acquired by the Society in 1894¹, having died, I am able to call the attention of the Society to some new facts in its anatomy.

The species to which it belongs, *B. alleni*, was described some years ago by Mr. Thomas² and figured. Mr. Thomas commented upon the close likeness which the animal bears to the Kinkajou (*Cercoleptes*), a likeness emphasized by the fact that the individual now under consideration was presented to the Society as a Kinkajou. To Mr. Thomas this singularly close resemblance

¹ P. Z. S. 1895, p. 521.

² "On Mammals from Ecuador," P. Z. S. 1880, p. 397, pl. xxxviii.

appeared to be an instance of the phenomenon known as mimicry. It seems to be more likely due to nearness of relationship, combined with a similar mode of life. Besides the external characters, Mr. Thomas described and figured the skull of the animal; I shall return to his descriptions later.

The genus *Bassaricyon* was first made known by Mr. Allen, who figured the skull of *B. gabbi*¹.

This species has been lately re-investigated by M. Huet², who figured the external characters as well as the skull; the latter was naturally especially compared with that of the Kinkajou. I am not myself acquainted with the skin of this species; but if M. Huet's figure really represents the appearance of *Bassaricyon gabbi*, then that species is very different indeed from *Bassaricyon alleni*, and not in the least like *Cercoleptes*. The skulls of two individuals are figured, the one being that of a young animal, the other of an older specimen.

In the Proceedings of this Society for 1885, Dr. Mivart summed up what was known about the animal at that date³. Dr. Mivart pointed out that "the skull is more like that of *Procyon* and *Nasua* than of *Bassaris*." An important point ascertained by the same author was that "a cast of the inside of the skull shows that the brain possesses an Ursine lozenge."⁴ This point alone would serve to refer the animal without any doubt to the Arctoid division of existing Carnivora, a conclusion to which other anatomical facts lead. It will be seen later that I am able to confirm this statement by an examination of the actual brain.

External Characters.

I have made the following measurements of the animal, after preservation in spirit.

Extreme length of body (measured along the curve of the back) from snout to root of tail	17 inches.
Length of tail ⁵	10½ "
Length of fore limb	6½ "
Length of hind limb	9 "
Length of ear	1¼ "

As to the colour of the fur I have nothing to add to Mr. Thomas's remarks, except to say that the specimen studied by myself was darker. I agree with him that the tail offers no evidence of being prehensile.

¹ Proc. Acad. Nat. Sci. Philadelphia, 1876, p. 21, pl. i.; and Bull. U.S. Geol. Survey, v. p. 169.

² "Note sur les Carnassiers du genre *Bassaricyon*," Nouv. Arch. Mus. Paris (2) v. p. 1.

³ "On the Anatomy &c. of the Arctoidea," P. Z. S. 1885, p. 363.

⁴ "Notes on the Cerebral Convolution of the Carnivora," Journ. Linn. Soc., Zool. xix. p. 13.

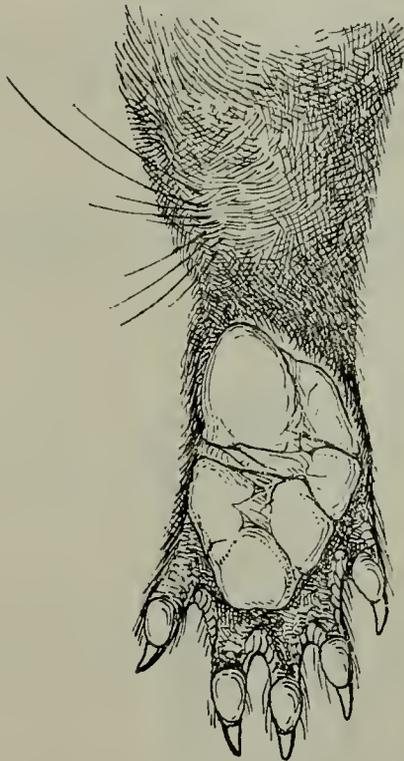
⁵ The tail was defective; I consider that about one inch is missing.

The nose is naked, and there is a marked median groove which also cleaves the upper lip. This groove is perfectly visible upon the dorsal surface of the nose, and there are even indications of it on the fur-clad region behind. The nostrils are prolonged into narrow slit-like orifices which are quite visible laterally.

The palms and soles are quite naked. The claws are not of great length or strength. Neither are they of course retractile.

There are five or six long vibrissæ forming the whiskers, three or four upon each cheek and two or three under the chin. Furthermore, on the arm not far from the hand is a tuft of long and quite

Fig. 1.



Manus of *Bassaricyon alleni*, illustrating the tuft of vibrissæ upon the wrist.

similar hairs. They appear to agree with a "cluster of long stiff hairs" described as occupying an identical position upon the arm of *Lemur catta* and of other Lemurs by Mr. Bland Sutton¹. Apart, however, from the subject of the present paper, these tufts of long hairs upon the arm are by no means peculiar to the Lemurs, as might be inferred from reading Mr. Sutton's paper. I have seen them on a Malabar Squirrel and upon the arms of several other

¹ "On the Arm-glands of the Lemurs," P. Z. S. 1887, p. 369.

kinds of mammals. They may very conceivably be tactile in function.

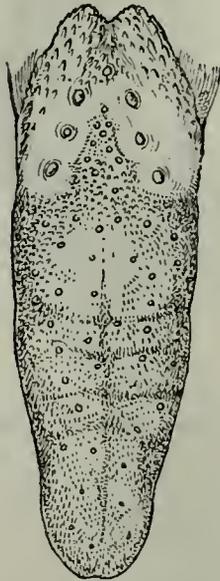
In any case they are connected with a strong nerve which can be readily felt and seen when cut by removal of the skin. The nerve is 1 mm. or so in thickness just where it enters the skin to supply these vibrissæ. The roots of the latter can be seen to project slightly from the under surface of the skin when the latter has been flayed off in the ordinary way. It is suggestive that these nervous structures should be present near to the wrist of mammals which make considerable use of their hands. A nocturnal habit may be also partly explanatory of their presence and obvious importance in some capacity or another; the large size of the nerve and of the vibrissæ themselves seem to justify the statement that they are obviously important.

The example of *Bassaricyon alleni* which I have studied is a female; it has, as had the skin examined by Mr. Thomas, a single pair of mammæ, which are some three inches or so in front of the anus. The same number of mammæ is found in *Cercoleptes*.

Alimentary Viscera.

The *tongue*, as exhibited in the drawing (fig. 2), seems to be very like that of *Cercoleptes*. It has seven circumvallate papillæ arranged in the usual triangular fashion with the apex directed

Fig. 2.



Tongue of *Bassaricyon alleni*, dorsal view.

towards the throat. The back part of the tongue at the fauces has a number of longish backwardly directed horny papillæ. The fungiform papillæ are scattered irregularly all over the dorsum of the

tongue; there is a group of them high up in the Λ formed by the circumvallate papillæ, and at this region there are no filiform papillæ, which commence somewhat lower though still between the limbs of the Λ . The fungiform papillæ extend to the very apex of the tongue.

Mesenteries.—Concerning the mesenteries, I have the following observations to offer, but I am unable at present to compare their arrangement with that obtaining in other Arctoids.

The free edge of the omentum was absolutely free, it having acquired no secondary connections with the rectum or other viscera.

The bottom of the duodenal loop is attached for about half an inch on the ascending limb by a special mesentery to the common dorsal mesentery of the alimentary canal in the region of the commencement of the large intestine. This is as nearly as possible exactly opposite to the insertion of the mesentery which passes from the gastro-splenic omentum and supports one limb of the pancreas.

Stomach.—The stomach is in no way remarkable in form. It is perhaps rather elongated. The œsophageal and pyloric orifices are about an inch apart, and the greater curvature is some $4\frac{1}{2}$ inches. The extreme length of the stomach is $2\frac{1}{2}$ inches. The pyloric portion, as in *Ælurus*¹, *Cercoleptes*, and other forms, is tubular and very thick-walled; it is hard to the touch, and can be thus easily distinguished from the rest of the stomach and from the duodenum. The length of this portion of the stomach is nearly an inch. Its orifice into the rest of the stomach is marked by numerous longitudinal converging folds, and it is traversed by similar folds. Externally it can be seen to commence abruptly. It is to be distinguished from the duodenum by a constriction.

The *spleen* is straight, wider at one end, and measures about 2 inches.

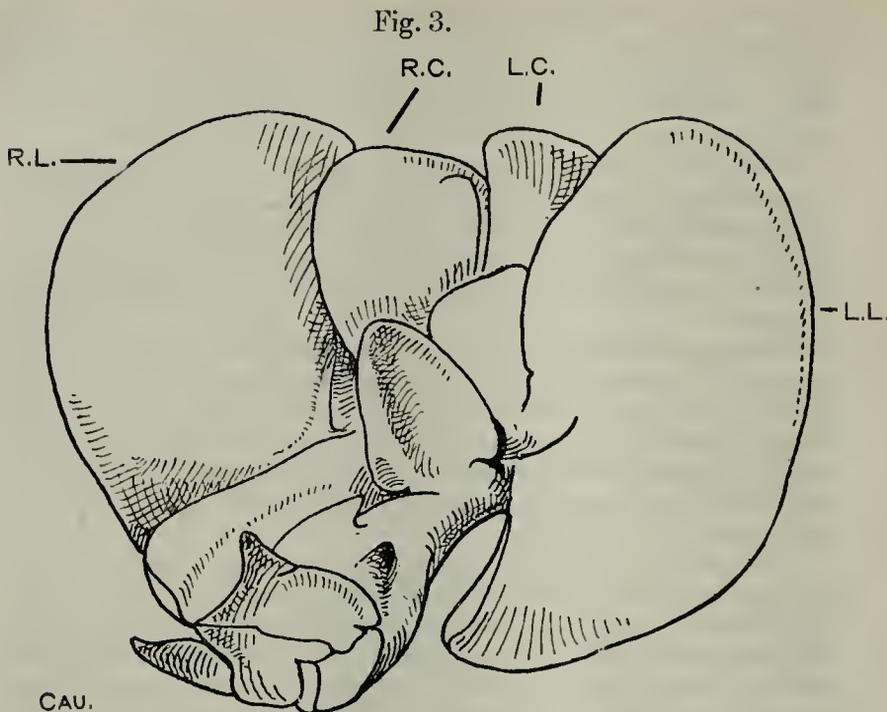
The *intestines* measure about 62 inches.

Although there is of course no cæcum, the increase in calibre marks the commencement of the large intestine. Reckoned in this way, the small intestine occupies 55 inches of the length of the entire tract, while the remaining 7 may be called large intestine².

The *liver* is displayed in the accompanying drawing (fig. 3, p. 666) from the abdominal surface. The features chiefly worthy of note are in the first place the very large size of the caudate, which consists of two very distinct lobes. The Spigelian lobe is also fairly developed. The gall-bladder is deeply imbedded in the liver, but is not visible upon the diaphragmatic aspect. The right lateral lobe is larger than the left lateral, but the left central lobe is larger than the right central. From the left lateral lobe is detached a small separate lobe,

¹ Flower, "On the Anatomy of *Ælurus fulgens*," P. Z. S. 1870, p. 752.

² Or perhaps this should be considered as rectum only.



Liver of *Bassaricyon alleni*, abdominal aspect.

CAU., caudate lobe; R.L., right lateral, R.C., right central,
L.C., left central, and L.L., left lateral lobes.

Pancreas.—The pancreas of *Bassaricyon* is a thinnish gland, divided as in *Bassariscus* into two limbs which join not far from the emergence of the pylorus from the stomach. They thus together form a **V** of which one limb is distinctly longer than the other. The longer limb runs parallel to the spleen. There is also a small lobe given off from the shorter limb near to its distal extremity; this curves round and joins the apex of the **V**, thus enclosing between itself and the shorter limb an oval tract of mesentery.

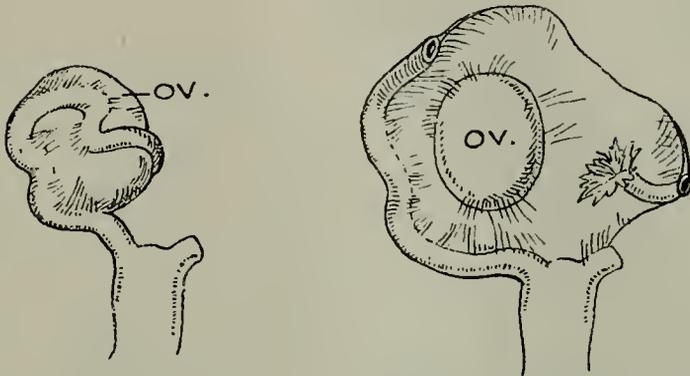
The pancreatic duct enters the small intestine in common with the bile-duct at a point about half an inch away from the pylorus.

The Ovary and the Oviduct.

It has been noticed that in a few mammals—in the Rat for example—the ovary is perfectly continuous with the oviduct owing to the fact that both the ovary and the mouth of the oviduct are enclosed in a completely shut-off pocket of peritoneum. I have found the same state of affairs to characterize not only *Bassaricyon* but also *Cercoleptes*, which is an interesting bond of union between these two Carnivora. There appeared to be absolutely no communication between the ovarian sac and the

surrounding peritoneal cavity. This state of affairs is an exaggeration of what is to be seen in some other mammals. In

Fig. 4.



Ovary (ov.) and oviduct of right side of *Cercoleptes*. In the right-hand figure the sac containing the ovary and the mouth of the Fallopian tube is cut open to display these structures.

the *Paca* for example the ovary can be perfectly easily pushed into a little pocket, and quite concealed from view when the fold bearing the mouth of the oviduct is drawn over it. It is normally half concealed.

The Brain.

The brain of *Bassaricyon* resembles very closely that of *Bassariscus*¹. The general outline is almost identical. The hemispheres diverge posteriorly to display the cerebellum. The crucial sulcus is situated rather anteriorly, and is well marked, curving round laterally after running forwards for a short way.

In *Bassariscus* a "lozenge" is not formed, there being in the brain of that animal no forward process of the crucial sulcus on either side to enclose a space.

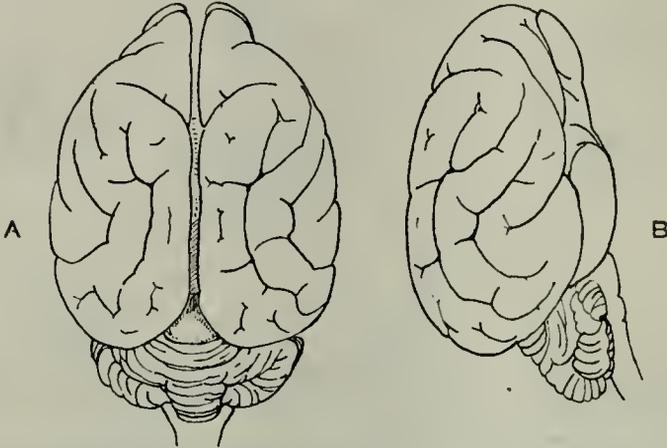
In *Bassaricyon* there are distinct indications of such forward processes, particularly on the right side. But, as will be seen from the drawing exhibited (fig. 5, p. 668), there is nothing like the complete "lozenge" of larger *Arctoids*. As to this feature in the brain, there is no possibility of confounding *Bassaricyon* with *Cercoleptes*, which latter has a fairly well developed "ursine lozenge"; and in addition the anterior part of the brain lying in front of the crucial sulcus is much more depressed below the level of the rest of the hemispheres than is the case with *Bassaricyon*.

The chief longitudinal fissure of the brain, that which divides the sagittal from the parietal gyrus, does not reach the margin of the pallium posteriorly; it does so however more nearly on the

¹ "On certain points in the Anatomy of the Cunning *Bassarisc*, *Bassariscus astutus*," P. Z. S. 1898, p. 129.

right side than on the left, thus resembling in a curious way the brain of *Bassariscus*. In both these animals the fissure in question is feebly marked compared with the same fissure in the brain of

Fig. 5.



Brain of *Bassaricyon alleni*. A, dorsal view; B, lateral view.

Cercoleptes. In a brain of the last mentioned animal which I have been able to study, I found a curious likeness to *Bassaricyon* (and *Bassariscus*) in the fact that this fissure did not quite reach the margin of the pallium.

The sagittal gyrus is folded upon itself anteriorly as it is in other Carnivora; but there is no fissure upon the reflected part of the gyrus such as occurs in *Bassariscus*.

The only other matter which seems to call for comment is the presence of a bridging convolution between the parietal and the sagittal gyrus on the left side of the brain. In the brain of *Bassariscus* this occurs on the right side. In the brain of *Cercoleptes* there is no bridging convolution on either side.

The Lungs and Heart.

On the right side there are three lobes of the lung, of which the lowest is the largest and the middle one the smallest. On the left side there are two lobes about equisized. In addition to these there is a small ventral unpaired lobe.

The heart gives off two main branches from the aortic arch—an innominate and a left subclavian.

The Muscular Anatomy.

Comparatively few of the genera of Arctoid Carnivora have been investigated as to their muscular anatomy. What is already known about the subject is summed up by Messrs. Windle and

Parsons in their account of the muscular anatomy of the Carnivora in general¹.

I have therefore thought it desirable to dissect at least the more important muscles of *Bassaricyon*, with a view of testing some of the classificatory conclusions of the two authors just named. This task has been rendered easier by the very useful summary of muscular characters in various families of Carnivora with which Messrs. Windle & Parsons's memoir concludes.

The *Pectoralis* consists, as in the Kinkajou², of three distinct portions. The anterior, and at the same time the most superficial part of the muscle, is the smallest division. It is about $\frac{3}{4}$ inch in breadth at its origin from the sternum, and narrows gradually towards the insertion. Beneath this, and extending from the anterior to very nearly the posterior extremity of the sternum, is a large sheet of muscle which forms the rest of the pectoralis. Anteriorly to behind the end of the first third of the sternum, this sheet of muscle is divisible into a superficial and a deeper layer; behind this point there is an oblique tendinous inscription and the two layers are fused. They are inserted perfectly separately on to the humerus. The origin is not only from the sternum but also from the adjacent parts of the ribs.

The *Rhomboideus* is entirely a single muscle; the anterior part which arises from the head cannot be distinguished as a rhomboideus anterior or rhomboideus capitis.

There is no trace that I could discover of any *Rhomboideus profundus* such as occurs in many Arctoids (especially Mustelidæ), and even in the near ally of the present genus, *Cercoleptes*.

The *Serratus magnus* forms one muscle including the levator anguli scapulæ. Its origin extends as far back as the 7th rib. Its attachment to the scapula is almost exactly coextensive with that of the Rhomboid. There is a tendency to a slight differentiation of the posterior muscle in that the insertion is faintly to be distinguished from that of the rest of the muscle.

The *Biceps*, as is the case with the majority of the Carnivora, is a single-headed muscle possessing only the long head. It is curious that in this feature *Bassaricyon* departs from its nearest allies; for in *Cercoleptes* and in some other Arctoids the second head of the biceps is present. In *Bassaricyon* there was an obvious though small fleshy coracobrachialis, but no trace of a second biceps head.

The *Coracobrachialis* has just been referred to. There was only one muscle present. Perrin reports its double character in *Cercoleptes*; but Windle & Parsons found it to be single in that Carnivore.

Latissimus dorsi.—This very large muscle is partly covered by the musculo-cutaneous, which latter is inserted into the humerus near

¹ "The Myology of the Terrestrial Carnivora," Pt. I., P. Z. S. 1897, p. 370; Pt. II., 1898, p. 152.

² For the muscular anatomy of that animal see Perrin, P. Z. S. 1871, p. 547.

to it. The chief facts about its origin to be noted are that it does not extend back as far as the ilium, and that part of its origin is from the last three ribs; it joins the teres at insertion which forks over the head of the biceps.

The *Trapezius* presents no particular features of interest; it is attached largely to nearly the whole length of the spine of the scapula; and there is also the cephalo-humeral portion which passes down the arm but is inserted on to the humerus as in other Arctoids.

The *Omotrachelian* is of course present and attached just in front of the last-mentioned muscle.

The *Dorso-epitrochlear* is slender and strap-shaped.

The *Deltoid* calls for no special remark. It is composed of two portions as in other Carnivora (not counting the *cephalo-humeral*).

The *Triceps* consists of four distinct portions which can be referred to this muscle, and possibly of a portion whose nature is somewhat doubtful and with which we shall deal presently.

The two outer heads are thick muscles which blend with each other not very far from their insertion on to the elbow. Their origins are concealed by the two divisions of the deltoid. The posterior of the two arises from the margin of the scapula near to the glenoid cavity. The origin of the anterior is from the head of the humerus. These two divisions are superficial to a deeper stratum of the triceps. This latter consists of the two portions that appear to exist in other Carnivora. Of these one arises just under the anterior superficial head and joins about halfway down the humerus the fourth head, which arises from the upper part of the shaft of that bone.

A broad slip of muscle, which appears to correspond to the second dorso-epitrochlear of some authors, arises superficially from the tendinous junction of the latissimus dorsi and the teres major, and therefore considerably above the origin of the undoubted dorso-epitrochlear. It is a flat strap-shaped muscle, and is inserted much nearer to the elbow-joint than the dorso-epitrochlear.

The *Anconæus* is a fleshy mass arising from the lower half of the humerus, and inserted on the same level as the deep portion of the triceps.

The *Epitrochleo-anconæus* was found.

The *Supinator longus* is present, as in all Arctoids and the majority of the Carnivora.

The *Extensores carpi radiales longior et brevior* are completely blended and indistinguishable at their origin. Concerning the *Extensor carpi ulnaris*, *Extensor communis digitorum*, *Extensor minimi digiti*, I have no remarks to offer.

The *Extensor digitorum profundus* arises from the dorsal surface of the ulna only.

The *Extensor ossi metacarpi pollicis* arises as in other Carnivora from both radius and ulna.

The *Pronator radii teres* appears to have an exceptional arrangement in *Bassaricyon*. As a rule in this group of Arctoids the

muscle appears to be inserted on to the end of the radius. It was inserted accurately into the middle of that bone in *Bassaricyon*.

The *Flexor carpi radialis* did not seem to be inserted on to a metacarpal but on to the radial carpal.

The *Flexor carpi ulnaris* is single-headed and is inserted on to the pisiform.

The *Palmaris longus* is a thin muscle associated with the last and overlapping the flexor sublimis: it spreads out below into a fascia. This muscle I believe to be the palmaris longus externus. The internus I could not discover, so that in this particular *Bassaricyon* departs from its ally *Cercoleptes*, where both muscles are present.

The *Glutæus maximus* has a fleshy insertion on to the middle of the femur for a very considerable part of that bone, after the great trochanter. The anterior part of the muscle is inserted quite separately on to the trochanter, there being a considerable interval between the insertions of the two muscles. It nearly completely hides the underlying *glutæus medius*. This muscle is very thick and fleshy and shows traces of being a compound structure including the pyriformis. At the insertion the distinction of the two is quite obvious.

The *Glutæus minimus* arises and is inserted below the last.

The *Tensor fasciæ* has a flat tendon and a short and flat muscular belly; it is inserted on to the fascia about half-way down the thigh.

The *Sartorius* is comparatively narrow at its origin, but it widens out greatly at its insertion, entirely covering the knee.

The *Gracilis* is formed of two quite distinct parts whose origins occupy together the whole length of the symphysis pubis; they unite before their insertion on to the leg; the posterior half of the muscle is the larger and has a partly tendinous origin.

The *Biceps* is two-headed: one, which is chiefly tendinous, springs from the tuber ischii; the other, which is fleshy, arises in common with the glutæus maximus. The insertion on to the leg is not very extensive, about the upper one-third.

I could not find a *Caudo-femoralis*.

The *Pectineus* is a huge fleshy muscle divided into two layers, and is distinct from the *Adductor*. There is but one adductor, which is strap-shaped and fleshy throughout. It is inserted at the end of the femur and partly on to the tibia. I am not quite certain whether this may not be the presemimembranosus of Messrs. Windle & Parsons.

The *Semitendinosus* has a strong, narrow, round tendon of origin from the tuber ischii and no second head.

The *Semimembranosus* presents no particular features of interest.

The *Tenuissimus* muscle of this animal is very plain on dissection, although extremely slender. It arises beneath the glutæus maximus; it ends in a flat tendon which is closely associated with the semitendinosus but close to the insertion of the latter.

The *Gastrocnemius* is two-headed.

The *Plantaris* is totally absent. This is very unusual, but there is no possible doubt about it.

The *Soleus*, on the other hand, is present. The muscle arises from the head of the fibula, and so it cannot possibly be confounded with the plantaris, which of course has a femoral origin. Moreover its fibres also partly arise from the septum between itself and the peroneal. Its tendon joins that of the gastrocnemius.

Of the *Flexores tibialis* and *fibularis* and the *Tibialis posticus* I have nothing to say save that they were present and quite normal.

The *Tibialis anticus* has a double tendon of insertion, and the muscle itself was double the smaller and lower portion, arising entirely from the fibula, while the larger half arose from both tibia and fibula. The lower half appears to be the equivalent of the *extensor proprius hallucis*, since its tendon is continued to the end of that digit; while the *tibialis anticus* proper is attached to the base of the first metacarpal by its much stouter tendon.

The *Extensor longus digitorum* is not remarkable. It has a long tendon of origin from the femur and a fleshy origin from the head of the fibula.

I found the three *Peroneals* mentioned by Perrin in *Cercoleptes*.

Osteology.

As has already been mentioned, both species of *Bassaricyon* have been described as regards the skull and teeth by the three gentlemen who have dealt with those two species. In order to make the present account of the skeleton more complete, I shall recapitulate the main features in the skull as well as of the other bones, comparing them with the corresponding bones of *Cercoleptes*.

On the palatal aspect of the skull, it is seen that the palate of *Bassaricyon* is wider than that of *Cercoleptes*, and increases in width from before backwards as far as the end of the series of teeth; its form is thus roughly triangular, as compared with an oval form in *Cercoleptes*. This feature appears to be more marked in *B. alleni* than in *B. gabbi*. The length of the zygomatic arch from before backwards where it becomes confluent with the tooth-line is greater than in *Cercoleptes*. The anterior end of the palate at the insertion of the incisors is almost semicircular in outline in *Bassaricyon*, and nearly straight in *Cercoleptes*. In *Bassaricyon* the tympani bullæ extend laterally and posteriorly nearly to the edge of the skull; in *Cercoleptes* there is a considerable flattened area of bone in this situation. The paroccipital processes, which are not long in either genus, thus come to lie close to the tympanic in *Bassaricyon* and some way away in the Kinkajou.

On the lateral aspect of the skull, the chief difference which is apparent is that the zygomatic arch in *Bassaricyon* is arched more strongly upwards than in *Cercoleptes*. The infra-orbital foramen is visible on this view in *Cercoleptes*; it is not in *Bassaricyon*. The last molar lies behind the maxillary part of the zygomatic arch in *Cercoleptes*; this is not the case with *Bassaricyon*.

On the dorsal aspect of the skull, the zygomatic arches are seen to project more at the sides in *Cercoleptes* than in *Bassaricyon*. In the latter, owing to the greater width and different curvature of that part of the zygomatic arch which joins the skull anteriorly, the infra-orbital foramen is visible on this view; it is not in *Cercoleptes*.

The mandible is much slighter, not nearly so deep in proportion to its length, in *Bassaricyon*. The symphysis, moreover, is considerably longer in *Cercoleptes*. The lower border of the mandible is curved convexly downwards in *Bassaricyon*; it is nearly straight and with a slight ventral concavity in *Cercoleptes*. The coronoid process is much longer than the angular process in *Bassaricyon*; the two are about equal in *Cercoleptes*.

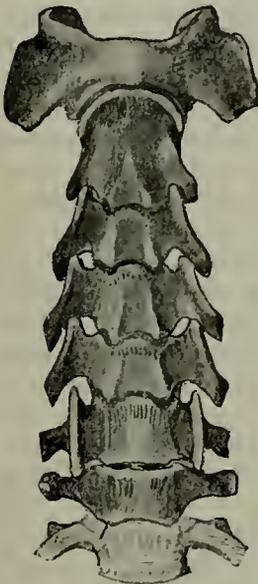
The vertebral column of *Bassaricyon* has the following formula:

C. 7. D. 13. L. 7 ca. S. 3. Ca. 15+

It has thus one dorsal fewer than has *Cercoleptes* and one lumbar more. Its formula is in fact the same as is that of *Bassariscus*.

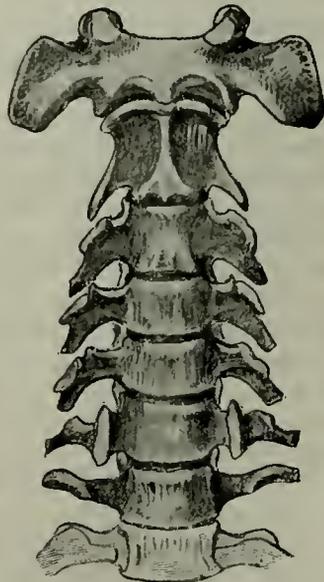
The atlas and the axis (*cf.* figs. 6 & 7) resemble those of the Kinkajou; the third, fourth, and fifth cervicals show hardly any

Fig. 6.



Cervical vertebræ of *Bassaricyon alleni*, ventral view.

Fig. 7.



Cervical vertebræ of *Cercoleptes caudivolvulus*, ventral view.

distinction between the lower and the upper lamellæ of the transverse processes; this, however, is partly shown on the fifth, and is very marked on the sixth. In *Cercoleptes*, on the other hand, all these vertebræ have markedly bifid transverse processes, while the lower lamella of the sixth vertebra is by no means so

large as in *Bassaricyon*. The third, fourth, and fifth cervicals have in *Bassaricyon* double hypapophyses; these are absent in *Cercoleptes*. In the dorsal vertebræ the spine slopes backwards in the first ten; the change is so marked (as indeed it always is in this group) that the spine of the eleventh is in absolute contact with that of the tenth. *Cercoleptes* is similar in this point of structure.

In the caudal series the first four vertebræ bear V-shaped chevrons which are not ankylosed to the centra. After this the two equivalent processes widely diverge with each other and are firmly ankylosed. In *Cercoleptes* the first five chevrons form complete canals and are detachable from the vertebræ; that of the sixth is composed of two pieces which nearly meet but are ankylosed with the centrum. The rest are divergent and do not enclose a canal; they are also ankylosed. Since the tail of *Cercoleptes* is prehensile while that of *Bassaricyon* is not, it is not surprising to find that the transverse and other processes of the caudal vertebræ are more marked and continue marked to nearer the end of the tail in that form than in *Bassaricyon*.

As already mentioned, there are thirteen pairs of ribs. Of these the first nine are attached to the sternum. The capitula of the first ten are intercentral in position; those of the rest have moved back on to the centrum of their vertebra. A distinct tuberculum is not visible after the tenth. In *Cercoleptes* there are fourteen pairs of ribs; the additional one in that animal differs from those which precede it in the fact that it is attached not to the centrum of its vertebra but to an apparent transverse process which, however, is not ankylosed to the centrum and, moreover, is directed backwards while those of the succeeding lumbar vertebræ are directed forwards. In *Bassaricyon* the transverse processes of this vertebra (which certainly have not ribs, as the skeleton was most carefully preserved) have the same direction as those which follow, though they are rather smaller. The first eleven ribs of *Cercoleptes* have capitula which are intercentral in articulation. This eleventh rib is the last which possesses a distinct tuberculum. Only nine, as in *Bassaricyon*, reach the sternum. In both genera the sternum consists of nine pieces; and in both the last but one is much smaller than those on either side of it.

The shoulder-girdle is very like that of *Cercoleptes*; the outline is precisely so, but the ridges, on the inner surface of which there are four in *Cercoleptes*, are reduced to two. I saw no clavicle, which if present must be very minute, as it is in *Cercoleptes*. As to the remaining parts of the skeleton, I have noted no differences from *Cercoleptes*.

It may be useful to append to the foregoing notes upon the structure of *Bassaricyon* a condensed definition of the genus. It should certainly be referred to the Procyonidæ, as has indeed been the opinion of all recent writers.

Genus BASSARICYON.

External form like that of *Cercoleptes*, but with non-prebensile tail. Nose grooved anteriorly. Mammæ 2. Sole of feet naked. Premolars 4; molars 2; both tri-tuberculate in upper jaw; in lower jaw 2 molars with 4 tubercles. Vertebral formula: C. 7, D. 13, L. 7, S. 3, Ca. 15+? Nine ribs join the sternum. Clavicle entirely absent. In skull, palate much produced behind last molars, coronoid process of mandible long and backwardly hooked, angular process slight.

2. On a new Serow from the Malay Peninsula. By A. L. BUTLER, F.Z.S., Curator, Selangor State Museum.

[Received June 19, 1900.]

It has hitherto been supposed that the Serow which occurs in the Malay Peninsula is identical with *Nemorhædus sumatrensis* (Shaw). No skin from this region, however, has ever been sent to Europe, and on examining two specimens recently obtained on the Larut Hills, Perak, I am convinced that they belong to a species as yet undescribed.

From the following description it will be seen that the Malayan Serow differs conspicuously from *Nemorhædus sumatrensis* in its jet-black legs, the limbs in that species being always tan or rufous. This uniformity of colouring on body and limbs alone gives the animal an entirely different appearance from the Burmese Serow.

Nor does it agree in any way, as might perhaps have been expected, with Blyth's *N. rubidus* from Arakan. Blyth described the Arakan species (Cat. Mamm. Mus. As. Soc. 1863, p. 174), from a stuffed head, an adult skin and one of a kid, as being "of a red-brown colour with black dorsal list; the hair shorter than of the others." The Malayan animal is mostly black, the under-colour on the back is greyish white; the hair is not shorter than in *N. sumatrensis*.

Description of a female specimen in the Perak Museum, shot by Sir Frank Swettenham on the Larut Hills, Perak, early in 1899:—

NEMORHÆDUS SWETTENHAMI, sp. n.

General colour black, the back strongly and the sides slightly grizzled with grey, the bases of the hairs being whitish. Along the lips whitish grey; the posterior portion of the upper lips, a patch on each side of the lower jaw and one on the throat rusty red. Ears black, grizzled with rusty at the base, and lined and edged with greyish-white hairs. Mane black, mixed with whitish hairs on the fore part of the neck and with reddish hairs towards the withers. Insides of the thighs rusty red. Remainder of head, neck, chest, belly, and legs black. Tail black.

Height at shoulder $36\frac{1}{2}$ inches; from nose to root of tail over curves of body 58 inches; tail $4\frac{1}{2}$ inches. Length of horns 6 inches.

Named after Sir Frank Swettenham, Resident-General of the Federated Malay States, whose specimen appears to be the first ever shot by a European.

Mr. L. Wray, of the Perak Museum, has seen an adult male in the flesh, too decomposed to be preserved, but of which he kept the skeleton. I once had an opportunity of watching one in jungle for a minute or so not more than fifteen paces distant; and quite recently a kid was captured alive by coolies on the Larut Hills, having strayed into a wired-in tennis-court. All these were similar in colour to the one described, which may therefore be taken as a typical specimen of the Malayan species. The kid differed from the adult only in having a very narrow ring of rufous round the top of the hoof. This youngster Mr. Wray and I were particularly anxious to send home alive to the Society's Gardens under the charge of Mr. Keilich, of the Perak Museum, who was shortly proceeding to England, but unfortunately it died after five or six days' captivity. The specimen is now in the Museum along with the adult.

Although this Serow is so little known to Europeans the horns are occasionally obtained from the Sakai tribes of the hills, and I have notes of a dozen pairs as follows:— $8\frac{1}{4}$ inches, 8, $7\frac{1}{2}$, $7\frac{1}{4}$, $6\frac{3}{4}$, $6\frac{3}{4}$, $6\frac{1}{2}$, $6\frac{3}{8}$, $6\frac{3}{8}$, $6\frac{1}{8}$, 6, 6. Eight inches appears to be a good head.

The Malay name for this animal is "Kambing grun," *i. e.* "Cave-Goat."

It is found on the mountains of the Peninsula from 2000 ft. to 4000 ft. altitude, and is said also to occur on various isolated limestone hills of much lower elevation.

The peculiar circumstances under which Sir Frank shot his specimen were narrated in the 'Sketch' of April 26, 1899, p. 22, the article being illustrated with a photo of the mounted animal. Sir Frank was taking a photograph one afternoon when the Serow was noticed on the hill beneath him, apparently quite fascinated by the appearance of the cloth-covered camera on its tripod. It remained motionless, still gazing intently at the camera, while a rifle was sent for, when an accurate shot brought it to bag.

3. The Significance of the Hair-Slope in certain Mammals.

By WALTER KIDD, M.D., F.Z.S.

[Received March 27, 1900.]

The following observations were suggested by a study of the well-known peculiarity as to the direction in which the hairs slope on the extensor surface of the human fore-arm. In 'Nature,' vol. lv. p. 236, I drew attention to certain considerations affecting the "vestigial" character of this hair-slope, and pointed out that most hair-clad mammals, except Ungulates, present much the

same direction of slope of hair in this region as Man. From this I was led to suggest that the direction in question is due to pressure of the weight of the fore part of the body acting downwards and forwards, and that the resultant of these two forces, in the cases of Carnivores and other animals accustomed to a "couchant" attitude when at rest, would tend to direct the slope of the hair away from the manus on the extensor surface of this limb-segment. As a matter of fact this slope is found in nearly all Carnivores, wild and domesticated, in which the hair is short enough to allow of its observation. On the other hand, in most Ungulates one finds that the slope on this extensor surface does not present the reversed curl of hair found in Carnivores and Primates. This rule is far from universal: *e. g.*, the Elk, Domestic Horse, and 4 Antelopes present on this limb-segment, over the distal fourth, a slope towards the radial border; and further, 11 Antelopes and 20 Cervidæ examined have a slope hardly differing from that of Carnivores (see subsequent remarks, p. 686). From this basis of fact I suggested that the hair-slope in Ungulates assumes this direction, which is more in accordance with the general slope of hair in other regions of the limbs, and so differs from that of Primates and Carnivores, because of the attitude assumed by Ungulates when at rest. These animals so commonly rest with the extensor surface in question resting on the carpus and manus in flexion, in other words with the fore-limb doubled underneath the body, that any pressure downwards on this area of hair serves only to confirm its manus-ward slope, there being no horizontal force acting with the vertical to produce a forward slide, as must always be the case in the "couchant" attitude of Carnivores.

Following up this point, in 'Natural Science,' Nov. 1897, p. 357, I made a short note of the bearing of these facts on the doctrine of the non-inheritance of acquired characters.

This matter has now been investigated somewhat further in a different region of the bodies of hair-clad mammals, namely, the frontal, nasal, and premaxillary areas. I find among the different mammalian orders some singular divergences in the arrangement of this hairy surface. Here is a part of the body very much open to inspection, and one which from its prominent position must be subject to the action of tolerably constant external forces, differing necessarily in different forms, according to their environments.

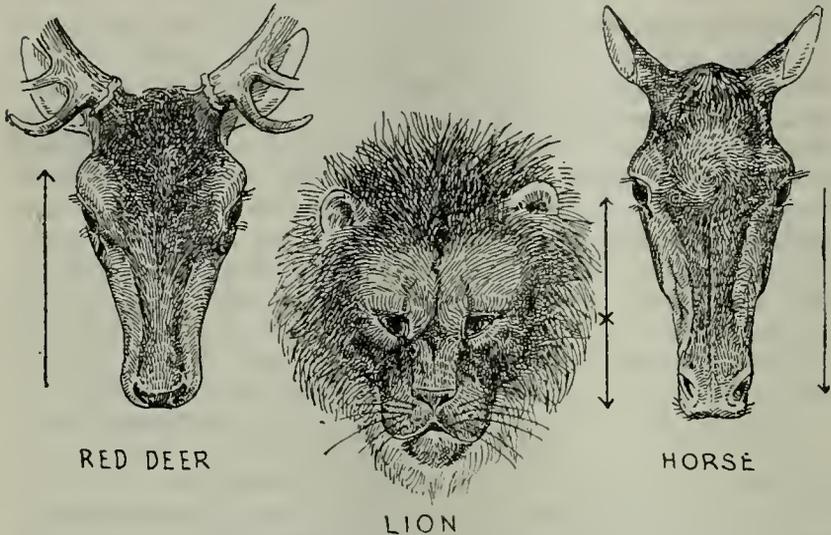
It is not possible to understand enough of the daily lives of many of the animals referred to below, but of some we may claim to know certain forces which cannot but act upon them in certain directions. A few of these will be considered later.

The most common hair-covered mammals occur among Primates, Insectivores, Carnivores, Ungulates, Rodents, Marsupials, and Monotremes.

The great majority of these conform to a certain general distribution and slope of the hair in this region of the head. This slope ordinarily commences in the premaxillary area just above the

muzzle with a small whorl or star, and the hair passes in two streams along the nasal up to the frontal area, diverging on its way in a fan-shaped fashion, to coalesce on either side with the hair round the orbits and that of the face and neck. In many forms, chiefly those with short hair, a clearly defined "parting" is found in the middle line of the nasal and frontal regions; in those with longer and thicker hair no such "parting" is visible. At about the junction of the frontal and parietal bones there is commonly a further whorl or star, at which point further divergences of hair-streams take place. This, which I would call for convenience the Ordinary Type, can be seen in many hair-covered mammals, especially those in which the hair is rather short. (See fig. 1, Red Deer.)

Fig. 1.



Types of heads showing hair-slope on frontal and nasal regions, arrows indicating general direction of slope.

I need do no more than enumerate those groups of animals which conform to the Ordinary Type.

1. MONOTREMES.—The fur of *Ornithorhynchus* and the spines of *Echidna* present this ordinary type of slope.
2. MARSUPIALS.
3. RODENTS.
4. INSECTIVORES.
5. UNGULATES.—Among the representatives of this great order, Ovidæ; Antilopidæ (except those mentioned below); Cervidæ; Capra; Suidæ (except one form noted); Camelidæ and Giraffidæ (peculiar and noted more particularly below); Hyracoidea; so far as observed, all present the Ordinary Type.

6. CARNIVORES.—Among these, Ursidæ; Procyonidæ (except the Great Panda); Mustelidæ; Otariidæ; Phocidæ; Trichechidæ; Viverridæ, and Canidæ conform to the Ordinary Type.
7. PRIMATES.—Lemuridæ mostly present this type, thus differing from the type found in Monkeys and Anthropoid Apes and in Man, which will be described later.

It is more particularly those instances among Carnivores and Ungulates, departing from the Ordinary Type, to which I desire to draw attention.

So far as I have been able to ascertain from a great number of specimens, living and dead, among Carnivores the great majority follow the Ordinary Type. The exceptions observed are somewhat remarkable—viz., *Felis leo*, *F. tigris*, *F. pardus*, *F. onca*, *F. concolor*, *F. lynx*, *F. jubatus*, and the Domestic Cat. In these animals so decidedly marked off, by their deep and massive muzzle, from the smaller and more numerous allies of the Felidæ, the direction of the slope of hair on the nasal region is towards the external nares, beginning from a whorl which is situated about midway between the level of the orbits and the external nares. From this whorl there is no interruption to the straight line taken by the hair-slope till it reaches the muzzle. (See Lion, fig. 1, p. 678.)

One singular exception to the Ordinary Type is found in the Panda (*Æluropus melanoleucus*), and in this animal the whorl is found slightly nearer to the external nares than that of the larger Felidæ, and the slope thence to the nares resembles theirs. The Panda and the larger Felidæ, it may be remembered, have all massive, deep muzzles.

As to Carnivores, then, it appears that all Dogs, Foxes, Wolves, Jackals, Smaller Cats, nearly all Bears, Racoons, Seals, Walruses, Weasels, Badgers, Otters, Skunks, present the Ordinary Type of hair-slope on the nasal and frontal regions.

These are all animals with elongated, more or less pointed snouts. The exceptions brought forward—Lion, Tiger, Leopard, Puma, Jaguar, Lynx, Cheetah, Panda—are those of animals with deep, massive snouts.

UNGULATES furnish a greater number of exceptions to the Ordinary Type than any other group of mammals. It has been seen that the majority even of this order are, so to speak, normal.

The exceptions which have been noted are as follows:—

Bovidæ, or True Oxen.

<p><i>Bos indicus</i>, <i>Bos frontalis</i>, <i>Bos sondaicus</i>, <i>Bos taurus</i> (or Congo Buffalo),</p>	}	<p>present a uniform slope from a whorl between the insertion of the horns to a point just above the margin of the muzzle, where a secondary small whorl is found.</p>
<p><i>Bos depressicornis</i>.—Slope passes from a whorl close below the</p>		

level of the orbits to the margin of the muzzle, where a secondary whorl is found.

Bos taurus or Chillingham Wild Cattle.—Of two specimens, one shows the whorl above, the other below the level of the orbits.

Bos bubalis, } present a bi-lateral whorl below the level of
Bos mindorensis, } the orbits.

Bos caffer.—Here the hair slopes uniformly from the whorl at the base of the great united horns to the small secondary whorl close to the margin of the muzzle.

Bos grunniens, } present thick long hair sloping to the small
Bos bonasas, } secondary whorl above the muzzle-margin,
Ovibos moschatus, } from the base of the horns, no primary whorl
Bos americanus, } here being visible.

Antelopes. Among these the exceptions are :—

Oryx beisa,
Bubalis swaynei,
Bubalis tora,
Bubalis tragocamelus,
White-bearded Gnu,
Blue-brindled Gnu, } primary whorl ranging from a position
just below the base of the horns to the
level of the orbits, and small secondary
whorl close to muzzle.

Saiga tartarica.—Muzzle shaped like that of Tapirs. Hair slopes from bilateral whorls, situated a little below the level of the orbits, towards the nares. Just above the nares is found a secondary whorl, in one female specimen; and in a male specimen there is a third whorl between the two other whorls. In this specimen the downward slope is thus broken up in its course.

Reindeer (*Cervus tarandus*).—Shows a whorl immediately above the margin of the muzzle, from which the stream of hair passes very closely in the long axis of the head over the convex rounded upper lip to the level of the horns.

Equidae.—All of those that I have been able to examine are exceptions to the Ordinary Type. (See fig. 1, Horse.)

Zebra has the whorl varying slightly above or slightly below the level of the orbits.

Quayga has the whorl nearer to the ears than Zebra.

Equus asinus (African Wild Ass) has the whorl at the level of the orbits.

Equus hemionus (Asiatic Wild Ass) has the whorl below the level of the orbits.

Equus caballus, at the level of the orbits.

The *Domestic Horse*, *Ass*, and *Mule* differ one from the other as to the position of the whorl as follows :—In the Horse it is at or just below the level of the orbits. In the Domestic Ass, which appears to be the tamed *Equus asinus*, it is midway between the level of the orbits and the muzzle. (In this connexion the great

relative size of the head of the Ass may be noted.) In the Mule it is not quite so far towards the muzzle as in the case of the Ass.

In the Tapirs the snout is elongated and curved gently towards the ventral surface in a very uncommon form. It thus differs from other elongated snouts, which are not only elongated but straight as a rule. In Tapirs the direction of the hair-slope is uniformly towards the muzzle.

Among the *Suidæ*, the only exception observed was the *Phacochoerus* or Wart-Hog, which presents a notable bristling whorl of hair, unusually far from the snout for a pointed head, such as this form shares with other *Suidæ*. This whorl is nearly midway between the nares and the level of the orbit.

The *Giraffidæ* and *Camelidæ* show the Ordinary Type of slope in the nasal and frontal regions, but on the broad thick upper lip the hair is arranged in a fan-shaped way, diverging from the level of the nares to the margin of the upper lip.

Primates.—In the case of the Primates, the whorl from which the hair of the frontal, nasal, orbital, and facial regions diverges is situated in most forms at the level of the orbits; and thus this great group, including Man, conforms to the exceptional type.

It is not claimed that these observations are exhaustive for all hair-covered mammals, but they are certainly quite representative. It comes then to this, that from the great majority of mammals there stand out in marked contrast to them, in respect to this character, seven *Felidæ*, one of the *Procyonidæ*, one of the *Ursidæ*, seven Antelopes, all Tapirs and *Equidæ* examined, thirteen *Bovidæ*, and one of the *Suidæ*, and Primates except *Lemuridæ*.

It appears desirable to ascertain, if possible, what characteristics are common to these rather divergent types of animal life, or what is common to them in the way of habits or environments.

In the first place, it may be suggested that this exceptional slope of hair is correlated with a deep, massive, somewhat truncated muzzle. It is clear that the more ordinary type is found in animals with pointed muzzles. It is equally clear that the larger *Felidæ* and the Domestic Cat have the exceptional form of hair-slope, correlated with the different types of muzzle referred to. This is also found in the Panda (*Ailuropus melanoleucus*). But among the *Antelopidæ* and *Bovidæ* specified, the Tapirs, and *Equidæ*, this type of snout is not marked enough to enable one to generalize as to this correlation. It is relatively not nearly so massive or deep as in *Felidæ*. It can, then, hardly be maintained that the exceptional slope is merely correlated with a certain type of snout.

Again, the *pose* of the head in rest, or its carriage when in motion, may have a bearing on the point. It cannot be that the *pose* of the head can effect the "set" of the hair in many cases by the action of gravity, for most of these are short-haired. But it is a fact that the larger *Felidæ*, the Panda, the specified Antelopes, *e. g.* the Gnus, the *Bovidæ*, Tapirs, and *Equidæ* carry their heads more set at an obtuse, or some at a right, angle to the longitudinal

axis of the body than those animals with pointed snouts. To such a rule there must be many exceptions, but a rule it is.

The fore-end of animals is necessarily subjected to numerous forces in the course of their wild life, and it seems a fair inference to draw, that the differences of "set" of hair on this prominent region are determined by different factors, such as the prevailing attitude of the head, habits, and environments. The hair-slope must break or "part" somewhere in the frontal or nasal region, and it may need but little in the way of difference in the angle of incidence of wind, tropical rain, pressure against undergrowth, burrowing in the ground, rooting in swamps or marshy ground, and, finally, method of cleaning the fur, to determine that point at which a whorl shall be established, and inherited in the course of many generations. These are no more than suggestions to account for some singular divergences in a very insignificant character, which have come about by some means or other, and they agree, in their way, with the suggested reason for the peculiar hair-slope on the extensor surface of the forearm of Man, certain Monkeys, and Carnivores.

There is some support for this view in the striking whorl with divergence of colour, so generally seen over the tuberosities of the ischia of short-haired Dogs, and the bare spots and callosities on the corresponding parts of many Monkeys, for both of these forms of animals are notoriously fond of sitting on their haunches. Another "abnormality" of set of hair for which one can see no explanation, is that strange slope towards the cephalic end, which is seen on the middle line of the dorsal region of some Antelopes. This may even start from a whorl over the sacral region, and pass thence right up to the horns, as in *Oryx beisa*, or from a whorl in the mid-dorsal region, as in *Cobus ellipsiprymnus*. In cases such as these, it may be that a fuller knowledge of the habits of such animals would provide a reason for so strange a departure.

APPENDIX.

I have ventured to make a short addition to this paper containing some notes illustrated by two diagrams, which, I think, lead to similar conclusions. They represent three regions of the domesticated Horse, an animal especially useful for investigation on account of the great numbers of individuals open to our inspection, and because it is an animal whose business in life is to walk, trot, canter, or gallop, and since it has been domesticated by man it has probably led, more than any other animal, a locomotive life.

Three regions of the Horse's body are illustrated:—

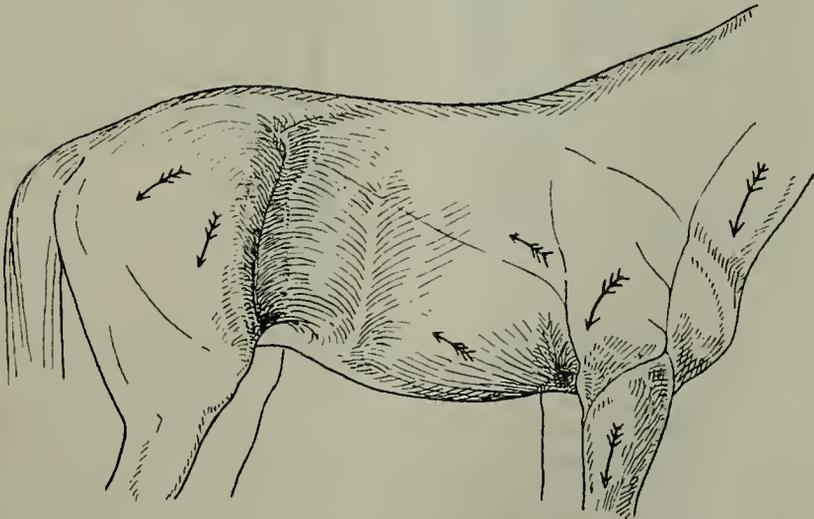
A. *Inguinal*.—Here is exhibited the well-known whorl from which a "feathering" starts, at the edge of the skin-fold of this region, opposite to the level of the patella, extending up the hollow of the flank, with a feather-shaped arrangement of the hair, to the level of the crest of the ilium, where it terminates, sharply

and with great uniformity, in a raised ridge of hair. The "feathering" diverges on each side, that on the gluteal region merging easily into the general hair-stream of this part, and the stream which passes on to the thorax sweeps more widely forward and curves again to the ventral surface, uniting with the hair-stream of the thorax.

This character in Horses is universal, and I have found it present, more or less marked, in 25 other forms of Ungulates (see Notes, p. 686).

B. *Post-humeral or axillary*.—This whorl, with occasionally a "feathering" arising from it, lies in the hollow between the great mass of extensor muscles of the fore-limb and the muscles of the thorax. It has been found by me in 87 Horses out of a very large number examined. In two of these it was unilateral; and of these 87, 57 were cart-horses, though the proportion of cart-horses examined was very small. In regard to this fact, it may be noted that in cart-horses the action of the shoulder-joint preponderates considerably over that of the carpal and metacarpophalangeal joints. One special group of 2159 Horses examined gave 42 cases of this feature, or nearly 2 per cent. I would suggest that this is a specially interesting case of a new character, like the more stable inguinal and pectoral whorls, being developed before our eyes. This whorl has also been noted in 16 other forms of Ungulates. (See Notes, p. 686.)

Fig. 2.

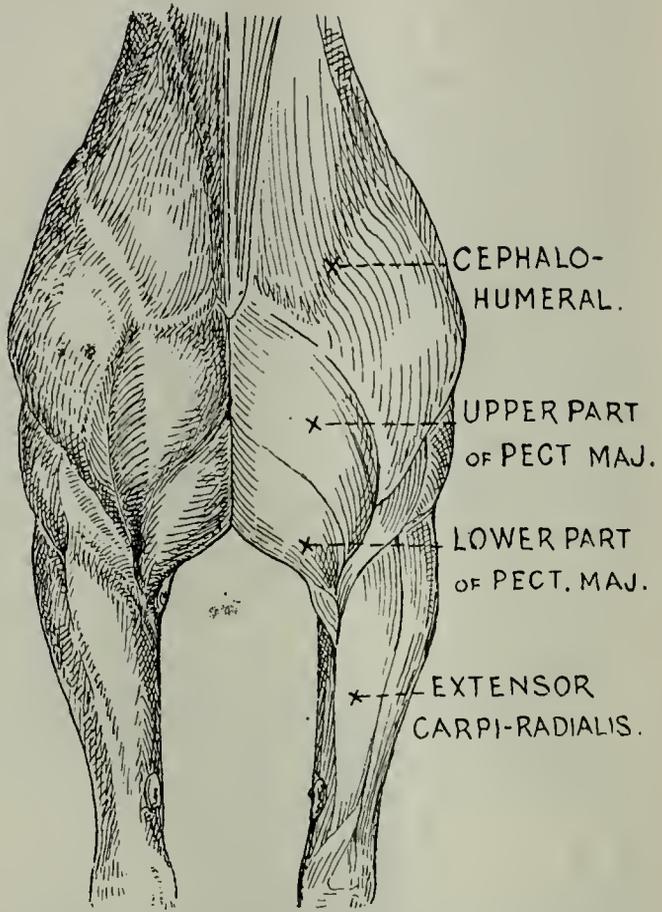


View of Horse showing post-humeral and inguinal whorls with feathering, arrows indicating directions of opposing muscles.

C. *Pectoral*.—This whorl (see fig. 3, p. 684) with oval "feathering" is bilateral, and extends from a point about at the level of the olecranon process over the mass of the pectoral muscles in a

line nearly parallel with the mesial plane. This is universal in Horses, and much more general than either A or B, being found in most Ungulates and Carnivores.

Fig. 3.



Front view of pectoral region of Horse, the left side showing muscles with opposing actions, the right showing pectoral whorl with feathering.

Two further points may be referred to. First, neither A nor B has been found in any but the Ungulate Order; second, in 9 of the 25 Ungulates noted, A and B co-existed.

The suggested interpretation of these facts is that they are due to the effect on the plastic hair-streams of the markedly divergent traction of the underlying muscles. These are seen to have a striking opportunity of influencing the structures lying over them, in each of the three regions alluded to, by a reference to the diagrams.

All the characters of hair-slope here referred to may be taken as congenital. Being then inherited they may have arisen in certain ancestors in one of the three ways:—

1. They may have been due to selection (*Natural*, i. e. *Personal*, *Sexual* or *Germinal*).

2. They may have arisen from the action of habits or environments—Lamarckian factors; or,

3. They may be vestigial.

Considering that, so far as it is possible to understand animal life, the survival-value of these differences of hair-slope is *nil*, natural selection and germinal selection may be put aside as accounting for them.

Though the slope on the extensor surface of the fore-arm is claimed to be vestigial, these peculiarities are not so claimed, and cannot be, in the face of the very tangled relationships which are presented.

The possibility of accounting for them by sexual selection must be considered; but as some of these divergences of slope are difficult for a human eye to discover at close quarters, and as usually no markings or coloration are attached to them¹, this theory cannot be seriously entertained.

If it may be fairly held that these exceptional forms of slope of hair found on the head, dorsal region, fore-arm, and gluteal region, indicate the working of certain Lamarckian factors, there is a much greater body of evidence pointing in a similar direction, viz., all those hairy mammals which conform to the ordinary type. Indeed the general trend of hair from the cephalic to the caudal extremity of every animal, and from the proximal to the distal extremity of each limb, may even be open to similar interpretations. As there is no evidence forthcoming as to the prototype of hair-covered mammals, no speculation as to the habits and environments thereof can be profitable. Whether it were Ornithodelphous, Marsupial, or Insectivorous in its type, there must have been a time when the development of hair was feeble, and capable of being affected by habits and environments. It is surely as reasonable to attribute to these the slope of hair which we find existing, and compatible with them, as to attribute it to any survival-value, under selection—if not considerably more so.

I would suggest that one habit which is common to such animals as here in question, that of cleaning their external coverings by friction, either against other objects, with their fore-paws, or with their tongues, must have a very potent influence in determining the general trend of hair referred to as found on all hairy animals. It is obvious that such forces must in the main act in the direction indicated.

¹ The "star" or "blaze" on Horses is one of the comparatively few instances of markings in this region; but *Equus caballus* is not an animal in a state of nature, and has been so much modified by artificial selection as to prevent this combination of markings and exceptional hair-slope from being brought under Sexual Selection.

In view of these considerations, it seems difficult to deny that cases of inheritance of acquired characters have been brought forward. It would appear at any rate to be a choice between this Lamarckian interpretation and the view of Professor Weismann, that these useful directions of variation have been produced by the adaptive requirement, by means of selectional processes within the germ.

NOTES.

Exceptions found among Ungulates to ordinary slope on extensor surface of ulna are as follows:—

Oryx gazella. *Oryx beisa*. *Strepsiceros kudu*. *Oreas canna*. *Alces machlis*. *Raphicerus campestris*. *Raphicerus melanotis*. *Ourebia nigricaudata*. *Ourebia hastata*. *Tetraceros quadricornis*. *Nesotragus moschatus*. *Cephalophus grimmi*, *C. rufilatus*, *C. leucogastris*, *C. abyssinicus*, *C. doriae*. *Pudua humilis*. *Moschus moschiferus*. *Xenelaphus antisieusis*. *Hydropotes inermis*. *Dorcelpaphus bezoarticus*, *D. americanus*, *D. hemionus*. *Cervulus muntjac*, *C. reevesi*, *C. lachrymans*. *Capreolus caprea*. *Elaphodus nuchianus*. *Cervus alfredi*, *C. porcinus*, *C. axis*, *C. duvauceli*, *C. elaphus*, *C. dama*, *C. cashmirianus*.

Also certain Chevrotains and Suidæ noted.

Re A. Ungulates in which an Inguinal Whorl is found.

Bubalis caama. *Rangifer tarandus*. *Cervicapra fulvorumfula*. *Cervicapra arundinum*. *Cobus thomasi*, *C. buffoni*, *C. vardoni*, *C. leche*. *Equus hemionus*. *Bos sondaicus*, *B. indicus*. *Oris ophion*, *O. ammon*, *O. sairensis*, *O. poli*. *Capra pyrenaica*. *Saiga tartarica* (present in male, absent in female). *Gazella granti*, *G. mhorr*. *Antilocapra americana*. *Cephalophus dorsalis*. *Cervus kuhli*, *C. elaphus*. *Camelus bactrianus*. *Lama huanacus*.

Re B. Ungulates in which a Post-Humeral Whorl is found.

Strepsiceros kudu. *Rangifer tarandus*. *Cobus leche*. *Equus hemionus*. *Equus burchelli* (young). *Bos sondaicus*, *B. depressicornis*. *Oris ophion*, *O. ammon*, *O. sairensis*, *O. poli*. *Antilocapra americana*. *Dorcelpaphus americanus*, *D. dichotomus*. *Elaphurus davidianus*. *Lama huanacus*.

4. On the Structure and Anatomy of the Musk-Ox (*Oribos moschatus*). By Dr. EINAR LÖNNBERG.

[Received April 25, 1900.]

CONTENTS.

- SECT. 1. The Development of the Horns, p. 687.
 " 2. Description of the Hoofs, p. 694.
 " 3. Description of the Skull, p. 695.
 " 4. Comparison between the Skull of *Oribos* and that of *Budorcas*, p. 715.

In further elucidation of the relationships of the Musk-ox, I beg leave to offer the following remarks in continuation of those read before the Society on February 20th last¹.

¹ See P. Z. S. 1900, p. 142.

Sect. 1.—THE DEVELOPMENT OF THE HORNS OF THE MUSK-OX.

The peculiar shape, structure, and position of the horns of the Musk-ox make them more interesting objects for an investigation than the greater number of horns of other Cavicornia. The material on which this essay is based has been brought home by the Swedish Expedition to East Greenland in 1899, under the direction of Professor A. G. Nathorst, and consists of a skull of a young calf and several skulls of adult bulls and cows. Unfortunately no intermediate stages are represented by young or half-grown animals, because no such animals were seen, Professor Nathorst informs me. This gap is to some degree filled by Sir John Richardson's description and fine figure of the skull with the horn-cores of a yearling or "16 months old" bull¹. With the aid of this description and figure, and above all by the extremely interesting markings of growth and structure which were made visible by preparing longitudinal sections of a horn of an old bull, I think that I shall be able to present a fairly exact sketch of the development of the horns of the Musk-ox. In preparing this I have had the valuable assistance of my friend G. Svenander, Cand. Phil., who has made the accompanying drawings of horns in three different stages of development, and to whom I therefore beg to express my best thanks.

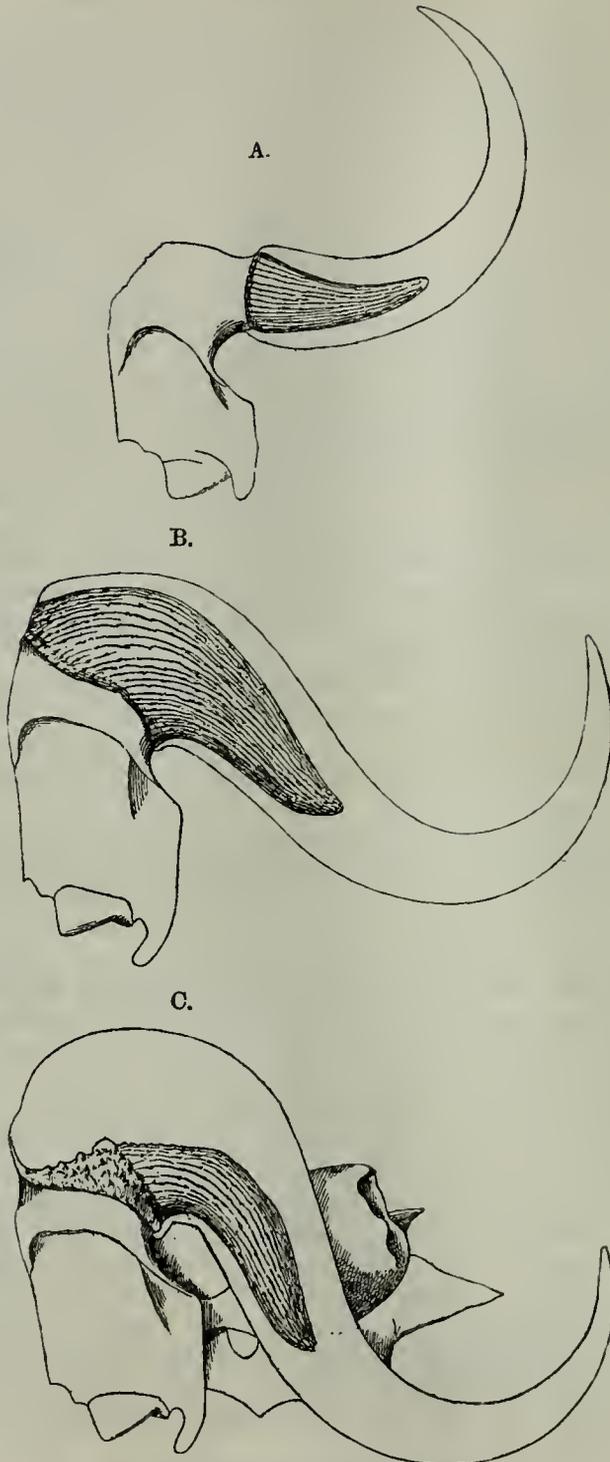
The origin of the horn-cores is conspicuous in the young summer calf as a slight prominence on the lateral surface of the frontal bone, about 1 cm. from the upper surface of that bone and about as far from the fronto-parietal suture, but 3½ cm. from the posterior margin of the orbit.

The development of the horn must be slow during the first winter, because, as Mr. R. Lydekker informs me, the calves which were brought to Tromsø by a Norwegian vessel, and subsequently sold to the Duke of Bedford, had not any horns even in December.

In the second summer the growth must be rather rapid, as the horn-cores of a 16 months old bull according to Richardson's figure (*l. c.*) measure about 11 or 12 cm. The author mentioned describes them in the following way:—"The horn-cores have a purely lateral origin, and do not rise at all above the facial line, but, springing from an almost cylindrical root immediately behind the orbits, stand out laterally with a moderate inclination basiad and antiniad, their axis forming with the mesial plane of the cranium an angle of 62°. These cores are moreover, in themselves, concave on their facial or coronal aspect, by which they receive a uniform upward curve in the direction of their length, in addition to their general direction of outwards, basiad, and forwards. The tips of the cores in this yearling extend further from the sides of the skull laterally than any part of the massy core or its sheath in the four-year-old animal." With the help of this description, and assuming that the horns of an adult animal have not been

¹ Zoology of the 'Herald,' p. 67, pl. iv.

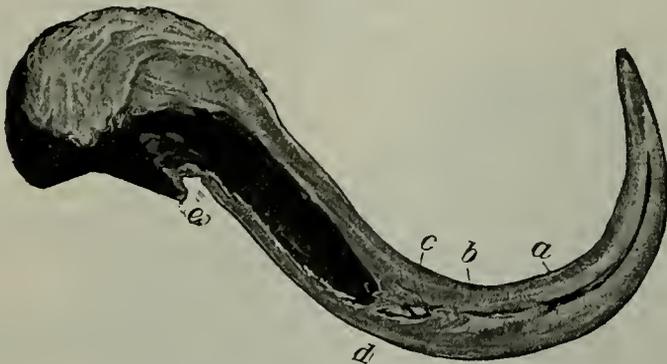
Fig. 1.



Schematic sketches showing different stages of development of the horn of the Musk-ox. A, represents the horn at the end of the first summer; B, an intermediate stage when the exostoses are at the height of their development; and C, a quite full-grown horn.

worn off in any higher degree than that a section from the tip of the horn in which such a horn-core fits fairly well corresponds to the original horn of that age, fig. 1 A is prepared. It is represented in the same plane as the main axis of the horn (as also is the case with figs. 1 B and C). Fig. 1 A should thus represent the horn of a young bull in the second autumn of its life. The longitudinal section of the horn of an adult bull, which is reproduced in fig. 2, shows that the horn has grown straight only until it reached a length of 5 cm. or hardly that, because already at that distance from the tip the originally ventral (later on distal) side of the horny sheath is thickened. Such a thickening of the ventral side of the horn produced by stronger growth of these parts effects, of course, the curving upwards of the tip of the horn. This curving upwards continues the whole of this period of growth, viz., the second summer of the animal's life. At the end of this summer the horns probably have attained a length of 35 cm., more or less, and their tips are at that time more raised above the facial line than at any later time.

Fig. 2.



Longitudinal section through a full-grown horn of the Musk-ox, showing lines indicating the growth at different periods.

I have above used the words "period of growth," for I think that the horns are chiefly enlarged during that time of the year when the animals are able to procure food in sufficient quantities not only to sustain life, but also to add to their bulk. Theoretically such an assumption does not seem too hazardous considering the circumstances under which these animals live. But the probability of this is strengthened by the fact that on the longitudinal section of the horn are seen some lines of demarcation which are most easily interpreted as the limits between such parts as have been added during different periods of growth¹. At "a" on fig. 2

¹ Similar lines of demarcation are also seen on a longitudinal section of the horns of a common cow, and stand in that case plainly in connection with the rings at the base of the horn which in this country commonly are called "calfrings," because it is known that a new ring, that is a new layer of horny

is such a mark, which is very pronounced: and I think that it may be regarded as the place where the distal tip of the horn-core was situated at the end of the first period of growth. Such a supposition corresponds also very well with the dimensions of the horn-core, as they have been given in Richardson's figure, compared with those of the horn.

During the second period of growth (third summer) the upper side of the horn is thickened by more rapid growth than that which takes place on the under side. Through this a pressure is effected by the horny sheath on the upper side of the horn-core, and this causes a reabsorption on the upper side of the same. On the lower side, on the contrary, the pressure is diminished and, therefore, the horn-core is thickened below by apposition. In such a manner the direction of the main axis of the horn is lowered. At the same time the length of the horny sheath is increased by basal growth, and it is driven out from the head in the direction of the axis of the horn-core on which it glides. In connection with this, new layers of horny substance fill up the end of the inner cavity of the horny sheath, and thus form the horny plug which can be seen on fig. 2 extending between "a" and "b."

Next period (fourth summer) the growth is continued mostly in the same way. The horny sheath is prolonged, and by stronger growth on the upper side the main axis of the horn-core causes reabsorption on its upper and apposition on its lower side¹. During this period the plug between "b" and "c" is formed.

substance, is added after each act of parturition. The cause of this is, of course, the following: as long as the cow is gravid all superfluous nourishment is consumed for the growth of the uterus with its contents, and thus only little can be spared for the enlargement of the horns, but as soon as the calf is born there is material enough also for that purpose.

¹ That pressure can effect a transformation of bone through reabsorption and apposition may be proved by a great number of examples, but I shall here only recall a few. The enlargement of the brain-case of the mammals takes place in such a way caused by the pressure from within produced by the physiological growth of the brain itself. In this case reabsorption and apposition caused by the pressure are moments of the normal growth. When the dentist wants to straighten a set of teeth the members of which are placed obliquely or irregularly, he applies a pressure from the palatal side, and so the teeth which protrude behind the row move forward into the same rank as the others (provided there is space enough). This takes place in such a way that through reabsorption of the pressed parts of the alveolar walls new room is procured for the respective teeth to move forward, and by apposition from behind they become fixed in the new socket. It is in this case a transformation of bone produced entirely by artificial, mechanical power. But also pathological pressure can alter the shape of the bone. When by pressure of a parasite, as in the cases of pentastomids described by Hensel, mis-shaping skulls of Mustelids, prominences of the cranial wall are produced, or when a tumour is encased in bony tissue, these are also results of reabsorption and apposition. From these examples it may thus be concluded that a pressure on a bone which is not especially adapted to endure pressure, as the bones of the articulations and some others, has as a result that the bone gives way by reabsorption, but for the maintenance of the equilibrium compensating material is deposited by apposition. This rule is also applied for the core in the development of the horn in the Musk-ox.

In the following period the development continues also in the same direction. The horn is lowered, the horn-core points more downwards, and the plug between "c" and "d" is formed. At the same time that these changes are going on in the distal and middle portions of the horn, the base of the horn-core is enlarged and expanded over a great part of the frontals and parietals, on which large exostoses are developed. It is possible, although not fully proved, that the prominences which can be seen on the skull of the summer calf a little behind the first rudiments of the horn-cores, on the fronto-parietal suture, have something to do with the formation of these exostoses¹. At their highest degree of development their appearance is such as is represented on Richardson's plate iii. (*l. c.*). As can be seen from that figure, they are highest, about 6 cm. or more, near the median line where they nearly meet from both sides.

By-and-by the horny sheath encroaches in a median direction over these exostoses, and when it has come so far that it caps over them it cannot be driven out any more or be prolonged, because its shape hinders this. Fig. 1 B (p. 688) is a schematic figure representing such a stage.

Fig. 3.



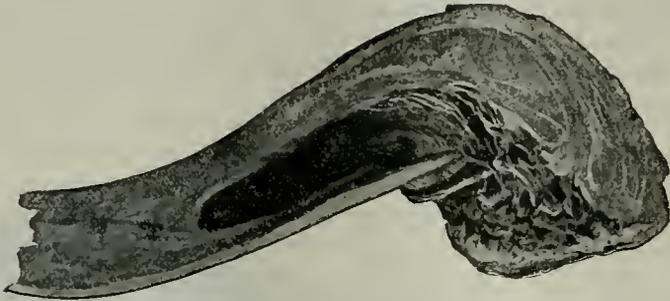
Lateral view of the skull of an old male Musk-ox, showing the horn-core and the remains of the reabsorbed exostoses.

The horn is, however, not yet fully formed although its length has reached its maximum. The continued growth tends to thicken the horny sheath, especially its upper layers. The bony substance

¹ This is on the supposition that the exostoses are pre-formed independently of the horn-cores, as seems at least partly to be the case in the Gnu. Cf. the interesting note on "The development of the horns of *Catoblepas gnu*" by F. E. Blaauw, Proc. Zool. Soc. London, 1889, Part I. On a skull of a young Musk-cow in the Zoological State Museum in Stockholm, there are also to be seen small exostoses quite independent of the horn-core and situated at a corresponding place.

of which the exostoses consist is reabsorbed and replaced by horny layers. It may be said metaphorically that the horny sheath eats down into the bony mass, which thus gets a rugged and pitted surface such as is seen on figs. 3 and 1 C. The pits and holes are filled up with horny substance. The interior surface of the basal part of the horny sheath is, in correspondence with this, densely beset with strong warty prominences, as can be seen in fig. 4. By this arrangement the horns become exceedingly strongly fixed to the skull, which is needed on account of the downward direction of the horn-core, which does not at all extend into the upward curve of the horn itself; every weight on or resistance against the hooked tip of the horn tends to pull the horny sheath of the core, and this would rather easily take place if it was not for this clinching of the

Fig. 4.



Lateral view of a longitudinal section of a horn of an old male Musk-ox, showing the structure of the inner part of the basal horn-layer, which has taken the place of the exostoses, and the lines indicating the periodical growth of the same.

basal parts to the bony mass of the skull. The horn cannot consequently be regarded as ready for use as a weapon before it is fixed to the skull in the manner described. Such an arrangement is also much more suitable than if the core should extend into the upward curve of the horn, because, as it is, the horn at the bend can be entirely filled up with horny substance, and thus be made much stronger at this place, on which the heaviness of a charge on the tip of the horn works most. If the core extended through the curve for the purpose of fixing the sheath, the horn at this place should consist of a comparatively thin layer of horny substance which could be relatively easily bent, and a central bone which would be broken even by a moderate charge.

That it is of great importance that the horn should be strong at the curve, and that it is used for heavy work, is proved by the fact that one of the bulls shot by Professor Nathorst had the tip of one of its horns broken in the bend at a place where it was $4\frac{1}{2}$ cm. thick. Such a breaking needs certainly a formidable strength and a heavy load.

The reabsorbing of the great exostoses and their replacement by

horny substance takes place periodically, as can be seen from the distinct lines of demarcation which are visible on the section (cf. fig. 2, p. 689, and fig. 4, p. 692). These lines are wavy, thus showing the continuation of the warts mentioned above, and on account of the same origin parallel layers can also be distinguished. The reabsorption of the bony mass continues until the horny substance has reached down nearly to the fronto-parietal surface, but on the median and partly posterior side there remains a vertical lamella, thin as a leaf and perforated (as can be seen in fig. 3, p. 691). Anteriorly it extends horizontally under the horn. This thin crest lies close to the surface of the base of the horn, the base of which thus rests as in a thin basket¹ of bone constituting the remains of the former exostoses. These facts, especially the presence of the thin median lamella, which hardly could have been produced in any other way, proves that the formation of the basal parts of the horns has taken place exactly in the manner described above, and that thus the greatest exostoses belong to comparatively young though just full-grown animals, but that in old bulls the exostoses are more or less completely reabsorbed.

The last modification of the outer appearance and of the direction of the horns happens during this last phase of development just described. It has been said that during the last periods of growth it is mainly the layers of the upper side at the base of the horn that are thickened. These new layers, which are added from the interior, partly take the place of the reabsorbed bony mass, but grow of course upwards from the matrix, and exercise thus a great pressure from within on the outer layers which have been formed before. This pressure is so strong that the outer layers are broken and cracked, and through this the bases of the horns receive their peculiar aspect, described by Richardson as "very rough" and "coarsely columnar" (*l. c.* p. 67), and by Lydekker² as "marked by coarse longitudinal groovings." In old horns finally transverse cracks across the basal ridges add still more to the roughness of these parts.

It has been said above that the basal growth also influences the direction of the horn. This depends upon the fact that when the horny sheath is strongly thickened at its base on the upper side, such an addition of substance tends to protrude the sheath; but when this cannot be done because the base clings to the head in the manner described above, and when moreover there is no corresponding growth on the under side, the effect produced is a pressure on the originally upper, now outer or distal, side of the core, which accordingly is reabsorbed. Simultaneously the core is strengthened by apposition on its first lower, now inner or proximal, side.

Such views as these cannot be proved without histological

¹ This thin, perforated basket of bone can also be seen on figure 5 (p. 697) of a longitudinally sectioned skull seen from the inner (mesial) side.

² 'Wild Oxen, Sheep, and Goats of all Lands,' p. 780.

researches, and material of that kind was not on hand, but indications of a development in such a direction as described above are not wanting. In a section through the core at this stage, it is plain that the bony tissue on the outer side is more spongy and has a more rugged surface than on the median side, where the tissue is very dense and has a smoother surface.

The result of this is that the direction of the horn-core becomes still more vertical, as is shown in figs. 1 C (p. 688) and 3 (p. 691), and the whole horn is broken downwards. This is effected with such force that the thin basal wall of the lower side of the horny sheath, which is too weak to withstand the pressure exercised by the growth of the upper parts, is bent angularly, as can be seen in fig. 2 (p. 689) and in fig. 4 (p. 692).

When this last change has taken place the horn may be regarded as fully developed. The shape of the horns as well as their direction is somewhat different in different individuals. In some they are directed more forwards than in others¹. The horns are often not even symmetrical in the same animal. Especially are the bases unlike, one being higher or broader than the other and so forth.

The most remarkable feature in the formation of the horn of the Musk-ox is perhaps the great changes to which the bony horn-core is subjected. Through reabsorption and apposition, it changes its shape and direction again and again. In the development of the horn of the Gnu an analogy to this is found. The first core of the young horns, which grow straight as spikes (cf. Blaauw, *l. c.*), forms nearly a right angle to the future core of a later period, and must therefore be completely reabsorbed to allow the growth of the horn. But also in the twice-bent horn of the Hartbeest no growth of the horn is possible without reabsorption and apposition, because the horny sheath cannot glide upward on the core—the less so as the middle portion of the sheath is narrower than the distal and proximal portion². But straight, and many spiral, horns can easily grow without reabsorption of the horn-core, because the sheath can glide upwards without difficulty as its length is increased by basal growth.

Sect. 2.—DESCRIPTION OF THE HOOFS OF THE MUSK-OX.

The hoofs of the Musk-ox have a very characteristic shape. The two main hoofs of each foot display on the whole a broadly rounded shape with posteriorly heart-shaped outline. The transverse diameter of the lower surface of the foot is as long posteriorly as at the middle, and a few millimetres longer than the longitudinal diameter. Each hoof has a convex upper and outer surface, is rounded anteriorly, has a deeply concave lower, and likewise very

¹ The animal which was the original of fig. 1 C (p. 688) had, for instance, its horns directed more laterally than in some other specimens.

² Some years ago Professor T. Tullberg drew the attention to this fact at a meeting of the Zoological Section of the Natural History Society of Upsala.

concave interior surface. Through this arrangement the plantar surface of the foot becomes concave, and in the middle there is a broad opening between both hoofs. This opening is about as broad as half the transverse breadth of each hoof measured separately. Through this opening or fissure between the hoofs, hair, growing between the fingers, protrudes to the lower surface of the foot, which otherwise of course is naked. But the hair of the leg hangs down on the hoofs, so that it is only a rather small portion of them anteriorly which is visible. Posteriorly this fissure is terminated by a transverse pad which very firmly unites both hoofs all the way to the treading surface, and consequently shares in supporting the animal.

The hoofs are a little irregular in shape, but not much so; and it can hardly be said that one hoof is more pointed than the other, because both are almost equally rounded. The fore hoofs are a little longer than those of the hind legs, so that in an adult bull the former measure about 12 cm. in length and the latter about 10 cm.

From what has been said above, it will be seen that the shape of the hoof is very different from that of the hoof of *Bos* and still more from the narrow pointed hoofs of the *Caprine*. In these animals the toes are not so closely and firmly connected posteriorly as in *Ovibos*. It seems more than probable that the shape of the hoofs of the Musk-ox is an adaptation acquired secondarily; and such a statement is plainly confirmed on comparing the similarly broadly rounded hoofs of the Reindeer, which lives under similar circumstances to the Musk-ox, with the pointed hoofs of other Deer.

The lateral hoofs of the Musk-ox are also comparatively large, and have a very characteristic shape and aspect because the vertical "Krallenplatte" does not together with the "Krallensohle," to use Boas's terminology¹, form an even cap over the rudimentary phalanges, but grows out so that it protrudes a good deal beyond the latter. This gives the lateral hoofs an irregular appearance as if they were torn. Although they are broad the lateral hoofs are not prolonged in such a way as in the Reindeer, and consequently the convergence with the latter animal is not extended to these parts.

Sect. 3.—DESCRIPTION OF THE SKULL OF THE MUSK-OX.

The osteology of the Musk-ox has been carefully described by Owen, Rüttimeyer, Dawkins, and others. A renewed description of already known facts is consequently unnecessary, and it is not my intention to give one on this occasion. But I will proceed to a discussion of the characteristics of the Musk-ox skull based on a comparison with other forms, and through this I hope to bring forward some points which have been hitherto neglected or misinterpreted.

¹ Boas, "Zur Morphologie der Wirbelthier Krallen," *Morph. Jahrb.* xxi. 1894.

The material, consisting of a skull of a young calf and skulls of adult bulls and cows, was derived from the same source that I have already mentioned, namely from Professor A. G. Nathorst's Greenland Expedition in 1899. Intermediate stages are wanting for the reason, already mentioned, that no such stages were observed by the Expedition.

The most striking features in the skull of an adult Musk-ox are the situation and great development of the horn-cores and the protruding orbits. These characteristics indicate specializations from an ancestral type; and they have also, naturally enough, produced correlative changes of the skull. This must be borne in mind; and the primary and secondary conditions ought to be estimated at their right value with regard to the systematic position of the Musk-ox—that is, the changes of structure which have taken place during the development of the present specialized type *Ovibos moschatus*, and which separate it from other Cavicornia, ought, if possible, to be distinguished from those characteristics which are more ancient and which already belonged to the forms from which the Musk-ox has been differentiated. If the latter can be traced, they might give some hints as to the affinity and at the same time the systematic position of the Musk-ox; the former, on the other hand, would show in which points the animal has diverged from the common stock.

With regard to the arrangement of the frontals and the parietals, three principal types can be discerned among the Cavicornia, as has been pointed out by Rüttimeyer¹. Firstly, the Antelopes, with a horizontal parietal region, quite, or at least nearly, in the same plane as the frontals. Secondly, the Sheep and Goats, in which the fronto-parietal plane is bent in an angle which forms a transverse ridge on which the horn-cores are situated; this “Knickung” has taken place on the frontals, and the parietal region slopes more or less steeply towards the occiput: and thirdly, the Oxen, in which the frontals alone form the roof of the brain-case and in which the parietals have been pressed backwards and towards the sides. The position of the horn-cores is also very characteristic for each of these three groups, although exceptions are found. As a rule, the horns of the Antelopes arise above or near the orbits. In the Goats and the Sheep the horns are placed on the transverse frontal ridge, which in them forms the summit of the head. The Oxen have their horns situated in the posterior corners of the skull at a considerable distance from the orbits. These three groups may thus be regarded as representing three different types of development, although of different value. The first is, of course, the most primitive, from which the others may be derived. The second and third have in different ways reached the same goal, namely of getting the horns on the most effective and suitable place, that is on the summit of the head. If it is asked, now, to which of these types does *Ovibos* show the greatest likeness, it is evident that the

¹ ‘Versuch einer natürl. Geschichte des Rindes,’ Zürich, 1867.

answer must be the first, or Antilopine, in fact the primitive one. The fronto-parietal region forms a perfect plane without the slightest trace of "Knickung," and the parietals are fully developed and partake in the roofing of the brain-case. It is accordingly quite evident that this part of the skull of the Musk-ox shows no affinity either with the Oxen or with the Sheep, but is of the more primitive Antilopine type¹. The origin of the horn-cores in *Ovibos* is different from that of the Antelopes, as it is perfectly lateral. In the skull of a young Musk-calf shot by Professor Nathorst on the 26th of August, and thus probably about three months old, the beginning of the horn-core appears as a small tubercle situated about 4 cm. behind the orbit, and about 1 cm. from the *sutura coronalis*². The horn-core thus originates only on the frontal bone, but its base expands gradually with age in a median as well as backward direction, so that in an old bull, as is well known, it covers not only the posterior portion of the frontal, but also the whole parietal as far as the *sutura lambdoidea*. In this way the same effect is produced in *Ovibos* as in the *Ovina* and *Bovina*, viz., the horns get their insertion on to the vertex of the skull. The

Fig. 5.



Section of skull of Musk-ox.

result is, however, obtained by quite different means in the three types, and the vertex is not situated in the same cranial region. It must also be remembered that the Musk-ox ontogenetically and gradually passes through all intermediate stages of its development from the primitive one; but this is not the case in the others.

¹ The fronto-parietal and the occipital planes form a right angle with each other, and the highest point of the Musk-ox skull is therefore at the *sutura lambdoidea*.

² There is a more pronounced tubercle situated at the edge between the upper and lateral surfaces of the skull, and divided by the *sutura coronalis*. This cannot, however, be the origin of the horn-core, as it becomes evident from Sir John Richardson's figure that the horn-core in a 16 months old animal is still situated only on the frontal bone.

Ovibos must therefore be regarded as less distinct from the ancestral Cavicorn types from which the development of all three, *Ovibos*, *Ovis*, and *Bos*, has diverged.

The direction of the horn-cores of *Ovibos* is quite different at different ages, as has been described in the section treating of the development of the horns. The frontal sinuses (cf. fig. 5, p. 697) are very large anteriorly, so that in an old bull the vertical diameter of the lumen of these sinuses just above the anterior border of the brain-cavity, where at its deepest, measures 45 mm. Just in front of this place is a vertical and transverse septum situated above the *lamina cribrosa*. In front of this the frontal sinus forms one large cavity which is nearly undivided and measures 6 cm. in length. Posteriorly from the septum mentioned, the frontal sinus is divided into several loculi by vertical septa, as can be seen in the figure. The sinus extends into the base of the horn-core as far as 2-3 cm. reckoned from the lateral or inferior line of insertion of the horn-core (cf. fig. 6). But although the base of the horn-core is taken up by rather large vacuities, the greater part of the same is devoid of such (fig. 6). In the specimen (an old bull) from which the above description is taken, the length of the horn-core, lacking vacuities, is 14 cm. The interior of this part of the horn-core is

Fig. 6.



Section of a part of the skull of the Musk-ox.

In this figure the horn-core is sectioned longitudinally, and the anterior portion is moved to the side and exposes its interior surface on the right side of the figure.

constituted by spongy bony tissue forming a layer about 20-24 mm. in thickness. This is again surrounded by a cortical layer, 6-10 mm. in thickness, of solid bone which, especially on the proximal side, is very dense (cf. fig. 6). The outer surface of the horn-core is, as can be seen from the figures, very rugged and also partly spongy. From this description it may be concluded that the structure of the horn-cores of *Ovibos* is quite different from that of the Oxen, in

which the vacuities extend through the whole length of the horn-core. In the horn-core of Goats the vacuities extend through three fourths of the length of the horn-core, but in Sheep only a little more than a fourth¹; the bony tissue is much more spongy in the latter.

From this it may be seen that *Ovibos*, in which the sinuous portion of the horn-core is only about a sixth of its length, represents a stage more like that of the greater number of Antelopes, or is, in other words, perhaps in a more primitive condition. It is, however, doubtful how much importance ought to be ascribed to the extension of the air-cells or sinuses in the horn-cores. By the above statements, it is shown how different the closely allied genera *Capra* and *Ovis* are in this respect. In *Nemorhædus* the sinuses extend through half or more than half of the horn-core, according to A. Milne-Edwards's figures²; but in *Rupicapra* the horn-core is only hollow at its base for one-tenth of the length. In both the latter genera the horn-cores have the same straight upward direction, so that such a condition does not seem to influence the development of the sinuses, as perhaps might be supposed from the difference in this respect between Goats and Sheep. On the other hand, the Buffalo with its horizontal horn-cores has large sinuses extending to the tips.

The parietals of the Musk-ox do not contain any sinuses or air-cells but are very thick and massive (cf. fig. 5, p. 697), so that their diameter in an old bull is 47 mm. measured a little in front of the *sutura lambdoidea*. It has been said above that the frontals and parietals lie in the same horizontal plane. This is already the case in the young calf, and is thus a primitive condition which has been retained; not an acquired characteristic, as it must have been if *Ovibos* were the direct descendant of the fossil *Bootherium* Leidy, and the latter derived from the Sheep. Rüttimeyer³ seems inclined to assume this for the purpose of more easily explaining the, according to his opinion, ovine origin of the Musk-ox⁴. It is, however, so far as I can judge, less probable that a form originating from ancestors with an even fronto-parietal region, such as the primitive ruminants must have had, should have acquired a specialization in form of a frontal elevation or "Knickung" as a base for the horns; and then again, without reduction of the horns, returned from such a specialization to the original arrangement of the frontals and parietals and devised, so to speak, a new plan for fixing the horns in a more suitable manner. That is, in other words, a reversion from the ovine specialization of the skull to the primitive antilopine

¹ This may be subjected to some variation, but I make my statements from the material at hand.

² Milne-Edwards, Rech. pour servir à l'hist. nat. des Mammifères (Paris, 1868-74), pl. 71 a, pl. 73.

³ Versuch einer nat. Gesch. d. Rindes, ii. pp. 17-20.

⁴ But if *Ovibos* was descended from *Bootherium* which had a "Knickung" of the frontals, it would be expected that the calf of the former would show some traces of likeness in this respect to its supposed progenitor, which however is not the case, as already stated.

type is improbable, at least as long as the armature—the horns—which have been the cause of the development, are retained. But there is no difficulty in assuming that from the same indifferent type have been developed forms which have specialized their armature differently, the one as *Ovibos moschatus* and the other as “*Bootherium*” or *Ovibos bombifrons*; and that in such a case the latter has acquired a characteristic, the frontal elevation, which offers some resemblance to the ovine type. But then this is only a parallel, and proves no affinity with the ovine type. There seems also no need for assuming *Bootherium* as being older than *Ovibos*, as both have occurred in the Pleistocene¹.

In a young calf of *Ovibos*, the length of the parietals near the median line is 40 per cent. of the length of the frontals measured in the median line. This relation, however, diminishes with age, so that in an old bull the corresponding percentage is 30–35. It is, however, a little difficult to perceive the sutures at the surface between the frontals and the parietals, but the *sutura lambdoidea* is distinguishable, although nearly obliterated, even in the oldest skull I have seen. The parietal zone on the top of the head is thus already in the calf, compared with the frontal region, shorter than in many Antelopes (*Gazella*, *Cephalophus*, *Nemorhædus*, *Rupicapra*, &c.). In the Sheep and the Goats the relation varies a good deal, but in many cases the parietal zone is not even 30 per cent. of the frontal, and is accordingly more reduced than in the Musk-ox. The latter seems thus, with regard to the development of the parietal region, to occupy an intermediate position between the Sheep and the more primitive Antelopes.

On the sides, the parietals of the Musk-ox extend with a rather short and truncate portion forward between the frontal and squamosal. The anterior end of this portion reaches only halfway between the orbit and a vertical line drawn through the *meatus auditorius externus*. This shortness of the lateral portion of the parietal in the Musk-ox has the result that the frontal meets the squamosal, and forms with it a rather long suture on the lateral

¹ I must confess, however, that I only know *Bootherium* from the figures published by Boyd Dawkins (Palæontographical Society, vol. xxv. Monogr. on the Brit. Mamm. of the Pleistocene, genus *Ovibos*, pl. v.), and from descriptions. Fig. 3 on the plate quoted is said to be a coronal view of the skull of *Bootherium bombifrons* Leidy, and is regarded by Dawkins as belonging to an adult female. It is, however, rather similar to the aspect of the skull of a young Musk-ox, and ought to be compared with Sir John Richardson's figure (Zoology of the 'Herald,' pl. iv. fig. 2). Fig. 4 on Dawkins's plate is said to be a lateral view of the same, which nevertheless is hardly possible, to judge from the general appearance as well as from the dimensions. Dawkins's fig. 4 of *Bootherium cavifrons* Leidy is regarded as belonging to an old male, which seems very probable from comparison with the Musk-ox, in which the large exostoses at the base of the horn-core get reabsorbed in old age. These forms may belong to the same species, representing the female and the male form, as Rüttimeyer and Boyd Dawkins have suggested, but their ovine affinities I cannot see. When Rüttimeyer says (*op. cit.* p. 18) that the horns of *Bootherium* have been “ohne Andeutung einer rückwärts Beugung der Spitzen,” it must be remembered that the horn-cores of these animals are so short that they indicate only the direction of the basal parts of the horns.

wall of the skull behind the orbit. The length of this squamoso-frontal suture equals half the vertical diameter of the orbit. This remarkable arrangement seems to be peculiar to the Musk-ox. In Sheep, Goats, and most Antelopes¹, as well as in *Bos bubalis*, the anterior lateral portion of the parietal meets the sphenoid and excludes the frontal from the squamosal. In *Gazella dorcas* there is a short suture between the squamosal and the frontal. Such a suture is also found in *Bos taurus*, in some specimens of which it attains a considerable length although not such an extent as in *Ovibos*.

In the calf two interparietals are found in the median line between the parietals and the supraoccipital. They form together an oval figure with 19 mm. transverse and 13 mm. longitudinal diameter. In the adult cow they have been separated from each other in the median line, but are not ankylosed to the parietal or the occipital. In the adult bull they are not conspicuous.

The angle between the parietal and occipital regions is straight. In the calf the occipital is visible from above, forming a zone as broad as its own thickness. In the adult cow the same condition is found, but in the oldest bull the parietal has extended more backward, so that the occipital zone of the coronal surface is more or less covered.

It is evident from this description that the supraoccipital forms only the vertical posterior wall of the brain-case. This is a difference from the condition found in Sheep, Goats and many Antelopes², in which the interparietal is ankylosed to the supraoccipital so that it looks as if the latter was angularly bent forward in the parietal plane and partook in the formation of the posterior roof of the brain-case. The *sutura lambdoidea* is in the Musk-ox plainly conspicuous even in old animals just behind the base of the horn-cores. It becomes first obliterated in the median line. The shape of the occipital region has been described by Richardson (*l. c.*) and Rüttimeyer. Strong muscles are needed, especially in the bull, for supporting the heavy head; and for that purpose a strong occipital ridge extends downwards in the median line. Laterally under the *crista lambdoidea* there are deep grooves for the insertion of muscles. The supraoccipital does not reach the *foramen magnum*, but is excluded from it by the exoccipitals, as can be seen in the skull of the calf. The thickness of the supraoccipital is exceedingly great, measuring in an old male 28 mm. (fig. 1, p. 688). The peculiar shape of the condyles is described by Richardson (*l. c.* p. 69), who has also drawn the attention to the "exterior heel that occupies much of the space between the condyle proper and the paroccipital spine and furnishes a pulley or trochlea, which moves on a concave pretty broad articular surface, formed by a lateral notch in the brim of the atlas." In the calf this heel is not developed at all, and in the cow only a little. It is thus a

¹ *Nemorhædus*, *Cephalophus*, *Antelope*, *Saiga*, *Gazella* (partly), *Bubalis*, &c.

² *Nemorhædus*, *Antelope*, *Saiga*, *Gazella*, *Cephalophus*, &c.

special adaption for the Musk-bull. Rüttimeyer says (*l. c.* p. 9) that he does not know any analogy to this except possibly slight traces "bei dem Gnu und beim Schaf." He thinks that it stands in connexion "zu dem unverhältnissmässigen Gewicht des Kopfes." I do not think, however, that it is a structure formed only for the purpose of more easily carrying the weight of the head, as, in such a case, a similar arrangement ought to be found at least in some of the different animals with a head comparatively as heavy as that of the Musk-ox, for instance in *Ovis poli* Blyth. This form has, as I have had the opportunity of seeing in the Zootomical Institute of the High School in Stockholm, a very massive and stout occipital region, but no lateral extension of the condyles. It is rather an adaption for the strengthening of the occipital joint in a transverse direction, which is needed for the use of the horns as weapons. The horns are, as is well known, placed so that their upturned points are situated at a considerable distance from the median line of the head. From their shape and arrangement it is evident that they are used sideways. That is, when hooking a foe, the Musk-bull does not move its head vertically up and down in the sagittal or median vertical plane; in such a case the usual articulation would have been satisfactory, or the articulating surfaces would have extended in a median direction, as is often the case in *Bos*¹. The movements of the Musk-ox when hooking are carried out obliquely or in a more or less transverse vertical plane². In such a way the horns become formidable weapons, but as the lever is rather long a strong fulcrum at the base of the head is needed, and this is afforded by the transverse extension of the articulation between atlas and occiput.

The horns of the cow have not exactly the same position to the head as those of the bull. They are directed more forward and less outward, at least in the specimens I have seen. This, together with the fact that the horns of the cow are weaker and probably less used as weapons than those of the bull, may explain the difference in the development of the occipital articulation of the male and female of *Ovibos*. Nevertheless, the occipital region is also in the cow very stoutly built, and the interspace between the condyles and the *processus paroccipitalis* (*paramastoidens*) is more filled out with bone than in other Cavicornia.

Boyd Dawkins (*l. c.*) and Rüttimeyer³ compare the *processus paroccipitalis* of *Ovibos* to those of the Sheep and the Argali. Such parts as merely serve for the insertion of muscles are, naturally enough, easily subjected to changes in shape and structure, and thus of comparatively little value for systematic purposes. This

¹ Such an extension of the articulating surfaces in a forward direction can also be observed for instance in *Oreos canna*; in species of *Cervus*, and in *Antilocapra*, it is remarkably great.

² That the tips of the horns are used, and not only the basal parts, is proved by the fact that in some specimens the points are plainly sharpened by wearing or polishing against something hard, and moreover one of the bulls shot by Professor Nathorst had the tip of one horn broken off.

³ 'Die Rinder der Tertiär-Epoche,' Zürich, 1877 & 1878.

can also be seen in the ontogenetic development of the Musk-ox. In the calf these processes are quite flattened from the sides as in *Bos* and many Antelopes, which perhaps is the primitive shape, as it is found in so many different forms. Later, in adult animals, the processes become thickened in such a way that they become triangular in section through the development of a lateral crista whereby a broad posterior face is produced. Distally the processes become compressed in an antero-posterior direction and end in a transverse edge. These modifications are of course effected for the purpose of getting larger space for the insertion of the muscles, and I do not lay much weight upon them: I mention them only to show that the *processus paroccipitalis* of the Musk-ox does not much resemble those of the Sheep, which are posteriorly narrow, slender and tapering towards the tips. These processes of the Musk-ox are slightly curved towards the median line¹, although not so much so as in the Sheep, Oxen, Buffaloes, and many other ruminants. They cannot be termed small (cf. Rüttimeyer), as their length in an adult bull measures about 3 cm., which is as much as $\frac{1}{4}$ of the height of the occipital region from the lower surface of the condyles to the *sutura lambdoidea*. The same relation is already found in the calf (resp. 2 cm. and 8 cm.).

"The basi-occipital bone in *Ovibos moschatus* is quadrate in outline," Boyd Dawkins says (*l. c.*). In the young calf it is quite hexagonal, but with age the posterior sides are shortened so that the corpus of the bone becomes quadrate in outline; and therein lies of course a certain similarity with the Sheep, but also with several Antelopes. It seems, therefore, contrary to Dawkins's opinion, questionable whether this characteristic can be of any other value than that of separating these animals from the Oxen, which have the basioccipital bone differently shaped. Dawkins also points out the difference between *Bos* and *Ovibos* with regard to the anterior muscular impressions of this bone, the former having them "supported on a tuberosity." Such things are of little importance; but as the question is open to discussion, it may be mentioned that in Sheep and Goats these impressions are situated at the sides, partly on the lateral surface, of the bone, and separated by a smooth area nearly as broad as the bone. In the Musk-ox, on the contrary, the same impressions cover the ventral surface of the bone so that they nearly meet in the median line in the adult male, but do not extend laterally (fig. 7). The basi-occipital of the Musk-ox is traversed by a low median keel which is already indicated in the calf. Richardson's exact description (*l. c.* p. 69) of these parts need not be repeated.

The auditory bulla is subjected to considerable ontogenetic changes, as can be seen from the following measurements. In the calf it is rather large and inflated. Its length is 39 and its greater width 20 mm. In the adult cow it also looks inflated,

¹ This may be subject to variation, as Richardson says that they "descend straight," but Rüttimeyer found them "einwärtsbogen wie beim Argali."

but it is hardly as large as in the calf, measuring 42 mm. in length but only 17 in width. In an adult bull the same measurements are (not counting spines) 31 mm. in length and 14 in width. The shape of the bulla cannot therefore be of classificatory value in this animal.

The *pars mastoidea* is visible on the occipital surface as a narrow strip between the paroccipital and the squamosal, which latter forms the lateral margin of this surface. At the upper end of the mastoid there is, in the calf, a small separate bone visible, with an outer surface measuring 8 mm. in diameter. It is intercalated between supraoccipital, paroccipital, mastoid, and squamosal.

It has already been mentioned that the squamosal constitutes the lateral margin of the occipital surface. This bone forms a strongly projecting edge posteriorly, which extends downward and forward in an even curve to the base of the zygomatic process, thus making a posterior termination and a broad floor to the temporal groove, which is roofed over by the horn. There is accordingly only an (in the bull, narrow) opening posteriorly in an oblique upward direction over the parietal zone. Rüttimeyer¹ seems to lay some weight on this opening as a difference from the Oxen and a resemblance to the Sheep. But, compared with the condition found in the Italian Buffalo, there is not much difference in this respect, and in nearly all Antelopes "die Schläfengrube öffnet sich . . . auch nach oben." It is consequently only the most specialized members of *Bos* in which "die Parietalzone seitlich die Schläfe überdacht," as the same author in his first paper rightly puts it. Later Rüttimeyer, like some other authors², seems only to think of two possibilities, *i. e.* "Is *Ovibos* a Sheep or an Ox?" and then every aberration in structure from the specialized type is regarded as a similarity to the ovine one, even if it is a feature common to most ruminants.

The articulating surface for the condyles of the mandible is very broad (see fig. 8, p. 709) and, to judge from my material, more convex in the cow than in the bull, in which it is almost flat. There is a broad and strong *processus postglenoideus*.

So far as my material allows a judgment, there are always two *foramina temporalia* in the Musk-ox, but only one in Sheep or Goats. This is, however, a less important and variable characteristic³.

The great development of the orbital tube is one of the most conspicuous features of the Musk-ox skull, as has also been mentioned by previous authors. [It is formed by the frontal to, roughly speaking, an extent of a little more than two-fifths (more exactly $\frac{5}{11}$) of the posterior and upper portion, by the lachrymal to one-

¹ 'Die Rinder der Tertiär-Epoche.'

² Boyd Dawkins, for instance.

³ *Nemorhaedus*, *Cephalophus*, *Bos taurus*, &c. seem to have two; *Antilope*, *Saiga*, *Gazella*, *Rupicapra*, *Bos bubalis*, &c. only one.

This is mentioned here only because Rüttimeyer says (Rind. Tert. p. 104): "Im übrigen folgt der Schädelbau (viz. of *Ovibos*) . . . demjenigen von Schafen bis in kleine Details, wie etwa Gestalt von Gefäß und Nervenrinnen."

fifth ($\frac{2}{11}$) anteriorly, and by the jugal to a little less than two-fifths ($\frac{4}{11}$) inferiorly. The length of the orbital tube is, in an old bull, between 6 and 7 cm. posteriorly and about $4\frac{1}{2}$ cm. anteriorly. In a cow the same measurements are about 5 and $3\frac{1}{2}$ cm. respectively. Already in the young calf the orbits protrude about $2\frac{1}{2}$ cm. measured posteriorly.] The reason why the orbital tubes have attained such a great development is double, but easy to understand. Firstly, a look at the skull of the Reindeer compared with those of other Cervicornia, teaches us that a ruminant, living in Arctic regions, and therefore provided with a long fur, is apt to develop a tube-like prolongation of the orbital ring for the purpose of not getting the eyesight hindered by the long hairs. This may be certainly applied to the Musk-ox also. It may be added, further, that the situation of the horns probably would to a great extent prohibit the animal from noticing any object, except those just in front, if the eyes were not protruding. Secondly, when for the reasons mentioned the eyes have become protruding, the peculiar development and position of the horns make a strong protection for the eyes, and one well needed; for it has already been said that when a Musk-bull charges he uses his horns sideways or at least obliquely. It is thus evident that the eye easily could be damaged, as it is just in the way of attack, if it were not protected by its thick bony case. That the eye-tube is meant for protection can also at once be seen from the heavy structure of the bony wall, which in an adult bull, above and below, reaches a thickness of more than $2\frac{1}{2}$ cm. The lower thickening is produced by the enlarged jugal, and the upper one by a stout ridge beginning on the lachrymal and extending in a median direction over the frontal to the neighbourhood of the *foramina supraorbitalia*. This ridge is also very useful when the bull is butting with its forehead. The orbital tubes are, however, not a new organ acquired by *Ovibos*, but only a development and prolongation for certain purposes of an orbital ring such as it exists not only in the Sheep, but also in a great number of Antelopes, e. g. *Antelope*, *Saiga*, *Gazella*, *Rupicapra*, *Nemorhædus* (at least some species), &c.,¹ in which the direction of the orbital brim is the same as in *Ovibos*, although much narrower. It is, therefore, no reason whatever to regard the orbital tubes of *Ovibos* as an excessive development of the orbital ring of the Sheep or, to use Boyd Dawkins's words, "a decided ovine affinity" (*l. c.* p. 7).

As a result of his comparing the Musk-ox only with Oxen and Sheep, Rüttimeyer (*l. c.* p. 10) writes: "Dem Schaf folgt dann auch ferner in jeder Beziehung die Bildung des Thränenbeines." It is chiefly the presence of a lachrymal groove which has created such an opinion, I think; but, as I have shown in the previous paper, the presence of an anteorbital gland is far from being an exclusively ovine character, and accordingly a lachrymal groove or pit is just as little so. The bending outward of the lachrymal bone for its

¹ Not to mention distant forms such as *Antilocapra*, Reindeer, Camel, &c.

share in the formation of the orbital tube, makes this pit look deeper than it really is. If the bone were straight this pit would be rather shallow. The shape of the lachrymal bone is different from that of the Sheep. It is broader and decidedly widened in front, where its breadth is about a ninth of the cranial length; whereas the lachrymal bones of the Sheep usually are narrowed in front or at most linear.

The suture between the lachrymal and the nasal bones is quite variable in length in the different specimens of Musk-ox. In my material this variation is from 25 to 5 mm. Richardson (*l. c.*) has treated of this as well as of the shape of the nasals. He has also observed that the nasals of the Musk-ox differ from those of the Sheep as well as from those of the Oxen. But it is evident that no characteristics of systematic value can be obtained from such variable bones as these. It may, however, be mentioned that a flat and broad nasal region, about $\frac{1}{7}$ of the basal length of the skull, is a feature common not only to *Ovibos* and the *Caprina* but also to a great number of Antelopes, when compared with the *Bovina*, in which the nasal region is more or less compressed to a ridge and thus narrowed to about $\frac{1}{5}$ of the cranial length. The great thickness of the nasals is in concordance with other bones of the Musk-ox skull, as may be seen from fig. 5 (p. 697).

The intermaxillaries do not reach the nasals. Their proximal portion is curved outwards a little, but the distal parts are rather strongly convergent, and through this the distal portion of the upper jaw becomes comparatively more narrow even than in the Sheep. In consequence of this, and because the intermaxillaries are thickened in the middle, the anterior part of the skull gets a characteristic aspect not seen in other Cavicornia. In Sheep as well as in Oxen the posterior extension of the intermaxillaries is subjected to variation. It is, however, perhaps worth mentioning for comparison, that in none of the genera *Budorcas*, *Nemorhædus*, *Haploceros*, and *Rupicapra* do the intermaxillaries reach the nasals.

It might be that the shortness of the intermaxillaries stands in relation to the Musk-ox's way of browsing with its thick lip instead of biting. The Reindeer, which has thick lips, has a short intermaxillary not reaching the nasal; but *Cervus dama*, for instance, with thin lips has a long suture between the intermaxillary and the nasal. There seems accordingly to be a certain correspondence or parallelism between the Reindeer and the Musk-ox, which is also visible in the shape of the thick and anteriorly pointed intermaxillaries.

The *foramina incisiva* of the Musk-ox are very large and posteriorly narrowed. *Ovibos* resembles in this respect the Sheep, but also *Nemorhædus*. These foramina do not offer any important characteristics.

The palatal surface is concave and rather strongly constricted behind the *foramina incisiva* (fig. 7, p. 707), much more than in *Bos taurus*, but much less than in *B. bubalis*. The palatines are larger comparatively than in the Sheep. The suture between palatines

and maxillæ is characteristic and wavy, because each palatine has a median and a lateral lobe extending forward on both sides of the *foramina palatina* (fig. 7). The molar series are a little arcuate and converge anteriorly, so that, for instance, in an adult bull the distance between them is anteriorly 56 and posteriorly 84 mm., measured at the alveolar brim. The length of the molar series in the same specimen is 144 mm. The length of the molar series compared with the basal length of the skull is in a cow 32 per cent. and in a bull 31 per cent. of the latter measurement¹. The palate extends well backwards so that the choanæ open behind a line connecting the posterior edge of the last molars. This seems to be a difference from the condition of the *Caprina* as well as that of

Fig. 7.



Palatal surface of skull of Musk-ox.

many Antelopes (*Nemorhædus*, *Rupicapra*, *Gazella*, *Antilope*², *Cephalophus*, &c.). On the other hand, it offers a superficial resemblance to the *Bovina*.

The extension of the masseter muscle in a forward direction over the lateral surface of the maxillary is comparatively short, probably because it has such a wide area on which it may expand, below the orbital tube (fig. 3, p. 691). As a result of this, the *crista*

¹ This relation between the length of the molar series and the basal length of the head seems to be pretty equal in the ruminants. The following results may be quoted to prove this: in a Buffalo the molar series measured 30.0 p. c. of the basal length of the skull, in a common Ox 29.3 p. c., in a Goat 31.1 p. c., in *Nemorhædus* 32.3 p. c., in *Rupicapra* 29.7 p. c., in *Gazella* 34.1 p. c., in *Antilope* 31.0 p. c., in *Cephalophus* 33.3 p. c., in the Wapiti 32.8 p. c., in the Reindeer 27.9 p. c.; but in *Saiga*, with its reduced number of teeth, not less than 29.8 p. c., and so on.

² In the *Saiga* the choanæ open behind the molars, a fact which may stand in relation to the reduced number of molars.

masseterica in an adult bull passes about a centimetre from the lower margin of the lachrymal bone and parallel with the same, but then it descends rather steeply to a *tuber maxillare* situated above the second true molar. This is constant in my material except in one bull, in which the *tuber maxillare* is situated on a vertical line drawn between the first and second true molars (fig. 3, p. 691). But there seems to be still more variation in this respect, because Rüttimeyer (*l. c.* p. 11) as well as Dawkins (*l. c.* p. 7) assert that the *tuber maxillare* is to be found above "the first true molar." It is apparent from these facts that the situation of the *tuber maxillare* does not offer any valuable characteristic for classification.

The *foramen infraorbitale* opens rather far back, as Rüttimeyer also remarks, above the third premolar or even first true molar. This seems to be a singular feature among Cavicornia. In Sheep, Goats, and Gazelles this foramen is situated above the second premolar, and in other forms it is still more advanced. *Budorcas* (including *Nemorhæchus* &c.) agrees with *Ovibos* in this respect, as will be seen later.

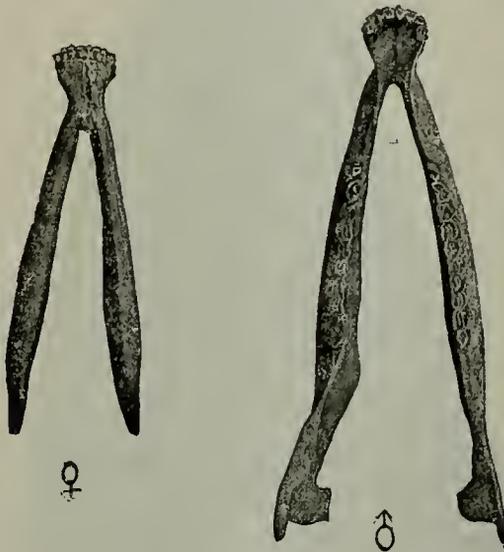
The mandible of *Ovibos* offers several points of interest. The *processus coronoideus* is strongly curved backwards and more pointed than is usual in other forms. It is also strikingly small, which can be expressed by comparing its length with the length of the mandible itself. The former measurement is in *Ovibos* about 16–17 per cent. of the latter, but in Sheep, Goats, and Gazelles about 24 per cent., in *Rupicapra* about 23 per cent., &c. The small Cavicornia seem as a rule to have their *processus coronoideus* more straight, thin, and squarish at the end. In *Bos* the condition resembles more that in *Ovibos*, with the length of *processus coronoideus* about 18·5–20 per cent. of the mandibular length. This may, therefore, be regarded as a parallel development, the more striking as the most specialized *Bos taurus* has a shorter and more pointed coronoid than *Bos bubalis*.

The articular surface of the mandible of the Musk-ox is remarkable for its shape, because the longitudinal diameter is about six tenths or more of the transverse one. In other ruminants the transverse diameter is at least twice (sometimes nearly thrice) as long as the longitudinal one.

The *symphysis mandibulæ* (fig. 8, p. 709) is about as long in *Ovibos* as in *Bos* (16 per cent. of the mandibular length in the former and 14·17 per cent. in the latter); but it is, as Richardson rightly remarks (*l. c.* p. 70), "more vertical, and it forms an angle or chin." The formation of such an angle or chin at the *symphysis mandibulæ* may be caused by the need to strengthen the symphysis in a vertical direction, because the opening of the *canalis inframaxillaris* is very wide and deeply excavated in the bone and thus weakens the bone. The great width of this canal may be due to the conditions under which the Musk-ox lives in the Arctic regions. It is not only this foramen which is comparatively large in *Ovibos*, but the foramina for blood-vessels are as a rule large. Rüttimeyer has

pointed out the parallel development in this direction in the Reindeer (*l. c. p. 12*). The anterior part of the mandible of the Musk-ox gets, through the already mentioned excavation for the *canalis inframaxillaris* and because the same is extended much forwards, a very constricted or compressed appearance which is rather striking (fig. 8). A result of this shape of the symphysis is, of course, that the incisors become more vertical than in other ruminants, and are therefore worn off straight (fig. 8, ♂), not obliquely as in other forms. The incisors of the Musk-ox cannot accordingly retain the anterior cutting-edge as the obliquely placed and obliquely worn teeth can, but in old animals the worn crown of the incisors presents a round surface placed at a right angle to the longitudinal axis of the nearly cylindrical tooth. But even the unworn incisors of *Ovibos* have quite another shape to those of other Cavicornia.

Fig. 8.



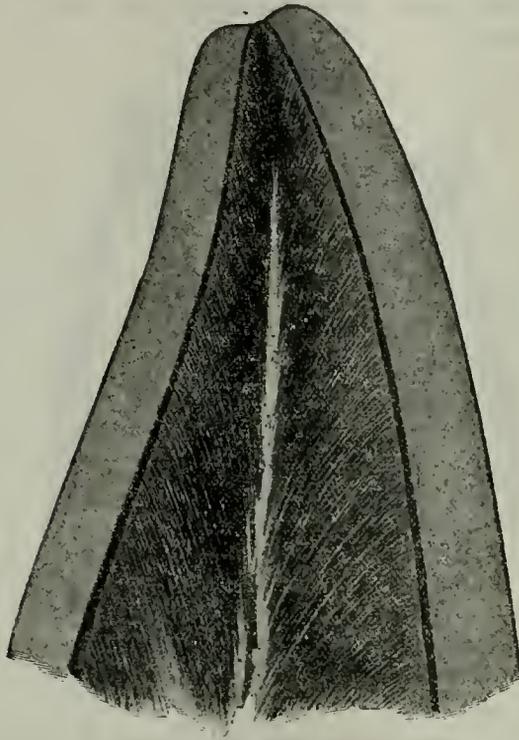
Mandibles of male and female Musk-ox.

The crowns of the incisors are very small, comparatively thick, and less spatulate than those of other forms¹. I am therefore inclined to think that the incisors of the Musk-ox—not being so much used because the strong lips act as substitutes for them in their function of seizing the food—are becoming gradually reduced. The crowns of the incisors of the Musk-ox are, however, evenly capped with enamel, and this can be said not only of the permanent, but also of the milk-dentition. The milk-incisors of the Musk-calf

¹ In the Gazelles and some others it is only the two median incisors which have been strongly developed and very broadly spatulate, the lateral ones being very narrow. The latter have, however, retained their cutting-edges and are worn obliquely, so that their function is the same although their breadth has been reduced.

have on their anterior surface a layer of enamel which, measured on a longitudinal section about $\frac{1}{2}$ mm. from the tip, has a thickness of 400–435 μ . On the posterior surface the enamel, measured at the same distance from the tip, has also a considerable thickness, namely about two-thirds of that of the anterior layer (fig. 9). This offers a striking contrast to the condition prevailing in the common Calf and the Lamb. In an unborn lamb the anterior layer of enamel, measured near the tip of the incisor, is 330 μ in thickness, but the posterior layer is at the middle of the crown only 66 μ or one-fifth of the anterior one, and is less than half that thickness

Fig. 9.



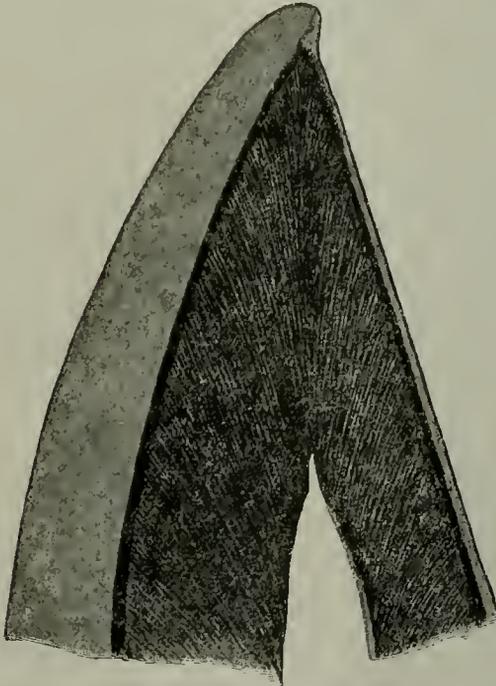
Section through the tip of a milk-incisor of a Musk-ox.

or not even one-tenth of the anterior layer. In a new-born common calf the incisors are provided with a layer of enamel on their anterior side which in thickness near the tip equals that of the Musk-calf (about 400 μ or more) (cf. fig. 10, p. 711). But on the interior surface the layer of enamel is very thin and becomes towards the tip only 20–10 μ . Such a thin layer is, of course, very soon worn off. The interior layer of enamel of the milk-incisors in Sheep, and still more in Cattle, can thus with full right be termed rudimentary. This condition is of course secondary; and *Ovibos*, with its fully developed layer of enamel, represents a more

primitive type. It is consequently impossible to derive *Ovibos* from the Sheep on account of this.

In the young summer calf the three milk-premolars of the upper jaw are developed, and the first molar is just protruding from the socket. The middle and three hindmost premolars are bilobed, and on the latter can be seen, between the two lobes on the inner side, a small, but distinct, ridge representing the accessory column. In the same calf the three mandibular milk-premolars are developed and the first molar just protruding. The foremost deciduous premolar is small and simple, the middle is two-lobed, and the hindmost is three-lobed. In the domestic calf there are on the outer side of this hindmost mandibular milk-premolar two well developed,

Fig. 10.



Section through a milk-incisor of a calf of *Bos taurus*.

although shorter, additional folds. These are not entirely absent in the Musk-calf, but only developed as two short tubercles in a corresponding situation at the base of the tooth. From Richardson's description (*l. c.* p. 71) it becomes evident that the deciduous molars are retained at least a year.

The permanent premolars of the Musk-ox are one-lobed; and the molars are two-lobed except the third mandibular molar, which is three-lobed, as is already recorded by previous authors. As Boyd Dawkins says (*l. c.* p. 8), the upper true molars of the Musk-ox "are differentiated from those of Bison and Buffalo by the

sharpness, stoutness, and prominence of the three principal costæ on their outer surface, and the small development of the two secondary ones." This is quite right, but it cannot be regarded as proving any close ovine affinity, as it is a primitive feature shared by a large number of Antelopes. In the next line (*l. c.*) Dawkins asserts of the upper true molars, as some authors (Richardson, *l. c.* p. 71 &c.) have done before him: "On the internal aspect there is no accessory column;" and he lays much weight on this. About five years earlier, however, the keen observer Rütimeyer had (*l. c.* p. 91 footnote) stated the normal presence of such accessory columns, although they are small. On the material I have received from the Nathorst Expedition to East Greenland, I am able to verify Rütimeyer's observations (fig. 7). These facts, in addition to the above statement concerning the milk-teeth, indicate that there is a remarkable difference in this respect between the dentition of the Musk-ox and that of the Sheep, instead of the presumed likeness. The "small accessory valley at the inner interspace between the two principal ones," as it is described by Dawkins (*l. c.* p. 8), is present in the upper true molars of *Ovibos*, which in this respect resembles *Bovida*, as that author has stated. The same valley is also found in *Nemorhaedus*, *Rupicapra*, and in Bubaline, Hippotragine¹, and Tragelaphine² Antelopes, but not in *Antilope*, *Gazella*, &c. In Sheep and Goats this "accessory valley" seems to be less constantly developed. *Ovibos* differs therefore with regard to its molars more from the Caprina and Antilopina than from the Rupicaprina, Bubalidina, Hippotragina, and Bovina. With the first mentioned of these latter groups it has the "accessory valley" in common, and with the others also the accessory column. The question now is to decide how much can be regarded as parallel and how much as affinity. This decision is again dependent upon what may be the origin of the accessory column. Rütimeyer seems inclined to make a sharp difference between accessory column and basal tubercles³. The former he thinks are derived from the isolated inner column of the *Anoplotherium* tooth; the latter are "blosse Ausbildungen des unter Hufthieren so allgemein verbreiteten Basalwulstes." As "accessory columns" he counts only those between the two main lobes of the inner side of the upper molars; but as "basal tubercles" are regarded not only accessory elements found at other places on the upper molars, but also all accessory tubercles and columns on the mandibular molars, even if they look exactly like the accessory columns, recognized elements of the upper molars and just as much developed. Such a division seems, however, less easy to carry out in a quite satisfactory manner. At the same time that Rütimeyer calls the accessory elements of the mandibular molars in *Bos* basal tubercles, he admits himself that a basal tubercle can be developed to something in shape and structure absolutely like an accessory

¹ Cf. Rütimeyer, *Gesch. d. Rind.* tab. i. fig. 11.

² Cf. Flower and Lydekker: 'Mammals, living and extinct.'

³ *Gesch. d. Rind.* pp. 78-79.

column. It is also very easy to understand how the short basal tubercles in primitive forms, with comparatively short teeth, for this reason are transformed to columns in higher, more specialized, forms with long teeth. At the same time that the teeth are developed from brachydont to hypselodont, the basal or accessory elements are drawn out in length. The "Basalwulst" does not exist any longer in the hypselodont teeth. The formerly basal elements must therefore take their origin at the vertical surface of one of the main lobes, and become easily soldered to them, as is the case in the mandibular molars of the Bovinæ. In this way the short basal tubercles are gradually changed into long columns, which together with the teeth themselves may become enlarged and add to the grinding-power of the teeth. Under such circumstances it should be only their situation at the inner side of the upper true molars that should guarantee to the accessory elements of these teeth the rank of "accessory columns,"¹ and something different from the common "basal tubercles." This is, however, far from sure. Rütimeyer regards the, as he thinks, true accessory columns as "Abgliederungen vom Vorjoch dieser Zähne" (*Anoplotherium* molars). In the young, not yet fully developed, first molars of the common calf I have seen the beginning of the accessory columns connected with the posterior lobes. Zittel² thinks that *Anoplotherinae* have become extinct without leaving any progeny. *Dichobuninae*, on the contrary, characterized by the same author as having "Obere M. fünfhöckerig, die Zwischenhöcker in der hinteren Reihe," are regarded as ancestors of the now existing ruminants³. The latter opinion agrees consequently better with the condition found in the common calf. But it is not so with all ruminants: in *Cephalophus*, for instance, the accessory elements of some of the upper true molars belong very plainly to the anterior lobes, and the same is the case with all *Ovibos* molars. It is thus apparent that the place of origin of these accessory elements of the upper molars varies a good deal, and consequently cannot in any higher degree be taken into account for systematic purposes. It may also justly be questioned whether the "true" accessory columns are to be regarded as "Abgliederungen" from the primary lobes of the teeth; and, if they should be so, what are then the common basal tubercles? I do not hesitate to express the opinion that both the accessory columns and the basal tubercles have a similar origin, namely, are more or less developed basal tubercles⁴.

¹ But in some instances not even this is sufficient, since Rütimeyer means that the accessory elements on the inner side of the molars in the Giraffe and the Deer ought to be regarded as "Basalwarzen" (*l. c.* p. 79).

² Handbuch d. Paläontologie, I. iv.

³ This theory seems later to have been accepted by Rütimeyer too.

⁴ A similar opinion seems also to be accepted by later authors. Röse and Bartels in their paper "Ueber die Zahnentwicklung des Rindes" (*Morph. Arb. herausg. v. Schwalbe*, Bd. 6) shortly remark (*l. c.* p. 97) about "die eigenartigen Basalpfleiler und Faltenbildungen...welche besonders die Zähne der Rinder so ausserordentlich compliciren," that these are "ganz nachträgliche Ausstülpungen des Zahnbeinkeimes."

Examples proving such a statement may be found in sufficient number, but I think that offered by the genus *Cephalophus* is among the best.

About this genus Sclater and Thomas say in 'The Book of Antelopes' (p. 121): "Upper molar teeth short and broad; in the larger species with an additional column on the inner side;" and Rüttimeyer¹ speaks of "Spuren von Basalsäulchen." In the small species of *Cephalophus* accessory elements are more or less comparatively wanting. In a skull of *C. melanorheus* Gray, from the Cameroons, I failed to find any accessory elements except on the hindmost milk-premolar. In the skull of the medium-sized *C. dorsalis* Gray, subsp. *castaneus* O. Thomas, the accessory elements are well developed, not only as tubercles, between the lobes on the inner side of all upper true molars. In the latter the following condition is found. On the hindmost upper molar a single tubercle is seen in connection with the *anterior* lobe of the inner side. On the middle and foremost upper molars, two accessory elements are found close to each other between the inner lobes and belonging one to either of them; thus *anterior* as well as *posterior* accessory elements are present. On the outer side of the middle and hindmost upper molars a similar tubercle is developed from the posterior lobes, and all mandibular molars carry such a tubercle on the outer side of the posterior lobes. In the largest species, *Cephalophus sylvicultrix* (Afzelius)², the accessory elements are present on the inner side of the upper molars, and arranged in such a manner that those in the foremost and middle molars belong to the posterior lobes, but in the hindmost molar originate from the anterior lobe. In the mandibular molars of the same species, accessory elements are found between the lobes of the outer side. But in this species the accessory elements have been modified into high columns, especially on the upper molars, in correspondence with the development of the molars to the hypselodont type. I do not think that it can be regarded as hazardous to draw the conclusion from this, that all these accessory elements of the molars are of the same morphological rank although differently developed in various species, depending upon the varying conditions of life and the adaptation to the same. But if this statement is accepted, as I hope it will be, there is no need to postulate any close kinship between such Cavicornia as are provided with accessory columns to the molars. They need only to be derived from more primitive forms which have been able to develop accessory tubercles, out of which the columns have been independently formed with the development of a hypselodont dentition. Consequently the presence of the small accessory columns of *Ovibos* need not suggest any relationship between this

¹ 'Die Rinder der Tertiär-Epoche,' p. 38.

² This species does not seem to have been recorded from the Cameroons before. Mr. Linell, a Swedish planter residing at Cape Debundscha, has sent home the flat skin and the skull of a young, but probably full-grown, female of this species.

animal and the Bovina. But, on the other hand, *Ovibos* must have sprung from a form which was capable of developing accessory (basal) tubercles; and that such tubercles are to be regarded as the origin of the accessory columns also in *Ovibos* is proved by the fact that sometimes these elements remain in a more primitive stage as free independent pillars of cylindrical shape occupying the place of the accessory columns. This is the case in both upper molars of the hindmost pair in an old bull. But as the ancestors of *Ovibos* must be sought for among ruminants with accessory elements on the molars, these progenitors of the Musk-ox could not have been Sheep, because the latter have specialized their teeth without retaining any of the accessory columns of the Musk-ox elements. Neither could it be assumed that the accessory columns of the Musk-ox have originated independently in this animal.

The result of the above discussion may be stated thus: the dentition of the Musk-ox as well as the other characteristics of the skull do not indicate any Ovine affinities, but point to a comparatively primitive origin from which *Ovibos* has been specialized in its own peculiar manner. It deserves consequently to maintain its position in a separate subfamily.

Sect. 4.—COMPARISON BETWEEN THE SKULL OF THE MUSK-OX AND THAT OF *BUDORCAS*.

Through the kindness of Geheimrath Dr. Möbius I received permission to borrow a skull of *Budorcas* from the Zoological Museum of Berlin. I regret to say that the specimen sent to me had been so badly damaged, that a comparison cannot be made except with the facial portion of the skull.

The nasals of *Budorcas* are much more curved, transversally as well as longitudinally, than those of *Ovibos*, and their outline is also quite different. Their greatest breadth, not quite a third of the length, is at a point a little behind the middle. They are expanded laterally in an obtuse angle so that each bone becomes triangular in outline. In *Ovibos* the greatest width of the nasals is at their posterior end, and their lateral border is a straight line. The greatest width of the nasals is about a fourth of the length, more or less, in the Musk-bull, in the Musk-cow not even that. The nasals of *Budorcas* are pointed anteriorly without any lateral notch, which is more or less conspicuous in the more blunt nasals of an adult *Ovibos*, although it is small in a cow. The great distance between the end of the nasals and intermaxillaries in *Budorcas*, which is greater than the length of the nasals, indicates a much greater development of the soft parts of the nose than in the Musk-ox. The shape of the nasals of *Budorcas* can therefore be derived from that of a more general form like *Nemorhædus* on the assumption that they have been shortened, as is always the case when the nose attains a more or less trunk-like development. As a result of such a development, the intermaxillaries are very

widely separated from the nasals in *Budorcas*, and even the maxillaries only touch them with a very short suture. The same is also the case with the upper anterior corner of the lachrymal bones. But, on the other hand, the nasals of *Budorcas* are comparatively more deeply sunk in between the frontals than in any other form. This can be concluded from the fact that the lateral suture between nasals and frontals measures about 7 cm. on each side, the posterior not reckoned. It is thus evident that the nasal portion of the skull of *Budorcas* has undergone such a transformation and specialization, that it can very well be used for comparison in determining the systematic position of this animal. The lachrymal bone of *Budorcas* is anteriorly very high or broad, and resembles in its shape that of some species of *Nemorhædus*¹. If the orbital tube of *Ovibos* is abstracted, there is a certain likeness in this respect between these forms, but this bone varies considerably within the same genus (*Nemorhædus*). The concavity of the lachrymal bone of *Budorcas* is very slight.

The *foramina incisiva* are larger in *Budorcas* than in *Ovibos*, so that their length in the former is contained three times and a third in the distance from the anterior end of the intermaxillaries to the posterior end of the palatines, but in the latter a little more than four times².

The *intermaxillæ* are shaped anteriorly as in *Nemorhædus* and allied forms, and resemble the condition found in the *Caprina*, and are thus comparatively less pointed than in *Ovibos*.

The *crista masseterica* of *Budorcas* nearly reaches the lachrymal bone in front of the orbit, as there is only an interspace of 2 or 3 mm. From its highest point in front of the orbit it descends steeply to the *tuber maxillare* which is situated above the first molar, but in *Ovibos* usually above the second. In *Nemorhædus*, this is subjected to great variation depending upon the size of the anteorbital pit and lachrymal; if these are large the crista is low and extends to the first molar, but if the lachrymal bone is narrow the *tuber maxillare* is situated above the second molar.

The palate of *Budorcas* is less concave than that of *Ovibos*, but the fold on the inner side between the two lobes of the molars is deeper in the former and there is, at least on the specimen at hand, no trace of accessory columns. The molars of the mandible are also rather similar, but the third or hindmost lobe of the third molar seems to be larger and better developed in *Budorcas* than in *Ovibos*. In the latter the lateral semilunar lobes are more broadly arcuate than in the former, in which the outline on the worn crown nearly forms an angle.

The incisors of *Budorcas* are much broader and larger than those of *Ovibos*, and resemble those of *Nemorhædus* and *Haploceros*.

The anterior opening of the *canalis alveolaris mandibulæ* lies in *Budorcas* distinctly behind the symphysis, as also seems to be the

¹ *Rupicapra*, which is regarded as an allied genus, has rather narrow lachrymals, and so has *Haploceros*.

² In *Nemorhædus* as in *Ovis*, $3\frac{1}{2}$ times.

case in *Nemorhædus* and *Haploceros*; but in *Ovibos* it lies in front of the posterior margin of the symphysis. *Rupicapra* resembles *Ovibos* in this respect.

The *hamulus pterygoideus internus* is larger, more pointed, and more curved backwards, in *Budorcas* than in *Ovibos*. The choanæ open in both species behind the molars. This is a difference from *Nemorhædus* and *Rupicapra*.

The *foramen infraorbitale* is, in *Budorcas* as well as in *Ovibos*, situated rather far back, above the last premolar, but in *Nemorhædus* above the first or second. *Rupicapra* and *Haploceros* resemble the latter.

The *processus postglenoideus* is smaller in *Budorcas* than in *Ovibos*, but the shape of the surface for articulation is similar.

These characteristics derived from the shape of the facial bones are of comparatively little value, as their possibility of variation is rather considerable.

The construction of the fronto-parietal region of the skull is, I regret to say, only known to me from the literature of the subject.

According to the description of *Budorcas* published by A. Milne-Edwards¹, the frontal sinuses do not extend farther than just to the base of the horn-core, and are consequently less developed than in *Ovibos*. The elevation of the frontals, however, on which the horns of *Budorcas* are placed, "contient une multitude de grandes cellules en relation indirecte avec les fosses nasales" (*op. cit.* p. 370).

Such an arrangement seems to agree very well with the corresponding one in the Sheep, but offers no resemblance to the massive exostoses on the head of the Musk-ox. The situation of the parietal in the Takin is also quite different from that of the Musk-ox. In the former this bone "se relève brusquement pour constituer la face postérieure de l'éminence cératophore." This elevation of the parietal corresponds with the same in the Caprina, and, as in the latter group, this bone seems to be considerably shortened compared with the condition in the Antelopes. The *fossa temporalis* is in *Budorcas*, as in the Antelopes in general and in the Caprina, quite open posteriorly and upwards.

The construction of the upper parts of the skull seems to indicate that the position of *Budorcas* in the system cannot be so very far from the Ovine branch. I have not had satisfactory material to express any decisive judgment, but I am inclined to think that *Budorcas* is most likely to be regarded as a primitive Sheep which has become specialized in a certain direction; but, on the other hand, its affinity to the *Nemorhædus* group cannot be denied. The resemblance between *Budorcas* and *Ovibos* is only superficial. Matschie, who lately has taken up this theory, seems² to have based it on the following "gemeinsame Merkmahe": (1) flat and broad metacarpal bones, (2) shape of

¹ 'Rech. pour servir à l'Hist. Nat. d. Mammifères,' Paris, 1868-74.

² Sitz. d. Ges. Naturf. Fr. Berlin, Jahrg. 1895, p. 31.

skull, (3) form of horns, (4) small and peculiarly formed ears, (5) shape of muzzle, (6) short tail, (7) short and thick legs, and (8) comparatively large lateral hoofs.

The difference with regard to the shape of the skull has already been discussed.

To judge from Milne-Edwards's figures, which give the impression of being remarkably well made, I must confess that I fail to see any resemblance with regard to the shape of the horns except that they are curved in both animals.

The ears of the Musk-ox, which are not so very small (13-14 cm. in length in the salted and dry skin of a cow, that is 35 per cent. of the basilar length of the skull, but of course longer in lifetime), do not seem to have the same form as those of *Budorcas* (see Milne-Edwards's figures), but are straight and more pointed. This is, however, a small matter upon which to found relationship. The shape of the muzzle is quite different, as *Budorcas* has a central groove. A short tail is a feature common to so many different ruminants that it is hardly worth while to lay much stress upon it, but it can just as well be quoted as indicating the resemblance between *Budorcas* and the Sheep. The lateral hoofs of *Budorcas* are, according to Milne-Edwards's figures, of an absolutely different shape from those of *Ovibos*, as the former are much more elongate and resemble in shape those of a Reindeer or a Wild Hog. The flatness and broadness of the canon-bones of *Budorcas* are very remarkable; but in this respect *Budorcas* is more different from *Ovibos* than the latter is from the Goats. This can be seen from the following table of comparative measurements of *Budorcas*, published by Milne-Edwards (*op. cit.* p. 376).

	<i>Budorcas.</i>	<i>Ovibos</i> ♂.	<i>Capra hircus.</i>
Front canon-bone: length in mm.	103	155	112
Transverse diameter of the same in per cent. of length	42.7	23.4	16.9
Thickness of the same in per cent. of length	19.4	13.0	11.6
Hind canon-bone: length in mm.	151	161	120
Transverse diameter of the same in per cent. of length	21.1	16.7	13.3

Under these circumstances I do not think it advisable to lay too much weight on this characteristic either; and I suppose that Matschie's attempt of classing *Ovibos* and *Budorcas* together in one and the same group "*Ovibovince*" must be regarded as a failure. A subfamily with such a name can, of now living animals, only include *Ovibos* alone.

5. On a Collection of Crustaceans made at Singapore and Malacca.—Part I. Crustacea Brachyura. By W. F. LANCHESTER, M.A., King's College, Cambridge¹.

[Received June 15, 1900.]

(Plates XLIV.—XLVII.)

This collection is part of a more general collection of marine animals made by Mr. F. P. Bedford and myself during a period of about seven months, of which six were spent in and around the island of Singapore, and one in the town of Malacca. The difference in the length of our stay in these neighbourhoods will, in part, explain the greater diversity and number of the forms which come from Singapore—out of 120 forms (116 distinct species), 91 are from Singapore, 14 from Malacca, 12 are common to both localities, and in 3 there is no record of locality. At the same time, something must be allowed, in this connection, for the more suitable nature of the collecting-ground at Singapore: the sea round which is broken by numerous islets, many of these bordered with coral-reef, leaving, at low water, a large expanse of rough ground (sandy mud, stones, and dead coral), very productive of the littoral forms. On the east of the town is a shore bordered with great patches of sand or mud, grown over in parts by a *Zostera*-like weed; while, for deeper forms, the bottom is no less varied, ranging from thick mud, through sand and gravel, to patches of stone and coral débris. From Singapore, then, came by far the greater number of the Oxyrhyncha and Cyclometopa (Actæids and all the Eriphiidæ); several of the Grapsoid Crabs (*Gelasini*, *Metopograpsus*, *Scopimera*); two species of *Dorippe* and several Leucosiidæ, the latter being almost invariably obtained from a bottom of dense mud, in contradistinction to the experience of Adams and White ('Samarang' Crust., pref. p. v), who found that they preferred a bottom of sand to one of mud.

In Malacca, on the other hand, the conditions are far more uniform: the coast consists mostly of mud swamps, and, with the exception of one partly exposed island near by, offers no very great scope for the collecting of littoral forms: the Grapsoidea—*Sesarmini*, *Gelasini*, *Ocypodidæ*, and *Macrophthalmi*—were, however, fairly well represented. As far as concerns work with the dredge, the bottom is too uniformly covered with thick mud to offer much variety of forms: here the Leucosiids and *Dorippids* were most representative and fairly abundant. At a spot, however, about 7 to 8 miles north of the town, where a strong current set round a promontory, we found a fairly productive piece of rough bottom, which supplied, amongst others, a few *Maioidæ* (*Chlorinoides*, *Hyastenus*). And, still farther north, at

¹ Communicated by Prof. BELL, F.Z.S.

Cape Rachado, where Mr. Bedford spent some time after my return home, he obtained several examples of *Matuta*, a genus of which, out of the three species in the collection, only one comes from Singapore.

As regards the systematic part, I have described as new 5 varieties and 7 species, and 2 of the species have had to be referred to new genera: one, a Leucosiid of the *Oreophorus* type, which is interesting because of the great lateral expansion of its carapace; the other, a small form with a very general resemblance to an *Actæa*, especially in the front and orbits, but with well-marked palatal ridges and other differences. As regards the common genus *Thalamita*, of which there are 3 species, I had hoped to be able to set at rest the question of the value of their specific characters, but was unfortunately unable to obtain sufficient specimens for comparison; but from what I have myself seen, and taking Kossmann's (*Zoolog. Ergebn.* p. 48), and other scattered evidence into consideration, I think it strongly probable that some at least of the species should be united—as, for example, the three in the collection, *T. crenata*, *T. spinimana*, and *T. danaë*. Dr. de Man (*Mergui Crust.* p. 78) has laid some stress on the form of the lobes of the internal angle of the eye; but these are certainly variable in the specimens I have examined.

I have taken measurements of the breadth and length of the carapace of nearly all the individual examples of each species, and, but for the lack of space, would have given the length of the rostrum, lateral margins, &c., in order to make the list more complete. It is, of course, very difficult to find any constant lines of measurement, owing to the variability, in the same species, of the form of the carapace; spines, whether rostral or lateral, are notoriously variable, and there is no necessary constancy in the straightness, or amount of convexity or concavity, of the frontal and posterior marginal lines. Under these circumstances, I have taken the following bases of measurement:—In the Oxyrhyncha, Cyclometopa, and Oxystomata, the length from the middle of the posterior margin to the middle of a line drawn from the one base to the other of the præocular or internal supraocular (as the case may be) spines: such a line approximately defines the base of the rostrum. I have never found the præ- or supraocular spine so ill-developed that this line cannot be traced. The breadth, in these groups, has been taken from the anterior base of the last lateral (Cyclometopa) or epibranchial (Oxyrhyncha) spine, or from the epibranchial angles. In the Catometopa, however, I have found myself obliged to include the rostrum in the measurement of length, and to take the breadth from the point of one external ocular spine to that of the other. None of these measurements, however, can be considered as other than approximate; I give them, as I have taken them, for what they are worth. They certainly do show a variability in proportions, which, though slight in a great many species, is in others rather striking.

As regards the references that are given, under each species, I

should like to say that they have been chosen, in nearly every instance, for one of two reasons, apart from those of synonymy: 1st, that the reference given contains a good description, or figure, or useful additional remarks; 2nd, that the reference points to the occurrence of the species in India or Australia, with the neighbouring seas, or that its existence has been previously noted at Singapore or Malacca.

Before proceeding to the account of the species, I should like to take this opportunity of expressing my personal thanks to the following gentlemen, who received us most kindly, and gave us valuable facilities in the pursuit of our object: Sir Alexander Swettenham, C.B., at the time of our visit Acting Governor at Singapore; Dr. R. Hanitsch, Curator of the Raffles Museum, who gave us the free use of a room in the Museum, and also useful advice as to collecting-grounds; Mr. H. N. Ridley, Curator of the Botanical Gardens, to whom I am particularly indebted for the new variety of *Potamon tridentatum* described below, and for the brief account of its burrowing habits (which I reproduce from memory); and also to the Hon. W. Egerton, Resident Councillor at Malacca. At home, I have to thank Prof. Jeffrey Bell for the very kind way in which he has placed a room at my disposal in the Natural History Museum, and for kindly communicating this paper to the Society; and Mr. G. A. Boulenger, for very useful advice given in connection with this paper.

NOTE.—In the measurements given, the first figures invariably represent the breadth: *e. g.* 10×7 = breadth 10, length 7. All measurements in millimetres.

I. Genus *ACHÆUS* Leach.

1. *ACHÆUS LACERTOSUS* Stimpson.

Achæus lacertosus, Stimpson, Proc. Acad. Nat. Sci. Philad. p. 218 (1857).

Achæus breviceps, Haswell, Proc. Linn. Soc. N. S. W. vol. iv. p. 433 (1879).

Achæus lacertosus, Miers, 'Alert' Crust. p. 188 (1884); Henderson, Trans. Linn. Soc., Zool. vol. v. p. 341 (1893).

Hab. Singapore; 6 fms. One male.

Dim. 3.5×4 .

2. *ACHÆUS LORINA* Ad. & White.

Inachus lorina, Ad. & White, 'Samarang' Crust. p. 3, pl. ii. f. 2 (1848).

Hab. Singapore; 6 fms. Sandy mud. One male.

Dim. 5.75×7.5 .

II. Genus *CAMPOSCIA* Latr.

3. *CAMPOSCIA RETUSA* Latr.

Camposcia retusa, Latr. Règne Animal, 2^e éd. t. iv. p. 60 (1829);

- M.-Edw. Hist. Nat. Crust. t. i. p. 283 (1834); Haswell, Cat. Austr. Crust. p. 4 (1882); Miers, 'Alert' Crust. p. 189 (1884).

Hab. Singapore; littoral. Two females, one with ova; and a male with a parasite under the abdomen. All are thickly clothed with small globular pieces of sponge.

Dim. ♂ 23×31.5 . ♀ 27.5×37 . ♀ 26×34.5 .

III. Genus ONCINOPUS de Haan.

4. ONCINOPUS ARANEA de Haan.

Oncinopus aranea, de Haan, Crust. Japon. p. 100, pl. xxix. f. 2 (1839).

Oncinopus neptunus, Ad. & White, 'Samarang' Crust. p. 1, pl. ii. f. 1 (1848).

Oncinopus subpellucidus, Stimpson, Proc. Acad. Nat. Sci. Philad. p. 221 (1857).

Oncinopus angulatus, Hasw. Proc. Linn. Soc. N. S. W. vol. iv. p. 433 (1879).

Oncinopus subpellucidus, Hasw. Cat. Austr. Crust. p. 5 (1882).

Oncinopus neptunus, Walker, Journ. Linn. Soc., Zool. vol. xx. p. 109 (1887).

Hab. Singapore; 5 fms. One male.

Dim. 2.5×3.25 .

IV. Genus MENÆTHIUS M.-Edw.

5. MENÆTHIUS MONOCEROS Latr.

Pisa monoceros, Latr. Encycl. t. x. p. 139 (1825).

Menæthius monoceros, M.-Edw. Hist. Nat. Crust. t. i. p. 339 (1834).

Menæthius subserratus, Ad. & White, 'Samarang' Crust. p. 18, pl. iv. ff. 1-2 (1848).

Menæthius monoceros, A. M.-Edw. Nouv. Arch. Mus. Hist. Nat. t. viii. p. 252 (1872).

Hab. Singapore. Littoral: from off seaweed, with Caprellids, Amphipods, &c. 5 males, 1 female. Malacca; 1 fm. Sandy mud. A larger, damaged female.

Dim. ♂ 6×8 . ♂ 6.75×8.5 . ♂ 5.5×7.5 . ♂ 4×5.5 .
♀ 7×9.5 . ♀ 10.75×13.5 . ♂ 16.5×13.5 .

V. Genus DOCLEA Leach.

6. DOCLEA MURICATA Herbst.

Cancer muricatus, Herbst, Naturgesch. der Krabben, t. i. p. 211, pl. xiv. f. 83 (1788).

Inachus muricatus, Fabr. Suppl. Ent. Syst. p. 355 (1798).

Doclea muricata, M.-Edw. Hist. Nat. Crust. t. i. p. 295 (1834); Walker, Journ. Linn. Soc., Zool. xx. p. 109 (1887).

Hab. Malacca; 1-2 fms., mud. A male and two females.

Dim. ♂ 8×9 . ♀ 15.5×17 . ♀ 12×13 .

VI. Genus *EGERIA* Latr.7. *EGERIA ARACHNOIDES* Rumph.

Cancer arachnoides, Rumph. D'Amboin. Rarit-kammer, pl. viii. f. 4 (1741).

Inachus longipes, Fabr. Suppl. p. 358 (1798).

Egeria arachnoides, Latr. Encycl. pl. cclxxxi. f. 1 (1825); M.-Edw. Hist. Nat. Crust. t. i. p. 291 (1834); Hasw. Cat. Austr. Crust. p. 11 (1882); Miers, 'Alert' Crust. p. 191 (1884).

Egeria longipes, Walker, Journ. Linn. Soc., Zool. vol. xx. p. 109 (1887).

Egeria arachnoides, Henderson, Trans. Linn. Soc., Zool. vol. v. p. 343 (1893).

Hab. Singapore; 2-4 fms. Muddy bottom. One male, rather damaged, and another larger.

Dim. ♂ 6 × 7. ♂ 16 × 16.

VII. Genus *MAIA* Lam.8. *MAIA MIERSII* Walker.

Maia miersii, Walker, Journ. Linn. Soc., Zool. vol. xx. p. 113 pl. vi. ff. 1-3 (1887).

Hab. Singapore; 6 fms. Bottom of sandy mud. One female example, entirely agreeing with Mr. Walker's description. The carapace is thickly covered with matted weed, in which are entangled tiny shells, gravel particles, &c., as well as mud, when first caught.

Dim. 16.5 × 21.5.

VIII. Genus *HYASTENUS* White.9. *HYASTENUS DIACANTHUS* de Haan.

Pisa (Naxia) diacantha, de Haan, Crust. Jap. p. 86, pl. xxiv. f. 1 (1839).

Hyastenus diacanthus, A. M.-Edw. Nouv. Arch. Mus. t. viii. p. 250 (1872); Hasw. Cat. Austr. Crust. p. 20 (1882); Miers, 'Alert' Crust. p. 194 (1884).

Hab. Malacca; 6 fms. Rough bottom. 3 small females.

Dim. ♀ 5 × 7.5. ♀ 4 × 5.5. ♀ 2.5 × 3.5.

9 a. *HYASTENUS DIACANTHUS BITUBERCULATUS*, var. nov.

There are, in addition to the above, three large specimens, in which the gastric prominence, besides being much elevated, bears two pointed tubercles, one in front of the other, the anterior being the more prominent; a small tubercle on the middle of the posterior border. In other respects they resemble *H. diacanthus*. There are three examples, a male and a female from 15 fms. at Singapore, and another female from 10-15 fms. at Malacca. In the female from Singapore there is a biggish round brown spot on the posterior declivity of the gastric eminence.

Dim. ♂ 15 × 21. ♀ 18.5 × 25. ♀ 12.5 × 18.

10. *HYASTENUS ORYX* A. M.-Edw.

Hyastenus oryx, A. M.-Edw. Nouv. Arch. Mus. t. viii. p. 250, pl. xiv. f. 1 (1872); Hasw. Cat. Austr. Crust. p. 20 (1882); Walker, Journ. Linn. Soc., Zool. vol. xx. p. 109 (1887).

Hab. Singapore; littoral. Two males and two females, one with ova.

Dim. ♂ 5.75 × 9. ♂ 4.5 × 7. ♀ 6.5 × 10.5. ♀ 5.25 × 8.

11. *HYASTENUS PLANASIUS* Ad. & White.

Pisa planasia, Ad. & White, 'Samarang' Crust. p. 9, pl. ii. ff. 4, 5 (1848).

Hyastenus planasius, A. M.-Edw. Nouv. Arch. Mus. t. viii. p. 250 (1872); Walker, Journ. Linn. Soc., Zool. vol. xx. p. 109 (1887).

Hab. Singapore; 2-3 fms. A female and two males.

On two of these is found a species of *Tubularia*, fixed to the upper and outer margins of the ambulatory legs.

Dim. ♂ 8.75 × 12.5. ♂ 6 × 9. ♀ 12.5 × 17.5.

IX. Genus *CHLORINOIDES* Haswell.12. *CHLORINOIDES ACULEATUS* M.-Edw.

Chorina aculeata, M.-Edw. Hist. Nat. Crust. t. i. p. 316 (1834).

Paramithrax (Chlorinoides) aculeatus, var. *armatus*, Miers, 'Alert' Crust. p. 193, pl. xviii. f. A (1884).

Chlorinoides aculeatus, Henderson, Trans. Linn. Soc., Zool. vol. v. p. 345 (1893).

Hab. Singapore and Malacca; 10-18 fms. Rough bottom.

One large and one small male from Singapore; and two smaller males from Malacca, in which the spines of the carapace and meropodites are relatively less developed.

Mr. Miers's variety *armatus* is founded on—(a) a small tooth-like expansion on the posterior margin of the postocular spine, and (b) the "existence (*usually*) of two spines at the distal ends of the merus-joints of the ambulatory legs" (*i. c.*). As regards (b), M.-Edwards describes the ambulatory legs as "garnies d'une forte épine a l'extrémité des troisième et quatrième articles"; and Mr. Miers's two spines are not invariably found. In my specimens, the larger male from Singapore has the second spine well developed, the smaller male very much less so. In the two still smaller males from Malacca the second spine is absent, though the postocular tooth still bears a small tooth on its posterior margin. I hardly think the slight difference in the postocular tooth is sufficient to admit of accepting a distinct variety.

Prof. Henderson points out the similarity between the postocular tooth of var. *armatus* and that of a form figured by de Haan as *Maia (Chorinus) aculeata*; but the arrangement of the dorsal spines in this figure show that it is wrongly referred to

C. aculeata, and a reference to the text confirms this; for it is there named *Maia* (*Chorinus*) *longispina*, and said to be "*Ch. aculeato* Edw. proximus."

Dim. ♂ 23.5 × 28. ♂ 13 × 17.5. ♂ 8.5 × 11.5. ♂ 6.75 × 10.5.

X. Genus SCHIZOPHRYS White.

13. SCHIZOPHRYS ASPERA M.-Edw.

Mithrax aspera, M.-Edw. Hist. Nat. Crust. t. i. p. 320 (1834).

Dione affinis, de Haan, Crust. Japon. p. 94, pl. xxii. f. 4 (1839).

Schizophrys serratus, Ad. & White, 'Samarang' Crust. p. 16 (1848).

Schizophrys aspera, A. M.-Edw. Nouv. Arch. Mus. t. viii. p. 231, pl. x. f. 1 (1872); Hasw. Cat. Austr. Crust. p. 22 (1882); Walker, Journ. Linn. Soc., Zool. vol. xx. p. 109 (1887).

Hab. Singapore and Malacca. A male and two females from Malacca, all of the typical form; a young male from Singapore, also typical. Littoral.

Dim. ♂ 15.5 × 19. ♂ 6.5 × 8.5. ♀ 24.5 × 31. ♀ 16.5 × 20.5.

XI. Genus MICIPPA Leach.

14. MICIPPA MASCARENICA Kossmann.

Micippa philyra, Leach, Zool. Misc. iii. p. 16 (1817) (nec *M. philyra* Herbst); M.-Edw. Hist. Nat. Crust. t. i. p. 330 (1834).

Micippa philyra, var. *mascarenica*, Kossm. Zool. Ergebn. Reise roth. Meeres, p. 7, pl. iii. fig. 2 (1877).

Micippa mascarenica, Miers, Ann. Mag. Nat. Hist. ser. 5, vol. xv. p. 7 (1885); Walker, Journ. Linn. Soc., Zool. vol. xx. p. 109 (1887).

Hab. Singapore; littoral. Two males and two females.

There are five tuberculiform teeth behind the postorbital tooth in the males, of which the 3rd and 4th are absent in the females.

Dim. ♂ 7.5 × 10. ♂ 10 × 12.5. ♀ 10 × 13. ♀ 7.25 × 9.

15. MICIPPA CURTISPINA Haswell.

Micippa curtispina, Hasw. Proc. Linn. Soc. N. S. W. vol. iv. p. 446, pl. xxv. f. 1 (1879); Walker, Journ. Linn. Soc., Zool. vol. xx. p. 109 (1887).

Hab. Singapore; littoral. One female with ova.

As in *M. mascarenica*, the lateral spines of the female are irregular: the five that Prof. Haswell mentions as bordering the postero-lateral and posterior margins are only represented in this specimen by two well-developed teeth on the postero-lateral angle. The subapical rostral lobes are well-developed.

Dim. 8.5 × 10.

16. MICIPPA EXCAVATA, sp. nov. (Plate XLIV. fig. 1.)

Hab. Singapore; 5-6 fms. A male and an ova-bearing female. This form comes nearest to the *M. curtispina* of Prof. Haswell.

The carapace is closely granulated, a few of the granules being larger than the others, more especially one on each branchial region, and one on the cardiac. The sides are irregularly tuberculate, two fairly prominent tubercles may be seen close behind the eye, and two more farther back, one on the branchial angle, the other on the postero-lateral margin. The middle line of the carapace is somewhat elevated; the hepatic regions are, as usual, very depressed. As regards the rostrum, the upper *half* is obliquely deflexed, the lower *half* vertically; its surface is granular and obtusely bicarinate, so as to form a median and two lateral grooves, the median terminating in the wide notch which separates the *two* lobes of the distal margin. The chelipedes are small and quite smooth; the distal half of the upper margin of the arm is strongly keeled, but the carina is not dentate. Ambulatory legs densely hairy, otherwise smooth: the meri are rather broad, but not so much as those of *M. curtispina*. The orbital margins are prominent; a single closed fissure above, and two below; pterygostomian regions smooth, and profoundly excavate. Basal joint of antennæ smooth, and the next two joints fairly narrow. The fingers of the chelipedes do not meet in their proximal half. Colour of carapace brick-red, touched with light yellow; chelipedes light yellow, distal two-thirds of fingers brown.

Dim. ♂ 9 × 11. ♀ 9.5 × 11.5.

XII. Genus LAMBRUS Leach.

17. LAMBRUS HOPLONOTUS Ad. & White.

Lambrus hoplonotus, Ad. & White, 'Samarang' Crust. p. 35, pl. vii. f. 3 (1848); Hasw. Cat. Austr. Crust. p. 33 (1882); Henderson, Trans. Linn. Soc., Zool. vol. v. p. 351 (1893).

Hab. Singapore; 10 fms. Two females, of the var. *planifrons*.

Dim. ♀ 9.25 × 8. ♀ 9.25 × 8.

18. LAMBRUS VALIDUS de Haan.

Parthenope (Lambrus) valida, de Haan, Crust. Japon. p. 90, pl. xxi. f. 1, & pl. xxii. f. 1 (1839).

Lambrus validus, Ad. & White, 'Samarang' Crust. p. 29 (1848).

Hab. Singapore; 15 fms. One male.

Dim. 30.25 × 26.5.

19. LAMBRUS LONGISPINUS Miers.

Lambrus longispinus, Miers, Ann. Mag. Nat. Hist. ser. 5, vol. iv. p. 18 (1879).

Lambrus spinifer, Hasw. Proc. Linn. Soc. N. S. W. vol. iv. p. 451, pl. xxvii. f. 4 (1880).

Lambrus longispinus, Miers, 'Alert' Crust. p. 199 (1884); Walker, Journ. Linn. Soc., Zool. vol. xx. p. 109 (1887).

Hab. Singapore; 6–8 fms. Two males.

Dim. ♂ 10.25 × 10.5. ♂ 16 × 16.

20. LAMBRUS PELAGICUS Rüpp.

Lambrus pelagicus, Rüpp. Beschreib. 24 Krabben, p. 15, pl. iv. f. 1 (1830); M.-Edw. Hist. Nat. Crust. t. i. p. 355 (1834).

? *Lambrus rumphii*, Bleeker, Rech. sur Crust. de l'Inde Archipel, Batavia, p. 18 (1856).

Lambrus affinis, A. M.-Edw. Nouv. Arch. Mus. t. viii. p. 261, pl. xiv. f. 4 (1872); Henderson, Trans. Linn. Soc., Zool. vol. v. p. 350 (1893).

Lambrus pelagicus, de Man, Decap. u. Stom. von Malakka, Borneo, etc., Zoolog. Jahrb. Bd. viii. p. 494 (1895).

Hab. Singapore; from sandy shore at low-water. One male.

Dr. de Man, by a comparison with Rüppell's original specimens, has shown that the *Lambrus affinis* of A. M.-Edw. is identical with Rüppell's *L. pelagicus*; and possibly also with *L. rumphii* Bleeker.

Dim. 17 × 16.

21. LAMBRUS TUMIDUS, sp. nov. (Plate XLIV. fig. 2.)

Hab. Malacca; 2-6 fms.; muddy bottom. A male and a female.

Carapace a very little broader than long, general surface smooth; gastro-cardiac and branchial regions strongly tumid, separated by two wide and deep depressions. A median carina, branched anteriorly towards the base of the rostrum and enclosing there a concave triangular space; a low tubercle at the point of bifurcation, a second stronger tubercle in the centre of the cardiac region, and a third, as strong, half-way between the second and the first. Behind the second the carina shelves rapidly to a slightly upturned median spine on the posterior margin; the shelving portion bears a minute tubercle. Antero-lateral margins, behind the narrow hepatic notch, with eight flattened, obscurely lacinated, triangular spines, which increase in size from before backwards to the 7th, while the eighth becomes suddenly twice as large as the 7th, quite thin and laminate. Between this and the median posterior tooth are three teeth: first, an outwardly directed tooth, as strong as the eighth antero-lateral, carinate above, the carina granular and extending on to the tumid branchial region, where it becomes tubercular; from the base of this tooth, on the postero-lateral margin springs a shorter flattened tooth, not carinate, and bearing in turn at its base a minute tooth; and at a little distance on the external angle of the posterior margin, a tooth equal in size to the median posterior. The bed of the furrow separating the gastro-cardiac and branchial regions has in it four or five relatively deep holes, having the appearance of pin-pricks. Rostrum conical, acute, with a single, obscure tooth on either side of the base, just above the eye. The suborbital tooth is very strong and carinated below; a low granulated carina extends from the base of this tooth to the base of the chelipedes: pterygostomian regions otherwise smooth, under a covering of rather dense hair which

extends under the antero-lateral margins. Chelipedes three times as long as the body, and generally quite smooth above and below, except for—(a) a longitudinal line of granules on the upper surface of the arm, not quite reaching its distal extremity; the most proximal of these is produced into a very strong tooth; (b) a similar, more obscure line on the under surfaces of the wrist and hand; the distal third of this surface in the hand is rather swollen, and the linear arrangement of the granules is here rather broken up. The whole of the inferior margin of the arm and hand is set with evenly disposed sharp tubercles, which in the wrist are granular (in the male they are less sharp than in the smaller female); on the posterior margin of the arm five strong teeth, with smaller ones between them; on the anterior margin a similar arrangement, the teeth being, however, less strong and more numerous; two strong teeth on the hind margin of the wrist; both upper margins of hand dentate, the teeth being much stronger in its distal third. Dactyl with upper margin dentate; both fingers with strong tubercular teeth on the inner margins; these margins do not meet, except at the tips. Ambulatory legs with mero-carpo- and pro-podites strongly carinated above; and with meri spinulose below, strongly on the 1st and 4th pairs, very obscurely on the 2nd and 3rd.

Length (base of posterior spine to tip of rostrum)	♂ .	♀ .
	25.5 mm.	20 mm.
Breadth (between 7th and 8th antero-lateral spines)	28	22.5
	„	„
Length of chelipedes	76	59.5
	„	„

This species is most nearly related to *L. validus* and *L. laciniatus*, from both of which it is distinguishable by its relative smoothness, and the fact that it is not so very much broader than long.

XIII. Genus CRYPTOPODIA M.-Edw.

22. CRYPTOPODIA FORNICATA Fabr.

Cancer fornicatus, Fabr. Ent. Syst. t. ii. p. 453 (1781); Herbst, Naturgesch. d. Krab. Bd. i. Hft. 6, p. 204, pl. xiii. ff. 79–80 (1785).

Cryptopodia fornicata, M.-Edw. Hist. Nat. Crust. t. i. p. 362 (1834); de Haan, Crust. Japon. p. 90, pl. xx. f. 2 (1839); Hasw. Cat. Austr. Crust. p. 37 (1882); Walker, Journ. Linn. Soc., Zool. vol. xx. p. 109 (1887); Hend. Trans. Linn. Soc., Zool. vol. v. p. 351 (1893).

Hab. Singapore. A male.

Dim. 22×13.

XIV. Genus HARROVIA White.

23. HARROVIA ALBOLINEATA Ad. & White.

Harrovia albolineata, Ad. & White, 'Samarang' Crust. pp. 55–56, pl. xii. f. 5 (1848).

Hab. Singapore; dredged from 10–15 fms. Two males. One of these shows the typical markings on the carapace and chelipedes; in the other, the red stripes on the carapace are fainter and less broad, and the crimson colour of the chelipedes is absent.

Dim. ♂ 5.5 × 5. ♂ 5.5 × 5.

23 a. *HARROVIA ALBOLINEATA LONGIPES*, var. nov. (Plate XLIV. fig. 3.)

Hab. Singapore. From a shoal of scattered stones and coral, with sand in places, partially exposed at low-water. One male.

In this specimen, the most striking feature is the length of the chelipedes, which are three times as long as the carapace, and not only twice as in *H. albolineata*. Further, the tubercles on the arm and wrist are very minute; and the two antero-lateral teeth are as low and as broad as the post-ocular tooth; the fourth is narrow and pointed.

Carapace raised but not tuberculate; minutely punctate, when seen through a lens, and of a diffuse dark red colour. Chelipedes rough, or even slightly granular, and generally as in *H. albolineata*. No tubercles on the ambulatory legs.

Dim. 7.5 × 7.

24. *HARROVIA TUBERCULATA* Haswell.

Harrovia tuberculata, Hasw. Proc. Linn. Soc. N. S. W. vol. iv. p. 455, pl. xxvii. f. 1 (1880).

Hab. Singapore. One female, taken from off the arms of a Crinoid (*Actinometra multiradiata*) dredged from 6 fms.

This species is very near *H. albolineata*, of which it is possibly only a variety. I can discern the same arrangement of tubercles on the carapace in one of my examples of *H. albolineata*, in which the colouring is altogether fainter than usual. In the other, strongly coloured, individual the arrangement is not so obvious; but in no instance is it very distinct.

The tubercles on the meri of the ambulatory legs seem to be the only distinctive feature; for, as regards the absence of colour-markings, the two examples of *H. albolineata* show that a certain variation occurs in this respect. Variation is also evident in the tubercles of the arm: thus in the above examples of *H. albolineata* I find:—

A. A spine at the base of the posterior margin just where it appears from beneath the carapace. In both arms of the one male this is relatively strong and spiniform, and in the right arm of the other male; in the left arm of the other male it is small, tubercular.

B. A spine in a corresponding position on the anterior margin. In the right arm of the one male this is single tuberculate, in the left arm bifid tuberculate.

In the right arm of the other male this is bifid and spinous, in the left it is only represented by a roughening of a granulous nature.

In addition, the right arm of the other male has a small tubercle on the middle of the posterior margin.

I have, however, two larger individuals, both females, whose presence in the collection I had at first overlooked, in which the tubercles of the carapace and the antero-lateral teeth are very strongly developed: the two anterior tubercles being quite tooth-like, and as big as the penultimate lateral teeth. It may be, then, that the species is a good one, although I am still inclined to suspect that the differences are only varietal.

The larger of these females bears ova, and was taken off another specimen of *A. multiradiata*.

Dim. ♀ 6 × 5.5. ♀ 10.5 × 8.5. ♀ 8.5 × 6.5.

XV. Genus ATERGATIS de Haan.

25. ATERGATIS INTEGERRIMUS Lamarck.

Cancer integerrimus, Lam. Hist. des Anim. sans Vert. t. p. 272 (1818); M.-Edw. Hist. Nat. Crust. t. i. p. 374 (1834).

Cancer (Atergatis) integerrimus, de Haan, Crust. Japon. p. 45, pl. xiv. f. 1 (1839).

Atergatis integerrimus, de Man, Mergui Crust. p. 24 (1888); id. Zoolog. Jahrb. Bd. viii. p. 496 (1895).

Hab. Singapore. Littoral: under stones or dead coral. 6 males and 2 females.

Dim. ♂ 81 × 51. ♂ 67 × 41.5. ♂ 44 × 27.5. ♂ 36.5 × 23. ♂ 24 × 15. ♂ 23 × 14.75. ♀ 62 × 39.5. ♀ 48.5 × 30.5.

Breadth taken is the *greatest* breadth.

26. ATERGATIS FLORIDUS Rumph.

Cancer floridus, Rumph. D'Amboin. Rariteit-kammer, p. 16, pl. viii. f. 5 (1741).

Cancer ocyroë, Herbst, Krab. u. Krebse, pl. liv. f. 2 (1801); M.-Edw. Hist. Nat. Crust. t. i. p. 375 (1834).

Cancer (Atergatis) floridus, de Haan, Crust. Japon. p. 46 (1839).

Atergatis floridus, Walker, Journ. Linn. Soc., Zool. vol. xx. p. 109 (1887); de Man, Mergui Crust. p. 24 (1888); id. Zoolog. Jahrb. Bd. viii. p. 498 (1895).

Hab. Singapore. 5 males and 3 females, one with ova. From same localities as *A. integerrimus*.

Dim. ♂ 51 × 35.5. ♂ 48 × 33.5. ♂ 43.5 × 30. ♂ 33.5 × 27. ♂ 24 × 17.25. ♀ 45.5 × 32.5. ♀ 41.5 × 29. ♀ 31 × 22.

Breadth taken is the *greatest* breadth.

27. ATERGATIS ROSEUS Rüpp.

Carpilius roseus, marginatus, Rüpp. Beschreib. 24 Krabben, p. 13, pl. iii. f. 3 (1830).

Cancer roseus, M.-Edw. Hist. Nat. Crust. t. i. p. 374 (1834).

Atergatis marginatus, Dana, U.S. Expl. Exped., Crust. pt. i. p. 158 (1852).

Atergatis nitidus, roseus, scrobiculatus, levigatus, A. M.-Edw. Nouv. Arch. Mus. t. i. pp. 239 seq. (1865).

Atergatis roseus, Kossmann, Zoolog. Ergebn. pp. 19-21 (1877).

Atergatis levigatus, Henderson, Trans. Linn. Soc., Zool. vol. v. p. 352 (1893).

Hab. Singapore and Malacca; littoral. Five males.

Kossmann has shown that probably all the above-named species are varieties of *A. roseus*. Of these specimens one is the var. *scrobiculatus*, with a slightly punctated carapace, generally red but with a very distinct white border. Two others belong to the var. *alba* (Kossm.), although not perfect examples of it, for a whiter margin may still be distinguished from the white carapace, and the latter is still slightly punctated. The fourth and fifth are respectively more and more intermediate between var. *alba* and var. *scrobiculata*, one of them more resembling the former, the other the latter.

The Singapore specimens are the two examples of var. *alba*.

Dim. ♂ 10.5×6.5 . ♂ 10.25×6.25 . ♂ var. *scrobic.* 11.75×7 .
♂ var. *alba*, 11.5×6.5 . ♂ var. *alba*, 6.5×4.5 .

Breadth taken is *greatest* breadth.

XVI. Genus CARPILODES Dana.

28. CARPILODES MARGARITATUS, A. M.-Edw.

Carpilodes margaritatus, A. M.-Edw. Nouv. Arch. Mus. t. ix. p. 182, pl. v. f. 2 (1873); Henderson, Trans. Linn. Soc., Zool. vol. v. p. 353 (1893).

Hab. Malacca; 15 fms. One female. Agrees with the descriptions of M.-Edwards and Henderson: like those of the latter, it is without the brilliant colours figured by M.-Edwards although still of a general red hue.

Dim. 24×17 .

29. CARPILODES SOCIUS, sp. nov. (Plate XLIV. fig. 4.)

Hab. Singapore; 8-10 fms. Two males and a female.

Carapace much broader than long, everywhere smooth to the eye, but minutely punctate viewed under the lens, posteriorly nearly flat, but very declivous anteriorly towards the front and anterolateral margins. Protogastric lobe divided by a groove which does not quite reach the branchio-hepatic groove. Epigastric lobes clearly defined, having a well-marked transverse groove behind as well as in front of them. Mesogastric lobe prolonged a little way between them; the two grooves enclosing this lobe are not prolonged backwards very far. Groove between cardiac and gastric regions less pronounced than the others.

Front notched in the middle, and sinuous, so as to form four lobes, the two median being large and broad, and the external, forming also the internal angle of the eye, small and conical. Upper margin of the orbit very much thickened in its internal half.

Antero-lateral margins curved, about as long as the postero-lateral, divided into four lobe-like teeth, and tending anteriorly to be continued below the orbits.

Chelipedes short; arm trigonous, externally punctated like the carapace, upper margin sharp, lower rounded; wrist punctate, armed internally with two approximate blunt teeth, externally with a line of three flat tubercles; hand compressed, grooved externally and above, just below the blunt crest formed by the upper margin; this groove is very wide and shallow, and not so conspicuous in small examples. Fingers brown, with white, strongly excavate tips; inner margins dentate; longitudinally bisulcate externally, uni-sulcate internally.

Ambulatory legs with meri smooth, or slightly punctate; compressed, and lightly keeled above. Upper borders of next two joints each with two tubercular prominences, one near the proximal, the other near the distal joint. Sixth joint rounded; dactyl very small and pointed. Abdomen of male five-, of female seven-jointed.

The two males are of a very deep crimson colour; the female is of a much lighter shade, more like terra-cotta.

This species comes between *C. rugipes* and *C. rugatus*. The carapace is broader than that of *C. rugipes*, but less broad than that of *C. rugatus*; there is a transverse groove behind the epigastric lobes as in the latter, but the protogastric groove, as in the former, is not prolonged backwards to meet the branchio-hepatic.

Dim. ♂ 18.5 × 11. ♂ 12.75 × 8. ♀ 24.5 × 15.

XVII. Genus LOPHACTÆA A. M.-Edw.

30. LOPHACTÆA GRANULOSA Rüppell.

Xantho granulatus, Rüpp. Beschreib. 24 Krabben, p. 24, pl. v. f. 3 (1830).

Ægle granulatus, de Haan, Crust. Japon. p. 17 (1839).

Cancer limbatus, M.-Edw. Hist. Nat. Crust. t. i. p. 377, pl. xvi. f. 1 (1834).

Lophactæa granulosa, A. M.-Edw. Nouv. Arch. Mus. t. i. p. 247 (1865); Henderson, Trans. Linn. Soc., Zool. vol. v. p. 354 (1893).

Hab. Singapore; from dead coral exposed at low water. Two females, one bearing ova.

The upper margins of the hands are *slightly* cristate.

Dim. ♀ 37 × 25. ♀ 31.5 × 21.

XVIII. Genus ACTÆA de Haan.

31. ACTÆA GRANULATA Audouin.

Cancer granulatus, Aud. Explic. d. Planches d'Égypte, Crust. pl. vi. f. 2 (1819).

Cancer savignyi, M.-Edw. Hist. Nat. Crust. t. i. p. 378 (1834).

Cancer (Actæa) granulatus, de Haan, Crust. Japon. p. 47 (1839).

Actæa granulata, A. M.-Edw. Nouv. Arch. Mus. t. i. p. 275

(1865); Hasw. Cat. Austr. Crust. p. 44 (1882); Henderson, Trans. Linn. Soc., Zool. vol. v. p. 356 (1893).

Hab. Singapore. From the New Harbour, in 6 fms. Two females; the larger a deep red, the smaller a lighter red.

Dim. ♀ 13·5 × 10·5. ♀ 10 × 7·5.

32. *ACTÆA NODULOSA* Adams & White.

Actæa nodulosa, Ad. & White, 'Samarang' Crust. p. 39, pl. viii. f. 4 (1848); A. M.-Edw. Nouv. Arch. Mus. t. i. p. 277 (1865); Miers, 'Challenger' Brachyura, p. 120 (1886); Henderson, Trans. Linn. Soc., Zool. vol. v. p. 356 (1893).

Hab. Singapore; reef. A female and two males. The female is a dull grey-white, the males white flecked with orange.

Dim. ♂ 7 × 5·25. ♂ 6 × 4·5. ♀ 8 × 6·5.

33. *ACTÆA RÜPPELLII* Krauss.

Egle rüppellii, Krauss, Südafrik. Crust. p. 28, pl. i. f. 1 (1843).

Egle rugata, Ad. & White, 'Samarang' Crust. p. 43, pl. viii. f. 5 (1848).

Actæa rüppellii, A. M.-Edw. Nouv. Arch. Mus. t. i. p. 270 (1865).

Actæa rugata, id. tom. cit. p. 269.

Actæa rüppellii, Miers, Ann. Mag. Nat. Hist. ser. 5, vol. v. p. 232 (1880); Walker, Journ. Linn. Soc., Zool. vol. xx. p. 109 (1887).

Actæa rufopunctata, de Man, Mergui Crust. p. 26 (1888).

Actæa rüppellii, Henderson, Trans. Linn. Soc., Zool. vol. v. p. 358 (1893); de Man, Zoolog. Jahrb. Bd. viii. p. 499 (1895).

Hab. Singapore; shore, and up to 12 fms. Three males and three females. These were generally found curled far down in the cavities of pieces of eroded stone, which had to be broken in order to find them. In all, the whole of the mesogastric and part of the protogastric lobes are red; the ground-colour a faint yellow, with scattered red spots both on the carapace, legs, and under surface.

Dim. ♂ 27 × 21. ♂ 25·5 × 19·5. ♂ 23 × 18. ♀ 27 × 20. ♀ 26·5 × 20. ♀ 20·5 × 15·5.

34. *ACTÆA AREOLATA* Dana.

Actæa areolata, Dana, U.S. Expl. Exped., Crust. pt. i. p. 162, pl. viii. f. 1 a (1852); A. M.-Edw. Nouv. Arch. Mus. t. i. p. 264 (1865); Miers, 'Alert' Crust. p. 209 (1884); de Man, Mergui Crust. p. 25 (1888); Walker, Journ. Linn. Soc., Zool. vol. xx. p. 109 (1887).

Hab. Singapore; under stones between tide-marks. Three females and a young male.

As in the 'Alert' specimens, so in these, the inter-regional grooves are much more clearly defined than in Dana's figure. But their general resemblance with the figure, and their close

agreement with the description make it almost certain that they are Dana's species. Dr. de Man has noticed (*t. c.*) that whereas the internal protogastric division is represented in Dana's figure as being much broader than the portion of the mesogastric next it, in his examples the former is scarcely broader than the latter. This I find to be also the case both in the Singapore and the 'Alert' individuals.

Dim. ♂ 9 × 5. ♀ 20 × 12.5. ♀ 19 × 12. ♀ 16 × 10.

35. *ACTEA PULCHELLA* A. M.-Edw.

Actea pulchella, A. M.-Edw. Nouv. Arch. Mus. t. i. p. 273, pl. xviii. f. 5 (1865).

Hab. Singapore; between tide-marks. Two males and a female.

These specimens agree entirely with the description and figures given, except that the granules on the hand tend, here, to form in definite rows.

I may also notice that the granules tend to disappear on the posterior part of the carapace. M.-Edwards's figure gives something of their appearance, but in his description he only says "surface couverte de granulations."¹

Dim. ♂ 12 × 9. ♂ 9.25 × 7. ♀ 10.5 × 7.5.

XIX. Genus *ACTEODES* Dana.

36. *ACTEODES TOMENTOSUS* Dana.

Zozymus tomentosus, M.-Edw. Hist. Nat. Crust. t. i. p. 385 (1834), and Atlas du Règne Anim. de Cuvier, Crust. pl. xi bis. f. 2.

Acteodes tomentosus, Dana, U.S. Expl. Exped., Crust. pt. i. p. 197 (1852).

Acteodes affinis, Dana, *t. c.* p. 197, pl. xi. f. 3 (1852).

Actea tomentosa et *affinis*, A. M.-Edw. Nouv. Arch. Mus. t. i. pp. 262-3 (1865).

Acteodes tomentosus, Miers, 'Challenger' Brachyura, p. 135 (1886).

Hab. Singapore; littoral. Three males and two females.

Of these, one male and one female agree entirely with Dana's *A. tomentosus*; the others agree with his *A. affinis* in having the cardiac areolet nearly completely bisected, the granules smaller and more numerous, and the outer maxillipedes relatively smoother, but not in the smoothness of the under surface of the hands, nor the fewer and larger spinules on the fingers; the hands are quite similar in all. Furthermore, all have a ratio of length to breadth of approximately 1 : 1.6; in Dana's *A. affinis* this ratio is 1 : 1.37 (*t. c.* p. 198). These specimens were all obtained from the same exposed reef. The internal surface of the hands of two of the males is encrusted with a Polyzoön.

In Milne-Edwards's description of *Zozymus tomentosus* (*t. c.*) he

¹ I have recently examined a larger individual from the Museum collection at Sarawak, which I am at present describing, and find that the granules on the posterior region are quite distinct, though smaller than those in front.

says that the pterygostomian regions are not granulous ; in all these specimens they are distinctly granulated.

Dim. ♂ 30·5 × 19·5. ♂ 29·5 × 19. ♂ 26·5 × 17. ♀ 28·5 × 18·5.
♀ 27·75 × 17·5.

XX. Genus CYCLOXANTHUS A. M.-Edw.

37. CYCLOXANTHUS LINEATUS A. M.-Edw. (?)

Cf. *Cycloxanthus lineatus*, A. M.-Edw. Nouv. Arch. Mus. t. ix. p. 209, pl. vi. f. 5 (1873); Miers, 'Alert' Crust. p. 212 (1884).

Hab. Uncertain. A small male.

I cannot definitely refer this specimen to M.-Edwards's species. The carapace is not at all smooth; there is a distinct low carina on each side over the branchial regions, extending from the last tooth nearly to the middle line; two low swellings on the mesogastric, and one on the cardiac regions. The whole surface, moreover, is finely and closely granulated. Colour a dull grey; legs yellow; fingers of chelipedes brown. This individual is identical with the two specimens obtained by the 'Alert.'

Dim. 7·5 × 5·5.

XXI. Genus EUXANTHUS Dana.

38. EUXANTHUS HUONII Jacq. et Lucas.

Cancer huonii, Jacq. et Lucas, Voyage au Pôle du Sud, Crust. p. 16, pl. iv. f. 1 (Hombron et Jacquinet, tome iii. 1853).

Euxanthus huonii, A. M.-Edw. Nouv. Arch. Mus. t. i. p. 290 (1865); Miers 'Alert' Crust. p. 204 (1884).

Hab. Singapore; littoral, from among stones and dead coral. One male.

A. M.-Edwards thinks it possible that *E. huonii* and *E. sculptilis* Dana may be identical. Mr. Miers, commenting on this, points out that the black coloration of the fingers extends on to the hand in M.-Edwards's figure, and also in his ('Alert') specimen. This, he adds, is not figured by Dana, nor does it occur in two Museum specimens one of which has been designated *E. huonii* by A. M.-Edwards, but which Mr. Miers refers provisionally to *E. sculptilis*. Now, in this example from Singapore, the colour is limited to the fingers also; yet there can be no doubt it is identical with *E. huonii*, and not with *E. sculptilis*, for two reasons—firstly, the fingers are not denticulate above: and secondly, the posterolateral margins are deeply concave, while in Dana's figure they are represented as nearly straight. For these reasons, also, I should still regard *E. huonii* and *E. sculptilis* as distinct. I was unfortunately unable to obtain the specimens referred to by Mr. Miers for purposes of comparison (*vide* footnote¹).

Dim. 18·5 × 13.

¹ The two specimens of *Euxanthus sculptilis* to which Mr. Miers refers (*op. cit.* p. 204) were not in the collection when I made a MS. catalogue of the Brachyura in 1895.—F. J. B., Nat. Hist. Mus. 16 April, 1900.

XXII. Genus LOPHOZOYIMUS A. M.-Edw.

39. LOPHOZOYIMUS EPHELITICUS Linn.

Cancer epheliticus, Linn. (fide auctor.).

Xantho octodentatus, M.-Edw. Hist. Nat. Crust. t. i. p. 398 (1834); Jacq. et Lucas, Voyage au Pôle du Sud, Crust. p. 23, pl. ix. f. 1 (Hombron et Jacq. tome iii. 1853).

Lophozoyimus octodentatus, Hasw. Cat. Austr. Crust. p. 58 (1882).

Lophozoyimus epheliticus, Walker, Journ. Linn. Soc., Zool. vol. xx. p. 109 (1887); de Man, Zoolog. Jahrb. Bd. viii. p. 518 (1895).

Hab. Singapore; littoral. One male and three females: and one younger male.

In these specimens I note the following variations:—In the adult male, the fissure in the dorsal crest of the merus of the chelipedes opens widely at the top in the left arm, being broader above than below, whereas in the right arm it is nearly closed above; and in the right arm of one of the females it is completely closed above. Further, in the females the two tubercles on the inner edge of the carpus show a tendency to unite and form a ridge with concave edge. In the right carpus of one it forms a tri-tuberculate ridge, in the left the posterior tubercle is rudimentary, lying at the base of the other: while on the right carpus of another the two are nearly obsolete, being only represented by a very small excrescence.

Dim. ♂ 56 × 36.5. ♂ 32.5 × 20. ♀ 64 × 41.5. ♀ 58.5 × 37.5.
♀ 56.5 × 37.

40. LOPHOZOYIMUS (LOPHOXANTHUS) LEUCOMANUS Lockington.

Xanthodes leucomanus, Lockington, Proc. Calif. Ac. Nat. Sci. pp. 32, 100 (1876).

Lophozoyimus (Lophoxanthus) bellus, var. *leucomanus*, Miers, 'Challenger' Brachyura, p. 115, pl. xi. f. 1 (1886).

Hab. Singapore. I have no record of the depth. A male and a female.

Colour of carapace grey-black, of legs white-yellow. I cannot but regard this as specifically distinct from *L. bellus* Stm., after comparing it with two examples of the latter that are in the Museum collection. Superficially, the carapace of *L. leucomanus* appears, and is actually, broader in proportion to the length than that of *L. bellus*, and the front projects much farther forward beyond the orbits. The result of this is that the crab has a definitely six-sided appearance, which is not seen in *L. bellus*. The antero-lateral margins also differ very considerably, for in *L. leucomanus* they are continued in front to a point below the orbits, making the hepatic regions somewhat concave; whereas in *L. bellus* the margin is continued, at the same level, to the external orbital angle, and the hepatic regions are slightly convex. The rugosities of the carapace are also very distinctive in *L. leucomanus*,

and these occur but little in *L. bellus*. Further, the carinæ of the upper margins of the ambulatory legs are very well developed in *L. leucomanus*; whereas in *L. bellus* the upper margins are only sharp, or even slightly rounded, as in the last pair. The chelipedes of *L. leucomanus* are very pitted and rugose, those of *L. bellus* are smooth.

In the two Museum specimens of *L. bellus*, the proportions are:—

Breadth of carapace	9 mm.	19 mm.
Length of carapace	7 mm.	14 mm.

Dim. ♂ 12 × 9. ♀ 10 × 7·25.

XXIII. Genus PARAPANOPE de Man.

41. PARAPANOPE EUAGORA de Man.

Parapanope euagora, de Man, Zoolog. Jahrb. Bd. viii. pp. 513–518, Bd. ix. pl. xii. f. 4 (1895).

Hab. Malacca. One male, entirely agreeing with Dr. de Man's excellent description.

Dim. 8 × 5·5.

XXIV. Genus CHLORODIUS Rüpp.

42. CHLORODIUS NIGER Forskål.

Cancer niger, Forskål, Descr. Anim. p. 89 (1775).

Chlorodius niger, Rüpp. Beschreib. 24 Krabben, p. 20, pl. iv. f. 7 (1830); A. M.-Edw. Nouv. Arch. Mus. t. ix. p. 214 (1873); de Man, Mergui Crust. p. 32 (1888), and Zoolog. Jahrb. Bd. viii. p. 519 (1895).

Hab. Singapore. One male.

Dim. 12·5 × 9.

XXV. Genus CHLORODOPSIS A. M.-Edw.

43. CHLORODOPSIS PILUMNOIDES Ad. & White.

Chlorodius pilumnoides, Ad. & White, 'Samarang' Crust. p. 41 pl. ix. f. 3 (1848).

Chlorodopsis pilumnoides, de Man, Mergui Crust. p. 35 (1888).

Hab. Malacca.

An adult female. Spines on anterior margin of arm well-developed; interspace between the fingers very wide as far as the tips, which are sharply curved to meet each other and strongly excavate. Mr. Miers states ('Alert' Crustacea, p. 531) that in an adult male specimen from Singapore in the Museum collection the black coloration of the fingers extends over the inner and outer surfaces of the hand: in this individual the fingers are deep brown with white tips, and the brown colour does not extend beyond their base. Dr. de Man also (*t. c.*) has found this to be the

case in his females from the Mergui Archipelago, so perhaps it is a sexual distinction.

In three females and a male from the Mergui collection, which I have examined, the actual colour varies from a deep black to a very pale brown.

Dim. 22×16 .

XXVI. Genus LEPTODIUS A. M.-Edw.

44. LEPTODIUS EXARATUS M.-Edw.

Chlorodius exaratus, M.-Edw. Hist. Nat. Crust. t. i. p. 402 (1834).

Xantho affinis, de Haan, Crust. Japon. p. 48, pl. xiii. f. 8 (1839).

Leptodius exaratus, A. M.-Edw. Nouv. Arch. Mus. t. ix. p. 222 (1873); Henderson, Trans. Linn. Soc., Zool. vol. v. p. 362 (1893); de Man, Zoolog. Jahrb. Bd. viii. p. 521 (1895).

Hab. Singapore; littoral. Several young examples.

Dim. ♂ 10×7 . ♂ 9.5×7 . ♂ 10.5×7.25 . ♂ 7.25×5.25 .
 ♂ 7.25×5.5 . ♀ 12×8 . ♀ 9×6.5 . ♀ 8×6 . ♀ 9×6.5 .
 ♀ 6.75×5 . ♀ 7.5×5.5 . ♀ 7×5 . ♀ 8.5×6 .

44a. LEPTODIUS EXARATUS GRACILIS.

Chlorodius gracilis, Dana, U.S. Expl. Exped. p. 210, pl. xi. f. 13 (1852).

Leptodius exaratus, var. *gracilis*, Miers, 'Alert' Crust. p. 530 (1884).

Hab. Singapore; littoral, together with the species. A male and a female.

Dim. ♂ 14.5×9.5 . ♀ 17×12 .

XXVII. Genus ETISUS M.-Edw.

45. ETISUS LEVIMANUS Randall.

Etisus levimanus, Randall, Journ. Ac. Nat. Sci. Philad. vol. viii. p. 115 (1839); Dana, U.S. Expl. Exped., Crust. pt. i. p. 185, pl. x. f. 1 (1852).

Etisus macrodactylus, Jacq. et Lucas, Voyage au Pôle du Sud, Crust. p. 30, pl. ix. f. 2 (Hombroun et Jacquinot, tome iii. 1853).

Etisus levimanus, A. M.-Edw. Nouv. Arch. Mus. t. ix. p. 234 (1873).

Hab. Singapore; littoral. Two males. One of these is ornamented with a large, oval, brown spot on the gastric region, and other brown spots dotted more or less regularly over the carapace generally.

Dim. ♂ 63.5×40 . ♂ 68.5×41.5 .

46. ETISUS UTILIS Jacq. et Lucas.

Etisus utilis, Jacq. et Lucas, Voyage au Pôle du Sud, Crust.

p. 27, pl. ii. f. 6 (Hombron et Jacq. tome iii. 1853); A. M.-Edw. *Nouv. Arch. Mus.* t. ix. p. 233 (1873).

Hab. Singapore; obtained at lowest tides. Five males.

Dim. ♂ 90 × 59. ♂ 78 × 52.5. ♂ 100 × 66. ♂ 104 × 66.
♂ 102 × 68.

Breadth taken from between *penultimate* lateral teeth.

XXVIII. Genus ETISODES Dana.

47. ETISODES ANAGLYPTUS M.-Edw. (Plate XLV. fig. 5.)

Etisus anaglyptus, M.-Edw. *Hist. Nat. Crust.* t. i. p. 411 (1834).

Etisodes anaglyptus, Miers, 'Alert' *Crust.* p. 218 (1884); Hasw. *Cat. Austr. Crust.* p. 55 (1882).

Hab. Singapore; littoral. Three males and a female.

These are all fine specimens, and, as I have not seen any description of the species since that of Milne-Edwards in 1834, and a few additional remarks by Mr. Miers (*t. c.*), I give a further one now.

Carapace somewhat lobulated, more particularly in front and on the sides, and rather depressed; under the lens everywhere minutely punctated; furrows between the lobules broad and rather deep. Front relatively narrow, consisting of two projecting lobes, separated by a deep median notch, closed posteriorly; each lobe with a short, thick, granulated and concave anterior margin, the external half of which is lower than the interior, so that the line of the front is curved dorso-ventrally; a deep wide notch between this and the internal orbital angle, below which, when viewed from above, appear the antennæ. This angle forms a salient tubercle. Upper orbital margin thick, its external half divided, by two conspicuous closed fissures, into two low tubercles, the outer of which forms the external angle of the orbit. Lower margin formed of two tubercles; one, more prominent, below and external to the internal orbital angle, the other below and internal to the external angle. A curved line of granules, set in a shallow furrow, separates the subhepatic and pterygostomial regions: merus of external maxillipedes granulated, as also are the anterior half of the first sternal segment and the internal edge of the others where they abut on the abdomen; the first sternal segment also presents a deep median groove.

Chelipedes fairly long; merus and carpus internally granulate, hand internally smooth and slightly punctate. External surface of merus smooth, its upper margin with a line of long hairs; external surface of carpus tuberculate and punctate, its internal angle with a strong forwardly curved spine, which has a low tubercle at its base posteriorly; external surface of hand punctate, and with three longitudinal rows of low tubercles; upper margin with two rows of tubercles, irregularly disposed. Fingers black, this colour extending a little way on to the under, lower external, and lower internal surfaces of the hand; externally

and internally more or less sulcate; mobile finger with two rows of 3 or 4 tubercles above, enclosing between them a furrow; tips strongly excavate and white; inner margins dentate and not quite meeting. Ambulatory legs with upper and under margins densely clothed with hair: upper margins tuberculate, the tubercles becoming stronger from the merus to the dactyl, under margins granulate.

Colour variable; smallest male greenish yellow with a few red-brown patches, the next in size with a much greater amount of red-brown, the largest completely brown; the female has a somewhat mottled appearance of brown and yellow.

The tubercles of the chelipedes tend to obsolescence in the largest male. Mr. Miers's statement (*t. c.*) that the distal ends of the frontal lobes are *convex* seems to be either a mistake or a misprint; for I have examined the 'Alert' specimen, and find them, like these, slightly *concave* when viewed from above; briefly, they are convex in a vertical, and concave in a horizontal plane.

Dim. ♂ 57.5 × 38. ♂ 45.5 × 30.5. ♂ 36 × 25. ♀ 42 × 28.

XXIX. Genus CYMO de Haan.

48. CYMO ANDREOSSYI MELANODACTYLA.

Cymo melanodactylus, de Haan, Crust. Japon. p. 22 (1839).

Cymo andreossyi, Miers, 'Alert' Crust. p. 532 (1884); de Man, Mergui Crust. p. 35 (1888); Henderson, Trans. Linn. Soc., Zool. vol. v. p. 363 (1893).

Hab. Singapore: from the reef at low water. A male. Fingers black: black colour extending on to under and lower external surface of hand; granules on this part small above, absent below; tips of fingers light brown, not white.

Dim. 11.5 × 9.5. Breadth taken is *greatest* breadth.

XXX. Genus MYOMENIPPE Hilgendorf.

49. MYOMENIPPE GRANULOSA A. M.-Edw.

Menippe granulosa, A. M.-Edw. Ann. Soc. Entom. de France, t. vii. p. 275 (1867).

Myomenippe duplicidens, Hilgendorf, Monatsber. k. Akad. Wiss. Berlin, p. 796 (footnote) (Nov. 1878).

Myomenippe granulosa, de Man, Mergui Crust. p. 40, pl. ii. f. 1 (1888), and Zoolog. Jahrb. Bd. viii. p. 525 (1895).

Hab. Malacca; littoral. One male example.

This agrees almost entirely with Dr. de Man's excellent description (*t. c.*); the only notable difference is the presence of numerous, rather thickly-set hairs on the ambulatory legs, especially on the upper margin of the meri; these would appear, from Dr. de Man's figure, to be much less numerous in his examples.

Dim. 38 × 27.5.

Distance between ext. orbital angles, 22 mm.

Length of larger hand, 29.25 mm.

XXXI. Genus *ACTÆOPSIS*, gen. nov.

This genus bears a very general resemblance to *Actæa*, both in the shape of the carapace, and arrangement of the front, orbits and antennæ. But it differs in having well-marked ridges on the endostome, and very distinct carinæ on the ambulatory legs; furthermore, the fingers are strongly excavate. The antero-lateral margins, too, are much straighter, and the carapace relatively more flat.

The characters of the genus, as exemplified in the present specimens (2 males and 2 females), are as follows:—

Carapace six-sided, broader than long, generally depressed, but a little declivous towards the front and sides; front broad, and a little advanced, its anterior margin sinuous; basal joint of the antennæ barely entering the internal orbital hiatus, reaching the base of the infero-lateral process of the front by the anterior half of its internal margin, but not quite reaching the apex of the internal subocular lobe externally¹; flagellum short. Endostome with well-marked ridges; merus of the exterior maxillipedes truncate, broader than long, the next joint being articulated at its emarginate antero-internal angle. Chelipedes short with excavate fingers; ambulatory legs of moderate length, meri uncarinate, next three joints bicarinate. Antero-lateral margins very thick, with four blunt and rounded teeth, the depressions between which are continued on to the subhepatic regions at well marked grooves. Abdomen, in the male five-, in the female seven-jointed.

50. *ACTÆOPSIS PALLIDA* (Borradaile). (Plate XLV. fig. 6.)

Carpiliodes pallidus, Borradaile, P. Z. S. 1900, p. 586, pl. xl. fig. 3.

Hab. Singapore; from interstices in coral from off the shore at low water, and up to 6 fms. Two males and two females.

Carapace nearly flat behind, slightly declivous towards the anterior and antero-lateral margins; under the lens it is seen to be everywhere closely punctate, with a tendency to a spongy appearance; breadth one and a half times the length. Proto-gastric grooves prolonged posteriorly to meet the branchio-hepatic; epigastric lobes limited by a transverse groove behind as well as before; mesogastric lobe projecting very slightly between them, and the grooves which bound it prolonged posteriorly and outwardly so as nearly to meet the protogastric grooves at their junction with the branchio-hepatic; hepatic and branchial regions lobulated. Front with a distinct median notch, and sinuous; median lobes broad and rounded and rather prominent, lateral lobes small and only faintly prominent. Superior orbital margin rather thickened internally, and externally to this two closed fissures. Antero-lateral teeth four in number, broad, low and very rounded, except the last which is conical and obtuse. The depressions between them are continued as grooves on to the subhepatic regions which, together with the exterior maxillipedes, the pterygostomial and sternal regions, are everywhere strongly punctate.

¹ *Note.*—This is not very clearly shown in the figure, Pl. XLV. fig. 6.

Chelipedes short, everywhere punctated, on the outside strongly so as to appear almost rugose, on the inside faintly so as to appear smooth in comparison. Merus trigonous, with a small double blunt tooth, subdistal, on its upper margin; carpus rounded, with a small double tooth internally; hand rather compressed, the punctæ, externally, tending to a linear arrangement; fingers brown, rather short, dentate on the inner margin and externally unisulcate; tips white and strongly excavate.

The ambulatory legs are all carinated, in the following manner, on their upper margins: the merus has a simple carina with a slight groove on its outer aspect; in the carpal joint this carina is faintly sinuous, the groove is very distinct, and outside it may be seen a second low carina; this carina is even more distinct in the fifth joint, until in the next it equals in size the first carina, and the two enclose the original groove between them. Thus the merus is unicarinate, the carpus obscurely bicarinate, and the remaining two joints distinctly bicarinate.

The carapace and limbs in one female are of a deep red hue; in the males and the other female the limbs and under-surface only are red or pinkish, the carapace being white or yellow-white.

This form is identical with one which Mr. Borradaile has referred to the genus *Carpilodes* in a recent paper (*supra*, page 586) and I too was at first inclined to refer it to that genus. But the differences it exhibits are very striking, namely, the depression of the carapace, the grooves on the subhepatic regions, the ridges of the endostome, and the carination of the ambulatory legs, while the lateral margins are much less curved than in *Carpilodes*. This combination of characters is also sufficient to separate it from *Actæa*; though I am inclined now to regard it as more nearly related to that genus than to *Carpilodes*.

Dim. ♂ 8.5 × 5.75. ♂ 8.5 × 5.75. ♀ 7.75 × 5.5 ♀ 9.25 × 6.

XXXII. Genus ACTUMNUS Dana.

51. ACTUMNUS SETIFER de Haan.

Cancer (Pilumnus) setifer, de Haan, Crust. Japon. p. 50, pl. iii. f. 3 (1839).

Actumnus setifer, A. M.-Edw. Nouv. Arch. Mus. t. i. p. 287, pl. xviii. f. 5 (1865).

Actumnus tomentosus, Dana, U.S. Expl. Exped., Crust. pt. i. p. 243, pl. xiv. f. 2 (1852).

Actumnus setifer, Miers, 'Alert' Crust. pp. 225-6 (1884); de Man, Mergui Crust. p. 47 (1888); Walker, Journ. Linn. Soc., Zool. vol. xx. p. 110 (1887).

Hab. Singapore; 5-10 fms. Five adult males and a smaller female, and two young males. These were found in holes made in soft stones, which were brought up by the dredge.

Dim. ♂ 20.5 × 16. ♂ 16 × 13. ♂ 13.25 × 10.5. ♂ 13.25 × 10.5. ♀ 13.75 × 10.5. ♀ 12.75 × 10.

XXXIII. Genus PILUMNUS Leach.

52. PILUMNUS VESPERTILIO Fabr.

Cancer vespertilio, Fabr. Suppl. Ent. Syst. p. 338 (1798).

Pilumnus vespertilio, M.-Edw. Hist. Nat. Crust. t. i. p. 418 (1834).

Pilumnus ursulus, Ad. & White, 'Samarang' Crust. p. 45, pl. ix. f. 6 (1848).

Pilumnus mus, Dana, U.S. Expl. Exped., Crust. pt. i. p. 240 (1852).

Pilumnus vespertilio, de Man, Mergui Crust. p. 58 (1888); Walker, Journ. Linn. Soc., Zool. vol. xx. p. 110 (1887).

Hab. Singapore; littoral. One large male, four smaller; a small female, and a very young male. The granulations of the under surface of the larger hand tend to disappear in the largest male (*cf.* de Man, *t. c.*).

Dim. ♂ 24.5 × 19. ♂ 13 × 10. ♂ 10 × 7. ♂ 10 × 7.
♂ 8.5 × 6.5. ♀ 10 × 7.5

53. PILUMNUS LABYRINTHICUS Miers.

Pilumnus labyrinthicus, Miers, 'Alert' Crust. p. 224, pl. xxii. f. C (1884); Walker, Journ. Linn. Soc., Zool. vol. xx. p. 110 (1887); Henderson, Trans. Linn. Soc., Zool. vol. v. p. 365 (1893).

Hab. Singapore; 5–15 fms., rough bottom. Two adult females and three very young males.

Dim. ♀ 12.5 × 10. ♀ 9 × 7.25. ♂ 5 × 6.

54. PILUMNUS MINUTUS HIRSUTUS.

? *Pilumnus minutus*, de Haan, Crust. Japon. p. 50, pl. iii. f. 2 (1839).

Pilumnus hirsutus, Stimpson, Proc. Ac. Nat. Sci. Philad. p. 37 (1858); Hasw. Cat. Austr. Crust. p. 69 (1882).

Pilumnus minutus?, var. *hirsutus*, Miers, 'Challenger' Brachyura, p. 154 (1886).

Hab. Singapore; littoral, from broken stones and coral. One larger male, damaged, and two smaller.

I agree with Mr. Miers in thinking it very probable that de Haan's *P. minutus* is nearly identical with *P. hirsutus* of Stimpson.

Dim. ♂ 9 × 7. ♂ 6 × 4.5. ♂ 4.5 × 3.5.

55. PILUMNUS LÆVIS Dana.

Pilumnus levis, Dana, Conspectus Crust., Proc. Ac. Nat. Sci. Philad. vol. vi. p. 82 (1852); de Man, Mergui Crust. p. 66, pl. iv. ff. 1–2 (1888); id. Zoolog. Jahrb. Bd. viii. p. 553 (1895).

Hab. Singapore; ? depth. A small male.

The infra-orbital margins may be seen to be finely granulous under the lens, but there is no hiatus just under the outer orbital angle on the right side; as in Dr. de Man's somewhat larger

specimens (Zoolog. Jahrb. loc. cit.) the margin is continuous on both sides.

From a shoal near Raffles lighthouse, a female with ova. Colour a deep pink, extending on to the legs.

Dim. ♂ 5×3.75 . ♀ 4.25×6 .

XXXIV. Genus EURYCARCINUS A. M.-Edw.

56. EURYCARCINUS MACULATUS A. M.-Edw.

Pilumnopus maculatus, A. M.-Edw. Annal. Soc. Entom. France, t. vii. p. 277 (1867); id. Nouv. Arch. Mus. t. iv. p. 82, pl. xix. ff. 17-19 (1868).

Eurycarcinus maculatus, de Man, Mergui Crust. p. 44, pl. ii. ff. 4-5 (1888).

Hab. Singapore; littoral, sandy shore. One male, slightly damaged.

Dim. 12.75×9 .

XXXV. Genus ERIPHIA Latr.

57. ERIPHIA LÆVIMANA SMITHII.

Eriphia smithii, McLeay, Annulosa in Smith's Illustr. Zool. S. Africa, p. 60 (1838); Krauss, Südl. Afrik. Crust. p. 36, pl. ii. f. 3 (1843).

Eriphia lævimana, var. *smithii*, Hilgendorf, Monatsber. Akad. Berlin, p. 797 (1878); Miers, Ann. Mag. Nat. Hist. ser. 5, vol. v. p. 237 (1880); Walker, Journ. Linn. Soc., Zool. vol. xx. p. 110 (1887).

Hab. Singapore; littoral. Three males and four females. These crabs run actively among rocks on the shore; they will also defend themselves well against attack, with their formidable chelipedes.

Dim. ♂ 39.5×29 . ♂ 45.5×34.25 . ♂ 57×42.5 . ♀ 38×27.5 . ♀ 37×28 . ♀ 43×31.5 . ♀ 47.5×34 .

Breadth taken is *greatest* breadth.

XXXVI. Genus TETRALIA Dana.

58. TETRALIA GLABERRIMA Herbst.

Cancer glaberrimus, Herbst, Naturgesch. d. Krabben, i. p. 262, pl. xx. f. 115 (1799).

Trapezia serratifrons, Luc. et Jacq. Voyage au Pôle du Sud, Crust. pl. iv. ff. 20-23 (Hombroun et Jacq. tome iii. 1853).

Tetralia glaberrima et nigrifrons, Dana, U.S. Expl. Exped., Crust. pt. i. p. 261, pl. xvi. ff. 2 & 3 (1852).

Hab. Singapore: littoral. A male and a female, the latter slightly damaged. Front and antero-lateral margins edged with a black band. Pit at base of hand in larger chelipede very distinct in the male; the female has lost its larger chelipede.

Dim. ♂ 8.25×7.25 . ♀ 9.25×8.25 .

XXXVII. Genus NEPTUNUS de Haan.

✓ 59. NEPTUNUS PELAGICUS Linn.

Cancer pelagicus, Linn. Syst. Nat. (ed. xii.) p. 1042 (1766).

Lupea pelagica, M.-Edw. Hist. Nat. Crust. t. i. p. 450 (1834).

Portunus (Neptunus) pelagicus, de Haan, Crust. Japon. p. 37, pl. ix. & x. (1839).

Neptunus pelagicus, A. M.-Edw. Arch. Mus. t. x. p. 320 (1861); Hasw. Cat. Austr. Crust. p. 77 (1882); Walker, Journ. Linn. Soc., Zool. vol. xx. p. 110 (1887); de Man, Mergui Crust. p. 69 (1888); id. Zoolog. Jahrb. Bd. viii. p. 556 (1895); Henderson, Trans. Linn. Soc., Zool. vol. v. p. 367 (1893).

Hab. Singapore. Six males and six females; all from pools at low water.

Dim. ♂ 84 × 45.25. ♂ 81 × 44. ♂ 68 × 37. ♂ 51.5 × 28.
 ♂ 51.5 × 27.5. ♂ 42.25 × 22. ♀ 58 × 31. ♀ 55.5 × 30.5.
 ♀ 44 × 24.5. ♀ 39 × 22. ♀ 37 × 21. ♀ 33 × 19.

✓ 60. NEPTUNUS SANGUINOLENTUS Herbst.

Cancer sanguinolentus, Herbst, Naturgesch. d. Krab. i. p. 161, pl. viii. ff. 56-57 (1796).

Portunus sanguinolentus, Fabr. Suppl. Ent. Syst. p. 367 (1798).

Lupea sanguinolenta, M.-Edw. Hist. Nat. Crust. t. i. p. 451 (1834).

Neptunus sanguinolentus, A. M.-Edw. Arch. Mus. t. x. p. 319 (1861); Hasw. Cat. Austr. Crust. p. 77 (1882); Henderson, Trans. Linn. Soc., Zool. vol. v. p. 368 (1893).

Hab. Singapore; sandy shore. Two males and a female.

Dim. ♂ 52 × 28. ♂ 40.5 × 22. ♀ 37.5 × 20.

✓ 61. NEPTUNUS (AMPHITRITE) HASTATOIDES Fabr. (Plate XLV. fig. 7.)

Portunus hastatoides, Fabr. Suppl. Ent. Syst. p. 368 (1798).

Cancer hastatus, Herbst, Naturgesch. d. Krabben, iii. p. 3, pl. lv. f. i. (1803).

Lupea hastata, M.-Edw. Hist. Nat. Crust. t. i. p. 455 (1834).

Portunus (Amphitrite) hastatoides, de Haan, Crust. Japon. p. 39, pl. i. f. 3 (1839).

Neptunus hastatoides, Henderson, Trans. Linn. Soc., Zool. vol. v. p. 368 (1893).

Neptunus (Amphitrite) hastatoides, de Man, Zoolog. Jahrb. Bd. viii. p. 557 (1895).

Hab. Singapore; 5 fms., mud. Five small males and one female.

In two of these the dark spot, on the end of the dactyls of the last pair, is absent. Like Dr. de Man's Malacca examples (*t. c.*) the middle teeth of the front project only as far as the middle portion of the upper orbital margin. The teeth mentioned by Dr. de Man as occurring on the distal end of the hind border of the meri of the last pair of legs are not readily distinguished in these small examples, but they seem to be variable and not constant.

I note the following sexual differences in this species:—

Males. The hind margin of the abdomen as seen from below (*i. e.* hind margin of 3rd segment) is medianly emarginate, and curved forward at the sides. The first and second sternal segments are crossed by transverse rows of granules, which are prominent in the larger examples.

Females. The hind margin of the abdomen not, or very faintly, emarginate, and almost transverse; first and second sternal segments smooth.

Dim. ♂ 15.5 × 9.5. ♂ 15 × 9. ♂ 15.5 × 9. ♂ 10.5 × 6.
♂ 12 × 19. ♀ 4.75 × 8.

XXXVIII. Genus ACHELOUS de Haan.

62. ACHELOUS WHITEI A. M.-Edw.

Achelous whitei, A. M.-Edw. Arch. Mus. t. x. p. 343, pl. xxxi. f. 6 (1861); Walker, Journ. Linn. Soc., Zool. vol. xx. p. 110 (1887); Henderson, Trans. Linn. Soc., Zool. vol. v. p. 371 (1893).

Hab. Singapore; up to 12 fms. An adult male and adult female; a spurious male, with the whole of the under surface covered with parasitic organisms, and a spurious female, less densely beset with the same parasite (= a *Sacculina*). In the adult female the last (epibranchial) spine is but little bigger than those in front, and the breadth of the carapace is relatively less than in the male.

Dim. ♂ 18 × 11.5. ♀ 16 × 12.

63. ACHELOUS RUBRO-MARGINATUS, sp. nov. (Plate XLVI. fig. 8.)

Hab. Singapore; taken from off a floating piece of wood. A single specimen, a female.

Carapace only moderately broad, and somewhat convex, covered with numerous, evenly disposed, and granulated prominences, between which is an exceedingly dense, short pubescence; this extends on to the prominences, but not so as to conceal the granules on them, which are quite smooth and rounded. Frontal lobes six: two median, short and conical, separated by a wide fissure from the submedian, which are broader and directed more obliquely outwards than the median, but do not project farther forwards; a deeper, wider, fissure separates these from the laterals, which are broad and less prominent, and form the internal orbital angle. All these lobes are granulated. Superior orbital margin granulated, with two fissures; tooth of external angle broad and salient; tooth next behind this about half the size, and the six antero-lateral teeth following equal, and still smaller than the second, all directed forwards; last tooth strong, a very little larger than the external tooth of the orbit, and with its point curved forwards. Lower orbital border granulous, with a deep fissure in its external half; internal angle of this lower border forming a strong and prominent tooth. Basal joint of antennæ broad, and reaching the infero-lateral process of the front, next joint moderately dilated; flagellum smooth and not very long. Ischium

of external maxillipedes with a longitudinal groove near its inner margin; merus with its external angle much dilated, this dilatation separated off by a broad groove. All the under surface, maxillipedes, abdomen, &c., clothed with pubescence, with longer hairs in places. The antero-lateral teeth are partially hidden by a line of long, thickly placed hairs, arising just below the margin of the carapace.

Merus of chelipedes with its anterior half visible from beneath the carapace; upper surface concave and faintly pubescent where it is applied to the carapace, somewhat rounded and more densely pubescent in front. Anterior margin with long hairs, and five teeth; one of these is placed about the centre of the margin; behind it are three placed very close together, closer to each other than the first of them is to the spine in the centre of the margin, the first being the same size as that in front, the two behind it being equal and half the size. Posterior margin convex, with long hairs, and a single small tooth at the distal end. Carpus externally pubescent, and costate; with a strong spine at its inner angle, and a smaller one on its lower outer surface. Hand rather thick, everywhere pubescent, externally with three strong costæ, and above with two, less strong costæ, none of them pubescent; the internal costa of the upper surface bears a single, forwardly directed spine at its distal extremity, between the two next costæ there is a similar spine at the angle of the joint, and the lowermost costa is continued on to the immobile finger. Each of the fingers presents five costæ, all perfectly smooth, except the uppermost one on the dactyl, which is evenly granulate at the base. Inner margins dentate, teeth strong and laciniate; tips decussate. Ambulatory legs much compressed, dactyls styliform; under margins of all the joints lined with hairs.

Colour dull yellow, granules lighter than pubescence; teeth of meri and antero-lateral margins with their bases red and their tips white.

Dim. 50×34.5 .

Base of chelipede to tips of fingers	about 75 mm.
Length of hand	about 16 mm.
Length of dactyl of hand	about 16 mm.

XXXIX. Genus GONIOSOMA A. M.-Edw.

64. GONIOSOMA AFFINE Dana.

Charybdis affinis, Dana, U.S. Expl. Exped., Crust. pt. i. p. 286, pl. xvii. f. 12 (1852).

Goniosoma affine, A. M.-Edw. Arch. Mus. t. x. p. 384 (1861); de Man, Mergui Crust. p. 80, pl. v. f. 2 (1888); Henderson, Trans. Linn. Soc., Zool. vol. v. p. 374 (1893); de Man, Zoolog. Jahrb. Bd. viii. p. 559 (1895).

Hab. Singapore; sandy shore. One male example.

In this individual the merus of the left chelipede has the typical three spines on its anterior border, the most posterior being smaller than the two in front; on the right side, however,

there is another small tooth between the first two spines, and an even smaller one between the second and third. Dr. de Man (Mergui, Crust. l. c.) says: "The outer and upper surfaces of the hands of *G. affine* are covered with short hairs, whereas in the specimen of *G. cruciferum*" (*i. e.* the only one obtained from the Mergui Archipelago) "their surfaces are perfectly glabrous and smooth." In this example of *G. affine*, their surfaces are nearly smooth in the case of the left chelipede, which is smaller than the right; the carpi are in both cases externally hairy.

Dim. 35×24 .

XL. Genus SCYLLA de Haan.

65. SCYLLA SERRATA Forskål.

Cancer serratus, Forskål, Descr. Anim. p. 90 (1775).

Cancer olivaceus, Herbst, Naturgesch. d. Krab. ii. p. 157, pl. xxxviii. f. 3 (1794).

Portunus tranquebaricus, Fabr. Suppl. Ent. Syst. p. 366 (1798).

Lupea tranquebarica, M.-Edw. Hist. Nat. Crust. t. i. p. 448 (1834).

Portunus (Scylla) serratus, de Haan, Crust. Japon. p. 44 (1839).

Scylla serrata, A. M.-Edw. Arch. Mus. t. x. p. 349 (1861); Hasw. Cat. Austr. Crust. p. 79 (1882); Henderson, Trans. Linn. Soc., Zool. vol. v. p. 372 (1893).

Hab. Singapore; one large male, caught in the fishing-stakes used by the natives, about 3-6 fms.

Dim. 152×102 .

XLI. Genus THALAMITA Latr.

66. THALAMITA CRENATA Latr.

Portunus crenatus, Latr. Coll. du Muséum.

Thalamita crenata, Rüpp. Krab. d. rothen Meeres, pl. 6, pl. i. f. 2 (1830); M.-Edw. Hist. Nat. Crust. t. i. p. 461 (1834).

Thalamita prymna, var. *crenata*, Kossmann, Zoolog. Ergebn., Malacostraca, p. 48 (1877).

Thalamita crenata, de Man, Mergui Crust. p. 79 (1888).

Hab. Singapore; from the nets of native fishermen. Three females. I note the following variations:—

Specimen A. The 4th antero-lateral tooth on the left side is only represented by a prolongation of the posterior edge of the tooth in front; thus forming one enormous tooth, completely filling the normal positions of the 3rd and 4th teeth. Right side normal. Posterior border of penultimate joint of last legs dentate.

Specimen B. Normal, except for denticulation of the posterior border of the penultimate joint of the last legs.

Specimen C. Penultimate joint of last legs denticulate; carapace, chelipedes, and posterior surface of last legs thickly covered with short hairs.

Dim. ♀ 67×44 . ♀ 60×39.5 . ♀ 53×35.5 .

67. THALAMITA SPINIMANA Dana.

Thalamita spinimana, Dana, U.S. Expl. Exped., Crust. p. 283, pl. xvii. f. 8 (1852); A. M.-Edw. Nouv. Arch. Mus. t. ix. p. 165, pl. iv. f. 5 (1873).

Thalamita prynna, var. *spinimana*, Kossmann, Zoolog. Ergebn., Malacostr. pp. 47-49 (1877).

Thalamita spinimana, de Man, Mergui Crust. p. 76, pl. iv. f. 7 (1888).

Hab. Singapore; from a shoal exposed at low water. Four males and two females. The approximation of the median lobes of the front varies, from a state of almost complete fusion in the smallest to a separation of quite a millimetre in the largest. In one female the median and submedian frontal lobes are partially fused.

Dim. ♂ 70 × 43. ♂ 59.5 × 37. ♂ 48 × 30.5. ♂ 59.5 × 37.
♀ 56 × 35. ♀ 54 × 33.5.

68. THALAMITA DANÆ Stimpson.

Thalamita crenata, Dana, U.S. Expl. Exped. pt. i. p. 282, pl. xvii. f. 7 (1852).

Thalamita danæ, Stimpson, Proc. Ac. Nat. Sci. Philad. p. 37 (1858); A. M.-Edw. Arch. Mus. t. x. p. 366, pl. xxx. f. 1 (1861).

Thalamita stimpsoni, A. M.-Edw. t. c. p. 362, pl. xxxv. f. 4.

Thalamita danæ, de Man, Mergui Crust. p. 78 (1888).

Hab. Singapore; littoral. Five adult females, three with ova, and four young males. These are all of the variety *stimpsoni*, with rudimentary fourth antero-lateral tooth.

Dim. ♀ 42 × 26. ♀ 27 × 17.5. ♀ 25.5 × 16.5. ♀ 21 × 12.5.
♀ 20 × 13.

XLII. Genus POTAMON Sav.

69. POTAMON (PARATHELPHUSA) TRIDENTATUM INCERTUM, var. nov. (Plate XLVI. fig. 10.)

For species cf. M.-Edw. Arch. Mus. t. vii. p. 171, pl. xiii. f. 1. (1854-55); Heller, 'Novara' Reise, Crust. p. 34 (1867); von Martens, Archiv für Naturgeschichte, pp. 18-22 (1868); Targioni-Tozzetti, Zoologia del viaggio della Magenta, Crostacei, p. 93, pl. vi. f. 4 (1877); de Man, Notes Leyd. Mus. vol. xxi. nos. i.-iii. pp. 67-70 (1899).

Hab. Singapore; from a lake in the Botanical Gardens. Three males and two females, ranging from 17 mm. to 39.5 mm. in the length of the carapace.

The most notable point in this well-marked variety is the structure of the inner and under angle of the eyes. The lower of the two teeth described by M.-Edw. as occurring in this position is well developed, and agrees entirely with his description and figure, but the upper tooth is not all prominent, though still represented by a very small lobe, occupying the same position and abutting on

the basal joint of the antenna, but leaving the orbit widely open at this point.

The postfrontal ridge is sinuous and not straight: and the extra-orbital tooth is lobular and not pointed, though its anterior angle is rather sharp. In this latter respect it agrees with a description by von Martens of seven Borneo examples (tom. cit.). As it has the same shape in all these individuals irrespective of size or sex, I do not think it is a peculiarity of age, as he at first suggests, but rather one of local race: the possibility of which von Martens admits a few lines further on.

In none of these specimens can I find any traces of the longitudinal groove of the median crest of the palate. As with Heller's examples of the species (t. c.), the meri of all five legs bear a sub-terminal spine on their anterior margins: in all other respects they agree with M.-Edwards's description. In colour they are uniformly dark brown above, with a tendency to yellow below.

These crabs form burrows with two mouths, one of which would open on the bank of the lake, just above the level of the water, the other opening at a distance of at least 10 feet over a stream which carries off the surplus water of the lake: the burrow, between its mouths, being straight and horizontal, more or less.

Tozzetti gives a figure of the internal angle of the orbit, but I cannot determine from it whether the upper tooth is well- or ill-developed, and he makes no mention of it in the text. He also describes the sub-apical teeth of the meropodites as being much less acute than in the *Thelphusæ* generally, and figures that on the 2nd pair, showing it to be more of a rounded lobe than a tooth: in all five legs in this variety they are, on the contrary, very acute indeed. External maxillipedes, male abdomen, and hands of chelipedes, however, entirely agree with his description and figures.

Dim. ♂ 52 × 38.5. ♂ 42 × 33. ♂ 37 × 28. ♀ 38 × 30.75.
♀ 19.75 × 16.

Length taken from base of rostrum to middle of posterior border.

XLIII. Genus *CARCINOPLAX* M.-Edw.

70. *CARCINOPLAX SUBINTEGER*, nom. nov. (Plate XLVI. fig. 9.)

Carcinoplax integra, Miers, 'Alert' Crust. p. 543, pl. xlvi. fig. C (1884).

Carcinoplax integra, de Man, Mergui Crust. p. 93 (1888).

Hab. I am uncertain as to whether this was obtained at Singapore or Malacca, or at what depth it occurs.

3 males, and 1 female with ova.

I propose to alter Mr. Miers's specific name in view of the fact that the antero-lateral margins are not entire but dentated. This I find to be the case in all my specimens (3 ♂ and 1 ♀), and also in two examples in the Museum from the Mergui collection. There are 4 teeth, small but distinct: the first two are low, broad, and truncate, the 2nd about as broad as the first; the 3rd, about

half the breadth of those in front, is also slightly more prominent; the 4th, very small and tuberculiform, lies close behind the 3rd: all are granulated.

In the larger individuals, the pubescence that covers both palms externally in the smaller tends to disappear from below upwards in the *right* palm; leaving the upper margin, in the largest example, and the base of the palm still thickly covered, while the rest of the surface is naked, smooth, and of a white colour. In the last mentioned example, also, the space between the bases of the finger of the *left* chela has lost its hairy covering.

Dim. ♂ 10.5 × 7.5. ♂ 7.75 × 6.25. ♂ 7.5 × 6. ♀ 6.25 × 5.

Length taken from base of rostrum to middle of posterior border.

70 a. CARCINOPLAX SUBINTEGER HIRSUTIOR, var. nov.

Hab. Singapore; littoral. A male, which has lost its right chelipede.

This variety shows a much greater development of hair than the preceding species. The front has a fringe of long silky hairs, which spring from a line connecting the external angles of the front; and similar hairs are seen thickly placed on the chelipede and legs, more especially on the anterior and superior faces of the carpo- pro- and dactylopodites: the meri are relatively smooth. In the left chelipede the hairs extend to the tips of the fingers but not on them: these tips are brown, the rest of the fingers white, as seen through the less dense covering of hair. I may add that the 2nd of the four antero-lateral teeth (orbital angle included) is less flattened and more prominent than in *C. subinteger*.

This variety is well-marked and the differences may be specific — *e. g.*, the denser hairiness, the somewhat different 2nd antero-lateral tooth, and the different coloration of the fingers; but it is difficult to form a certain opinion from a single individual, in which, moreover, a chelipede is wanting.

Dim. 10.75 × 8. Length taken from base of rostrum to middle of posterior border.

XLIV. Genus CERATOPLAX Stimpson.

71. CERATOPLAX LÆVIS Miers.

Ceratoplax? lævis, Miers, 'Alert' Crust. p. 244, pl. xxv. fig. C (1884).

Hab. Singapore; 2½ fms. One male specimen.

Dim. 6.5 × 4.75. Length taken from base of rostrum to middle of posterior border.

XLV. Genus OCYPODE Fabr.

72. OCYPODE CERATOPHTHALMA Pallas.

Cancer ceratophthalmus, Pallas, Spicil. Zool. fasc. ix. p. 83, pl. v. f. 17 (1772).

Ocypode ceratophthalma, Fabr. Suppl. Ent. Syst. p. 347 (1798).

Ocypoda ceratophthalma, M.-Edw. Hist. Nat. Crust. t. ii. p. 48 (1837); Hasw. Cat. Austr. Crust. p. 94 (1882); Walker, Journ. Linn. Soc., Zool. vol. xx. p. 110 (1887); de Man, Mergui Crust. p. 107 (1888); Hend. Trans. Linn. Soc., Zool. vol. v. p. 387 (1893).

Ocypode ceratophthalma, de Man, Zoolog. Jahrb. Bd. viii. p. 570 (1895).

Hab. Singapore and Malacca: in holes in the dry sand, above the mean high-water mark. These holes are not more than a foot to a foot and a half in depth, with at least one more or less sharp turn in them: they are only covered at the highest spring tides, at least in the great majority of cases. Five males and two females, all adult, about 35–40 mm. in length: seven males and a female, ranging from 5–20 mm.

The individual 20 mm. long shows the first trace of ocular styles in the shape of tubercles barely a millimetre in length (*cf.* de Man, Zoolog. Jahrb. l. c.); that next in size, 13 mm. long, shows no trace of them.

Close to the distal extremity of the eyestalk, in the young specimens, may be seen a small hair: and a little farther back a similar hair, just where the stalk is left uncovered by the cornea. In the adult this second hair retains its position, but the first is carried farther and farther away, as the ocular style increases in length. These two hairs may equally be seen in *O. cordimana*, but with numerous smaller hairs interspersed between and around them. In four of the smallest specimens the epibranchial angles attain the same level as the external orbital angle, the margin between being straight or concave: in the other two it projects farther than the orbital angle, the margin between being concave just behind the latter angle, but becoming convex towards the epibranchial. In the individual of 13 mm. length it is much more prominent than the orbital, and forms a sharp angle: the antero-lateral margin is straight. In the adults the two angles are approximately on the same level, with the margin between slightly concave.

Dim. ♂ 41.5 × 36.5. ♂ 41 × 37. ♂ 40.5 × 36.5. ♂ 35 × 31.75
♂ 32.5 × 29. ♂ 23 × 20. ♀ 40.75 × 36.5. ♀ 37.5 × 34.5
♀ 35 × 31.

Breadth taken from epibranchial angles.

73. OCYPODE CORDIMANA Latr.

Ocypoda cordimana (Latr.) M.-Edw. Hist. Nat. Crust. t. ii. p. 45 (1837); de Man, Notes Leyden Mus. vol. iii. p. 248 (1881); id. Mergui Crust. p. 108 (1888); id. Zoolog. Jahrb. Bd. viii. p. 572 (1895); Henderson, Trans. Linn. Soc., Zool. vol. v. p. 387 (1893).

Hab. Singapore: holes like those of *O. ceratophthalma*. Two males and a female. Prof. Henderson (t. c.) states that it is "terrestrial, and lives in burrows at some distance from the sea." These specimens came from holes which would sometimes be liable to be covered by the sea, though the strip of beach was not an open

one like that which supplied specimens of *O. ceratophthalma*, but part of a small bay, and further protected by an expanse of the mangroves which grow out into the sea on many of the islets round Singapore.

Dim. ♂ 33·25 × 30·25. ♂ 32·75 × 31. ♀ 35·5 × 30·5.

Breadth taken from epibranchial angles.

XLVI. Genus *UCA* Leach.

74. *UCA ACUTA* Stimpson.

Gelasimus acutus, Stimpson, Proc. Ac. Nat. Sci. Philad. p. 99 (1858); de Man, Mergui Crust. p. 113, pl. vii. ff. 8-9, pl. viii. ff. 1-4 (1888); id. Zoolog. Jahrb. Bd. viii. p. 573 (1895).

Hab. Singapore: Malacca, from mangrove-swamps near the edge of the sea. From Malacca there are five males; from Singapore three males, six females and two young examples. The difference in coloration between these two sets is interesting. The Malacca specimens have their carapace of a light blue-green colour, and the external surface of the hand rose-coloured: in those from Singapore the carapace is a fine purple, with, in most cases, two light blue spots on each side of the gastric region, and the hands externally are of a deep plum-colour. In one or two of the females the purple of the carapace becomes mottled in front with green, this colour tending to replace the former.

The Singapore specimens were obtained from the same place as the next-described species; which is interesting, in view of their close relationship to each other.

Dim. (a) Singapore forms:—♂ 13·75 × 9·5. ♂ 28 × 18. ♂ 16·5 × 11. ♀ 23·5 × 16. ♀ 19·5 × 13·5. ♀ 17·5 × 12. ♀ 17 × 12. ♀ 16·5 × 11·5.

(b) Malacca forms:—♂ 20·5 × 12. ♂ 20 × 12. ♂ 19 × 11·75. ♂ 18 × 11. ♂ 17·25 × 10·75.

75. *UCA DUSSUMIERI* M.-Edw.

Gelasimus dussumieri, M.-Edw. Ann. Sci. Nat. ser. 3, t. xviii. p. 148, pl. iv. f. 12 (1852); Kingsley, Proc. Ac. Nat. Sci. Philad. p. 145 (1880); de Man, Mergui Crust. p. 108, pl. vii. ff. 2-7 (1888); id. Zoolog. Jahrb. Bd. viii. p. 576 (1895).

Hab. Singapore: from the shore on the mouth of a small river. Seven males and thirteen females. Colour of females, when alive, a rich blue over the carapace, a light sky-blue on the legs; the males a more sombre brown or bronze; lower half of hand, and index, orange; upper half, and dactyl, nearly white.

In some cases the females were ornamented with one median, or one median and two lateral, fair-sized white spots in the gastric region. The interest of the colour-marking here lies in the fact that the gay colours appear in the females; and not in the males, as is generally the case (*cf.* Darwin's 'Descent of Man,' 2nd ed. 1894, p. 271).

Dim. ♂ 28 × 17·5. ♂ 28 × 17·5. ♂ 27 × 17·5. ♂ 22 × 14·5.

♂ 18.5 × 12.75. ♂ 18.5 × 12.5. ♂ 14.5 × 9.5. ♀ 23.5 × 16.5.
♀ 21.5 × 14.75. ♀ 23 × 15. ♀ 22 × 14.5. ♀ 20.5 × 14.

76. *UCA VOCANS* M.-Edw.

Gelasimus vocans, M.-Edw. Ann. Sci. Nat. sér. 3, t. xviii. p. 145, pl. iii. f. 4 (1852).

? *Gelasimus cultrimanus*, Ad. & White, 'Samarang' Crust. p. 49 (1848).

Gelasimus nitidus Dana, U.S. Expl. Exped., Crust. pt. i. p. 316, pl. x. f. 5 (1852).

Gelasimus vocans Miers, Ann. Mag. Nat. Hist. ser. 5, vol. v. p. 308 (1880); id. 'Challenger' Brachyura, p. 242 (1886); Hasw. Cat. Austr. Crust. p. 92 (1882); Walker, Journ. Linn. Soc., Zool. vol. xx. p. 110 (1887).

Hab. Singapore and Malacca: burrowing in the beach, holes covered at high water. Six males and three females.

In one male the tooth between the base of the index and the subdistal tooth is absent.

Dim. ♂ 20 × 13.5. ♂ 18 × 12.5. ♂ 17 × 11.5. ♂ 15 × 10.25
♂ 13.75 × 9.5. ♂ 12.75 × 8.75. ♀ 16.75 × 12.25. ♀ 16.25 × 11.5. ♀ 14.75 × 10.25.

77. *UCA TETRAGONON* Herbst.

Cancer tetragonon, Herbst, Naturgesch. d. Krab. i. p. 257, pl. xx. f. 110 (1790).

Gelasimus tetragonon, Rüpp. Besch. 24 Krab. p. 25, pl. v. f. 5 (1830); M.-Edw. Hist. Nat. Crust. t. ii. p. 42 (1837); id. Ann. Sci. Nat. sér. 3, t. xviii. p. 147, pl. iii. f. 9 (1852); Kingsley, Proc. Ac. Nat. Sci. Phil. p. 143, pl. ix. f. 11 (1880).

Hab. Singapore: a male from the shore at the west entrance to the New Harbour.

Dim. 24.5 × 17.

78. *UCA ANNULIPES* M.-Edw.

Gelasimus annulipes, M.-Edw. Hist. Nat. Crust. t. ii. p. 55, pl. xviii. ff. 10-13 (1837); id. Ann. Sci. Nat. sér. 3, t. xviii. p. 149, pl. iv. f. 15 (1852).

Gelasimus perplexus, M.-Edw. t. c. p. 150, pl. iv. f. 18.

Gelasimus annulipes, Kingsley, Proc. Ac. Nat. Sci. Philad. p. 148 (1880); de Man, Mergui Crust. p. 118, pl. viii. ff. 6-7 (1888); id. Zoolog. Jahrb. Bd. viii. p. 577 (1895); Henderson, Trans. Linn. Soc., Zool. vol. v. p. 388 (1893).

Hab. Singapore: very common in holes on the shore, or a short distance inland, near brackish and tidal water.

Out of 63 males 34 have the big claw on the right side, and 29 have it on the left; 13 females. There are also a male and a female from Malacca. General colour of the carapace, alternate transverse, rather irregular, bands of light blue and black.

Dim. ♂ 14.5 × 9. ♂ 15 × 8.75. ♂ 13.5 × 7.75. ♂ 13 × 7.5.

♂ 13.5 × 8. ♂ 12.5 × 7.5. ♀ 11 × 6.75. ♀ 12.5 × 8. ♀ 11.5 × 6.5.
♀ 10.5 × 6.25. ♀ 10.5 × 6.

XLVII. Genus GRAPSUS Lam.

79. GRAPSUS STRIGOSUS Herbst.

Cancer strigosus, Herbst, Naturgesch. d. Krab. iii. p. 55, pl. xlvii. f. 7 (1799).

Grapsus (Goniopsis) strigosus, de Haan, Crust. Japon. p. 33 (1839).

Grapsus strigosus, A. M.-Edw. Nouv. Arch. Mus. t. ix. p. 286 (1873); Hasw. Cat. Austr. Crust. p. 97 (1882); Walker, Journ. Linn. Soc., Zool. vol. xx. p. 110 (1887); Henderson, Trans. Linn. Soc., Zool. vol. v. p. 390 (1893).

Hab. Singapore; rocks along the shore. Two males and a female.

General colour of carapace and legs a light yellow with maroon markings, the latter having a somewhat linear arrangement on the sides of the carapace.

Dim. ♂ 52 × 49.5. ♂ 38.5 × 36. ♀ 47.5 × 43.

XLVIII. Genus METOPOGRAPSUS M.-Edw.

80. METOPOGRAPSUS OCEANICUS Jacq. & Lucas.

Grapsus oceanicus, Jacq. et Lucas, Voyage au Pôle du Sud, Crust. p. 73, pl. vi. f. 9 (Hombroun et Jacq. tome iii. 1853).

Metopograpsus quadridentatus, Stimpson, Proc. Ac. Nat. Sci. Philad. p. 102 (1858).

Metopograpsus oceanicus, Kingsley, Proc. Ac. Nat. Sci. Philad. p. 191 (1880).

? *Pachygrapsus transversus*, Gibbes, et syn. vide Kingsley, t. c. p. 199; Walker, Journ. Linn. Soc., Zool. vol. xx. p. 110 (1887).

Hab. Singapore: from rocks or piles of landing-stages. Twelve males and sixteen females, five having ova. Carapace generally has a mottled appearance of green and purple; but the colour of these crabs is exceedingly variable.

I have also from Malacca six specimens, three male and three female, of a form which seems to be identical with *Pachygrapsus transversus* Gibbes; the internal subocular lobe being reduced so that the antennæ just enter the orbit. They also agree with descriptions given of that species. But, excepting that the antennæ are more in contact with the orbit, these individuals agree so entirely with those of *Metopograpsus oceanicus*, that I am inclined to agree with Mr. Walker (t. c. p. 113) that *P. transversus* is a variety of a *Metopograpsus*—but of *M. oceanicus*; not *M. messor*, as he suggests, seeing that this latter species has no teeth on the antero-lateral margin.

Dim. ♂ 28.5 × 24. ♂ 28.5 × 23.5. ♂ 27 × 22.5. ♂ 25.25 × 22.
♂ 24 × 20.5. ♂ 22.25 × 19. ♀ 34 × 28. ♀ 33.5 × 27. ♀ 29 × 24.
♀ 26 × 21.5. ♀ 27 × 22.5. ♀ 24 × 19.

XLIX. Genus VARUNA M.-Edw.

81. VARUNA LITTERATA Fabr.

Cancer litteratus, Fabr. Suppl. Ent. Syst. p. 342 (1798); Herbst, Naturgesch. d. Krab. iii. p. 58, pl. xlviii. f. 4 (1799).

Varuna litterata, M.-Edw. Hist. Nat. Crust. t. ii. p. 95 (1837).

Grapsus (Trichopus) litteratus, de Haan, Crust. Japon. p. 32 (1839).

Varuna litterata, Hasw. Cat. Austr. Crust. p. 103 (1882)
Henderson, Trans. Linn. Soc., Zool. vol. v. p. 391 (1893).

Hab. Singapore; from off a floating log of wood. Two males and four females.

The shape of the frontal margin is slightly variable. According to Herbst, it is "in der Mitte ein wenig aufgeschnitten": and his figure shows it to be very distinctly concave. Of these specimens it is very slightly, yet distinctly concave in three; in the other three it is straight.

Dim. (a) With straight front.

♂ 31.5 × 30. ♀ 26.5 × 25.75. ♀ 21 × 20.

(b) With concave front.

♂ 29 × 26.5. ♀ 30.5 × 28.5. ♀ 25.75 × 25.

L. Genus SESARMA Say.

82. SESARMA QUADRATA Fabr.

Cancer quadratus, Fabr. Suppl. Ent. Syst. p. 341 (1798).

Sesarma quadrata, M.-Edw. Hist. Nat. Crust. t. ii. p. 75 (1837); Hilgendorf, von d. Decken Reise, p. 90, pl. iii. f. 3 c (1869).

Sesarma quadratum, A. M.-Edw. Nouv. Arch. Mus. t. ix. p. 302 (1873).

Grapsus (Pachysoma) quadratus, de Haan, Crust. Japon. p. 62, pl. viii. f. 3 (1839).

Grapsus (Sesarma) affinis, de Haan, t. c. p. xxx.

Sesarma aspera, Heller, Crust. der Novara Reise, p. 63, pl. vi. f. 1 (1867); de Man, Mergui Crust. p. 169 (1888).

Sesarma quadrata, Henderson, Trans. Linn. Soc., Zool. vol. v. p. 392 (1893).

Hab. Singapore; taken from under decayed logs of wood on marshy ground a short distance from the sea. Two males: typical specimens of *S. quadrata*, with eleven tubercles on the dactyl.

Sesarma aspera Heller I judge to be a variety of *S. quadrata*, and not distinct.

Dim. ♂ 19.5 × 16. ♂ 14 × 11.5.

83. SESARMA TENIOLATA White.

Sesarma teniolata, White, List Crust. Brit. Mus. p. 38 (1847).

Sesarma mederi, M.-Edw. Ann. Sci. Nat. t. xx. p. 185 (1853).

Sesarma teniolata, de Man, Mergui Crust. p. 181 (1888); id. Zoolog. Jahrb. Bd. ix. p. 166 (1897); Bürger, Zoolog. Jahrb. Bd. vii. p. 615 (1894).

Hab. Malacca; mangrove swamp on the edge of the sea. Two males (one young) and two females. These are all covered, on the back of the carapace, with dense tufts of hair.

Dim. ♂ 34 × 32.5. ♂ 19 × 16. ♀ 36.5 × 33. ♀ 32 × 29.

84. SESARMA CALYPSO de Man.

Sesarma (*Parasesarma*) *calypso*, de Man, Zoolog. Jahrb. Bd. ix. pp. 185–189 (1897), & Bd. x. pl. xxx. f. 34 (1898).

Hab. Malacca; littoral. Two males.

I am inclined to refer these to the above species, because in the general form of the carapace and chelipedes they agree with Dr. de Man's description, and more especially in the cross-markings on the tubercles of the dactyl, which are very distinctive: they give them an appearance which Dr. de Man describes as "treppenformig," for which I can find no English equivalent. There are, however, two points in which these individuals differ from the type: (a) in the number of the tubercles; these are fewer, being 8–9 instead of 12–13: (b) in the number of pectinated ridges (= Kammleisten, de Man) of the hand. Of these, in the larger male there are four, all well-marked, the proximal one being a little shorter than the distal three, which are equal in length. In the smaller, however, there are only three on the left hand, *i. e.* counting disto-proximally 1, 2, and 4: 3 being merely represented by a short line of granules projecting only a little way between the external terminations of 2 and 4. In the right hand, 3 is more developed as a pectinated ridge extending half-way to the internal upper margin, and 4 is correspondingly reduced to a granular line, becoming externally fainter. Allowing, then, for this variability, and also for the fact that the actual number of tubercles on the dactyl is also slightly variable in the species of *Sesarma*, I have not thought it advisable to separate these two individuals from *S. calypso*. Colour of hands orange-red.

Dim. ♂ 17 × 13. ♂ 16.5 × 12.5.

85. SESARMA ONYCHOPHORA de Mau.

Sesarma (*Perisesarma*) *onychophora*, de Man, Zoolog. Jahrb. Bd. ix. pp. 214–18 (1897), & Bd. x. pl. xxxi. f. 39 (1898).

Hab. Singapore: off wooden piles. Two males, and a female with ova. Colour of hands deep red.

Dim. ♂ 16.75 × 13.25. ♂ 15 × 12. ♀ 17.75 × 14.

86. SESARMA EDWARDSI de Man.

Sesarma edwardsi, de Man, Mergui Crust. pp. 185–188, pl. xiii. ff. 1–4 (1888); *cf.* also *Sesarma edwardsi*, var. *levimana*, Zehntner, Rev. Suisse Zool., tom. ii. fasc. i. p. 181 (1894).

Sesarma edwardsi, var. *crassimana*, de Man, Mergui Crust. p. 188; Zehntner, t. c. p. 180.

Hab. Malacca. These specimens were taken from the stomach of a species of *Varanus*, the monitor lizard. A male and female

are representative of the species: and two males and two females (although with some doubt) of *M. Zehntner's* variety. I also find two males answering to Dr. de Man's var. *crassimana*; these were obtained on the shore.

Dim. ♂ 14 × 13. ♀ 17 × 15.

Var. *crassimana*. ♂ 11.5 × 10.25. ♂ 7.75 × 7.25.

Var. *laevimana*? ♂ 12 × 10.5. ♂ 12.75 × 11. ♀ 10 × 9.
♀ 9 × 7.75.

87. *SESARMA FASCIATA*, sp. nov. (Plate XLVII. fig. 12.)

Hab. Singapore: marshy ground near sea. One male and three females.

This species belongs to Dr. de Man's subgenus *Parasesarma*, in which the sides have no tooth behind the orbital angle, and in which there are two or more pectinated ridges on the palms. Carapace smooth to the eye, but under the lens seen to be closely punctated everywhere: sides nearly parallel (but broken up in one of the females just behind the eyes so as to give indications of a tooth behind the orbital angle). Tooth at distal end of the upper border of the merus very small and obtuse, and the anterior border only slightly expanded, the long proximal edge of the expansion being dentated. External surfaces of merus and carpus rugose, inner angle of carpus with a large triangular tooth; outer surface of palm and fingers quite smooth to the eyes, but minutely punctate under the lens; whole inner surface of chelipedes smooth. Inner upper border of hand thick and prominent: external to this there are three pectinated ridges, which lie more nearly longitudinal than transverse. The middle one consists of:—*a*, a short distal portion, practically one with the distal part of the inner upper border; *b*, a longer middle portion running obliquely from near the upper border to the upper part of the posterior border, and cutting off a small semicircular piece of the upper surface in which lies another very small pectinated ridge; and *c*, a proximal portion, curving sharply from the middle portion to run parallel to the posterior border as far as the joint of hand and carpus. The third pectinated ridge starts from the inner and upper base of the dactyl, to run in front of, and parallel with the middle portion of the middle ridge, and to stop abruptly half-way between its starting point and the joint of hand and carpus. Only 5 or 6 obscure, low tubercles can be distinguished on the upper margin of the dactyl, which stop some distance from the tip: inner margins of both fingers with 4 or 5 broad triangular denticulations. Meri of ambulatory legs with a subdistal low and blunt spine; remaining joints with hairs, rather diffuse, but tending to be arranged on the anterior and posterior margins. Male abdomen seven-jointed, broad, regularly tapering from the middle of the 3rd segment to the middle of the 6th where it suddenly narrows; the 7th has a rounded extremity, parallel sides, and is only a little longer than broad. Colour a deep crimson red, with regular mottlings of a light yellow, and a light yellow band, or fascia, placed transversely on the frontal

eminences between the bases of the eyestalks, and extending along the latter as far as the corneæ; but the degree of this mottling varies, and is less conspicuous in some individuals. Hands and fingers bright yellow.

Dim. ♂ 8.75 × 8. ♀ 9.5 × 8.5. ♀ 9.25 × 8.25. ♀ 8.75 × 7.5.

LI. Genus MACROPHTHALMUS Latr.

88. MACROPHTHALMUS DILATATUS CARENS, var. nov. (Plate XLVII. fig. 11.)

Cf. *Ocypode* (*Macrophthalmus*) *dilatata*, de Haan, Crust. Japon. p. 55, pl. xv. f. 3 (1839).

Macrophthalmus dilatatus, M.-Edw. Ann. Sci. Nat. sér. 3, Zool. t. xviii. p. 157 (1852); de Man, Notes Leyd. Mus. vol. xii. pl. iv. f. 9 (1890); Ortmann, Carcinol. Stud., Zool. Jahrb. Bd. x. p. 345 (1898).

Hab. Singapore and Malacca; littoral. Five males and six females, four of the latter carrying ova.

There is a specimen in the Museum from Singapore, from the 'Alert' collection, referred to "*M. dilatatus*, young?," presumably by Mr. Miers; of which, however, I can find no mention in the descriptive account of the 'Alert' Crustacea. It is identical with the present specimens; and on an examination of these, I find them sufficiently distinct from the type to be considered as a well-marked variety.

The average size of these specimens is 15 mm. breadth to 7.5 mm. length: two of the females with ova are considerably larger, but the other three (two having ova) are of these dimensions, so that they may all be regarded as adult. I find the following departures from the type:—

a. The chelipedes are shorter, being only just longer than the breadth of the carapace, whereas in de Haan's species they are not quite half as long again.

b. The spinules on the upper margin of the hand are wanting, and the granules on the outer surface very small, though numerous.

c. A well-marked dentated tubercle exists at the base of the dactyl; and there is a flattened dentated prominence extending from the base to the middle of the thumb, which is less evident in *M. dilatatus*. The thumb is only slightly deflexed, and the carina near the lower margin is rather strong and obscurely granulous.

Dim. ♂ 15 × 8. ♂ 15.5 × 8.25. ♂ 13.75 × 7.5. ♂ 12 × 6.5.
♀ 11.5 × 6.5. ♀ 19.25 × 10. ♀ 18 × 9.5. ♀ 13.5 × 7.5. ♀ 13 × 7.
♀ 12.5 × 7. ♀ 11.5 × 6.5.

89. MACROPHTHALMUS CRASSIPES M.-Edw.

Macrophthalmus crassipes, M.-Edw. Ann. Sci. Nat. sér. 3, Zool. t. xviii. p. 157 (1852); de Man, Notes Leyd. Mus. vol. xii. p. 76, pl. iv. f. 7 (1890); Ortmann, Carcinol. Stud., Zool. Jahrb. Bd. x. p. 345 (1898).

Hab. Singapore; littoral. Four males and three females, one of

the latter with ova: two of the males, however, only represented by exuvia.

The tubercle on the inner margin of the thumb is, in these, rather more flattened than in the type (*v. de Man*, t. c.), leaving a larger interspace between itself and the finger.

Dim. ♂ 17×9.5 . ♂ 17×9.25 . ♂ 15.25×9 . ♂ 12.5×7.5 .
♀ 14.5×8.5 . ♀ 15×8.5 . ♀ 12×6.5 .

90. MACROPHTHALMUS PODOPHTHALMUS Eydoux & Souleyet.

Macrophthalmus podophthalmus, Eyd. & Souleyet, Voy. 'Bonité', Zool. Crust. vol. i. pl. iii. f. 6 (1841); M.-Edw. Ann. Sci. Nat. sér. 3, Zool. t. xviii. p. 155 (1852); Hasw. Cat. Austr. Crust. p. 88 (1882); Miers, 'Challenger' Brachyura, p. 249 (1886).

Hab. Singapore; littoral. A male.

In this specimen the eye-peduncles do not project by much more than a quarter of their length.

Dim. 14×8.5 . Length of eyes 8.25. Length of projecting portion of eyes 2.5.

91. MACROPHTHALMUS JAPONICUS de Haan.

Ocypode (Macrophthalmus) japonica, de Haan, Crust. Japon. p. 54, pl. vii. f. 1, & pl. xv. f. 2 (1839).

Macrophthalmus japonicus, Ad. & White, 'Samarang' Crust. p. 51 (1848); M.-Edw. Ann. Sci. Nat. sér. 3, Zool. t. xviii. p. 158 (1852).

Hab. Singapore; littoral. A female with ova.

Dim. 10.5×8 .

LII. Genus SCOPIMERA de Haan.

92. SCOPIMERA MYCTIROIDES M.-Edw. (Plate XLVII. fig. 14.)

Doto myctiroides, M.-Edw. Ann. Sci. Nat. sér. 3, Zool. t. xviii. p. 152, pl. iv. f. 24 (1852).

Dotilla myctiroides, Walker, Journ. Linn. Soc., Zool. vol. xx. p. 111 (1837).

Scopimera myctiroides, Henderson, Trans. Linn. Soc., Zool. vol. v. p. 390 (1893).

Hab. Singapore. In great numbers on the sand between tide-marks, burrowing in holes.

Out of 81 specimens, I find 7 females, one bearing ova. I think it has hitherto escaped notice that the shape of the female abdomen is almost exactly similar to that of the male. Prof. Henderson (tom. cit.) states that out of a very large series he had only met with males. But on examining a bottle in the Museum collection, labelled "*Sc. myctiroides*, Rameswaram, J. R. Henderson, 92.7.15," I find, out of about 30 examples, at least as many females as males. The female abdomen, however, may still be distinguished externally from that of the male by a generally broader aspect. Taking measurements from the base of the 5th segment to the tip of the

7th, and across the base of the 6th, I find these to be, approximately, for most examples :—

	Length.	Breadth.
♂	4·5 mm.	2 mm.
♀	4 mm.	2·5 mm.

giving a ratio for the female of 1 : 1·6, for the male 1 : 2·25.

Dim. ♂ 7 × 9. ♂ 7·75 × 9·5. ♂ 7·25 × 9. ♂ 8·25 × 10·5.
 ♂ 7 × 8·5. ♂ 6·5 × 8. ♀ 7 × 8·5. ♀ 7 × 8·5. ♀ 7·25 × 8·75.
 ♀ 6·75 × 8. ♀ 6·5 × 8. ♀ 6 × 7·25. ♀ 5·5 × 6·5.

Breadth taken across posterior margin, just above the last legs.

LII. GENUS ELAMENE M.-Edw.

93. ELAMENE UNGUIFORNIS de Haan.

Inachus (Elamene) unguiformis, de Haan, *Crust. Japon.* p. 75, pl. xxix. f. 1 (1839).

Elamene unguiformis, Henderson, *Trans. Linn. Soc., Zool.* vol. v. p. 394 (1893).

Hab. Singapore. A female.

Dim. 6·25 × 6·5.

LIV. GENUS PINNOTHERES Latr.

94. PINNOTHERES SEMPERI Bürger.

Pinnotheres semperi, Bürger, *Zoolog. Jahrb.* Bd. viii. p. 382, pl. ix. f. 28, & pl. x. f. 27 (1895).

Hab. Singapore; right respiratory tree of *Holothuria scabra*. A male, and a female with ova.

The specimens which Dr. Bürger has described came from the cloaca of *Hol. fusco-cinerea*; whereas the specimens we obtained from that Holothurian are, I find, referable to *P. ortmanni*. The host, from which came Dr. Bürger's example of the latter species, was, I suppose, not known, as he makes no reference to it. In both these species, the animal was found high up the respiratory tree, forming an enormous gall; whether it would be able to extricate itself from this, and move, at will, up or down the respiratory tree, I do not know, but it has the appearance of being a fixture, *nolens volens*.

Dim. ♀ 10·5 × 11. ♂ 7·75 × 8.

95. PINNOTHERES ORTMANNI Bürger.

Pinnotheres ortmanni, Bürger, *Zoolog. Jahrb.* Bd. viii. p. 384, pl. ix. f. 30, pl. x. f. 28 (1895).

Hab. Singapore; right respiratory tree of *Holothuria fusco-cinerea*. Two females, both with ova.

Dim. ♀ 12 × 11·5. ♀ 12·25 × 11·75.

96. PINNOTHERES MODIOLICOLA Bürger.

Pinnotheres modiolicola, Bürger, *Zoolog. Jahrb.* Bd. viii. p. 370, pl. ix. f. 9, & pl. x. f. 9 (1895).

Hab. Singapore ; from Lamellibranch shells. Seven females, six with ova.

These were collected by natives, and as I never saw the shells from which the *Pinnotheres* were taken, I am unable to state their genus.

Dim. ♀ 9.5 × 8. ♀ 7 × 5.5. ♀ 6.5 × 5.25. ♀ 10 × 8.25.
♀ 9 × 8. ♀ 9 × 7.5. ♀ 8 × 7.5.

97. PINNOTHERES ARCOPHILUS Bürger.

Pinnotheres arcophilus, Bürger, Zoolog. Jahrb. Bd. viii. p. 371, pl. ix. f. 10, & pl. x. f. 10 (1895).

Hab. Singapore : from Lamellibranch shells. Four females, all with ova. For the same reason as with *P. modiolicola*, I am unable to give the genus of the mollusc they inhabited.

Dim. ♀ 9 × 7. ♀ 10 × 8.5. ♀ 8.5 × 7. ♀ 9 × 7.5.

LV. Genus MATUTA Fabr.

98. MATUTA VICTRIX Fabr.

Matuta victor, Fabr. Suppl. Ent. Syst. p. 369 (1798).

Matuta peronii, Leach, Zool. Misc. iii. p. 13, pl. cxxvii. ff. 1-2 (1817).

Matuta lesuerii, Leach, tom. cit. p. 14.

Matuta victrix, Miers, Trans. Linn. Soc. 2nd ser. Zool. vol. i. p. 243, pl. xxxix. ff. 1-3 (1877); Hasw. Cat. Austr. Crust. p. 134 (1882); Walker, Journ. Linn. Soc., Zool. vol. xx. p. 111 (1887); Henderson, Trans. Linn. Soc., Zool. vol. v. p. 306 (1893).

Matuta victor, Alcock, Journ. As. Soc. Bengal, vol. lxxv. pt. ii. No. 2, p. 160 (1896).

Hab. Singapore ; sandy shore. Three adult males, three young males, and three small females. Also from Malacca two adult and one young female.

Dim. ♂ 46.25 × 42. ♂ 40.5 × 37. ♂ 34.25 × 32. ♂ 24.75 × 23.25. ♂ 24 × 22.5. ♂ 20.25 × 19.25. ♀ 25 × 23. ♀ 22 × 21.75. ♀ 15.25 × 15. ♀ 32 × 30. ♀ 33 × 31.5. ♀ 17 × 16.

99. MATUTA BANKSII Leach.

Matuta banksii, Leach, Zool. Misc. iii. p. 14 (1817); Miers, Trans. Linn. Soc. 2nd ser. Zool. vol. i. p. 245, pl. xl. ff. 1-2 (1877); Walker, Journ. Linn. Soc., Zool. vol. xx. p. 111 (1887); de Man, Archiv f. Naturgesch. p. 389 (1887); Zehntner, Rev. Suisse Zool. t. ii. p. 183 (1894); Alcock, Journ. As. Soc. Bengal, vol. lxxv. pt. ii. No. 2, p. 158 (1896); de Man, Zoolog. Jahrb. Bd. ix. p. 363 (1896).

Hab. Malacca ; littoral. Five males, and two smaller females. In the males, besides some rather big crimson spots on the meri of the legs, there is a very large crimson patch on the penultimate joint of each of the 1st, 2nd, and 4th pairs. The latter is not seen

on the females ; but only a few small spots on the meri. In one of the males the spots on the carapace are arranged in pairs, or even in groups of three, giving it a more densely spotted appearance. I may add that I should describe the rostrum, in these individuals, as being *distinctly* emarginate (*vide* Alcock, t. c., "rostrum entire or faintly emarginate"; and Miers, t. c., "front obtuse and rounded or obscurely emarginate"), the emargination taking the form of a wide, triangular notch, quite as distinct as in *M. lunaris*. Otherwise they entirely agree with Mr. Alcock's description.

Dim. ♂ 35 × 34. ♂ 32 × 30.5. ♂ 31.75 × 31. ♂ 29 × 28.75.
 ♀ 25.5 × 24.25. ♀ 22 × 21.25. ♀ 21.5 × 20.5.

100. MATUTA LUNARIS Herbst.

? *Cancer lunaris*, Herbst, Krab. u. Krebse, i. p. 140, pl. vi. f. 44 (1790).

Matuta planipes, Fabr. Suppl. Ent. Syst. p. 369 (1798).

Cancer lunaris, Herbst, op. cit. iii. p. 43, pl. xlvi. f. 6 (1799).

Matuta lunaris, Miers, Trans. Linn. Soc. 2nd ser. Zool. vol. i. p. 247, pl. xl. f. 10 (1877); Alcock, Journ. As. Soc. Bengal, vol. lxx. pt. ii. No. 2, pp. 161-2 (1896).

Hab. Malacca ; littoral. Two young males and a female.

Dim. ♂ 22.5 × 21.25. ♂ 16.25 × 15. ♀ 20 × 19.

LVI. Genus LEUCOSIA Fabr.

101. LEUCOSIA CRANIOLARIS Herbst.

? *Cancer craniolaris*, Linn. Syst. Nat. 12th ed. p. 1041 (1766); Herbst, Naturgesch. d. Krab. Bd. i. Hft. ii. p. 90, pl. ii. f. 17 (1783); Fabr. Ent. Syst. ii. p. 441 (1792).

Leucosia craniolaris, Fabr. Suppl. Ent. Syst. p. 350 (1798); Bell, Trans. Linn. Soc. vol. xxi. p. 283 (1855).

Leucosia craniolaris, var. *lavimana*, Miers, 'Alert' Crust. p. 250, pl. xxvi. f. A (1884).

Leucosia craniolaris, Walker, Journ. Linn. Soc., Zool. vol. xx. p. 111 (1887); Henderson, Trans. Linn. Soc., Zool. vol. v. p. 397 (1893); Alcock, Journ. As. Soc. Bengal, vol. lxx. pt. ii. No. 2, p. 231 (1896).

Hab. Singapore and Malacca ; 5 fms.; muddy bottom. Two females, of which the larger is from Malacca.

Dim. ♀ 19 × 21.75. ♀ 14.5 × 16.

102. LEUCOSIA RHOMBOIDALIS de Haan.

Leucosia rhomboidalis de Haan, Crust. Japon. p. 134, pl. xxxiii. f. 5 (1839); Bell, Trans. Linn. Soc. vol. xxi. p. 284 (1855).

Leucosia maculata, Stm. Proc. Ac. Nat. Sci. Philad. p. 159 (1858).

Leucosia rhomboidalis, Alcock, Journ. As. Soc. Bengal, vol. lxx. pt. ii. No. 2, p. 234 (1896).

Hab. Singapore : 5 fms. ; muddy bottom. A male and a female. Both these individuals have a row of three yellow spots arranged

crescent-wise on each side of the gastric region, and the female has, in addition, a reticulated yellow patch on the cardiac and uro-cardiac regions.

Dim. ♂ 10.5 × 12. ♀ 12 × 13.5.

103. LEUCOSIA BRUNNEA Miers.

Leucosia brunnea, Miers, Trans. Linn. Soc. 2nd ser. Zool. vol. i. p. 237, pl. xxxviii. ff. 10-12 (1877).

Hab. Singapore: 7 fms.; muddy bottom. A female.

A very deep yellow patch on the uro-cardiac declivity, extending forward laterally nearly to the epibranchial angle; the same yellow colour on all the legs, but less deep on the abdomen.

Dim. 25.5 × 29.75.

LVII. Genus PHILYRA Leach.

104. PHILYRA GLOBOSA Fabr.

Cancer globosus, Fabr. Ent. Syst. ii. p. 441 (1792).

Leucosia globosa, Fabr. Suppl. Ent. Syst. p. 349 (1798).

Philyra globosa, M.-Edw. Hist. Nat. Crust. t. ii. p. 132 (1837).

Philyra porcellana, M.-Edw. t. c. p. 133.

Philyra globosa, de Man, Mergui Crust. p. 203 (1888).

Philyra globosa et *globulosa* et syn., Alcock, Journ. As. Soc. Bengal, vol. lxxv. pt. ii. No. 2, pp. 243-246 (1896).

Philyra polita, Henderson, Trans. Linn. Soc., Zool. vol. v. p. 401, pl. xxxviii. ff. 1-3 (1893).

Hab. Malacca: 5 fms.; muddy bottom. Eight males, seven females: one of the latter carrying ova.

In none of these does the epistome project farther than the front; the inner angles do, but in a greater or less degree in the different individuals. Five of the males have the small tubercle on the abdomen (*P. globulosa*); in the other three it is absent (*P. globosa*)—yet in one of the males with a tuberculated abdomen the whole of the upper surface of the arm is granulated except near the tip (*P. globosa*), while in the three with no tubercle only the proximal half is granular (*P. globulosa*); in all the females it is entirely granulous except at the tip. The internal edge of the exopodite of the external maxillipedes seems to show a gradation from a nearly straight line to a slightly curved one; but, curiously, the nearly straight edge (*P. globosa*) is found in the males with abdominal tubercle (*P. globulosa*), the slightly curved (*P. globulosa*) on a male with no tubercle (*P. globosa*). In all cases the under surface of the meri of the legs is smooth (*P. globosa*); equally in all cases, the size of the granules on the edge of the carapace varies (*P. globulosa*). The males with abdominal tubercles have a low dentiform eminence at the base of the thumb, in those with no abdominal tubercle it is absent; this is the normal correlation in *P. globulosa* and *P. globosa* respectively. The amount of definition of the regions of the carapace varies from one to

another; but the cardiac region is always more or less distinct, and the hepatic regions always project slightly in a lateral and obliquely downward direction, so as to break the plane of the antero-lateral margins.

Dim. ♂ 14.5 × 15. ♂ 13.75 × 13.5. ♂ 12.5 × 13. ♂ 13 × 13.
 ♀ 10.5 × 10.5. ♀ 9.75 × 10. ♀ 12.5 × 12.75. ♀ 13 × 12.75.
 ♀ 15.25 × 15. ♀ 11.5 × 11.5. ♀ 11.5 × 11. ♀ 9 × 9. ♀ 13 × 13.
 ♀ 11.5 × 11.25.

105. PHILYRA SEXANGULA Alcock.

Philyra sexangula, Alcock, Journ. As. Soc. Bengal, vol. lxxv. pt. ii. No. 2, p. 241, & pt. ii. No. 3, pl. vii. f. 2 (1896).

Hab. Singapore: from mud, at low water. A female with ova.

Mr. Alcock's description is from a male; in this female I note the following differences:—The median carina is raised into four low tubercles over the cardiac and mesogastric regions; the teeth at the outer edge of the posterior margin are not very strong; the black colour of the carapace shades off to a dull yellow-green in the anterior half, commencing at the anterior termination of the branchial carinæ; the finger-tips are white, and the four posterior pairs deep yellow.

As regards the abdomen, it is composed of three distinct pieces: a narrow basal segment; a long, broad, dome-shaped median piece, composed of segments 2 to 6, segment 2 being still clearly marked off by a transverse groove; and the 7th segment, very small and rounded triangular. Segments 1 and 2 are obtusely carinated transversely; the whole abdomen is honeycombed and pubescent like the carapace, and uniformly black, except the 7th segment and the anterior and lateral margins of the middle piece, which are nearly white.

Dim. 9.75 × 9.5.

Length of middle piece of abdomen	7.0 mm.
Breadth " " " "	6.0 ";
Length of chelipede	20.5 ";

LVIII. Genus PSEUDOPHILYRA Miers.

106. PSEUDOPHILYRA MELITA de Man.

Pseudophilyra melita, de Man, Mergui Crust. p. 199 (1888); Henderson, Trans. Linn. Soc., Zool. vol. v. p. 397 (1893); Alcock, Journ. As. Soc. Bengal, vol. lxxv. pt. ii. No. 2, p. 253 (1896).

Hab. Uncertain. One female.

I have no doubt that this specimen belongs to *P. melita*; but the following—possibly sexual—differences may be noted. The surface of the carapace is nowhere granular, but everywhere fairly closely punctate, the punctæ being distinct, and quite visible to the naked eye. The distal third of the upper and under surfaces of the arm, and the wrist, both above and below, are also punctate,

the under surfaces less so than the upper; and there is no sign of any granules on the inner (anterior or lower) margin of the hand. The inner edges of both fingers have a line of 5 or 6, widely separate hairs, very distinct under the lens.

Dim. 7.25×8 .

LIX. Genus MYRA Leach.

107. MYRA AUSTRALIS Hasw. (?)

Myra australis, Hasw. Proc. Linn. Soc. N. S. W. vol. iv. p. 50, pl. v. f. 3 (1879), & Cat. Austr. Crust. p. 122 (1882); Miers, 'Alert' Crust. p. 251 (1884), & 'Challenger' Brachyura, p. 315 (1886); Walker, Journ. Linn. Soc., Zool. vol. xx. p. 111 (1887); Henderson, Trans. Linn. Soc., Zool. vol. v. p. 402 (1893).

Hab. Singapore: 4-5 fms.; bottom of broken shells and sand. A small male, which I refer rather doubtfully to this species with which it seems to agree, excepting that there is an additional minute spine over the base of each of the posterior legs, and there is no denticle on the penultimate joint of the abdomen.

Dim. 8×8 .

LX. Genus ARCANIA Leach.

108. ARCANIA ERINACEUS Fabr.

Cancer erinaceus, Fabr. Ent. Syst. ii. p. 460 (1792); Herbst, Naturgesch. d. Krab. Bd. ii. Hft. 2, p. 258, pl. xx. f. 111 (1790).

Leucosia erinaceus, Fabr. Suppl. Ent. Syst. p. 352 (1798).

Arcania erinaceus, Bell, Trans. Linn. Soc. vol. xxi. p. 309 (1855); Alcock, Journ. As. Soc. Bengal, vol. lxxv. pt. ii. No. 2, p. 268 (1896).

Hab. Singapore: 4 fms.; sandy bottom. A damaged male.

Dim. 11×11 .

LXI. Genus IPHICULUS Ad. & White.

109. IPHICULUS SPONGIOSUS Ad. & White.

Iphiculus spongiosus, Ad. & White, 'Samarang' Crust. p. 57, pl. xiii. f. 5 (1848); Alcock, Journ. As. Soc. Bengal, vol. lxxv. pt. ii. No. 2, p. 256 (1896).

Hab. Singapore: 5 fms.; muddy bottom. A male.

Dim. 10.5×8 .

LXII. Genus NURSIA Leach.

110. NURSIA PLICATA Herbst.

Cancer plicatus, Herbst, Naturgesch. d. Krab. Bd. iii. Hft. 4, p. 2, pl. lix. f. 2 (1804).

Nursia plicata, Alcock, Journ. As. Soc. Bengal, vol. lxxv. pt. ii. No. 2, p. 180 (1896).

Hab. Singapore: 12 fms., rough bottom; south of Blakang Mati island. One male.

I quite concur with Mr. Alcock in the separation of this species from the next, and its identification with Herbst's form. This specimen lacks the red colouring of his Indian examples, being only of a rather dark, yellow-brown hue.

Dim. 9.5×7.75 .

111. *NURSIA HARDWICKII* Leach.

Nursia hardwickii, Leach, Zool. Misc. iii. p. 20 (1817); M.-Edw. Hist. Nat. Crust. t. ii. p. 137 (1837).

Nursia plicata, Bell, Trans. Linn. Soc. vol. xxi. p. 307, pl. xxxiv. f. 4 (1855).

Nursia plicata?, Miers, Trans. Linn. Soc. ser. 2, Zool. vol. i. p. 240, pl. xxxviii. f. 28 (1877).

Nursia plicata, Hasw. Cat. Austr. Crust. p. 127 (1882); ? Walker, Journ. Linn. Soc., Zool. vol. xx. p. 111 (1887); Henderson (*vide* Alcock), Trans. Linn. Soc., Zool. vol. v. p. 404 (1893).

Nursia hardwickii, Alcock, Journ. As. Soc. Bengal, vol. lxx. pt. ii. No. 2, p. 181 (1896).

Hab. Singapore: 6-10 fms., rough bottom; from both north and south side of Blakang Mati island. A male and a female.

Rather yellow than, like Mr. Alcock's examples, flesh-coloured.

It is interesting to find this species living together with the closely-related *N. plicata*.

Dim. ♂ 10.5×9.5 . ♀ 9.75×8.75 .

LXIII. Genus *OREOPHORUS* Rüpp.

112. *OREOPHORUS RUGOSUS* Stimpson.

Oreophorus rugosus, Stimpson, Proc. Ac. Nat. Sci. Philad. p. 259 (1858); A. M.-Edw. Ann. Soc. Entom. Fr. t. v. p. 152, pl. vi. f. 3 (1865); id. Nouv. Arch. Mus. t. x. p. 49 (1874); Hasw. Cat. Austr. Crust. p. 130 (1882).

Hab. Singapore: a male from 2-3 fms., muddy bottom, and a female from the reef.

Dim. ♂ 13×9 . ♀ 18.5×14 .

LXIV. Genus *FAVUS*¹, gen. nov.

Carapace twice as broad as long, extended laterally so as quite to conceal the 2nd, 3rd, and 4th pairs of legs in flexion, but suddenly narrowed behind so as to leave the whole of the posterior pair exposed; front small and upturned; antennules obliquely folded; antennæ with flagellum either very rudimentary or completely absent, and basal portion imbedded in the inner orbital angle and fused with the orbital margin; orbits, in consequence,

¹ *Favus*=a honeycomb.

circular and complete, small; eyes very small, but not fixed; endostome deeply excavate in the middle line; exopodite of exterior maxillipedes broad, and not reaching beyond the middle of the merus; chelipedes and legs short and rugose. Abdomen (of female) composed of only two pieces, of which one is the narrow basal segment.

113. *FAVUS GRANULATUS*, sp. nov. (Plate XLVII. fig. 13.)

Hab. Singapore; littoral. One female.

Carapace convex in both directions, regularly honeycombed, the pits being more distinct on the branchial regions or lateral expansions, the elevated parts covered with relatively large rounded granules; a rather strong prominence—granulated, and with two deep sulci on either side—on the narrowed uro-cardiac region. The marginal line is regularly curved, and defined as a non-pitted, but granulated border; edges thick, and under side of lateral expansions honeycombed, transversely concave, longitudinally convex. Front very small, appearing as a slightly upturned prominence in the anterior margin; epistome and tip of exterior maxillipedes just visible from above. Chelipedes very rugose, with carpus just appearing from under the carapace; hand as high as it is long, and as thick also, in its posterior portion; fingers shorter than hand, curved, with short decussating tips. Legs rugose and granulous, with carpo- and propodites obtusely carinate. Maxillipedes and abdomen also granulate; the latter (in a female) with four distinct grooves, marking the segmental sutures. The rather long and narrow 7th segment, which nearly reaches the base of the maxillipedes, is partially fused on to the large, only slightly rounded, middle piece. The sternum is deeply hollowed.

Dim. 15×7.5 .

LXV. Genus *DORIPPE* Latr.

114. *DORIPPE FACCHINO* Herbst.

Cancer facchino, Herbst, Naturgesch. d. Krab. Bd. i. Hft. 6, p. 190, pl. xi. f. 68 (1785).

Dorippe sima, M.-Edw. Hist. Nat. Crust. t. ii. p. 157, pl. xx. f. 11 (1837).

Dorippe facchino, de Haan, Crust. Japon. p. 123 (1839).

Dorippe sima, Miers, Ann. Mag. Nat. Hist. 5th ser. vol. v. p. 317 (1880); Walker, Journ. Linn. Soc., Zool. vol. xx. p. 111 (1887).

Dorippe facchino, Henderson, Trans. Linn. Soc., Zool. vol. v. p. 405 (1893); Alcock, Journ. As. Soc. Bengal, vol. lxxv. pt. ii. No. 2, p. 278 (1896).

Hab. Singapore and Malacca; 2-6 fms., muddy bottom.

A large male from Malacca, and a smaller one from Singapore; also, from Singapore, a much smaller female which had just

moulted, and which carries on its dorsum a small anemone, with a bivalve shell interposed (*vide* Alcock, t. c. p. 279). The right hand is much swollen in the two males. Mr. Alcock describes both edges of the merus of 1st and 2nd legs as being densely pubescent in the male; in these only the posterior edge is so, as with the pro- and carpopodite.

The base of the anemone rests directly on the shell; but, the latter being only half the size of the anemone's base, it follows that the outer edge of the base projects beyond the shell on every side. Between this part of the base and the dorsum of the *Dorippe* is found a circular flattened ring, with a wrinkled surface; with the appearance and consistency of mud supported by a few scattered fibres.

There is also another female from Malacca, which carries an anemone. There is no shell interposed between the base of the anemone and the crab, but only what appears to be the operculum of a large Gastropod. The circular flattened ring mentioned above is evidently the remains of a similar structure.

Dim. ♂ 28.75 × 22. ♂ 25 × 19.5. ♀ 16.5 × 13. ♀ 13.5 × 19.25.

115. DORIPPE DORSIPES Linn.

Cancer dorsipes, Linn. Mus. Lud. Ulr. p. 452, & Syst. Nat. ed. xii. i. 2, p. 1053 (1766).

Cancer frascone, Herbst, Naturgesch. d. Krab. Bd. i. Hft. 6, p. 192, pl. xi. f. 70 (1785).

Dorippe quadridens, Fabr. Suppl. Ent. Syst. p. 361 (1798).

Dorippe quadridentata, M.-Edw. Hist. Nat. Crust. t. ii. p. 156 (1837).

Dorippe quadridens, de Haan, Crust. Japon. p. 121, pl. xxxi. f. 3 (1839).

Dorippe quadridentata, Hasw. Cat. Austr. Crust. p. 137 (1882).

Dorippe dorsipes, Henderson, Trans. Linn. Soc., Zool. vol. v. p. 404 (1893); Alcock, Journ. As. Soc. Bengal, vol. lxxv. pt. ii. No. 2, p. 277 (1896).

Hab. Singapore: 10 fms.; muddy bottom. Three males.

Dim. ♂ 15 × 14.5. ♂ 12.5 × 12. ♂ 11 × 10.5.

116. DORIPPE ASTUTA Fabr.

Dorippe astuta, Fabr. Suppl. Ent. Syst. p. 361 (1798).

? *Dorippe callida*, Fabr. t. c. p. 362.

Cancer astutus, Herbst, Naturgesch. d. Krab. Bd. iii. Hft. 3, p. 45, pl. lv. f. 6 (1803).

Dorippe astuta, M.-Edw. Hist. Nat. Crust. t. ii. p. 157 (1837); Hasw. Cat. Austr. Crust. p. 136 (1882); Walker, Journ. Linn. Soc., Zool. vol. xx. p. 111 (1887); Henderson, Trans. Linn. Soc., Zool. vol. v. p. 405 (1893); Alcock, Journ. As. Soc. Bengal, vol. lxxv. pt. ii. No. 2, p. 280 (1896).

Hab. Malacca: 2 fms.; muddy bottom.

Seven adult males and five young ones. There is also another

male, still carrying a comparatively large leaf, beneath which it is entirely concealed when the legs are flexed. In three of the males the right hand is swollen.

Judging from Fabricius' description of his *D. callida*, it seems to me very probable that it is really identical with his *D. astuta*.

Dim. ♂ 13.25 × 12.5. ♂ 13.5 × 12.5. ♂ 13.5 × 13. ♂ 12.75 × 12. ♂ 9.75 × 9.5. ♂ 7.5 × 7. ♂ 8.25 × 7.5. ♂ 6 × 5.75. ♂ 6 × 5.5. ♂ 5.75 × 5. ♂ 5.5 × 4.75. ♂ 5.25 × 4.75.

EXPLANATION OF THE PLATES.

PLATE XLIV.

- Fig. 1. *Micippa excavata*, p. 725. *a.* Rostrum. *b.* Chelipede. *c.* Pterygostomial region.
 2. *Lambrus tumidus*, p. 727. *a.* Dorsal view. *b.* 5th ambulatory leg.
 3. *Harrovia albolineata longipes*, p. 729. *a.* Dorsal view.
 4. *Carpilodes socius*, p. 731. *a.* Dorsal view. *b.* 3rd maxillipede.

PLATE XLV.

- Fig. 5. *Etisodes anaglyptus*, p. 739. *a.* Dorsal view. *b.* Frontal region.
 6. *Actæopsis pallida*, p. 741. *a.* Dorsal view. *b.* Frontal and buccal regions. *c.* Male abdomen.
 7. *Neptunus (Amphitrite) hastatoides*, p. 745. *a.* Male, *b.* Female abdomen.

PLATE XLVI.

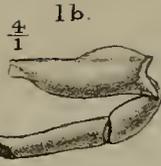
- Fig. 8. *Achelous rubro-marginatus*, p. 746. *a.* Dorsal view. *b.* 3rd maxillipede.
 9. *Carcinoplax subinteger*, p. 750. *a.* Anterior portion of carapace.
 10. *Potamon tridentatum incertum*, p. 749. *a.* Anterior portion of carapace. *b.* 3rd leg. *c.* Orbital region.

PLATE XLVII.

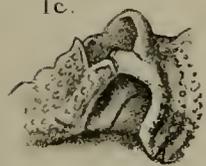
- Fig. 11. *Macrophthalmus dilatatus carens*, p. 759. *a.* Chelipede.
 12. *Sesarma fasciata*, p. 758. *a.* Dorsal view. *b.* Chelipede. *c.* Male abdomen.
 13. *Favus granulatus*, p. 768. *a.* Dorsal view. *b.* Frontal region. *c.* Female abdomen.
 14. *Scopimera myctiroides*, p. 760. *a.* Male, *b.* Female abdomen.
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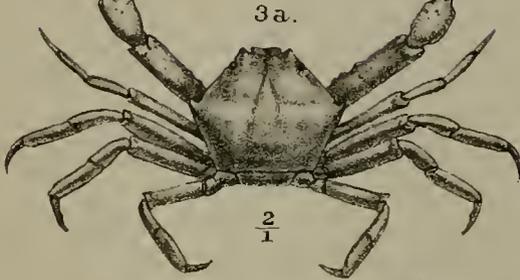
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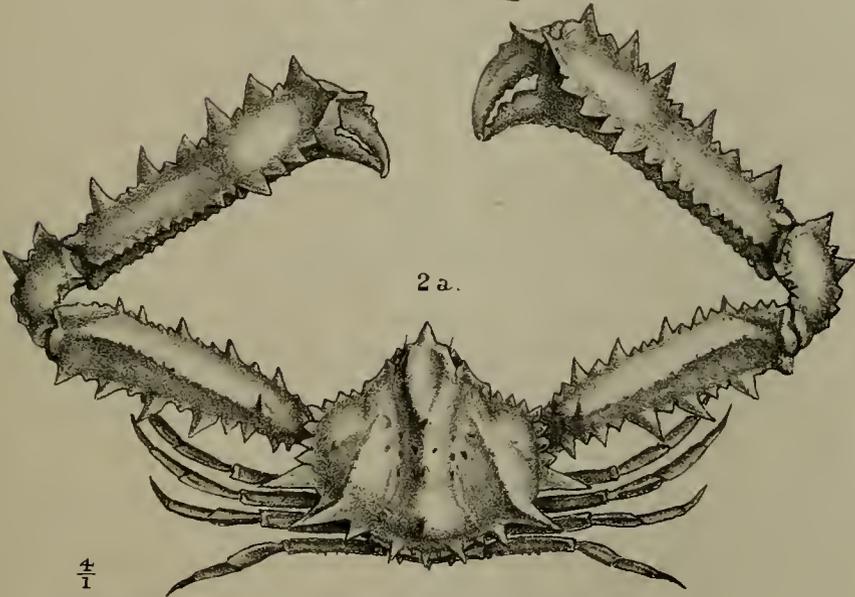


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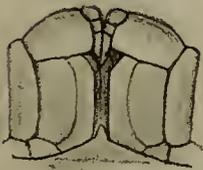
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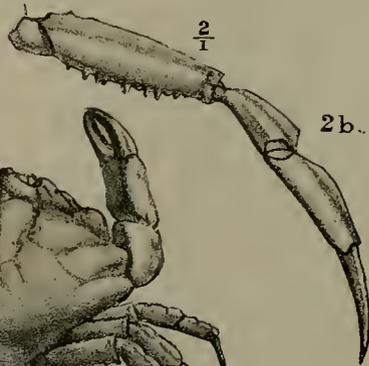


2a.

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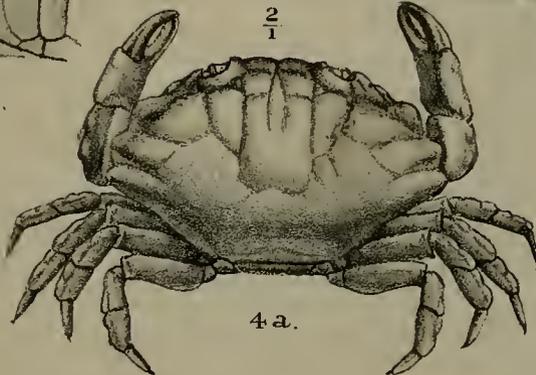


4b.



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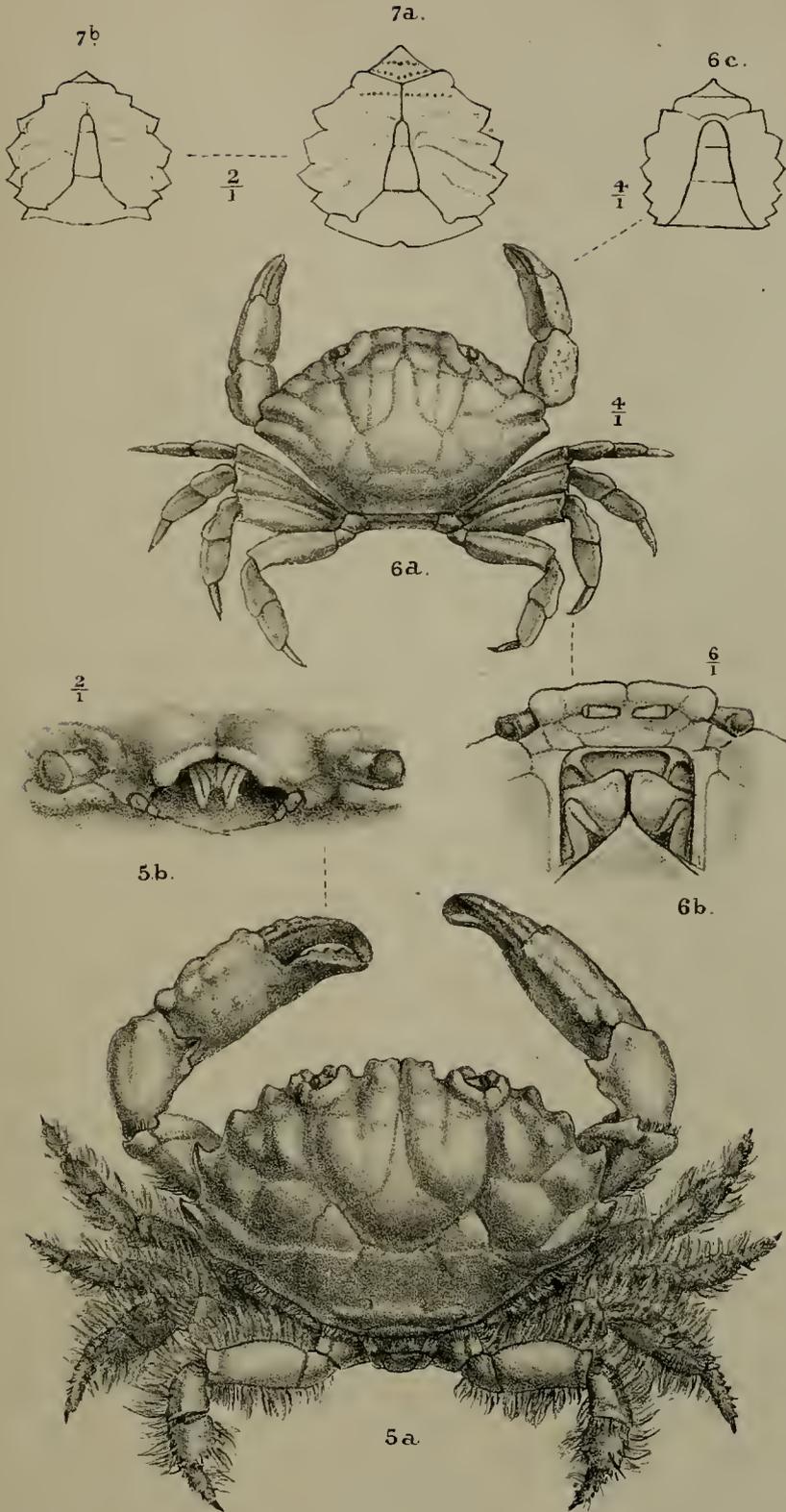
2b.



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4a.

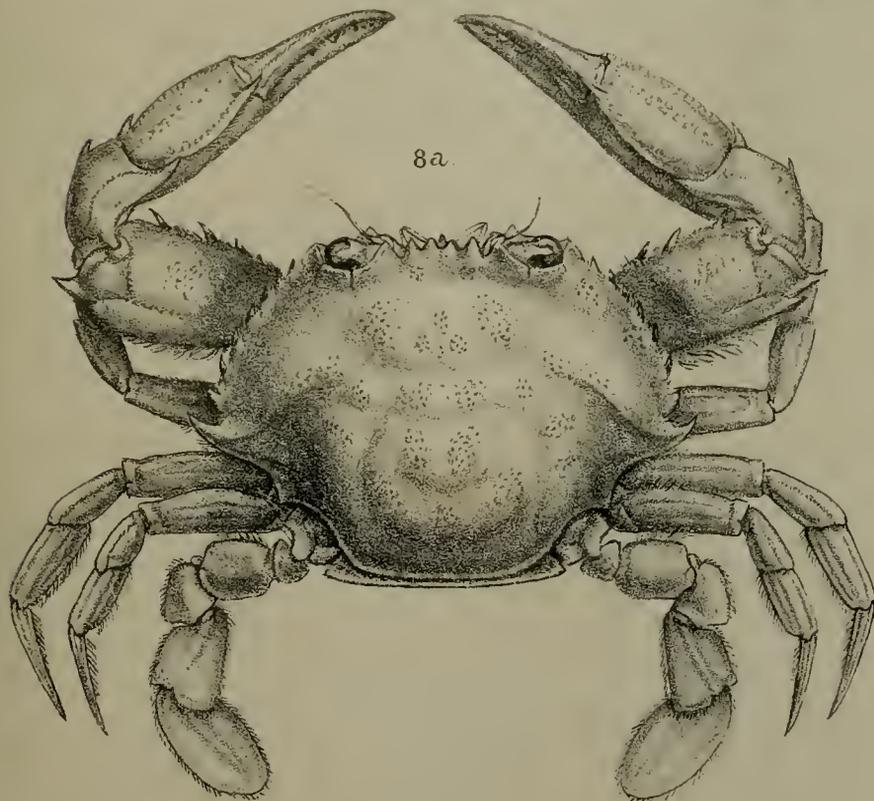
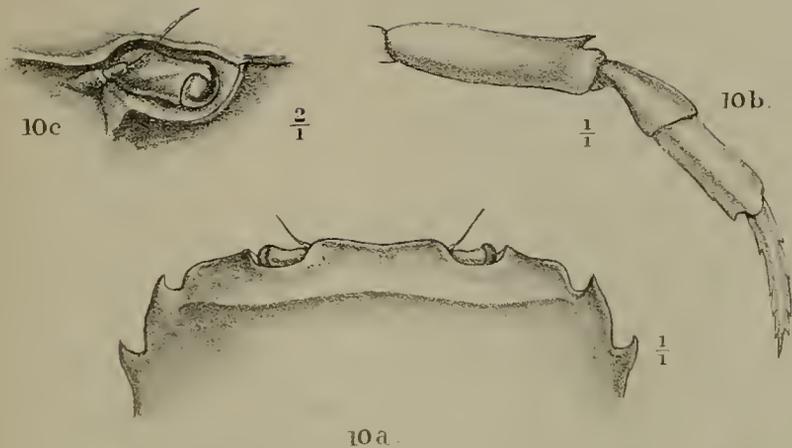




Highley del. et lith.

Hanhart imp.

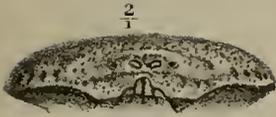




Highley del et lith.

Hanhart imp

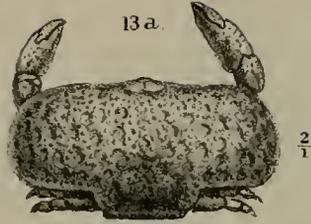




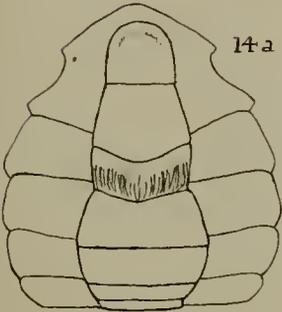
13b.



13c.

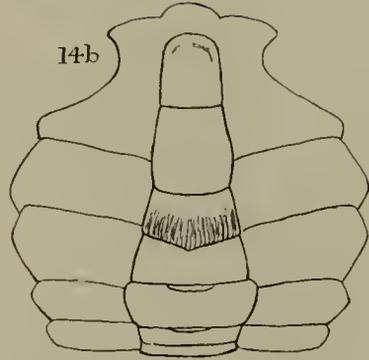


13a.



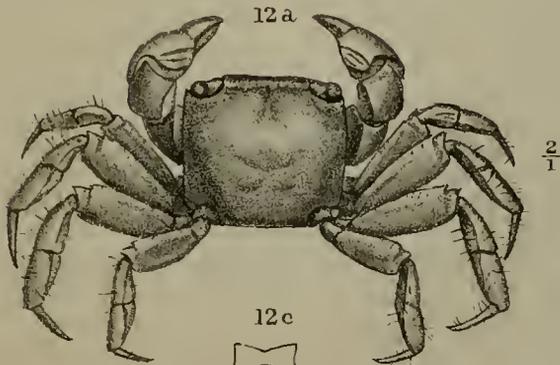
14a

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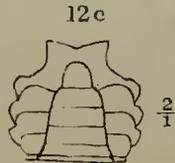
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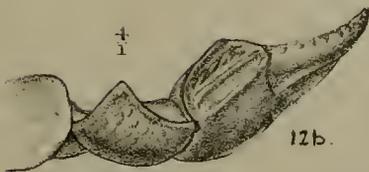
12a

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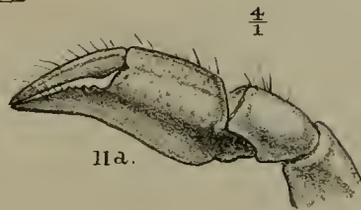
12c

$\frac{2}{1}$



$\frac{4}{1}$

12b.



$\frac{4}{1}$

11a.







CONNOCHÆTES TAURINA, ♂ jr.

J. Smit del. et lith.

Mintern Bros. imp.

November 20, 1900.

Dr. W. T. BLANFORD, F.R.S., Vice-President,
in the Chair.

The Secretary read the following reports on the additions made to the Society's Menagerie during the months of June, July, August, September, and October, 1900:—

The total number of registered additions to the Society's Menagerie during the month of June was 251, of which 87 were by presentation, 18 by birth, 42 by purchase, 2 were received in exchange and 102 on deposit. The total number of departures during the same period, by death and removals, was 162.

Among the additions special attention may be called to a young male Rocky-Mountain Goat (*Haploceros montanus*) from British Columbia, purchased June 6th, of Mr. J. La Montagne, by whom it had been captured on Elfa Mountain, British Columbia, on June 12th, 1899. This is believed to be the first living specimen of the species brought to Europe. It is now changing into its summer dress. In reply to enquiries, Mr. La Montagne informs me that he shot the mother of the present specimen on Elfa Mountain (at about 7000 feet altitude) and captured the young one, then about a fortnight old. It is the same specimen as that of which I exhibited a photograph on January 23rd last, forwarded to me by Dr. A. R. C. Selwyn, C.M.G., F.R.S., C.M.Z.S. (see P. Z. S. 1900, p. 1). Our best thanks are due to Dr. Selwyn for assisting us in obtaining the present specimen of this interesting animal.

Five Gentoo Penguins (*Pygosceles tæniatus*) from the Falkland Islands were purchased June 7th. This Penguin is rarely met with in captivity, although abundant in its native haunts.

Three White Ibises (*Eudocimus albus*) were hatched in the Great Aviary on June 13th. They were bred by a pair received in immature plumage on June 14th, 1897. This is the first occasion upon which this interesting species has propagated in the Society's Gardens.

The total number of registered additions to the Society's Menagerie during the month of July was 137, of which 43 were by presentation, 18 by birth, 11 by purchase, 5 were received in exchange and 60 on deposit. The total number of departures during the same period, by death and removals, was 149.

A young female Brindled Gnu (*Connochaetes gnu*) was born in the Gardens on July 14th, being the first instance of this species breeding in the Society's Menagerie.

I exhibit a drawing by Mr. Smit (Plate XLVIII.) representing this interesting little animal, which, it will be seen, is very different from the calf of the White-tailed Gnu.

I believe that this Antelope has already bred in the Garden of the Zoological Society of Breslau¹.

Four Red-collared Lorrikeets (*Trichoglossus rubritorques*) were deposited by the Hon. W. Rothschild, M.P., on July 27th. This beautiful species is new to the Society's Parrot-house.

The registered additions to the Society's Menagerie during the month of August were 182 in number. Of these 52 were acquired by presentation, 24 by purchase, 14 were born in the Gardens, 9 were received by exchange and 83 on deposit. The total number of departures during the same period, by death and removals, was 130.

The total number of registered additions to the Society's Menagerie during the month of September was 141, of which 80 were by presentation, 10 by purchase, and 51 were received on deposit. The total number of departures during the same period, by death and removals, was 148.

Amongst the additions attention may be called to :—

Two Tenrecs (*Centetes caudatus*), deposited by the Hon. Walter Rothschild, M.P., on Sept. 4th. No example of this curious Insectivore has been previously exhibited in the Society's Gardens.

The total number of registered additions to the Society's Menagerie during the month of October was 160, of which 38 were acquired by presentation, 4 by purchase, 105 were received on deposit, 9 in exchange, and 4 were born in the Menagerie. The total number of departures during the same period, by death and removals, was 178.

Amongst the additions special attention may be called to two fine birds, one of which is new to the Collection :—

1. A Caffre Bustard (*Eupodotis caffra*), from Port Elizabeth, presented by J. E. Matcham, Esq., C.M.Z.S., Oct. 22nd. Mr. Matcham kindly informs me that this fine bird was captured at Zwartkops in the vicinity of Port Elizabeth, where these birds are always to be found, but not in great quantities.

2. A Bouquet's Amazon (*Chrysotis bouqueti*), from Dominica, West Indies, acquired by purchase, Oct. 31st, new to the Collection.

Mr. Sclater made some remarks on some of the objects noticed in the Zoological Gardens of Hamburg, Berlin, and Rotterdam, which he had visited during the vacation.

At Hamburg the Zoological Garden (under the direction of Dr. H. Bolau, C.M.Z.S.) was found to be in its usual excellent order. Two buildings lately erected, one for European Birds and the other for Rodents and Marsupials, had been much admired and carefully examined.

Among the Carnivorous Mammals noticed was a fine young

¹ See Sclater and Thomas, 'Book of Antelopes,' i. p. 103.

Leopard from Corea, remarkable for its long-haired fur and densely-haired ears—perhaps *Felis fontainieri* M.-Edw., but apparently only a subspecies of *Felis pardus*; and a very large example of the Red Wolf of Paraguay, *Canis jubatus*. A Hedgehog from West Africa, belonging to the white-fronted section of the genus, labelled *Erinaceus pruneri*, was new to Mr. Sclater.

The full series of Cervidæ had been lately enriched by the acquisition from Amoorland of a young male and a female of Luehdorf's Deer, *Cervus luehdorfi*—one of the largest and finest of the Red Deer Section. These were the first fresh examples received at Hamburg since the arrival of the original specimens more than twenty years ago, upon which the species had been founded¹.

Of the many interesting mammals noticed at Berlin it was hardly necessary to say much after the full account of this Garden given by Mr. F. E. Blaauw at a recent meeting of the Society (see P. Z. S. 1900, p. 299). It might, however, be stated that to the full series of the larger Antelopes recorded by Mr. Blaauw had recently been added a fine male specimen of the White-bearded Gnu (*Connochætes albo-jubatus*) obtained in the Kilimandjaro district of East Africa, and brought home by Herr Schillings. This was the first living example of this form of the Brindled Gnu Mr. Sclater had seen, and seemed to show readily distinguishable characters from *C. taurinus*.

In the Ape-house had been specially noticed a fine large olive-green Baboon with a black face from Khartoum (supposed to be *Papio doguera*), and an example of a new Monkey from Togoland, which Herr Matschie was proposing to call *Cercopithecus zechi*, after its discoverer Count Zech, who had recently brought it home.

Mr. Sclater stated that during a short visit to Gibraltar in September last he had not omitted to make enquiries as to the state of the herd of Barbary Apes (*Macacus inuus*) which is well-known to inhabit the higher and less frequented parts of the 'Rock,' and that he had been assured on all sides that these animals had much increased in numbers of late years and had in some cases become rather troublesome². When riding in the evening up to the Signal Station at the top of the Rock he had himself seen small parties of this Monkey both going and returning. They were apparently quite tame and fearless, and allowed an approach within a few paces. Some authorities were of opinion that the herd now consisted of at least 130 individuals or more.

Capt. J. S. Inglefield (of H.M.S. 'Devastation') had favoured Mr. Sclater with the following remarks on the subject, gathered from two years' experience:—

"I have seen the Monkeys in parties of 15 and more, but have

¹ See P. Z. S. 1880, p. 451; List of An. (9) p. 174 (1896); and Bolau, Abh. Ver. Hamb. vii. p. 33 (1880); Lydekker, Deer of all Lands, p. 102.

² For previous notes on this subject see 'Galton's Vacation Tourists,' ser. i. p. 206 (1867), and 'Nature,' xxxix. p. 30 (1888).

“never counted more than 29 together at one time. They go generally in families—an old patriarch accompanied by several females and young ones of different sizes. The young ones appear in early summer, when the females carry them for a few weeks at their breasts, afterwards on their backs. Nearly every evening in summer, Monkeys may be seen about 5 P.M. near Ferdinand’s Battery and Devil’s Gap, grubbing for roots and playing about the bushes. They have a sentinel on the look-out while feeding—he warns them of danger by a noise like the distant bark of a dog. On two occasions my dog (a Scotch Terrier) has been attacked by the older animals. On several occasions also they have waited till the writer and his dog have arrived on the path below them, when they have sent down upon them showers of stones, some of the size of a coconut. The writer has never been personally attacked by a Monkey, but has known the old males approach quite close and grin at him.”

The Monkeys are also said to have occasionally committed great devastation in some of the fruit-gardens near Europa Point, so that the owners have obtained leave to shoot them. But as a rule they are strongly protected by the authorities.

A letter was read addressed to the Secretary by Sir Harry Johnston, K.C.B., F.Z.S., dated Fort Portal, Toru, Uganda, August 21st, 1900. Sir Harry stated that he had made an excursion round the southern base of Mount Ruwenzori and had crossed the Semliki River halfway between Lake Albert Edward and Lake Albert. He had entered the Great Congo Forest, which here comes down to and even crosses the Semliki River. In the forest he had obtained something like proof of the existence of a very remarkable new horse (*Equus* sp. inc.) which appeared to inhabit the forest. The following passage in Sir Harry Johnston’s letter contained his account of this animal:—

“Reading through Stanley’s ‘Darkest Africa’ I noticed that he mentions his Dwarf having a name for horse or ass, and stating that such animals were found in their forests. As the ordinary Zebra type of Equine steadily avoids dense woodlands, this statement seemed to me a curious one. When I entertained for months the pigmy band which had been captured by a filibustering German (and the restoration of whom to their homes was one of my motives for going into the Congo Free State), I questioned them on this subject and they were very explicit; they told me they called the animal ‘O’Api’ (‘ stands for a gasping sound like an aspirate or Arabic K). They described it as being dun-coloured or dark grey over all the upper parts of the body, with stripes on the belly and legs. As soon as I reached the Belgian post of Mbéni I began questioning my host, who at once acknowledged the existence of this animal and promised to send me where I should shoot one. They stated that it frequented the deepest parts of the Forest, went usually in pairs, was dark iron-grey on the upper part of the

body, and had brownish stripes on the belly and legs. I found the Bambuba natives dwelling alongside the dwarfs called it 'Okapi.' The Belgians state that the head is very long 'et très effilée.' One man said that the muzzle was particularly 'effilé'—*i. e.* drawn out. At first they excited me by declaring that there was a skin lying about which I could have; eventually it was found that the skin had been cut up by their native soldiers to be made into waist-belts and bandoliers. Two of these fragments were found and given to me, and I shall send them home to you by first opportunity. Whatever the animal may be to which these pieces belong, it is not any one of the known Zebras or wild Asses; the pieces of skin unfortunately exhibit chiefly the stripes of the belly and legs. These are very irregular with a chestnut border, and they look as though from above they emerged from a uniform dun or dark grey.

"Unfortunately we did not succeed in seeing a specimen of this animal in the Forest during our short stay, but one of the Congo Free State officials has promised to send me a complete skin and skull."

Mr. Boulenger exhibited one of the type specimens of a new species of *Protopterus* from the Congo, for which he had proposed the name *P. dolloi* (Ann. Mus. Congo, Zool. i. pl. lvi.). Mr. Boulenger pointed out the remarkable characters of the new Dipnoan, which, whilst agreeing with *Protopterus annectens* in the essential generic features (limbs, gills), approached *Lepidosiren* in the greater elongation of the body (length of head 5 to 6 times in distance from snout to vent), the greater number of ribs (54) and of scales along the body (86-91 to vent), and the smaller eye (its diameter 15-19 times in length of head, 4-6 times in interocular width).

Mr. W. T. Blanford, F.R.S., exhibited a very fine skull and antlers of the Central Asiatic Wapiti, *Cervus maral* var. *songaricus* Severtzow, *C. eustephanus* Blanford, and also skins of the Wapitis of Central Asia and of America. Attention was called to the great development of the 4th tine, which measured in one antler $23\frac{3}{4}$ inches from the angle with the upper part of the beam, and was very massive and considerably flattened. The antler itself measured 54 inches from the base along the outside curve. The head had been obtained along with others by Messrs. P. Church and J. V. Phelps. Mr. Blanford was indebted to Mr. Rowland Ward, F.Z.S., for the opportunity of exhibiting the head and skin of this fine Stag.

Mr. F. E. Beddard, F.R.S., Prosector and Vice-Secretary to the Society, read a paper entitled "Contributions towards a Knowledge of the Osteology of the Pigmy Right Whale (*Neobalæna marginata*)."

This paper will be published in full in the Society's 'Transactions.'

The following papers were read:—

1. A Description of *Wynyardia bassiana*, a Fossil Marsupial from the Tertiary Beds of Table Cape, Tasmania. By BALDWIN SPENCER, M.A., F.R.S., C.M.Z.S., Professor of Biology in the University of Melbourne, Director of the National Museum, Melbourne.

[Received July 9, 1900.]

(Plates XLIX. & L.)

For many years the Tasmanian Museum in Hobart has been in possession of a block of calcareous sandstone, obtained from the "Turritella-zone" in the Tertiary beds of Table Cape, containing, partly exposed to view, the remains of a marsupial, which in life must evidently have been of the size of a large Phalanger, though of stouter and more massive build than any existing one.

I have to express my cordial thanks to the Council of the Museum and to the Curator, Mr. Morton, for the opportunity of examining the specimen, the especial interest of which lies in the fact that it is the oldest marsupial yet found in Australia, as the Turritella-zone is regarded, from palæontological evidence, as belonging to the Eocene deposits¹.

Whilst a large number of fossil mammals from Australia have been dealt with by Owen, McCoy, de Vis, Stirling and Zietz, Broome, and others, none of an age earlier than Pleistocene have been hitherto discovered, the specimen now described being the solitary one as yet found in Australia which dates back as far as the Tertiary period. Pleistocene fossils reveal the existence of highly specialized forms such as *Thylacoleo* and *Diprotodon*, associated with representatives of living genera; whilst the Eocene form appears to be in no way highly specialized, but unites within itself structural features which serve to ally it, on the one hand, with the most generalized of the Diprotodontia—the Phalangeridæ, and on the other hand with the most typical Polyprotodontia—the Dasyuridæ. This is exactly what we might expect to find, on the supposition that the present Diprotodont marsupials of Australia have been developed in the Australian region from earlier Polyprotodont forms, and that the more highly specialized Diprotodonts were comparatively late developments.

The earliest and, in fact, the only reference to the fossil occurs in Johnston's 'Geology of Tasmania,' where it is briefly described as "the almost perfect skeleton of a species of *Halmaturus* obtained

¹ G. B. Pritchard, "A Revision of the Fossil Fauna of the Table Cape Beds, Tasmania," Proc. R. S. Vict. 1895, p. 74. Professor Tate, however, has recently referred the beds, doubtfully, to the Oligocene: Trans. R. S. South Austr. vol. xxiii. pt. i. p. 107.

embedded in the 'Turritella-zone' of the marine beds at Table Cape"¹. Unfortunately it is far from being nearly perfect.

Table Cape itself is a promontory near to the little township of Wynyard and looks out northwards across Bass Strait. Close to it are two small bluffs, from one of which² the specimen was obtained. The bluff is about 160 feet high, with a capping of basalt, beneath which lie the Tertiary beds, which in their turn rest on Silurian slates. The upper Tertiary beds, called by Johnston the "Turritella-zone," are about 80 feet where fully exposed and contain in addition to marine forms leaf-impressions. The same author says: "With respect to the occurrence of the plant-remains amongst marine forms, it is most probable that the calcareous sandstones were formed at the mouth of an estuary or river, and that the leaves and other land organisms were washed down and included with the marine forms. This interpretation also throws some light upon the discovery of the almost complete skeleton of the species of *Halmaturus* already derived from the calcareous sandstone." In regard to the underlying Crassatella-bed, he says: "It hardly deserves to be considered as distinct from the Turritella group which rests immediately upon it, were it not for the fact that it appears to have been accumulated under different circumstances."

Pritchard³ says in regard to the collection of shells studied by him that it "came principally from the lower deposits known as the Crassatella-beds, and judging from the fossils I regard the zone as the direct equivalent of the so-called middle beds of the Spring Creek section in Victoria. The coarseness of the material in which a number of the Table Cape fossils is preserved, the worn character of many of the species, and the abundance of fragments of shells clearly indicate the littoral character of the deposit, and as an attendant fact of some importance we have certain faunal characteristics indicative of the same feature."

In their suggested arrangement of the sequence of the Eocene rocks of Victoria, Messrs. Hall and Pritchard place the Spring Creek beds at the base of the series⁴.

The block of sandstone, as it was originally found, had broken off from the face of the bluff and tumbled down to the base, which was surrounded, when the author visited the spot in 1892 in company with Professor Tate, with masses of various sizes strewn about in all directions. Evidently this fall from the upper part of the bluff had smashed the block in such a way as to partially expose the fossil, and subsequent weathering resulted unfortunately in the breaking off of the lower part of the skull; though it is quite possible that considerable damage had been done to the skull before it was embedded, as the part of the lower jaw enclosed in the matrix, and so not exposed to recent weathering, has all of

¹ Pp. 261, 288 *et seq.*

² Figured and described by Mr. Johnston, *op. cit.* pp. 258 *et seq.*

³ Proc. R. S. Vict. 1895, p. 77.

⁴ Proc. R. S. Vict. 1894, p. 180. "The older Tertiaries of Maude with an indication of the sequence of the Eocene Rocks of Victoria."

its teeth broken away. That it must have lain for some time exposed within reach of the tide is shown by the fact that a barnacle three quarters of an inch in diameter has grown attached to a fragment of the sacral region. When it was originally found (and as it came into my hands) only a small portion of the broken under surface of the skull was visible. A portion of one side of the lower jaw, parts of ten vertebral bodies, a portion of the sacrum, a broken ilium, various bones of the hinder limbs, one of the marsupial bones, and parts of ribs were also visible. All traces of teeth, shoulder-girdle and front limbs, hind feet and tail were unfortunately lacking. The ten vertebræ are but little disturbed, the zygapophyses of eight fitting closely on to one another.

By dint of careful working, the comparatively soft matrix which is full of *Turritella*-shells was removed, and the remains of the skull, lower jaw, femur, and tibia were extracted. One of the coronoid processes was found between the zygoma of the right side and the cranium, detached from the lower jaw and inverted in position; but though a considerable part of the matrix has been worked away, not a trace of a tooth could be found. There can be little doubt but that the lower jaw and pelvic girdle had been smashed before the specimen was finally embedded in the matrix; the pectoral girdle and limbs and possibly also the hind feet were contained in the part of the block from which the preserved portion was broken off, while weathering will account for the damage done to the lower part of the skull and the hind-limb bones.

The strongly inflected angle of the lower jaw, the general structure of the skull and the marsupial bones indicate the essentially marsupial nature of the animal; but at the same time it will be seen, when dealing with various parts of the skeleton, that this early Australian mammal shows structural features which in certain respects are not characteristic of living marsupials, and in others are characteristic of various groups belonging on the one hand to the Diprotodontia and on the other to the Polyprotodontia.

The name of *Wynyardia bassiana* is proposed for the fossil, the generic name being derived from that of the township close to which lie the Table Cape beds in which it was found.

The Skull. (Figs. 1 & 2, Pl. XLIX., & fig. 5, Pl. L.)

The upper surface of the skull is fairly intact, but the lower is unfortunately broken, the exoccipital and basioccipital, the auditory bullæ and the palatal region being absent.

The most striking features are (1) the considerable relative size of the cranial as compared with the facial portion, (2) the strong development of the sagittal crest and the lambdoidal crista, (3) the broad sweep and upward curvature of the zygomatic arch, (4) the large size of the squamosal, (5) the large size of the lachrymals,

which meet the nasals and prevent the maxillæ from coming into contact with the frontals, (6) the great width of the nasals, (7) the very anterior position of the infraorbital foramen, and (8) the general massiveness.

Owing to the base of the skull being broken, the length measurement from the basion to the gnathion cannot be taken, and therefore, for the purpose of comparison with other skulls, the total length from the posterior end of the sagittal crest to the anterior end of the nasals, that is the total length along the mid-dorsal line, is taken. Though this is not so satisfactory as the former measurement, still it will serve to a certain extent as a basis of comparison.

The total length is just 100 mm., and the greatest width across the zygomata is 67 mm. Taking the same length of various species of marsupials, measured for comparison, as 100, we find that the proportionate breadth is as follows:—*Trichosurus fuliginosus* 58·7, *T. vulpecula* 53·7, *Pseudochirus herbertensis* 60, *P. archeri* 63·8, *P. cooki* 53·7, *Phascolarctos cinereus* 59, *Cuscus* sp. 59, *Bettongia penicillata* 56·3, *Dendrolagus bennettianus* 55·7, *Phascalomys mitchelli* 75·2, *Dasyurus maculatus* 68·2, *Sarcophilus ursinus* 77, *Didelphys* sp. 56·9. In regard to this it is intermediate between such extreme forms as *Sarcophilus* on the one hand and *Petrogale* on the other, and approaches most nearly to *Dasyurus*, showing a decidedly greater width than is met with in the Phalangeridæ.

The occipital region is separated from the upper surface of the skull by a well-marked lambdoidal crista which curves somewhat backward, so as to afford a concave surface for the muscles of the neck, the occipital plane sloping slightly downwards and forwards and not being vertical as in most marsupials. The curvature of the ridge is carried to about the same extent as it is in *Dasyurus*, the ridge of either side curving slightly towards the middle line.

From a point just behind the intertemporal constriction a strongly marked sagittal crest runs backwards to the lambdoidal crista, the former being as well developed as in *Thylacinus* and *Dasyurus*. In this respect the fossil offers a strong contrast to the Phalangeridæ, in which the two temporal ridges run backwards converging towards the lambdoidal crista; so that no such sagittal crest is formed as is characteristic of the Dasyuridæ, and is seen also in *Didelphys marsupialis*. On the upper surface of the frontals there is a shallow, but sharply outlined, depression, the converging margins of which are continuous posteriorly with the sagittal crest. The parietal suture extends about as far forwards as the latter.

A very remarkable feature is the great extent and anterior extension of the squamosals, the anterior ends of which reach almost as far forwards as those of the parietals. An equally striking feature, and one in which the fossil agrees with *Dasyurus* and *Sarcophilus*, is the general parallelism of the upper part of the suture of the squamosal with the sagittal crest. In such forms as the Phalangeridæ for example the sutures show a continuous marked convergence towards the middle line posteriorly. In regard

to the straightness and to a certain extent the length of the squamosal suture, the fossil resembles *Phascolomys* and *Phascolarctos*, from both of which it differs, however, to a great extent in other features. The squamosal is indeed larger than in any existing or fossil marsupial yet known, and its forward extension completely prevents the alisphenoid from coming into contact with the parietal as it does in most marsupials, such as *Phalanger*, *Trichosurus*, *Pseudochirus*, and *Dasyurus*; though, on the other hand, the parietal does not reach the alisphenoid in *Peragale*, *Æpyprymnus*, and *Phascolomys*, with which in other respects the fossil has but little in common.

No intertemporal bone can be detected.

The zygomatic arch is strong and massive, most resembling in form that of the *Dasyuridæ* both in the considerable outward sweep of the hinder part and in its marked upward curvature; in the former respect it most nearly resembles a large skull of a *Dasyurus*, and in the latter that of a *Sarcophilus*. There is not a trace of the swollen posterior part of the squamosal which is such a striking feature in certain of the *Phalangeridæ*, such as the genera *Phalanger*, *Trichosurus*, *Pseudochirus*, and *Petaurus*; but, in strong contrast to what is characteristic of these forms, the arch arises low down, and, as is well seen in lateral view (fig. 5, Pl. L.), the upper surface rises immediately so as to form a strongly marked curve: at the same time the arch flattens out laterally, bends over (fig. 1) towards the upper surface and runs forwards to be inserted into the notch in the malar process of the maxilla. The latter process is well developed and passes off almost at right angles to the side of the maxilla, bending abruptly backwards and at the same time outwards to be attached in the characteristic way to the hinder end of the arch, beneath which it runs backwards to the glenoid cavity. The abrupt bend of the malar process most resembles that of *Phascolarctos*, though in the latter the main body of the arch runs parallel to the length of the skull. In the *Phalangeridæ* the bend is a more gradual one, and the sweep of the arch is not nearly so pronounced as it is in this fossil form. Though the lower part of the arch is broken away, it appears probable that there was a slight zygomatic process at the anterior end; and, as in *Trichosurus* and certain other genera, only still more markedly, there is a very distinct ridge (Pl. L. fig. 5), which traverses almost the length of the arch, and sharply marks off an outer and upper from an outer and lower surface, the latter serving for the attachment of the masseter muscle.

The glenoid cavity is considerably elongated transversely, the downward process which bounds it posteriorly being, as in the *Dasyuridæ* and *Perameles*, apparently independent of any structure concerned with the auditory passage. The shape and relationships of this process are most similar to those of *Thylacinus*, and differ markedly from those which obtain in the *Phalangeridæ*, amongst the members of which the process in question forms the anterior part of a well-marked bony canal. Also, as in *Dasyurus*, the

meatus is directed outwards and a little forwards. The glenoid cavity is placed neither very high nor very low in regard to the base of the skull; it is higher than in the Dasyuridæ, where it is more nearly on a level with the base of the skull, and somewhat lower than in the Phalangeridæ, though it approximates more nearly to the position in the latter.

The frontals show only a faint trace of a postfrontal process tending to bound posteriorly an orbital space; their greatest width occurs in the cranial and not in the facial portion—a feature which is the reverse of that which is characteristic of marsupials, amongst whom the broadest part of the frontal is characteristically found in the facial part of the skull. Dorsally the frontal region is marked by a concavity of a V-shape, sharply outlined. This concavity is nothing like so wide nor so extensive in length as it is in *Cuscus*, *Trichosurus*, and *Pseudochirus*, from which it differs markedly in appearance and very much more resembles that of *Dasyurus*. Its posterior end, which practically corresponds in position with that of the least intertemporal width, is marked by the commencement of the sagittal crest.

The lacrymals are of large size and extend upon the face to such an extent that, owing partly to the width of the nasal bone, they come into contact with the latter and so prevent the upward process of the maxilla from reaching the nasal. This feature is also met with in *Phascalomys*, while in some of the Phalangeridæ also the lacrymal extends very nearly to the nasal. A very characteristic feature of marsupials is seen in the extra-orbital position of the lacrymal foramen, which is single and placed as in *Sarcophilus*.

The nasals present two points of importance—first, the considerable expansion of their upper ends, the greatest width occurring at rather more than a quarter of the length from this point; and second, the forward extension of the bones beyond the premaxillæ so that they overhang the nasal cavity. Their greatest length is 40.5 mm. and the greatest width 18.5 mm. The expansion which brings the nasals into contact with the lacrymals is indeed more marked than in the Phalangeridæ, *Dasyurus*, and certain Didelphidæ in which it is characteristically present. In the forward projection of the bones over the nasal cavity, the skull differs from that of the Dasyuridæ and agrees with those of *Phalanger*, *Trichosurus*, *Pseudochirus*, and certain species of *Didelphys*; in fact the general structure and relationships of the nasal bones recall most strongly that which obtains in the latter.

The lower part of the maxillary bone is broken away at the level of the infraorbital foramen, but there are two features of importance. First, the upward process, as already described, is completely shut off from contact with the frontal; and second, the infraorbital foramen is situated close to the suture between the maxilla and premaxilla, being considerably farther away from the orbit than in any existing marsupial.

The premaxillæ are of large size, approximating most in form

to those of *Trichosurus*, and their dimension would appear to indicate the existence of a fair-sized incisor dentition. It is most unfortunate that the lower part of the premaxillæ should have been broken away at such a level as to leave no indication of the exact nature of the teeth.

With regard to the ventral surface, the specimen is so broken that it is not possible to say much. The palate is completely wanting; parts of the basi- and presphenoid remain and the ento-carotid canals, as is characteristic of marsupials, pierce the basisphenoid and enter the skull close to the middle line, the opening on the right side being larger than that on the left. Each artery runs forward in a deep strongly marked groove, the two grooves converging anteriorly. These grooves, which lead forwards from behind the level of the foramen ovale on each side, are considerably longer and more strongly developed than in any other marsupial and are well seen in the figure of the under surface of the skull (Pl. XLIX. fig. 2).

The foramina leading from the skull, so far as they remain, agree in essential features with those of marsupials. The optic foramen and the foramen lacerum anterius are united to form a sphenoidal foramen opening outwards from the sella turcica, and the foramina of the two sides are confluent, so that in lateral view (fig. 5) of the skull there is a small but well-marked opening leading from the lower part of the temporal fossa of one side into that of the other. The passage thus formed is bounded below by the basisphenoid and presphenoid, the suture between which lies in the floor of the cavity, and above by the ali- and presphenoids. A similar passage is seen in *Macropus*, *Trichosurus*, *Pseudochirus*, *Phascolumys*, and *Dasyurus*, but is quite wanting in other forms such as *Phascolaretos* and *Sarcophilus*. The foramen rotundum opens close to the outer and slightly to the under and posterior side of the sphenoidal forameu, from which it is as usual only separated by a thin plate of bone.

Within the cavity of the skull the entocarotid canals enter close behind the sella turcica, the right being twice the size of the left. The sella turcica has no posterior clinoid process, and from the foramen rotundum of each side a well-marked groove leads back to the Gasserian fossa, the outer edge of the groove being formed by the projecting ridge of bone which is developed from the alisphenoid in the tentorial plane. The same feature occurs in *Macropus*, *Sarcophilus*, and *Dasyurus*. The periotic lies completely behind the ridge marking the tentorial plane, the bony structure in which is not very strongly developed in contrast with what obtains, for example, in *Cuscus* and *Trichosurus*. The periotic differs from that of other marsupials, first in its relatively small size, and secondly in its structure. The lower part, in which lies the auditory meatus, has, facing the cerebellar cavity, a nearly vertical surface measuring 8 mm. by 5 mm. in height; above this portion the bone is impressed so as to form a horizontal platform from which, on the outer and posterior sides, rise the thin curved

plates which are attached to but not fused with the skull-wall. It thus differs markedly from that of other marsupials, in almost all of which there is a well-marked pit for the lodgment of the lateral appendage of the cerebellum. In the Wombat the pit is represented by a depression, but there is no horizontal platform developed, and the whole structure is very different from that of the fossil.

The cranial cavity is relatively of considerable size as compared with that of recent marsupials. Some idea of this may be gained from the following measurements¹, which, for the sake of more easy comparison, have all been reduced so as to make them proportionate in dimension to skulls of the same length² as that of the fossil specimen (100 mm.):—

	Fossil.	<i>Trichosurus vulpecula.</i>	<i>Dasyurus maculatus.</i>	<i>Macropus rufus.</i>	<i>Phascolomys mitchelli.</i>	<i>Perameles gunni.</i>	<i>Sarcophilus ursinus.</i>
Total length of cranial cavity ... }	58	50.5	50.4	44.8	42.1	44	42.6
Greatest height ...	26	21	20.4	24	20.5	21.3	18.2
Length of cerebral fossa	33	30.5	30.7	32	27.5	26.3	23.4
Length of cerebellar fossa..... }	12.5	13.7	10.8	10.3	9	9.3	8.6
Greatest width of cerebral fossa ... }	33	29.4	28.9	29	28	28	23.4

It will be evident from these figures, which represent approximately the cranial development in typical examples of the families Macropodidæ, Phalangeridæ, Dasyuridæ, Phascolomyidæ, and Peramelidæ, that in the extinct form we have an animal in which the relative size of the brain was greater than in existing marsupials; in the total length of the brain, and in the height, length, and breadth of the cerebral hemispheres, it has decidedly the advantage, and as indicating a possible retrogression in cranial development within the marsupial group since Eocene times, the fossil is of peculiar interest.

¹ The cranial cavity has been cleared of matrix since the drawings were made.

² This measurement is along the dorsal surface from the front end of the sagittal crest to the tip of the nasal bones, as, owing to the broken under surface, the length from basion to gnathion cannot be taken. In the case of the Kangaroo the difference between the latter and the dorsal length is greater than in the other forms, and causes the relative dimensions of the skull-cavity to be slightly greater than they would be if the more satisfactory measurement of gnathion to basion had been available.

In regard to their dentition as well as to the nature of the foetal membranes, Wilson and Hill¹ have come to the conclusion that there is very clear evidence of retrogression within the marsupial order, and it appears to be very probable that this retrogression has affected the cranial development.

The Lower Jaw.—Only a fragment of one ramus of the lower jaw (figs. 6 & 7, Pl. L.) is preserved together with a broken-off coronoid process (fig. 8), and, just as in the case of the upper jaw, no teeth are visible. The angle of the jaw has the inward bending so as to form, as seen from below (fig. 7), a flat surface of considerable extent, which evidently formed, as in *Potorous* and *Phalanger*, the floor of a deep and fairly wide depression on the inside of the ascending ramus, which is completely broken away. It differs, however, from that of the *Phalangeridæ* in being of much greater proportionate length and in running backwards into a long and markedly upturned process, more like that in *Perameles* than in any other form. It will be noticed that there is on the under surface a well-marked ridge which accentuates the convexity of the outline when seen from the side. The structure of the jaw, while distinctly marsupial, is in certain respects unlike that of any known form. The inflected angle, which is in fact longer than is represented in the figure (a broken off portion 8 mm. in length not being represented), is quite unlike that of any existing species both in regard to its length and upward curvature. It must also have been of considerable vertical height, as there were no traces left of even the lower parts of the sockets; and either there were no largely developed incisors, or else the symphysis was a remarkably long one, as there is not a trace of any sockets at the anterior end. The ventral curvature and sharply marked ridge are again characteristic features, while further still there is a curious and inexplicable feature in regard to the ramus, consisting in the presence of a deep depression across the upper surface, which must apparently have been situated in the area occupied by the molar series. It extends in a slanting direction from side to side across the jaw, and its smooth, rounded floor-surface and margins show clearly that it is not a mere break in the jaw. With this is associated a swelling on the internal face, which is well seen in the view from below (fig. 7). What can have been the meaning of this it is impossible to state², as it is apparently unlike anything known in any mammalian jaw, while its definite outline and the normal condition of the surface of the bone appear to negative the idea that it is a pathological feature.

The dental foramen is not present, having evidently been placed farther back than the most posterior limit of the preserved portion of the ramus. The mylo-hyoid groove, if present, is only very faintly marked, contrasting in this respect strongly with earlier marsupials,

¹ J. P. Hill, "The Placentation of *Perameles*," Q. J. M. S. vol. xl. p. 435.

² The only suggestion which can be made is that possibly it may have been associated with the presence of a large sectorial tooth in the molar or premolar series such as is developed in *Alderites*.

and on the other hand agreeing with the majority of recent ones, in which it is variable and only feebly developed¹.

The coronoid process is that of the right side (fig. 8). It is a remarkably thin plate, in comparison with the general solidity of the other bones, with the anterior and upper margin but little thickened. In comparison with that of other marsupials it is of considerable breadth; there is no concavity on the lower half of the outer surface such as is present in most forms. The form of the posterior curved margin, where it is passing backwards and downwards towards the condyle, may be taken as indicating that the latter was placed fairly high up as regards the angle of the jaw.

Limb-bones.

These are represented by a fairly complete left and a broken right femur; a left tibia broken distally, and a right tibia also broken; a left fibula broken distally and a right more perfect one. No part of the anterior limb or of the foot is preserved.

The Femur (text-fig. 1, and figs. 10, 11, Pl. L).—The left femur (figs. 10, 11, Pl. L.) is entire except for the upper end of the trochanter, which evidently rose slightly beyond the head. Its total length is 107 mm., and when compared with the corresponding bone of a *Trichosurus*, which is of about equal length, it is at once seen to be remarkable on account of its massiveness. The shaft is straight without any anterior curve, and the posterior surface is flattened. A line passing along the long axis practically cuts through the tip of the great trochanter, the head being turned considerably inwards. The lesser trochanter is characterized by the strong development of the tuberosity at its upper end; while the ridge, which is continued downwards from the great trochanter, has a marked tuberosity at its lower end similar to that which is present in *Phascolomys*. At its ventral distal extremity the shaft swells out, the lateral surface of the outer side being turned, so that it becomes visible in ventral view as in the femurs of *Phascolomys* and *Phascolarctos*. There is also a distinct depression beneath the inner condyle, which is present but not so strongly developed in *Phascolarctos*.

The condyles are of interest because, whilst in marsupials it is characteristic to find the outer larger (in Macropodidæ and Phalangeridæ notably so) than the inner, the reverse condition obtains here, and the inner one is slightly larger than the outer—a point of structure in which the fossil apparently differs from all other Marsupialia.

On the anterior face at the condylar end there is a broad surface with only a slight development of groove, the latter being less marked even than in Phalangers and Dasyures, in which there is a broad, distinctly concave surface with distinct margins. What

¹ H. F. Osborne, "Mesozoic Marsupialia," Journ. Acad. Nat. Sci. Philadelphia, vol. ix. 2, 1888, p. 262.

groove there is in the fossil is only as broad as the deep depression which lies between the condyles posteriorly; starting from this it runs in a slanting direction towards the external side, separating a larger internal rounded eminence from a smaller external one¹.

Fig. 1.

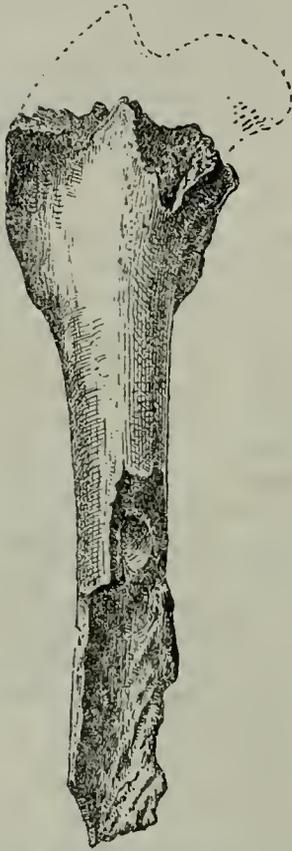
*Wynyardia bassiana.*Fig. 1.—Portion of right femur.
Nat. size.

Fig. 2.

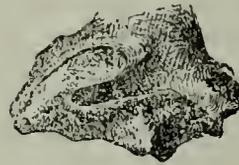


Fig. 2.—The same. Upper extremity, from above. Nat. size.

The total length of the femur is 107 mm.; the least width, in the centre, is 10 mm.; the greatest width, immediately below the condyle, is 22 mm. Some idea of the relative length of the femur in regard to that of existing marsupials may be gathered from the following list, which represents the length of the femur in proportion to that of the skull in the species named, calculating the length of the skull in each case as 100, that is equal to that of the fossil:—*Trichosurus fuliginosus* 119·5; *Dasyurus maculatus* 95·8; *Pseudochirus herbertensis* 93·8; *P. archeri* 100·8; *Sarcophilus ursinus* 107·6; *Bettongia penicillata* 142·7; *Phascolarctos* 112·5; *Didelphys marsupialis* 80·9; *Phalanger* sp. 89·5; *Phascalomys*

¹ This groove is too strongly marked in fig. 11, Pl. L.; and its depth is shown where it is seen in profile at the extremity of the bone.

mitchelli 85·4. It will be observed that there is a very considerable variation within the limits of the Phalangeridæ, the fossil having a decidedly shorter femur than is found in *Trichosurus* and a decidedly longer one than in *Phalanger*, while it agrees very closely with that of *Sarcophilus*.

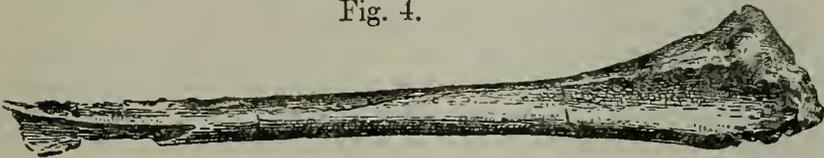
The Tibia (fig. 9, Pl. L.).—The tibia is a strong bone with the shaft much compressed and twisted. At about a fifth of its length from the upper end there is a well-marked tuberosity, flattened from side to side and considerably more prominent than in the tibia of Phalangeridæ or *Dasyurus*, though not so strongly marked as in *Phascolarctos*, where it forms a very prominent structure with an extended broad surface. The inner articular surface of the head is of much greater extent than the outer, in correspondence with the large size of the inner condyle of the femur. In this feature it differs from the tibia of recent marsupials.

Fig. 3.



Wynyardia bassiana. Portion of right fibula, anterior aspect.

Fig. 4.



The same, posterior aspect. Both nat. size.

The Fibula (text-figs. 3 & 4).—The fibula is a complete separate bone. Unfortunately neither fibula is perfect distally, but sufficient of this end of the right one remains to indicate that though the head was somewhat expanded, it was considerably less in size than that of the tibia. The proximal end is much enlarged, the most noticeable features being (1) the fact that evidently the outer condyle of the femur, as in *Phascolomys* and to a certain extent *Phascolarctos*, articulated with the upper of the two articular facets, the outer head of the tibia playing upon the lower one; (2) the extension upwards of the olecranon portion (broken off in the specimen figured), which carries a well-marked surface with which, as in other marsupials, a sesamoid evidently articulated. The lower tuberosity is strongly marked and in general features the head of the fibula rather calls to mind that of *Phascolomys* and to a lesser degree that of *Phascolarctos*. In both of these a line drawn through the middle of the lower tuberosity at right angles to the long axis of the bone lies considerably below the level of the lowest angle of the tuberosity which articulates with the sesamoid, while

in *Trichosurus* and other Phalangerinæ it cuts across the same angle.

The measurements of the tibia and fibula are as follows:—Tibia, length 99 mm.; greatest width of head 25; width at tuberosity 13. The comparative lengths of the tibia in the following species, taking in each case the length of the skull as 100, are:—*Trichosurus fuliginosus* 118·4; *Dasyurus maculatus* 94·6; *Pseudochirus archeri* 97·4; *Sarcophilus ursinus* 96; *Bettongia penicillata* 218; *Phascolarctos* 82·6; *Didelphys marsupialis* 82·2; *Phascalomys mitchelli* 65·2; *Phalanger* sp. 80·6.

Fibula, length 99. Comparative length of the fibula in the following species, taking in each the length of the skull as 100:—*Trichosurus fuliginosus* 115·4; *Dasyurus maculatus* 94·6; *Pseudochirus archeri* 97·4; *Sarcophilus ursinus* 94·2; *Bettongia penicillata* 210·9; *Phascolarctos* 81·2; *Didelphys marsupialis* 71·5; *Phascalomys mitchelli* 65·2; *Phalanger* sp. 80·6.

It will be noticed that the nearest approach in relative length of both tibia and fibula is met with in *Pseudochirus*, the next nearest being *Dasyurus* and *Sarcophilus*.

Pelvic Girdle. (Fig. 4, Pl. XLIX.)

The parts of this remaining are the acetabular region and ischium and the greater part of the ilium of the right side. The whole girdle is remarkable for its great massiveness.

The ischial portion is somewhat similar to that of *Trichosurus*, the border which lies on the internal side in the acetabular region bending outwards and downwards to the tuber ischii, though it is nothing like so sharply marked as it is in *Trichosurus*, in which it forms a distinct ridge. The acetabular cavity is deeper than in *Trichosurus* or *Dasyurus*, the two margins of the articulating surface approaching more nearly one to the other inferiorly, owing to the fact that the posterior margin which overhangs the cotyloid notch faces somewhat more forwards than it does in the Phalangeridæ or Dasyuridæ. The cotyloid notch is deep, though not so deep as in the Macropodidæ. The synovial cavity is distinctly outlined, but, except in the posterior part, is not overarched by the acetabular border. Owen¹ laid some stress upon the presence of this feature in *Thylacoleo* as being indicative of the alliance of the latter with the carnivorous marsupials, but it is also present in certain herbivorous forms. The shape of the acetabular region on the whole more nearly resembles that of *Phascalomys* than of any other form.

The ilium is unfortunately somewhat broken along its postero-internal or iliac border, but is sufficiently intact to show that it does not closely resemble that of any existing marsupial. The three surfaces—gluteal, iliac, and sacral—are sharply defined, and

¹ "Pelvic Characters of *Thylacoleo carnifex*," Phil. Trans. R. S. part ii. 1883, p. 639.

in certain respects have much the same relationship one to another that they have in the Macropodidæ. They differ markedly from those of the Dasyuridæ, and still more from those of the Phalangeridæ. The bone gradually spreads out towards the crest, which curves out as in the Phalangeridæ, but in the fossil the crest is formed by the union of the gluteal and sacral surfaces. The bone is roughly triangular in section, with two broad and one narrow side, much as in the Macropodidæ, from which, however, it differs strongly in the gradual swelling out towards the crest. The acetabular border, which is rounded proximally, becomes more and more angular distally and curves outwards to the external limit of the crest. The pubic border, which is distinctly marked along its whole length, much as in Macropodidæ, is very sharply defined distally, and between these two borders runs the iliac surface which is distinctly concave distally. The ilium in its broad, flattened distal part with outcurving crest bears only a superficial resemblance to that of the Phalangeridæ, for whereas in the latter the acetabular border lies almost in the middle line of the expanded surface, in the fossil it forms the lower and outer boundary of this, the iliac surface being as it were pushed forwards and downwards so as to form, as in the Macropodidæ, a very distinct antero-inferior surface. From that of *Dasyurus* and *Perameles* the bone differs in that the iliac border does not meet the acetabular, and so obliterate the iliac surface in the upper and distal part, though this obliteration is not quite complete in all specimens of *Dasyurus*.

The marsupial bones are well developed, and fortunately one of them is in a good state of preservation. It is straight, flattened, and considerably expanded at the proximal extremity, where, as in the Wombat, there are two distinct surfaces for articulation with the pubis. They differ markedly from those of the Phalangeridæ both in size and in the absence of the curve which is characteristic of the bone in such forms as *Trichosurus*. The length of the bone is 55 mm.; that of the corresponding bone in a *Trichosurus*, the femur and skull of which are of approximately the same length as those of the fossil, being only 31 mm. In shape the bone is closely similar to that of the Wombat, though relatively larger; in fact it is as large in proportion to the ilium as in *Phascolarctos*, though it is markedly different from that of the latter in being straight instead of strongly curved. The width of the expanded proximal end is 22 mm.; at 11 mm. from this end the width is 9 mm.; at 15 it is 6 mm., and this width is continued to the distal end.

Sacrum.

Only a broken portion of the sacrum is preserved, showing the bodies of three fused vertebrae. The transverse processes are too broken to allow of the method of attachment of the ilia being determined, but the bodies and processes of the three are firmly fused together. The neural spine of the first is broad and flattened, measuring 14 mm. in length; the total height cannot be ascertained,

as it is broken off at a height of 12.5 mm. It slants slightly forwards.

Vertebral Column.

Of the vertebral column there remains the broken axis and a continuous series of 9 vertebræ belonging to the presacral region. The axis has the odontoid process firmly attached. The articular surface is elongate, its length being 10 mm.; the anterior margin of the neural arch arises at the level of the posterior end of the articular surface, and is almost vertical, the under surface of the overhanging end of the neural spine forming almost a right angle with it. The exact extent of the spine cannot be determined as the posterior part is broken. The transverse process differs from that of marsupials generally (ex. *Trichosurus*, *Dasyurus*, *Perameles*, *Macropus*) in running out nearly at right angles to the body. It is stoutly built and relatively short. The width (11 mm.) of the neural cavity is decidedly greater than its height (7.5), a condition which does not usually obtain in marsupials; in a specimen of *Dendrolagus bennettianus* both width and height are 9 mm.; in *Trichosurus* both are 7 mm.; in *Dasyurus viverrinus* and *Perameles gunni* the height is 5 mm., the width a shade greater; in *Phascolumys* the width is 15, the height 12; and in *Macropus rufus* the width is 16 and the height 11.5. The ridge of bone which forms the floor of the vertebrarterial canal instead of being, as in recent marsupials, narrowed from before backwards so that there is a distinct open space between the backwardly slanting process and the centrum ventrally, is expanded so as to form a platform which serves as a floor for the vertebrarterial canal. In ventral view there is a low median keel; this runs forwards to meet a ridge which runs across the anterior end of the centrum and then diverges outwards on each side, when it is confluent with the lower edge of the articular surface, and then passes outwards on to the process at the base of the vertebrarterial canal. The space between this ridge on either side and the median keel is occupied by a platform of bone across which runs a small ridge. This platform, stretching across between the process and the centrum, is a distinctive feature of the axis of the fossil form, and is not met with in recent marsupials.

The remaining vertebræ are all considerably broken; they are lying on their right side, the processes of the left side being all broken off. Under the four anterior ones there lie the broken remains of ribs.

The total length of this part of the vertebral column is 191 mm.; that of a corresponding part of a *Trichosurus vulpecula*, of which the skull is slightly smaller than that of the fossil, is 160 mm. Owing to their broken state it is not possible to determine which of them carried ribs. The third from the anterior end is the only one in which the neural spine is preserved; it has the form of a broad plate slanting backwards, with a length of 14 mm. at its base and 12 along its dorsal margin; its anterior, backwardly

sloping margin measures 9 mm.; its vertical height is 7 mm. It gradually thickens from before backwards, the width of the somewhat swollen dorsal surface being 2 mm. in front and 4 mm. behind. The length of the broken base of the neural spine of the vertebra next in front is 16 mm. Its general form is much like that of *Trichosurus*, only much enlarged, the corresponding process in a *T. vulpecula* (with a skull of almost the same size as that of the fossil) being 8 mm. in length and 4 mm. in vertical height.

The metapophyses are well developed, and fit in between the posterior zygapophyses and the anapophyses. The latter are well developed, forming rounded processes on four of the vertebræ, those of the last two being broken off; they gradually diminish in size from before backwards. The zygapophyses and associated metapophyses lie in a more horizontal plane than they do in *Trichosurus* and other forms, their general relationship being very much that which obtains in *Dendrolagus*.

The most striking feature in regard to these presacral vertebræ is the structure of the transverse processes, which are unlike those of any existing marsupial. They are well developed on all the last five vertebræ, but in front of this cannot be seen, owing to the manner in which the ribs have been pressed up against the vertebral column. The most perfectly preserved one is that on the fourth vertebra counting from the posterior end; here it has the form of a flat plate slightly increasing in width towards the free end and slightly slanting forwards, both its anterior and posterior edges being straight. The width of the attached end is 10 mm. and of the free end 12 mm.; the length of the process is 15.5 mm. On the vertebra in front of this the width at the attached end is 11 mm. and the length 12 mm., the anterior edge being slightly concave. On the vertebra behind, the process is broken off close to its base, while on the next vertebra it is directed outwards at right angles to the length of the body, has a length of 16 mm. and a uniform width of 9 mm. In the last of the presacral vertebræ the shape is different; for the length of 5 mm. the proximal part lies at right angles to the body, but beyond this the process bends forwards, the total length being 22 mm. The process, which only measures 7 mm. in width, is marked by a ridge which runs obliquely across its width, continuing the line of the curved front edge of the distal part. All of the processes run in an almost horizontal plane, as they do in *Phascalomys*; but whereas in the latter they are long and narrow, here they are long and broad, unlike those of existing marsupials except to a slight extent those of *Phascolarctos*, in which, however, they are relatively much smaller.

Summary of Important Points.

(1) Proportionate length to the breadth of the skull, 100 : 67. This approximates most nearly to *Dasyurus*, and shows a decidedly greater proportionate width than in the Phalangeridæ.

(2) Lambdoidal crest well developed, as in *Dasyurus*.

(3) Sagittal crest strongly developed, resembling that of *Dasyuridæ* and species of *Didelphys*.

(4) Large size of the squamosal. This is more strongly marked than in any recent marsupial except perhaps *Phascalomys*. The dorsal suture of the squamosal runs generally parallel to the sagittal crest as in *Dasyuridæ* and does not converge posteriorly as it does in *Phalangeridæ*.

(5) The wide sweep and upward curvature of the zygomatic arches, as in *Dasyuridæ*.

(6) The entire absence of the inflated part of the squamosal, which is characteristic of the *Phalangeridæ* generally.

(7) The transverse elongation of the glenoid cavity, the downward produced plate of bone which forms the boundary is not connected with any structure forming part of the auditory passage. In this respect it agrees with *Dasyuridæ* and *Perameles*, and differs markedly from the *Phalangeridæ*, amongst which it forms the anterior part of a bony auditory canal.

(8) The position of the glenoid cavity in reference to the base of the skull. In the relatively high position of this it approximates most nearly to the *Phalangeridæ*, though it is placed somewhat lower than in these.

(9) The greatest breadth of the frontals is in the cranial part. In this the fossil differs apparently from all recent marsupials.

(10) The large size of the lacrymals, which meet the nasals as they do in *Phascalomys*.

(11) The great width of the nasals. In their general shape the bones are closely similar to those of certain species of *Didelphys*.

(12) The forward extension of the nasals, as in the *Phalangeridæ* and certain *Didelphyidæ*, and in contrast to what obtains amongst the *Dasyuridæ*.

(13) The very anterior position of the infraorbital foramen.

(14) The development of a groove running forward from the foramen rotundum to the fossa gasseriana. In this it agrees with *Macropus*, *Sarcophilus*, and *Dasyurus*.

(15) The structure of the petiotic bone, which is quite unlike that of any other marsupial.

(16) The size and shape of the premaxillæ, which are very similar to those of *Trichosurus* and may probably be regarded as indicating the presence of a fair-sized incisor dentition.

(17) The relative size of the cranial cavity, which is greater than that in any recent marsupial.

(18) The great length of the inflected angle of the lower jaw and the height to which it rises. This characteristic marsupial feature is strongly emphasized in the fossil.

(19) The probable high position of the articulating surface of the lower jaw.

(20) The remarkable obliquely transverse groove in the lower jaw.

(21) The strongly marked curved ridge on the under surface of the lower jaw.

(22) The massive nature of the femur and the fact that the inner condyle is larger than the outer one, which is the reverse condition of that which is typical of recent marsupials.

(23) The strong development of the tuberosity at the upper end of the lesser trochanter, and the presence of a tuberosity at the lower end of the ridge which is continued down from the great trochanter. The latter feature is met with in *Phascolomys*.

(24) The position of the head of the femur, which is turned considerably inwards.

(25) The proportionate length of the femur to that of the head. It is longer than in *Trichosurus*, shorter than in *Phalanger*, and agrees most nearly with that of *Sarcophilus*.

(26) The strong development of the anterior tuberosity in the tibia. This is more strongly developed than in *Phalangeridæ* and *Dasyurus*, but not so strongly as in *Phascolarctos*.

(27) The distal head of the fibula is somewhat less in size than that of the tibia.

(28) The upward extension of the olecranon portion of the fibula is considerable and most resembles that found in *Phascolomys*. The outer condyle of the head articulates with the femur.

(29) The proportionate length of the fibula and tibia to that of the skull is nearest to that of *Pseudochirus*.

(30) The ischium is massive and shows a general resemblance in form to that of *Trichosurus*.

(31) The acetabular region is most similar to that of *Phascolomys*, the lower part only of the distal acetabular border overhangs the synovial cavity in the region of the cotyloid notch. The notch is fairly deep, and the whole acetabular region resembles most nearly that of *Phascolomys*.

(32) The ilium is unlike that of any recent marsupial. It has the trihedral form of *Macropus* or *Dendrolagus*, but combined with this the distal expansion characteristic of other forms, such as the *Phalangeridæ*, from which, however, it differs markedly in essential structure.

(33) The great size and straightness of the marsupial bones, which have two articulating surfaces as in *Phascolomys*.

(34) The sacrum consists of three fused vertebræ. This occurs in *Dasyurus viverrinus*.

(35) The structure of the axis, in which the transverse process runs out almost at right angles to the body, and the ridge which forms the base of the vertebrarterial canal is flattened out, instead of being narrowed from before backward as in all recent marsupials.

(36) The transverse processes are large broad plates running out almost horizontally: they are unlike those of any recent marsupial.

It will be seen from the above that the fossil presents a remarkable combination of characters, some of which serve to distinguish it from recent marsupials, while others serve to ally it on the one

hand with existing Polyprotodontia, and on the other with existing Diprotodontia.

If we had only the anterior part of the skull preserved, there is but little doubt that it would be referred to the Phalangeridæ; but, on the other hand, if we had only the hinder part showing the strong sagittal crest, the low origin and wide sweep of the zygomatic arch, it would be referred to the Dasyuridæ; the ilium alone would be regarded as belonging to an animal more allied to *Dendrolagus* than to any existing marsupial; while the head of the fibula would be regarded as indicating affinity to *Phascolomys*. We may divide the more important characters into three groups as follows:—

(1) Those in which it differs from recent marsupials. These characters are seen in numbers 9, 13, 15, 17, 22, 32, 35, 36. The most important features in connection with these is the greater relative size of the cranial cavity, in conjunction with the fact that the greatest breadth of the frontal bones lies in the cranial and not in the facial region. There is no indication of affinity with any special group outside of the marsupials, but an indication that within the marsupials retrogression has most probably taken place in this respect.

(2) Those in which it shows alliance with the Polyprotodontia. These are seen in numbers 1, 2, 3, 5, 7, in all of which it shows a decided alliance with the Dasyuridæ.

(3) Those in which it shows alliance with the Diprotodontia. These are seen in numbers 8 (to a certain extent), 12 (to a certain extent, though this character is common to Didelphyidæ), 16, 19, 28, 29, 30, 31, 32. In some of these features it shows alliance with the Phalangeridæ and in others with *Phascolomys*, and in 32 with Macropodidæ to a certain extent.

In the complete absence of teeth and of the bones of both fore and hind feet, it is unsafe to attempt to refer it to any existing family; there are, indeed, only two which could possibly be considered in this respect—the Dasyuridæ and Phalangeridæ. From both of these it differs in the points mentioned in the first group: from the Dasyuridæ in the characters mentioned in the third group as well as in 4 (in part), 18, 32, and 33; from the Phalangeridæ in those of the second group as well as in 4, 6, 18, 28, 32, 33, 34.

The structure of the premaxillæ appears to indicate the existence of a fair-sized incisor dentition; and a consideration of all the features would appear to lead to the conclusion that the fossil is the representative of a now extinct series of forms which were more nearly allied to ancestral Polyprotodonts than are any of the existing Diprotodont forms. It may, in fact, be regarded as intermediate between the former and the latter, and as indicative of a stage in the development of Australian marsupials when the ancestors of the recent Diprotodontia were beginning to diverge from the original Polyprotodontid stock from which they have been developed within the limits of the Australian region.

Melbourne, May 1900.



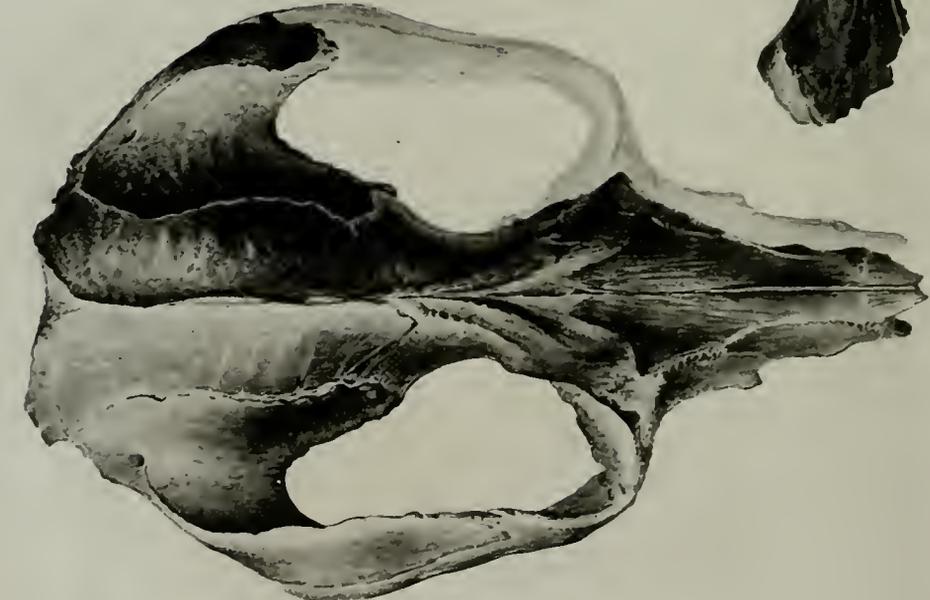


Fig. 1.



Fig. 2.



Fig. 3.



Fig. 4.



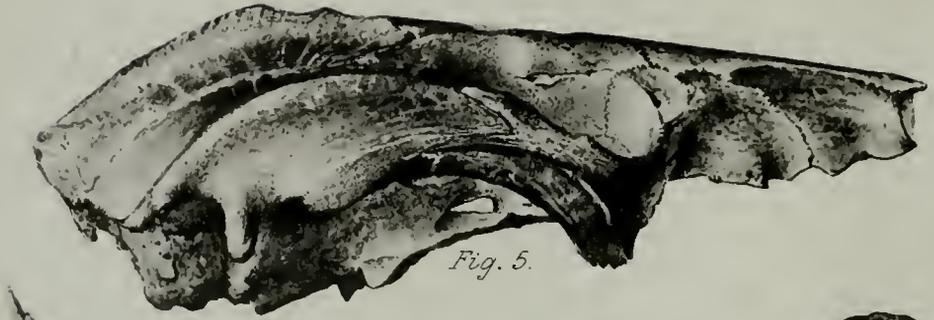


Fig. 5.



Fig. 6.

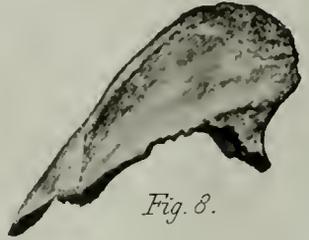


Fig. 8.



Fig. 7.



Fig. 9.



Fig. 10.



Fig. 11.

EXPLANATION OF THE PLATES.

PLATE XLIX.

Wynyardia bassiana.

- Fig. 1. Upper surface of the skull.
 2. Lower surface of the skull.
 3. Axis vertebra, from the left side.
 4. Portion of the pelvic girdle, showing the acetabulum and ischium.

PLATE L.

Wynyardia bassiana.

- Fig. 5. Side view of the skull.
 6. The left ramus of the mandible, from the inner side.
 7. The same, from the under surface.
 8. The coronoid process of the right side.
 9. The left tibia.
 10, 11. The left femur.

All the figures are drawn of the natural size.

2. On some Crustaceans from the South Pacific.—Part V.
*Arthrostracans and Barnacles*¹. By L. A. BORRADALE,
 M.A., F.Z.S., Lecturer in Natural Sciences at Selwyn
 College, Cambridge.

[Received June 6, 1900.]

(Plate LI.)

The material on which the present report is based was collected in the islands of Funafuti (Ellice group), Rotuma, and Viti Levu, Fiji, by Mr. Stanley Gardiner, to whom the writer is much indebted for the opportunity of examining it.

The following species were furnished by the three localities respectively :—

From Rotuma.

ARTHROSTRACA.

Armadillidium pacificum, n. sp.

CIRRIPEDIA.

Tetractita porosa (Gmelin), var. *viridis* Darwin.

From Funafuti.

ARTHROSTRACA.

Cirolana latistylis Dana.

Armadillidium pacificum, n. sp.

Leptocheilia sp.

Hyale gracilis (Dana).

CIRRIPEDIA.

Lithotrya pacifica, n. sp.

¹ For Parts I.—IV., see P. Z. S. 1898, pp. 32, 457, and 1000, and 1900, p. 568.

From Fiji.

CIRRIPEDIA.

Lepas anatifera Linn.

Balanus tintinnabulum (Linn.), var. *occator* Darwin.

There are altogether four species of Arthrostraca, of which two are described as new, and four of Cirripedia, of which one is new.

Subclass *ARTHROSTRACA*.

Order ISOPODA.

Tribe ONISCOIDEA.

Family ARMADILLIDIIDÆ.

Genus ARMADILLIDIUM Brandt, 1833.

1. ARMADILLIDIUM PACIFICUM, n. sp. (Plate LI. figs. 1, 1 a.)

Diagnosis: "An *Armadillidium* with the body oblong-oval, more than twice as long as broad ($\frac{8}{3}$); the surface minutely pitted, not hairy; the head transverse, shorter and narrower than the thoracic segments, its fore edge straight as seen from above, its hind edge hollowed; the first free thoracic segment broader than any of the rest, its hind angle rounded and overhung by a squarish lobe, under which the fore edge of the next segment fits when the animal curls up; side plates of remaining segments narrow, those of segments 2, 5, 6, and 7 squared, those of 3 and 4 subacute; each segment with a row of small longitudinal furrows on each side; the abdomen short, broad, semicircular; the last segment broader at the base than it is long, hollowed at the sides, and thus narrowest in the middle of its length, broader and truncate at the end; the antennæ very short, their flagella shorter than the last joint of the stalk, with the first joint about one-fourth of the length of the end joint; the outer branch of the uropods rather shorter than the base, broad, its free edge completing the semicircular outline of the abdomen, but projecting slightly beyond this outline; the copulatory appendages on the first abdominal appendage of the male slightly diverging at the tip."

Colour in spirit, mottled grey.

Length of largest specimen, 8 mm.

The genus *Armadillidium* seems not to have been met with hitherto in the South Seas, if we except the world-wide *A. vulgare*, which has been found at Melbourne. The name of the present species is proposed in commemoration of this fact.

Funafuti; one male, seven females.

Rotuma; one male, one female.

Tribe FLABELLIFERA.

Family CYMOTHOIDÆ.

Subfamily CIROLANINÆ.

Genus CIROLANA Leach, 1818.

2. CIROLANA LATISTYLIS Dana, 1852.

Cirolana latistylis, Dana, U.S. Expl. Exped., Crust. ii. p. 772, pl. li. fig. 6 (1852); Whitelegge, Mem. Austral. Mus. iii. 2, p. 149 (1897).

Funafuti; three examples found on weed in the lagoon, one dredged in the lagoon in 15–25 fathoms of water.

Order ANISOPODA.

Family TANAIDÆ.

Genus LEPTOCHELIA Dana, 1849.

3. LEPTOCHELIA sp. (Plate LI. figs. 2–2c.)

The collection contains seven female specimens of a *Leptochelia* near to, and perhaps identical with, *L. minuta* Dana, which was described from the male only. There are, however, well-marked differences between the present specimens and Dana's, besides that of the chelæ, which is known to be a sexual one. Of these differences the most prominent are those affecting the uropods. The following is a description of the animals:—

Head large, equal to the three succeeding segments.

First antennæ not longer than the head, of four simple joints.

Second antennæ of five joints and a minute end-joint; the second joint bearing on the inside a spine which is two-thirds the length of the much narrower third joint.

Chelipeds fairly strong, outreaching the head by the hand and wrist, about half the total length of the body; the hand as long as the wrist but rather narrower.

First walking-leg with the dactyle very long, longer than the preceding joint. The remaining dactyles not so long.

Uropods with the inner branch five-jointed, the outer one-jointed.

Colour in spirit, white.

Length of the longest specimen, 3.5 mm.

Order AMPHIPODA.

Family ORCHESTIIDÆ.

Genus HYALE Rathke, 1837.

4. HYALE GRACILIS (Dana), 1850.

Allorchestes gracilis, Dana, Proc. Am. Ac. Sci., Boston, ii. p. 205 (1850); U.S. Expl. Exped., Crust. ii. p. 890, pl. ix. fig. 5 (1852).

Funafuti; numerous individuals of both sexes.

Class ENTOMOSTRACA.

Order CIRRIPEDIA.

Family LEPADIDÆ.

Genus LEPAS Linn., 1758.

5. LEPAS ANATIFERA Linn., 1758.

Lepas anatifera, Linnæus, Syst. Nat. 10th ed. p. 668 (1758); Darwin, Mon. Cirr. i. p. 73, pl. i. fig. 1 (1851).

The basal parts of the scuta are distinctly furrowed in the present specimens, but the line of quadrilateral depressions across the shell is entirely wanting.

Fiji; two examples.

Genus LITHOTRYA Sowerby, 1822.

6. LITHOTRYA PACIFICA, n. sp. (Plate LI. figs. 3, 3 a.)

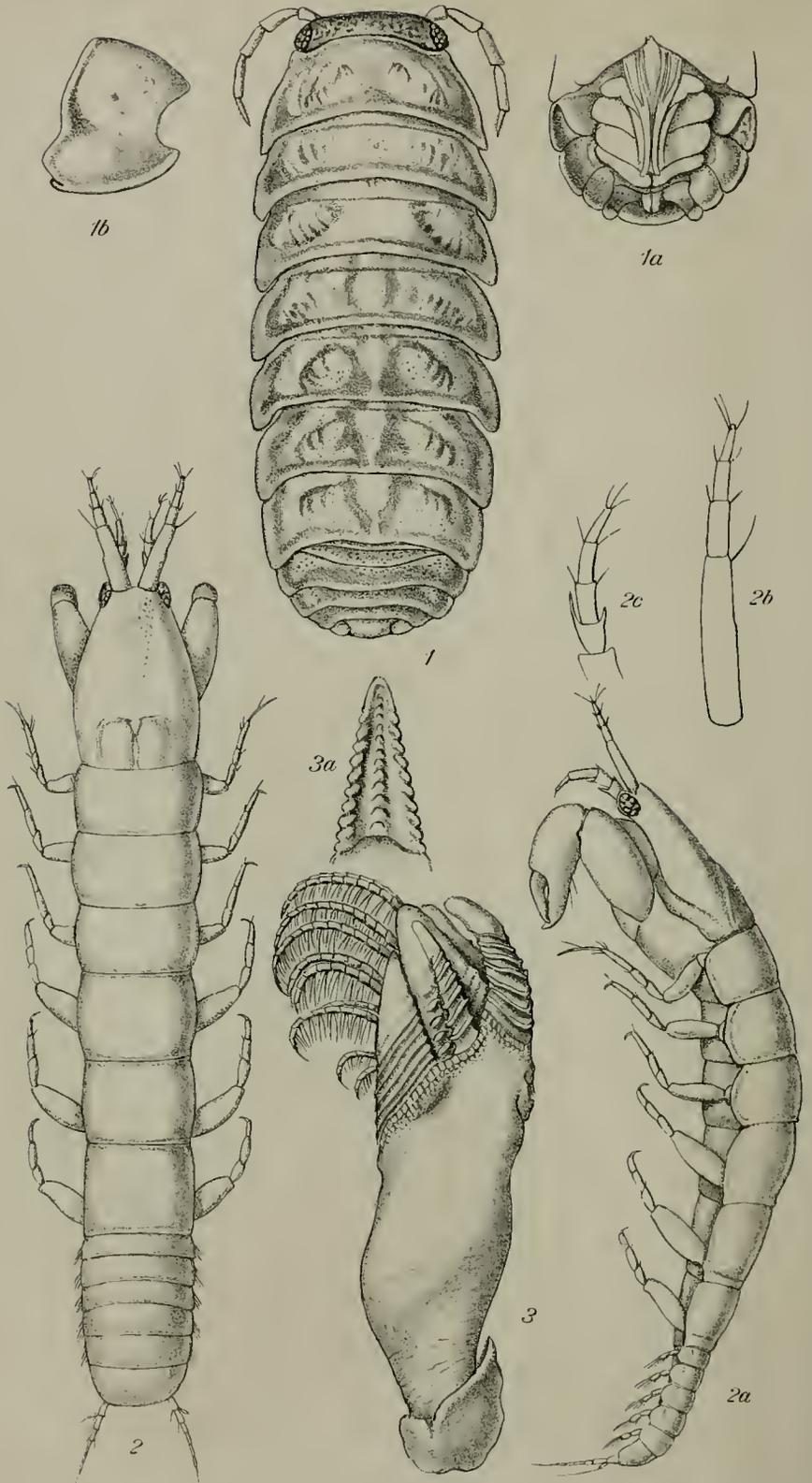
Diagnosis: "A *Lithotrya* with the scuta triangular, somewhat narrowly overlapping the terga; the terga long, narrow, triangular, the ridges outside them short and straight; the laterals very long, more than three-fourths the length of the terga, the base of each of them marching with seven of the underlying scales; the carina long, rather narrow, curved somewhat strongly, inside hollow with, in the upper part, a middle row of triangular knobs corresponding to the external ridges; rostrum (which seems to be broken short in the present specimens) bordered by a curved row of five scales; peduncle long."

Colour in spirit, white.

Length of largest specimen, including stalk, 28 mm. Length of carina of same specimen, 6.5 mm.

Funafuti; two specimens from the outer reef.





Edwin Wilson, Cambridge

Family BALANIDÆ.

Genus BALANUS Da Costa, 1778.

7. *BALANUS TINTINNABULUM* (Linn.), 1758, var. *occator* Darwin, 1854.

Balanus tintinnabulum, var. *occator*, Darwin, Mon. Cirr. ii. p. 196, pl. i. fig. *k*, pl. ii. fig. 1 *b* (1854).

The one specimen is of a white colour, with here and there faint traces of purple.

The only locality mentioned by Darwin for this variety is "South Seas."

Fiji; one specimen.

Genus TETRACLITA Schumacher, 1817.

8. *TETRACLITA POROSA* (Gmelin), 1789, var. *viridis* Darwin, 1854.

Tetracrita porosa, var. *viridis*, Darwin, Mon. Cirr. ii. p. 329 (1854).

Rotuma; thirteen specimens growing on rock.

In ending this series of papers on South Pacific Crustaceans the writer has to tender his best thanks to several gentlemen:—To Mr. J. Stanley Gardiner and Dr. A. Willey for permission to examine their collections, to Messrs. R. I. Pocock and F. Jeffrey Bell of the British Museum for much kind advice and assistance, and to Mr. Edwin Wilson for a great deal of trouble bestowed upon a number of very difficult drawings.

NOTE.—Errata in Parts II. and IV. of this paper:—On p. 458 of P. Z. S. 1898, for "*BIRGUS LATRO* (Linn.), 1766," read "*BIRGUS LATRO* (Linn.), 1767"; on p. 577 of P. Z. S. 1900, for "*GONIOCAPHYRINÆ*" read "*CATOPTRINÆ*," and for "*GONIOCAPHYRA TRUNCATIFRONS* de Man, 1887," read "*CATOPTRUS* A. M.-Edw., 1870." This genus is placed by Milne-Edwards, Ortmann, and Alcock among the Gonoplacidæ. De Man regards it as belonging to the Portunidæ, where it is placed in the present work. For synonymy, see Alcock, Journ. As. Soc. Beng. lxi. 2, iii. p. 307 (1900).

EXPLANATION OF PLATE LI.

- Fig. 1. *Armadillidium pacificum*, ♂, × 8: p. 796.
 1 *a.* " " " underside of abdomen, × 8.
 1 *b.* " " " side of 1st free thoracic segment, × 8.
 2. *Leptocheilia* sp., ♀, × 16: p. 797.
 2 *a.* " " " from the left side, × 16.
 2 *b.* " " " 1st antenna, × 40.
 2 *c.* " " " 2nd antenna, × 40.
 3. *Lithotrya pacifica*, × 3: p. 798.
 3 *a.* " " " carina, from within, × 3.

3. List of Mammals obtained by Dr. Donaldson Smith during his recent Journey from Lake Rudolf to the Upper Nile. By OLDFIELD THOMAS.

[Received October 19, 1900.]

On his return from his recent adventurous journey to the Upper Nile from Somaliland *viâ* Lake Rudolf, Dr. Donaldson Smith has been so good as to entrust to me for description the specimens of mammals that he obtained, and has further been generous enough to present a number of them, including all the types, to the British Museum.

Owing to the great difficulties of transport large series of specimens were not brought home, nor were many small mammals obtained, but, from the knowledge gained on his previous expeditions, Dr. Smith was enabled to select those that were most likely to be interesting, and this knowledge has been rewarded by the considerable proportion of novelty that the examination of his specimens reveals.

The specimens were mostly prepared by Mr. W. Carlile Fraser, who accompanied Dr. Smith as collector and taxidermist.

1. *COLOBUS ABYSSINICUS*¹ *POLIURUS*, subsp. n.

a, b. ♂ ♀. Omo River, 21 Dec., 1899. (121, 122.) Also a number of native skins.

Similar in most respects to the typical form, of which the British Museum possesses an original example from Rüppell's collection, but the basal two-thirds of the tail, instead of being nearly black, or with a fine sprinkling of white hairs, is greyish white with merely a scarce intermixture of black hairs. Below, in the majority of specimens, it is altogether white. The caudal tuft is also of greater extent, and its hairs longer, so that it approaches the magnificent tuft of *C. caudatus*. Mantle rather less developed than in true *abyssinicus*.

Hab. Omo River, north of Lake Rudolf.

Type. Female. B.M. No. 0.11.7.3. No. 122 of the Donaldson Smith collection.

In Mr. Oscar Neumann's recent paper² on *Colobus matschiei*, he speaks of the "graumelirte Färbung des Schwanzes" in the true *C. abyssinicus*, but in the Rüppellian specimen above referred to, as also in some examples from Harris's Shoan collections, the tail is practically black, and it is possible that the specimens seen by Mr. Neumann really belonged to *C. a. poliurus*.

Of this fine Monkey, Dr. Donaldson Smith brought home a pair of properly preserved specimens, with skulls and all particulars,

¹ *Lemur abyssinicus*, Oken, Lehrb. Naturg. iii. pt. ii. p. 1182 (1816).

Mr. de Winton has drawn my attention to this reference, which antedates Rüppell's description of "*guereza*" by many years. *L. abyssinicus* is clearly the same form as the latter, and even the native name "*Guereza*" is used for it.

² SB. Ges. nat. Fr. Berl. 1899, p. 15.

and in addition a number of native furrier's skins, all of which agree with the type in the light colour of their tails. The good male skin has the blackest tail of all, and is evidently exceptional in this respect, but it has still far less black than the Abyssinian examples. Had it not been for this variation, however, I should have been disposed to call the Omo River *Colobus* a distinct species, as has been done with the other East-African forms of the genus.

2. *CERCOPITHECUS RUFOVIRIDIS* Geoffr.

- a. Juba R., 2 Oct., 1899.
- b. Webi Dawa.
- c. Omo R., 21 Dec., 1899.

3. *CERCOPITHECUS OMENSIS*, sp. n.

- a. ♀. Mursu, Omo River, about 40 miles N. of Lake Rudolf.

Allied to *C. albigularis*, but very markedly smaller, and without the yellowish infusion in the dorsal colour.

Head and back clear grizzled grey, the former without the brownish and the latter without the yellowish or rufous tone found in the allied species. Crown, centre of nape, and withers blackish. Lips, chin, throat, and sides of neck dull white. Hairs on ear also white. Whole of arms and legs uniformly black. Hairs round anus rufous. Tail black, grizzled proximally with white.

Skull, as compared with that of *C. albigularis*, markedly smaller and lighter. Upper outline more convex. Nasal opening small. Face particularly narrow, as shown by the measurement across the orbits. Teeth small and delicate, less in every dimension than those of the allied species.

Dimensions of the skull, that of a fully adult female, with all the teeth worn:—

Greatest length 87 mm.; basal length 64; zygomatic breadth 57; least breadth of face across outside orbits 46; breadth of nasal opening 9; combined length of upper premolars and molars 22·3; the same below 26. The flat skin measures approximately, head and body 440, tail 480.

Type. Female. B.M. No. 0.11.7.7. Original number 128. Collected 29 Dec., 1899, and presented by Dr. Donaldson Smith.

This little representative of the common East-African *C. albigularis* may be readily recognized by its much smaller size and less yellowish coloration. *C. stuhlmanni*, Matsch., is as large as *C. albigularis*.

4. *CERCOPITHECUS NEGLECTUS* Schl.

- a, b. ♀. Omo River, 23 Dec., 1899. (124, 126.)

This interesting Monkey, almost a topotype of the species, proves to be quite similar to a West-African skin of *Cercopithecus brazzae* M.-Edw., and thus confirms the suppression of the latter name as being merely a synonym of the former.

5. PAPIO DOGUERA Puch.

a. Omo River, 28 Dec., 1899.

This may represent *P. heuglini*, Matsch.

6. GALAGO GALAGO Schr.

Skin. ♂. S.E. of Lake Stephanie in Boran Galla Country, 21 Nov., 1899; 3000 feet.

7. MACROSCELIDES¹ BORANUS, sp. n.

Rather larger than *M. rufescens*, to which it is most nearly allied. Colour above very much as in that species, but the back rather a deeper chestnut, and the sides rather more greyish, so that there is a more marked contrast between back and sides. Face-markings as in the allied form. Ear-conch and the low rounded metatragus as in *M. rufescens*. Under surface white, more

¹ As it is from the same part of Africa, I may take this opportunity of describing a new Bat from a specimen recently obtained by Mr. J. J. Harrison, and presented by him to the British Museum:—

KERIVOULA HARRISONI, sp. n.

Most nearly allied, according to the characters used in Dobson's synopsis, to *K. lanosa* A. Smith, but considerably smaller. Fur very long, soft, and woolly, the hairs of the back about 9 mm. in length. Muzzle thickly hairy. Back of ears hairy, except at the edges, these and the whole inner surface practically naked. In shape the ears are very much as in *K. lanosa*; their inner margin slightly convex below, more strongly so above; tip inconspicuous, behind and below the level of the most convex point of the anterior edge; below the tip a marked concavity, after which the hinder edge is evenly convex to its base. Tragus, so far as can be seen in the dried skin, very like that of *K. lanosa*; its basal lobe small.

Fur of back not extending on to the wing-membranes, but the interfemoral is clothed basally with scattered long hairs; the legs are thickly clothed down to the toes; the upperside of the tail is well haired to the tip, and the interfemoral membrane has a thick fringe of hairs along its posterior edge. The forearm is irregularly tufted with fine golden hairs, which are continued on the thumb to the base of its claw, and again along the final edge of the second digit, edge of wing-membrane, and terminal part of third digit to the extreme tip of wing.

The general colour of the back is a dull "old gold," the woolly hairs being blackish basally, then dull buffy orange with their tips blackish, longer hairs tipped with silvery yellow. The hairs on the legs, feet, tail, and calcars, like those on the forearm, golden yellow, but the interfemoral fringe is a dull pale brown. Belly-hairs blackish basally, dull buffy white terminally.

Skull very fine and delicate, on the whole very like that of *K. brunnea* Dobs., though the nasal notch is not so deep.

Upper outer incisors nearly as long as the inner ones, the former with a low postero-internal secondary cusp, the latter with a posterior one at about the level of the tip of *i*².

Forearm 31.5 mm. Front of canine to back of *m*³ 5.2.

Hab. Walamo, between Lakes Suai and Margherita, N.E. Africa. Alt. 6700 feet.

Type. B.M. No. 0.11.4.1. 21st February, 1900. Collected and presented by Mr. J. J. Harrison.

No species hitherto described can be confused with *K. harrisoni*. *K. lanosa* is larger and of a different colour; *K. smithi* has no interfemoral fringe; *K. ærosa* has minute outer incisors; and *K. brunnea* and *K. africana* have the same teeth unicuspidate, and the tragus of a different character.

or less washed with a pinkish suffusion; basal halves of belly-hairs dark slaty; line of demarcation on sides indistinct. Upper surface of hands and feet white. Tail rather longer than head and body, brown above, ill-defined dull buffy below.

Skull apparently quite like that of *M. rufescens*, except that the interorbital space is much broader, very much as in *M. revoili*.

Dimensions of the type, measured by collector in the flesh:—

Head and body 113 mm.; tail 128; hind foot 32; ear 21.

Skull—greatest length 36; basal length 31; zygomatic breadth 20; nasal length 13; interorbital breadth 7.1; breadth of brain-case 15.5; palate length 18.5. Combined length of last three cheek-teeth (*p.*¹, *m.*¹, and *m.*²) 6; length of lower tooth-row 16.5.

Hab. Mega, Western Boran Galla, S.E. of Lake Rudolf; altitude 4500 feet.

Type. Female (as determined by the collector). B.M. No. 0.11.7.11. Original number 51. Collected 9 Nov., 1899.

This species is no doubt closely allied to *M. rufescens*, but differs by its pinkish-washed, less snowy-white, and less defined belly, dull buffy instead of white underside of tail, and its markedly broader interorbital space, in which latter respect it resembles the very differently coloured *M. revoili*.

8. LYCAON PICTUS Temm.

Skin. Hado, 60 miles S. of Milmil, Somali, Aug. 1890.

9. SCIURUS MULTICOLOR Rüpp.

Skin. ♂. Luoi, 50 miles E. of Fort Berkeley, Upper Nile, 13 March, 1900.

10. MUS ARBORARIUS Pet.

Skin. ♂. Loavie, between Tarangoli and Fort Berkeley, 10 March, 1900.

11. ARVICANTHIS ABYSSINICUS Rüpp.

Skin. ♂.

12. THRYONOMYS SWINDERENIANUS Temm.

Young. Fort Berkeley, 13 March, 1900.

This probably represents Heuglin's *Aulacodus semipalmatus*, but is too young for any comparison.

13. BUBALIS LELWEL Heugl.

Skull and head-skin. 60 miles E. of Lado, 25 Feb., 1900.

Skull. Near Fort Berkeley, 13 March, 1900.

14. OREOTRAGUS OREOTRAGUS Zimm.

Klipspringer.

a. Skin and skull. ♀. 190 miles E. of Lado, 21 Jan., 1900.

15. OUREBIA MONTANA Rüpp.

a. ♂. 120 miles E. of Lado, on 4° 40' N., 17 Feb., 1900. (141.)

16. OUREBIA HAGGARDI Thos.

- a. ♀. 190 miles E. of Lado, 23 Jan., 1900. (121.)
 b. ♀. Plain N.W. of Rudolf, Jan. 1900. (127.)
 c. ♀. 100 miles W. of Rudolf, 22 Jan., 1900. (142.)
 d. ♂. Near Sogodi, 5 March, 1900. (147.)

17. MADOQUA GUENTHERI Thos.

Several specimens from the Webi Dawa, Somali, October 1899.

18. MADOQUA GUENTHERI SMITHII, subsp. n.

a. Head-skin and skull. ♂. About 30 miles S.E. of Lake Stephanie, 16 Nov., 1899.

Skull like that of the typical *M. guentheri*, but much larger, and especially more bulky and less lightly built, its breadth and height exceeding those in true *guentheri* proportionally more than is the case with the length.

Horns and colour of head as in *guentheri*; body-colours not yet known.

Dimensions of the typical skull:—

Greatest length 119 mm.; basal length 102·5; greatest breadth 59; nasals, length 14·5, combined breadth 16; interorbital breadth 39; intertemporal breadth 42·5; breadth of brain-case 44·2; gnathion to junction of nasals and maxillæ 45·5; gnathion to orbit 59; gnathion to front of alveolus of *p.*² 29·2; length of upper tooth-series 37. Horn, in straight line, 69.

Type. Male. Specimen *a* above. B.M. No. 0.11.7.13. Collected by Dr. Donaldson Smith.

A comparison of the above measurements with those given of the type of *M. guentheri* (P. Z. S. 1894, p. 326) shows how much larger the present animal is, especially as the type was a female, and in this group the females are rather larger than the males. The height of the crown of *M. g. smithii*, when the skull is resting on the molars and bullæ on a plane surface, is 47·8 mm., as compared with 44, 43·8, 43, and 42·5 in four male specimens of the typical form. A good male skull of *guentheri* in the collection measures 96 mm. in basal length by 53 in breadth, and the majority of specimens are decidedly smaller than this.

This fine Dik-Dik, which I have named in honour of its donor and discoverer, evidently bears very much the same relationship to the true *M. guentheri* that *M. cavendishi* does to *M. kirki*; but as there is a great probability that specimens intermediate in size will turn up, I think it wise to describe it as a subspecies rather than species.

19. CERVICAPRA BOHOR Rüpp.

- a-c. ♂ ♂ ♀. 150 miles E. of Lado, 9 & 10 Feb., 1900. (133, 135, 136.)
 d. ♀. 90 miles E. of Lado, 20 Feb., 1900. (143.)
 e, f. imm. ♂ ♂. 80 miles E. of Lado, 26 Feb., 1900. (144, 145.)
 g. Skull. ♂.

The reasons that have induced me to consider this exceedingly handsome Reedbuck as the true *C. bohor* of Rüppell have been detailed in a separate paper on the subject¹. These are the first specimens with exact localities that have been brought to England.

The horns of the finest head measure 15 inches in length by 5½ inches in basal circumference.

20. *CERVICAPRA CHANLERI* Rothsch.

a, b. ♂ ♀. South end of Lake Stephanie, 20 Nov., 1899. (130, 131.)

21. *GAZELLA GRANTI BRIGHTI*, subsp. n.

a. ♂. 160 miles E. of Lado, 28 Jan., 1900. (132.)

b. ♂. 150 miles E. of Lado, 6 Feb., 1900. (137.)

c. ♂. 150 miles E. of Lado, 5° 20' N., 34° 5' E., 6 Feb., 1900.

Type of the subspecies. (138.)

d, e. ♀ ♀. 200 miles E. of Lado, 20 Jan., 1900. (125, 129.)

Size rather smaller than in other races. Fur exceedingly short. General colour very pale. Face-markings normal. No darker lateral bands (at any age, *vide* Smith). White projection into body-colour on rump deep, quite surrounding tail. Pygal band short, narrow, sometimes almost obsolete. Horns comparatively short; the youthful growth-boss at their anterior bases retained into adult life and covered with a noticeable tuft of hair.

Dimensions of the skull of the type, an adult male:—Basal length 240 mm.; greatest breadth 106; muzzle to orbit 140. Horns, length over curves in front 460 (18.1 in.); circumference at base 143.

Hab. Country between Lake Rudolf and the Nile. Type from about 150 miles E. of Lado, on lat. 5° 20' N.

Type. Adult male, skin and skull. B.M. No. 0.11.7.14. Original number 138. Collected 6 February, 1900, and presented by Dr. Donaldson Smith.

For some time I have been aware that the Grant's Gazelle of the desert country west of Lake Rudolf was not quite the same as the typical East-African form; but although the Museum was last year given a female skin and skull by Lieut. (now Major) R. T. Bright, which were obtained in September 1898 on the N.W. shore of Lake Rudolf, and later on a separate male skull by Capt. J. D. Ferguson from Lumian, on the same shore of the Lake, it is only now that material sufficient to recognize it definitely has been brought to Europe. As Major Bright was the first to bring an example of this Gazelle to the National Museum, I have applied his name to this form.

Dr. Smith noticed particularly that all the specimens seen were, like the type, very short-horned, that there was a prominent tuft

¹ Ann. & Mag. N. H. (7) vi. p. 303 (1900).

of hairs at the base of the horns in all of them, and that there was no lateral stripe in specimens of any age.

The presence of the boss from which the tuft of hair grows up at the base of the horns is of course normally a character of youth, and is especially marked in the youthful type of *G. g. petersi* figured by Peters¹. In the present case, however, this character is kept until old age (just as happens in the Reedbuck), for not only is the type skull fully adult, as shown by the teeth, but Capt. Ferguson's Lumian skull is quite aged. Yet both clearly show the boss, and have the horns sloping back away from it.

The characters and ranges of the four subspecies of *G. granti* that I should recognize may be briefly epitomized as follows:—

G. granti typica.—Horns long, more or less lyrate. Lateral stripe present in youth. Pygal band well-marked. White on top of rump passing right over root of tail.—Interior of East Africa, from the Boran Galla country to Ugogo.

G. g. petersi.—Horns more parallel. Colour of back passing on to tail, and dividing the white rump-patch.—Coast districts of East Africa.

G. g. smithi.—Horns shorter. No lateral stripe at any age. Pygal band very small. White of rump undivided. Growth-boss of horn retained to adult life.—Country between Lake Rudolf and Nile.

G. g. notata.—Fur comparatively long. Lateral markings and pygal band very strong and black.—Hill-country S. and S.E. of Rudolf. Loroghi Mts. (*Neumann*); Turquel (*Ferguson*); Gessima (*Delamere*).

22. GAZELLA THOMSONI Günth.

a. ♂. 90 miles E. of Lado, on 4° 40' N., 20 Feb., 1900. (134.)

This is the most northern point from which *G. thomsoni* has been recorded.

23. TRAGELAPHUS SCRIPTUS BOR.

♂ ♀. Skin and skull. 80 miles E. of Lado, 22 Feb., 1900. (139, 140.)

These specimens show that the Bushbuck of the Upper Nile, to which Heuglin gave the provisional name of *Tragelaphus bor*², and which is referred to in the 'Book of Antelopes'³ under *T. decula*, is really a tenable subspecies of *T. scriptus*. The following is a description of Dr. Donaldson Smith's specimens:—

Female more abundantly marked than male. Neck well-haired, not mostly short-haired as in *T. s. fasciatus*. White markings of limbs well-developed as usual, not obsolete as in *T. delamerei*⁴.

Male. General colour of back pale brownish. Dark nuchal line

¹ MB. Ak. Berl. 1879, p. 832, pl. v.

² Reise N.O.-Afr. ii. p. 122 (1877).

³ iv. p. 107 (1900).

⁴ The type of *T. delamerei*, Pocock, proves, on the recovery of its skull, which had been mislaid, to be quite young; not subadult, as was stated in the original description.

diffuse. White lineation of body much reduced; the upper shoulder-stripe very short on one side in the single skin and absent on the other. Lower shoulder-stripe broken into spots. Vertical bands inconspicuous, three on one side and four on the other, but only the two middle bands at all prominent. Five stripes mentioned in Heuglin's description.

Female. General colour bright rufous, but the nape and the middle line of the back over a breadth of about 4 to 6 inches fuscous brown, in unusual contrast to the rufous sides. White stripes numerous and conspicuous; the lower shoulder-stripe prominent, well-developed, continuous, rather longer than usual; upper shoulder-stripe, on the other hand, narrow and little developed. Vertical stripes very numerous, 9 on one side and 10 on the other, therefore more in number (though hardly so broad and sharply defined) than in *T. s. scriptus*.

Basal length of male skull (c.) 196 mm., greatest breadth 90. Horns (in straight line) 258 mm.

Female skull: basal length 193 mm., greatest breadth 86, orbit to muzzle 107.

This Nilotic form of the Common Bushbuck is distinguished by having its female more numerously striped than the male, the sexes being about equal in this respect in *T. s. scriptus*, and the male more striped than the female in *T. s. ornatus*; also by its well-haired neck, which separates it from *T. s. fasciatus*.

Singly the sexes may be distinguished—the male by its few and the female by its many stripes from the corresponding sexes of the allied subspecies, and the female is also characterized by the contrasted fuscous area on the back.

4. Revision of the Rhynchota belonging to the Family *Pentatomidæ* in the Hope Collection at Oxford. By W. L. DISTANT.

[Received June 18, 1900.]

(Plates LII. & LIII.)

In the years 1837 and 1842 there were published at Oxford Parts I. and II. of 'A Catalogue of Hemiptera in the Collection of the Rev. F. W. Hope,' which still form part of the well-known "Hope Collection" in the Oxford Museum. Part I. bears no name of author, and the descriptions therein have very often been ascribed to Hope, as his name is appended to the nomenclature. Part II. is stated to have been written by the late Prof. Westwood, and there is no doubt that he was the author of both, and that conclusion is now generally followed by entomologists.

The publication consists of short Latin descriptions of a considerable number of species considered as then undescribed; but of these many now rank only as synonyms and mostly require generic revision—a result which causes little surprise when the

fragmentary knowledge of the Order in those days is considered, with the obscurity that then enshrouded the Fabrician species, which Westwood seems to have almost ignored. Much of this synonymy has been elucidated, especially by the late Dr. C. Stål, who in 1862 visited this country, examined the collection and made notes thereon, which were published in the *Öfv. Vet.-Akad. Förh.* 1862, p. 501. These were again given, sometimes in a revised form, in his subsequent 'Enumeratio Hemipterorum.' Like all Stål's work, this casual examination produced reliable correction, but much was still left in an obscure condition, and our catalogues contain many doubtful references to a number of Westwood's species described from this collection.

I have to thank Prof. Poulton, who has succeeded Prof. Westwood at Oxford, for placing the whole collection in my hands for comparison and revision. I have carefully compared all the types with those contained in the British Museum and my own collection, with the result of finding that though many of Westwood's species must rank as synonyms, he has on the other hand priority in many cases over the descriptions of more recent workers, who have failed to recognize his species by their short descriptions and unrevised generic position. It is probable that Continental describers may also be compelled to withdraw some of their own descriptions for a similar reason, and the figures with which the Society has allowed me to illustrate this communication may facilitate that result.

Some few species are in such indifferent condition as to render generic identification impossible—at least with certitude; but in most cases these are figured, and thus eventually, when better specimens reach the hands of workers, they can be recognized and then generically disposed.

Subfam. DISCOCEPHALINÆ.

DINOCORIS UNICOLOR.

Dinidor unicolor Westw. in Hope Cat. i. p. 25 (1837).

Antileuchus piceus Dall. (part.) List Hem. i. p. 165. n. 6 (1851).

Dinocoris unicolor Stål, En. Hem. ii. p. 9. n. 16 (1872).

Dinocoris piceus Dist. (part.) Biol. Centr.-Am., Rhynch. i. p. 46. n. 2 (1880).

In the Biol. Centr.-Amer. I had followed Dallas in placing the *D. unicolor* Westw. as a synonym of *D. piceus* Pal. Beauv. On examination I find the two species are quite distinct, that of Westwood having a greater width of abdomen and the upper surface distinctly rugose.

DINOCORIS TESSELLATUS.

Dinidor tessellatus Westw. in Hope Cat. i. p. 24 (1837).

Dinocoris tessellatus Stål, En. Hem. ii. p. 9. n. 14 (1872).

A species closely allied to the *D. amplus* Walk., but having the second and third joints of the antennæ wholly black.

Subfam. PENTATOMINÆ.

SPUDEUS PARVULUS. (Plate LII. fig. 1.)

Halys parvula Westw. in Hope Cat. i. p. 22 (1837).

The species identified with this by Dallas (List Hem. i. p. 169, 1851) is altogether different, and must not be treated as the same, as has been enumerated by Stål, and catalogued by Lethierry and Severin.

DALPADA CLAVATA.

Cineæ clavatus Fabr. Ent. Syst. Suppl. p. 532 (1798).

Halys latipes Westw. in Hope Cat. i. p. 23 (1837).

Halys concinna Westw. loc. cit.

NEVISANUS ALTERNANS.

Halys alternans Westw. in Hope Cat. i. p. 22 (1837).

Nevisanus orientalis Dist. Ann. & Mag. Nat. Hist. ser. 6, vol. xi. p. 391 (1893).

ORTHOSCHIZOPS ASSIMILIS. (Plate LII. fig. 2.)

Halys assimilis Westw. in Hope Cat. i. p. 21 (1837).

Orthoschizops assimilis Stål, En. Hem. v. p. 49. n. 8 (1876).

ORTHOSCHIZOPS ? RUGOSUS. (Plate LII. fig. 3.)

Atelocerus rugosus Westw. in Hope Cat. i. p. 21 (1837).

The type and only specimen which I have seen is without the abdomen, and is consequently unable to be strictly identified in a generic sense. It seems, however, to belong to the genus *Orthoschizops*.

(?) HALYS RUFESCENS Westw. in Hope Cat. i. p. 24 (1837).

This species is recorded by Stål (En. Hem. v. p. 42, 1876) as belonging to the genus *Pæcilometis*. It is not, however, contained in the type collection forwarded to me from Oxford.

(?) HALYS DENTIPES Westw. in Hope Cat. i. p. 24 (1837).

I have the following note from Oxford relating to this species—
“*dentipes* is missing, space empty, specimen not to be found.”

KALULA, gen. nov.

Body elongate. Head long, about two-thirds the length of the pronotum, the lateral margin sinuate and slightly widened, rounded, and moderately laminate at the apices of the lateral lobes, which are a little longer than the central lobe and cleft centrally; antennæ moderately short, first joint not nearly reaching apex of head, second joint considerably passing it, fourth and fifth joints distinctly thickened; ocelli much nearer eyes than to each other; rostrum reaching the posterior coxæ. Pronotum distinctly depressed from between the pronotal angles, which

are obtusely prominent at about the centre of the lateral margins, from which the margins are concavely sinuate to apex. Scutellum about half the length of abdomen. Abdomen unarmed.

I have placed this genus near *Ocrophara* Stål, from which, apart from other differences, it may be distinguished by the shape and structure of the head.

KALULA VARICORNIS. (Plate LII. fig. 4.)

Ælia varicornis Westw. in Hope Cat. i. p. 33 (1837).

Hab. Gambia.

DICTYOTUS SEMIMARGINATUS.

Pentatoma semimarginata Westw. in Hope Cat. i. p. 42 (1837).

Westwood gave no locality for his species, but the British Museum possesses specimens from Baudin Island, West Australia.

Antennæ with the first and second joints ochraceous, third, fourth, and fifth joints piceous, apices of third and fourth joints ochraceous.

DICTYOTUS CÆNOSUS.

Pentatoma cænosa Westw. in Hope Cat. i. p. 42 (1837).

Pentatoma vilis Walk. Cat. Het. ii. p. 309. n. 147 (1867).

Dictyotus vilis Dist. Ann. & Mag. Nat. Hist. ser. 7, vol. iv. p. 434 (1899).

I have previously given the full synonymy of this species, but now, from an examination of the Hope Collection, am compelled to remove it one stage further back.

DICTYOTUS PALLIPES. (Plate LII. fig. 9.)

Pentatoma pallipes Westw. in Hope Cat. i. p. 41 (1837).

In size and general appearance allied to *D. roei* Westw., but having the head more elongate and not prominently cleft at the apex, the central lobe being longer.

Westwood's type is unlocalized, and I have not seen another specimen.

DICTYOTUS ROEI.

Pentatoma roei Westw. in Hope Cat. i. p. 42 (1837).

Dictyotus affinis Dall. List Hem. i. p. 141. n. 4 (1851).

This is not the species identified by Dallas as *roei* Westw. (List Hem. i. p. 140), which is an ally of *D. tasmanicus* Dall., and is the *D. cequalis* Walk.

NIPHE SUBFERRUGINEA.

Pentatoma ferruginea Westw. in Hope Cat. i. p. 35 (1837).

Pentatoma cephalus Dall. List Hem. i. p. 245. n. 32 (1851).

Pentatoma lateralis Walk. Cat. Het. ii. p. 301 (1867).

Niphe cephalus Dist. Ann. & Mag. Nat. Hist. ser. 7, vol. iv. p. 435 (1899).

TROPICORYPHA DEPLANATA.

Pentatoma deplanata Westw. in Hope Cat. i. p. 35 (1837).

Agonoscelis rufescens Walk. Cat. Het. iii. p. 546 (1868).

Tropicorypha rufescens Dist. Ann. & Mag. Nat. Hist. ser. 7, vol. iv. p. 435 (1899).

PALOMENA PRASINA.

Cimex prasinus Linn. Faun. Suec. p. 241. n. 931 (1761).

Pentatoma confusa Westw. (MS.) in Hope Cat. i. p. 9. n. 65 (1837).

This species stands, as Westwood pointed out, under the name of *juniperinus* in the Banksian Collection. Westwood apparently substituted his name *confusa*, but did not describe the species.

PALOMENA VIRIDISSIMA.

Cimex viridissima Poda, Ins. Mus. Gr. p. 56. n. 10 (1761).

Pentatoma rotundicollis Westw. (MS.) in Hope Cat. i. p. 9. n. 66 (1837).

This appears to be a name substituted by Westwood for "*prasinus* Wolff nec Linn.," and with no published description.

PALOMENA UNICOLOR. (Plate LII. fig. 5.)

Pentatoma unicolor Westw. in Hope Cat. i. p. 41 (1837).

A species allied to *P. spinosa* Dist. and *P. angulosa* Motsch.

PENTATOMA SENILIS.

Pentatoma senilis Say, New Harm. Ind., Dec. 1831; Compl. Writ. i. p. 316. n. 8 (1859); Leth. & Sev. Cat. Gén. Hém. i. p. 120 (1893).

Lioderma (Rhytidolomia) senilis Stål, En. Hem. p. 33. n. 2 (1872).

Pentatoma ovalis (oblonga) Westw. in Hope Cat. i. p. 39 (1837).

Pentatoma grisea Dall. List Hem. i. p. 246. n. 33 (1851).

This is not the *P. oblonga* Westw. loc. cit. p. 37, as stated by Stål (En. Hem. ii. p. 33) and repeated by Lethierry and Severin (Cat. p. 120), which is a Javan species, and a synonym of *Nezara viridula* Linn.

MORMIDEA SCUTELLATA. (Plate LII. fig. 7.)

Pentatoma scutellata Westw. in Hope Cat. i. p. 37 (1837).

EUSCHISTUS SERVUS.

Pentatoma serva Say, New Harm. Ind., Dec. 1831; Compl. Writ. vol. i. p. 314 (1859).

Pentatoma spilotota Westw. in Hope Cat. i. p. 42 (1837).

Westwood's habitat is "Brasilia?," but it is doubtless a North American specimen which forms the type of his *P. spilotota*.

EUSCHISTUS TRISTIGMUS.

Pentatoma tristigma Say, New Harm. Ind., Dec. 1831; Compl. Writ. i. p. 314 (1859).

Pentatoma inconspicua Westw. in Hope Cat. i. p. 42 (1837).

ILLERDA PALLESCENS. (Plate LII. fig. 10.)

Pentatoma pallescens Westw. in Hope Cat. i. p. 41 (1837).

A species allied in structure to *I. sudana* Dist.

CARBULA OBSCURA.

Pentatoma obscura Westw. in Hope Cat. i. p. 35 (1837).

CARBULA INSOCIA.

Eysarcoris insocius Walk. Cat. Het. iii. p. 556 (1868).

Pentatoma bimaculata Westw. MS.

In the Hope Cat. i. p. 35, under the MS. name *Pent. bimaculata*, Westwood unites "*Species delenda, varietas precedentis*," referring to his *Carbula (Pent.) obscura*. The two species are, however, quite distinct and easily distinguished by the shape and structure of the pronotal angles.

CARBULA DIFFICILIS.

Pentatoma difficilis Westw. in Hope Cat. i. p. 35 (1837).

A species resembling largely the *C. insocia* Walk.

CARBULA MELACANTHA.

Cimex melacanthus Fabr. Ent. Syst. iv. p. 103 (1794).

Pentatoma hostilis Westw. in Hope Cat. i. p. 40 (1837).

CARBULA INDICA.

Pentatoma indica Westw. in Hope Cat. i. p. 42 (1837).

Carbula fusca Dist. Trans. Ent. Soc. Lond. 1887, p. 346.

THYANTA ANTIGUENSIS.

Pentatoma antiguensis Westw. in Hope Cat. i. p. 36 (1837).

Pentatoma teniola Dall. List Hem. i. p. 250 (1851).

THYANTA VITREA.

Pentatoma vitrea Westw. in Hope Cat. i. p. 36 (1837).

Type in bad condition, without abdomen.

MURGANTIA VARICOLOR.

Pentatoma varicolor Westw. in Hope Cat. i. p. 37 (1837).

Strachia munda Dall. List Hem. i. p. 264. n. 19 (1851).

Murgantia tessellata? Leth. & Sev. Cat. Gén. Hém. t. i. p. 156 (1893).

NEZARA CHLOROCEPHALA.

Pentatoma chlorocephala Westw. in Hope Cat. i. p. 38 (1837).

Lethierry and Severin (Cat. Gén. Hém. t. i. p. 167) have

placed this species as a synonym of *N. viridula* Linn. From that species *N. chlorocephala* differs by its elongate form, and particularly by its more elongate and narrower head.

Westwood localized it as "Brasilia?" The British Museum possesses specimens from Nyasaland collected by Mr. A. Whyte.

NEZARA CHLORIS.

Pentatoma chloris Westw. in Hope Cat. i. p. 38 (1837).

Pentatoma mentiens Walk. Cat. Het. ii. p. 296. n. 92 (1867).

Stål (En. Hem. ii. p. 41, 1872) places this species as a synonym of *Nezara viridula* Linn. In this case, however, he has fallen into error. *N. chloris* is a smaller, more elongate, narrower, and much more convex species; the head is large and broad.

I possess specimens both from Congo and Nyasaland.

NEZARA CAPICOLA.

Pentatoma capicola Westw. in Hope Cat. i. p. 39 (1837).

Pentatoma lata Westw. loc. cit.

Pentatoma frontalis Westw. loc. cit. p. 37.

Rhaphigaster capicola Dall. List Hem. i. p. 276. n. 5 (1851).

Nezara capicola Stål, Hem. Afr. i. p. 195. n. 3 (1864).

Pentatoma africana Westw. in Hope Cat. i. p. 39 (1837).

P. frontalis and *P. africana* are colour varieties. In the strict usage of the laws of priority, *frontalis* is the earliest name; but as this is clearly a variety or "sport," I do not disturb the arrangement of Dallas and Stål.

NEZARA VIRIDULA.

Cimex viridulus Linn. Syst. Nat. ed. 10, i. p. 444. n. 28 (1758).

Pentatoma oblonga Westw. in Hope Cat. i. p. 37 (1837).

Pentatoma unicolor Westw. loc. cit. p. 38.

Pentatoma berylina Westw. loc. cit.

Pentatoma subsericea Westw. loc. cit.

Pentatoma leii Westw. loc. cit.

Pentatoma tripunctifera Westw. loc. cit.

Pentatoma proxima Westw. loc. cit.

Pentatoma chinensis Westw. loc. cit.

Rhaphigaster subsericeus Dall. List Hem. i. p. 275. n. 3 (1851).

Nezara viridula Stål (part.), En. Hem. ii. p. 41. n. 6 (1872).

ÆTIUS, gen. nov.

Body moderately short, broad, and convex. Head long, almost as long as the pronotum, lateral margins strongly sinuate, lateral lobes a little longer than the central lobe and cleft at apices; antennæ four-jointed, basal joint not quite reaching apex of head, second joint very long, third and fourth joints subequal in length; ocelli placed somewhat near the eyes; rostrum reaching the posterior coxæ, second joint longest. Pronotum broad, the lateral angles produced in long robust spines directed forward

and somewhat upward; anterior lateral margins coarsely dentate, a somewhat larger and lobate tooth at anterior angle. Scutellum broad, sinuate about centre. Connexivum prominent; abdomen beneath with a broad central sulcation, which does not extend to apex.

ÆTIUS VARIEGATUS. (Plate LII. fig. 8.)

Atelocerus? variegatus Westw. in Hope Cat. i. p. 21 (1837).

Hab. Australia: Swan River.

PLAUTIA FIMBRIATA.

Cimex fimbriatus Fabr. Mant. ii. p. 295 (1787).

Pentatoma fimbriata Westw. in Hope Cat. i. p. 32 (1837).

PLAUTIA VIRIDICOLLIS.

Pentatoma viridicollis Westw. in Hope Cat. i. p. 35 (1837).

Plautia viridicollis Leth. & Sev. Cat. Gén. Hém. i. p. 169 (1893).

Pentatoma inconspicua Dall. List Hem. i. p. 250. n. 42 (1851).

CRESPHONTES MONSONI. (Plate LII. fig. 6.)

Raphigaster monsoni Westw. in Hope Cat. i. p. 31 (1837).

Cresphontes nigro-maculatus Haglund, Stett. ent. Zeit. xxix. p. 157 (1868).

Westwood recorded a wrong locality ("Caput Bonæ Spei") for this species. I have compared the types of both Westwood and Haglund.

ANTESTIA CRUCIATA.

Cimex cruciatus Fabr. Syst. Ent. p. 714 (1775).

Pentatoma pantherina Westw. in Hope Cat. i. p. 34 (1837).

Westwood undoubtedly was led astray by the wrong habitat "*Georgia America*" in redescribing this well-known Oriental species.

ACTUARIUS, gen. nov.

Body oblong. Head with the lateral lobes considerably longer than the central lobes, and very distinctly cleft at their apices, which are obliquely rounded, their lateral margins moderately sinuate; ocelli situate between the eyes and nearer to them than to each other. Antennæ with the second joint a little shorter than either third or fourth, which are subequal in length; rostrum about reaching the posterior coxæ, second joint longest, third slightly shorter than the fourth. Pronotum long, moderately convex, the lateral margins sinuate, the posterior angles rounded and subprominent, the anterior angles shortly dentate. Scutellum about half the length of the abdomen, slightly gibbous at base, narrowed towards apex. Corium distinctly moderately widened at about one-third from base; membrane with longitudinal veins.

Abdomen probably spined at base, but mutilated there by pin in type and only specimen.

Allied to *Menida* Motsch.

ACTUARIUS ALBONOTATUS. (Plate LII. fig. 11.)

Pentatoma albonotata Westw. in Hope Cat. i. p. 37 (1837).

Hab. Gambia.

MENIDA HISTRIO.

Cimex histrio Fabr. Mant. ii. p. 296. n. 176 (1787).

Pentatoma bengalensis Westw. in Hope Cat. i. p. 36 (1837).

OCIRRHÖË ROEI. (Plate LII. fig. 12.)

Rhynchocoris roei Westw. in Hope Cat. i. p. 30 (1837); Leth. & Sev. Cat. Gén. Hém. i. p. 181 (1893).

The species identified by Dallas (List Hem. i. p. 297. n. 4, 1851) is not conspecific.

OCIRRHÖË? VIRESCENS. (Plate LIII. fig. 7.)

Raphigaster virescens Westw. in Hope Cat. i. p. 31 (1837).

The type and only specimen is in a very mutilated condition, wanting the abdomen, but the species apparently belongs to the genus *Ocirrhoë*.

AVICENNA, gen. nov.

Head deflected, moderately broad, lobes of equal length, apex rounded, lateral margins moderately sinuate at about centre. Antennæ with the second and third joints subequal in length, or second slightly shorter than the third. Pronotum strongly deflected anteriorly from between the area of the lateral angles; lateral margins moderately concavely sinuate, punctate before anterior margin, posterior margin strongly concave at base of scutellum; posterior angles subprominent, lateral angles produced in long acute spines. Scutellum broad, distinctly narrowed a little before apex. Rostrum with the second and third joints about subequal in length. Sternal process extending beyond base of head. Spines at apices of sixth abdominal segment and anus strongly developed.

This genus agrees with *Morna* in the concave posterior margin of the pronotum, but differs in not having the posterior pronotal angles acutely produced. It is allied to *Vitellus* by the shape and production of the sternal process, but differs by the less triangular and elongate head, the longer and non-triangular scutellum, &c.

AVICENNA INQUINATA. (Plate LIII. fig. 1.)

Rhynchocoris inquinata Westw. in Hope Cat. i. p. 29 (1837).

Cuspicona inquinata Walk. Cat. Het. ii. p. 387. n. 29 (1867).

Vitellus inquinatus Leth. & Sev. Cat. Gén. Hém. p. 182 (1893).

EDESSA LINEATA.

Edessa lineata Westw. in Hope Cat. i. p. 28 (1837).

Allied to *E. saturata* Dall., differing by the unicolorous connexivum and the non-apically excavated scutellum.

EDESSA MINIATA.

Edessa miniata Westw. in Hope Cat. i. p. 28 (1837).

Edessa scutellata Herr.-Schäff. Wanz. Ins. v. p. 101, fig. 552 (1839); Stål, En. Hem. ii. p. 55. n. 36 (1872).

Var. *Edessa lurida* Dall. List Hem. i. p. 328. n. 28 (1851); Stoll, Pun. fig. 148.

EDESSA FLAVIDA.

Edessa flavida Westw. in Hope Cat. i. p. 28 (1837); Stål, En. Hem. ii. p. 53. n. 21 (1872).

Edessa lutea Westw. in Hope Cat. i. p. 28 (1837).

Edessa simplex Herr.-Schäff. Wanz. Ins. v. p. 103, fig. 554 (1839).

Edessa jutea Stål, En. Hem. ii. p. 59. n. 76 (1872).

This is quite distinct from the species recorded as *E. flavida* and *E. lutea* by Dallas.

EDESSA CARNOSA.

Edessa carnosa Westw. in Hope Cat. i. p. 29 (1837).

Aceratodes costalis Stål, Eug. Resa, Ins. p. 231. n. 29 (1859).

Edessa senilis Walk. Cat. Het. iii. p. 450. n. 128 (1868).

Edessa fulvipes var. *costalis* Stål, En. Hem. ii. p. 58 (1872); Dist. Biol. Centr.-Amer., Rhyn. vol. i. p. 458. n. 39 (B) (1893).

Var. *Aceratodes fulvipes* Dall. List Hem. i. p. 335. n. 6 (1851).

The form *costalis* Stål has hitherto been recorded as the variety of *E. fulvipes* Dall. Now that Stål's *costalis* is found to be synonymic with *E. carnosa* Westw. the oldest name, the subsequently described *E. fulvipes* Dall. must be regarded as the varietal form.

Subfam. ASOPINÆ.

DORYCORIS FUSCOSUS.

Asopus fuscus Germ. in Silberm. Rev. v. p. 187 (1837).

Pentatoma miniata Westw. in Hope Cat. i. p. 43 (1837).

Both these descriptions were published in the year 1837, and there is no evidence as to which appeared first. The species has been hitherto known and recorded under Germar's name, and it is therefore better to make no alteration.

AUDINETIA SPINIDENS.

Cimex spinidens Fabr. Mant. Ins. ii. p. 285 (1787).

Pentatoma aliena Westw. in Hope Cat. i. p. 40 (1837).

GLYPsus SPARSUS. (Plate LIII. fig. 5.)

Ælia sparsa Westw. in Hope Cat. i. p. 33 (1837).*Ælia assimilis* Westw. loc. cit.

PODISUS NEGLECTUS. (Plate LIII. fig. 4.)

Raphigaster neglectus Westw. in Hope Cat. i. p. 31 (1837).*Podisus neglectus* Stål, En. Hem. i. p. 53. n. 29 (1870).

Subfam. TESSARATOMINÆ.

TESSARATOMA PAPILLOSA.

Cimex papillosus Drury, Ill. Nat. Hist. i. p. 96, tab. 43. fig. 2 (1770).*Tessaratoma proxima* Westw. in Hope Cat. i. p. 27 (1837).Stål (En. Hem. i. p. 67, 1870) treats *T. proxima* as a synonym of *T. javanica* Thunb., restricting *T. papillosa* to China only. This, in my view, is clearly incorrect.

Subfam. PHYLLOCEPHALINÆ.

MELAMPODIUS, gen. nov.

Head with the lateral lobes very much longer than the central, projecting forward and somewhat upward, their apices wide apart; ocelli placed very close to the eyes. Antennæ of five joints; basal joint very stout, reaching to about half the length of the lateral lobes; apical joint somewhat thickened. Rostrum passing the anterior coxæ, stout, third joint longest. Pronotum with the lateral angles produced forward in long, slightly diverging horns, which are strongly toothed internally. Scutellum broad, narrowed about midway to apex. Membrane with longitudinal veins. Legs stout and pilose.

Allied to *Cressona* Dall.

MELAMPODIUS CERVICORNIS. (Plate LIII. fig. 10.)

Atelocerus cervicornis Westw. in Hope Cat. i. p. 21 (1837).*Hab.* Sierra Leone.

BASICRYPTUS IRRORATUS. (Plate LIII. fig. 6.)

Phyllocephala irrorata Westw. in Hope Cat. i. p. 27 (1837).

Subfam. ACANTHOSOMINÆ.

ACANTHOSOMA LATERALIS.

Edessa lateralis Say, New Harm. Ind., Dec. 1831; Compl. Writ. i. p. 312. n. 2 (1859).

Acanthosoma affinis Westw. in Hope Cat. i. p. 30 (1837).*Acanthosoma picicolor* Westw. loc. cit.

ACANTHOSOMA CRUCIATA.

Edessa cruciata Say, New Harm. Ind., Dec. 1831; Compl. Writ. i. p. 311 (1859).

Acanthosoma borealis Westw. in Hope Cat. i. p. 30 (1837).

SASTRAGALA VARIOLOSA. (Plate LIII. fig. 3.)

Acanthosoma variolosa Westw. in Hope Cat. i. p. 30 (1837).

A species allied to *S. binotata* Dist.

SPECIES OF UNCERTAIN POSITION.

—— ? *ATRICORNIS*. (Plate LIII. fig. 8.)

Ælia atricornis Westw. in Hope Cat. i. p. 32 (1837).

I do not quite see my way to generically locate this species. The antennæ are in too mutilated a condition for the foundation of a new genus, and as the species is now figured, it will be well to wait for more perfect material before deciding its classificatory position.

—— ? *NIGRIPES*.

Pentatoma nigripes Westw. in Hope Cat. i. p. 41 (1837).

The solitary type specimen is without abdomen and lacking also half the scutellum. It is thus in too mutilated a condition for figuring or for generic identification.

—— ? *HARRISI*. (Plate LIII. fig. 2.)

Pentatoma harrisi Westw. in Hope Cat. i. p. 41 (1837).

Westwood gives the habitat of this species as "*Georgia America*," a locality we have already seen, as in his *P. pantherina* = *Antestia cruciata*, he had applied to an Oriental species. I can find no trace of this species in the descriptions of North-American Pentatomidæ, which are now presumably fairly complete, and am inclined to consider that the locality is also incorrect. It is therefore perhaps better to figure the species and leave the genus an open question till its locality is authenticated.

—— ? *LATERALIS*. (Plate LIII. fig. 9.)

Pentatoma lateralis Westw. in Hope Cat. i. p. 43 (1837).

The typical and only specimen is in a bad condition, with the rostrum wholly absent. Generic identification is thus impossible.

Summarized Disposition of the Hopeian Genera and Species.

PENTATOMIDÆ.

NEW GENERA DESCRIBED.

Plataspis Westw. in Hope Cat. i. p. 16 (1837).

Hoplistodera Westw. loc. cit. p. 18.

Aplosterna Westw. loc. cit. p. 26.

Lyramorpha Westw. loc. cit. p. 27.

Rhynchocoris Westw. loc. cit. p. 29.

Urolabida Westw. loc. cit. p. 45.

Urostylis Westw. loc. cit.

<i>Callidea purpurea</i> Westw. loc. cit. p. 15			belongs to genus <i>Chrysocoris</i> .
„ <i>marginella</i> Westw. loc. cit.	„	„	„
„ <i>obtusa</i> Westw. loc. cit. p. 16	„	„	<i>Lamprocoris</i> .
„ <i>roylii</i> Westw. loc. cit.	„	„	„
„ <i>purpurata</i> Westw. loc. cit.	„	„	<i>Cantao</i> .
<i>Plataspis hemispherica</i> Westw. loc. cit. p. 17	„	„	<i>Brachyplatys</i> .
„ <i>nitida</i> Westw. loc. cit.	„	„	„
„ <i>subanica</i> Westw. loc. cit.	„	„	„
„ <i>nigriventris</i> Westw. loc. cit. p. 18	„	„	„
<i>Cydnus piceus</i> Westw. loc. cit. p. 18	„	„	<i>Adrisa</i> .
„ <i>latipes</i> Westw. loc. cit.	„	„	<i>Scoparipes</i> .
„ <i>serripes</i> Westw. loc. cit. p. 19	„	„	<i>Pangeus</i> .
„ <i>subferrugineus</i> Westw. loc. cit.	„	„	<i>Annestus</i> .
<i>Megarhynchus acanthurus</i> Westw. loc. cit. p. 20	„	„	<i>Diploxys</i> .
<i>Atelocerus furcatus</i> Westw. loc. cit.	„	„	<i>Diplorhinus</i> .
„ <i>centro-lineatus</i> Westw. loc. cit.	„	„	<i>Omyta</i> .
„ <i>rugosus</i> Westw. loc. cit. p. 21	„	„	<i>Orthoschizops</i> ?
„ <i>cervicornis</i> Westw. loc. cit.	„	„	<i>Melampodius</i> , g. n.
„ <i>varicornis</i> Westw. loc. cit.	„	„	<i>Aleaus</i> .
„ <i>variegatus</i> Westw. loc. cit.	„	„	<i>Ætius</i> , g. n.
<i>Halys assimilis</i> Westw. loc. cit. p. 21	„	„	<i>Orthoschizops</i> .
„ <i>parvula</i> Westw. loc. cit. p. 22	„	„	<i>Spudaeus</i> .
„ <i>nigricollis</i> Westw. loc. cit.	„	„	<i>Dalpada</i> .
„ <i>alternans</i> Westw. loc. cit.	„	„	<i>Nevisanus</i> .
„ <i>lata</i> Westw. loc. cit. p. 23	„	„	<i>Atelocera</i> .
„ <i>apicalis</i> Westw. loc. cit.	„	„	<i>Eumecopus</i> .
„ <i>strigata</i> Westw. loc. cit.	„	„	<i>Pœcilometis</i> .
„ <i>reticulata</i> Westw. loc. cit. p. 24	„	„	<i>Spudaeus</i> .
„ <i>lineata</i> Westw. loc. cit.	„	„	<i>Pœcilometis</i> .
<i>Dinidor melanoleucus</i> Westw. loc. cit.	„	„	<i>Dinocoris</i> .
„ <i>tesselatus</i> Westw. loc. cit.	„	„	„
„ <i>variolosus</i> Westw. loc. cit. p. 25	„	„	„
„ <i>dispar</i> Westw. loc. cit.	„	„	<i>Hyrmine</i> .
„ <i>unicolor</i> Westw. loc. cit.	„	„	<i>Dinocoris</i> .
<i>Aspongopus siccifolius</i> Westw. loc. cit.	„	„	<i>Cyclopelta</i> .
<i>Phyllocephala irrorata</i> Westw. loc. cit. p. 27	„	„	<i>Basicryptus</i> .
<i>Eusthenes laticollis</i> Westw. loc. cit.	„	„	<i>Mattiphus</i> .
<i>Tesseratoma cuprea</i> Westw. loc. cit.	„	„	<i>Eusthenes</i> .
„ <i>taurus</i> Westw. loc. cit.	„	„	<i>Emblosterna</i> .
<i>Edessa nodifera</i> Westw. loc. cit. p. 28	„	„	<i>Peromatus</i> .
<i>Rhynchocoris inquinata</i> Westw. loc. cit. p. 29	„	„	<i>Avicenna</i> , g. n.
„ <i>unimaculata</i> Westw. loc. cit.	„	„	<i>Ocirrhoë</i> ?
„ <i>thoracica</i> Westw. loc. cit. p. 30	„	„	<i>Cuspicona</i> .
„ <i>roei</i> Westw. loc. cit.	„	„	<i>Ocirrhoë</i> .
<i>Acanthosoma variolosa</i> Westw. loc. cit.	„	„	<i>Sastragala</i> .
<i>Raphigaster neglectus</i> Westw. loc. cit. p. 31	„	„	<i>Podisus</i> .
„ <i>luteus</i> Westw. loc. cit.	„	„	<i>Platacantha</i> .
„ <i>guldinigi</i> Westw. loc. cit.	„	„	<i>Piezodorus</i> .
„ <i>flavolineatus</i> Westw. loc. cit.	„	„	„

<i>Raphigaster virescens</i> Westw. loc. cit.	belongs to genus	<i>Ocirrhöe?</i>
" <i>monsoni</i> Westw. loc. cit.	" "	<i>Cresphontes.</i>
" <i>longitudinalis</i> Westw. loc. cit.	" "	<i>Axona.</i>
<i>Ælia nasalis</i> Westw. loc. cit. p. 32	" "	<i>Cermatulus.</i>
" <i>erosa</i> Westw. loc. cit. p. 33	" "	<i>Agonoscelis.</i>
" <i>melanoleuca</i> Westw. loc. cit.	" "	<i>Platynopus.</i>
" <i>sparsa</i> Westw. loc. cit.	" "	<i>Glypsus.</i>
" <i>conspicua</i> Westw. loc. cit.	" "	"
" <i>varicornis</i> Westw. loc. cit.	" "	<i>Kalula</i> , g. n.
<i>Pentatoma formosa</i> Westw. loc. cit. p. 34	" "	<i>Menida.</i>
" <i>violascens</i> Westw. loc. cit.	" "	<i>Murgantia.</i>
" <i>gloriosa</i> Westw. loc. cit.	" "	<i>Stenozygum.</i>
" <i>varia</i> Westw. loc. cit.	" "	"
" <i>deplanata</i> Westw. loc. cit. p. 35	" "	<i>Tropicorypha.</i>
" <i>obscura</i> Westw. loc. cit.	" "	<i>Carbula.</i>
" <i>difficilis</i> Westw. loc. cit.	" "	"
" <i>subferruginea</i> Westw. loc. cit.	" "	<i>Niphe.</i>
" <i>viridicollis</i> Westw. loc. cit.	" "	<i>Plautia.</i>
" <i>ventralis</i> Westw. loc. cit. p. 36	" "	<i>Eysarcoris.</i>
" <i>lineaticollis</i> Westw. loc. cit.	" "	<i>Æliomorpha.</i>
" <i>caffrae</i> Westw. loc. cit.	" "	"
" <i>antiquensis</i> Westw. loc. cit.	" "	<i>Thyanta.</i>
" <i>vitrea</i> Westw. loc. cit.	" "	"
" <i>albo-notata</i> Westw. loc. cit. p. 37	" "	<i>Actuarius</i> , g. n.
" <i>varicolor</i> Westw. loc. cit.	" "	<i>Murgantia.</i>
" <i>marginalis</i> Westw. loc. cit.	" "	<i>Oplomus.</i>
" <i>scutellata</i> Westw. loc. cit.	" "	<i>Mormidea.</i>
" <i>chloris</i> Westw. loc. cit. p. 38	" "	<i>Nezara.</i>
" <i>chlorocephala</i> Westw. loc. cit.	" "	"
" <i>capicola</i> Westw. loc. cit. p. 39	" "	"
" <i>crassa</i> Westw. loc. cit.	" "	<i>Zangis.</i>
" <i>pavonina</i> Westw. loc. cit.	" "	<i>Dorycoris.</i>
" <i>bronzea</i> Westw. loc. cit. p. 40	" "	"
" <i>luteipennis</i> Westw. loc. cit.	" "	<i>Loxa.</i>
" <i>atrox</i> Westw. loc. cit.	" "	<i>Euchistus.</i>
" <i>crocipes</i> Westw. loc. cit.	" "	"
" <i>3-maculata</i> Westw. loc. cit.	" "	<i>Dalpada.</i>
" <i>3-notata</i> Westw. loc. cit.	" "	<i>Tolumnia.</i>
" <i>unicolor</i> Westw. loc. cit. p. 41	" "	<i>Palomena.</i>
" <i>pallescens</i> Westw. loc. cit.	" "	<i>Plerda.</i>
" <i>pallipes</i> Westw. loc. cit.	" "	<i>Dictyotus.</i>
" <i>roei</i> Westw. loc. cit. p. 42	" "	"
" <i>indica</i> Westw. loc. cit.	" "	<i>Carbula.</i>
" <i>semimarginata</i> Westw. loc. cit.	" "	<i>Dictyotus.</i>
" <i>cenosa</i> Westw. loc. cit.	" "	"
" <i>purpurea</i> Westw. loc. cit. p. 43	" "	<i>Afrius.</i>
" <i>varipennis</i> Westw. loc. cit.	" "	<i>Menida.</i>
" <i>platygaster</i> Westw. loc. cit.	" "	<i>Candace.</i>
" <i>aculeata</i> Westw. loc. cit. p. 44	" "	<i>Myrochea.</i>
" <i>rufo-pilota</i> Westw. loc. cit.	" "	<i>Lineus.</i>

<i>Pentatoma rugicollis</i> Westw. loc. cit.	belongs to genus	<i>Basicyrptus</i> .
„ <i>cummingii</i> Westw. loc. cit.	„ „	<i>Ditomotarsus</i> .
„ <i>marginella</i> Westw. loc. cit. p. 45	„ „	<i>Lubentius</i> .
„ <i>luteo-varia</i> Westw. loc. cit.	„ „	<i>Anischys</i> .
<i>Urostylis histrionica</i> Westw. loc. cit. p. 46	„ „	<i>Urolabida</i> .

SPECIES TREATED AS SYNONYMIC.

<i>Eurygaster cognatus</i> Westw. in Hope	=	<i>Eurygaster maurus</i> Linn.
	[Cat. i. p. 11.	
„ <i>orientalis</i> Westw. l. c.	=	<i>E. maurus</i> Linn., var. <i>pictus</i> [Fabr.
<i>Trigonosoma apicale</i> Westw. l. c.	=	<i>Hotea gambiæ</i> Westw.
<i>Agonosoma bicolor</i> Westw. l. c. p. 12	=	<i>Agonosoma trilineata</i> Fabr., [var.
<i>Pachycoris linnæi</i> Westw. l. c.	=	<i>Pachycoris torridus</i> Scop., var.
„ <i>nitens</i> Westw. l. c.	=	<i>Pachycoris fabricii</i> Linn., var.
„ <i>pumila</i> Westw. l. c.	=	„ „ „
„ <i>flavescens</i> Westw. l. c.	=	<i>Diolcus irroratus</i> Fabr.
„ <i>piperitia</i> Westw. l. c. p. 13	=	<i>Ascanius hirtipes</i> Herr.-Sch.
<i>Sphærocoris annularis</i> Westw. l. c.	=	<i>Sphærocoris annulus</i> Fabr.
„ <i>punctaria</i> Westw. l. c.	=	<i>Sphærocoris testudo-grisea</i> [De Geer, var.
„ <i>4-notata</i> Westw. l. c.	=	<i>Steganocerus multipunctatus</i> [Thunb., var.
„ <i>polysticta</i> Westw. l. c.	=	<i>Sphærocoris testudo-grisea</i> [De Geer, var.
<i>Tectocoris affinis</i> Westw. l. c.	=	<i>Pæcilocoris hardwickii</i> Westw.
„ <i>gambiæ</i> Westw. l. c. p. 14	=	<i>Tectocoris lineola</i> Fabr., var.
„ <i>javana</i> Westw. l. c.	=	<i>Chrysocoris atricapillus</i> Guér.
„ <i>nepalensis</i> Westw. l. c.	=	<i>Scutellera fasciata</i> Panz.
„ <i>obscura</i> Westw. l. c.	=	<i>Calliphara excellens</i> Burm.
„ <i>binotata</i> Westw. l. c. p. 15	=	<i>Philea senator</i> Fabr., var.
<i>Callidea abdominalis</i> Westw. l. c.	=	<i>Chrysocoris dilaticollis</i> Guér.
„ <i>formosa</i> Westw. l. c.	=	<i>Chrysocoris eques</i> Fabr., var.
„ <i>taprobanensis</i> Westw. l. c.	=	<i>Chrysocoris stockerus</i> Linn.
„ <i>aurifera</i> Westw. l. c.	=	<i>Chrysocoris auratus</i> Guér.
„ <i>bengalensis</i> Westw. l. c.	=	<i>Chrysocoris patricius</i> Fabr.
„ <i>dispar</i> Westw. l. c. p. 16	=	<i>Cantao ocellatus</i> Thunb.
„ <i>regia</i> Westw. l. c.	=	<i>Calliphara imperialis</i> .
„ <i>pulchra</i> Westw. l. c.	=	<i>Graptophara reynaudii</i> Guér.
<i>Augocoris gigas</i> Westw. l. c.	=	<i>Augocoris gomesi</i> Burm.
<i>Plataspis flaviceps</i> Westw. l. c. p. 17	=	<i>Brachyplatys flavipes</i> Fabr.
<i>Stiretrus rubro-maculatus</i> Westw.	=	<i>Stiretrus decemguttatus</i> Lep. & [l. c. p. 18. [Serv.
<i>Sciocoris cupensis</i> Westw. l. c.	=	<i>Pododus orbicularis</i> Burm.
<i>Megarhynchus 4-spinosus</i> Westw.	=	<i>Tetroda histeroides</i> Fabr. [l. c. p. 19.
„ <i>marginellus</i> Westw.	=	<i>Macrina juvenca</i> Burm. [l. c. p. 20.

- Halys humeralis* Westw. l. c. p. 21 = *Euoplilus laciniatus* Spin.
 „ *carolinensis* Westw. l. c. p. 22 = *Brochymena annulata* Fabr.
 „ *timorensis* Westw. l. c. = *Halymorpha picus* Fabr.
 „ *obscura* Westw. l. c. = *Dalpada nigricollis* Westw.
 „ *serrigera* Westw. l. c. p. 23 = *Halys dentata* Fabr.
 „ *concinna* Westw. l. c. = *Dalpada clavata* Fabr.
 „ *serricollis* Westw. l. c. = *Halys dentata* Fabr.
 „ *latipes* Westw. l. c. = *Dalpada clavata* Fabr.
Dinidor punctiger Westw. l. c. p. 25 = *Dinocoris tripterus* Fabr.
Aspongopus vicinus Westw. l. c. = *Aspongopus janus* Fabr.
 „ *alternans* Westw. l. c. = *Cyclopelta obscura* Lep. &
 [p. 26. [Serv.
Tesseratoma proxima Westw. l. c. = *Tessarotoma papillosa* Dru.
 [p. 27.
Lyramorpha pallida Westw. l. c. = *Lyramorpha rosea* Westw.
 [p. 28.
Edessa lutea Westw. l. c. = *Edessa flavida* Westw.
 „ *vicina* Westw. l. c. p. 29 = *Piezosternum calidum* Fabr.
Acanthosoma luteicornis Westw. l. c. = *Arvelius albopunctatus* De
 [p. 30. [Geer.
 „ *picicolor* Westw. l. c. = *Acanthosoma lateralis* Say.
 „ *affinis* Westw. l. c. = „ „
 „ *borealis* Westw. l. c. = *Acanthosoma cruciata* Say.
Raphigaster transversalis Westw. = *Platacantha lutea* Westw.
 [l. c. p. 31.
 „ *punctulatus* Westw. l. c. = *Piezodorus incarnatus* Germ.
 „ *abdominalis* Westw. l. c. = *Vulsirea violucea* Fabr.
 [p. 32.
Elia crucifera Westw. l. c. = *Agonoscelis nubila* Fabr.
 „ *sanguinea* Westw. l. c. = *Agonoscelis venosa* Thunb.
 „ *gambiensis* Westw. l. c. = *Agonoscelis versicolor* Fabr.
 „ *infusata* Westw. l. c. = „ „
 „ *depressa* Westw. l. c. = *Dolycoris baccarum* Linn.
 „ *assimilis* Westw. l. c. p. 33 = *Glypsus sparsus* Westw.
Pentatoma equinoxialis Westw. l. c. = *Arocera acroleuca* Perty.
 „ *nitida* Westw. l. c. = *Nezara marginalis* Herr.-Sch.
 „ *pantherina* Westw. l. c. = *Antestia cruciata* Fabr.
 [p. 34.
 „ *binotata* Westw. l. c. = *Dismegistus sanguineus* De
 [Geer.
 „ *wilkinsoni* Westw. l. c. = *Carpocoris nigricornis* Fabr.
 [p. 35.
 „ *bimaculata* Westw. l. c. = *Carbula insocia* Walk.
 „ *pennsylvanie* Westw. l. c. = *Hymenarcys nervosa* Say.
 „ *orbitalis* Westw. l. c. = *Antestia variegata* Thunb.
 „ *nepalensis* Westw. l. c. = *Eysarcoris guttiger* Thunb.
 [p. 36.
 „ *punctipes* Westw. l. c. = „ „
 „ *bengalensis* Westw. l. c. = *Menida histrio* Fabr.

<i>Pentatoma 3-fasciata</i> Westw. l. c.	= <i>Murgantia bifasciata</i> Fabr.
	[p. 37.
„ <i>frontalis</i> Westw. l. c.	= <i>Nezara capicola</i> Westw., var.
„ <i>oblonga</i> Westw. l. c.	= <i>Nezara viridula</i> Linn.
„ <i>unicolor</i> Westw. l. c. p. 38	= „ „
„ <i>berylina</i> Westw. l. c.	= „ „
„ <i>subsericea</i> Westw. l. c.	= „ „
„ <i>leii</i> Westw. l. c.	= „ „
„ <i>3-punctigera</i> Westw. l. c.	= „ „
„ <i>proxima</i> Westw. l. c.	= „ „
„ <i>chinensis</i> Westw. l. c.	= „ „
„ <i>lata</i> Westw. l. c. p. 39	= <i>Nezara capicola</i> Westw., var.
„ <i>africana</i> Westw. l. c.	= „ „ „
„ <i>ovalis</i> Westw. l. c.	= <i>Pentatoma senilis</i> Say.
„ <i>fimbriata</i> Westw. l. c.	= <i>Plautia fimbriata</i> Fabr.
„ <i>concinna</i> Westw. l. c.	= <i>Zicrona cœrulea</i> Linn.
„ <i>violacea</i> Westw. l. c.	= „ „
„ <i>aliena</i> Westw. l. c. p. 40	= <i>Audinctia spinidens</i> Fabr.
„ <i>crudelis</i> Westw. l. c.	= <i>Veterna sanguineirostris</i> [Thunb.
„ <i>hostilis</i> Westw. l. c.	= <i>Carbula melacantha</i> Fabr.
„ <i>collaris</i> Westw. l. c.	= <i>Thyanta perditor</i> Fabr.
„ <i>sublurida</i> Westw. l. c.	= <i>Podisus luridus</i> Fabr.
	[p. 41.
„ <i>spilota</i> Westw. l. c. p. 42	= <i>Euschistus servus</i> Say.
„ <i>inconspecta</i> Westw. l. c.	= <i>Euschistus tristigmus</i> Say.
„ <i>pulchella</i> Westw. l. c.	= <i>Stiretrus anchorago</i> Fabr.
„ <i>anchorago</i> Westw. l. c.	= „ „
„ <i>miniata</i> Westw. l. c. p. 43	= <i>Dorycoris fuscus</i> Germ.
„ <i>miniaticollis</i> Westw. l. c.	= <i>Agonoscelis venosa</i> Thunb.
„ <i>bifida</i> Westw. l. c.	= <i>Macropygium reticulare</i> Fabr.
„ <i>bufo</i> Westw. l. c. p. 44	= <i>Hypogomphus bipunctatus</i> [Guér.
„ <i>interrupta</i> Westw. l. c.	= <i>Basicryptus rugicollis</i> Westw.
„ <i>angularis</i> Westw. l. c.	= <i>Dalsira modesta</i> Fabr.

SPECIES WITH GENERIC DETERMINATION STILL UNDECIDED.

Alia atricornis Westw. in Hope Cat. i. p. 32.

Pentatoma harrisii Westw. loc. cit. p. 41.

„ *nigripes* Westw. loc. cit.

„ *lateralis* Westw. loc. cit. p. 43.

TYPES NOW MISSING FROM COLLECTION.

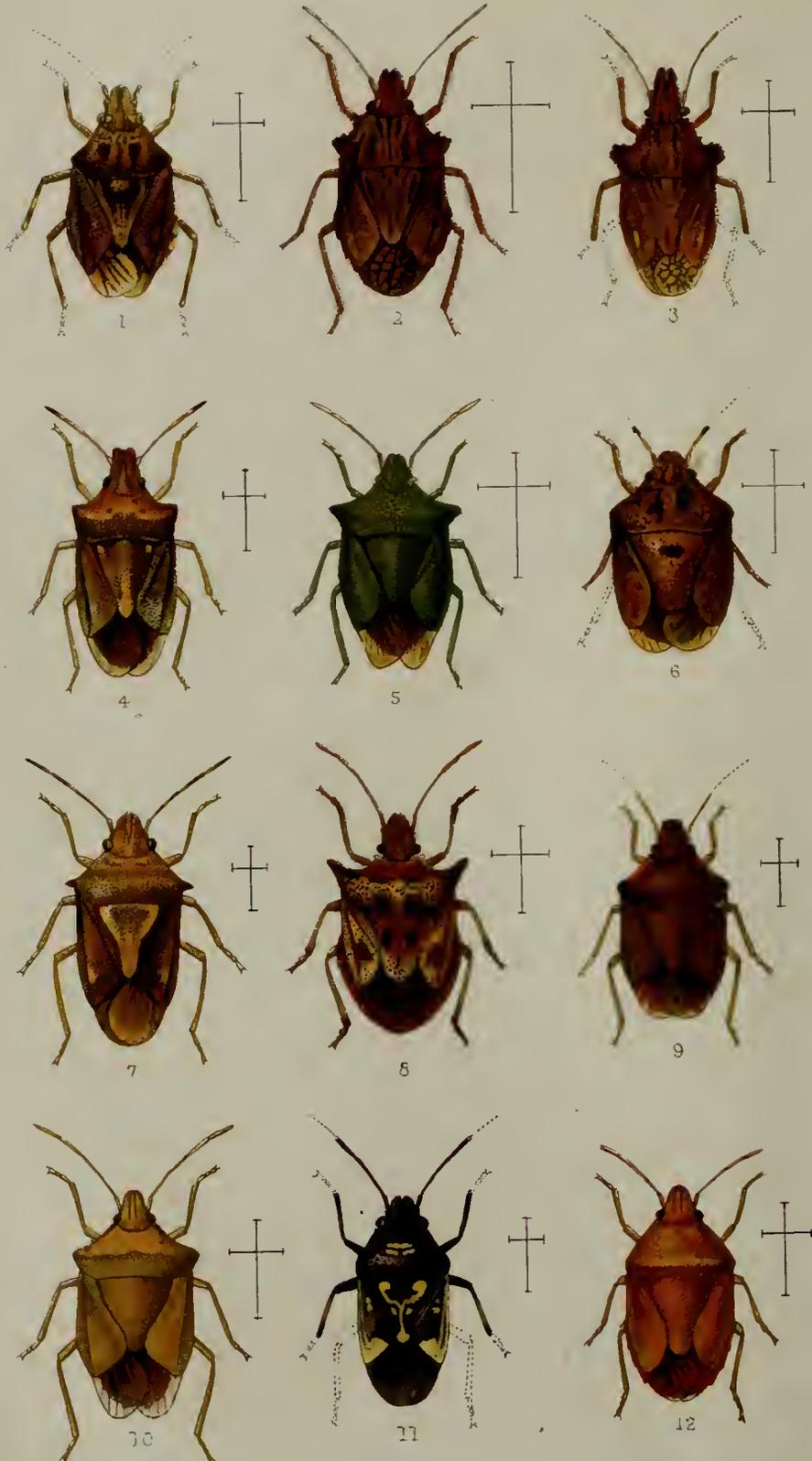
Halys rufescens Westw. in Hope Cat. i. p. 24.

„ *gravis* Westw. loc. cit.

„ *dentipes* Westw. loc. cit.

Pentatoma pulchra Westw. loc. cit. p. 34.



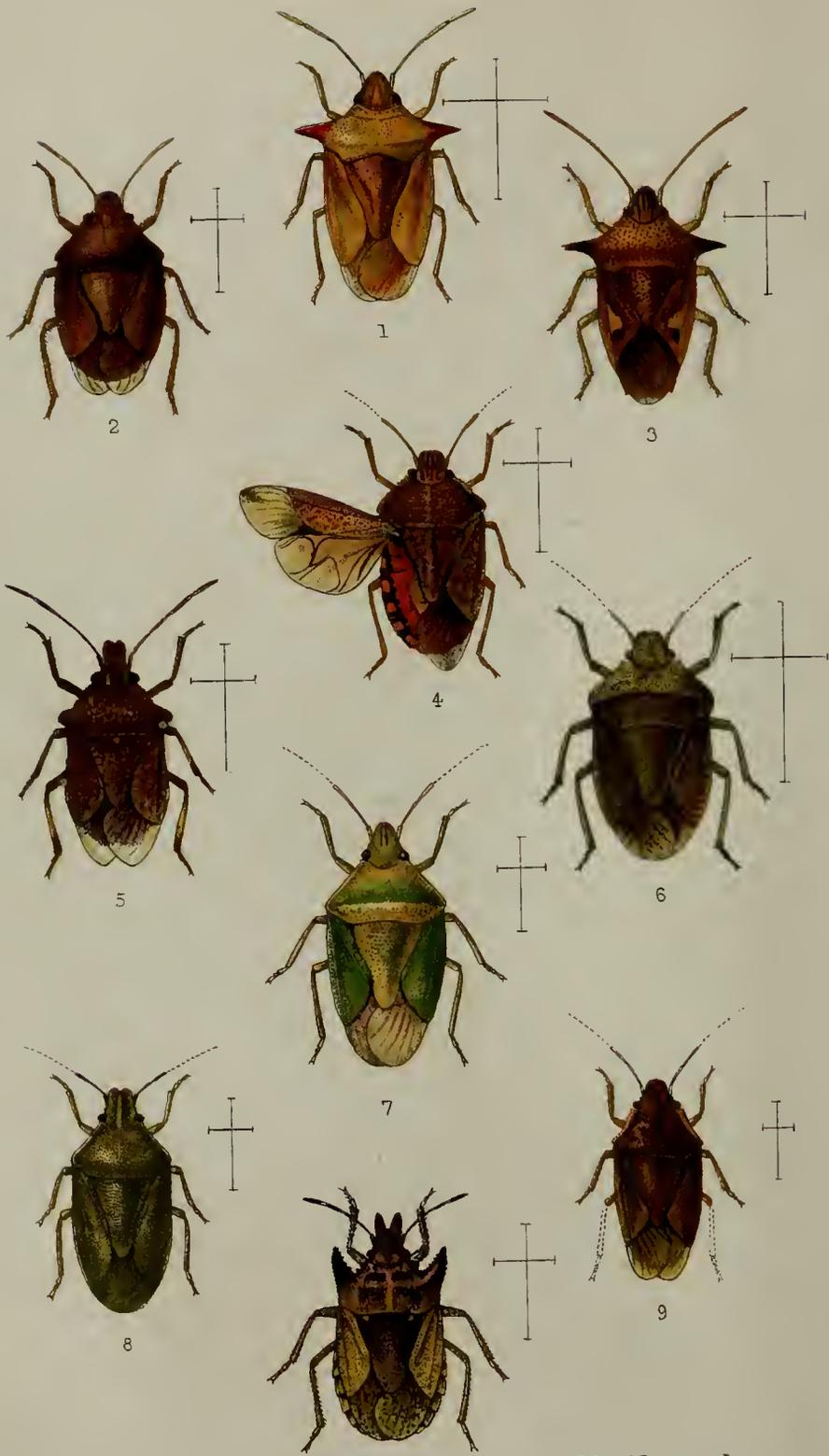


Horace Knight del. et lith.

West, Newman chromo.

RHYNCHOTA OF THE FAMILY PENTATOMIDÆ.





Horace Knight del et lith

10

West, Newman chromo.

RHYNCHOTA OF THE FAMILY PENTATOMIDÆ.

EXPLANATION OF THE PLATES.

PLATE LIII.

1. *Spudæus parvulus*, p. 809.
2. *Orthoschizops assimilis*, p. 809.
3. " ? *rugosus*, p. 809.
4. *Kalula varicornis*, p. 810.
5. *Palomena unicolor*, p. 811.
6. *Cresphontes monsoni*, p. 814.
7. *Mormidea scutellata*, p. 811.
8. *Ætius variegatus*, p. 814.
9. *Dictyotus pallipes*, p. 810.
10. *Ilerda pallescens*, p. 812.
11. *Actuarius albonotata*, p. 815.
12. *Ocirrhœ roci*, p. 815.

PLATE LIIII.

1. *Avicenna inquinata*, p. 815.
2. gen. ? *harrisi*, p. 818.
3. *Sastragala variolosa*, p. 818.
4. *Podisus neglectus*, p. 817.
5. *Glypsus sparsus*, p. 817.
6. *Basicyrptus irroratus*, p. 817.
7. *Ocirrhœ ? virescens*, p. 815.
8. gen. ? *atricornis*, p. 818.
9. " *lateralis*, p. 818.
10. *Melampodius cervicornis*, p. 817.

5. On some Nemerteans from Torres Straits.

By R. C. PUNNETT, B.A.¹

[Received June 29, 1900.]

(Plates LIV. & LV.)

The specimens of Nemerteans which I now propose to describe were collected by Prof. Haddon in Torres Straits during the year 1889. Most of the species have been previously named, the only new species being three Lineidæ. In none of these specimens was the whole animal preserved, so that it is impossible to say whether a caudal appendage was present or not; yet, although the chief feature relied upon in the existing system of classification for the determination of the genus was absent, the fragments in each instance comprised the whole of the anterior end, the anatomy of which is sufficient to distinguish them from any species of the family yet described. Consequently I have thought it advisable to give them specific names whilst assigning them provisionally to the genus *Cerebratulus*.

HETERONEMERTINI.

Fam. EUPOLIIDÆ.

EUPOLIA DELINEATA.

Eupolia delineata Delle Chiaje, 1825; Bürger (2) p. 234.

Fragments of a single specimen about 2.5 mm. in breadth. The chocolate-coloured lines are well preserved by the chromic acid in which the animal was fixed; they are perfectly continuous and number about 24 in all, those on the dorsal surface being rather more numerous and more clearly marked. In these respects it resembles a specimen described by Bürger from Java (2. p. 234), rather than those found at Naples, in which the lines are fewer and more broken. The absence of head-slits, the relative positions of

¹ Communicated by Dr. S. F. HARMER, F.Z.S.

the dorsal and ventral ganglia, and the relative thickness of the epithelium and cutis, all show that this specimen belongs to the species *delineata* and not to *curta*. The nephridia, however, possess several openings on each side, and this fact, in view of Bürger's statement (3. p. 601) that there is only a single pair in *E. delineata*, led me to examine a specimen of *delineata* which I procured whilst at Naples. Here there were five openings on one side and seven on the other, which seems to show that Bürger's statement is probably inexact. In all the other members of this family whose excretory system has been worked out by Hubrecht (8. p. 115), Oudemans (4. p. 144), or by myself (5 & 6), there have always been more than one pair of ducts present, with the exception of *E. henprichi*, in which (5) they were altogether absent.

EUPOLIA MELANOGRAMMA.

Eupolia melanogramma Punnett (6), 1900, = *E. quinquelineata*, Bürger (2).

A very large specimen of this species was obtained, measuring 190 cm. in length and about 2.4 cm. in breadth at the thickest, with a dorso-ventral depth of 7 mm. Five dorsal lines were present, all being well marked and unbroken. This worm is one of the largest Nemerteans recorded, being only exceeded in bulk by a specimen of *Lineus longissimus* recorded by McIntosh¹ and a specimen of *Cerebratulus lacteus* measured by Verrill (7. p. 435). The internal anatomy of the species has already been described by Punnett (6) and Bürger (2).

Fam. LINEIDÆ.

LINEUS ALBOVITTATUS Bürger.

A single specimen of this easily recognized species was procured. In the preserved state it measures about 9 cm. in length and 5 mm. in breadth at the middle of the body. It appears to be a fairly plentiful species with a wide distribution, having been recorded by Stimpson² from Loo-choo, by Bürger (1) from Amboina, Timor, Matuka, and Mauritius, and by myself (5) from New Britain.

CEREBRATULUS COLORATUS Bürger.

A fragment 9 cm. long and 1 mm. in diameter is probably to be referred to this species, as the markings agree with the description given by Bürger (1). Unfortunately the anterior portion is missing.

CEREBRATULUS TORRESIANUS, n. sp. (Plate LIV. figs. 1 a-e, 3, & 6.)

About 4 cm. of fragments including the anterior end, and having an average width of about 1.8 mm. The head-slits measured 2.5 mm.

¹ British Annelids: The Nemerteans, p. 183.

² Proc. Acad. Nat. Sci. Philad. vol. vii., 1856.

in length and reached rather over the mouth which was 2 mm. long. Colour in life a uniform brown.

The *epithelium* contains in its outer part a number of granular unicellular gland-cells (fig. 3). It rests on a well-developed basement-membrane (*bm.*), beneath which is the outer longitudinal muscle-layer of the body-wall. Squeezed in between the muscles are the somewhat scanty cutis-glands (*cgl.*). There is no connective-tissue layer (Bindgewebsschicht).

The *muscular system* presents no features of special interest. There is no diagonal muscle-layer.

In the *vascular system* there is a well-marked head-loop anteriorly. The dorsal blood-vessel quits the proboscis-sheath at the level of the posterior termination of the excretory system, and at this same level the œsophageal lacunæ cease, becoming confluent with the two lateral blood-vessels, which at this level are very large.

The *proboscis* is lacking.

The *proboscis-sheath* contains the usual outer longitudinal and inner circular muscle-layers.

The *alimentary canal* possesses a small ventral gutter.

The *generative sacs* contained ova.

The *excretory system* commences some little way behind the mouth (fig. 6). On both sides there is a duct opening to the exterior near its posterior end. On the left side there is an additional duct at the anterior end. The system lies for its whole extent dorsal to the level of the side stems.

In the *nervous system* the median dorsal nerve is scarcely differentiated from the nervous sheath surrounding the circular muscle-layer. Anteriorly well-marked head-nerves are given off the dorsal ganglion. The dorsal commissure is stronger than is usual in the group, and is given off slightly behind the level of the ventral one. In both the dorsal and ventral ganglia and in the side stems the central fibrous core is unusually large in comparison with the thickness of the ganglion-cell layer. Neurochord-cells occur in the brain at the level of the ventral commissure. The dorsal lobe of the dorsal ganglion is large and reaches back some way (fig. 1 a-c, *ddg.*).

The *cerebral organ* is rounded in form and is partly covered by gland-cells both above and below.

The *head-slits* are deep, reaching nearly to the brain. Even after the ciliated canal has been given off, they remain deep for a considerable distance (fig. 1 a-d, *hs.*, & fig. 6, *hs.*).

Eyes are probably represented by small structures lying dorsal to the head-slits in the snout, though in the absence of a well-marked pigmentary layer (which may have been extracted by the long sojourn in spirit) it is impossible to be certain.

The *frontal organ* is well marked.

The *head-glands* are scanty and soon fuse with the cutis-glands.

CEREBRATULUS QUEENSLANDICUS, n. sp. (Plate LIV. figs. 2 a-e, 4, & 5.)

Fragments of the anterior portion of a single specimen were

procured. Width about 2.5 mm. The head-slits are very long, extending over 5 mm. The posterior 3 mm., however, are very shallow. The mouth commences at about the termination of the deep portion of the head-slits and is about 3 mm. in length. After preservation the colour was dark olive-brown. Starting from about .5 mm. from the tip of the snout, a paler dorsal band about 1 mm. in breadth reached backwards.

The *epithelium* contains a number of large granular unicellular glands in its deeper portion. Beneath the thin basement-membrane is a layer of longitudinal muscle-fibrils in the *cutis*, and underneath these again are the cutis-glands and the connective-tissue layer of the cutis. Dorso-laterally for a small portion of the circumference, as seen in transverse section, the cutis is modified on each side by the presence of an enormous quantity of what appear to be small rhabdites (fig. 4, *rh.*). They take a very vivid colour with picric acid, and may easily be traced through the cutis-muscles (*mle.*), the basement-membrane, and the epithelium.

The *muscle-layers* show no special features. There is no diagonal layer.

In the *vascular system* there is a well-marked head-loop. It was not possible to fix definitely the point of exit of the dorsal vessel, as the fragment cut only just included the excretory system. At this level the vessel still ran in the sheath.

The *proboscis* was lacking.

The *proboscis-sheath* shows the usual inner longitudinal and outer circular muscle-layers.

The *excretory system* commences at the posterior limit of the cerebral organ (fig. 5). It lies wholly dorsal to the level of the side stems. There is a single duct on each side near its middle portion.

In the *nervous system* the median dorsal nerve is well marked. The dorsal commissure in the brain is very posteriorly situated, not being given off until after the separation of the dorsal from the ventral ganglia. Neurochord-cells are present at the level of the ventral commissure. The dorsal lobe of the dorsal ganglion is large. The brain as a whole is much flattened, as, indeed, is the whole of the fragment by which this species is at present represented.

The *cerebral organ* is elliptical in shape, being flattened dorso-ventrally. Gland-cells are found above and below (fig. 2 c-e). A portion open into the ciliated canal before it joins the dorsal ganglion (fig. 2 a).

The *frontal organ* is well marked.

Eyes are probably absent.

The *head-glands* are very short and soon become fused with the cutis-glands.

This species bears some resemblance to that described by Bürger (1) under the name of *Cerebratulus spadix*, but seems to be distinguished from it by the vascular head-loop and by the fact that the mouth commences before the termination of the cerebral organs. The curious agglomeration of rhabdites also seems peculiar.

CEREBRATULUS HADDONI, n. sp. (Plate LV. figs. 7 a-e, 8, & 9.)

About 5 cm. of fragments of a single specimen from Thursday Island. The œsophageal region is round and about 6 mm. in diameter. In the intestinal region the breadth is about 8 mm., the depth being 5 mm. The mouth is large. The head-slits extend backwards to the level where the mouth commences. Colour in the preserved state whitish grey, covered with darker mottlings except on the snout.

The *epithelium* in the œsophageal region contains a few large granular cells (Stäbchenzellen) in its deeper portion. There is no well-marked basement-membrane. The *cutis* presents the fine circular and longitudinal muscle-fibrils. The cutis-glands are poorly developed. The connective-tissue layer (fig. 8, *cu.*) is very strong, being almost as thick as the powerful external longitudinal muscle-layer. It contains a very few muscle-fibrils.

The *muscle-layers* are all well developed.

The *vascular system* shows a well-marked head-loop.

The *proboscis* is of moderate size, but presents no muscle-crosses.

The *proboscis-sheath* contains the usual outer circular and inner longitudinal muscle-layers. The latter is more strongly developed ventrally than dorsally.

The *alimentary canal* possesses a wide, shallow, ventral gutter in the intestinal region.

The *excretory system* starts some way behind the mouth and extends over about 2 mm. in the preserved specimen (fig. 9). I have been able to observe no openings to the exterior¹. The œsophageal vascular lacunæ are very small. The excretory tubules lie wholly ventral to the level of the side stems.

The *generative sacs* are small, numerous, and scattered in the intestinal region, thus not conforming to the usual arrangement, in which there is a single sac between each successive pair of intestinal pouches. Apparently the ducts are not yet developed.

In the *nervous system* the brain presents no special features. Neurochord-cells are not present at the level of the ventral commissure. The median dorsal nerve is not distinguishable from the rest of the nervous sheath surrounding the circular musculature. An inferior median dorsal nerve, lying just above the proboscis-sheath, is well marked in this species.

The *cerebral organ* is seen in section before the separation of the dorsal and ventral lobes of the dorsal ganglion (fig. 7 b). It is invested by gland-cells only on its ventral surface.

The *head-slits* are deep, reaching almost to the brain. Externally they end abruptly before the level where the cerebral organ commences (fig. 9).

Eyes and *frontal organ* are both absent.

The *head-glands* are very scanty and end early.

¹ Cf. *C. robustus* (Punnett, 6), which this species greatly resembles with regard to its excretory and vascular systems.

In conclusion, the leading features of these three new species may be briefly characterized as follows:—

- C. torresianus*.—Size small. Basement-membrane stout. Cutis without connective-tissue layer, its place being taken by longitudinal muscle-fibres. Vascular head-loop. Neurochord-cells. Head-slits remain deep some distance behind cerebral organ. No eyes. Well-marked frontal organ. Excretory system starts behind mouth and has few ducts.
- C. queenslandicus*.—Size small. Dorso-ventrally flattened. Cutis packed with rhabdites at certain parts. Vascular head-loop. Neurochord-cells. Head-slits prolonged far behind cerebral organ as very shallow canals. No eyes. Well-marked frontal organ. Excretory system commences at lacunæ of cerebral organ and has one pair of ducts.
- C. haddoni*.—Size fairly large. Much thickened. Connective-tissue layer of cutis extremely thick. Cutis-glands much reduced. Vascular head-loop. Proboscis without muscle-crosses. No neurochord-cells. Eyes and frontal organ both absent. Excretory system commences some way behind mouth and is without ducts.

List of Papers referred to.

- (1) BÜRGER, O.—Untersuchungen über die Anatomie und Histologie der Nemertinen nebst Beiträgen zur Systematik. Zeitschr. wiss. Zool. Bd. 50, 1890.
- (2) ——. Südgeorgische und andere exotische Nemertinen. Z. Jahrb., Abth. Syst. Bd. 7, 1893.
- (3) ——. Die Nemertinen des Golfes von Neapel. Berlin, 1895.
- (4) OUDEMANS, A. C.—The Circulatory and Nephridial Apparatus of the Nemertea. Q. Journ. Micr. Sci. (Supplement), 1885.
- (5) PUNNETT, R. C.—Some Nemerteans from the Pacific. Willey's Zoological Results, Pt. v., 1900. (In the press.)
- (6) ——. On a Collection of Nemerteans from Singapore. Quart. Journ. Micr. Sci., vol. 44, 1900.
- (7) VERRILL, A. E.—The Marine Nemerteans of New England and adjacent waters. Trans. Connecticut Acad. vol. xiii., 1892.
- (8) HUBRECHT, A. A. W. The Nemertea. 'Challenger' Reports, vol. xix., 1887.

P.S.—Since this paper was read, Prof. Haddon has kindly supplied me with the following notes on several of the living worms:—

EUPOLIA DELINEATA (p. 825).

From reef, Waier, Murray Is. Colour buff, with very fine interrupted longitudinal brown lines, about a dozen in number, on both dorsal and ventral aspect. The lines are more deeply coloured and more definite in form on the dorsal surface.



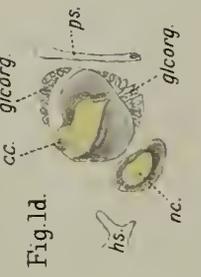
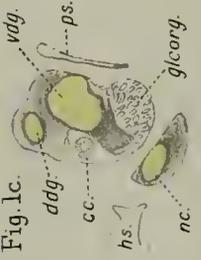
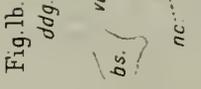
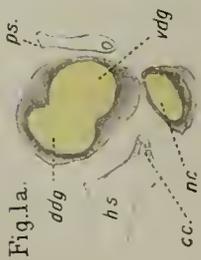


Fig. 1e.

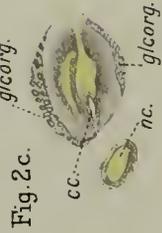
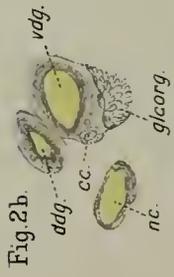


Fig. 2e.

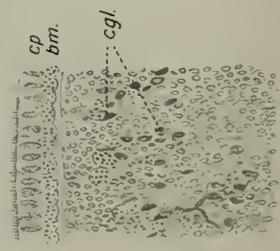


Fig. 3.

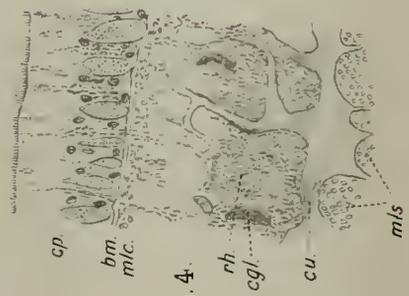


Fig. 4.

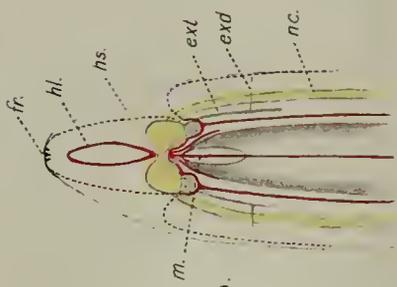


Fig. 5.

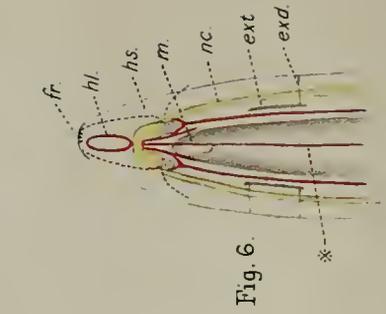


Fig. 6.

NEMERTEANS FROM TORRES STRAITS



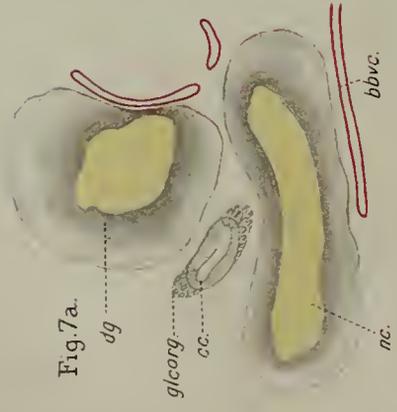


Fig. 7a.

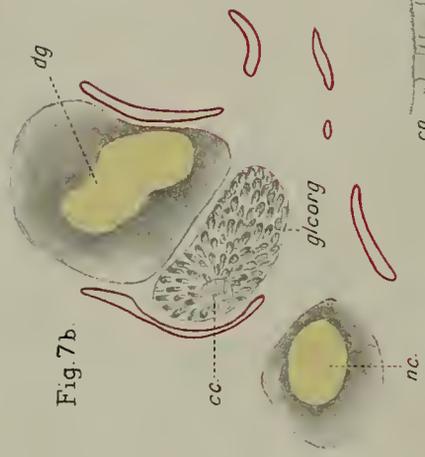


Fig. 7b.

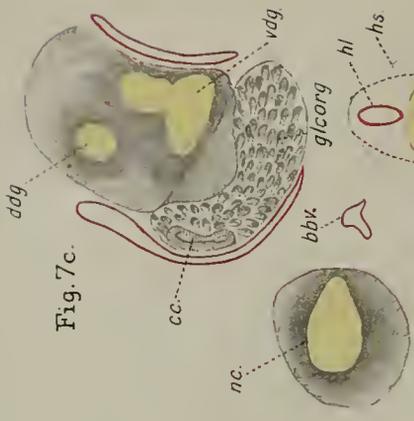


Fig. 7c.



Fig. 7d.

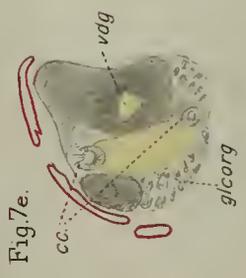


Fig. 7e.

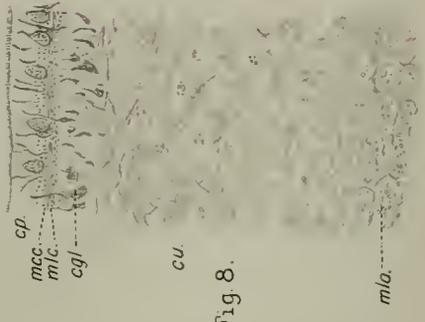


Fig. 8.

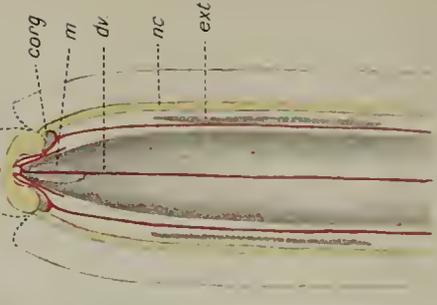


Fig. 9.

EUPOLIA MELANOGRAMMA (p. 826).

Length over 20 feet. Average breadth $\frac{3}{4}$ inch. Ground-colour white, with five dorsal and two median ventral black lines; very sticky mucus.

LINEUS ALBOVITTATUS (p. 826).

From the channel between Mer and Danar, Murray Is. Depth 15-20 fathoms. Colour dark green, with a bluish sheen. There is a chevron-pattern on the head consisting of a white line bordered with pale green. Tail pointed. Length about 158 mm. and breadth about 2.75 mm.

EXPLANATION OF THE PLATES.

<i>bbv.</i> , buccal vessel.	<i>ext.</i> , excretory tubules.
<i>bbvc.</i> , commissure of buccal vessels.	<i>fr.</i> , frontal organ.
<i>blc.</i> , blood-lacuna of cerebral organ.	<i>gcorg.</i> , gland-cells of cerebral organ.
<i>bm.</i> , basement-membrane.	<i>hl.</i> , vascular head-loop.
<i>br.</i> , brain.	<i>hs.</i> , head-slit.
<i>cc.</i> , ciliated canal of cerebral organ.	<i>m.</i> , mouth.
<i>cgl.</i> , cutis-glands.	<i>mcc.</i> , circular muscles of cutis.
<i>corg.</i> , cerebral organ.	<i>mle.</i> , longitudinal muscles of cutis.
<i>cu.</i> , connective-tissue layer of cutis.	<i>mlo.</i> , outer longitudinal muscle-layer.
<i>ddg.</i> , dorsal lobe of dorsal ganglion.	<i>nc.</i> , lateral nerve-cord.
<i>dv.</i> , median dorsal vessel.	<i>ps.</i> , proboscis-sheath.
<i>ep.</i> , epithelium.	<i>rh.</i> , rhabdites.
<i>exd.</i> , excretory duct.	<i>vdg.</i> , ventral lobe of dorsal ganglion.

PLATE LIV.

- Fig. 1 a-e. *Cerebratulus torresianus*, p. 826. Sections through the cerebral organ taken at intervals of 50 μ . \times 36.
- Fig. 2 a-e. *C. queenlandicus*, p. 827. Sections through the cerebral organ taken at intervals of 50 μ . \times 36.
- Fig. 3. *C. torresianus*, p. 826. Section through skin of œsophageal region. \times 128.
- Fig. 4. *C. queenlandicus*, p. 827. Section through skin of œsophageal region showing rhabdites (*rh*). \times 300.
- Figs. 5, 6. Diagrammatic reconstructions of the various systems in the anterior portion of the body.
- Fig. 5. *C. queenlandicus*, p. 827. \times 8.
- Fig. 6. *C. torresianus*, p. 826. \times 8. * marks the spot where the median dorsal vessel leaves the proboscis-sheath.

PLATE LV.

- Fig. 7 a-e. *C. haddoni*, p. 829. Sections through the cerebral organ taken at intervals of 100 μ . \times 36.
- Fig. 8. *C. haddoni*. Section through skin of œsophageal region. \times 88.
- Fig. 9. Diagrammatic reconstruction of anterior portion of *C. haddoni*. \times 4.

December 4, 1900.

Dr. HENRY WOODWARD, F.R.S., Vice-President, in the Chair.

The Secretary read an extract from a letter which had been addressed to the Colonial Office by the West India Committee, and sent by the Colonial Office to the Society for information, concerning the proposed introduction of the English Starling (*Sturnus vulgaris*) or the Indian Mynah (*Acridotheres tristis*) into St. Kitts, West Indies, in order to check the increase of Grasshoppers, which were causing great damage to the growing crops in that island.

Mr. Lydekker exhibited the mounted skin of a female Musk-ox, which Mr. Rowland Ward, F.Z.S., was about to present to the British Museum. It had been obtained from East Greenland, together with the skin of a male, which had also been set up by Mr. Ward's firm. Both specimens differed from the Musk-ox of Arctic America (and probably West Greenland) by the presence of a large patch of long whitish hair in the middle line of the face between the horns and the muzzle, and also by the hair on the rest of the front of the face being grizzled, instead of uniformly dark brown. In the female the hair between the bases of the horns was also white, and a little white hair was observable between the closely approximated horns of the bull.

Both Mr. Thomas and Mr. Lydekker had previously been struck with the presence of the white on the face of the young East-Greenland Musk-oxen at Woburn Abbey (see the figure in P. Z. S. 1899, p. 886), but had not been satisfied that the feature might not be due to immaturity alone. Now, however, it was demonstrated to occur in the adult of the East-Greenland race, which Mr. Lydekker proposed to name *Ovibos moschatus wardi*, taking the above-mentioned female specimen as the type of the subspecies. The race would be sufficiently characterized by the presence of the light grey tuft in the middle of the face of both sexes of the adult. But not improbably the still larger amount of greyish white, or white, on the face of the calves was also a distinction; for Mr. Lydekker had been informed by the manager to Mr. Rowland Ward that in young American Musk-oxen the face (to the best of his belief) was uniformly brown.

It was also suggested that in future the fossil Asiatic and European Musk-ox, which was doubtless subspecifically distinct from both the living American races, might be designated *Ovibos moschatus pallantis* (De Kay), the name *maximus* being available for the fossil American form if considered desirable.

Dr. Forsyth Major exhibited a few bones of a species of *Macacus* found associated with the remains of the Dodo in the Mare aux Songes (Mauritius), and made the following remarks:—

The bones here exhibited, two radii, right and left, are preserved

in the Natural History Museum; there is in the Cambridge Zoological Museum a cubitus from the same locality and apparently of the same species. My purpose in exhibiting them is to draw attention to the fact, in the hope that more characteristic remains will turn up.

A species of *Macacus*, said to be *M. cynomolgus*, is living in a wild state at Mauritius. According to I. Geoffroy Saint-Hilaire's Catalogue of Primates (pp. 26 & 29), the remains of two species of *Macacus* from Mauritius, *M. sinicus* and *M. cynomolgus*, are in the Paris Natural History Museum. A. Newton, in his 'Dictionary of Birds' (p. 215, footn. 1) states the Mauritius Monkey to be the *Macacus pileatus* from Ceylon.

I have not succeeded in determining accurately the few bones from the Mare aux Songes; all I can say for the present is that they belong to a species of *Macacus* which is not *M. cynomolgus*.

Monkeys have been known to exist in the Mauritius since 1627-28 at least, and were, it seems, supposed to have been introduced there by the Portuguese, as mentioned in the following passage in Sir Thomas Herbert's Travels: "The Ile (*i. e.* Mauritius) affords us withall Goats, Hogges, Beeves and Kine, land Tortoyses (so great that they will creepe with two mens burthens, and serue more for sport, then seruice or solemne Banquet), Rats and Monkeyes, all of which becomes food to such ships as anchor here. They were first brought hither by the *Portugall*" (Th. Herbert, A Relation of some Yeares Travaile, Begunne Anno 1626. Into *Afrique* and the greater *Asia* London, 1634, p. 213.)

Dr. Forsyth Major made the following remarks on remains of *Cyon sardous* (Studiati) from a cave at Capo Caccia (N.W. Sardinia):—

The mandible of a member of the Canidæ here exhibited has been communicated to me, together with other Pleistocene Vertebrates from Sardinia, by Professor D. Lovisato, of the University of Cagliari, who for years has been exploring the fossiliferous deposits of Sardinia with characteristic energy and at considerable personal sacrifice.

In the absence of the posterior part of the ramus, whereby it must be left undecided whether a third true molar was present or not, the determination of this fossil rests chiefly on the conformation of the talon of the lower carnassial, which is unicuspid and trenchant, whereas in *Canis* it is composed in the main of a stronger outer and a lesser inner tubercle.

Amongst recent Canidæ, three genera exhibit the trenchant conformation of the lower carnassial's talon; viz., the South-American *Iticyon*, the African *Lycan*, and the Central and South-east Asiatic *Cyon*. There are no *a priori* grounds why such a feature might not be independently developed in various forms. As to *Iticyon*, Lund, Huxley, and Winge have insisted upon its close relation in other characters to the other South-American

Canidæ, Wings pointing out, moreover, transitional forms between both.

With regard to *Lycaon* and *Cyon*, their closer relation with each other than with *Canis*, as shown by the skull and dentition, is a very striking fact and can scarcely be regarded as a mere parallelism. Huxley observes (P. Z. S. 1880, p. 276) that "in the breadth of the præmolar region of the upper jaw, and in a more or less marked convexity of the facial contour, *Lycaon* strongly reminds one of *Cyon*;" whilst Mivart shows that *Lycaon* agrees with *Cyon* in having large incisive foramina and strongly sigmoid external margins of the nasals (A Monograph of the Canidæ, p. 196, 1890). Nehring was aware (Sitzungsber. naturf. Freunde, 1890, p. 20) that the lower carnassial of *Lycaon* agrees with *Icticyon* and *Cyon* in its unicuspid talon. A similar agreement exists with regard to the lower *m* 2, which in *Lycaon* is quite as reduced in form as in several lower jaws of *Cyon*. In the former, this tooth has two roots; but this condition also occurs quite as often in *Cyon* as the presence of only one root. The lower *m* 3 reappears very rarely in *Cyon* (Van der Hoeven); conversely in one of the five skulls of *Lycaon* in the Natural History Museum this tooth is missing. In the upper jaw, *m* 1 of *Lycaon* is reduced almost to the extent of *Cyon*, and *m* 2 is also reduced more than in *Canis*. Therefore, in my opinion, *Lycaon* and *Cyon* are much more closely allied than has hitherto been supposed.

The first recorded Pleistocene Carnivore of this Canine type is Studiati's *Cynotherium sardoum* (1857), from the ossiferous breccia of Bonaria near Cagliari, well described by Studiati, who, however, was not aware of its affinities with *Cyon*. These were pointed out by myself in 1872, and later on (1877) corroborated by figuring some of Studiati's specimens side by side with Canine remains of the ordinary type.

The specimens from the two Sardinian localities agree with *Cyon bourreti* Harlé, from the cave of Malarnaud (Ariège, France), in the conformation of the lower posterior premolar (*p* 1), which is the same as in the recent species of *Cyon*; whereas the same tooth of *Cyon europæus* Bourg., from caves of the Maritime Alps and Moravia, exhibits a strongly developed anterior basal cusp, which is a characteristic feature of *Lycaon*, and therefore acquires additional interest in connection with the above remarks on the relationship of both genera. With each other the Sardinian fossils agree in the absence of the lower anterior premolar (*p* 4) and in the presence of a diastema between *p* 2 and *p* 3. These two characters are certainly of specific, but not of generic value. As I formerly pointed out, the establishment of a separate genus, *Cynotherium*, appears to be unnecessary; the characters upon which Studiati insisted for generic distinction are those of *Cyon* and *Lycaon*. Pending more complete materials, the latter genus may be excluded on account of the conformation of the lower *p* 1 and of the more slender build of the teeth generally. The present Sardinian Carnivore will accordingly have to be known as *Cyon*

sardous (Studiati). There are slight differences between the fossils of the two localities, but as they refer to secondary details which cannot be well demonstrated without figures, I must postpone their discussion.

Mr. J. S. Budgett, F.Z.S., read a paper entitled "The Breeding-habits of some West-African Fishes, with an Account of the External Features in the Development of *Protopterus annectens*, and a Description of the Larva of *Polypterus lapradii*," in which a history was given of a collecting-trip made during the previous summer to the swamps of the Gambia River in search of the eggs of *Polypterus*.

The eggs of *Polypterus* were not discovered, though a very young specimen was found measuring only one inch and a quarter in length. In this small specimen the dermal bones were not developed, and the external gills were of very great size, the base of the shaft being situated immediately behind the spiracle. The dorsal finlets formed a continuous dorsal fin.

While the eggs of *Polypterus* were being searched for, the underground nests of *Protopterus annectens* were found in abundance, and a complete series of eggs and larvæ were preserved.

The male *Protopterus* was found to live in the nest until the larvæ were fit to leave it.

The nests of this fish were made in but a few inches of water; frequently the water round the mouth of the nest was dried up, and then the parent was seen lashing the surface of the water in the entrance to the nest with the end of its tail out of water. The larvæ were provided with four pairs of plumose external gills and a ventral sucker as in *Lepidosiren*; soon after hatching they attached themselves to the sides of the nest by the sucker and hung in a vertical position.

The larvæ hatched in eight days and left the nest as young *Protopteri* in twenty days.

The external features in their development were remarkably like those of the South-American Lung-fish (*Lepidosiren*), differing, however, from the latter in several details, which possibly could be traced to the presence in *Lepidosiren* of a larger amount of food-yolk.

The colour change at night-time, which is found to be so marked in both members of the Dipneumona at a certain stage of their life-history, was discussed, and was shown in *Protopterus* to be associated with the nocturnal habits of the larva at this period.

Nests were also found of *Gymnarchus niloticus* Cuv. These were made in about three feet of water and floated on the surface. The nests were two feet long and a foot wide, the wall of the nest standing several inches out of water except at one end, where it was two or three inches below the surface, and left an entrance to the nest. Inside the nest the depth of water was about six inches.

The eggs measured 10 mm. in diameter; the larvæ hatched in

five days when in an embryonic state and left the nest in eighteen days. Soon after hatching the larva was provided with great bunches of protruding gill-filaments, which hung down as a blood-red beard. The yolk-sac became drawn out into a long cylindrical bag, which was completely absorbed by the time the larva left the nest. The larvæ while in the nest continually came to the surface and took air into the lung-like swim-bladder.

The nests of *Heterotis niloticus* were also found. These were built on the swamp-bottom in two feet of water. They measured four feet across the walls reaching the surface of the water. The fish was observed making its nest, which, when finished, was perfectly round and quite smooth. The larvæ soon after hatching formed a swarm in the centre of the nest, and were at that stage provided with long protruding gill-filaments.

Another remarkable fish, *Sarcodaces odoë* Bl., was found breeding in the same swamps. It laid its eggs in masses of foam, which floated on the surface of the water. The hatched larvæ were provided with adhesive structures on the front of the head, with which they hung to the underside of the surface.

Nests were also found containing eggs which apparently belonged to *Hyperopisus bebe* Lacép., one of the *Mormyridæ*. These nests were scooped out from the swamp-bottom; the eggs were attached to the rootlets thus laid bare. The hatched larvæ were provided with six cement-glands on the surface of the head: by these a delicate rope of mucus was spun, often nearly the length of the body of the larva, by which the larva hung suspended from the rootlets until the yolk-sac was absorbed.

This paper will be printed entire in the Society's 'Transactions.'

The following papers were read:—

1. Note on the Gestation of the Pine-Marten.

By A. H. COCKS, F.Z.S.

[Received August 21, 1900.]

Pine-Martens (*Mustela martes*) first bred in my collection in 1882, a note on which was published in the 'Zoologist' for 1883, p. 203. Various details concerning the rate of growth of the young were recorded, including the interesting fact, which seems to have been previously unsuspected, that the young are at first perfectly white. Since then other litters of this species have been bred in my collection; but as we never could discover when the female came in season (and have never even yet seen this species pairing), all attempts at breeding were extremely hazardous: the allowing of a pair to run together was apt to result in the death of the female, in consequence of one or more of the long canines of the male penetrating her brain, the damage being inflicted so instantaneously that there was no possibility of a timely separation.

At last, this year, we noticed little mouthfuls of short straw

deposited here and there in the cage of a female Marten, a sign of her being in season, which I first observed some years ago in the case of Otters.

Accordingly a male was admitted from the adjoining cage on January 5th; shut off again on the 16th, but readmitted the next day, and the pair were finally separated on the 18th. Pairing probably took place on the nights of the 8th, 10th, and 13th, though quite possibly at other times also.

Young, which proved to be two males, were born early on April 22nd; and by the end of July they were already bigger than their mother.

The probable period of gestation of this species is therefore a few hours over 103 days, the extremes of possibility ranging from 94 to 106 days.

Beyond certain contributions towards determining the gestation of the Badger, among which I would specially refer to that of Mr. E. G. Meade-Waldo ('Zoologist,' 1894, p. 221), and the common statement that the Ferret "goes about six weeks," I know of no published record of the gestation of any of the *Mustelidæ*, except in the case of two species in my own experience, viz.: Otter, 61 days (cf. P. Z. S. 1881, p. 249; 'Zoologist,' 1882, p. 201); and Polecat, 40 days ('Zoologist,' 1891, p. 344). Although I had long suspected that the gestation of the Pine-Marten must be a good deal longer than that of the Polecat, yet the actual state of the case was unexpected, and is certainly remarkable.

2. Observations on the Habits and Natural Surroundings of Insects made during the "Skeat Expedition" to the Malay Peninsula, 1899-1900. By NELSON ANNANDALE, B.A.¹

[Received May 11, 1900.]

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I. INTRODUCTION.

The observations which form the subject of this paper were made in the months of April to September, 1899, while I was a member of Mr. W. W. Skeat's expedition to the Siamese Malay States. I take this opportunity of expressing my thanks to the University of Cambridge for permitting me to join that expedition as a

¹ Communicated by Prof. E. B. POULTON, F.R.S., F.Z.S.

volunteer, and also of saying how much I am indebted to Professor Poulton, F.R.S., of Oxford, and to Dr. David Sharp, F.R.S., of Cambridge, who have aided me in ways too numerous for specification. I also must thank Mr. Malcolm Burr, F.Z.S., F.E.S., for identifying many of the Orthoptera mentioned. The immaturity of many of my specimens has made it impossible to place them more definitely than by saying that they belong to such and such a family; in at least one instance even this has been impossible. In the few cases in which species are new to science I have not ventured to name them, as that is more properly the task of the specialist who describes them from a systematic or anatomical point of view. The immense importance of climatic and other physical conditions of life in the consideration of an animal's habits has induced me to preface my observations with a short general account of the country through which we passed, especially as little is known of the geography of lower Siam. I found a knowledge not only of the native names of animals but even of the native stories in connection with them to be of such value in my work, both as a collector and as an observer, that I have treated the etymology and what may be called the mythology of the subject at greater length than is perhaps usual in a zoological paper.

The climate of lower Siam is extremely damp, and is not divided into regular seasons in most districts, though more rain is liable to fall during the winter (November, December, and January) months than at any other time of the year. The most northerly State that we visited, except for a hurried trip to the Tale Noi (Little Lake) in Ligor, was Patalung, which abuts on the Tale Sap or Great Lake of Singora. In Patalung the rainfall is very small in March and April, but the jungle is never parched by drought. The interior of the eastern States is mountainous, and is buried in deep jungle, which is only broken, along the banks of the numerous rivers, by villages; clearings for hill rice, bananas, and maize; and by lawns, which are cropped smooth by half-tamed or feral buffaloes. The soil on the sea-coast is sandy, and in some places produces only a scanty vegetation. Between the mountains and the sea there is a great plain, dotted with isolated hills, mostly of limestone, some of which reach a considerable height, and some of which are riddled with caves. The mountain-region is the dampest of the three, being subject to violent thunderstorms, which are very local and lose much of their violence before they reach the coast. In nearly all regions rain falls almost daily for the greater part of the year.

A very large proportion of my observations were made at Aring, in the hill-country of Kelantan, the most southerly of the States which I visited. Aring is a village in the midst of exceedingly dense jungle, which commences close to the houses. The specimens which we obtained there were comparatively few in number, but very many of the species were peculiar in one way or another. Biserat in Jalor, the only other place where we stayed for more than a few days at a time, is in the plains, at the base of some hills

of no great height about 25 miles from the coast; it is the Siamese headquarters of the State. At Biserat we obtained a very large number of specimens, including probably more individuals and species than did the rest of our land collections; but very few of the species were highly specialized. Every sort of environment is to be found near a place like Biserat: swamp, lawn, orchard, open wood, cave, river, and even jungle on the hills, but not jungle of the densest. The animals in such a locality have no need to adapt themselves to any very limited environment, they can choose what environment they will. In the deep jungle, on the other hand, though few animals of any sort are seen on the ground, the fiercest struggle for existence rages among the upper foliage and also in the rotten wood underfoot—though there the termites, as a rule, far outstrip all competitors; while, even in the clearings, the space and the food-supply is so limited that every animal must make the best use of its natural advantages or else disappear. Though the clearings are of recent formation, due to man, who has become no longer a savage, yet the struggle which goes on in them seems already to have led in many cases to extreme modifications in habit and structure. We can only suppose that this struggle commenced long ago in places such as sand-spits running out into the rivers, where vegetation was necessarily scanty, owing to poverty of soil or constant change of conditions.

II. FLOWER-LIKE MANTIDÆ.

Hymenopus bicornis (pupa).

Colour.—*Head*: very pale grey, almost white. Eyes of same shade, but with a slightly darker longitudinal stripe running down the centre of each. Leaf-like process between the eyes white, with median vein of pale green. Antennæ black.

Thorax: prothorax pale pink, with a tendency towards mauve; shading off posteriorly to white, and finally bounded by a bold transverse bar of deep sage-green. The posterior region of the thorax, which was usually concealed by the upturned abdomen, was pearl-white, as were also the rudimentary wings.

Abdomen: ventral surface pale pink. Dorsal surface pale pink, with 5 longitudinal dotted stripes of deep yellow-brown. Near the junction with the thorax were several irregular transverse bars of the same colour, but slightly darker. At the extreme tip of the abdomen, surrounding the anus, was a very conspicuous dark patch, almost black.

Limbs: 1st pair pale translucent pink. 2nd and 3rd pairs pink of a deeper shade, with a more marked tendency towards mauve. The distal joints were horn-coloured and almost transparent. At the inner edge of the broad petal-like expansions on the femur of the 2nd and 3rd pairs, more conspicuous on the 3rd than on the 2nd, was a slightly livid, bruise-like mark, such as one sees on flowers that have been battered by tropical rain.

The whole surface of the trunk and that of the flattened

expansions of the femur of the posterior limbs had that semi-opalescent, semi-crystalline appearance that is caused in flower-petals by a purely structural arrangement of liquid globules or of empty cells. On the grasping-limbs and on the extremities of the other pairs the absence of this peculiar sheen was compensated for by the translucency of the integument and the tissues—a translucency more proper to Cœlenterates than to an air-breathing insect. The petals of *Melastoma polyanthum*, the flower with which the Mantis was found associated, are of mauve-pink on the upper surface, slightly darker in tone than that of the limbs of the insect. Their lower surface, and consequently the visible surface of the older flower-buds, is considerably darker than the upper, more like that of the Mantis's abdomen. The leaves are of the same shade of green as the bar across its thorax. The flower was in bloom in

Fig. 1.



Pupa of *Hymenopus bicornis* on inflorescence of *Melastoma polyanthum*.
(Photographed from life.)

The Mantis is seated in an upright position, with the abdomen flexed backwards. The photograph represents it as it is seen on a level with the eye, and shows the horn-like eyes of the insect (at the apex of figure), the V-shaped bar on the thorax, the predatory limbs folded in front of the body, the petal-like expansions of the femora of the 2nd and 3rd pairs of legs arranged on the flowers, and the ventral surface and dark tip of the abdomen. The tarsus of the left leg of the 3rd pair is seen stretching out from beneath the expansion of the femur to a seed-vessel of the plant.

Patalung at the end of March, and not yet completely passed at Aring in the middle of September; but possibly the flowering-season does not exactly coincide in the two districts. I know of no other flower at all like it in the jungle of lower Siam. A rarer species of the same genus, very similar in general appearance, is found in the clearings.

Habits and Attitude.—The only specimen which I obtained was caught about midday on August 17th in a buffalo-lawn near Kampong Aring, a village in the Ulu Lebeh district of Kelantan—that is to say, almost at the centre of the broad part of the Malay Peninsula. I was attracted to a bush of the "Straits Rhododendron" (*Melastoma polyanthum*) by a curious movement among the flowers of a large inflorescence at the height of about five feet above the ground. On a cursory examination I could only see that one of the flowers—so it appeared—was swaying slowly from side to side; and it was not for several seconds that I realized that the moving

Fig. 2.



Pupa of *Hymenopus bicornis* on inflorescence of *Melastoma polyanthum*.
(Photographed from life.)

The same specimen as in figure 1, viewed from above, showing the dotted lines on the dorsal surface of the abdomen and the bruise-like markings on the expansions of the femora of the 3rd pair of legs. The head and fore limbs are slightly out of focus, and part of the bar on the thorax appears behind them. This photograph shows the difference in shape between the expansions on the legs of the Mantis and the petals of the flower.

flower was not a flower at all, but a Mantis. Even then it betrayed itself by turning round and staring me in the face in the manner characteristic of the Mantidæ. When I held the branch on which the insect had established itself in my hand, I could not tell exactly where animal tissue commenced and where flower ended, so perfectly was the one assimilated to the other, not only in colour but in surface texture, and perhaps even to some degree in structure. The Mantis had ensconced itself in the very centre of the inflorescence, a position which it never assumed in the three days during which it remained alive in my hands: it will be noticed in the figures (pp. 840, 841), which are from photographs taken from life at Aring, that the insect is clinging to the edge of a bunch of flowers. The attitude which it adopted did not change with its position in the inflorescence. In all cases, so long as the insect was on the watch for prey, the abdomen was bent backwards until its dorsal surface almost touched that of the thorax. The head and thorax were held upright, and the fore limbs in front of them, in the ordinary "praying" attitude of the Mantidæ. The other two pairs of legs, by which it clung to the flowers, were disposed round the upturned abdomen, more or less at right angles to the main axis of the body. Sometimes this was the same as that of the inflorescence, but often it was at an angle to it; for the Mantis seemed indifferent as to whether its head or one of its sides was uppermost. When once a position had been taken up, it was never changed so long as the insect remained on that particular inflorescence. Perfect as was the concealment thus effected, I cannot say that the Mantis imitated a single flower or part of a single flower with any great accuracy. Perhaps the upturned abdomen might be taken to represent a bud not yet opened, while the darker expansions on the femora showed a greater resemblance to petals which had already unfurled themselves. The petals of *Melastoma*, however, are more elongated than these structures on the legs of the Mantis, which are almost circular in shape, though their diameter is as great as, if not greater than, that of the floral structures which they represent. What I can say with certainty is, that a most marvellous resemblance is produced between the insect *Hymenopus bicornis* and part of an inflorescence of *Melastoma polyanthum* when the flower and the insect are combined, as they sometimes are in nature. I cannot say that they are always found together. An interesting point in connection with this simulation of the flowers is the part played by the green bar across the thorax of the Mantis. This bar divided the prothorax from the rest of the body, and apparently separated the insect into two parts, which appeared to have no connection with one another on the inflorescence. In no ordinary inflorescence of this plant are the flowers large enough to afford an expanse of uniform coloration of the size of *Hymenopus*.

During an unsuccessful search for further specimens in the buffalo-lawn at Aring, the Mantis was placed, together with the inflorescence to which it still clung, in a large box lined with dead leaves. On the lid being taken off from this, after about half an

hour's interval, it was found that the insect had deserted the flowers and was sitting quite still among the leaves at the bottom of the box. Though its attitude was essentially the same as before, its whole appearance was now completely changed; for it no longer resembled the flowers among which it had been found except in the most remote degree, but appeared rather to simulate an orchid fallen upon the ground. The brown lines on the upper surface of the abdomen, which had before been concealed among the petals of the flowers, became conspicuous from many points of view, now that the body was seen from above. Converging as they did towards the junction with the thorax, they bore no slight likeness to the "honey-guides" of many orchids. The darker transverse bars seen in the shadow cast by the head and thorax gave an idea of hollowness such as might be expected round the nectaries; while the abdomen itself represented the labellum, and the limbs the other petals of the orchid. The head and thorax took the place of the stamen and anthers, their resemblance to which was greatly increased by the horn-shaped eyes; and even the green bar on the thorax had a new part to play, for on not a few orchids there is just such a band at the base of this part of the flower. No change of colour aided the change of appearance. The Mantis remained among the dead leaves for the rest of the day of its capture and for the night which followed, without altering its tint or losing anything of its brilliancy. I do not know of any specific orchid which it may have simulated; orchids of sufficient size and brilliancy of colour are rare, if not unknown, in lower Siam.

Early the next morning the Mantis was placed on a packing-case in the open air, near a large branch of the "Rhododendron" fixed upright in a natural position. It deliberately walked towards the branch, swaying its whole body from side to side as it progressed, and commenced to climb one of the twigs. This twig, however, bore only green buds and unripe fruit. When the Mantis reached the tip of the twig and found no flowers, it remained still for a few seconds, and then turned and descended with the same staggering gait. It proceeded to climb another twig. This also bore no flowers. The Mantis descended from it and mounted a third twig, which was topped by a large bunch of full-blown blossoms. To these it clung by means of the claws of the two posterior pairs of limbs. For a few minutes it remained perfectly still, and then began swaying its body from side to side, as it had done while walking. (It was only during this brief interval of rest that I was able to secure a photograph, for in a tropical climate so damp as that of lower Siam instantaneous photography is never satisfactory. The light, in spite of its apparent intensity, is very feebly actinic, and the moisture of the atmosphere combined with the heat makes it impossible to keep "rapid" plates for any length of time.) While the body of the Mantis was in motion the fine hair-like antennæ were also in constant agitation, sometimes being held upright, sometimes stretched out like horns, and sometimes lying back along the thorax.

Almost as soon as the Mantis had settled itself on the inflorescence, a small, dark, dipterous insect, of a kind very commonly seen on the flowers of this species of *Melastoma*, alighted on one of its hinder legs. It was soon joined by others, apparently of the same species as itself. They settled quite indiscriminately on the petals and on the body and limbs of the Mantis. It was then that the significance of the black spot at the tip of the abdomen became apparent, for at the distance of a few feet it was impossible to distinguish it, except by its symmetrical position, from one of these small Diptera. The Mantis made no attempt either to drive off or to capture the small flies, for its motions seemed to attract rather than to repel them. After a short time a larger Dipteron, as big as a common house-fly, alighted on the inflorescence within reach of the predatory limbs. Then the Mantis became active immediately; the fly was seized, torn in pieces and devoured, notwithstanding the presence of a large crowd of natives who had collected to watch what was happening. I did not see *Hymenopus* actually catch an insect on its own person; but very probably this was owing to the short duration of my observations. The smaller Diptera were unable to discriminate between real and simulated vegetable tissue, and there is no reason to suppose that the larger ones are more intelligent. I was unable to detect any secretion from the integument or any part of the body of the Mantis which might have attracted them. It is quite probable that they acted gratuitously as lures for its prey, in that they made it appear that there was no trap set, if they did not form an actual bait for predaceous insects.

After the Mantis had been on the watch for some little time, I noticed that the abdomen was drooping slightly and was gradually coming to lie in line with the thorax. As it did so, the brown lines on its dorsal surface came into sight, and they grew more conspicuous the more it drooped. At last, only a very few minutes after I had first noticed this movement, the Mantis gave a sudden leap into the air and alighted on the ground at the distance of several feet from the place where the base of the stem would have been had it leaped from a real bush of the "Rhododendron." It then staggered quietly away along the ground. When interrupted in its progress it gave a short jump; but it was easily recaptured, as its leaping powers were chiefly developed in the direction of jumping to the ground from a height. I was able to watch this drooping of the abdomen and final hasty desertion of the flowers on four separate branches. In each case the process commenced when the flowers began to droop, and occupied, perhaps, two minutes in completion. The drooping of the abdomen was primarily a preparation for leaping. Of that I have no doubt, for the body was bent again the moment the insect reached the ground, almost as if it were brought into position by the action of a powerful spring. Whenever the Mantis gave one of its short jumps on the level, the body was previously straightened with almost the same rapidity of action.

Moreover, the upturned position of the abdomen is common to many Mantid larvæ, for instance those of several species of *Hierodula* and *Pseudomantis*, though in the adults of these forms it becomes an impossible attitude when the insects are at rest, owing to the outgrowth of the wings; and these larvæ have the habit of leaping to the ground when disturbed on the tree-trunks on which they watch for prey, and always straighten their body before they leap. But that this action has a secondary significance in the case of *Hymenopus bicornis* is proved by the deliberate and gradual way in which it takes place when the insect is seated on an inflorescence. It seems to me that its secondary object is to display the brown lines on the dorsal surface, in order that, as the flowers wither, the flower mimic may appear to wither also. It must be remembered that in the tropics the process of fading, in the case of most flowers, is an exceedingly rapid one. It is difficult, however, if this be the true explanation, to see why the Mantis should leap to the ground when the flowers of a single inflorescence begin to fade, for we can hardly assume that it looks round to see whether other flowers on the same branch are fading also, and *Melastoma* is not a plant on which all the blossoms naturally fall off at the same time. In the case when it could find no proper concealment on one twig of a branch, the insect did not behave in this way. It is quite possible that its instinct may warn it to seek for other shelter whenever the petals begin to droop, for flowers of this plant close at night and in very bad weather. Under either of these conditions the insect must find it impossible to get its prey, and may be exposed to death from cold or from the violence of the rain, should it remain in an exposed position. Most probably it takes shelter among the undergrowth during storm and dark. When placed in a dark box it deserted the flowers to which it clung while they were plucked from the bush with considerable violence.

Malay Beliefs.—The Kelantan Malays call this insect "*Kanchong*," but they consider it so rare that my desire to obtain more than a single specimen was ridiculed as being quite extravagant. I was told that few men ever saw more than one such Mantis in the course of their lives. It was agreed at Aring that the *Kanchong* is not a "*belalang*"¹ (the general term in Malay for any Orthopteron which is neither a cockroach, "*lipas*," nor an earwig, "*sipit-sipit*")², but a flower which has become alive. "Its origin is from the flowers." The blossoms of the "*Sendudok*" give birth to it, in the same way as the leaves of the "*Nanka*," or Jack-fruit tree (*Artocarpus integrifolia*), give birth to *Heteropteryx dilatata*, a large prickly Phasmid

¹ *Belalang* are named after the *Lalang* Grass (*Imperatia koenigii*), which affords a favourite shelter to many orthopterous insects.

² *Sipit* are the tweezers with which the Malays pluck out the few hairs that naturally grow upon their chins. The reduplication of a word in Malay either gives it a metaphorical sense or turns it into a plural of indefinite multitude. Thus, *mata-mata*, from *mata* an eye, means a policeman; *macham* is a kind or sort, *macham-macham* all sorts.

of great rarity which rich men keep alive in cages in order to secure its eggs, which they set in rings like jewels, and consider to be a most powerful charm against evil spirits of all kinds. These eggs are said to be of a beautiful red colour.

Remarks.—Professor Poulton has been kind enough to show me some young larvæ of *Hymenopus bicornis* that he has lately received from Mr. Shelford, Curator of the Sarawak Museum, Borneo, together with some Heteroptera to which they bear a very close and detailed resemblance. It is indeed remarkable that any animal should be so highly specialized in two different directions of deception during the lifetime of an individual. The imago of this form, judging solely from dried specimens, may possibly show a likeness in life to a withered flower. Its long white tegmina, with their faint brown markings, may well have this appearance in life, if they are possessed of the flower-like glistening which distinguishes certain parts of the body of the pupa.

The pupa of the Indian Mantis, *Gongylus gongyloides*¹, the habits of which have been described by Dr. J. Anderson, resembles the *Kanchong* in swaying its body while waiting for prey, but differs from it in that only the lower surface is coloured like a flower, the back being green, and that the flower-like shape is brought about by the expansion of the thorax. Two varieties of the pupa of *Hymenopus* itself are known: the one is pink, the other white. Any information as to whether these are seasonal forms, whether they confine themselves to the flowers which they resemble, and whether they are in any way modified by light reflected from their environment, would be of the very greatest interest. Wood-Mason reports² two specimens, the one white and the other pink, taken at an interval of six months, apparently from the same district, in Assam. Mr. R. L. Butler of Selangor tells me that he has taken white specimens, and white specimens only, on the verandah of a bungalow at Kuala Lumpur, on which white lilies were growing in pots. Wallace³ says that in India the pink variety will settle among any flowers or leaves, and he seems to lay stress on this point in a note which I have received from him. In the figure⁴ of this insect given in Poulton's 'Colours of Animals' (p. 74) it is represented as sitting head downwards, on a leaf, with the abdomen and thorax in a straight line; in all of which points the attitude of the specimen depicted differs from that of mine, though the first is of no great importance. The brown lines on the dorsal surface of the insect⁵, and the dark spot at the tip of the abdomen, are entirely omitted by the Indian artist. My specimen certainly refused to sit among leaves when it was in

¹ P. Asiat. Soc. Bengal, 1877, p. 193.

² Ent. Soc. London, 1877, p. xxix.

³ 'Darwinism,' p. 212.

⁴ The figure is from a native drawing sent to Wallace by Wood-Mason, from whom the information about this insect in 'Darwinism' was also obtained.

⁵ These lines, and also the black tip to the abdomen, are just as conspicuous, judging from dried specimens, in individuals from other parts of the East as they were in the one observed at Aring.

the light; and I am sorry that I did not experiment with other flowers than those among which it was found. It would have been exceedingly difficult, if not impossible, to find any of sufficient size in the immediate neighbourhood of Kampong Aring.

Hymenopus bicornis, the only representative of its genus, is an insect which has a fairly wide distribution, being found in Sikkiin, Java, and Sarawak; but in none of these localities does it appear to be at all common; in Kelautan it is exceedingly rare. During the six weeks which the expedition spent at Aring, only one specimen was seen, though every clearing in the district was full of the blossoms of the *Sendudok*. It may be said that an animal so well able to hide itself might easily exist in considerable numbers without being detected. This would have been perfectly true had the Mantis been in the habit of sitting still; but movement in an apparent flower is just as attractive to a biologist as it is to a lizard. After the first specimen had been captured, hundreds of bushes were examined with the very greatest care by three zoologists and a botanist, but no *Hymenopus* was found. Granted that the insect is as highly specialized in instinct as it is in form—and I think there can be little doubt that this is the case—it is not difficult to suggest an explanation of its rarity. It is an animal which, for some reason, has had the greatest difficulty in holding its own in past ages, and it has been driven in the course of its struggle for existence to the extremes of specialization. It has become so highly specialized, in fact, that it has condemned itself, as it were, to a single and very limited environment; and should that environment be changed, even to a slight extent, by external circumstances, the insect must either perish or alter both its structure and its habits immediately, a thing which no highly-specialized animal is likely to do rapidly. Now in the Malay Peninsula the conditions of life are always undergoing small changes that are apparent even to a traveller hastening through the country; there must be many that years of research could not reveal. Suppose that the district of Aring were decimated by the small-pox, as many a Malayan district has been, and that the inhabitants who survived fled over into Pahang with their buffaloes, in a few years the jungle would kill off all the *Sendudok* bushes in the neighbourhood, for the plant can only exist in a clearing. In olden times, before the advent of the Malays into the Peninsula, the *Sendudok* must have been a rare plant in Kelantan, as neither the Sakais nor any of the other aboriginal tribes make clearings or keep cattle. The extremely local nature of the fruiting-season of various semi-cultivated trees, such as the Mangosteen (*Garcinia mangostana*), must have some influence on the insects of the different districts, and seems to depend not so much on local variations of climate as on the different varieties of the trees that are popular in the different villages. One would like to know whether the variations of a fruit of such ancient cultivation as the banana affect the insects which live upon it. In lower Siam over a hundred varieties of

this fruit are said to be commonly grown, differing from one another in shape, size, colour, and even smell; and it is often the case that in two villages separated by only a few miles the predominant variety of banana is different. The introduction of a foreign weed such as the "*Putri Malu*," or Shy Princess (*Mimosa pudica*), among the teeming insect population of a tropical clearing must have some direct effect upon the life therein, and indirectly must influence all the surrounding country. This plant has appeared in the Peninsula since the arrival of the white man, its natural home being South America; and has succeeded in becoming one of the commonest and most noxious weeds in the country, even in the districts to which the white man himself has not yet penetrated.

III. ANOTHER HARPAGID PUPA.

Colour.—*Head*: pink, eyes and mandibles black. Antennæ black.

Thorax: prothorax, which is broad and slightly flattened, dull pink, striped transversely with dingy white and pale green, and edged with black. (There is no bar on the posterior edge of the prothorax as there was in the other form.) Posterior region of thorax dull pink. Rudimentary wings dingy white, with a pale green band at the base of each.

Abdomen: pale pink, ringed with pale green, dingy white, and black. The green and black rings did not completely encircle the body, but were interrupted in the mid-ventral line by a number of prominences, one to each segment, of pale pink. At the extreme point of the abdomen, surrounding the anus, was a black spot, not so large or so prominent as the one on the corresponding position in *Hymenopus bicornis*, but still conspicuous.

Limbs: all the limbs were ringed with bands of dingy white, pink, and green, which completely surrounded them, including the expansions on the femora of the 2nd and 3rd pairs. The spines on the predatory limbs were some of them green and some black. The black spines predominated towards the distal extremities.

This Mantis had none of the flowery sheen of the other, and the lappets on the 2nd and 3rd limbs are small, rounded, and in nowise petal-like. The flowers with which it was found associated were of a deep cream-colour. Their buds and leaves were considerably darker than the green markings on the insect's body.

Habits and Attitude.—Unfortunately I was unable to observe this species in a state of nature, but I have no doubt that its habits are very similar to those of the Kanchong. The natural attitude of the two species is precisely the same, and though they adopt different methods of concealing themselves, they were both found hidden among flowers, presumably for the same purpose—that of obtaining their food. The common possession of a black tip to the abdomen is interesting. A single specimen of the striped Mantis was brought me on August 19th, by Mr. R. H. Yapp,

then botanist to the Expedition, together with a spray of the flowers and leaves of an acacia among which he had found it. The flowers of this tree are very much like those of the common *Mimosa*, but larger in size and of a far less brilliant shade of yellow. The leaves are much divided. Mr. Yapp tells me that he found the specimen on a tree near the edge of a buffalo-lawn across the Kelantan river opposite Aring, about eleven o'clock in the forenoon. Even in the dim light of the mosque in which we were then staying the insect was very inconspicuous among the flowers; and when it was taken out into the brilliant sunshine it completely disappeared among the shadows cast by them and the leaves. The dark bars on its body and limbs were slightly wider than the spaces between the pinnules of the acacia-leaves, and the prominences on the ventral surface of the abdomen were of the shape, though not of the colour, of the prominent parts on the unopened flower-buds; for it will be noticed that the buds were green, while the structures on the insect's body were pale pink. These prominences were conspicuous; but the lights and shadows among the feathery leaves and fur-like flowers were so confused that a difference in colour detracted little from the similitude between the abdomen, cut into as it was by the black bars which were conspicuous on its edges but interrupted in its middle line, and the distal extremity of one of the racemose inflorescences of the acacia.

The insect and the flower had not a single colour in common intrinsically; and yet, under given conditions of climate, the colours of the two became indistinguishable from one another.

The Malays at Aring called this insect Striped Kanchong; but the name was evidently invented for the occasion. The plant on which it was found being a tree and not a shrub, it was much more liable to escape detection, even had the acacia been as common as the "*Rhododendron*." There are plenty of similar acacias in Kelantan, and there is no reason why the Mantis should confine itself to one species, for its colour and form are adapted for concealment among any flowers and leaves of this peculiar type. The possession of leaf or petal-like expansions on the limbs is a peculiarity shared by many Mantids with leaf-like insects of different groups, but as a rule their outline is not so regular as it is in the case of this species and of *Hymenopus*. With regard to the origin of such structures and their primitive function, it is worth while noticing their rudimentary condition, whether it be a specific or merely a pupal character, in forms like this Striped Harpagid from Kelantan. It cannot be said that in this case they give any direct aid in concealing the insect by resembling petals of a flower or any other vegetable organ. But, especially where we get the extremes of light and shade, any little irregularity of outline or projection from the surface of the body of an animal may give it a distinct aid in hiding itself. This is truer in the case of the smaller invertebrates than it is in that of vertebrates, though the principle is well exemplified by many fish, and not a few lizards, that live among terrestrial and aquatic plants. A large nocturnal

snake, like the "*Ular katam tebu*" (*Dipsadomorphus dendrophilus*)¹ gliding among mangrove-roots beneath the moonlight, or a tiger resting at midday in the *Lalang* grass, is well concealed by its colour gradations and its black and yellow stripes, and has no need of an elaborately foliated tail like that of a heraldic lion; such a tail might be of very great advantage to a small Arthropod. Repeated observations, more especially in the small caves of the Koh Sih Hah, or Five Isles of the Tale Sap, have convinced me that the extreme elongation of the spinnerets in the Araneid family of Hersilidæ—the "*laba-laba berekor*" or tailed spiders of the Malays—aids greatly in effecting their concealment on the grey stones and tree-trunks which they frequent, by breaking the otherwise smooth and rounded outline of the abdomen, as the long legs break the outline of the cephalothorax. In short irregularity of outline bears much the same part in hiding an animal as does irregularity of colour such as is exemplified by the black bars on the otherwise pale and inconspicuous tints of the striped Mantis.

But irregular protective colour is by no means confined to definite bars and stripes, which might be said more exactly to represent definite shadows or spaces; it possesses even more frequently a scattered or speckled arrangement. In fact, it is very often the case that the actual colours present are not of such great importance as the manner in which they are arranged and their multiplicity in a given space. It is well known that even in the ordered light and surroundings of a picture gallery, if sufficient brilliant colours are crowded into a sufficiently small space they "kill" one another and are no longer brilliant. This is doubly true in the deep gloom of the jungle, where any colour has the greatest difficulty in asserting itself, and where so many hues that are in themselves brilliant have to contend with one another. On the jungle floor almost all colours are present in small quantities; there are patches of deep blue where the sky is reflected through a crevice in the upper foliage upon rain-water held in the hollow of a dead leaf; among the dead leaves themselves there is every shade of brown and yellow, and scattered black and white in plenty; patches of scarlet caused by fungi on rotten wood are sometimes frequent; there is the brown-pink of the seedlings struggling towards the light; and the dull green of tree-stems and creepers, and of the ferns and the few phanerogams which are adapted to exist down below. Bright green alone is absent, except in some

¹ *Katam tebu* are little round pieces of sugar-cane from which the outer skin has been removed. They are sold in the markets on bamboo skewers. The term "*Ular Katam Tebu*," in the Siamese States at any rate, is generic, and is applied to all snakes, whether marine or terrestrial, which are conspicuously ringed and which are too big to come under the category of "*Ular Kapak*" or Axe-snakes; the dark skin of the reptile being taken to represent the spaces between the *katam* on the skewer, and the lighter rings the *tebu* or sugar-cane itself. *Dipsadomorphus* is by far the commonest of such snakes, and therefore the species with which the name is most generally associated. In other parts of the Peninsula it is probable that the "*Ular Katam Tebu*" is *Bungarus fasciatus*.

mosses of the minutest size; so that large Locustids of yellows green, *Pseudophyllus* and others, which in the cabinet, and perhaps in their own place, form such admirable imitations of bamboo-leaves in colour, and to a lesser degree in form also (for doubtless they are part of the *plancton* of the jungle, and only gravitate down into its depths by misadventure), are the most conspicuous of the smaller jungle fauna which one meets with below. Yet all these shades are so altered and commingled in the chequer of deep shadow with occasional gleams of sunlight that they become completely confused to the eye. One is tempted to speculate as to whether the gorgeous tartan-like checks in which the Malays are so fond of clothing themselves may not have originally developed among a jungle-loving and somewhat murderous people at constant feud with their neighbours, as a means of secondary protective coloration, and have become more brilliant and less useful through the vagaries of sexual selection. On festive occasions these combinations of many colours are chiefly worn by the men, the women preferring for their holiday dresses simpler and more striking costumes into which only four or five masses of colour enter as a rule. On the jungle floor itself the most inconspicuous animals are certain long-legged but by no means bulky Phalangiids, which appear and disappear as they move or are still. Intrinsically they are of brilliant colours; one species is black, speckled on the body and limbs with scarlet, white, yellow, and green. But they are less conspicuous even than the majority of Phasmids found in similar situations, even than the forms which have green markings resembling minute liverworts, such as cover the stems and leaves of the jungle flora, on their otherwise stick-like bodies; for it is generally easy to distinguish the exact outlines of such insects if they have once been located; but even when the Phalangiids are moving it is rarely possible to see either their limbs or their bodies, though their motions are perfectly visible. Every such stick-insect resembles a particular stick, an ideal stick it is true; the Arachnids are assimilated, not to any particular object, but to their surroundings generally, by their irregular colour, their irregular form, and by the large extent of their surface in comparison with their bulk. The limbs of the Phasmids are often held in angular vegetable attitudes, but they do not always blend into their environment as the almost hair-like legs of the Phalangiids do; for it is often the case that the instinct of the insects is at fault in the choice of their immediate surroundings¹, whereas the protective adaptation of the Arachnids, being general and not particular, does not necessitate any high specialization of instinct to accompany it.

But that the object of brilliant coloration arranged in stripes is not always the same, even in a single group of insects, is proved, if proof were necessary, by comparing the striped pupa from Aring with the Arabian and African imago *Idolum diabolicum*², a form of which the natural colour and attitude have lately been described

¹ See Proc. Roy. Phys. Soc. Edinburgh, Dec. 1900.

² P. Cambr. Phil. Soc. vol. x. p. 175 *et post.*, plate ii.

by Sharp. This latter insect makes no attempt to conceal itself, but sits among leaves, showing, by reason of its broadened thorax and coxæ of the first pair of limbs, a likeness to some gorgeous flower.

In connection with these flower-like Mantids it may not be superfluous to mention the leaf-like form, *Deroplatys trigonodera*, which is sometimes found in the deep jungle near Aring. Though the whole visible surface of this species, including that of the tegmina and of the legs, is coloured like a dead leaf¹, and though the tegmina, the thorax, and the two posterior limbs bear irregular leaf-like processes, yet the posterior wings, where they are concealed by the tegmina, are coloured deep maroon, veined and rimmed with white. A specimen which crawled up my leg from the jungle floor made no attempt to fly when captured, but defended itself with its armed predatory limbs, drawing blood from my finger. Very possibly this species also may be nocturnal, or at least crepuscular, and only use its wings in the evening. This is certainly the case with the various species of large green Mantidæ that are common through the whole of lower Siam. At Biserat, in the State of Jalor, specimens of *Hierodula modesta* flew into our verandah in the evening on several occasions, and settling on the whitewashed wall, would feed on the termites and small Orthoptera attracted by the lamp, they themselves showing no inclination towards its flame. The insects which they caught did not avoid them in any way, but walked straight into their clutches. The larvæ of *Hierodula* and allied genera are often to be seen sitting on tree-trunks in the middle of the day; but I never observed an adult on the wing before sunset.

Ceratomantis saussurei is another interesting Mantis which may be taken at Aring. The head, body, and limbs of this species are of a dingy yellowish grey, speckled with black. The wings, which are unusually broad, are transparent, but the tegmina are marked with curious black streaks. The head is prolonged forwards between the eyes into a peculiar spike. The predatory limbs are broad and flattened dorso-ventrally; and the sides of the abdomen are produced into several irregularly shaped lobes. On the inner surface of the fore leg, which is concealed by that of the opposite limb except when the insect is struggling with its prey, there is a black bar running along the femur.

One morning in September, I found a specimen of this Mantis at Aring in the interior of a fallen tree which I was chopping up in the jungle. The wood was rotten and afforded a harbour to many other insects, such as beetles and cockroaches. A few days earlier another specimen was brought me by a Malay, together with a dead Selaginellid among which he had found it. If this Mantis is seated among the dead wood, its colour makes it inconspicuous; but if it is among dead fern-fronds or withered Selaginellids, its predatory limbs entirely disappear, owing to their

¹ Numerous other species of the same genus are coloured in a similar fashion.

colour and form. Among these leaves, the head and wings, though they are inconspicuous, are not invisible; the wings may be detected because they are transparent and glary, the head because it is held well raised above the surface on which the insect is sitting. Seen in such surroundings, there is nothing that would lead a human being to judge that the Mantis was a predaceous animal. Indeed, it bears a general likeness to a moth or a non-predaceous Neuropteran, not particular enough, perhaps, to justify one in saying that it "mimics" any other form, but sufficiently marked to deceive one as to its real nature. The fact that a specimen of the Mantis was found concealed in a dead tree would lend colour to the idea that it is nocturnal, as a large proportion of the Mantidæ appear to be. But it is quite possible that it may be sufficiently active in the daytime to seize any prey which comes within its reach. If so, it affords an instance that may be compared with that of the Kanchong. While the latter simulates a flower, and so actually allures its prey, the former sits still and looks harmless, so that its prey chances to come to it uninvited. The difference seems to me to be one of degree. Supposing that a green Mantis were seated among leaves of the same colour as its own body, and that a phytophagous insect alighted upon it, it might then be said to be an instance of "alluring" coloration. Whereas if the insect only alighted near it, the Mantis would scarcely come under this category. In any case the adaptation appears to be calculated to deceive Arthropod prey rather than mammalian enemies. The Mantidæ are well adapted for self-defence, and the movements of the Kanchong, at any rate, betray the insect to vertebrate eyes.

The curious prolongation of the head in *Ceratomantis* is not a feature of any systematic value; many other Mantids, belonging to widely separate genera, have a similar peculiarity. Undoubtedly, however, in this case it aids in masking the characteristic shape of the Mantid head; or, at any rate, appears to do so.

With regard to the marking on the femora of the fore limbs, similar markings, often emphasized by yellow lines running parallel to them or across them, occur in the same position in a large number of Mantidæ. I do not know that a function has ever been assigned to marks situated in this position except by the Russian naturalist Porschinsky, whose interesting observations¹, and imaginative explanations thereof, Professor Poulton has been kind enough to have translated for me from the Russian. Porschinsky has a theory that all eye-like markings on insects represent glands, which may be imagined to excrete a noxious fluid. He supposes that such markings simulate the liquid which has issued forth, with the blue sky or some other object reflected in it. He points out that the display of such spots is sometimes accompanied by a sound which might be taken to imitate liquid hissing out of a narrow opening such as the duct of a gland. *Mantis religiosa* is one of his examples. He says that there is a large

¹ Lepidopterorum Rossiaë Biologia, iv. (Petersburg, 1893), p. 36, fig. 10.

blue "eye" ringed with black on the inner surface of the femur of the fore limb in this species; and that the "eye" is concealed when the Mantis is at rest, because the two limbs are held folded together in front of the body. "But when danger threatens," to quote his own words, "the praying Mantis assumes a very peculiar and interesting attitude, which, so far as I know, was first described by Goureaux. The long and narrow prothorax assumes a vertical position, so that the body is supported only by its two pairs of hind legs. Under these circumstances the insect widely separates the front pair of legs, giving to its long femora a horizontal position, so that the distal ends of them are directed on opposite sides. In this way the eye-spots, which are situated at their bases, stand out conspicuously and are most obvious, owing to their colour. The tibiæ of the front pair of legs are directed vertically upwards. At the same time the insect lifts up its tegmina and unrolls its wings, giving them a horizontal position, and it begins quickly to raise and lower its abdomen, which, rubbing against the posterior edge of the wings at the same time as these continual movements, produces a sound. The Mantis can produce the latter artificially by rubbing its wings against some extraneous object."

In the 'Entomologist's Record' for January 1900, Brunner von Wattenwyl calls attention to the markings on the fore limb of a species of *Hierodula* from Borneo. He speculates as to their origin, but does not assign them a use.

IV. ALARMING COLOUR AND ATTITUDE.

A Hooded Locustid (*Capnoptera* sp. n. near *C. staudingeri*).

Colour.—♀. Body and limbs dull green, marked with dark brown. Tegmina dull green, veined and spotted with dull blue and marked with black. Hind wings pale smoke-colour. Between the head and the thorax there is a rectangular bladder of vivid scarlet. This is habitually concealed beneath the dorsal plate of the prothorax, but can be everted and project behind the head like a hood. When not in use the two corners most remote from its point of origin are inverted. When it was displayed these were everted, apparently by the forcing of blood into the hollow of the structure. ♂. Similar to female, but considerably smaller. The hood was equally well developed in both sexes.

Habits and Attitude.—The species is not uncommon in the jungle of Nawnchik, Patalung, and Jalor; but the male is much rarer than the female. I only obtained a single specimen of the former. So far as I know, there is nothing peculiar about the habits of this species when it is left to itself, except that the saltatorial legs being less highly developed than they are in most Malayan Locustids, it is unable to take the enormous leaps of forms, like the "*Belalang Rusa*" or Deer Grasshopper (*Mecopoda*), which are found in the same environment. When the hooded locust is taken in the hand it makes very little resistance. Leaving the consideration of its peculiar means of defence for a moment, this

is not surprising, as the chief resistance that the ordinary large Locustid can offer is that performed with its third pair of legs, which are incredibly powerful in some species and often armed with formidable spines. Instead of resisting, it lowers its head, so as to separate it from the thorax, and erects the hood. If this does not cause its enemy to let it loose, its resources are at an end. The sudden apparition of the vivid scarlet patch on the dull and inconspicuous body of the insect may well be disconcerting to its natural enemies. To a human observer it appears that he has injured his specimen, and that some brilliantly coloured portion of its internal anatomy is issuing from its neck.

Malay Name.—The Jalor and Rhaman Malays call this and allied species "*Belalang Gambor*," or Image Grasshopper, perhaps because they recognize a likeness between it in its alarming attitude and images of Buddha overshadowed by Cobras with expanded hoods. A colossal statue of this kind exists in a cave-temple near Biserat. When I asked for the "*Belalang Gambor*" at Aring, the natives brought me a large Locust (*Acridium succinctum*), that is known to the Malays at Biserat as "*Belalang Babi*," or Pig Grasshopper.

Remarks.—In the jungle near Kota Bharu, Rhaman, I found a single specimen of another species (*Capnoptera*, sp. n.) which had the same peculiarity of structure and attitude as this form, but differed from it in that the brilliant coloration was not confined to a part of the body which was concealed when the insect was at rest. Its head and body were of a dull neutral green; its tegmina pale, dull translucent yellow, barred and spotted with black; and its legs magenta. Magenta was also the colour of the hood, which in form and extent resembled that of the commoner species.

The action of these two grasshoppers may be compared with that of certain caterpillars, *e. g.* of one which is not common on pomegranate trees at Biserat in the month of June. It is a fair-sized form, probably belonging to the *Lymantriidæ*, which reaches a length of from 4 cm. to 6 cm. The dorsal surface is covered with long hairs of a pale lemon-yellow colour, those on the 4th to 7th segments being shorter and more closely set than the others. Between the 4th and 5th segments a black bar of a peculiar velvety appearance extends right across the body. This bar is surrounded by a kind of white halo, and is almost completely concealed when the caterpillar is feeding or walking; which it does in rather a peculiar manner, always resting after every few paces, and twisting its body about, as if it were feeling round to see that there was nothing wrong. If one blew upon the caterpillar, or irritated it in any other way, it suddenly bent the anterior and posterior regions of its body together, thus causing the black bar on the back to become stretched and be conspicuous, and to appear like a gaping, cavernous mouth, of which the bunches of hair behind and before formed the jaws. The phenomenon was first pointed out to me by Mr. D. T. Gwynne Vaughan, then botanist to the Expedition.

Some such cases come near to mimicry; for the one just

mentioned differs but little in essentials from that of the Sphinx larvæ, which bring into prominence the eye-like markings on their sides when alarmed, and thus seem to mimic small reptiles or mammals. One such caterpillar¹ is not uncommon in Nawncchik and Patalung during April. It feeds on a species of *Caladium*² growing in marshy localities, and is generally found on the underside of the broad leaves, in the shadow of which it may easily be mistaken for a small gecko which has lost its tail; though geckos do not live in the marshes, and though its eye-spots are perfectly round, more like the eyes of a snake than those of a gecko in the daytime.

In some cases structures which are alarming at one stage of an animal's existence may be mimetic or protective at another. The case of the larva of our English Lobster Moth (*Stauropus fagi*)³, which in its youth is said to mimic an ant, is so well known that I need only refer to it. In lower Siam there is a common caterpillar, of what family it is impossible to say, which has a series of curious long, flattened processes rising in three rows from the dorsal surface of the anterior part of the body. When the animal is walking these structures are kept in constant motion. They may be supposed to alarm its enemies by their movements, and certainly they give the full-grown caterpillar no aid by concealing it or by making it resemble any other animal. But I have been completely deceived by a very young specimen of this form. It was hanging by a thread from a tree, and looked so extremely spider-like as it hung, that I captured it to add to our collection of spiders. Nor was I undeceived before the insect was in my spirit-tube; for in the Malay jungle there are many Araneids with elongated abdomens.

An animal which is habitually of an alarming appearance may even lose this appearance periodically. At Aring, one afternoon in the beginning of September, a caterpillar nearly allied to *Stauropus fagi*, and probably belonging to the same genus, came under my notice. When first I saw it I mistook it for a bird's dropping. It was seated on the edge of a leaf of *Melastoma polyanthum*, with the anterior and posterior regions of its body bent towards one another, with the true legs folded together upon the under surface of the thorax, and the abdominal feet firmly clutching the edge of the leaf. The body was bent over so that one side lay on the upper surface of the leaf, parallel to the mid-rib. The insect was motionless. Its skin was smooth and shiny; intense black in colour, except for some vivid white markings about the middle of the body. The likeness to a bird's dropping was not exact, because these white markings were at the

¹ The Malays do not appear to have any superstitious dread of this caterpillar, such as is felt by the Irish for that of the Elephant Hawk Moth (*Charocampa elpenor*), a form to which it bears a close resemblance. For the Irish beliefs with regard to the caterpillar, see Miss Ormerod's Reports, 1898, pp. 72-73.

² The "*Kladi mabok*" or Sick Caladium, so called because, unlike some other species, it is inedible.

³ See Poulton, Journ. Linn. Soc., Zool. xxvi. pl. 40, and 'Colours of Animals.'

centre and not towards the periphery; but, nevertheless, it was striking and, at a first glance, quite deceptive. When disturbed the caterpillar commenced to walk along the leaf, slowly and irresolutely, unbending and rebending its long thoracic limbs as it moved, and shaking the two processes with which its abdomen terminated. I took it home, and shut it up till the next morning with a supply of leaves, hoping to photograph it when the light was better. During the night the insect cast its skin, and in the morning all likeness to anything else had left it. The skin was no longer polished and glittering, and the colour had changed to a dull brown with dingy white bars. Moreover, all sluggishness of movement had disappeared, and the caterpillar was now exceedingly brisk, behaving very much as a well-grown specimen of our own English form would do. During the languor and dangerous inactivity of the ecdysis and the period immediately preceding it, protective coloration had been assumed; as soon as the operation had been safely performed, the habitual means of defence were adopted once more.

But to return to animals which, being otherwise inconspicuous, have the power of exhibiting brilliant colour when alarmed. This phenomenon is not only exemplified by insects. A good instance is that of the Toad *Callula pulchra*, which is found not uncommonly in the Siamese States, among the rubbish which collects under the houses and in like situations. In this species, the upper surface of which is otherwise of a warm brown colour, a broad yellowish stripe runs along either side of the back; but the peculiar looseness of the skin and the folds into which it naturally falls prevent this stripe from becoming conspicuous. When the animal is disturbed, however, it draws air into its lungs until its body becomes almost globular, and the skin is stretched in such a way that its contrasting colours are displayed to their best advantage. We may compare this amphibian to the fish of the genus *Tetrodon* and others, which have earned the name of Balloon-fish among Europeans, and of "*Ikan buntal*," or Pillow-fish, among Malays, by the manner in which they gulp down air into their stomachs, so causing the brilliant coloration of many of them to become conspicuous, and also the spines with which they are armed to be erected.

Another interesting example is afforded by the Lizard *Liolepis bellii*, which the Malays call "*Biawak Pasir*"¹, or Sand Monitor, and which is common in all sandy plains where the vegetation is scanty in the north of the Malay Peninsula. The male of *Liolepis* is coloured in what sounds a very gorgeous fashion, and what is in nature by no means a conspicuous one. The upper surface is grey, mottled and eyed with green, the lower surface pale yellow veined with blue, which is more conspicuous on the underside of the thighs and the neck than on the rest of the body. Along each side there are a number of transverse bars, alternately of orange

¹ "*Biawak*" is the Malay name of *Varanus*.

and of deep purple. The female is very like the male, except that she is smaller, that her colouring is not so brilliant, and that the blue markings are almost entirely absent from her under surface. When the Lizard is running about the sand its brilliant shades are not conspicuous, for the lower surface is hidden beneath the body, and the bars on the sides are almost concealed in the folds of loose skin which are present in the living specimen. *Liolepis* is exceedingly timid and very agile; as a rule one does not see it until it commences to run away, at the distance of several yards. It lives in burrows, which it excavates, so the Malays say, by means of its feet and its snout. When one of the males is taken in the hand, it attempts to bite, for it has sharp teeth and a strong jaw, and struggles violently. As it struggles, it flattens out its body, by enlarging the lower angle formed by the ribs with the vertebral column, so that the purple and orange stripes on its sides come into view. The female tries the same tactics, but without such great effect, for in her case neither are the stripes so brilliant nor the ribs so mobile. It is very possible that the male makes some display¹ before the female at the time of courtship. The Malays say that the "*Biawak Pasir*" is monogamous, and on many different occasions, at Biserat and elsewhere, children brought me two specimens together, male and female, which they said they had snared in a single hole. The case of the Lizard is not quite parallel to that of the Grasshopper, for it is evident that in

¹ That reptiles do indulge in nuptial dances is proved by the case of the "*Sumpah-sumpah*" (*Calotes versicolor*), a Lizard whose great powers of changing its colour have caused the colonists of the Straits to misname it the Chameleon. When the male is courting the female, he is of a pale yellow colour early in the day, though in the afternoon he appears to become slightly darker; and he has a very conspicuous black patch^a on either side of the throat which calls attention, as it were, to the gular pouches, that he is constantly inflating. He posts himself on some conveniently conspicuous perch, such as the top of a fence or a banana leaf, with his tail stretched out behind him and his fore-quarters raised as high as possible upon the legs. The head is held very erect, but is constantly being nodded up and down, very much in the same way as that of a cock pigeon is nodded under similar circumstances. He opens and shuts his mouth continually, as if he were chattering, but no sound is emitted; it is probably this habit which has given the Lizard its Malay name, which seems to be connected with a word (*sumpak*) that means to curse. In this manner the male advances gradually towards the female, only progressing a few steps at a time. The female remains concealed during the performance, which often commences at a considerable distance from her retreat. I found on several occasions that if one male was killed while dancing, his place was taken by another before many hours had passed. If he was captured, the black spots disappeared from his throat immediately; but they reappeared after death. The males of this Lizard are extremely pugnacious, and when they are fighting together they change colour repeatedly, the victor usually assuming a reddish tinge. The females differ from the males in most species of this genus in that the gular pouches and the nuchal and dorsal crest are smaller than in the other sex; also they do not seem to have the power of colour-change so well developed.

^a See also Capt. Stanley Flower's paper on "The Reptiles of the Malay Peninsula and Siam," in the 'Proceedings' of this Society, 1899, p. 641. My observations were made in Bangkok, Singora, and Patalung, in the months of March and April.

the former the exhibition of brilliant colour is primarily a sexual attraction, being better developed in the male than it is in the female; but it seems probable that even in *Liolepis* any excitement may cause a display, and that in a secondary manner this display has come to be used as a means of alarming enemies, though it will be noticed that the conspicuous stripes are not exhibited suddenly, or immediately on disturbance, but only when the animal is handled. Also it is strange if the larger, more active male has this means of defence better developed than the female, which must be much less agile at times. The fact that *Liolepis bellii* has particularly strong teeth and jaws does not seem to me to be of any importance in considering the case. The Cobra affords one of the best instances of alarming coloration and attitude, and it happens to be a particularly venomous animal; but there are instances of similar display among animals which have no such dangerous qualities.

The black-and-yellow Snake, *Dipsadomorphus dendrophilus*, which is the commonest large Snake in Lower Siam, when driven to extremities exhibits movements which may be compared with the sudden display of colour by other forms. If a specimen of this Snake is tied up so that it cannot escape, it raises its head, gapes, hisses, strikes wildly at anything that is held near it, and drums spasmodically upon the ground with the last few joints of its tail, thus producing a curious noise. But I have never seen it bite, even when a stick was held close to its mouth; though many Snakes, e. g. *Coluber teneiurus*, will snap at anything, even at their own bodies, when they are sufficiently enraged. The Malays say that *Dipsadomorphus* is not poisonous; but they are much afraid of its bite, because of its violent appearance.

V. SOUNDS PRODUCED BY INSECTS.

A Cicada (*Dundubia intemerata*).

There are two distinct colour varieties of this species, found together and independent of sex; the body of one being grass-green, and that of the other pale brown, which becomes yellow as the insect dries. Among my dried specimens there are intermediate forms more or less mottled; but this peculiarity did not appear for some days after death, and in life all the individuals were either one colour or the other.

At certain seasons this Cicada forms a regular article of diet among the Siamese inhabitants of Patalung; and as their method of capturing it is based upon a knowledge of its habits, I cannot do better than give an account of this method, as I saw in operation at Ban Nah, a village on the border of the hill-country of Patalung. Immediately after the sun had set several of the natives gathered in an open space, round a fire of brushwood or a number of torches fastened to stakes stuck into the ground, and commenced to clap their hands in unison, observing a regular time and rhythm. Very soon, if they were fortunate, the Cicadæ flew

out from the undergrowth of the surrounding orchards and jungle, and alighted on the persons of their captors, who had no difficulty in picking off the insects with their fingers and securing them, still alive, in a fold of their draperies. The clapping only continued for about half an hour every evening, and when, with considerable difficulty, I persuaded the men to recommence it again later in the night, not a single Cicada came near them, though the stridulating had now become loud all over the village, like the noise of machine hair-brushes in a barber's shop.

The insects were silent on the wing, and I only heard one stridulate when caught. The voiceless females, as might be expected, were in great preponderance over the males among the specimens taken; probably the one individual which was not dumb when captured was the only male taken that night. In order to be sure that the fire was not the chief attraction for the Cicadae, I stood among a party of natives who were clapping, together with another member of the Expedition, who clapped also; while I kept my hands still. In the course of a few minutes, the natives captured many specimens, and ten alighted on my friend's coat; but only one settled on mine. Afterwards I heard from a Patani Malay that the children of Patani town have a game in which they attract Cicadas by clapping their hands, and without the aid of light at all; though they sing, as they clap, a nursery rhyme, calling upon the insects to come down from the trees. The season of the edible Cicada seems to be a very local one in Patalung. At Ban Nah on the 1st of April, and again on the 6th of the same month, the natives secured me as many specimens as I wanted, besides serving a dish of them with our curry on the second occasion. On April 3rd, at Ban Kong Rah, which is only about eight miles further inland than Ban Nah, our guard of native military police were unable to catch a single individual, although they adopted exactly the same method of procedure as the Ban Nah people had done, and clapped at the same time of evening. On none of these three occasions had the moon risen, and in Patalung one night is like another in the dry season. On April 5th, I noticed that the ground in a patch of primæval jungle near Ban Kong Rah was covered with the cast pupal skins of a Cicada. Whether they were those of the edible species or not, I am unable to say with certainty, but they were of the correct size, and, so far as I could see, such as might be expected to belong to this form.

Malay Name, etc.—The Malay-speaking Malays of lower Siam call a Cicada "*Riang-riang*," confusing it with certain large Melolonthid beetles belonging to at least four different species—*Lepidiota stigma*, another species of the same genus, and two species of *Leucopholis*—which buzz round the tops of the cocoanut-palms in the evening, and produce, probably in the same way as the common Cockchafer¹, a sound with a considerable resemblance

¹ See Lubbock, 'The Senses of Animals,' p. 67.

to the word "*riang*" (to call back) pronounced very rapidly and repeatedly. All four species of beetle are on sale for food in the local markets of Patalung, and their grubs, which are found in the earth or under fallen trees, are eaten also. (A conventional representation of the grubs is often carved on rice-stirrers and other objects of household use by the Malays, who call them "*Ulat Kiki*.") Both beetles and Cicadæ are either boiled or fried in cocoanut-oil. The latter have very little flavour of any sort, and what they have is vegetable rather than animal.

Remarks.—The existence of auditory organs in the Cicadæ has not been demonstrated with certainty. The insects must indeed be deaf if they mistake the sound of clapping for the squeaky whirr of the male's stridulation. It is evident, however, that the females have some perception of rhythm, if not of sound. May not this perception be due to vibrations produced in the opercula of the stridulating apparatus? The opercula are often well developed in the voiceless females, though they differ in shape from those of the males. The males, supposing that the perceptive organ were situated in the stridulating apparatus, would be deafened by their own song; as Sharp points out when dealing with Swinton's theory that one of the membranes of the apparatus itself, a membrane which apparently is only present in the male, is an auditory organ. But there is no need for the males to hear their own song, and no proof that they do so. Though only one species of Cicada is attracted by the particular rhythm with which the people of Patalung clap their hands, another rhythm might attract another form. The several species of Cicadæ inhabiting the same country undoubtedly sing in different rhythm¹ from one another. The song of this species is fairly monotonous and unbroken, though it rises and falls to a slight extent. That of the large form *Pomponia imperatoria*, which restricts itself to deep jungle, rises in a series of trills, each of which concludes with a kind of click. Each section of the song is faster, louder, and clearer than the one which preceded it; until, about five minutes after the Cicada's settling, the noise suddenly comes to an end, as the insect flies off to another tree, where it commences again. The sound produced by this species is, at the beginning of the song, like the winding-up of a large clock, and ends by being comparable to the notes of a penny whistle. Another insect, commonly heard at night in the jungle, presumably also a Cicada, has a clear, loud, clarion-like call which can be heard for a great distance.

The sounds in a Malayan jungle after dark may justly be compared to those in the machinery-hall of an exhibition at the busiest time of day, and their volume increases materially before the coming of dawn. The body of the din is the work of small Cicadæ, like the edible species, but the true *riang-riang* and certain Locustids have no mean share in its production. In some places the "Singing

¹ See Riley, Proc. Amer. Assoc. Adv. Science, vol. xxiv. p. 331.

Earthworm"¹, a Gryllotalpid cricket, contributes from its hole in the ground a deep, organ-like note. What is the meaning of all this noise? "The *riang-riang* sing," a Malay would say, "because their livers are glad"; and in many cases we are not in a position to give any better reason. The stridulation of the male Cicada appears to be in the main and primarily a sexual call, but may also be used as a warning or alarming cry.

Of insects capable of producing a sound, some species stridulate when captured, but all do not. The brilliantly coloured little black and scarlet *Huechys sanguinea*, which, unlike the majority of Malayan Cicadæ, is diurnal and flies about among bushes in the open at midday, is silent when handled. The male of the large dung-beetle *Helicopris mouhotus*, a pair of which was brought to me at Biserat by an elephant mahout, squeaks like a bat when touched, but is silent when lifted from the ground. The female of this species is dumb. On the other hand, many kinds of Orthoptera only stridulate when they are left in peace and quiet. In the Malay Peninsula the majority of stridulating species are nocturnal, or only sing at sunset and just before sunrise. There one does not hear the noise of grasshoppers among long grass at midday as one does in this country, though in the jungle there is a subdued hum of insects continually. At Belimbing in Legeh a man brought me several specimens of the "*Belalang Rusa Ijou*" or Green Deer Grasshopper (*Mecopoda elongata*). Each specimen was in a small bamboo-cage, as he said that if two were put together they would fight. He told me that children kept this grasshopper as a pet, feeding it on the young shoots of the pineapple, in order that they might hear it "crow." My specimens were silent all day, and all the evening while the lamp was lit; but in the middle of the night we were awakened by their stridulations.

VI. INSECT LUMINOSITY.

An Aquatic Lampyrid Larva.

Form and Colour.—The body is elongated and narrow: the head is minute, and can be retracted within the thorax. There are eight abdominal segments, which are little differentiated from those of the thorax superficially. The upper surface is corrugated. The colour is dark brown, minutely marked with dull yellow in some specimens. The luminous organs were situated in two small oval patches on the under surface of the last abdominal segment, just behind the anus.

Habits.—On March 30th, when catching fire-flies by the side of a marsh at Lampam, the chief town of Patalung, I noticed a number of luminous points on the surface of a small stagnant pool. We had some difficulty in ascertaining the origin of these, for they died away slowly when the water was disturbed; and it was not until we examined some of the plants floating on the top of the

¹ See 'Oxford Magazine,' Oct. 17th, 1900, p. 9.

pool that we discovered that the light proceeded from beetle larvæ, which were clinging, dorsal surface downwards, to the floating fronds of a small cryptogam. The luminous points were blue in colour and very brilliant, though small. They did not flicker like the lights of the fire-flies which flitted in hundreds over the surface of the marsh, and when they were extinguished they died away gradually. In the pool they did not change their position, but they became sometimes brighter and sometimes less bright slowly, occasionally dying out entirely for no apparent cause. When the larva was taken out of the water, its luminosity disappeared, and did not reappear until it had been restored to its habitual element for some minutes. The light of some specimens which were placed with water and weeds in a glass jar, and brought near a lamp after they had recovered from their capture sufficiently to shine again, went out. After a longer or shorter interval of rest near the lamp, on different trials, it reappeared again. Poking them with a twig sometimes caused them to shine more brightly, but more often to become entirely dark. If several individuals were in a bottle and one of them became brilliant from any cause, the others followed suit after a few seconds. A specimen which was put into corrosive solution ceased to be luminous, but after about a quarter of an hour became exceptionally bright. It was then transferred to a weak solution of formalin; whereupon its light went out finally, taking several seconds to disappear.

During the day I was unable to find any of the larvæ on the surface of the pool; but the captive specimens had deserted the floating weeds before morning, and were crawling slowly on the bottom of the jar. I did not see them feed, though the water in the jar was full of small animals of different sorts—Copepods, Protozoa, and water-mites. Nor, while I was watching them, did the larvæ ever come to the surface to take in air or to breathe. I can find no special respiratory organs in my specimens: when alive no part of the body was silvery in appearance under water.

Remarks.—The question of luminosity is one even more enigmatical than that of the sounds produced by insects. It is a phenomenon which is manifested right down among the Protozoa, and even in the border-land between the two great kingdoms; it reaches its highest development among some of the *Lampyridæ*. In the Westmann Isles I have seen a whole village accidentally lighted up by the action of putrefactive bacteria in cods' heads hanging to dry on the walls of the gardens; and a dead shark upon the shore was visible on the darkest night from the same cause to the distance of half a mile. *Noctiluca* and other marine animals—coelenterates, crustaceans, tunicates, &c.—produce even more astonishing luminescent effects. It is not apparent what is the object of this display among these forms; though possibly in the case of the Medusæ it may serve as a lure for prey, as it appears to do among certain deep-sea fishes. Among the insects and Myriapoda the purpose of luminescence is also obscure¹. It

¹ See Dubois, Bull. Soc. Zool. France, "Les Elatérides lumineux" (1886), &c.

cannot be in all cases a sexual attraction, for it is exhibited by larvæ and even by eggs¹; neither can its object always be to attract prey: that it is a warning to enemies seems hardly probable, for most small animals, whether aquatic or terrestrial, are attracted rather than repelled by light. In the bacteria and in forms like *Noctiluca* it appears to be an adventitious result of metabolism rather than to bring any practical gain to the organism; among the adults of the *Lampyridæ* it very probably acts as a sexual charm; among the larvæ of the same group its purpose may possibly be to attract prey. In the case of the aquatic form there must be some reason why the larvæ should come to the surface at night and display their light on the top of the water. That purpose can hardly be to warn surface enemies not to eat them, or to scare away aerial aggressors. Much more probably the light attracts some surface or aerial prey. The fact that the light disappears when the water is disturbed also supports this view. It is not to the advantage of the larvæ to attract the attention of any animal big enough to make a commotion in the pool.

In three other species of Lampyrid larvæ, all terrestrial,—two, which were both over an inch in length, being found crawling on the ground among bushes in Patalung, and the other seated on a cocoon-husk under a house in Kelantan—the light, which was situated in all cases on the ventral surface of the abdomen, was steady, and neither flickered as it did in the winged forms, nor slowly disappeared without apparent cause as in the case of the aquatic larva. A small specimen which I found under the mosque at Aring, mistaking it at first sight for luminous fungus which grew there commonly, continued shining when picked from the ground, but immediately became dark when dropped into formol, and never shone again. Professor Poulton tells me that North-American² fire-flies lose control of their lights when placed in a cyanide-bottle, and are no longer able to extinguish them. The same is true of the Malayan winged forms, though occasionally a specimen becomes entirely dark for a few minutes when first introduced into the bottle. The aquatic larva which allowed its light to reappear after it had been in corrosive sublimate for some minutes was probably only just beginning to become affected, for corrosive penetrates hard chitin very slowly. The insect allowed itself, when once affected, to be transferred into a more pungent medium before it finally ceased to shine.

Of all the manifestations of luminescence among animals there is none more curious, or, in the present state of our knowledge, more inexplicable, than the manner in which large numbers of individuals of certain fire-flies are able to display their light with absolute apparent simultaneity and unison and with regular intervals of darkness, under circumstances which make it impossible for all the members of the swarm to see one another. Even the power,

¹ See Dubois, Bull. Soc. Zool. France, xii. 1887, p. 137.

² Darwin makes very much the same remark with regard to the Brazilian forms, in his 'Voyage of a Naturalist' (p. 30).

possessed by some peculiar South-American beetles¹, of showing lights of different colours on different parts of the body at the same time is not more wonderful, or more conspicuous, than this. The phenomenon is not common on the east coast of the Malay Peninsula, where the soil is sandy; but it is said to be often manifested both in Siam proper and among the mangrove-swamps of Perak and Selangor in the west. I have only been able to see it on one occasion, and that was on the bank of the river near Kuala Patani, one fine evening at the end of June.

A large tree was covered with many hundreds of fire-flies, the majority of which seemed, judging from the similarity of their lights, to belong to one species, or perhaps to one sex. There were three individuals seated together, however, whose lights were larger and bluer than those of the others. The lights of all the specimens of the more abundant variety flickered in unison with one another; those of the minority, the three individuals, flickered together also, but in a different time. At one instant the tree was all lighted up as if by hundreds of little electric lamps; at the next it was in complete darkness, except for three blue points. Then, again, it was covered with white points, except for a little patch of darkness where the three blue lights had been, and would be again immediately. A similar power of displaying luminosity in unison is said to be exhibited by some marine animals, even after they have been removed from the water; but the questions as to how this unison is effected and what is its exact object are obscure. The power by which it is regulated may be somewhat analogous to that which causes all the individuals composing a flock of birds to wheel at the same instant. As Professor Poulton has pointed out to me, the rhythmical display of light among a crowd of individuals appears much more conspicuous to the eye than the simple flickering of a number of independent points.

Malay Names.—The ordinary Malay term for a fire-fly is *klip-klip*, a name which seems to suggest the rapid flickering of the insect's light, though the word *klip* is used in the sense of to glitter. Our west-coast servants called the luminous beetle larvæ with which we met in Patalung, "*klip-klip tanah*," land or earth fire-flies. The aquatic species, which they had never seen or heard of before, they christened "*klip-klip ayer*," or water fire-fly. His Excellency Phya Sukum, the Siamese Chief Commissioner for the Ligor Circle, to whose hospitality and administration we owed much, tells me that he has seen, in the south of Ligor and near Singora, a large green worm which sits on trees, and it is so brilliantly luminous at night that it well deserves its Siamese name of Lightning Grub. On one occasion he secured a specimen, and was conveying it to Bangkok; but unfortunately it was killed on the voyage through the carelessness of a servant who closed the box in which it was.

¹ See Haase, *Deutsche ent. Zeitschr.* 1888, pp. 146-167.

VII. THE USE OF THE SPINES OF CERTAIN ORTHOPTERA.

The Locustid (*Eumegalodon blanchardi*).

Colour and Form.—The whole exposed surface of this well-known and peculiar form is coloured pale brown, speckled, but not in any very marked way, with a darker shade. Its coloration bears a general, and by no means highly specialized, resemblance to a withered leaf.

The most peculiar features of its external form are the enormous stoutness of the head and jaws, and the well-developed thorn-like processes on the thorax.

Habits.—The only specimen secured was captured in a rice-field, then partially flooded, at Belimbing in the Ulu Legeh, on July 22nd. I was crossing the swamp towards a solitary tree of large size that grew on the embankment halfway across. When about ten yards distant from this tree, I noticed what appeared to be a dead leaf falling from one of its lower branches at a height of perhaps eight feet from the ground. Judging from the way it fell that the leaf must have something, perhaps a chrysalis, attached to it, I left the embankment and waded to the place where it had touched the ground, and was surprised to find a fine male specimen of *Eumegalodon* seated motionless on the damp earth. It made no attempt to escape but did its best to defend itself with its really formidable mandibles, a bite from which would have taken a piece right out of the finger.

Remarks.—It is very dangerous to generalize from a single instance of this sort; but the behaviour of the insect was interesting, and may possibly cast some light on the use of the peculiar spines on its back. I am sure, from the rapidity with which it fell and from its appearance while in the air, that the wings were folded as it dropped from the tree; I am also convinced that it dropped and did not leap down. Supposing that its usual habit is to descend thus—and I have no reason to suppose that the behaviour of my specimen was at all peculiar—it is easy to see that its spines, combined with the sturdy build of the anterior part of its body, might assist greatly in breaking its fall, should it strike against anything hard or sharp; for necessarily it would fall head downwards, the head and thorax being heavier than the abdomen. This suggestion does not interfere with the view that these structures may also be of use in defending the insect against its enemies, whatever they may be, should it be attacked from behind; in which case its jaws could not assist it; very possibly it may drop from the tree to escape assailants. Professor Meldola has suggested the same use for the hairs and spines on caterpillars.

VIII. THE PECULIAR PROLONGATION OF THE HEAD IN CERTAIN FULGORIDÆ, AND ITS USE.

Hotinus, Pyrops, &c.

The curious anterior prolongation of the head in many genera of the Fulgoridæ has long puzzled entomologists, and some have

been found bold enough to suggest that in life it is luminous¹; being led to this suggestion, I suppose, by the lantern-like outline of the "nose" in the more highly specialized members of the family, and perhaps by the fact that some of the species at any rate are nocturnal or crepuscular, and rest by day on the trunks of trees in a very open manner. At Biserat in Jalor I was fortunate enough to observe the real use of this peculiar structural modification.

On the morning of May 30th, I noticed a specimen of *Hotinus spinolæ* seated on the trunk of a Durian tree in the village and incautiously attempted to catch it in my hand. The insect remained almost still, merely drawing in its legs towards its body and pressing the claws firmly against the bark, until I had almost touched it. Then, it lowered its head with very great rapidity, flew up into the air without spreading its wings, and alighted on the roof of a house about six feet behind the tree and considerably higher than the position on the trunk whence it had started. When it was at rest its dorsal surface had been directed towards the roof and its head had pointed upwards; but it started off at a tangent from its original station, and landed with its head, speaking roughly, at right angles to an imaginary line drawn through the main axis of the body as it had been on the tree. The insect remained on the roof without moving while I went to get a butterfly-net, in which it was easily captured by a man who swarmed up one of the house-posts.

At the time I did not notice anything peculiar in the way in which this Fulgorid jumped, for there are many large species of the same family (e. g. *Aphaena atomaria*) which, without being provided with long noses, can leap for a considerable distance by means of their legs only; but, as I was examining my specimen after it had died in a cyanide-bottle, I was struck by an indentation or crease that ran across the central region of the nose, at right angles to its main axis. Then I discovered that the chitin was flexible at this point, and at this point only; and that if the tip of the nose and the dorsal surface of the abdomen were pressed together between the finger and thumb and then suddenly released, the insect would not fall straight to the ground, but would be propelled for some distance through the air before doing so; just as would be the case if a piece of whalebone were treated in like manner. Now supposing that the whalebone (representing the nose of the insect) was fixed rigidly to a small rigid object (the head), which in its turn was fastened by a flexible juncture to a larger rigid object (the thorax and abdomen); supposing that the larger object was then laid so that it rested for all its length along a smooth vertical support with the whalebone pointing in front of it, that the free extremity of the whalebone was bent downwards by some force, and that the whole structure was simultaneously shoved away from the support (as the body of

¹ For a coloured picture of a *luminous* Fulgorid, see Donovan's 'Natural History of the Insects of China,' p. 27; also for much evidence as to its luminosity.

the insect might be by its legs), it is obvious that the whole structure would fly off into the air at a tangent; only supposing that the pressure was slightly oblique at any point. I have no doubt that this is substantially what occurs in the case of *Hotinus*; but in the living insect the action is far too rapid for the eye to discriminate its details, and dead specimens cannot be made to leap in this way, because it is impossible to force the legs to perform their part of the action. In two specimens of *Hotinus*, which I observed on tree-trunks at Aring, the wings were spread after the insects had leapt into the air, but not immediately they left their perch. Both of them distinctly bent down their heads before they jumped.

The nose is perfectly hollow, and does not appear to contain any muscle. It differs, of course, from the whalebone in respect of its hollowness, and also in that it is only flexible at one point. In specimens preserved in spirit it is largely filled with liquid, but contains a bubble of air, which naturally rises to the tip when the apparatus is in its resting position, and runs towards its base when the head is lowered.

When I had made the discovery in my first specimen of *Hotinus*, I examined some Fulgorid larvæ, almost certainly those of *Pyrops nobilis*, which had been brought to me by a native at Ban Sai Kau in Nawnchik, and which I had preserved in spirit. The nose was well developed in these, although the abdomen was still small and unexpanded and the wings as yet mere stumps. I found that the joint was present in these specimens also, and still retained a certain amount of springiness, though they had been dead for a month.

Since coming home, I have been enabled, by the kindness of Professor Poulton, to examine dried specimens of twenty-six species of long-nosed Fulgoridæ, belonging to nine genera. In individuals of sixteen of these species I am able to distinguish a crease running across the nose in exactly the same position as it does in my specimen of *Hotinus*. All of the remaining ten species in the Hope Collection, of which species *Pyrops nobilis* is one, have either comparatively short, spiny, or otherwise peculiar noses. I have no doubt that the joint would be found in them also, were fresh specimens examined; even in my larvæ, in which it is still flexible, there is no external sign of its existence except a slight translucency of the integument. The members of the bulbous-nosed American genus *Fulgora* probably use their heads in the same manner as the less highly modified Oriental forms. There is a deep hollow across the noses of the former which seems to correspond to the crease in that of *Hotinus*; and I have satisfied myself at any rate that a certain very limited flexibility exists at this point even in dried specimens. What is wanted is a series of instantaneous photographs from life.

Malay Name.—At Biserat *Hotinus spinolæ* goes by the name of "*Raja Legch*," but this is probably a corruption of some more direct appellation,

A large proportion of the insects mentioned in this paper have been identified by comparison with specimens preserved at Oxford in the Hope Department of the University Museum, to the officials of which I offer my thanks for the ready help which they have given me. I cannot conclude without expressing my personal gratitude to the Siamese Government for the kindness and generosity with which it treated us throughout: to the officials at Bangkok and Singora who arranged for our reception in lower Siam: to the Malay Rajas through whose territory we passed, without whose aid the Siamese Malay States are practically a closed country to Europeans: and to Luang Phrom, Commissioner of Patani, to Kun Rhat Wan Hussein, and to the other gentlemen who accompanied us as agents of the Siamese Government; at whose hands I received much personal kindness, and whose assistance and advice made it possible to travel in such a country with physical comfort and with some degree of celerity.

3. On the Mammals collected during the "Skeat Expedition" to the Malay Peninsula, 1899-1900. By J. LEWIS BONHOTE, B.A.

[Received October 16, 1900.]

(Plate LVI.)

I have the pleasure of furnishing a report on the collection of Mammals made in the Malay Peninsula by Messrs. R. Evans and F. F. Laidlaw, who accompanied an expedition under Mr. W. W. Skeat. As might be expected, the collection, which includes specimens of 54 species, is of considerable interest, although only one, a rodent, appears to be new to science. A fine specimen of *Macacus rufescens* was procured, which has hitherto only been known by the type, a young example; the presence of *Trichys lipura*, a Bornean species about whose occurrence in this region considerable doubt had been expressed, is of great interest. The collection also contains a fine skull of *Hystrix yunnanensis*; a skin of *Mus cremoriventer*, a scarce species lately described from the Malay Peninsula by Mr. G. Miller, jun., of Washington; and several specimens of *Vesperugo tylopus*, originally described from Borneo.

As Capt. Stanley Flower has lately published a catalogue of the Mammals of Siam and the Malay Peninsula, I have not given the full synonymy but have referred to his paper, only adding the references to one or two subsequent papers to which he did not have access. Great praise is due to Messrs. Evans and Laidlaw for the careful way in which they collected: almost all the specimens having careful dates and measurements, which, apart from greatly adding to their value, has considerably lessened the work of identification. With regard to the position of the places

mentioned: Talé-sap is a large inland sea in the State of Patélung, which lies on the east coast of the Peninsula, where it begins to widen out in the north; Singora is the capital of the State and is situated near the entrance to the sea. Jering is a small State on the east coast considerably to the south, in a latitude slightly north of that of Penang. Patani, Kelantan, and Tringganu form the remaining States under Siamese protection along the coast from the north. Due south of Jering and Patani lies the State of Jalor with Biserat as its capital; Bukit Besar is a mountain (3000 ft.) on its western border. South of Jalor lie the small States of Raman and Legeh with its capital Belimbing. The State of Kelantan takes its name from a large river of that name, near the mouth of which is situated the town of Khota Bharu. The Lebeh is a tributary of this river and lies in the southern portion of the State, where it is joined by the Ariug, another river. The prefixes Kwala and Ulu indicate the lower or upper waters of the river. Gunong Inas is a large mountain (5861 ft.) about 50 miles due east of the southern boundary of Province Wellesley, in the State of Perak; the head-waters of the river Selama rise there, and Ulu Selama practically indicates the foot of the mountain. This locality, which was visited by Messrs. Laidlaw and Yapp after the rest of the expedition had gone home, seems to be of great interest, several species, including the undescribed one and *Trichys lipura*, having been found there only. Mr. Laidlaw having given me some interesting notes on the Mammals of this mountain, dealing more especially with the species of which specimens were not procured, I have great pleasure in recording them here:—

“*Primates*.—A Gibbon, I believe the Siamang (*Hylobates syndactylus*), ranges well up to 4000 ft. on Gunong Inas. It has quite a different cry to the species common at Kwala Aring.

“A very large *Semnopithecus* with a long tail is also common at that height, as are one or two smaller species. I was unable to get a specimen of any of these.

“*Sciuromorpha*.—I saw a very fine pair of large Flying Squirrels at about 3000 ft.

“*Sciurus tenuis* is the common species. I only saw the one *S. erythræus* that I shot. There is another black species about the same size as *S. caniceps* that occurs, but is rare at that height (it is perhaps *S. atridorsalis*). A very small species with a yellow and black lateral stripe is common but very difficult to shoot; this species ranges well up to 5000 ft. There is another large Squirrel, of which I saw a single specimen; its head is shaped much like that of *S. bicolor*, but it is not so large and more plainly coloured, a dull grey: 4000 ft.

“*Carnivora*.—The Tiger does not occur high up in the mountain so far as we could discover, neither did we see any trace of Bears or Leopards, though I imagine the latter must occur.

“*Ungulata*.—The Elephant does not appear to get much above 2000 ft. The Tapir ranges right up to the summit-ridge of the

mountain, and the Rhinoceros to nearly 4000 ft. at any rate. Of *Nemorhædus* we saw tracks on the summit-ridge. At the foot of the mountain was a hot sulphur spring, which the Malays assured us was much frequented just at sunset by many kinds of beasts. We were never so fortunate as to see any there, although it had evidently been frequented from time to time by Elephants."

1. *MACACUS RUFESCENS* Anders.

Macacus rufescens Anderson, P. Z. S. 1872, p. 204; Selater, op. cit. p. 495; id. P. Z. S. 1873, p. 194; Anders. Zool. Res. (1879) p. 79; S. S. Flower, P. Z. S. 1900, p. 315.

a. ♀ sk. Patelung, 7th April, 1899.

This specimen is of considerable interest, for the species is apparently known only from two specimens; the first of which was sent by Dr. Anderson to this Society with no further particulars than that it had been "purchased at Singapore," and Dr. Anderson, not knowing to which species it should be referred, suggested the above name. This specimen is now in the British Museum, where I have examined it, and, except in its slightly smaller size, agrees in all respects with the present example.

Shortly afterwards Dr. Anderson procured a young female in the Calcutta market, which subsequently also found its way to this Society, through Mr. Jamrach, with the additional information that it was supposed to have been brought to Calcutta from Batavia. The present specimen therefore fixes the hitherto somewhat doubtful habitat of this species as being the Malay Peninsula, whence doubtless the second specimen also came, as it is not unlikely that a ship bound for Calcutta from Batavia would touch at Singapore. The present example is not quite adult, but being rather older than either of the other two specimens I append a full description:—Hair moderately long and wavy on the back, shorter and rather sparse on the underparts. Face and buttocks naked. General colour of a warm reddish brown, but many of the hairs, especially on the dorsal area, with a dark tip and one or more dark annulations. Tail very short, about an inch in length, and covered with hair. The hair of the crown, which is short and light in colour, radiates from a central point, while a few black bristles grow out from the edge of the forehead. The measurements and colour of the soft parts are not given, and those given below are from the dried skin.

The skull is considerably larger than the specimen in the British Museum, which I take to be the type, and is that of an individual a good deal older although not quite adult. Its chief points of difference from the skulls of other nearly allied species (e. g. *M. brunneus*) are the length of the snout, narrowness of the brain-case, and also the sharp and clearly defined supraorbital processes: in these points it completely agrees with Anderson's description.

Measurements [from skin]. Length, tip of muzzle to root of tail, 22 in.; tail $1\frac{1}{4}$ in.; hind foot $5\frac{1}{4}$ in.

Skull. Greatest length 124 mm.; zygomatic breadth 81; breadth of brain-case 64: length, occipital to back of nasals, 89; back of nasals to tip of præmaxillæ 47.

2. *MACACUS CYNOMOLGUS* (Schreb.).

Macacus cynomolgus, Schreb. Säugeth. i. p. 91, pl. xiii. (fig. Buffon), nec Linn.; S. S. Flower, P. Z. S. 1900, p. 316.

a. ♂ ad. sk. Koh Nam Kam, Talé-sap, Nu Pau, 12th April, 1899.

b. ♂ ad. sk. Jering, 19th June, 1899.

3. *SEMNOPIITHECUS OBSCURUS* Reid.

Semnopithecus obscurus, Reid, P. Z. S. 1837, p. 14; Flower, op. cit. p. 317.

a. ♀ ad. sk. Koh Nam Kam, Talé-sap, 12th April, 1899.

4. *SEMNOPIITHECUS ALBOCINEREUS* Cantor.

Semnopithecus albocinereus, Cantor, J. A. S. B. xv. p. 174 (1846) (nec Desm.).

Semnopithecus mitratus (Eschs.), Flower, op. cit. p. 319.

a. ♂ ad. sk. Aring, Kelantan, 23rd Aug., 1899.

This Monkey, which is of a clear ashy grey on the back, white below, with dark hands, feet, and tail, agrees with the example from Klang referred to by Mr. Thomas (P. Z. S. 1896, p. 72) as being identical with Cantor's *S. albocinereus*, which in Dr. Anderson's opinion, is synonymous with *S. siamensis* of Müller and Schlegel. Under the name *siamensis* Dr. Anderson gives a description of the present species; but on reading Müller's original description I find *siamensis* to be a dark-coloured Monkey, and there are several specimens in the British Museum of a dark brown Monkey, rather smaller than the specimen under consideration, which agree fairly with Müller's description and are labelled *siamensis*. There is therefore no alternative but to allow Cantor's name to stand for the present.

Cantor's type was founded on a young specimen, but he remarks that when adult it is hardly to be distinguished from *S. obscurus*; this remark, however, hardly seems to hold good, the present specimen being fully adult and yet showing no such resemblance.

5. *SEMNOPIITHECUS* sp. inc.

a. ♂ juv. sk. Biserat in Jalor, 26th May, 1899.

This specimen is very young and shows no distinctive features by which, with our present knowledge of the group, it could be identified. It shows no sign of a crest and the hair of the head radiates straight back from the facial limit, while the face and cheeks are surrounded by long black hairs. In colour it is of a light golden buff all over, with a tendency to a black tip on the tail.

6. NYCTICEBUS TARDIGRADUS (L.).

Lemur tardigradus, Linn. Syst. Nat. p. 44 (1766).

Nycticebus tardigradus, Flower, op. cit. p. 321.

a. ♀ sk. Komlom, opposite Singora, 17th April, 1899.

b. ♀ ad. sk. Tremangan, 15th July, 1899.

c. ♀ ad. sk. Bukit Blinja, 15th July, 1899.

7. FELIS BENGALENSIS Kerr.

Felis bengalensis, Kerr, Animal Kingdom, p. 151 (1792); Flower, op. cit. p. 325.

a. Ad. sk. Khota Bharu, Kelantan, 17th Oct., 1899.

b, c. ♀ juv. sk. Patelung, Nu Pan, April 1899.

8. VIVERRA ZIBETHA L.

Viverra zibetha, Linn. Syst. Nat. i. p. 65 (1766); Flower, op. cit. p. 327.

a. ♂ juv. sk. Biserat in Jalor, 13th May, 1899.

This specimen, which is very young, may be easily recognized as belonging to this species by the markings on the back and neck; the hairs along the centre of the back are longer and stiffer than those elsewhere, although there is no noticeable crest, the white subdorsal lines start from the middle of the back and run to the root of the tail, and the markings on the neck are very clear and distinct. The sides of the body, which are dark brownish, are flecked with dull white spots, which show a tendency to arrange themselves into transverse lines.

9. PARADOXURUS HERMAPHRODITUS (Pall.).

Viverra hermaphrodita, Pallas, Schreber, Säugeth. iii. p. 426 (1778).

Paradoxurus hermaphroditus, Flower, op. cit. p. 329.

a, b. ♂ imm. sk. Patelung, Nu Pau, April 1899.

c. ♀ imm. sk. Biserat, Jalor, 10th May, 1899.

d. ♀ ad. sk. Kota Bharu, Kelantan, 15th Oct., 1899.

10. HEMIGALEA HARDWICKEI Gray.

Hemigalea hardwickei, Gray, Spicil. Zool. 1830, p. 9, pl. i. (nec Lesson, 1827); Flower, op. cit. p. 330.

a. ♀ ad. sk. Kwala Selama, 10th January, 1899.

11. HERPESTES JAVANICUS (Geoffr.).

Ichneumon javanicus, Geoffr. Descript. de l'Egypte, 1813, Hist. Nat. vol. ii. p. 133. no. 5.

Herpestes javanicus (Desm.), Flower, op. cit. p. 332

a. ♀ ad. sk. Biserat in Jalor, 18th May, 1899.

b. Skull. Patani, May 1899.

12. CANIS FAMILIARIS L.

Canis familiaris, Linn., Flower, op. cit. p. 333.

The collection contains three skulls of the native domestic or semi-domestic Dog; they are fairly large, measuring some 6 inches in length, and are chiefly noticeable from the fact that in two of them the dentition is asymmetrical.

No particulars are given.

Dentition:—

(a)	i.	$\frac{3-3}{3-3}$,	c.	$\frac{1-1}{1-1}$,	pm.	$\frac{4-4}{4-4}$,	m.	$\frac{2-2}{2-2}$.
(b)	i.	$\frac{3-3}{3-3}$,	c.	$\frac{1-1}{1-1}$,	pm.	$\frac{2-2}{1-3}$,	m.	$\frac{2-2}{2-2}$.
(c)	i.	$\frac{3-3}{3-3}$,	c.	$\frac{1-1}{1-1}$,	pm.	$\frac{3-4}{4-3}$,	m.	$\frac{2-2}{3-3}$.

13. LUTRA sp. inc.

a. Juv. Bangkok, Patelung, 5th April, 1899.

I have been unable to satisfactorily identify this specimen, which is very young; it is apparently referable to either *L. vulgaris* or *L. macrodus*, probably to the latter; but owing to the confusion that seems to exist between the species I have thought it best to leave it doubtful.

14. LUTRA CINEREA Illiger.

Lutra cinerea, Illiger, Abh. Akad. Berl. 1811, p. 99; Flower, op. cit. p. 334.

a, b. ♂ ♀ imm. sk. Patelung, 8th April, 1899.

15. TUPAIA FERRUGINEA Raffles.

Tupaia ferruginea, Raffles, Trans. Linn. Soc. xiii. p. 256 (1822); Flower, op. cit. p. 336.

a. ♀ ad. sk. Belimbing, Legeh, 27th July, 1899.

b. ♀ ad. sk. Aring, Kelantan, 3rd Sept., 1899.

c. ♀ ad. sk. Gunong Inas (2700 ft.), 16th December, 1899.

d. One spec. in al. Kota Bharu, June 1899.

16. CROCIDURA MURINA (Linn.).

Sorex murinus, Linn. Syst. Nat. ed. 12, i. p. 74 (1766).

Crocidura murina, Flower, op. cit. p. 337.

a. Sk. Kota Bharu, Kelantan, 16th Oct., 1899.

17. SORICULUS NIGRESCENS (Gray).

Corsira nigrescens, Gray, A. M. N. H. x. p. 261 (1842).

a. ♀ ad. sk. Biserat, June 1899.

The skull of this animal not having been preserved, I am unable to identify it with certainty. Outwardly, however, it only differs from the type of *S. nigrescens* in its slightly darker colour; under this species I therefore place it.

18. *GALEOPTHECUS VOLANS* (Linn.).*Lemur volans*, Linn. Syst. Nat. i. p. 45 (1776).*Galeopithecus volans*, Flower, op. cit. p. 338.

a. Skeleton. Bau Kong, Patelung, April 1899.

b. Fœtus in al.

19. *PTEROPUS VAMPIRUS* (Linn.).*Vespertilio vampyrus*, Linn. Syst. Nat. i. p. 31 (1758).*Pteropus edulis*, Geoff., Flower, op. cit. p. 339.

a, b. ♂ ad. sk. Biserat, Jalor, 27th May, 1899.

20. *PTEROPUS NICOBARICUS* Fitzinger.*Pteropus nicobaricus*, Fitzinger, Sitzungsber. Wien. Akad. p. 389 (1860).

a. ♀ in al. Gt. Redang, off the E. coast of Peninsula.

21. *KIODOTUS MINIMUS* (Geoffr.).*Pteropus minimus*, Geoffr. Ann. Mus. xv. p. 97 (1810).*Carponycteris minima* (Geoffr.), Flower, op. cit. p. 341.

a. ♂ in al. Ulu Selama.

22. *CYNOPTERUS SPHINX* Vahl.*Vespertilio sphinx*, Vahl, Scrivter af Naturhistorie-Selskabet, 4^{te} Bind, 1^{ste} Hefte, p. 123 (1797).*Cynopterus marginatus* (Geoffr.), Flower, op. cit. p. 341.

a. ♂ sk. Kikalin, Raman, 20th June, 1899.

b, c. in al. Biserat, Jalor.

23. *CYNOPTERUS LUCASI* Dobs.*Cynopterus lucasi*, Dobs. Ann. & Mag. Nat. Hist., Aug. 1880 ; Flower, op. cit. p. 341.

a, b. in al. Ulu Selama.

24. *RHINOLOPHUS LUCTUS* Temm.*Rhinolophus luctus*, Temm. Mon. Mamm. ii. p. 24, pl. 30 (1835); Flower, op. cit. p. 341.

a. ♀ in al. Ulu Selama.

25. *HIPPOSIDERUS ARMIGER* (Hodgs.).*Rhinolophus armiger*, Hodgson, J. A. S. B. iv. p. 699 (1835).*Hipposiderus armiger*, Flower, op. cit. p. 342.

a. ♀ ad. sk. Jalor Caves, June 1899.

26. *HIPPOSIDERUS DIADEMA* (Geoffr.).*Rhinolophus diadema*, Geoffroy, Ann. Mus. Hist. Nat. xx. p. 263 (1813).*Hipposiderus diadema*, Flower, op. cit. p. 342.

a-f. ♂ sk. Biserat, Jalor, 12th, 16th, 21st, 25th May, 1899.

g. ♀ sk. Biserat, Jalor, 25th May, 1899.

h. Sk. No particulars.

27. PIPISTRELLUS ABRAMUS (Temm.).

Vespertilio abramus, Temm. Mon. Mamm. ii. p. 232 (1835-41).

Vesperugo abramus (Temm.), Flower, op. cit. p. 345.

Pipistrellus abramus (Temm.), Bonhote, P. Z. S. 1900, p. 191.

a. Ad. sk. Biserat, Jalor, 11th May, 1899.

28. VESPERUGO TYLOPUS Dobs.

Vesperugo tylopus, Dobson, P. Z. S. 1875, p. 473; Blanf. Faun. Br. Ind., Mamm. p. 602.

15 specs. in alc. Biserat, Jalor.

29. SCOTOPHILUS KUHLLI Leach.

Scotophilus kuhlli, Leach, Tr. L. S. xii. p. 72 (1822); G. Miller, jun., Proc. Acad. Nat. Sci. Phil. p. 321 (1898); Bonhote, P. Z. S. 1900, p. 191.

Nycticejus kuhlli, Flower, op. cit. p. 346.

4 specs. in alc. from Biserat, Jalor.

30. VESPERTILIO EMARGINATUS.

Vespertilio emarginatus, Geoffr. Ann. Mus. vol. viii. p. 198 (1806).

a. spec. in alc. Biserat, Jalor.

31. VESPERTILIO MURICOLA Gray.

Vespertilio muricola, Gray, Cat. Mamm. Nepal & Thibet, p. 4 (1846); Flower, op. cit. p. 347.

9 specs. in alc. from Biserat, Jalor.

32. SCIUROPTERUS PHAYREI Blyth.

Sciuropterus phayrei, Blyth, J. A. S. B. xxviii. p. 278 (1859); Bonhote, P. Z. S. 1900, p. 193.

Sciuropterus sagitta, Flower, op. cit. p. 353.

a¹, b. ♂ ad. sk. Biserat, Jalor, 29th May, 1899.

c. ♀ ad. sk. Bukit Besar, Jalor, June 1899.

d. ♂ in alc. Bukit Besar, Jalor, May 1899.

The female is slightly smaller and distinctly lighter in colour. The male in spirit was dropped by a Monitor lizard.

33. RATUFA² BICOLOR³ (Sparrm.).

Sciurus bicolor, Sparrm. Götheb. Vet. Svensk. Handl. i. p. 70 (1778).

Ratufa bicolor, Flower, op. cit. p. 354; Bonhote, Ann. & Mag. Nat. Hist. ser. 7, vol. v. 1900, p. 493.

¹ One specimen labelled in parenthesis "(from Bukit Besar)"; probably they all came from there.

² For use of generic term *Ratufa* and other terms in the former genus *Sciurus* see Thomas, P. Z. S. 1897, p. 938.

³ Since this paper was read, Mr. G. Miller, jun. (Proc. Wash. Acad. Sci. 1900, ii. p. 71), has described this species under the name *Ratufa melanocephala*.

- a, b.* ♂ ♀ ad. sk. Koh Nam Kam, Talé-sap, 12th April, 1899.
c. ♂ ad. sk. Biserat, Jalor, 15th May, 1899.
d-g. ♀ ad. sk. Biserat, Jalor, 15th, 24th, & 25th May, 1899.
h. ♂ ad. sk. Kota Bahru, Kelantan, June 1899.

These eight specimens are the true *R. bicolor* and are identical with the southern race from Java, but differ in size and one or two minor points from the large form of the Himalayas, which also occurs in the Malay Peninsula. I have measured the skulls of all the specimens, which entirely bear out my former observations on this race. The average measurements of the eight specimens are:—Greatest length 71·2 mm.; basal length 56·4; zygomatic breadth 43·7; length of nasals 21·1; length of palate to hensenion 26·5.

All these specimens show a tendency to bleaching, although this has taken place to a far less degree than in most of the specimens I have examined; one or two of the specimens from Biserat, moreover, show a tendency to erythrisms, having reddish tips to many of the dorsal hairs, most noticeable on the hind-quarters and tail.

34. SCIURUS ERYTHREUS Pall.

Sciurus erythræus, Pall. Glires, p. 337 (1778); Flower, op. cit. p. 356.

- a.* Ad. sk. Gunong Inas, 4000 ft., N. Perak.

35. SCIURUS CANICEPS, Gray.

Sciurus caniceps, Gray, A. M. N. H. x. p. 263 (1842); Flower, op. cit. p. 356; Bonhote, P. Z. S. 1900, p. 194.

- ♂ ♀ ad. sk. Bankok, Patelung, 6th April, 1899.
 ♀ ad. sk. Lambom, Singora, 17th April, 1899.
 ♀ ad. sk. Komlom opp. Singora, 17th April, 1899.
 ♀ ad. sk. Bukit Besar, Jalor, 7th May, 1899.
 ♂ ad. sk. Biserat, Jalor, 17th May, 1899.
 3 ♀ ad. sk. Biserat, Jalor, 10th & 25th May, 1899.
 ♀ imm. sk. Biserat, Jalor, 11th May, 1899.
 4 specs. very young in al. Biserat, Jalor (no date).
 ♂ ad. sk. Tremangan, 12th July, 1899.
 2 ♂ & 2 ♀ ad. sk. Belimbing, Legeh, 29th July, 1899.
 ♀ ad. sk. Sungei Labeh, Angadik, 5th August, 1899.
 ♂ ad. sk. Aring, Kelantan, 17th & 29th August, 1899.
 ♂ ad. sk. Aring, Kelantan, 2nd Sept., 1899.
 2 ♂ ad. sk. Aring, Kelantan, 5th Sept., 1899.
 ♂ ad. sk. Aring, Kelantan, 6th & 7th Sept., 1899.
 ♂ imm. sk. Aring, Kelantan, 5th Sept., 1899.
 4 ♀ ad. sk. Aring, Kelantan, 16th, 25th, 30th, & 31st Aug., 1899.
 ♀ ad. sk. Aring, Kelantan, 6th Sept., 1899.
 ♀ imm. sk. Aring, Kelantan, 18th August, 1899.
 3 ♀ ad. sk. Kota Bharu, Kelantan, 4th, 5th, & 8th Oct., 1899.
 ♂ ad. sk. Tringgannu, 22nd, 30th, & 31st October, 1899.
 ♀ ad. sk. Tringgannu, 26th October, 1899.

This large series shows hardly any variation throughout; the April specimens from Bangkok and Singora are somewhat greyer in their general tone, and young individuals appear to be browner on the back and to have the tail more distinctly annulated. None of the specimens have the bright yellow back, the majority having only a warm tinge of brown.

36. *SCIURUS TENUIS* Horsf.

- Sciurus tenuis*, Horsf. Zool. Res. (1824); Flower, op. cit. p. 357.
a-f. ♂ ad. sk. Aring, Kelantan, 26th & 29th Aug., 1st, 9th, 11th, & 14th Sept., 1899.
g. ♀ ad. sk. Bukit Besar, Jalor, 1st May, 1899.
h, j. ♀ ad. sk. Aring, Kelantan, 31st Aug. & 3rd Sept.
k, l. ♂ ad. sk. Gunong Inas (4000 ft.), 14th & 17th Dec., 1899.
m. ♀ ad. sk. Gunong Inas (4000 ft.), 16th Dec., 1899.

37. *SCIURUS NOTATUS*, Bodd.

Sciurus notatus, Bodd. Elench. Anim. (1785) p. 119; Flower, op. cit. p. 358.

A. Variety with bright red underparts.

- a.* ♂ ad. sk. Ko Nam Kam, 12th April, 1899.
b, c. ♂ ad. sk. Aring, Kelantan, 25th & 26th Aug., 1899.
d. ♀ ad. sk. Aring, Kelantan, 31st Aug., 1899.
e-h. ♀ ad. sk. Aring, Kelantan, 2nd Sept., 1899.
j-k. ♀ ad. sk. Aring, Kelantan, 14th Sept., 1899.
l. ♀ ad. sk. Ulu Selama, 5th Jan., 1900.

B. Variety with blue underparts.

- m.* ♂ ad. sk. Aring, Kelantan, 26th Aug., 1899.
n. ♀ ad. sk. Aring, Kelantan, 13th Sept., 1899.

38. *FUNAMBULUS INSIGNIS*, Cuvier.

Sciurus insignis, F. Cuvier, Mamm. 1821, p. 233.
Funambulus insignis, Flower, op. cit. p. 360.

- a.* ♀ ad. sk. Aring, Kelantan, 26th Aug., 1899.

This solitary specimen is rather a dark variety and shows no trace of the rufous on the flanks.

39. *MUS RUFESCENS*, Gray.

Mus rufescens, Gray, Charlesw. Mag. Nat. Hist. i. p. 585 (1837).
Mus alexandrinus var. *rufescens*, Thos. P. Z. S. 1881, p. 534.
Mus rattus, Flower, op. cit. p. 361.

- a.* ♀ ad. sk. Aring, Kelantan, 25th Sept., 1899.

This specimen agrees with Mr. Thomas's description of var. *rufescens*, viz., body small, tail longer than head and body; fur coarse, intermixed with many spines; colour rufous above, much paler below.





Mintern Bros. imp.

MUS CILIATA.

J Smit del. et lith

40. *MUS CONCOLOR* Blyth.

Mus concolor, Blyth, J. A. S. B. xxviii. 1859, p. 295; Flower, op. cit. p. 361; Bonhote, P. Z. S. 1900, p. 195.

a. ♂ ad. sk. Aring, Kelantan, 25th Sept., 1899.

b. ♂ imm. sk. Aring, Kelantan, 28th Aug., 1899.

c-e. ♀ ad. sk. Biserat, Jalor, June 1899.

f-g. ♀ ad. sk. Aring, Kelantan, 23rd Aug. & 25th Sept., 1899.

41. *MUS DECUMANUS* Pallas.

Mus decumanns, Pallas, Glires, p. 91 (1779); Flower, op. cit. p. 362.

a-c. ♂ ad. sk. Kota Bharu, Kelantan, 1st Oct., 1899.

42. *MUS CREMORIVENTER* Miller.

Mus cremoriventer, G. Miller, jun., Proc. Biol. Soc. Wash. xiii. p. 144 (1900).

a. No particulars (probably Jalor.—J. L. B.)

I have no hesitation in referring this specimen to the species which has lately been described by Mr. Gerritt S. Miller, jun. It is allied to *Mus jerdoni*, but is easily recognizable by its slightly larger size, slender form, and long tail with a whitish tip. Mr. R. Evans, who procured the specimen, states that it was taken in an absolutely dark cave, but when found was in too decomposed a condition for satisfactory measurements to be taken.

43. *MUS CILIATA*, sp. n. (Plate LVI.)

General colour above dark brown; many of the hairs having fawn tips, which, especially on the sides, give the animal a lighter appearance. Underparts yellowish white, sharply marked off from the colour of the back. The fur is of three kinds—(1) a light grey underfur; (2) fine soft hairs light at their bases with a fawn or dark tip, the former colour being most abundant at the sides and the latter on the back; (3) long stiff spines, also light at their bases but with a very dark tip. Ears moderately long, naked, and uniformly rounded. Hands and feet uniform dark sepia-brown above, sometimes with an irregular longitudinal whitish stripe. Tail long, unicolour, and covered with very short stiff bristles. Whiskers very long and numerous; the two supraorbital bristles especially are longer than those in any other species except *Mus edwardsi*, while there is also a long cheek-bristle on either side starting from midway between the eye and the ear.

The skull closely resembles that of *M. vociferans*, Miller, and in a less degree that of *M. sabanus*. It differs from the former in being slightly longer and of greater depth over the brain-case, while the nasals are somewhat straighter. From the latter it differs in the supraorbital ridges being much less prominent and in the shape of the anteorbital foramen, which is narrower, especially at its upper end, caused by the maxillary plate being flatter, *i. e.* less concave and nearer the rostrum at its upper end. The skull

may also be distinguished from that of *Mus edwardsi* by its smaller size, less prominent supraorbital ridges, and the much smaller auditory bullæ, which in this respect agree with those of the *sabanus* group.

Teeth similar to those of *M. vociferans*, but the anterior crescent of the first molar has a deep constriction at its inner side, so that when the tooth is worn it becomes split into a narrow crescent and a round tubercle.

Dimensions of the type (approx., see below). Head and body 290 mm.; tail 315; hind foot 47.

Skull. Greatest length 57 mm.; basilar length 44; palatal length to henselion 23; length of nasals 21.5; breadth of brain-case above zygoma-roots 21; interorbital breadth 9.

Hab. Gunong Inas, Malay Peninsula (4000 ft.).

Type. Adult ♀, Gunong Inas, 4000 ft., 23rd Dec., 1899.

I have no hesitation in describing this species as new, although it bears a certain likeness to 3 species, viz.: *Mus sabanus* Thos., from Borneo; *Mus vociferans* Miller jr., from the west side of the Malay Peninsula; *Mus edwardsi* Thos., from W. Fokien, China. From the first two it may be at once distinguished by the great length of the supraorbital bristle, which in the type measures 71 mm., and in the ♂ specimen 78 mm., as compared with 40 mm. in the type of *sabanus*. The tail is also much shorter, being hardly longer than the body. From *Mus edwardsi*, which it more closely resembles, it may be at once distinguished by its unicolor tail, darker colour, smaller size, and the impure colour of the underparts.

For this species I propose the name *ciliata*, from the long bristles, which form so distinctive a character. Mr. F. F. Laidlaw, who collected these specimens, has brought home examples of both sexes and three skulls, all from the same locality; but owing to the imperfect condition of the skull of the male, I have been obliged to make the female the type. With regard to the measurements which were taken on the spot, there appears to have been some slight oversight. Those given for the ♂, namely, head and body 285 mm., tail 300, hind foot 49, are probably correct; but I am unable to understand those given for the type, which are "snout to tail 12.3 mm., tail 11.4, hind foot 2.9." The tail of the type is 15 mm. longer than that of the ♂, and the hind foot approximately the same size, while the skulls are also practically identical; but if the measurements of the type, which are presumably taken in inches, be transposed to millimetres, they would not at all fit in either with the measurements of the other specimen, or with the measurements of the type taken by myself from the skin and given in the description.

44. MUS WHITEHEADI Thos.

Mus whiteheadi, Thos. Ann. & Mag. Nat. Hist. ser. 6, xiv. pp. 452 & 457 (1894).

a. ♀ ad. sk. Gunong Inas, about 4000 ft.

b. ♀ imm. sk. Gunong Inas, about 4000 ft.

c. Gunong Inas.

The adult ♀ is typical and very spiny; the immature specimens, which are about $\frac{3}{4}$ grown, are much darker, showing hardly any fawn-colour, and, except on the underparts, where the mature pelage has commenced to show itself, are entirely spineless.

45. *MUS METTADA* (Gray).

Golunda mettada, Gray, Charlesworth's Mag. Nat. Hist. i. p. 586 (1837).

a. ♀ in al. Bukit nr. Biserat, Jalor, 12th June, 1899.

This is, so far as I am aware, quite a new locality for this species, which is, however, a fairly typical specimen.

46. *RHIZOMYS SUMATRENSIS* (Raffles).

Mus sumatrensis, Raffles, Tr. Linn. Soc. xiii. p. 258 (1822).

a. ♀ ad sk. Biserat, Jalor, 18th May, 1899.

b. ♀ ad sk. Aring, Kelantan, 8th Sept., 1899.

47. *HYSTRIX YUNNANENSIS* Anders.

Hystrix yunnanensis, Anders. Zool. Res. p. 332 (1880).

a. Skull, ad. ♀. Biserat.

b, c. 2 fœtuses in al., taken from the above ♀.

d. Imm. in al. 24th Jan., 1900.

I have compared the skull with other *Hystrix* skulls in the Museums of Cambridge and London, and, although there did not appear to be a skull of this species among them, I had little difficulty in determining it.

The characteristic points, which are well brought forward in the original description, are:—

(i) The posterior border of the nasals being in a line with the posterior edge of the 1st molar.

(ii) The posterior margin of the premaxillary is anterior to the 1st molar.

(iii) The nearly equal breadth of the nasals throughout their length.

(iv) The greatest length of the frontals being nearly equal to that of the nasals.

The measurements of the skull are:—

Greatest length 131 mm.; hensenion to lower edge of occipital foramen 113 mm.; zygomatic breadth 68 mm.; length of nasals 53 mm.; greatest length of frontals 57 mm.; breadth of conjoint nasals at posterior margin of premaxillæ 29 mm.; ditto at tip 22 mm.

48. *TRICHYS LIPURA* Günth.

Trichys lipura, Günth. P. Z. S. 1876, p. 739.

a. ♀ ad. sk. Ulu Selama, 12th Jan., 1899.

This specimen, which is young, is of chief interest as confirming the fact that this animal occurs in the Malay region, and consequently renders it possible that the species described by Buffon

as "le porc épic de Malacca," and called *Hystrix fasciculata* by Shaw, might be referred to the animal in question, as stated by Dr. Jentink¹.

I have been carefully through Buffon and Shaw's descriptions, comparing them with the present specimen, which differs in the following points:—

(i) The tail is much longer, measuring about half the length of the body.

(ii) Muzzle and legs are brown *not* black.

(iii) The fifth digit on the fore feet has a small nail and is not merely a tubercle.

(iv) The spines have a brown tip with a white base, instead of having a white tip and base and centre brown.

This specimen agrees precisely in all these details with some six specimens of *T. lipura* from Borneo, and undoubtedly belongs to that species, which is, moreover, quite distinct from *Hystrix fasciculata* Shaw.

Judging from the length of the tail and the white tips to the spines, Buffon's description appears to me to refer to *Atherura macrura* (Linn.); at the same time Dr. Jentink's generic differentiations² between *Atherura* and *Trichys* appear to hold good, so that the specimens in the Leyden Museum from Malacca may probably be referred to *T. lipura*.

Mr. Thomas gave the name *guentheri* on the assumption that *lipura* meaning tailless could not apply to an animal with a long tail, an assumption which in these days does not hold good.

49. TAPIRUS INDICUS Cuv.

Tapirus indicus, Cuv., Desm. Nouv. Dict. d'Hist. Nat. xxxii. p. 459 (1819); Flower, op. cit. p. 368.

a. Imm. sk. & skel. Aring, Kelantan, Sept. 1899.

50. NEMORHÆDUS SUMATRENSIS (Shaw)³.

Antilope sumatrensis, Shaw, Gen. Zool. ii. pt. 2, p. 354 (1801).

Nemorhædus sumatrensis, Flower, op. cit. p. 370.

Two pairs of horns, the one without any data and the other from near Biserat, Jalor, presented by Mr. D. T. Gwynne Vaughan, are referable to this genus and probably to *N. sumatrensis*, but the material does not admit of a complete identification.

51. CERVUS UNICOLOR Bechstein.

Cervus unicolor, Bechstein, Allgem. Uebers. d. vierfüss. Thiere, i. p. 112 (1799); Flower, op. cit. p. 372.

a. ♀ skull. Biserat, Jalor, May 1899.

This is a skull marked "Rusa Deer," which, according to Mr. Flower, is the local name for the species.

¹ Notes from the Leyden Museum, vol. xvi., Dec. 1894, p. 235.

² Tom. cit.

³ The *Nemorhædus* from the Peninsula has, since this paper was read, been separated under the name *N. swettenhami* by Mr. Butler (P. Z. S. 1900, p. 675), and is said to be distinguished by its jet-black legs.

52. *CERVUS PORCINUS* Zimm.

Cervus porcinus, Zimm. Spec. Zool. Geogr. Quad. p. 532 (1777);
Flower, op. cit. p. 374.

The collection contains a pair of horns belonging to this species,
but with no data.

53. *TRAGULUS JAVANICUS* (Gmel.).

Moschus javanicus, Gmelin, Syst. Nat. i. p. 174 (1788).

Tragulus javanicus, Flower, op. cit. p. 374.

a. ♂ ad. sk. Tale Nowy, Lagoon, 3rd April, 1899.

b. ♂ juv. sk. Tale Nowy, Lagoon, 3rd April, 1899.

c. ♀ ad. sk. Tale Nowy, Lagoon, 4th March, 1899.

d. ♂ ad. sk. Aring, Kelantan, 11th Sept., 1899.

e. ♀ ad. sk. Biserat, Jalor, 14th May, 1899.

f, g. ♂ ♀ skeletons. Bukit Besar, 8th May, 1899.

h. Skull (no particulars).

Native name: "Kanchil, Pelandoc."

54. *MANIS JAVANICA* Desm.

Manis javanica, Desm. Mamm. p. 377 (1822); Bonhote, P. Z. S.
1900, p. 195; Flower, op. cit. p. 378.

a. Ad. sk. Biserat, Jalor, May 1899.

b, c. Ad. sk. (Recd. 18th Sept., 1899.)

4. On the Frogs collected during the "Skeat Expedition"
to the Malay Peninsula, 1899-1900. By F. F. LAIDLAW,
B.A.

[Received October 24, 1900.]

(Plate LVII.)

The collection of Frogs made by Mr. Annandale and myself
during the Skeat Expedition includes no specimens new to science,
but we have been able to add four species to the fauna of the
Peninsula.

These are, with their previously recorded habitats:—

Rana signata. Borneo.

Rana lateralis. Burmah.

Bufo jerboa. Borneo.

Microhyla inornata. Burmah; Sumatra.

Of these *Rana signata* and *Bufo jerboa* were obtained in Perak;
Rana lateralis and *Microhyla inornata* are from the east side of the
Peninsula.

It is worth remarking that specimens of *Rana limnocharis*, *Bufo*
melanostictus, and *Callula pulchra* from the neighbourhood of Patani

have in some cases carmine-coloured spots, which are symmetrical in one *Callula* (see Boulenger, P. Z. S. 1890, p. 31).

Some species appear to be very careless of the welfare of their young; it is very usual to find spawn or tadpoles in little puddles left after heavy rain which must dry up long before the wretched tadpoles can escape from them.

Frogs occur plentifully up to a height of at least 5000 feet above sea-level. At about this height I found several small pools, only a few feet across, in which there were numbers of tadpoles.

As to localities, beginning on the east coast, Patalung was the most northerly district in which collections were made, mostly near Singora, a large town at the mouth of the Talé-sap or Inland Sea which lies on the east coast of the northern half of the Peninsula. The next locality is Patani, a town on the east coast just below the narrowest part of the Peninsula. From here Mr. Annandale with the rest of the party travelled inland to Biserat, a village in a small state called Jalor; near this village is a hill about 3000 feet in height called Bukit Besar (Great Hill). From Biserat the party travelled south overland through Jalor, Legeh, and Raman, and reached the Kelantan River; then, passing up the Lebeh River, they stayed for some time at Kwala Aring, a small village at a point where the Aring River runs into the Lebeh. At this point I joined the party, which next moved down to Khota Bharu, the capital town of the state of Kelantan. After a short stay here we went by steamer to Tringganu, a large town some 60 miles farther down the east coast. From here we went back to Singapore, then to Penang, and thence reached Ulu Selama, a district about the headwaters of the Selama River, a tributary of the Krian River which runs between Kedah and Perak. Gnnong Inas is the mountain in which the Selama River rises.

I have to acknowledge the kindly interest displayed by Mr. G. A. Boulenger in our collections and to thank him for much assistance in describing them.

Order ECAUDATA.

Fam. RANIDÆ.

OXYGLOSSUS LIMA (Gravenh.).

Oxyglossus lima, Boulenger, Cat. Batr. Sal. p. 5; id. Rept. & Batr. of British India, p. 436.

Three specimens from near Biserat in Jalor.

OXYGLOSSUS LEVIS Günther.

Oxyglossus levis, Boulenger, Cat. Batr. Sal. p. 6; id. P. Z. S. 1897, p. 288 (tadpole); id. Rept. & Batr. of British India, p. 437; S. S. Flower, P. Z. S. 1899, p. 886.

Several examples were collected by Mr. Annandale in the same locality as the last species. Two of them have very warty skin, and a third is by no means smooth.

RANA MACRODON Kuhl.

Rana macrodon, Boulenger, Cat. Batr. Sal. p. 24; S. S. Flower, P. Z. S. 1899, p. 888, pl. lix. ff. 1, 1 a.

I caught two adult specimens of the variety with the rounded snout in Singapore, and one half-grown individual at Khota Bharu, Kelantan. Of the variety with a pointed snout, one at Kwala Aring, Kelantan, and one at Ulu Selama, Perak.

RANA LIMNOCHARIS Wiegman.

Rana gracilis, Boulenger, Cat. Batr. Sal. p. 28.

Rana limnocharis, Boulenger, Rept. & Batr. of British India, p. 450; S. S. Flower, P. Z. S. 1899, p. 893.

Specimens were collected in Patalung, at Biserat, at Kwala Aring and Khota Bharu, Kelantan, and at Tringganganu.

RANA TIGRINA Daud.

Rana tigrina, Boulenger, Cat. Batr. Sal. p. 26; id. Rept. & Batr. of British India, p. 449; S. S. Flower, P. Z. S. 1899, p. 891.

Specimens were collected at Biserat, Patani, Kwala Aring, and Khota Bharu, Kelantan.

RANA MACRODACTYLA Günther.

Rana macrodactyla, Boulenger, Cat. Batr. Sal. p. 54; id. Rept. & Batr. of British India, p. 455; S. S. Flower, P. Z. S. 1899, p. 896.

Mr. Annandale caught three specimens hopping about in a rice-field near Biserat in Jalor.

RANA PLICATELLA Stol.

Rana plicatella, Boulenger, Cat. Batr. Sal. p. 26; S. S. Flower, P. Z. S. 1899, p. 890.

A full-grown male of this species agrees with the specimen described by Flower in having an occipital knob, but with Stoliczka's type in having only eight longitudinal dorsal folds. This specimen and an adult female were caught at the foot of Gunong Inas. Two others, both young, were caught in rain-puddles—one at a height of about 3000 feet, the other about 4000 feet above sea-level.

RANA HASCHEANA (Stol.).

Polypedates hascheana, Stoliczka, J. A. S. B. 1870, p. 147, pl. ix. fig. 3.

Rana hascheana, S. S. Flower, P. Z. S. 1899, p. 894.

Three specimens from the foot of Gunong Inas, taken on different days just at dusk.

RANA ERYTHRÆA (Schleg.).

Rana erythraea, Boulenger, Cat. Batr. Sal. p. 65; S. S. Flower, 58*

P. Z. S. 1896, p. 203, pl. xlv. fig. 2; Boulenger, Rept. & Batr. of British India, p. 460.

Specimens were collected at Belimbing (Legeh), Biserat, and Singapore in the botanical gardens.

RANA LABIALIS Blgr.

Rana labialis, Boulenger, Ann. & Mag. N. H. (5) xix. 1887, p. 345, pl. x. fig. 1; S. S. Flower, P. Z. S. 1896, p. 903, pl. xlv. fig. 3; id. P. Z. S. 1899, p. 896.

I caught a young specimen at Kwala Aring, and another nearly full-grown at the foot of Gunong Inas.

RANA SIGNATA Günther.

Rana signata, Boulenger, Cat. Batr. Sal. p. 71.

I caught a single young specimen of this Frog at the foot of Gunong Inas, and saw but could not catch a much larger individual in the same locality. It has not hitherto been recorded from the Peninsula, but is known in Borneo.

RANA LARUTENSIS Blgr. (Plate LVII. figs. 3, 4.)

Rana larutensis, Boulenger, Ann. & Mag. N. H. (7) iii. 1899, p. 273, pl. xi. fig. 1; S. S. Flower, P. Z. S. 1899, p. 898.

These handsome Frogs are extremely common along the banks of the rapid jungle torrents running about the foot of Gunong Inas. They sit on the great boulders strewn along the courses of the streams, and when one approaches them spring boldly into the water, no matter how fiercely it may be pouring down. Soon after being disturbed they will again take up their station on the rock which they had quitted, and in such a position their colouring renders them well-nigh invisible.

The tadpole is provided with a well-developed ventral sucker extending from the lower lip to beyond the middle of the abdomen. The beak is of two pieces, an upper and lower minutely serrated. The arrangement of the labial teeth is

$$\begin{array}{cc} & 4 & \\ & 5 & 5 \\ \hline & 1 & 1 \\ & 4 & \end{array}$$

It is thus apparently closely allied to the tadpoles of *Rana jerboa* Blgr., *R. latopal mata* Blgr., *R. cavitympanum* Blgr., and *Staurois hainanensis* Blgr.

Coloration is much as in the adult, greenish white, mottled with dark green on the back; ventral surfaces white. There are a few minute black denticles scattered on the head. Total length of the single specimen caught 65 mm., tail 45 mm.

RANA LATERALIS Blgr. (Plate LVII. figs. 1, 2.)

Rana lateralis, Boulenger, Ann. Mus. Genov. (2) v. 1887, p. 483, pl. viii. fig. 2; id. Rept. & Batr. of British India, p. 457.

I caught a single example of a Frog, apparently belonging to this species, in thick jungle at Kwala Aring. It is a female and much larger than the type (70 mm. from snout to vent). The back is grey, with very curious glandular folds running obliquely backward from left to right, making an angle of about 45° with the long axis of the body. The tympanum is as large as the eye. A black line from the tip of the snout passes back through the eye and broadens above the shoulder, disappearing abruptly immediately behind the tympanum. The flanks are grey with a few black spots. This species has hitherto been found only in Burmah.

RANA GLANDULOSA Blgr.

Rana glandulosa, Boulenger, Cat. Batr. Sal. p. 73, pl. vii.; S. S. Flower, P. Z. S. 1899, p. 897.

One specimen from Bukit Timah, Singapore.

RHACOPHORUS LEUCOMYSTAX (Gravenh.).

Rhacophorus maculatus, part., Boulenger, Cat. Batr. Sal. p. 83.

Rhacophorus leucomystax, Boulenger, P. Z. S. 1889, p. 29; id. Rept. & Batr. of British India, p. 474; S. S. Flower, P. Z. S. 1899, p. 898, pl. lix. figs. 3, 3a.

Malay name: "Katak pisang," Banana Frog.

This is perhaps the commonest of the Malay Frogs and is abundant everywhere. The measurements of the largest specimen obtained, a female, are:—

Snout to vent	75 mm.
Thigh to knee	38 "
Knee to ankle	37 "
Ankle to end of 4th toe	47 "

At Kwala Aring we found this species breeding in the month of September and the end of August. The eggs were laid in a frothy mass on the leaves of trees overhanging small pools of water. After a short time (I believe less than 48 hours) they slid off the leaves and fell into the water, where the frothy envelope is dissolved away, setting free the tadpoles. (Cf. S. Ikeda on *Rhacophorus schlegeli* Gnthr., Annot. Zool. Jap. i. part iii. p. 113.)

Fam. ENGYSTOMATIDÆ.

MICROHYLA ORNATA (Dum. et Bibr.).

Microhyla ornata, Boulenger, Cat. Batr. Sal. p. 165; id. Rept. & Batr. of British India, p. 491; S. S. Flower, P. Z. S. 1899, p. 901, pl. lx. figs. 1, 1a, 1b.

A single specimen from Kwala Aring was caught in long grass close to a small pond on the edge of the jungle.

MICROHYLA INORNATA Blgr.

Microhyla inornata, Boulenger, P. Z. S. 1890, p. 37; S. S. Flower, P. Z. S. 1899, p. 905.

Mr. Annandale caught three specimens of this small Frog on Bukit Goah, near Biserat in Jalor. It has not, I believe, been reported previously to this from the Peninsula, but is known from Sumatra and Borneo.

MICROHYLA ACHATINA (Boiè).

Microhyla achatina, Boulenger, Cat. Batr. Sal. p. 166; S. S. Flower, P. Z. S. 1899, p. 906.

One specimen from Kekabu, Rhaman, and three from Kwala Aring, these last from the same spot as *M. inornata*.

MICROHYLA BERDMORII (Blyth).

Microhyla berdmorii, Boulenger, Cat. Batr. Sal. p. 166; id. Rept. & Batr. of British India, p. 412; S. S. Flower, P. Z. S. 1899, p. 906.

A single specimen from Belimbing, Legeh, from very thick forest.

CALLULA PULCHRA (Gray).

Callula pulchra, Boulenger, Cat. Batr. Sal. p. 170 (fig.); S. S. Flower, P. Z. S. 1899, p. 906.

This strange creature was very plentiful at Khota Bharu, Kelantan, especially in the market-place, where they hide during the day amongst the numerous rubbish-heaps, coming out at night and making an intolerable noise when it rains. They are found down the east coast as far as Tringgannu, but in this town are much scarcer than in Kelantan.

Fam. BUFONIDE.

BUFO ASPER Gravenh.

Bufo asper, Boulenger, Cat. Batr. Sal. p. 313; id. Rept. & Batr. of British India, p. 507; S. S. Flower, P. Z. S. 1899, p. 912.

Malay name: "Katak puru."

Specimens were collected in Legeh at Belimbing, at Biserat in Jalor, at Kwala Aring in Kelantan and near Ulu Selama.

BUFO MELANOSTICTUS Schneid.

Bufo melanostictus, Boulenger, Cat. Batr. Sal. p. 306; id. Rept. & Batr. of British India, p. 505 (fig. p. 506); S. S. Flower, P. Z. S. 1896, p. 911, pl. xlv. fig. 3; id. P. Z. S. 1899, p. 910.

Common all along the east coast of the Peninsula; two specimens from Biserat show carmine-coloured spots on the back and head.

BUFO PARVUS Blgr.

Bufo parvus, Boulenger, A. M. N. H. (5) xix. 1887, p. 346, pl. x.; S. S. Flower, P. Z. S. 1899, p. 911.

One specimen from near Biserat in Jalor, three from Ulu Selama in Perak.

BUFO JERBOA Blgr.

Bufo jerboa, Boulenger, P. Z. S. 1890, p. 328, pl. xxv. fig. 3.

A Malay brought me a single male specimen of this interesting Toad, which he had caught squatting on the ground amongst dead leaves in dense forest on Gunung Inas. I believe this is the first specimen taken in the Peninsula. Its coloration and proportions are closely similar to those of the type specimen from Borneo.

Distance from snout to vent	30 mm.
" " thigh to knee	19 "
" " knee to ankle	20 "
" " ankle to end of toe	25 "

Fam. PELOBATIDÆ.

LEPTOBRACHIUM HASSELTII Tschudi.

Leptobrachium hasseltii, Boulenger, Cat. Batr. Sal. p. 441; S. S. Flower, P. Z. S. 1899, p. 913.

Mr. Annandale collected a large number of the tadpoles of this species at the foot of Bukit Besar in Jalor. They are very curiously coloured, being a pale yellow and spotted with numerous fine black dots. (See Hanitsch, Rep. Raffles Mus. & Libr. Singapore, 1897, p. 8.)

MEGALOPHRYS NASUTA (Schleg.).

Megalophrys montana, part., Günther, Rept. Brit. Ind. p. 413.

Megalophrys nasuta, Boulenger, Cat. Batr. Sal. p. 443; S. S. Flower, P. Z. S. 1899, p. 913.

This Frog is fairly common in the Botanical Gardens at Penang, where I obtained two specimens, one young and one adult. A specimen in the University Museum at Cambridge from Java (labelled *Megalophrys montana*) is very much more richly coloured, especially on the under surface, than are either of my specimens or others that I have seen from the Peninsula.

MEGALOPHRYS MONTANA Kuhl.

Megalophrys montana, Boulenger, Cat. Batr. Sal. p. 442; S. S. Flower, P. Z. S. 1899, p. 914.

Mr. Annandale caught an adult female on Bukit Besar in Jalor at a height of about 2000 ft.; and I found one adult and three young on Gunung Inas at from 1000 to 1500 ft. above sea-level. It is a very sluggish animal, as is also the first species of the genus.

The following are the principal measurements of an adult:—

Snout to vent	65 mm.
Thigh to knee	25 "
Knee to ankle	26 "
Ankle to 4th toe	42 "
Total length of hind leg	93 "

The tadpoles of *M. montana* were found in the same locality

during the month of June, in a stream with a gravelly bed. They are provided with a very remarkable funnel-like float, formed by the lips, which are fused together at the angles of the mouth. This funnel is much wider than it is long, and opening dorsally at its wider end leads down to the mouth, which is subterminal and faces ventrally as in other tadpoles. The "buccal vestibule" so formed has on its inside rows of minute widely separated denticles. By means of it the tadpoles can apparently float motionless, hanging as it were from the surface of the water by their lips. The total length of the largest individual obtained by Mr. Annandale is 31 mm., the length of the head and body 8.5, and the breadth of the funnel-opening 7, the length about 3 mm.

A fuller account of this interesting creature, with figures, is given by Prof. Max Weber in the 'Annales du Jardin Botanique de Buitenzorg,' 1898, Supplément ii. pp. 5-10.

MEGALOPHYRYS LONGIPES Blgr.

Megalophrys longipes, Boulenger, P. Z. S. 1885, p. 850, pl. lv.; Günther, A. M. N. H. (5) xx. 1887, p. 316; S. S. Flower, P. Z. S. 1899, p. 914.

Fairly common on Gunong Inas from a height of 3000 ft. upwards. I caught two females and a male which is much smaller than the females. This species is much more active than either of the preceding members of the genus.

The measurements of the larger female are:—

Snout to vent	62 mm.
Thigh to knee	30 "
Knee to ankle	37 "
Ankle to end of 4th toe	48 "
Total length of hind leg	115 "

Order APODA.

Fam. CECILIIDÆ.

ICHTHYOPHIS GLUTINOSUS (Linn.).

Ichthyophis glutinosus, Boulenger, Cat. Batr. Grad. &c. p. 89, pl. iv. fig. 2; id. P. Z. S. 1895, p. 403; id. Rept. & Batr. of British India, p. 515, fig. p. 516; S. S. Flower, P. Z. S. 1899, p. 914.

Mr. Annandale collected many specimens, adult and young, at a small village near Biserat. The natives told him that they were found only in places where ants were not very plentiful. The Siamese speaking natives call them "Ngu kling (? pling)," and the Malays "Ular Belógelengong," or sugar-mill snake.

EXPLANATION OF PLATE LVII.

- Figs. 1, 2. *Rana lateralis*, p. 886.
 Fig. 3. *Rana larutensis*, p. 886, tadpole, ventral surface.
 4. " " enlarged view of mouth and sucker.



Edwin Wilson, Cambridge.

FROGS FROM THE MALAY PENINSULAR



5. On the Earthworms collected during the "Skeat Expedition" to the Malay Peninsula, 1899-1900. By FRANK E. BEDDARD, M.A., F.R.S.

[Received November 20, 1900.]

The Earthworms upon which I now report were collected by Mr. R. Evans of Oxford, during the Skeat Expedition in the Malay Peninsula. They belong for the most part to the characteristic and abundant Oriental genus *Amyntas*.

The collection contains, however, a number of examples of the ubiquitous *Pontoscolex corethrura* and of a small *Benhamia*. Since so many species of *Amyntas* are now known—I allow 109 or so in my recently published¹ revision of the genus—I was not prepared for the large number of novelties that occur in the collection. It must be remembered, however, that this region of Asia has been but little explored from the point of view of its earthworm fauna.

It is also important to notice that the greater proportion of the entire list of species recorded here are peculiar to the mainland, and do not, so far as is known at present, occur upon the islands of the Malay Archipelago; these latter are regarded by Michaelsen, and apparently with justice, as the headquarters of the genus *Amyntas*. Further to the west, though still in the Oriental Region of zoogeographers, the genus becomes scarcer and scarcer, the forms occurring in India itself and in Ceylon being but very rarely peculiar forms², and being far from numerous altogether.

It is interesting to find that the condition hitherto peculiar to *A. stelleri*, *A. phakellotheca*, and *A. biserialis*, of an increased number of spermathecae in each segment, is also characteristic of *A. minutus* and *A. polytheca* described as new species in the present communication. The interest lies of course partly in the more widely-spread occurrence of this geoscolecoid characteristic, but also in the fact that small species like the two described here may show a character which is more intelligible in a large species such as *A. stelleri*, where there is more room for a reduplication of these organs.

Another novelty of structure for the group which is recorded in the present communication, is the curious intersegmental position, and the single row, of numerous genital papillae, which is the principal characteristic of the new species *A. evansi*. I am not aware that any closely similar arrangement of such papillae occurs elsewhere among Earthworms of this genus.

The large size of the various organs belonging to the reproductive system is, as a very general rule, a marked feature in the

¹ P. Z. S. 1900, p. 609.

² In Ceylon there is only *A. taprobanæ* (Beddard, P. Z. S. 1892, p. 163) and in India only *A. alexandri* (Beddard, P. Z. S. 1900, below), and *A. travancorensis* (Beddard, J. Bombay Nat. Hist. Soc. xi. p. 435), which occur in those regions and are not found elsewhere.

anatomy of Earthworms. The extraordinary reduction in size of the spermathecae in the new species *A. virgo* must therefore be considered as one of the more important new facts which I detail here. It is interesting to notice that the reduction in size is apparently not accompanied by a reduction in number, and certainly not by an increase in number, as with the small but numerous spermathecae of such a form as *Microchaeta*.

The marked resemblance in *A. biporus* between the "genital papillæ" of segment xix. and the male pores, confirmed by microscopic investigation, seems to indicate the remnant of a second pair of spermiducal glands, which is new to the genus.

In other respects the species represented in the collection show no particularly noteworthy divergences in structure from other species of *Amyntas*.

We shall now proceed to the description of the new species, after mentioning the forms already known to science.

(1) *Amyntas posthumus*¹ Vaillant.

(2) *Amyntas cingulatus*¹ Vaillant.

These two species, the latter, as I believe, with many synonyms, are so widely spread, and have been so frequently reported upon and described, that I have nothing of novelty to add to existing descriptions.

(3) *Amyntas bosschæ* Horst.

Perichæta bosschæ, Horst, Notes Leyd. Mus. xv. p. 324.

Perichæta bosschæ, Michaelsen, Abh. Senck. Ges. xxiii. p. 238.

Amyntas bosschæ, Beddard, P. Z. S. 1900, p. 625.

It is rather curious that the collection contains a number of specimens of a species of Earthworm which really does appear to be identical with *A. bosschæ*. It is at least extremely near to that species, and I do not attempt at present to separate it. Nor do I give a full description, since that has been done. In size and general external appearance *A. bosschæ* is very like *A. pulahensis*, which I describe later; but it has no genital papillæ.

I find, as did Michaelsen, that there are three pairs of sperm-sacs in segments x.-xii. The spermiducal glands, however, are not compact and small; they extend through segments xv.-xx. and are much broken up into lobules. Their short duct is coiled into a circle or is perfectly straight. The spermathecae agree rather with Michaelsen's than with Horst's description.

Hab. Khota Bharu.

(4) *Amyntas papulosus* Rosa.

Perichæta papulosa, Rosa, Ann. Mus. Civ. Genova, (2) xvi. p. 525.

Amyntas papulosus, Beddard, P. Z. S. 1900, p. 644.

I have examined two specimens which are undoubtedly referable

¹ For synonymy and localities see Beddard, P. Z. S. 1900, pp. 641, 615.

to this species. I am able in a few small points to supplement Dr. Rosa's account. I find, for example, that in both specimens there are more setæ upon the clitellum than he found, *i. e.* 6 or so upon the last two segments. The figure given by Rosa (*loc. cit.* tav. i. fig. 14) of the very remarkable arrangement of the genital papillæ entirely bears out and admirably illustrates the appearances detected by myself. This being so, I was surprised to find on opening one of the two specimens not a trace of the cæca which Rosa has very emphatically stated to be present. To make certain about this point, which is of some systematic importance, I dissected the second specimen, in which I also failed to find these appendages.

The gizzard of this worm is rather remarkable in shape; it is wide from side and short in antero-posterior diameter; it is constricted in the middle, and presents somewhat the appearance of a doctor's hat viewed, of course, from the side.

In other points, including size, my specimen seems to agree with that described by Dr. Rosa. The spermathecæ, however, happen to be more globular, no doubt a question of a different degree of distension with sperm, while the diverticula are a little less conspicuous in length than they are figured by Dr. Rosa.

Hab. Biserat.

(5) *Amyntas malayanus*, n. sp. (Fig. 1, p. 894.)

Of this species I have been able to examine a number of examples. The individual selected for measurement was 144 mm. in length and consisted of 105 segments.

The setæ on the anterior segments show no differences in size from those of the posterior segments. They are present on all the segments of the clitellum.

The clitellum occupies the usual segments, but it does not begin or end sharply.

The genital papillæ are highly characteristic. There are four pairs of these in all, which lie upon the xviiith to the xixth segments. The first pair lie behind and to the inside of the male pores; the remaining pairs are in line with them upon successive segments. The papillæ, as shown in the accompanying figure (fig. 1), are small, considerably smaller than the male pores, to which, however, they have a general resemblance in appearance. They are slightly projecting and surrounded by a circular wrinkle of the integument. There are no papillæ upon the anterior segments.

The male pores are conspicuous and widely separated. Each is surrounded by several circular wrinkles of the integument. From the tip of each porophore, which is somewhat raised, protrudes a slight conical process, which can be regarded as a penis.

As to internal structure it is noticeable that the septum separating segments viii./ix., which is so often absent in *Amyntas*, is present in *A. malayanus* though rather thin.

The intestine begins in the xvth segment, and the cæca are present,

occupying about three segments; these reach, in fact, as far forward as the second segment in front of that in which they originate.

The last pair of *hearts* are placed in segment xiii.

The *sperm-sacs* lie in segments xi. and xii. and are large and racemose; they are in contact above the œsophagus.

Fig. 1.



Anterior end of *Amyntas malayanus*. $\times 3$.

The *spermiducal glands* are largish, somewhat irregular in shape, and occupy segments xvii.-xix. The duct itself is curved in a horseshoe-like fashion; it has no terminal sac, but widens somewhat towards the orifice.

There are four pairs of *spermathecae*, situated in segments vi.-ix. The sacs are large, irregularly oval in contour, and with a short

muscular duct. The diverticulum is short, barely one-third of the length of the sac.

Hab. Aring.

The following is the abstracted definition of

Amyntas malayanus, n. sp.

Length 144 mm.; number of segments 105. Setæ of anterior segments not enlarged. Clitellum xiv.-xvi., with setæ. Genital papillæ paired on xviii.-xxi. Male pores far apart. Septum viii./ix. present. Cæca present. Last hearts in xiii. Sperm-sacs in xi., xii. Spermiducal glands in xvii.-xix., with horseshoe-shaped duct and no terminal sac. Spermathecæ in vi.-ix., with shortish diverticulum.

Hab. Malay Peninsula.

(6) *Amyntas virgo*, n. sp.

I have examined seven and dissected four fully mature examples of this species, whose characters do not fit in with those of any other species that has been adequately described.

The largest individual, which, however, like the others, is somewhat softened in the clitellar region, measures 152 mm.

The setæ upon the anterior segments are rather larger than upon the following segments.

The clitellum, which occupies the usual segments, has no setæ.

The male pores are very conspicuous and quite far apart.

There are no genital papillæ.

The gizzard-septum is wanting; two septa following the gizzard are of considerable thickness.

The usual paired cæca are present.

The last heart is in segment xiii.

The remarkable feature about this species which at once differentiates it from *A. impudens*¹ and *A. philippinus*²—the only two that could be confused with it by reason of their possessing a terminal sac to the spermiducal-gland duct, no setæ upon the clitellum, and 3 pairs of spermathecæ in vii.-ix.—is the very small size of all the parts of the generative apparatus. In this the present species resembles *A. taprobane*.

The sperm-sacs are small and lie in segments xi., xii.; they do not reach as far as to the dorsal surface of the intestine.

The spermiducal glands vary in size, but are small and confined to their segment. The short duct leads into the circular end-sac.

The spermathecæ are so small that they might be readily overlooked; and yet the external apertures are quite large and conspicuous. Each pouch has a diverticulum of about the same shape and size, especially resembling in this *A. taprobane*. The spermathecæ lie in segments vii., viii., ix., and open between vi./vii., &c.

Hab. Paddy-fields, Tale.

¹ Michaelsen, JB. Hamb. wiss. Anst. xvi. p. 84.

² Rosa, Ann. Hofm. Wien, vi. p. 397.

From the foregoing account of its structure may be abstracted the following brief definition of

Amyntas virgo, n. sp.

Length 152 mm. *Setæ* of anterior segments rather larger. Clitellum xiv.-xvi., without *setæ*. Male pores far apart. No genital papillæ. Gizzard-septa wanting. *Cæca* present. Last hearts in xiii. Sperm-sacs small, in xi., xii. Spermiducal glands confined to xviiiith segment, with circular terminal sac. Spermathecae very minute in vii., viii., ix., with equal-sized diverticulum.

Hab. Malay Peninsula.

(7) *Amyntas perichæta*, n. sp.

Although I have had for examination only a single example of this species, there is no possible doubt, in my opinion, of its distinctness as a species. It furnishes, moreover, an excellent example of how necessary it is to dissect an earthworm merely for the purpose of discovering whether it is known or not described. Externally, the present species might readily be confounded with many others. But its somewhat negative external characters combined with several internal features of very positive value enable it to be placed with accuracy.

It is a stontish worm of 170 mm. in length.

The number of segments is 116.

The *setæ* are more or less equal in size; those of the anterior segments show no special differentiation.

I could find no *genital papillæ* of any kind.

The *clitellum* occupies the usual segments and is quite free from *setæ*.

The *male pores* are conspicuous orifices separated from each other by a fairly wide interval.

The *gizzard-septa* appear to be wanting. The *intestine* commences in the xvith segment. The usual *cæca* of moderate length are present.

The last *hearts* are in segment xiii.

The *sperm-sacs* lie in segments xi. and xii.; they are fairly large and solid bodies. The two sperm-ducts of each side unite very shortly after they have emerged from the sperm-reservoirs.

The *spermiducal glands* are on the whole very compact, although they are much divided into small lobules. They occupy segments xvii.-xix. and they have a kidney-like outline. Their duct is not long; it runs forward and then backward, after the very prevalent fashion, and then debouches into a fairly large *terminal bursa* of approximately circular outline, which is confined to the xviiiith segment.

A pair of small *egg-sacs* occur in the xivth segment, attached of course to the anterior wall of that segment.

There are three pairs of *spermatheca*. These lie in segments vi., vii., and viii., and are lateral in position, occupying the average place that these organs occupy in the members of the genus

Amyntas. The pouches are not large and have but a short duct ; they taper gradually towards the free cæcal extremity, which gives to them a pear-shaped outline.

The diverticulum of each spermatheca is considerably longer than the pouch ; it is tubular in form, and the greater part of it is coiled into a tight knot-like coil. This, however, could be unravelled, though I have not done so. There is no external sheath enclosing the whole coil such as exists in *A. peguanus*. The end of the diverticulum is only very slightly dilated to form the sac-like extremity.

Hab. Malay Peninsula¹.

We may thus define

Amyntas perichata, n. sp.

Length 170 mm. ; number of segments 116. *Setæ* of anterior segments not enlarged. Clitellum xiv.-xvi., without *setæ*. No genital papillæ. Male pores far apart. Gizzard-septa missing. Cæca present. Last hearts in xiii. Sperm-sacs in xi., xii. Spermiducal gland in xvii.-xix., with not long, horseshoe-shaped duct and terminal sac. Spermathecae 3 pairs in vi.-viii., with much-coiled diverticulum, much longer than the pouch.

Hab. Malay Peninsula.

(8) *Amyntas polytheca*, n. sp. (Fig. 2, p. 898.)

The same tube which contained the numerous specimens of *A. kelantanensis* contained a single example of a small *Amyntas* which differed from these by its pale (light brown instead of violet) coloration. It proved to be the representative of a distinct new species. The single example was imperfect and I do not therefore give accurate measurements ; it is a slender worm and can hardly have been more than two inches in length.

The *setæ* on the anterior segments are larger than on those which follow.

The *clitellum* occupies the usual three segments and has *setæ* very plainly present upon the ventral side of all of them.

The *male pores* (see fig. 2, p. 898) are exceedingly prominent as large round protruding discs, which are widely apart.

On the segment in front of that which bears the male pore and upon the two segments following are a pair of *genital papillæ* of much smaller size than the porophores and rather closer to the middle ventral line of the body.

The alimentary canal of this species has the usual strong *gizzard*, which is rather elongated in form and not so globular as is often the case. The usually missing gizzard-septa are often absent in the present species. The *intestine* begins in the xvth segment and has not any *cæca*. The typhlosole is quite conspicuous.

The last pair of *hearts* are in segment xii.

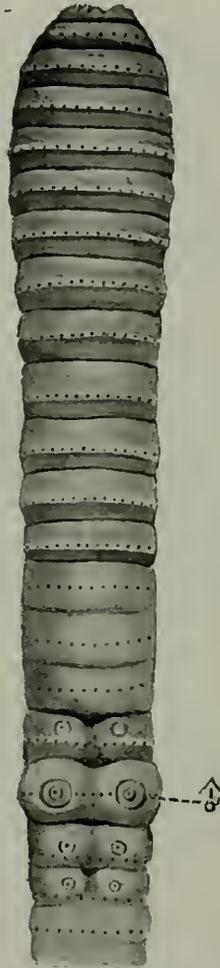
The arrangement of the *sperm-sacs* is rather different from that which usually obtains in this genus. There are large pairs in

¹ I have not seen a label indicating the exact locality.

the xth and xith segments, which are quite distinct, at least in the case of the former pair, from the sperm-reservoirs. In the xiith segment there are a pair of sperm-sacs, but they are quite small and compact bodies.

In the xiiith segment there are a pair of still smaller *egg-sacs*. It may be thought perhaps that I have made an error of a segment, and that the two pairs of small sacs are both egg-sacs and lie, as the two pairs of these sacs sometimes do, in segments xiii., xiv. I believe, however, that this is not the case.

Fig. 2.

Anterior end of *Amyntas polytheca*. $\times 5$.

The *spermiducal glands* are extensive, reaching from segments xvii.-xx.; they are much lobulated. The duct runs forward as a narrow tube into the xviiith segment and then runs back, widening out to the xviiiith segment, where it opens directly on to the exterior and not through the intermediary of a terminal sac.

The *spermatheca*, like those of *A. stelleri* and of a number of other species, are present in several pairs in the segments in which they occur. These segments are the vith to the ixth; in each there is on either side of the nerve-cord a group of smallish spermathecae up to 8 or 9 in number, each of course with its own diverticulum as usual.

Hab. Aring, Kelantan.

The species may be thus defined:—

Amyntas polytheca, n. sp.

Small, slender worm. Setæ on anterior larger than on posterior segments. Clitellum xiv.–xvi., with setæ on ventral surface of all segments. Genital papillæ paired on xvii., xix., xx. Male pores further apart than genital papillæ. Gizzard-septa absent; no cæca. Last heart in xii. Sperm-sacs in x.–xii. Spermiducal glands xvii.–xx., lobate, with not long curved duct and no end-sac. Spermathecae several pairs in each of segments vi.–ix.

Hab. Malay Peninsula.

(9) *Amyntas aringeanus*, n. sp. (Fig. 3, p. 901.)

This species has a superficial likeness to *A. posthumus* by reason of the fact that the xviiiith and the xixth segments are provided with papillæ which lie exactly in the same line as the male pores upon the xviiiith segment. A closer examination of these papillæ, however, shows that they are not in the least like those of *A. posthumus*.

This species measures up to 115 mm. in length. A specimen which is of that length has 142 segments, a disproportion which is not usual in this genus, where there is generally a very close connection between the number of segments and the number of millimetres in length.

The setæ show no differences in size in the anterior segments. They appear to be totally absent from the clitellum.

The clitellum occupies all of segments xiv.–xvi.

The most characteristic feature of the new species concerns the genital papillæ (see fig. 3, p. 901). These occur both in the neighbourhood of the male pore and more anteriorly. The latter are somewhat unusual in arrangement and position: they commence as early as the fifth segment and there are altogether four pairs of them, the last pair being situated upon segment vii. On segment vi. there are two pairs of papillæ. They are rather large and not very conspicuous and are placed in front of and just overlapping the line of setæ. The additional pair of segment vii. are behind the line of setæ. The two papillæ of segment v. are rather closer together than those of subsequent segments, and there is a slight progressive increase in the distances separating them from first to last. Occasionally two or three pore-like depressions are to be seen like those of the posterior papillæ. The posterior genital papillæ are upon segments xvii. and xix. They correspond exactly in position to the male pores and are of considerable size. Each papilla is in

reality a group of 9–11 small circular papillæ apparently very like those of *A. aspergillum*. They are disposed in two slightly curved lines, one in front of and one behind the line of setæ. The whole area upon which they are borne is not only raised above the area of the surrounding integument, but is slightly different in colour. In one case only the lowest left-hand papillæ merely consisted of the raised area without an indication of the separate papillæ upon it.

The *male pores* are very large and conspicuous, the orifice is much wrinkled. There are about fourteen setæ between the pores.

Dorsal pores are present.

The gizzard of this species shows, more plainly than I have observed in other species of the genus, a disposition of the blood-vessels of the gizzard which has been figured and described in other genera. There are about 8 parallel vessels on each side of the gizzard which run from end to end of that organ. In the gizzard-segments also, which are undivided by a septum, two strong lateral blood-vessels run one on each side; anteriorly each gives off a very strong and much-branched twig to the body-wall. The last heart is in segment xii.

The intestine has *no cæca*.

There appear to be three pairs of *sperm-sacs* in segments x., xi., and xii. Those of the tenth and of the twelfth segments are much smaller than those of the eleventh; but in every case they nearly or quite meet each other above the œsophagus. In the tenth segment the sperm-sacs swell out below into the sperm-reservoirs, which lodge the anterior pair of vas deferens funnels. These reservoirs are not fused together below though they come into contact. Their dorsal extension must, as it appears to me, be regarded as an anterior pair of sperm-sacs.

The *spermiducal glands* are squarish in outline and occupy segments xvii.–xix. Their duct leaves them as nearly as possible exactly in the middle; it is quite slender and is curved back upon itself in a horseshoe-like form; there is no terminal sac, the presence of which might possibly be inferred by the large size of the male pore.

A moderately large pair of *egg-sacs* are appended to the front wall of segment xiii. They are transversely elongated.

The *spermatheca* are constituted upon the plan of those of *A. stelleri*, and occupy the same segments as do the spermatheca of that species. There are in fact in segments vi. and vii. 8 to 10 spermatheca on each side in each segment. Each spermatheca is pear-shaped, lessening gradually in calibre towards the duct; it has a diverticulum of about half its own length which is slender. The diverticulum has the form that has been noted in *A. stelleri*; there is a marked constriction between the swollen end of the diverticulum and another swollen region which gradually diminishes in calibre to the duct.

Hab. Aring, Kelantan.

From the foregoing account may be extracted the following definition of

Amyntas aringeanus, n. sp.

Length 115 mm. ; number of segments 142. • Clitellum xiv.-xvi., without setæ. Genital papillæ paired upon segments v., vi. (two pairs), vii., on xvii. & xix. paired groups of 9-11 papillæ in line with

Fig. 3.



Anterior end of *Amyntas aringeanus*. × 3.

male pores. Male pores large and far apart. Septum viii./ix. absent. Last heart in xii. No cæca. Sperm-sacs in x.-xii. Spermiducal glands in xvii.-xix., compact and square in outline ;

no terminal sac to their duct. Spermathecae 8 to 10 pairs in vi. and vii.

Hab. Malay Peninsula.

It is clear that this species comes nearest to *A. stelleri*, from which, however, it can readily be differentiated by the nature and position of the genital papillae.

(10) *Amyntas kelantanensis*, sp. n. (Fig. 4, p. 903.)

I have examined some thirty individuals of this new species, which cannot be confused with any of its allies. It is a long and slender species, measuring up to 105 mm. in length by about 3 mm. in breadth. The number of segments in the longest individual is 100.

The *setae* on the anterior segments are fewer and larger than those upon the following segments.

The *clitellum* occupies fully its usual segments and is entirely without *setae*.

Genital papillae are rarely to be seen. When present (fig. 4, p. 903) they consist of three pairs of whitish round patches, one pair on each of segments vi.–viii., lying in front of the line of division between each segment and that which follows. They are related to stalked glands, which will be described when the internal viscera are treated of. The *male pores* are conspicuous and widely separated. There are about a dozen *setae* between them.

The gizzard-septa appear to be absent. The last heart is in the xiiith segment. The large *intestine* begins in segment xv., and has the usual pair of *caeca*, which are of fair length.

The *sperm-sacs* are racemose in form and lie in segments xi. and xii.

The *spermiducal glands* extend from segment xvii. to xxi. They are much broken up into lobules; that part of the gland which lies behind the male pores is wider from side to side than the part lying anterior to them. The duct is not particularly long and is coiled into a circle. There is no terminal sac.

The *spermathecae* are present to the number of three pairs and are situated in segments vii., viii., ix. The pouch has a round or oval contour and communicates with the exterior by a duct which is almost as long as the pouch. The diverticulum has a characteristic form; it is very long and if unwrapped would be considerably longer than the spermathecae. The greater part of the diverticulum is much coiled, and it is dilated at its extremity into an oval chamber; the muscular duct is comparatively short. An oval gland, whiter in colour than the diverticulum and with a long stalk, opens in common with the spermathecal duct. The arrangement, in fact, is very like that of *Amyntas houletti*, with which species, however, there is no possibility of confusing the present.

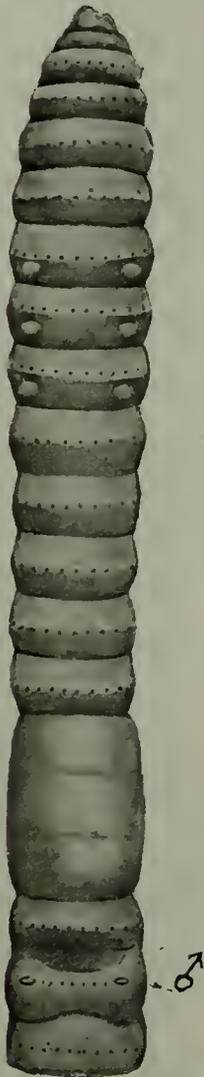
Hab. Aring, Kelantan.

The following definition embodies the principal characters of this new species:—

Amyntas kelantanensis, n. sp.

Length 105 mm.; number of segments 100. Setae on anterior segments large. Clitellum xiv.-xvi., without setae. Paired papillae upon vi.-viii. Male pores far apart. Septum viii./ix. absent. Last

Fig. 4.

Anterior end of *Amyntas kelantanensis*. × 4.

heart in xiii. Cæca present. Sperm-sacs xi., xii. Spermiducal glands xvii.-xix., with curved duct and no terminal sac. Spermathecæ vii.-ix., with long coiled diverticulum and a stalked gland.

Hab. Malay Peninsula.

(11) *Amyntas pulauensis*, n. sp. (Fig. 5, p. 905.)

The present species is represented by a number of specimens, all of which do not show the principal diagnostic character of the species, and led me to confuse it with Dr. Horst's *Amyntas bosschue*, from which it appears to be perfectly distinct, provided that there are no lacunæ in the descriptions given by Horst¹ and Michaelsen².

The length of the largest individual is 165 mm.; the number of segments I am unable to state with accuracy.

The *clitellum* occupies the whole of segments xiv.-xvi. and appears to have no setæ upon it.

The *genital papillæ* are the distinguishing feature of the species so far as concerns external characters. On segments xvii. and xviii. in front of the line of setæ is an area which presents the appearance of a sieve owing to the presence of 40-50 pore-like depressions, which are the external expression of numerous white glands which are visible on dissection. These groups of papillæ are median and unpaired. There appears to be a similar area upon the viiith, viiiith, and ixth segments, which is very like that of *A. hilgendorffi* as figured by myself³.

The *male pores* are very conspicuous and widely separated; 13 setæ lie between them.

The gizzard-septa are absent. The *intestine* begins in the xvith segment, and is furnished with a pair of *cæca*, which are rather short, barely reaching to the level of the xxvth segment.

The last pair of *hearts* are in segment xiii.

The *sperm-sacs* are large, solid, and compact. They lie in segments xi. and xii.

The *spermiducal glands* are not of a compact structure; they are much lobulated and occupy segments xvii.-xix. Their duct is short and thick and opens into a rounded, rather flattened terminal sac.

The *spermathecae* are four pairs and lie in segments vi.-ix. Each sac is oval or more or less pear-shaped in outline; its duct is sharply marked off and about $\frac{1}{3}$ the length of the sac. The diverticulum is not large and not a great deal longer than the duct of the spermatheca. It is divisible into an oval sperm-holding receptacle and a narrower folded duct.

Hab. Pulau, Bidang, Kelah, and Aring.

The following is a brief definition of

Amyntas pulauensis, n. sp.

Length 165 mm. Clitellum xiv.-xvi., without setæ. Genital papillæ median unpaired group of pores upon viii., ix., xvii., xviii., in front of setæ. Male pores large and far apart. Septum viii./ix. absent. Last heart in xiii. Cæca present. Sperm-sacs xi., xii.

¹ Notes Leyden Mus. xv. p. 324.

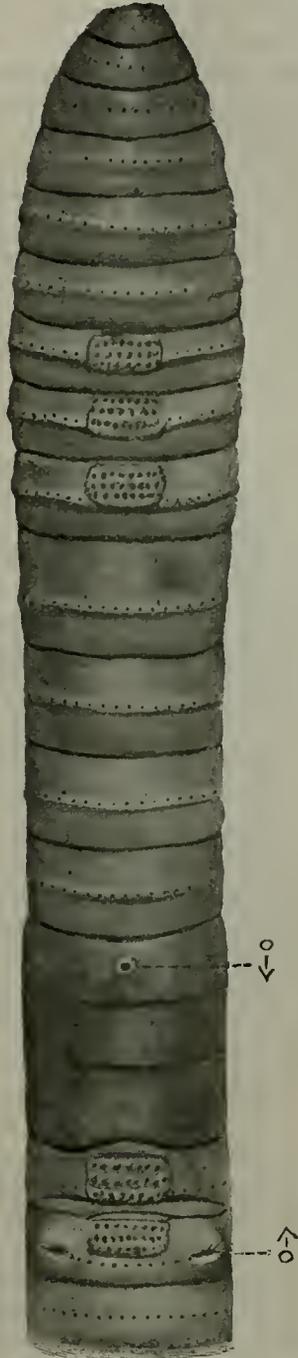
² Abh. Senck. nat. Ges. xxiii. p. 238.

³ Zool. Jahrb., Abth. f. Syst. vi. pl. fig. 1.

Spermiducal glands xvii.-xix., loose-textured; terminal sac present.
Spermathecæ in vi.-ix., with short diverticulum.

Hab. Malay Peninsula.

Fig. 5.



Anterior end of *Amyntas pulauensis*. $\times 3$.

(12) *Amyntas minutus*, n. sp.

Of this very small species I have examined only a single specimen, which is 48 mm. in length. I counted 103 segments. The setæ upon the anterior segments are very large.

The *clitellum* occupies the whole of segments xiv.-xvi. It has setæ upon it. The median region of the xvth segment is not invaded by glandular tissue, so that it presents the appearance of a papilla. There is a swollen area of corresponding position and extent upon segment xvii.

Apart from these there are a series of paired *genital papillæ* which follow the male pores upon segments xix.-xxi. They are paired upon the first two segments, but the xxist has only the left-hand one. They are much smaller than the male pores and lie nearer to the middle line.

The *male pores* are very large indeed. They are shallow but large depressions borne upon very conspicuous porophores. They are sucker-like in appearance.

With regard to the internal structure, I have been able by dissection to note the principal structural features which fix the position of and distinguish the present species. I am not certain, however, whether the gizzard-septum is present. The gizzard itself is large and typically 'perichæatous'; the failing or vanished gizzard of some small Earthworms is sometimes put down to smallness of size and consequent simplification by degeneration; instances like the present appear to show that the reduction of the gizzard is rather to be referred to difference of habitat and food. The intestine has no *cæca*. I could not fix the position of the last heart.

There are undoubtedly three pairs of large *sperm-sacs*, which lie in segments x.-xii.

The *spermiducal glands* are large, loose in texture, and much incised. The duct is rather long; it runs forward and then back, opening directly on to the exterior, and not by the way of a terminal sac. The gland itself extends through segments xvi.-xxi.

The *spermatheca* present the unusual character of being massed in considerable numbers in a single segment. There are 6-10 pairs of them, not only in segments vi. & vii. as in *A. stelleri*, but also in segment viii. behind the last thick septum and alongside of the gizzard.

Hab. Aring.

The following will be the definition of

Amyntas minutus, n. sp.

Length 48 mm.; number of segments 103. Setæ on anterior segments larger. Clitellum xiv.-xvi., with setæ. Papillæ paired on xix.-xxi., smaller and nearer to the middle line than the prominent, widely separate male pores. *Cæca* absent. Sperm-sacs in x.-xii. Spermiducal glands xvi.-xxi., with longish duct and no end-sac. Spermatheca 6-10 pairs in each of segments vi.-viii.

Hab. Malay Peninsula.

(13) *Amyntas evansi*, n. sp. (Fig. 6.)

Three examples of an *Amyntas*, unfortunately not fully mature, cannot, I believe, be included in any known species of the genus, though they come near to well-known forms with four pairs of spermathecae.

The largest specimen measures 120 mm. and consists of about 120 segments. The anterior setae are at least not markedly larger than those upon the segments which follow.

The position of the *clitellum* cannot be fixed.

The only distinctive external feature of this species is the one which leads me to separate it specifically. Between segments vii. and viii. are a closely-set row of small cup-shaped *papillae*, 8 on each side, a small space separating each S. I took these at first for numerous spermathecal pores such as are found in *A. stelleri* and one or two allied forms. They are, however, only genital papillae, though of unusual position.

Fig. 6.

Anterior end of *Amyntas evansi*. $\times 4$.

The spermathecal pores, four pairs, are quite obvious, and lie to the outside of these papillae; they are of course intersegmentally placed, and lie between segments v./ix.

The *male pores* are placed upon very conspicuous porophores, which are widely separated and directed outwards, *i. e.* away from each other. There is no *gizzard-septum*. The last hearts are in xiii.

The *intestine* commences in segment xv. and has a pair of *cæca*, which arise in segment xxvii. and extend forward so far as xxiv. or xxiii.

The *sperm-sacs* are large in x., xi., xii. The *spermiducal glands*

(defective on the right side of one specimen) occupy segments xvii.-xix. ; they are lobate and have but a short duct.

The *spermathecae* (in vi.-ix.) have a diverticulum which is very short.

Hab. Biserat.

We may thus define the species :—

Amyntas evansi, n. sp.

Length 120 mm. ; number of segments 120. Anterior setæ not larger than those upon following segments. Clitellum ? Genital papillæ 8 pairs on intersegmental groove vii./viii. Male pores far apart. Gizzard-septum absent. Cæca present. Last heart in xiii. Sperm-sacs in x., xi., xii. Spermiducal glands xvii.-xix., with short duct and no terminal sac. Spermathecae in vi.-ix., with short diverticulum.

Hab. Malay Peninsula.

(14) *Amyntas biporus*, n. sp. (Fig. 7, p. 910.)

Of this species I have been able to examine a large number of individuals. They are all of moderate size. The length is fairly illustrated by a specimen which measured 115 mm. and consisted of 93 segments.

The *setæ* are a trifle stouter upon the anterior segments of the body ; they are particularly small upon the xth and, though the difference is less marked, upon the xith segment. The xth segment, as is so often the case, is larger than the others.

The *clitellum* completely occupies its usual segments. I found setæ upon all of its three segments.

Genital papillæ are found both anteriorly and posteriorly ; in nearly all of the specimens which I examined there are a pair of papillæ upon the viiith segment, lying just behind the circle of setæ ; these are not large and have an elliptical contour ; they are almost eye-like in form. In one specimen there were, in addition to these, an exactly similar pair of papillæ lying on the viiith segment, but in front of the circle of setæ and rather near to each other in the median line. In another worm the right-hand one only of the additional pair of papillæ was present. As the great majority of the specimens had but the single pair of papillæ on segment vii., that may be regarded perhaps as the normal arrangement for the species.

The posterior pair of papillæ are upon the sixth segment, and they showed no variations at all ; there was always one pair and one only. The curious fact about these papillæ is that they are exactly like the male pores which precede them. It would be quite impossible from an examination of the external characters of the worm alone to say definitely which was male pore and which papilla. Indeed the opinion arrived at would probably be that this species possessed two pairs of male pores. The first specimen that I examined was put down by me as an abnormality until the examination of others showed that it was a constant character. It

naturally suggested the specific name. The papillæ in question have a transverse direction and are oval in form, bearing a conspicuous slit; they interrupt the line of setæ, and correspond exactly in position to the male pores.

The *male pores* need no special description, as they are exactly like the copulatory papillæ of the nineteenth segment. As to the internal anatomy, the gizzard-septum appears to be wanting. *Cæca* are present. The last heart is in segment xii.

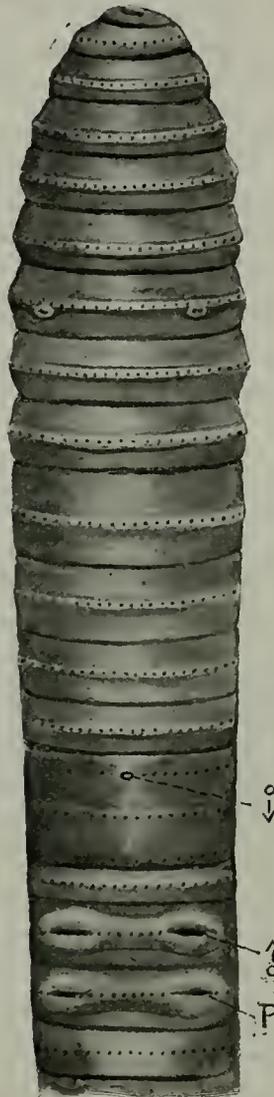
The *sperm-sacs* are large and racemose, meeting in the middle line above; there are three pairs of them lying in segments x., xi., xii.

The *spermiducal glands* are large and rather ragged. They occupy segments xvii.,-xix. and a trifle of the adjoining segments also. The duct is thin and curved upon itself in the usual horse-shoe-shape. It opens on to the exterior through a not very large terminal sac. In segment xix. is a similar sac, which corresponds to the papilla on the exterior of the body already described. The likeness between these two sacs, coupled with the external resemblances already referred to, suggests that we may have to do with a species which has only recently lost the primitive double male efferent apparatus.

I have made a series of sections through this region of the body in order to attempt to further elucidate the remarkable appearances seen externally and on a dissection. With regard to the male pores, the duct of the spermiducal gland does not open directly into the terminal sac, but is prolonged into a penis-like process which lies within the sac and does not extend quite so far as to its external orifice; doubtless it can be protruded. The walls of the sac are much wrinkled by deep folds, the interstices between which are reduced to a minimum, as the epithelium on either side is very nearly in contact. It is surrounded by a layer of loosely arranged muscular fibres, which in my sections (transverse to the longitudinal axis of the body) are seen to run over the sac from left to right and to be mingled with numerous fibres running in a longitudinal direction. The actual orifice of the sac, though large, does not occupy the whole of the groove upon the xviiiith segment. The orifices upon the xixth segment, which are externally so like the male pores upon the xviiiith segment, lead, like them, into a sac. This sac in structure is precisely like that of the bursa copulatrix of the male efferent apparatus. It has a widish mouth; it is lined by tall columnar epithelial cells, and its walls are thrown into close folds. The resemblance to the bursa copulatrix does not, however, end here. A penis-like process depends from the dorsal wall of the sac into the interior; I cannot distinguish this structure from the penis of segment xviii., save for the fact that it has no lumen. For the rest its shape, size, and relations are precisely those of the penis. Instead of by a lumen its thickness is occupied by the ducts of numerous unicellular glands which form a mass above the sac and are surrounded by a special muscular layer. They are precisely like those of other species of *Amyntas*.

It is plain, therefore, that the minute anatomy of this species bears out the very close external resemblance between the male pores upon segment xviii. and the "genital papillæ" upon segment xix. We may possibly regard the mass of gland-cells in the latter as representing the glandular investment of the spermiducal gland of the

Fig. 7.



Anterior end of *Amyntas biporus*. $\times 4$.

P, papilla on segment xix.

former. In any case this is the nearest approach to be seen in a true *Amyntas* of the originally present second pair of spermiducal glands which occur in so preponderant a proportion of Acanthodriloid forms.

The *spermathecae* are four pairs in segments vi.-ix. The main pouch is circular, sometimes even kidney-shaped in outline; in the latter case the duct arises from the hilum. The duct is quite as long as the pouch¹. The diverticulum is altogether longer than the spermatheca; it is made up of an oval pouch and a long duct. In the neighbourhood of the second or third spermatheca is a soft cushion-like gland, bilobed, which appears to be related to the papillæ upon the spermathecal segments.

The following definition of the species includes the principal characters of

Amyntas biporus, n. sp.

Length 115 mm.; number of segments 93. Anterior setæ a little stouter than upon succeeding segments. Clitellum xiv.-xvi., with setæ upon all segments. Genital papillæ upon vii., viii., and upon xix. a pair of slit-like orifices leading into a sac resembling a bursa copulatrix and with penis-like process. Male pores far apart. Gizzard-septum absent. Cæca present. Last hearts in xiii. Sperm-sacs in x., xi., xii. Spermiducal glands in xvii.-xix., with horseshoe-shaped duct and small terminal sac. Spermathecae in vi.-ix., with long diverticulum.

Hab. Malay Peninsula.

6. On two Consignments of Butterflies collected by Mr. Richard Crawshay in the Kikuyu Country of British East Africa in 1899 and 1900. By ARTHUR G. BUTLER, Ph.D., F.L.S., F.Z.S., &c., Senior Assistant-Keeper, Zoological Department, British Museum.

[Received September 8, 1900.]

(Plate LVIII.)

Early in the present year I received a letter from Mr. Crawshay (Nairobi, March 17), in which he says:—"I am taking the opportunity, now that I am in actual close touch with a reliable post-office, to send you another consignment of Lepidoptera, about three hundred insects in all, some of which *ought* to prove especially interesting, as latterly I have been collecting high up in Kikuyu in primæval forest, at altitudes varying from 7500 to 7800 feet."

These insects (two boxes) came safely to hand, and about a month later a second (smaller) consignment, together with a letter dated April 1st, as follows:—

"I have to write you an introduction to the collection of Lepidoptera despatched to you some three weeks ago.

"As far as I can recollect, there are no insects—*Butterflies*, that

¹ This is not always apparent. Sometimes the diverticulum is shorter; hence the need for care in basing specific distinctions.

is—of any striking interest from the lower altitudes [unless maybe one or two taken at the last *here*, which I will deal with later when sending you another consignment¹]; so I need only give a description of the high country at and in the neighbourhood of Roromo where, during the last six months, I have been working amongst the wild Wakikuyu, and where most of my insect collecting has been done.

“From Nairobi—which lies at about 5400 feet—the Uganda Railway ascends from the vast open plains of Masailand into the Kikuyu hills, at first through cultivated land for some twenty-five miles, then through primæval forest of gigantic growth, commencing at about 7000 feet, and reaching 7820 feet on Lali flat—on either side of which, again, there are hills some 400 or 500 feet high.

“It was in this primæval forest that I had my camp, at approximately 7700 feet.

“There could hardly be a more unique country in its way; for, though practically on the Equator, the climate is never hot, or rarely warm [except in broad noonday, when the sun is out in all its force], but is generally moist or even downright raw—as, whether or not the rainy seasons are on (there are two in the year) there are desultory rains and blanket-like mists; there is, therefore, really no dry season in the proper sense of the term. The highest temperature I remember having recorded in the daytime, in the shade, is $71\frac{1}{2}^{\circ}$; the lowest, at night, 54° .

“It is scarcely surprising to find the Flora of such a country and climate to some considerable extent that of Northern Europe:—On the open grass-flats at Mayimoru, Ikwiakwi, Roromo, and Lali grow juicy clovers of the white and pink flowered species, foxtail grass, monstrous thistles breast high, docks, dandelions, plantains (so troublesome on the lawns at home), buttercups, sorrel, and other familiar plants and flowers.

“In the forest and on its outskirts grow blackberry-bushes with dark mulberry-coloured fruit, nettles of preposterous size and proportionally painful even through khaki, jasmine in and out of flower every few weeks, and last but not least interesting, from old associations, that long tendril-like burr which it so delighted one in one’s childhood to pluck and attach to unsuspecting elders.

“The Fauna consists of Elephants [now Royal Game], Leopards, Sewals, Genets, Tree-Isyra [the most striking, perhaps, of all the denizens of the forest], Galagos, monster Baboons with long shaggy coats, *Colobus*, a species of *Cercopithecus* with a white throat [probably *C. albigularis*], and birds innumerable, though for the most part small and retiring, the more conspicuous among them being Hornbills, Plantain-eaters, Green Parrots, and the red-legged, red-billed, dusky Francolin common to Kikuyu forest and generally the earliest harbinger of dawn.

“Reptiles are represented by—as far as I now know—one small harmless Snake [two specimens of which I have secured, to

¹ Apparently the third box, which reached me just after I got this letter.—A. G. B.

send to Dr. Günther: one taken by Dr. Waters of the Uganda Railway and given to me; one taken by Mapeyani, my servant, in our zariba]; Chamæleons—one with three horns on the frontal bone; and many small Batrachians—of which I have secured a few for examination.

“White ants there are none at the highest altitudes, neither are there Scorpions, Spiders of the venomous type, or Centipedes [Scolopendræ]—unless maybe one small yellow Centipede of which I secured three in all when breaking up a crumbling giant tree-trunk in clearing the ground for our zariba, and which appears to be venomous on a small scale.”

As might be expected from this description of the country, the collection of Butterflies, of which the following is an account, is of exceptional interest. In addition to six new species of the genera *Argiolaus*, *Epamera*, *Cyelyrius*, *Phrissura*, *Eagris*, and *Celonorrhinus*, examples of the following species new to the Museum collection were obtained:—*Charaxes ansorgei* ♀, *Uranothauma antinorii*, *Mylothris rubricosta* (previously represented by only one small example in the Hewitson collection), *Mylothris neumanni*, *Teracolus elgonensis*, *Papilio rex*; also the following, of which additional specimens were urgently required:—*Panopea expansa* both sexes (showing that *P. tarquinia* is synonymous therewith), *Lachnoptera ayresii*, *Argynnis hanningtoni*, *Neptis trigonophora* (proving *N. lermanni* to be synonymous), *Chrysophanus abbottii*, *Teriomima aslauga*, *Pilodeudorix cerulea*, *Myrina dermaptera*, *Uranothauma cordatus*, *U. falkensteini*, *Castalius margaritaceus*, the dry phase of *Teracolus chromiferus*, the Eastern form of *Belenois zochalia*, the dry phase of *Pinacopteryx gerda*, both sexes of *Papilio nobilis* (the tailless female being new to science), two very dissimilar females of *P. phorcas* (both of the *P. thersander* type) and a pale-coloured male, *Sarangesa motozioides*, both sexes, *Caprona canopus*, *Cyclopides midas* and *C. quadrisignatus*, *Parnara micans*, and *Perichares teli-signata*. Lastly, the collection contained a very remarkable intermediate example between *Precis sesamus* and *P. natalensis*, which Mr. Marshall has proved by breeding to be only forms of one species, and which (as the fact of the identity of these wonderfully different-looking Butterflies is still doubted by some entomologists) ought certainly to be figured.

NYPHALIDÆ.

1. AMAURIS ALBIMACULATA.

Amauris albimaculata, Butler, Ann. N. H. (4) xvi. p. 394 (1875).

♂, Roromo, 7700 feet, Kikuyu, Oct. 5, 1899; ♀, Jan. 26, 1900; ♂♂, Ruarka R., 5500 feet, Kikuyu, April 22, 1900.

Of the first pair Mr. Crawsbay writes—“Fairly common; usually to be seen on the outskirts of the forest.” And “Fairly common these days, though comparatively rarely is a perfect specimen obtainable. It has somewhat astonished me to find an insect of this genus a fowl feeder: some ten days ago I counted

no less than eleven of this species, in company with some two or three *Charaxes*, feeding voraciously on the excreta of a Leopard."

Of the remaining males, which arrived in the later consignment, Mr. Crawshay says:—"Apparently the first appearance of this species since my arrival here in February: each example of the few seen has newly emerged."

The Eastern specimens of this species frequently have the white spots on the primaries reduced in size.

2. *LIMNAS CHRYSIPPUS*, var. *KLUGII*.

Limnas klugii, Butler, P. Z. S. 1885, p. 758.

♀, Nairobi plains, 5400 feet, April 25, 1900.

"Commonly distributed all over the country; never, however, anywhere in great numbers, but here one and there one. No butterfly is easier to take, as its flight is heavy, weak, and of but short duration. Oblong pale yellow ova."

3. *GNOPHODES DIVERSA*.

Gnophodes diversa, Butler, Ann. N. H. (5) v. p. 333 (1880).

♂, Nairobi forest, 5460 feet, April 14; ♀, March 25, 1900.

"An insect of owlish haunts and habits, frequenting dark forests and apparently never emerging into the sunlight. It is new to me and the only one of its kind I have seen, though I have taken an insect of similar form, haunts, and habits in the Nyasa forests. Grass-green ova partially developed."

4. *MELANITIS LEDA*.

Pupilio leda, Linnæus, Syst. Nat. ed. 10, i. p. 474 (1788).

Nairobi plains, 5400 feet, Kikuyu, April 22, 1900; Ruarka R., 5500 feet, April 27, 1900.

Respecting the first specimen Mr. Crawshay observes:—"Somewhat to my astonishment, I took this insect—usually an inhabitant of dark forest—out in the open, in a small patch of scrub, in broad noonday." Of the other he says:—"As I have previously remarked, this butterfly frequents the depths of the forest, or thickets, where daylight scarcely penetrates to any great extent. Unless disturbed it appears never to take wing in the daytime; and if disturbed, flops down again into the depths of the undergrowth a few yards away. Its habits are, I should think, strictly crepuscular, if not nocturnal."

5. *MONOTRICTIS SAFITZA*.

Mycalesis safitza, Hewitson, Gen. Diurn. Lep. ii. p. 294 note, pl. lxxvi. fig. 3 (1851).

♂, Nairobi forest, March 20, 1900.

"This Ringlet is common in the depths of the forest, where it is to be seen hopping about or settling on the barer places, one here and one there." (R. C.)

6. *CHARAXES ANSORGEI*.

♂. *Charaxes ansorgei*, Rothschild, Nov. Zool. iv. p. 181 (1897), v. pl. v. fig. 2 (1898).

♀. Considerably larger than the male: the basal area of the primaries much darker, maroon-reddish; the macular upright belt across the disk white, more or less washed with ochre towards costa; three spots beyond the cell, the two uppermost maroon or deep sienna reddish, the lower spot, which almost touches the white belt, deep ochraceous; the third spot of the transverse belt wanting, and the three subapical spots thrown farther out and continued, by the addition of three others, to near the first median branch: the secondaries differ but little from those of the male, excepting that the white belt is more regular and tapers away through the lilac and bluish area almost to the abdominal margin; the tails are longer than in the male, the outer one being the longer (instead of the shorter) of the two; on the under surface there is no difference worthy of note. Expanse of wings 106-7 millimetres.

♀ ♀, Roromo, Kikuyu forest, Dec. 16, 1899, and Jan. 22, 1900.

Of the first specimen Mr. Crawshay says:—"Taken on the wing, when passing me, with a very lucky stroke of the net. As the specimen has the appearance of having lately emerged from its chrysalis, and was most carefully handled by me, I think the piece snipped from the right lower wing is probably the act of a bird." Of the second example he writes:—"Hovering over a bush in the most confiding manner and thus easily taken, doubtless in the act of depositing her ova, which on coming to disembowel her proved to be fully developed. Large rich yellow spherical ova, some twenty in number."

This handsome *Charaxes* is entirely new to the Museum: I believe the male has hitherto been unique in the Rothschild collection, and the female is quite new.

7. *CHARAXES ROSEÆ*.

Charaxes roseæ, Butler, P. Z. S. 1895, p. 255.

♂. Ruarka River, 5500 feet, April 29, 1900.

Mr. Crawshay has inadvertently labelled this as a female; he says of it:—"I think an insect well known to me in days gone by in B. C. A.; taken feasting on the mud." As we have males from Zomba, it is possible that Mr. Crawshay may have seen it; but the only male which he sent home was of the allied *C. manica*, which differs above in having subapical spots on the primaries, and below in its much more glossy paler surface and less defined markings.

Although Prof. Aurivillius is of opinion that the group of *Charaxes* with black males cannot be separated into well-defined species by either sex, I have never found much difficulty in pairing the sexes since we have possessed a good series of specimens from various parts of Africa. I feel confident that when these species come to be bred, the males will be found to be more constant to

their slight differences than the females to their greater ones; this is certainly the case with *C. guderiana* and *C. hollandi*, of which we possess long series. Breeding only can decide this.

8. CHARAXES CANDIOPE.

Nymphalis candiope, Godart, Enc. Méth. ix. p. 353 (1823).

Ruarka River, 5500 feet, Kikuyu, April 15 & 22, 1900.

"By great good luck, I came upon some six or seven of these, usually very difficult to take, insects feasting vigorously on the moist ground bordering on the stream, and was able to secure five—four of them are absolutely perfect." (*R. C.*)

Unfortunately by the time these specimens reached me one of them had lost the tips of both antennæ; one of the remaining three also when set proved not to be absolutely perfect, two chips having been snapped out of the right hind wing, apparently by a bird; nevertheless, considering how rarely it is possible to get perfect specimens of this butterfly, those obtained by Mr. Crawshay are wonderfully good.

9. CHARAXES ZOOLINA.

Nymphalis zoolina, Westwood in Gen. Diurn. Lep. pl. 53. fig. 1, ♀ (1850).

♂ ♀, Ruarka River, April 22, 1900.

The male was obtained when at rest on the mud sucking up the moisture, the female by a lucky stroke of the net as it dashed past Mr. Crawshay in the forest; the latter contained "sea-green spherical ova."

10. PRECIS SESAMUS. (Plate LVIII. fig. 1.)

Precis sesamus, Trimen, Trans. Ent. Soc. London, 1883, p. 347.

Wet phase.—♂ ♀. Nairobi plains, April 14, 1900.

Intermediate phase.—♀. Nairobi plains, April 20, 1900.

Dry phase.—♂ ♂. Nairobi plains, April 22 & 29, 1900.

Of the intermediate phase, Mr. Crawshay rightly says:—"The blue mingling with the scarlet of this insect is, I think, unusual." Mr. Trimen has, indeed, figured an intergrade between the wet and dry phases, but it is by no means so palpably an intermediate form as that now secured by Mr. Crawshay, which is certainly the most convincing bit of evidence of the specific identity of the two extreme phases that I have ever seen, and as such is well worthy of illustration. The Oxford Museum possesses a similar example.

It will of course be noted that all three forms of this species were secured in the same month and therefore could hardly be spoken of correctly as seasonal forms; they represent the forms prevalent at certain seasons, but are not as yet exclusively confined to those seasons: for this reason I prefer to use the term "seasonal phase."

11. *PRECIS CLOANTHA*.

Papilio cloantha, Cramer, Pap. Exot. iv. p. 93, pl. cccxxxviii. A, B (1781).

♂, Nairobi plains, 5400 feet, April 12, 1900.

12. *PRECIS PYRIFORMIS*.

Junonia pyriformis, Butler, P. Z. S. 1895, p. 726, pl. xlvi. figs. 5, 6.

♂, Roromo, Kikuyu forest, Jan. 12, 1900.

"A very ragged specimen; none the less welcome, as the only one of this species I have come across in these parts." (*R. C.*)

Mr. Crawshay might have added "or anywhere else," for there is not the least doubt in my mind that it is quite distinct from *P. milonia* of the West Coast and *P. tugela* of the South and East. The specimen now sent, although sufficient for identification, is unfortunately too much shattered for the cabinet.

13. *PRECIS ELGIVA*.

Junonia elgiva, Hewitson, Exot. Butt., Jun. pl. 1. fig. 1 (1864).

♂, ♀ ♀, Nairobi forest, March 2, 20, & 25, 1900.

"Distinctly arboreal in its haunts and living in the shade of the forest; plentiful and very easily taken, as its flight is generally only a few yards at a time and low, within two or three feet of the ground." (*R. C.*)

14. *PRECIS CEBRENE*.

Precis cebrene, Trimen, Trans. Ent. Soc. 1870, p. 353.

♀, Roromo, Kikuyu forest, Feb. 6, 1900.

"Common enough elsewhere, but not so here, as I have seen only some eight or ten since I have been in these parts. Taken by my servant Mapeyani. Emerald-green ova, spherical and very small." (*R. C.*)

15. *PRECIS CLELIA*.

Papilio clelia, Cramer, Pap. Exot. i. p. 33, pl. xxi. E, F (1775).

♂, Nairobi, March 5, 1900.

"A common insect enough, but a most perfect specimen." (*R. C.*)

16. *HYPANARTIA SCHÆNEIA*.

Hypanartia schæneia, Trimen, Trans. Ent. Soc. London, 1879, p. 329.

♂, ♀, Roromo, Kikuyu forest, 7700 feet, Jan. 7 and March 24 1900.

"Grass-green spherical ova semi-developed." (*R. C.*)

Mr. Crawshay asks: "How many species of these African Admirals are there?—three in this neighbourhood, I think." I believe he is correct, although it has been said that *H. hippomene* is only a seasonal phase of the present species. The third species is a true Admiral (a *Pyrameis* near to *P. atalanta*). In W. Africa

there are one or two other *Hypanartias* allied to the present species and two more occur in Madagascar and Mauritius.

17. HYPANARTIA HIPPOMENE.

Hypanartia hippomene, Hübner, Samml. exot. Schmett. ii. pl. 25. figs. 3, 4 (1806).

Roromo, Nov. 24, 1899; Ruarka River, 5500 feet, April 27, 1900.

Of the five examples taken at Roromo, Mr. Crawshay writes:—"Very common in the openings in the forests or on the outskirts, and seldom seen singly, but in little colonies of three or four to half a dozen.

"During the hot hours of the day, these insects are extremely lively—chasing and tilting with one another in mid-air, and dashing off for a short swift flight of fifteen or twenty yards or so, to return and perch on some favourite tree-trunk or leaf, or more rarely on the ground, only, after a brief rest, to be off again to continue their play." Of the last specimen he says: "Just this single example seen. Rather surprising to find this species at—for these parts—so low an altitude."

18. PROTOGONIOMORPHA ANACARDII.

Papilio anacardii, Linnæus, Mus. Lud. Ulr. p. 236 (1764).

Ruarka River, 5500 feet, Kikuyu, April 25, 1900.

"The only specimen I have come across in Kikuyu. By great good luck taken at rest on the mud, sucking away voraciously at the moisture." (*R. C.*)

19. PYRAMEIS ABYSSINICA.

Pyrameis abyssinica, Felder, Reise der Nov., Lep. p. 397 (1867).

♂, ♀, Roromo, Kikuyu, Nov. 23 & 26, 1899.

"Here and there this insect is met with singly and in pairs, its favourite haunt being the bare ground, which forms its favourite perch. Dull-looking and hard to follow on the wing, and of short low flight, skipping from place to place and never going far at a time. Grass-green spherical ova." (*R. C.*)

20. PYRAMEIS CARDUI.

Papilio cardui, Linnæus, Syst. Nat. ed. 12, i. p. 774 (1767).

♂, ♀, Roromo, Kikuyu forest, Dec. 16, 1899; ♂ (starved), Nairobi plains, 5400 feet, March 31, 1900.

"The commonest and most ubiquitous butterfly in these parts; seen anywhere and everywhere and in all stages of its imago existence, from newly emerged to the most ragged and featherless specimen." (*R. C.*)

Of the starved male Mr. Crawshay says—"The smallest 'Painted Lady' I think I have ever seen." It certainly is small—the smallest African example I have seen,—but we have specimens from India and one from Colorado of the same size.

21. *PANOPEA EXPANSA*.

Panopea expansa, Butler, Ann. N. H. (5) ii. p. 177 (1878).

♀, Ruarka River, April 22; ♂♂, April 25 & 29, 1900.

"A graceful insect, both when on the wing and when at rest fanning its wings. This (♀) and the succeeding number were taken on the wing with a single stroke of the net when chasing one another round and round over my head. It is an active insect of rapid gliding flight. I have some recollection of having taken this butterfly, or one very nearly resembling it, in the Mweru country in 1891-1892. Dark yellow spherical ova." (R. C.)¹

The specimens now sent prove the correctness of Prof. Aurivillius's decision as to *P. tarquinia* being the male of *P. expansa*.

It has been suggested that *P. heliogenes* from Nyasa is the female of *P. tarquinia*; but the pattern of the primaries seems to me to differ too much for this to be correct, and I note that Prof. Aurivillius regards the two as distinct.

22. *HYPOLIMNAS MISIPPUS*.

Papilio misippus, Linnæus, Mus. Lud. Uhr. p. 264 (1764).

♀, Nairobi plains, March 29; ♂, April 14, 1900.

♀. "Common, though not in such numbers as is generally the case in localities where it is found." ♂. "The males of this species are distinctly in the minority here. For ten females I doubt if I see one male." (R. C.)

23. *HAMANUMIDA DÆDALUS*.

Papilio daedalus, Fabricius, Syst. Ent. p. 482 (1775).

♂, Ruarka River, 5500 feet, April 27, 1900.

"Three weeks or so ago I did not remark a single fresh specimen of this butterfly." (R. C.)

24. *CRENIS BOISDUVALLI*.

Crenis boisduvalli, Wallengren, Kongl. Sven. Vet.-Akad. Handl., Lep. Rhop. Caffr. p. 30 (1857).

Nairobi plains, 5400 feet, March 29, 1900.

"This is an insect which I think I took on my journey to the S.W. slopes of Mt. Kenya in 1898-1899. It somewhat surprises me therefore to find it here. By luck I came on this specimen in the early morning when not very lively. Its favourite perch seems to be a tree-trunk, where it sits generally head downwards. It is an active insect, of short, rapid, skipper-like flight." (R. C.)

25. *LACHNOPTERA AYRESII*.

Lachnoptera ayresii, Trimen, Trans. Ent. Soc. London, 1879, p. 326.

♂♂, ♀♀, Ruarka River, 5500 feet, April 27, 1900.

¹ It was *P. heliogenes*.—A. G. B.

Of the four males Mr. Crawshay writes:—"I am somewhat puzzled to know whether this and the three following specimens are or are not identical as species with the two foregoing insects. I am inclined to think *not*, as not only are their markings different, but the former are larger than the latter." Of the two females (which are the larger and differently marked specimens referred to in the preceding note) one example is much shattered, and Mr. Crawshay thinks it "has probably weathered several seasons."

26. ATELLA PHALANTHA.

Papilio phalantha, Drury, Ill. Exot. Ent. i. pl. xxi. figs. 1, 2 (1770).

Roromo, Kikuyu forest, Jan. 12, 1900.

"Elsewhere a common enough species. Here not common nor easily taken, since it is always travelling in desperate haste, with its swift, straight flight, turning neither to the right nor the left." (R. C.)

27. ARGYNNIS HANNINGTONI.

Argynnis hanningtoni, Elwes, Trans. Ent. Soc. London, 1889, p. 558.

Itugi, 7400 feet, Kikuyu, Oct. 2; Loromo, 7700 feet, Oct. 5; Roromo, Nov. 11, 23, 30, 1899.

The series of this interesting species now sent home by Mr. Crawshay fully bears out the constancy of the characters upon which I distinguished my *A. excelsior*. Considering that our series of the latter consists of eleven specimens from Ruwenzori, all showing the same characteristic differences of form and colouring, I cannot comprehend the meaning of the term "variety" as applied to it by Aurivillius; if he had said local, or representative form, it would have been comprehensible, but to my mind a variety is a sport coexisting with the typical form.

28. NEPTIS AGATHA.

Papilio agatha, Stoll in Cramer's Pap. Exot. iv. pl. cccxxvii. A, B (1782).

♂ ♀, Ruarka River, 5500 feet, April 27, 1900.

29. NEPTIS TRIGONOPHORA.

Neptis trigonophora, Butler, Ann. N. H. (5) ii. p. 177 (1878).

Var. *Neptis lermanni*, Aurivillius, Öfvers. Vet.-Akad. Förbandl. liii. p. 431 (1896); Rhop. Æthiop. pl. 1. fig. 8 (1898).

♂, Ruarka River, 5500 feet, April 27, 1900.

My type has a smaller white patch in the discoidal cell of primaries than that figured by Prof. Aurivillius; but this is clearly a variable character, as the specimen obtained by Mr. Crawshay shows no discoidal patch on the upper surface.

30. NEPTIS MARPESSA.

Neptis marpessa, Hopffer, Mon. k. Ak. Wiss. Berl. 1855, p. 640; Reise n. Mossamb., Ins. p. 383, pl. xxiv. figs. 9, 10 (1862).

♂♂, Nairobi forest, March 20; Ruarka River, 5500 feet, April 15 & 27, 1900.

The first specimen obtained was much faded, and Mr. Crawshay thought he detected embryo ova in the abdomen; it, however, possesses the front legs and prehensores of a male, together with the curved inner margin of primaries and pale sericeous costa of secondaries characteristic of this sex.

31. NEPTIDOPSIS OPHIONE.

Papilio ophione, Cramer, Pap. Exot. ii. p. 27, pl. cxiv. E, F (1777).

Ruarka River, April 25, 1900.

"By no means common; perhaps I have seen altogether three to-day." (R. C.)

32. EURYTELA HIARBAS.

Papilio hiarbas, Drury, Ill. Exot. Ent. iii. p. 17, pl. 14. figs. 1, 2 (1782).

♀, Nairobi forest, Kikuyu Escarpment, March 9, ♂ 18 & 20; ♂♀, Ruarka River, April 25 & 27, 1900.

"This is an insect I recollect seeing when accompanying the expedition to recover poor Capt. Harland's remains in May 1898. On the wing the combination of black and white lead one to think the specimen is blue, not white.

"An insect calculated to wear out the patience of anyone: it will dart round and over a clump of bush for twenty minutes or half an hour without resting, and then go off, as a rule, without having given one a chance to effect its capture after waiting and watching its gyrations in fear and trembling all that time." (R. C.)

Of the third example taken Mr. Crawshay writes:—"At last a perfect specimen of this lovely but difficult butterfly to take. By great good luck netted on the wing when skimming along past me so fast that I could hardly follow it with my eyes."

In six of the eight specimens captured by Mr. Crawshay the band on the primaries is narrower than in any of our Southern examples; but one damaged example (the first taken) has the white band of both wings nearly as wide as in Western examples; *E. angustata*, therefore, can only be regarded as a variety, not a strictly local form.

33. EURYTELA DRYOPE.

Papilio dryope, Cramer, Pap. Exot. i. p. 125, pl. lxxviii. E, F (1775).

♂♂, Nairobi forest, March 20, 1900.

"Fairly common, but always gyrating and skimming closely

over and round the bushes and so difficult to take: finally I have got the better of them by going after them in the afternoon, when they are tired with their day's play and so inclined to rest." (*R. C.*)

One perfect example was chased for ten minutes before it could be captured.

34. BYBLIA ILITHYIA.

Papilio ilithyia, Drury, Ill. Exot. Ent. ii. pl. xvii. figs. 1, 2 (1773).

♀, Roromo, Kikuyu forest, Jan. 12; ♂, Ruarka River, April 25, 1900.

Of the female Mr. Crawshay writes:—"An insect unknown to me, I think"; and of the male:—"A new arrival on the scene; until the last day or two I have not come across one."

35. BYBLIA GOETZIUS.

♀. *Papilio goetzius*, Herbst, Natursyst. Schmett. ix. p. 193, pl. 258. figs. 3, 4 (1798).

♂, Ruarka River, April 25, 1900.

I quite agree with Prof. Aurivillius that *B. vulgaris* is only a variety of this species and *B. acheloia* the dry form; but I regard *B. castaneu*, *boydi*, and *anvatara* as representative species: I am quite sure that the last two are so, whatever *B. castanea* may prove to be.

36. ACRÆA ALICIA.

Acræa alicia, E. M. Sharpe, Ann. N. H. (6) v. p. 442 (1890).

♀, Nairobi forest, March 18; ♂♂, Ruarka River, 5500 feet, April 15, 1900.

Of the female Mr. Crawshay says:—"The only one of its kind I have seen here. This insect does not succumb to 90 per cent. cyanide in an hour—cyanide which suffocates every other Lepidopteron in 25 to 30 seconds." Of the male he writes:—"Simply in swarms on the mud on the rocks in the bed of the stream; dies very hard in the cyanide-bottle."

We have so few examples of this pretty species that I much regret the fact that only the female noted above, two good males, and one which lost its antennæ on the journey, were sent home.

37. ACRÆA ENCEDON.

Papilio encedon, Linnæus, Syst. Nat. ed. 10, i. p. 488 (1758).

♀, var. *lycia*, Fabr., Nairobi plains, 5400 feet, May 4, 1900.

"Unfortunately, with my fingers shaky after a night's fever, I have destroyed one of the antennæ when pinching this specimen—all the more regrettable as I do not know this *Acræa* unless it be a variety of some known species." (*R. C.*)

Var. *daira*, Godm., ♂♂, ♀, Nairobi plains, March 28, May 4, 1900.

"Plentiful on the grass-land round my tent these days, newly

emerged after the incessant rains. This is a graceful insect in its flight—alternately flapping its wings and skimming along in its flight, very differently to other *Acræinæ*.” (*R. C.*)

38. *ACRÆA CÆCILIA*, var. *STENOBEA*.

Acræa stenobea, Wallengren, Wien. ent. Monatschr. 1860, p. 35.

♀, Nairobi plains, April 14, 1900.

“Dark yellow oblong ova.” (*R. C.*)

This appears to be a second female form of *A. stenobea*, of which *A. ligus* seems to be the more typical female; excepting in the narrow border to the primaries, this new form much resembles the commoner female of *A. caldarena*, but the arrangement of the spots is as in *A. stenobea*.

39. *ACRÆA ACRITA*, var. *PUDORINA*.

♂, Nairobi plains, 5400 feet, March 29, 1900.

“Common round my tent on the plains.” (*R. C.*)

Females of this species (no. 440) are much needed for the Museum collection; of *A. pudorina* we possess only one of the dark variety of female, and of typical *A. acrita* the same; we have several females of *A. pudorina* resembling the male in colouring, but they are not in good condition.

40. *ACRÆA NEOBULE*.

Acræa neobule, Doubleday, Gen. Diurn. Lep. pl. xix. fig. 3 (1848).

♂, Nairobi plains, April 14, 1900.

“Common, and fond of perching on a violet-coloured ‘Devil’s-bit’ like flower which grows on the plains.” (*R. C.*)

41. *ACRÆA QUIRINA*.

Papilio quirina, Fabricius, Spec. Ins. ii. p. 36 (1781).

♂, ♀, Ruarka River, 5500 feet, April 27, 1900.

“All these *Acræinæ* were taken in the gloom of the forest, flitting about feebly and settling on the bushes. Spherical yellow ova.” (*R. C.*)

42. *ACRÆA INSIGNIS*, var. *BALBINA*.

Acræa balbina, Oberthür, Etud. d’Ent. xii. p. 6, pl. 3. fig. 8 (1888).

Roromo, Kikuyu forest, Feb. 18 & 27, 1900.

“I have achieved the capture of this remarkable insect after having seen some three or four during the past ten days without being able to get on level terms with one of them. This *Acræa* frequents primæval forest: rather unusual for members of the genus, I should think.”

“Half an hour has this insect retained its senses in the fumes

of strong cyanide, which renders almost every other butterfly and moth senseless in less than thirty seconds. *Acræinæ* have this peculiar to them, I have always observed." (*R. C.*)

LIBYTHÆIDÆ.

43. LIBYTHEA LABDACA.

Libythea labdaca, Westwood, Gen. Diurn. Lep. p. 413 note, pl. lxxviii. fig. 6 (1851).

Ruarka River, 5500 feet, Kikuyu, April 25; Nairobi plains on outskirts of forest, April 25, 1900.

"An insect quite new to me, taken sitting on a rock on the banks of the stream." (*R. C.*)

Best known as a West-African species and hitherto unrecorded, I believe, from Eastern Africa.

LYCÆNIDÆ.

44. ALCÆIDES TAIKOSAMA.

Cigaritis taikosama, Wallengren, Kongl. Svenska Vet.-Akad. Handl., Lep. Rhop. Caffr. p. 43 (1857).

♂, ♀, Nairobi plains, April 1 & 14, 1900.

Of the female, which was first taken, Mr. Crawshay writes:—"I do not recognize this 'Copper' as an insect known to me. It was taken when I was out shooting, and I fear became very much knocked about during a long day's tramp." Of the male he says:—"Found on the path on its side almost dead after a shower of rain."

Although well known as a South African insect, these are the first examples of it I have seen from British East Africa.

45. CHRYSOPHANUS ABBOTTII.

Chrysophanus abbotii, Holland, Entomologist, xxv. suppl. p. 90 (1892); Proc. U.S. Nat. Mus. xviii. p. 240, pl. 7. fig. 4 (1895).

♂, ♀, Roromo, Kikuyu, Nov. 23 and Dec. 16, 1899.

On the under surface this bright little species scarcely differs at all from highly coloured examples of *C. phleas*.

46. TERIOMIMA ASLAUGA.

D'Urbania aslauga, Trimen, Trans. Ent. Soc. London, 1873, p. 117; S. Afr. Butt. p. 220, pl. ix. figs. 9, 9a (1887).

♂♂, Kiu, 5200 feet, April 11, 1899; Nairobi forest, 5400 feet, March 18 and April 5, 1900.

Of those taken at Kiu, Mr. Crawshay says:—"Newly emerged these last two days." Of the later captures, which are more heavily marked and therefore more typical, he says:—"Hardly did I expect to find this species at such an altitude. Hitherto I have not seen it this side of Kiu, where on the flowering *Mimosa* it abounds."

We previously possessed one shattered example, which I identified (from Maranga) as *T. pallida*, Trimen; but when my friend Trimen saw it this year, he told me that he believed it to be *T. aslauga*; and, as he ought to know more about his own species than I, this identification is admitted in the present paper: undoubtedly the examples from the Nairobi forest are much like the figures of *T. aslauga*. The chief difference I note in the figures of the two species is in the width of the outer border of the primaries, which in *T. pallida* is reduced below the apical triangular patch to a mere line. Judging by the much greater variability of *T. hildegarda*, I somewhat doubt the validity of *T. pallida* as a distinct species.

47. PILODEUDORIX CÆRULEA.

Deudorix cærulea, H. H. Druce, Ann. Nat. Hist. (6) v. p. 28 (1890).

♂, Nairobi forest, March 20, 1900.

"A lovely 'Blue,' which I do not recollect having taken or seen before." (*R. C.*)

This is a wonderful extension of the range of an apparently rare *Lycaenid*. Mr. Trimen recorded it from the south-east (Minene valley) in 1894; but previously it had, I believe, only been known from Western Africa.

48. MYRINA FICEDULA.

Myrina ficedula, Trimen, Trans. Ent. Soc. London, 1879, p. 324.

♀ (shattered), Ruarka, 5500 feet, April 25; ♂♂, plains bordering Mundu muha River, 5600 feet, April 29; ♀, Nairobi plains, 5400 feet, May 3, 1900.

♀. "Pale emerald-green spherical ova, probably a second, if not a third laying."

♂. "This stoutly built 'Blue' shows a marked preference for the dwarf wild fig-trees which occur here and there on the plains bordering on the forest. For pugnacity I have never come across the equal of this butterfly: selecting the outermost leaf of an outstanding top branch as his perch, he dashes down and attacks any other butterfly coming near him, returning always to his one particular perch."

♀. "In the abdomen I found one solitary ovum. This is, I think, the identical insect which has frequented the vicinity of my tent for the last three weeks without my being able to capture her." (*R. C.*)

49. MYRINA DERMAPTERA.

♀. *Loxura dermaptera*, Wallengren, Kongl. Svensk. Vet.-Akad. Handl. 1857, Lep. Rhop. Caffr. p. 34.

♂, Plains bordering Mundu muha River, 5600 feet, April 29, 1900.

"This butterfly was taken on the same fig-tree as the preceding species and its habits are almost identical. I saw also a second example which I could not secure." (*R. C.*)

We previously possessed only one female of this species: it is new from Eastern Africa.

50. *ARGIOLAUS CRAWSHAYI*, sp. n. (Plate LVIII. fig. 3.)

♀. Nearest to *A. trimeni*; of a more glistening and bluer tint than in the female of that species, and with no trace of white in the primaries, but the median vein and its branches more thickly blackish-scaled; secondaries with the costa and first two internervular spaces decreasingly whitish, the veins dividing them blackish, the outer border about as broadly blackish as in *A. lalos*, with two subconfluent orange spots close to its inner edge towards anal angle; fringe grey tipped with white; tails black with basal fringe and tip white; anal lobe white with two black spots; above, and almost touching the latter, a blood-red spot irrorated with pale blue; abdominal area smoky greyish brown; body similar to that of *A. silas*. Underside chalky white, slightly sericeous; the primaries with dusky tipped fringe; two ill-defined submarginal blood-red dashes indicating a submarginal line on median interspaces: secondaries with an externo-discal blood-red stripe, angled on subcostal and second median veins, terminating on first median branch, where it is confluent with a tiny patch of blood-red and opaline blue scales (probably indicating the second red spot of *A. silas*); anal spot black, crowned by two blood-red crescents and an opaline blue intervening crescent; above this anal spot are a few scattered irregular black lines and dots; an indistinct smoky-grey line varied with black, from the median vein backwards, near and parallel to outer margin; tails as above: body below white. Expanse of wings 41 millimetres.

♀, Kikuyu, 6800 feet, Oct. 11, 1899.

I have been through the descriptions and figures of the known species, but can find nothing agreeing with the above.

51. *EPAMERA SIDUS*.

Iolus sidus, Trimen, Trans. Ent. Soc. London (3) ii. p. 176 (1864); Hewitson, Ill. Diurn. Lep. pl. 20. fig. 25 (1865).

♀ (fragment), Roromo, 7700 feet, March 22, 1900.

"It is not an uncommon occurrence for me to be robbed of intended victims to the cause of entomology by the many Flycatchers of as many species which inhabit the trees in our zariba. In this instance, however, I robbed the Flycatcher of his prey: he was pursuing the 'Blue' heading downwards from a tree above, snapping pieces out of her, when—as he was at the insect on the ground—I drove him off and secured the 'Blue,' or rather her mangled remains. Orange spherical ova." (*R. C.*)

We want a series of this species badly, but the above is too much damaged for the cabinet.

52. *EPAMEBA ARBORIFERA*, sp. n. (Plate LVIII. fig. 2.)

Size, colouring, and general aspect above of *E. mimosæ*, the primaries with straighter outer margin and broader outer border, the secondaries also with blacker and broader marginal markings, the patch between the second and third tails being large and crossed by a broad white bar: below the wings remind one somewhat of *E. aphnæoides*, *diametra*, and *æmulus*, being pure glistening white; the primaries with five black-edged mahogany-red bands, of which the first two are short and cross the discoidal cell, the third discal, extending to first median branch, the fourth submarginal and the fifth marginal; fringe black, tipped with brown: in the secondaries are seven bands branching from one root above the anal lobe; the first is slender and borders the lower half of the abdominal area, the second runs inwards obliquely parallel to the first, the third and fourth fork in the form of a Y from the latter, the inner ramus curving round at the base, the outer one passing to costa; the fifth band extends from the root across the disk obliquely to the middle of costa; the sixth is submarginal, its black border becoming confluent with that of the seventh, which is marginal and has its first two divisions crescentic and white, only becoming red above the first tail; anal lobe black, enclosing a pale blue dash, which passes into the white of the marginal band; abdominal fringe and intercaudal fringes white; tails black, tipped with white; fringe from first tail to apex grey-brown: body below white, the face mahogany-red; antennæ black, white-ringed, tip of club mahogany-red; palpi black above, white below, excepting the third joint; venter with longitudinal reddish ochreous line. Expanse of wings 32 millimetres.

♂, Roromo, Kikuyu, Nov. 26, 1899.

"This lovely insect was taken by my servant Bvalamkombi sitting on a twig, after a rainy morning, and I suppose only just emerged." (R. C.)

E. arborifera is certainly one of the most beautiful novelties which Mr. Crawshaw has sent home.

53. *LYCÆNESTHES LEMNOS*.

Lycænesthes lemnos, Hewitson, Ill. Diurn. Lep. p. 221, pl. 90. figs. 13, 14 (1878).

♂♂, Rungayi, 6700 feet about, March 21; Ruarka River, April 25, 1900.

"This 'Blue,' be it noticed, has three pairs of tails—which I have never before remarked in any butterfly I have ever taken. By the merest chance I took this 'Blue' on the railway-line while the locomotives were stopping to water. A perfectly lovely blue." (R. C.)

54. *LYCÆNESTHES DEFINITA*.

Lycænesthes definita, Butler, Ann. N. H. (7) iv. p. 342 (1899).

♂, Fort Smith, Kikuyu, June 25, 1899.

"A lovely insect, not known, new to me; I have seen, I think, one or two before." (*R. C.*)

We received a single female from Mr. Crawshay in 1896 which was identified as *L. hodes* (the name under which this species then stood in collections); a male was received in the last collection from the Kikuyu country between Machakos and Neungia: therefore Mr. Crawshay is quite correct.

55. URANOTHAUMA CORDATUS.

Hyreus cordatus, E. M. Sharpe, P. Z. S. 1891, p. 636, pl. xlviii. fig. 4.

♂ ♂, Roromo, Dec. 14, 16, 17, 1899; Jan. 12, 1900.

"On first seeing this insect with its wings closed and after hastily examining the inside of its wings, I took it to be the *Uranothauma* from the Nyika Mountains in British Central Africa. But I see it is *not* identical: it is smaller and differs widely in its mode of flight and habits. Its flight is low, irregular, and jerky, skimming the ground within a few inches: its favourite perch is the bare ground. It is a difficult insect to follow with the eye when on the wing."

It is an odd thing that all the examples of this genus now sent home by Mr. Crawshay are males.

56. URANOTHAUMA ANTINORII.

Lycena antinorii, Oberthür, Ann. Mus. Genov. xviii. p. 731, pl. ix. fig. 3 (1883).

♂ ♂, Ruarka River, 5500 feet, April 15, 22, 25, 1900.

"A lovely little 'Blue,' new to me." (*R. C.*)

It is also quite new to the Museum and to me; Oberthür's figure gives no idea of its colouring or the darkened central area on the upper surface of the wings. Oddly enough, this species seems to differ from the other species of *Uranothauma* in not possessing any distinctly thickened scales on the primaries; in this respect it comes nearest to *U. falkensteini*, in which the androconia appear to be confined to the veins. On the under surface the markings indicate affinity to *U. crawshayi*.

57. URANOTHAUMA FALKENSTEINI.

Plebeius falkensteini, Dewitz, Nova Acta Acad. Nat. Cur. xli. 2, p. 204, pl. xxv. fig. 5 (1879).

♂ ♂, Roromo, Kikuyu forest, Dec. 16 & 17 (1899); Ruarka River, 5500 feet, April 22, 1900.

"An insect I do not know; another specimen also seen." (*R. C.*)

58. CACYREUS PALEMON.

Papilio palemon, Cramer, Pap. Exot. iv. p. 209, pl. cccxc. E, F (1782).

♂ ♂, Roromo, Dec. 16, 1899.

"A lovely little insect with the sun on its open wings." (*R. C.*)

59. *CASTALIUS MARGARITACEUS*.

Castalius margaritaceus, E. M. Sharpe, P. Z. S. 1891, p. 636, pl. xlvi. fig. 3.

♂ ♀, Kiambu, 5600 feet, April 29, 1900.

“Just the two examples seen and taken.” (*R. C.*)

This is a species of which we much need specimens.

SYNTARUCUS, gen. nov.

The species of this genus have hitherto been incorrectly associated with *Tarucus* (which contains *T. theophrastus* and allies); it is characterized by hairy eyes, the costal and subcostal of primaries approximated but not fused; secondaries with a single tail at extremity of first median branch. Type *S. telicanus*.

60. *SYNTARUCUS TELICANUS*.

Papilio telicanus, Lang, Verz. Schmett. ii. p. 47 (1789).

♀ ♀, Roromo, Nov. 26, 1899; Nairobi forest, March 20, Nairobi plains, April 14; ♂, Ruarka River, April 25, 1900.

Of the last female obtained Mr. Crawshay says:—“A new arrival with the rains, I think”; the female obtained on March 20 was taken on the edge of the forest.

61. *AZANUS MORIQUA*.

Lycena moriqua, Wallengren, Kongl. Svensk. Vet.-Akad. Handl. 1857, Lep. Rhop. Caffr. p. 39.

♂ ♂, Ruarka River, April 22, 1900.

“Taken perching on a rock on the brink of the stream.” (*R. C.*)

62. *CYCLYRIUS SHARPLE*, sp. n. (Plate LVIII. figs. 4, 5.)

Hyreus equatorialis, Butler, P. Z. S. 1894, p. 567.

♀ ♀, Roromo, Oct. 7; ♂ ♂, Nov. 23 and Dec. 16, 1899.

I was evidently in error in supposing that this species was a variety of *C. equatorialis*, E. M. Sharpe; it appears to be quite constant and more nearly related to *C. juno*, whereas Miss Sharpe's insect (which we received from Ruwenzori in the Scott-Elliott collection) is related to *C. noquasa*.

The present species nearly resembles *C. noquasa* on the upper surface, but is usually rather larger; the males of a richer violet colour with more sharply defined borders, that of the secondaries rather broader; fringes checkered; occasionally there is a small ocelloid subanal spot on the secondaries; on the under surface the pattern is much like that of *C. juno*, but the primaries are longer and the band across the middle of the secondaries is straighter, broader on abdominal margin and tapering to the costa. Expanse of wings 23–27 millimetres.

I have named this pretty little species after Miss Emily Sharpe, whose careful work on the Butterflies of Africa is well known.

63. SCOLITANTIDES STELLATA.

Lycæna stellata, Trimen, Trans. Ent. Soc. London, 1883, p. 349.
Fort Smith, June 25; Roromo, 7800 feet, Dec. 17, 1899,
Jan. 12, 1900.

"I recognize this as the little insect I took at Ngong, where it is very plentiful.

"Taken on the railway-line in the midst of thick forest on either side. I have not previously remarked a specimen of this insect at this altitude (7800 feet).

"Here and there a solitary specimen seen; not, as at Ngong, where sometimes six could be taken with a single stroke of the net." (*R. C.*)

Mr. Crawshay evidently only sent us his best examples, or else we returned a series to his brother; we have five specimens from Ngong.

64. POLYOMMATUS BÆTICUS.

Papilio bæticus, Linnæus, Syst. Nat. ed. 12, i. p. 789 (1767).

♂♂, Roromo, Dec. 17, 1899; Jan. 21, 1900.

"An insect of irregular fluttering flight, fond of hovering low over moist ground, but, if once missed, very difficult to take." (*R. C.*)

65. ZIZERA GAIKA.

Lycæna gaiika, Trimen, Trans. Ent. Soc. (3) i. p. 403 (1862).

♂, Nairobi, 5400 feet, March 17, 1900.

"Taken on the open plain, half a mile from Nairobi railway-station." (*R. C.*)

For many years we have had an example of this species in the Museum labelled as received from Pernambuco; I doubted the correctness of this locality, but M. de Johannis has shown me a second example which he said he knew to have been undoubtedly received from Brazil.

66. CHILADES TROCHILUS.

Lycæna trochilus, Freyer, Nœnere Beitr. Schm. v. p. 98, pl. 440. fig. 1 (1844).

Nairobi plains, 5400 feet, April 24, 1900.

PAPILIONIDÆ.

67. MYLOTHRIS RUBRICOSTA.

Pieris rubricosta, Mabille, Ann. Soc. Ent. France, (6) x. p. 28 (1890); Nov. Lep. viii. p. 61, pl. 10. fig. 3 (1892).

♀, Nairobi plains, 5400 feet, March 28, 1900.

Mr. Crawshay took this for a small example of the common *M. agathina*; it is quite new to our collection, though a smaller example agreeing more nearly with M. Mabille's figure stands in the Hewitson collection.

68. MYLOTHRIS NEUMANNI.

Mylothris neumanni, E. M. Sharpe, Ann. N. H. (6) xvii. p. 125 (1896); id. Neumann's Elephant Hunting, p. 444, plate (facing p. 66), figs. 1, 1 a, 2, 2 a (1898).

♂ ♂, ♀ ♀, Roromo, 7800 feet, Jan. 27 & 29; Feb. 6, 7, 10, 15, 17, 18; March 24, 1900.

Of the first females captured Mr. Crawshay writes:—"I think, on opening the abdomen, I have found and taken out a quantity of what appear to be partially developed ova of a young leaf-green colour."

A pair *in coitu* was taken on Feb. 6th. A female was captured by Bvalamkombi, Mr. Crawshay's "faithful follower," on Feb. 10.

Of the last example captured Mr. Crawshay writes:—"After several months' incessant rain this insect is fairly plentiful, though difficult to get within reach of owing to its absolutely arboreal habits, and perfect specimens are now practically impossible to obtain; the enclosed is the only decent specimen of four netted." (*R. C.*)

Among the examples previously secured were several magnificent specimens.

Although this species shows a fair amount of variation as regards the size of the white markings of the primaries, not one of the specimens could, by any possibility, be confounded with any of the other quite distinct species which Prof. Aurivillius has associated together as variations of *M. narcissus*: it comes nearest to *M. dentatus* (of which the insect referred to *M. narcissus* is perhaps the true female, the male *M. narcissus* being distinct and more nearly related to *M. jacksoni* and *swaynei*; but of this I cannot be sure until females have been received from Nyasaland); the costal margin of the primaries, however, is constantly and very perceptibly shorter in *M. neumanni* ♂ than in *M. dentatus* ♂, and the white on the primaries, when most developed in this sex, consists only of four subconfluent internervular fusiform dashes, the veins encircling the discoidal cell being also white; in some males these dashes are small and slender, leaving the primaries almost entirely black.

The secondaries of the female vary on the under surface to ochreous, and in some examples a tint of buff shows on the upper surface; this tends to indicate that *M. knutsoni*, Aurivillius, may be only a slight colour-variation of *M. jacksoni* (from which its describer says that it can scarcely be distinguished excepting in its ochraceous yellow posterior wings). We have a female of *M. trimenia* in which the secondaries are ochreous above, but whether this is constant or not I cannot say; the under surface of these wings in the males is certainly variable in this respect.

With regard to *M. crawshayi*, which Prof. Aurivillius thinks may be an aberration, it is the best defined species of this group, having more nearly the outline and general aspect of the species for which I founded the genus *Phrissura*, though with the neurulation of *Mylothris*; we have five males and one female, and they do not vary in the least.

69. NYCHITONA MEDUSA, var. ALCESTA.

Papilio alcesta, Cramer, Pap. Exot. iv. p. 175, pl. cclclxxxix. A (1781).

Nairobi forest, March 20; Ruarka River, 5500 feet, April 27, 1900.

"An old friend, I think from Tana River; the first of its species I have seen in these parts." (R. C.)

"This frailest of frail butterflies frequents dark forest, and rarely is seen in the sunshine. Its flight is ridiculously weak. Like a Kestrel it hovers over the same spot, only a few inches from the ground, for minutes on end, without either materially advancing or receding." (R. C.)

Prof. Aurivillius is of opinion that *N. medusa* and *N. alcesta* are distinct species. He may be right; but I must confess that I am sceptical as to the value of the characters upon which he separates them. Every gradation of size exists from the largest *N. medusa* to the smallest *N. alcesta*: the apical black patch sometimes borders the outer margin to below vein 2, sometimes (in the large form) only extends to just below vein 6; the discal spot in the large form is sometimes crossed by veins 3 and 4, and in the small form sometimes scarcely extends above vein 4. If it be correct that, whereas *N. medusa* ♀ sometimes takes the form of *N. immaculata*, *N. alcesta* ♀ always takes the form of *N. nupta*, that might possibly serve to distinguish the females; but, for the present at any rate, I do not see my way to regarding the genus as consisting of more than one very widely distributed and variable species.

70. COLIAS ELECTO, var. EDUSA.

Papilio electo, Linnæus, Cent. Ins. p. 21 (1763).

♀ ♀ (*C. helice* type), Fort Smith, May 28; Lali flats, 7850 feet, Kikuyu forest, Dec. 19, 1899.

♀ (*C. edusa* type), Nairobi plains, 5400 feet, April 12, 1900.

"On Lali flats, which are open grass-land surrounded by black forest, *C. edusa* is far and away the most plentiful butterfly and could be taken in almost any number. . . . Quite ten if not fifteen per cent. of the females seen are this pale-coloured variety." (R. C.)

71. TERIAS BRIGITTA, var. ZOË.

Terias zoë, Hopffer, Monatsb. k. Akad. Wiss. Berl. 1855, p. 640; Peters' Reise n. Mossamb., Ins. p. 369, pl. xxiii. figs. 10, 11 (1862).

♀ ♀, Roromo, Dec. 14, 19, 29, 1899, Jan. 14, 1900; Mayi móru flat, Feb. 10; ♂ ♂, Ikwiaku, 7600 feet, Feb. 27; Nairobi plains, 5400 feet, April 5, 12, 14, 1900.

72. TERIAS BOISDUVALIANA.

Terias boisduvaliana, Mabille, Hist. Mad., Lép. i. p. 253, pl. 32. figs. 4, 5 (1885-7).

♀, Roromo, Kikuyu forest, Feb. 6; ♂ Ruarka River, April 25, 1900.

"If struck at with the net two or three times and missed, this insect becomes terrified and drops to the ground, where it perches and is easily taken; this specimen (♀) behaved in this way."

73. TERIAS MARSHALLI.

Terias marshalli, Butler, P. Z. S. 1897, p. 851, pl. 1. figs. 8, 9.

♀, Roromo, Jan. 7; ♂, Nairobi plains, April 14, 1900.

Nobody, comparing a series of this species with *T. regularis*, could hesitate about keeping them separate; the fact is that few Lepidopterists have the least idea as to what *T. regularis* really is; they mistake it for the extreme wet form of the present species, which it neither resembles in outline of wing, border, or pattern of under surface; moreover it has a female with a broad black border to the secondaries. I consider the nearest ally to *T. regularis* to be possibly *T. marshalli*, but it is really much more like *T. solomonis* of the *T. candida* group; it has a heavier costal border to the primaries and is, as a rule, a smaller insect; the under surface also though without spots is also destitute of dark borders. In the Museum we have twenty-one wet-season examples of *T. regularis*, including four females; excepting that they are comparatively broader and shorter in wing, they more nearly resemble *T. zoë* than *T. marshalli*.

74. TERACOLUS CALAIS.

Papilio calais, Cramer, Pap. Exot. i. p. 84, pl. liii. C. D. (1775).

♂, Roromo, Feb. 27, 1900.

"The first of its kind, I think, I have seen in these parts, and somewhat a surprise." (R. C.)

I believe it will be found that this species ranges over nearly the whole of Africa.

75. TERACOLUS ELGONENSIS.

Teracolus elgonensis, E. M. Sharpe, P. Z. S. 1891, p. 191, pl. xvi. fig. 6.

♂, Roromo, Kikuyu, Jan. 12, 1900.

This species is new to the Museum. The single example taken is a little shattered; the dark border of the primaries and the spots on the under surface of the secondaries are barely indicated; it probably represents the intermediate phase of the species.

76. TERACOLUS CHROMIFERUS.

Teracolus chromiferus, Rothschild, Nov. Zool. i. p. 538 (1894); E. M. Sharpe, Mon. Ter. i. p. 37, pl. 13. figs. 2-2 d (1899).

♀, Nairobi plains, 5400 feet, April 4; ♂, Nairobi forest, 5400 feet, April 5, 1900.

This is evidently the dry phase of the species; it is decidedly smaller than usual, the male finely black-veined above, the magenta

subapical patch separated by a well-defined white edge from the dark border; the secondaries without marginal spots: below opaline white; the primaries with a small black transverse spot on the discocellulars; no other markings. Expanse of wings 54 millimetres.

The specimen is a good deal worn, therefore the under surface, when fresh, may have been far more pink in tint.

The female much resembles the insect figured by Miss Sharpe under *T. puniceus* (Mon. Ter. pl. 14. fig. 1 *g*), but is rather larger and has much better defined marginal spots to the secondaries. On the under surface the apical area of the primaries and whole of secondaries are sprinkled and transversely striated with pale sandy olivaceous, the discal series of spots on the primaries and oblique transverse stripe on the secondaries being darker olivaceous; the discocellular spot on the primaries is small and black, that on the secondaries large and white. Expanse of wings 62 millimetres.

Of the female Mr. Crawshay says:—"Pale yellow oval ova. This is a butterfly altogether new to me." And of the male:—"An insect which I have no recollection of taking before; the only specimen seen."

77. TERACOLUS INCRETUS.

♀. *Teracolus incretus*, Butler, Ent. Month. Mag. xviii. p. 146 (1881).

♂. *Callosune vulnerata*, Staudinger, Exot. Schm. i. p. 46, pl. 23 (1884-5).

♂. Nairobi plains, 5400 feet, April 12, 1900.

"An insect new to me in these parts." (*R. C.*)

78. TERACOLUS XANTHUS.

♂. *Teracolus xanthus*, Swinhoe, P. Z. S. 1884, p. 440, pl. xxxix. fig. 10.

♀ (dry phase), Roromo, Kikuyu forest, Feb. 10, 1900.

"Taken in my zariba, which is a partial clearing in the forest, by my servant Bvalamkombi." (*R. C.*)

79. TERACOLUS ANTEVIPPE.

Anthocharis antevippe, Boisduval, Sp. Gén. Lép. i. p. 572, pl. 18. fig. 3 (1836).

♂, Nairobi plains, 5400 feet, April 27, 1900.

80. TERACOLUS OMPHALE.

Pieris omphale, Godart, Enc. Méth. ix. p. 122 (1819).

♂, Nairobi forest, March 18; ♀, Nairobi plains, April 12, 1900.

81. TERACOLUS PSEUDACASTE.

Teracolus pseudacaste, Butler, P. Z. S. 1876, p. 156, pl. vi. fig. 12.

♂, Nairobi plains, April 12, 1900.

82. TERACOLUS AURIGINEUS.

Teracolus aurigineus, Butler, Ann. N. H. (5) xii. p. 103 (1883).

Dry phase, ♂♂, Kedong valley, Oct. 22, 1899.

Wet phase, ♂, Nairobi plains, April 12, 1900.

83. CATOPSILIA FLORELLA.

Papilio florella, Fabricius, Syst. Ent. p. 479 (1775).

Var. *C. pyrene*, ♂, ♀♀, Roromo, Kikuyu forest, Jan. 12, 1900.

Var. *typical*, ♀, Nairobi plains, 5400 feet, May 8, 1900.

Of the Roromo specimens Mr. Crawshay says:—"On arrival in these parts a little over three months ago and until lately I never remarked a 'Brimstone.' Now they are extremely plentiful though difficult to take in this rough country, as they seldom or never perch. All five taken on the wing by standing on the edge of the forest on their favourite line of flight." Of the solitary female from the Nairobi plains he says:—"Here and there a specimen is seen travelling rapidly over the open ground and sometimes alighting on some flower."

84. GLUTOPHRISSA CONTRACTA.

Glutophrissa contracta, Butler, P. Z. S. 1888, p. 75.

♂♂ *wet phase*, Nairobi forest, 5400 feet, March 18 & 20, 1900.

"Plentiful, and, almost without exception, perfect specimens. Evidently newly emerged after the recent rains."

"By far the commonest butterfly just now in the forest." (*R. C.*)

Mr. Crawshay comments upon the great difference of size in individual examples, which vary from an expanse of 64 to 48 millimetres.

Prof. Aurivillius ignores the genera *Glutophrissa*, *Phrissura*, &c., on the ground that the generic characters ascribed to them are inconstant. I based the former chiefly upon the fact that both sexes possess a tuft of hair projecting from the extremity of the abdomen; in the female this tuft is external and projects over the swelling in front of the anal orifice. In *Phrissura*, when the abdomen is squeezed out, the lateral fringe to the anal orifice gets flattened forward and thus offers a deceptive semblance of this tuft, though it originates at the sides, and not in front, of the opening. In fact *Phrissura*, although quite dissimilar in form of wing from *Tachyris*, is more nearly related to it than *Glutophrissa* is. That the African species of *Phrissura* differ greatly in neuration from the type of the genus I am unable to admit; in *P. ægis* (= *illana*) vein 8 of the primaries is nearer to the end of the cell than in the African forms, whilst in *P. polisma* it is omitted close to the end of the cell (this sort of character being usually variable), but I can find nothing else. From *Belenois*, with which it has been suggested that *Phrissura* of Africa should be amalgamated, the tufting of the abdomen distinguishes it at once.

85. *PHRISSURA PHOEBE*, sp. n. (Plate LVIII. figs. 6, 7.)

Allied to *P. confusa*, the male above with yellow internervular folds interrupting the divisions of the external border, the basal orange patch clear and bright; secondaries lemon-yellow, washed towards base, on abdominal area, and on outer margin with a more ochreous tint; marginal spots much larger than in *P. confusa*: primaries below white; discoidal cell nearly filled with bright orange; apical area and outer margin bright ochreous crossed by white veins terminating in black points, two small black submarginal spots near extremities of median nervules: secondaries bright ochreous, costal border orange towards the base; marginal spots small and black: body below white. Expanse of wings 54-62 millimetres.

♀. Chiefly differs from the male in the shorter primaries, the obscure ruddy tint instead of the clear orange at the base of these wings above, in the heavier marginal spots and more ochreous secondaries; below the primaries show rather less orange in the cell and four submarginal spots, the upper ones running inward and bounding the ochreous apical area. Expanse of wings 58 millimetres.

A variety (answering to *P. dubia* of *P. isokani*) also occurs, in which the apical area of the primaries and the secondaries are primrose-yellow traversed by blackish veins and with a squamose blackish border. Expanse of wings 44 to 56 millimetres¹.

♂ ♂, ♀ ♀, Nairobi forest, March 20, 1900.

Both sexes are labelled as females, the pale variety being apparently regarded as distinct. I have been unable to discover what species Mr. Crawshay believed to be the male; the similarity in the sexes doubtless deceived him.

86. *BELENOIS ZOCHALIA*.

Pieris zochalia, Boisduval, Sp. Gén. Lép. i. p. 506 (1836).

♂ ♂, ♀ ♀, Roromo, Nov. 23 & 26, 1899; ♀ ♀ (yellow form), Jan. 22 and Feb. 18, 1900.

"Frequents open glades in forest: a dashing flyer, not easily taken." (*R. C.*)

Of one worn example Mr. Crawshay writes—"A relict of the dry season, as I have taken four newly emerged specimens of this insect to-day" (Nov. 26). The under-surface markings prove this to be correct, as they are feebly defined. The first yellow-winged female is noted as "a somewhat dilapidated specimen, which proved a very difficult insect to take—a quick flyer, and a great adept at doubling."

The second example, which was tolerably perfect, is noted as:—"Elsewhere a very familiar form; but I have not previously met with this insect here until to-day: doubtless the recent heavy rains are responsible for new animals on the scene."

It is evident from this note that Mr. Crawshay did not recognize

¹ Is the reputed male of *P. isokani* really distinct from the Western *P. phaola*? the female (= *P. dubia*) certainly is.

this as identical with the shattered insect taken a month previously, or as a second form of the female of those obtained in the preceding November: not having the specimens mounted, it is quite likely that this yellow female was mistaken for a form of *B. mesentina*, which certainly is a very "familiar form" all over Africa, *B. zochalia* being far less abundant and with a considerably more restricted range.

87. *BELENOIS SEVERINA*, var. *INFIDA*.

Beleois infida, Butler, P. Z. S. 1888, p. 77; 1894, p. 578, pl. xxxvii, figs. 1, 2.

♂, Fort Smith, June 26, 1899; ♀, Nairobi forest, March 11; Nairobi plains, April 25; ♂, Ruarka River, April 25, 1900.

Of the first female Mr. Crawshay says:—"I am inclined to think this is an insect altogether new to me. Yellowish-white barley-corn-shaped ova." In this belief I think he is correct, although he obtained the male of it at Maranga. The species occurs not uncommonly at Zomba, so that it is strange that Mr. Crawshay should not have come across it in Nyasaland: I am not sure that he did not obtain a female at Lake Mweru.

88. *BELENOIS MESENTINA*.

Papilio mesentina, Cramer, Pap. Exot. iii. p. 140, pl. cclxx. A, B (1780).

♀, Roromo, Nov. 26, 1899.

89. *SYNCHLOE JOHNSTONII*.

Synchloe johnstonii, Crowley, Trans. Ent. Soc. 1887, p. 35, pl. iii, figs. 1-3.

♂♂, Roromo, Nov. 22, 1899.

"Taken in a waste plantation in the midst of black forest." (R. C.)

90. *PINACOPTERYX GERDA*.

Pinacopteryx gerda, Smith and Kirby, Rhop. Exot. vol. ii. Genus *Pinacopteryx*, p. 4, pl. i. figs. 10, 11.

Dry phase, ♂♂, ♀, Ruarka River, April 23 & 27, 1900.

Of the males Mr. Crawshay writes:—"I took this butterfly, I think, on the Tana River about 15 months ago. Here it is not plentiful, at any rate as yet, for to-day I have seen only three amongst a great crowd of other 'Whites' feasting on the mud, all which three I took without any difficulty." Of the single female he says:—"I do not think I have seen this insect before to-day and then only the one specimen." One female with a (intermediate rather than dry) male was secured on the Muthambi River.

91. *ERONIA DILATATA*.

Eronia dilatata, Butler, P. Z. S. 1888, p. 96.

Dry phase, ♂, Ruarka River, 5500 feet, April 17; ♀, Nairobi plains, 5400 feet, April 29, 1900.

92. LEUCERONIA ARGIA.

Papilio argia, Fabricius, Syst. Ent. p. 470 (1775).

♂♂, Ruarka River, April 25, 27, & 29, 1900.

"About three weeks ago I saw two specimens of this lovely butterfly at the Ruarka River high up amongst the trees, where it was impossible to get at them. Probably, as I have seen no others in the meantime, this and the following number are the pair originally seen." (*R. C.*)

On April 27th a perfect example was taken, and Mr. Crawshay observes:—"Perhaps altogether I have seen three or four to-day. The flight of this butterfly is strong, irregular, and dashing: in the midst of its headlong career it stops as if shot and settles on a bush."

On the 29th a single broken example was taken settled on a leaf.

93. PAPILIO REX.

Papilio rex, Oberthür, Ann. Soc. Ent. France, (6) vi. Bull. p. 115 (1886); Etudes d'Ent. xii. p. 2, pl. 1. fig. 2 (1888).

Ruarka River, 5500 feet, April 27, 1900.

"At last I have secured a perfect specimen." (*R. C.*)

From the above note it would appear that Mr. Crawshay has met with other examples of this rare *Papilio*, or possibly of the equally beautiful *Melinda formosa* (which it mimics). The present species is quite new to the Museum, and it is to be regretted that the club of the right-hand antenna has been lost in transit.

94. PAPILIO NOBILIS.

Papilio nobilis, Rogenhofer, Verh. zool.-botan. Ver. Wien, xli. p. 563 (1891).

Papilio pringlei, E. M. Sharpe, P.Z.S. 1894, p. 352, pl. xix. fig. 3 (1894).

♀, Nairobi forest, March 20; ♂, ♀, Ruarka River, April 23 & 29, 1900.

Of the male (a fine and almost perfect example) Mr. Crawshay says:—"An insect quite new to me." Of one of the two females:—"Gravid, with pale sea-green spherical ova."

Of the male the Museum previously possessed one less perfect and slightly varied example from Uganda; but the two females now sent are new to science, being tailless, and of a type approaching the *tibullus* ♀ form of *P. cenea*: the ground-colour of the wings is buffish white, somewhat more sordid within cell of primaries; these wings with the costa and apical half black, sometimes replaced by grey scaling in a patch between veins 3 and 4, thus connecting a broad white postcellular patch with the ground-colour of the interno-basal half; the latter is also more or less connected in a similar manner with an oblique narrow bar within the end of the discoidal cell; a subapical cream-whitish oval spot either present or wanting, and three submarginal spots as in females of *P. cenea*;

the secondaries marked as in *P. tibullus* ♀; on the under surface the apical area of the primaries and external area of secondaries are broadly grey-brown; the inner half on the primaries forming an externally diffused black belt upon which the pale patches and spots of the upper surface are sharply outlined; the internal half on the secondaries merely darker brown; veins and internervular folds dark brown. Expanse of wings 100–103 millimetres.

95. PAPILIO CENEA.

♀. *Papilio cenea*, Stoll, Suppl. Cramer, p. 134, pl. xxix. figs. 1, 1a (1791).

♂ ♂, ♀ ♀, Nairobi forest, March 11, 18, & 20, 1900.

♂. "Common in the forest at the foot of the escarpment and easily taken, its flight being sluggish and almost always well within reach of the net.

"In an hour I saw perhaps twenty-five or thirty, flying along between the trees or hovering over some flowering bush: I netted six, two of which had their tails entire. This insect does not relish or frequent open country, though occasionally I have seen one here and there out on the plains fully a mile from the forest, when obviously it is anything but in its element, as its flight is then absolutely regular and horizontal with the ground, and within five or six feet of it, hurrying for all it is worth. In the forest its flight is lazy; it often stays to hover and returns over and over again over the same ground and the same bush.

"Quite a common characteristic of its flight is a perpendicular drop of ten, fifteen, or twenty feet: it closes its wings and falls straight away." (*R. C.*)

♀. "Pale sea-green spherical ova." (*R. C.*)

Of a male obtained on March 18th Mr. Crawshay writes:—"Very plentiful nowadays. At a water-hole I saw to-day a number of this species and about a dozen of the black velvet and metallic blue coloured Swallow-tail (*P. nireus*) feeding on the moist ground in company with each other."

Of a female (white-spotted *P. cenea* type) he writes—"Have seen and netted several specimens, but not one is perfect." Lastly of a female (*P. tibullus* type)—"There could be no easier insect to take than this."

96. PAPILIO PHORCAS.

♂. *Papilio phorcas*, Cramer, Pap. Exot. i. p. 4, pl. ii. B, C (1775).

♀. *Papilio thersander*, Fabricius, Ent. Syst. iii. pt. 1, p. 32 (1793).

♂, Nairobi forest, March 11; ♂ ♂, ♀ ♀, Ruarka River, April 22 & 27, 1900.

♂. "Common in the forest, and, I suppose, a very common insect in other African forests; it is not easy, however, to secure a perfect specimen."

♀. "As far as I know this Swallow-tail is new to me. Close

to where I took this specimen I saw a second flapping along over the open in desperate haste, as if anxious to make the forest."

♂. "This lovely insect can be captured practically in any numbers on the Ruarka River these days. It is not uncommon to find a dozen or more congregated on the mud feasting voraciously on the moisture, and here they may often be trodden underfoot before they will take wing."

♂. "A curiously pale example, the shade of green being distinctly different to the normal colour."

♀. "Containing a few boiled-sago coloured spherical ova." (R. C.)

The only two females are of the usual (*P. thersander*) type: why Prof. Aurivillius should think it possible that these may be abnormal I fail to understand; I think the green female resembling the male (which is of great rarity) should rather be regarded as an aberration¹. Why are all females of this abundant species so rare?

97. PAPILIO NIREUS.

Papilio nireus, Linnæus, Syst. Nat. ed. 10, i. p. 464 (1758).

Nairobi forest, 5400 feet, March 18; Ruarka River, 5500 feet, April 22, 1900.

"Common in the forest, but it is not easy to secure perfect specimens." (R. C.)

98. PAPILIO DEMODOCUS.

Papilio demodocus, Esper, Ausl. Schm. p. 205, pl. li. fig. 1 (1798).

♀, Roromo, Kikuyu forest, Dec. 22, 1899; ♂ ♂, Nairobi forest, April 5, 1900.

Of the female Mr. Crawshay writes:—"This insect appears to be identical in species with one which I have found to be both common and easy of capture elsewhere, since it is of lazy flapping flight and frequently stops to hover nervously over a flower or a wet piece of ground.

"Here, however, neither characteristic obtains, as it is of rather rapid straight flight, rarely stopping to hover or rest, and (frequenting forest such as this) proved really very difficult to take. Daily I see perhaps a dozen or so, but this is the first which has found its way into my net."

HESPERIIDÆ.

99. SARANGESA SYNSTALMENUS.

Antigonus synstalmenus, Karsch, Berl. ent. Zeit. vol. xxxviii. p. 263, pl. vi. fig. 8 (1893).

Nairobi plains, April 14, 1900.

¹ The male "*P. thersander*" to which Prof. Aurivillius refers may have been *P. euphranor*. Why not?

100. SARANGESA ELIMINATA.

Sarangesa eliminata, Holland, P. Z. S. 1896, p. 9, pl. v. fig. 9.
Nairobi plains, March 31, 1900.

101. SARANGESA MOTOZIOIDES.

Sarangesa motozioides, Holland, Ann. & Mag. Nat. Hist. (6) x. p. 288 (1892); Ent. News, Jan. 1894, pl. 1. fig. 5, ♀; P. Z. S. 1896, p. 7.

♀, Nairobi forest, April 5; ♂ ♂, ♀ ♀, Ruarka River, April 15 and 22, 1900.

The yellow markings below vary considerably in definition in this species; the size of the transparent spots also varies, though they are never of the same shape as in *S. motozi*, that within the end of the discoidal cell being either L-shaped or broken up into two small spots; the transparent spot in the cell of the secondaries is sometimes wanting, but frequently replaced by a smaller semi-transparent spot placed much nearer to the base than in *S. motozi*. The general tint of the upper surface is more greenish ashy than that of *S. motozi*. There are two undoubted males among the five examples sent home by Mr. Crawshay; they agree with the females in pattern and colouring. The first example (♀) was "taken sitting on a tree-trunk in the, setting, sun." Of the others Mr. Crawshay writes:—"This 'Skipper' frequents the shade of the forest, and perches with outspread wings on the bare ground." The female lays "emerald-green spherical ova."

102. EAGRIS PLICATA, sp. n. (Plate LVIII. figs. 8, 9.)

♂. A prominent costal fold from base to end of discoidal cell of primaries; general tint sericeous golden brown, slightly ashy towards anal angle of secondaries: black-edged transparent spots on primaries (right wing) arranged almost in the form of the Greek letter γ , but the costal terminations of the furca turned towards each other; of these spots six are subapical, small, the second displaced and above the third, the fifth represented by a black spot without transparent centre: the spots of the inner ramus consist of a small one above cell towards extremity of costal fold; a large one within the cell, below the preceding; a small spot within posterior angle of cell; the remaining spots, four in number, cross the disk obliquely parallel to outer margin, the second only being large and irregularly quadrangular; two dusky spots at basal third of interno-median area: secondaries with a double-lined dusky marking at end of cell surrounded by an arched series of dusky spots between the nervures: body more golden than wings; the palpi, head, and collar above transversely barred with black; antennæ black above, pale buff below. Under surface ochreous; the primaries clouded with brownish on external area; transparent spots as above, but without black margins: secondaries with two dusky apical spots on margin; fringe dusky with paler tips; a discal arched series of small blackish spots, the second largest. Expanse of wings 38 millimetres.

♀. Paler than male, secondaries sometimes whitish; veins dusky: transparent spots on primaries much larger than in the male, especially those towards centre of wing, which are chiefly separated by the veins; outer borders dusky, the markings on secondaries better defined owing to the paler ground-colour: body darker, the transverse bars on head less defined: colouring below a trifle paler, the darker portions cupreous brown; some of the spots on secondaries indistinct. Expanse of wings 40–45 millimetres.

♀, Nairobi forest, March 18; ♀, ♂, Ruarka River, April 27 & 29, 1900.

Of the first example taken Mr. Crawshay writes:—"This Hesperid appears to me possessed of a devil: half an hour have I expended in endeavouring to close the wings, and only with indifferent success. Light emerald-green spherical ova."

The nearest ally of *E. plicata* is *E. sabadius* from Madagascar, but it is altogether a darker and more strongly marked species on both surfaces: it is also allied to *E. decastigma*, but differs in outline and pattern.

103. ERETIS DJÆLÆLÆ.

Pterygospidea djælcælcæ, Wallengren, Kongl. Svensk. Vet.-Akad. Handl. 1857, Lep. Rhop. Caffr. p. 54.

Roromo, Feb. 4, 1900.

"The first of its kind I have seen in these parts, and on cursory examination I think a different insect to one very nearly resembling it common in Ukamba proper. The fore legs of this specimen are white (externally), which, as far as my recollection goes, is not the case with the 'Skipper' of Ukamba." (*R. C.*)

104. CELÆNORRHINUS OPALINUS, sp. n. (Plate LVIII. figs. 10, 11.)

Allied to *E. galenus*: the male more richly coloured; the semi-transparent black-edged markings on the primaries deeper in tint and more brilliantly opalescent, the subbasal and interno-median spots much smaller, the outermost of the subapical spots only represented by a small black patch, in one example with a minute transparent point on one wing; in the secondaries the spots which cross the cell in *C. galenus* are wholly absent; the spots towards anal angle are ill-defined and the orange patch projects inward on its inner edge, leaving a broader brown marginal band: below the differences are nearly as above, but the secondaries show one well-defined orange spot in the cell, the remainder of the basal area being pretty uniformly dark brown finely irrorated with orange scales. Expanse of wings 39–40 millimetres.

In the female, which is of a less mahogany-red colour, the spots are much paler, those of the primaries as in *C. biseriatius* (of which *C. maculatus* is the male), excepting that the outermost of the subapical spots on the primaries is reduced to a mere point: on the secondaries there are only four spots towards outer margin, the first, third, and fourth minute, the second large and rhomboidal,

extending between the veins almost from the margin to the end of the cell. Expanse of wings 37 millimetres.

♂ ♂, ♀, Roromo, Feb. 17, 18; March 23, 1900.

In his Revision of the African Hesperiidæ (P. Z. S. 1896, pl. iii. figs. 3, 4) Dr. Holland appears to have figured *C. biseriatus* ♀ and *C. maculatus* ♂, showing almost the same differences as in the two types: the differences are just what one finds between the sexes of other species, and are certainly less marked than in the sexes of *C. opalinus*. Of the latter Mr. Crawshay writes as follows:—

♂. "An exceedingly difficult insect to take: the first of its kind I have seen: ten days' almost incessant rain day and night will probably have affected the butterfly world."

♂. "Taken in the early morning when numbed with the cold—a very different insect to what it is in the warm sunshine."

♀. "This Skipper habitually perches on the underside of the leaf on which it settles: this and the two consecutive specimens were all taken in this position."

105. CAPRONA CANOPUS.

Caprona canopus, Trimen, Trans. Ent. Soc. London, 3rd ser. ii. p. 180 (1864); Rhop. Afr. Austr. ii. p. 309, pl. 6. fig. 2 (1866).

♂ ♂, ♀ ♀, Ruarka River, April 15, 22, 27, & 29, 1900.

♀. "This very striking 'Skipper' I have seen perhaps three times in all during my time in Kikuyu. Until now (April 15), I have never been able to secure a specimen. It frequents dense forest. This particular insect I took perching on a flowering bush close to the stream."

♂. "Taken on the same flower as the following specimen (April 22). The favourite perch of this striking 'Skipper' is a flowering bush in the sunshine. Its first appearance when seen only a few feet away is that of a veritable rag, even when a perfect specimen. It does not perch on the ground, I think, nor anywhere very low."

Mr. Crawshay tells me that this insect looks so much like the flowers of the bush on which it settles that it is not easily seen when perching.

106. PYRGUS SPIO.

Papilio spio, Linnæus, Mus. Lud. Ulr. p. 338 (1764).

♂, Lali flats, Kikuyu forest, Dec. 19, 1899; ♀, ♂ ♂, Roromo, Jan. 12 & 23; ♀, Nairobi plains, April 14, 1900.

♂. "Taken on open grass-land, the only one seen."

♂. "Taken asleep on the stem of a flower on a cold evening at sunset and carried in to this camp resting on the flower."

107. GOMALIA ELMA.

Pyrgus elma, Trimen, Trans. Ent. Soc. London, 3rd ser. i. p. 288 (1862); Rhop. Afr. Austr. ii. p. 291, pl. 5. fig. 8 (1866).

♀, Itugi, 7400 feet, Kikuyu, Oct. 2, 1899; ♂, Roromo, Jan. 20; ♀, Nairobi forest, March 18; ♂, Nairobi plains, April 12, 1900.

♀. "Taken in the hot sunshine on almost bare open ground flitting from weed to weed."

♂. "A new insect altogether to me, I think: taken on the moist ground in my garden inside the zariba after the night rain."

♀. "A ragged specimen, but the only one seen. Pale bluish-emerald-green coloured spherical ova."

♂. "Taken by my servant Bvalamkombi. An insect unknown to me, I think."

Mr. Crawshay had evidently forgotten this variable little species (an unusual circumstance!): he took it in July and September, 1898, and in January, 1899. How he remembers even the obscure little things he catches is a wonder to me, though I rarely forget a *mounted* butterfly which I have once seen.

108. CYCLOPIDES METIS.

Papilio metis, Linnæus, Mus. Ind. Ulr. p. 325 (1764).

Cyclopides quadrisignatus, var., Butler, P. Z. S. 1896, pp. 130 & 842.

♂ ♂, Roromo, December 17, 1899, Jan. 25, 1900.

"The first time I have remarked this 'Skipper' or anything resembling it in B. E. Africa, though it appears to resemble very closely an insect in B. E. Africa. All four specimens I owe directly to a pool of water, on the railway-line, brought about through an accident to a locomotive which ran off the rails and turned over." (*R. C.*)

Of the last specimen Mr. Crawshay says:—"Taken on the moist earth of a vegetable bed in my garden in the zariba."

Mr. Crawshay has now sent examples indistinguishable from Southern specimens of the species and not separable specifically from those which I wrongly recorded in 1896 as varieties of *C. quadrisignatus*. The latter species, of which he has sent three specimens, but which he tells me is not uncommon, proves to be far more constant than I was led to suppose when we first received examples of *C. metis* approaching it in pattern: unfortunately the first examples of *C. quadrisignatus* which we received were both rubbed and faded, so that they failed to show the characteristic purplish-black ground-tint, whilst the spots on the primaries in the type were unusually large for the species. Mr. Crawshay promises to try and obtain more examples for us.

109. CYCLOPIDES MIDAS.

Cyclopides midas, Butler, P. Z. S. 1893, p. 671; 1895, pl. xv. fig. 6.

Nairobi plains, April 12 & 14, 1900.

110. CYCLOPIDES QUADRISIGNATUS.

Cyclopides quadrisignatus, Butler, P. Z. S. 1893, p. 670, pl. lx. fig. 9.

Nairobi forest, March 18; Ruarka River, April 22, 1900.

One example shows only three spots in the primaries, the outer subapical spot failing to appear. Mr. Crawshay thinks he took a similar insect on the lower ranges of the Nyika Mountains; but he certainly never sent this species before, though he did send examples of *C. metis* with similarly arranged though larger and more numerous spots, and which, in the absence of fresh specimens of *C. quadrisignatus*, puzzled me somewhat at the time. Since then Mr. Marshall has sent us the same form of *C. metis* from Karkloof.

111. PADRAONA ZENO.

Pamphila zeno, Trimen, Trans. Ent. Soc. London, 3rd ser. ii. p. 179 (1864); S. Afr. Butl. iii. pl. xii. fig. 2, ♀ (1889).

♀, Mayi moru flat, Kikuyu, Feb. 10; ♂, Nairobi forest, March 18; ♀, Ruarka River, April 27, 1900.

112. GEGENES LETTERSTEDTI.

Hesperia letterstedti, Wallengren, Kongl. Svensk. Vet.-Akad. Handl. 1857, Lep. Rhop. Caffr. p. 49.

♂, ♀ ♀, Roromo, Oct. 8, Dec. 18, 1899, Jan. 12 & 21; ♂ ♂, ♀, Nairobi plains, outskirts of forest, March 18 & 28, April 12, 1900.

♂. "Fairly common, though rather difficult to take."

♀. "Fairly common on Roromo flat, where the country is open with very short grass."

♀. Similar remarks, also—"being of dull colour and of most unobtrusive habits, is not very often seen. Its flight is very low, a few inches only above ground, and generally limited to a few yards each time."

113. PARNARA DETECTA, var.

Pamphila detecta, Trimen, Trans. Ent. Soc. London, vol. xli. p. 141, pl. viii. fig. 12 (1893).

♂, ♀, *in coitú*, Ruarka River, April 25, 1900.

The specimens now received are rather larger and blacker than S. African examples: neither male nor female shows a spot in the cell of primaries, but this sometimes fails in Southern examples: the female also has seven spots in the discal series, whereas Southern examples generally have only five or six (the first three forming a subapical series). The patterns of this female and of a male obtained by Mr. Crawshay at Kondowi, Lower Nyika, in April 1895, exactly correspond with that of *Baoris philippina* (the Nyasa specimen having been associated with *B. fatuellus*). It would therefore seem that *P. detecta* varies not a little: one of our Mashonaland examples has only two spots on the primaries.

114. *PARNARA MICANS*.

Parnara micans, Holland, P. Z. S. 1896, p. 63, pl. iii. fig. 19.

♂, ♀, Fort Smith, Kikuyu, Jan. 9, 1900.

The sexes, Mr. Crawshay says, were "taken with the same stroke of the net; apparently in the act of attempting coition."

In the Eastern examples the spots are more decidedly ochreous and lie farther from the outer margin than in the typical figure. In the Museum we have one worn male obtained by Dr. Gregory at Ndari and two damaged females from Fwambo. The upper surface of the female somewhat resembles that of *Erynnis comma*.

115. *PERICHARES TELISIGNATA*.

Perichares telisignata, Butler, P. Z. S. 1896, p. 133, pl. vi. fig. 9.

Roromo, 7800 feet, Kikuyu forest, Dec. 24, 1899.

116. *RHOPALOCAMPTA FORESTAN*.

Papilio forestan, Cramer, Pap. Exot. iv. pl. cccxci. E, F (1782).

Nairobi plains, 5400 feet, April 22, 1900.

117. *RHOPALOCAMPTA PISISTRATUS*.

Hesperia pisistratus, Fabricius, Ent. Syst. iii. 1, p. 345 (1793).

Plains north of Ruarka River, 5500 feet, April 15, 1900.

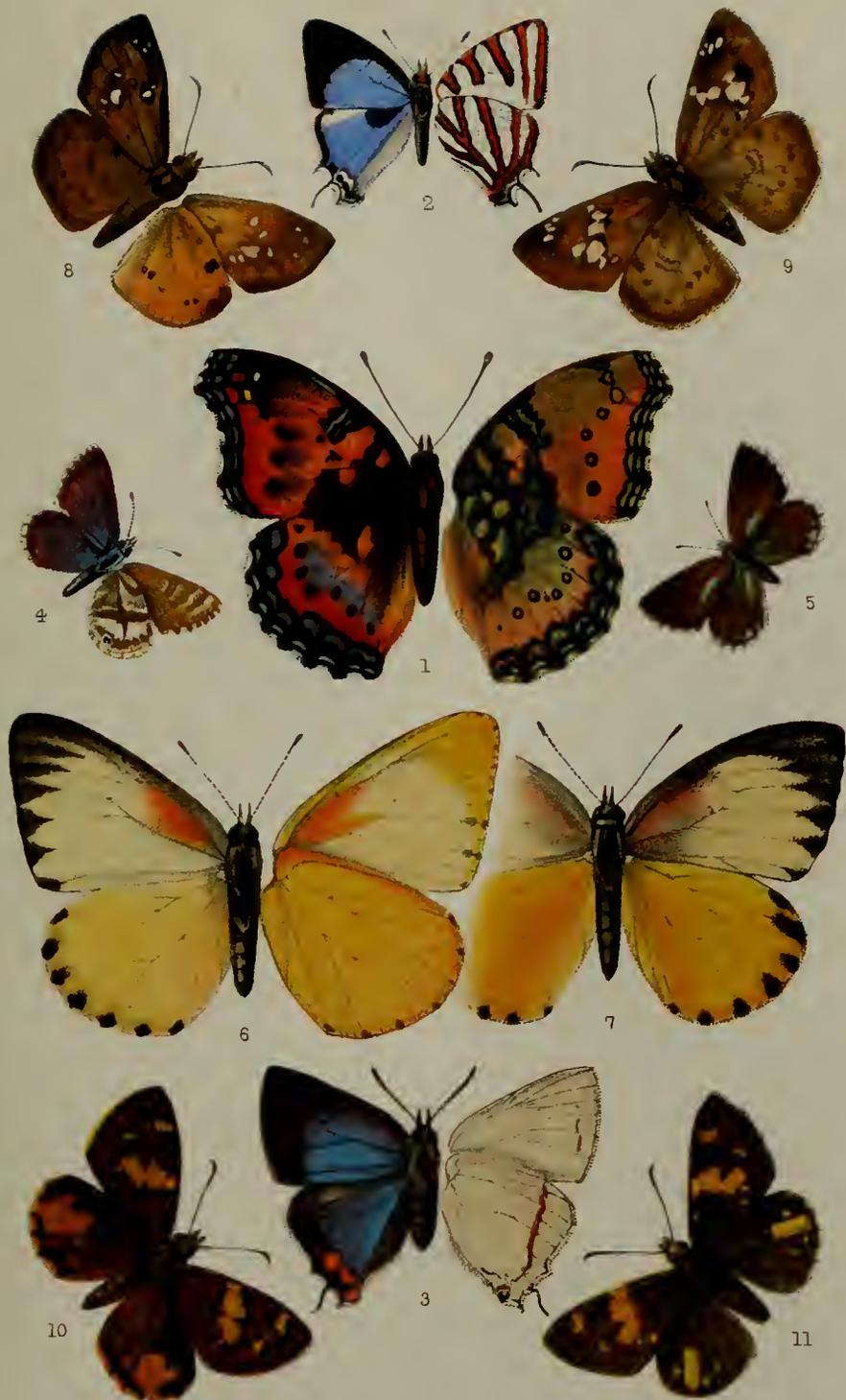
"I have remarked this insect more than once whizzing along past me at Nairobi." (*R. C.*)

Mr. Crawshay having recently returned to England brought half a dozen other Butterflies with him, among which were specimens of *Herpenia iterata* ♀ (seen here and there on the Nairobi plains, but not more than one or two in a morning), May 15, 1900, and *Lachnocnema durbani* (taken resting on a vegetable-marrow leaf), Nairobi, May 18, 1900.

The Moths of this collection will be worked out by Sir George Hampson when he takes up the Heterocera of Eastern Africa.

EXPLANATION OF PLATE LVIII.

- Fig. 1. *Prccis sesamus* (intermediate phase), p. 916.
 2. *Epamera arborifera*, ♂, p. 927.
 3. *Argiolaus crawshayi*, ♀, p. 926.
 4, 5. *Cyclyrius sharpæ*, ♂ ♀, p. 929.
 6, 7. *Phrissura phæbe*, ♂ ♀, p. 936.
 8, 9. *Eagris plicata*, ♂ ♀, p. 941.
 10, 11. *Celænorrhinus opalinus*, ♂ ♀, p. 942.



E.C. Knight del et hth.

West, Newman chromo

NEW BUTTERFLIES FROM EAST AFRICA.



7. On a new Scale-Insect from Zomba, British Central Africa. By R. NEWSTEAD, F.E.S., Hon. Mem. R.H.S.

[Received September 28, 1900.]

(Plate LIX.)

WALKERIANA PERTINAX, n. sp.

♀. Adult (Pl. LIX. figs. 1, 2, 3) dark castaneous, slightly shining; form above generally highly convex and evenly rounded, forming an almost complete hemisphere, but one specimen was decidedly more elongate and less convex; cephalic area suddenly constricted, much wrinkled and furrowed at the sides, and with 4-6 large, deep, and variously-shaped punctures; margin in front emarginate, and within a broad, deep, upward-sloping, central groove, surmounted on either side by a strongly-rounded ridge. Subdorsal and marginal rows of very short, stout, dusky-white, waxy processes, placed close together, and gradually lessening in size from the centre towards the extremities; there is also a double dorsal row of much smaller processes, which also lessen towards the extremities, the largest pair occupying almost a central position. Much mealy substance is scattered round the base of the waxy processes, and the hollows and wrinkles are covered with the same material. Underside (fig. 3) flat or slightly concave, with radiating grooves, more or less covered with white mealy secretion; sides sharply raised. Antennæ (fig. 5, 5 a) of 10 joints, of which the terminal one is much the longest, and, with the exception of the first, all the joints are furnished with short, fine hairs: formula 10, 1, 2, 3 (4, 5, 6) (7, 8, 9). Legs (fig. 4, b) very small; digitules to claw simple. Rostral apparatus present, but owing to the density of the surrounding tissues it is impossible to make out its true character. Ventral opening (fig. 4) very large, somewhat hexagonal and without marginal hairs, the whole aperture covered by a thin anteriorly-binged valve or flap (fig. 3) of dark brown *secretionary matter* occupying approximately the area indicated by the dotted line in fig. 4; the line of attachment being immediately beneath the insertion of the posterior legs, its exact course being indicated by large gland-tracks (fig. 4, a, a), the largest of which are hidden beneath the legs. Epidermis covered with minute hairs and circular glands.

Long 14-20.50, wide 11-15, high 7-10 mm.

Larva (figs. 6, 7) elongate ovate, above (fig. 6) with median, sub-dorsal, and marginal bands of spiny hairs. Antennæ (figs. 8, 8 a) of 5 joints, of which 5 is equal in length to 2, 3, and 4 together: formula 5, 3, 2, 1, 4. Legs very long and slender; digitules to claw very fine simple hairs; claws (fig. 9) faintly tridentate. Anal ring without hairs.

6258 well-matured larvæ were counted from the interior of a single ♀.

Hab. On an unknown tree, Zomba, Central Africa. Collected by H.B.M. Commissioner A. Sharpe, C.B., 1900.

This remarkable species is quite a giant among the Coccidæ, being one of the largest species known to me.

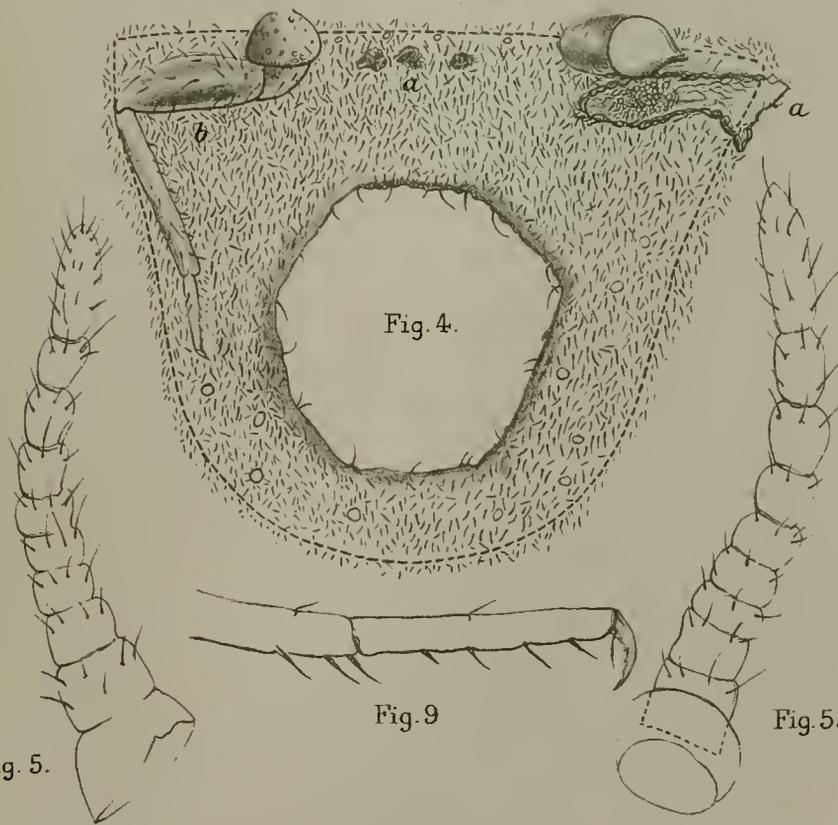
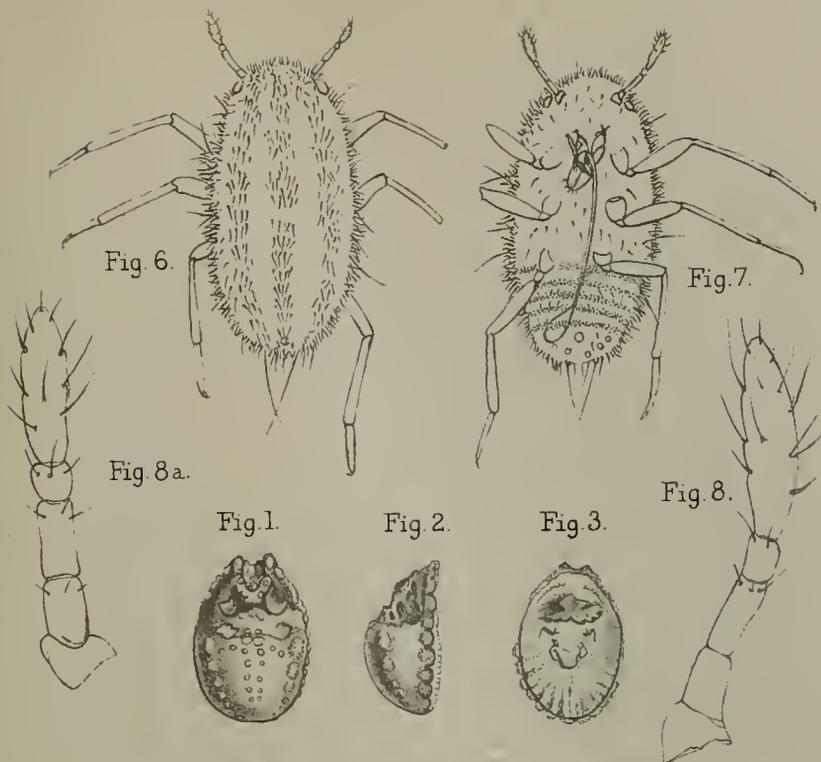
The strength of the rostral apparatus must also be very great, as I found it impossible to separate the insect intact from the fragment of bark to which it was attached (see Pl. LIX. fig. 3) without previous immersion in caustic potash.

The curious secretory flap or valve which covers the large ventral opening is, I believe, a unique feature. I also found a very large and apparently pouch-shaped piece of epidermis in the *interior* of the body, which I have little doubt in some way intussuscepted the abdomen and formed a receptacle for the ova and subsequently for the larvæ, which undoubtedly mature within the body of the parent. Mr. Claude Fuller (Trans. Ent. Soc. Lond. 1899, pt. iv. p. 436, pl. xv. fig. 1 a) calls attention to the existence in the genus *Callipappus* of a remarkable receptacle in the interior of the body of the adult ♀; he says (*l. c.*) there is a "complete intussusception of several of the abdominal segments of the mature ♀'s in the form of a marsupium in which the eggs are laid and incubated." And, further (p. 437), that the sexual orifice and anus are situated at the back of the pouch. In *Callipappus* the mouth-parts in the ♀ are entirely absent, and the larval antennæ are 6-jointed, which entirely precludes my placing the insect in that genus. Of the family Monophlebidae, to which this insect undoubtedly belongs, the characters of the genus *Walkeriana* agree better than any other, but the abnormal characters set forth may be considered of generic importance. In view of this, I at one time thought the insect might form the type of a new genus under the name of *Aspidoproctus*; but in the absence of Mr. E. E. Green's description of his Ceylonese species, I have decided for the present to regard the characters as specific.

EXPLANATION OF PLATE LIX.

Walkeriana pertinax.

- Fig. 1 Adult ♀, actual size, dorsal.
 2. " actual size, profile.
 3. " actual size, ventral; with fragment of bark attached to rostrum. Secretory valve also shown *in situ*, immediately below the insertion of the posterior legs.
 4. " Portion of ventral epidermis containing ventral opening, which in life is covered by a secretory flap, or valve, extending approximately to the dotted line: *a, a*, glands which secrete the covering; *b*, posterior leg.
 5 & 5 a. Adult ♀, antennæ.
 6. Larva, dorsal, enlarged.
 7. " ventral, enlarged.
 8 & 8 a. " antennæ.
 9. " tarsus and claw.
-





December 18, 1900.

Dr. ALBERT GÜNTHER, F.R.S., V.P., in the Chair.

The Secretary read the following report on the additions to the Society's Menagerie during the month of November 1900:—

The total number of registered additions to the Society's Menagerie during the month of November was 143, of which 41 were by presentation, 8 by purchase, 84 were received on deposit, and 10 were born in the Menagerie. The total number of departures during the same period, by death and removals, was 138.

Mr. Sclater stated that he had much admired the fine collection of heads of Antelopes and other animals exhibited by Major A. St. Hill Gibbons at the Meeting of the Royal Geographical Society on the 10th inst., when Major Gibbons gave an account of his remarkable journey across Africa. Major Gibbons had kindly sent three of these specimens of special interest to be laid before the Society's Meeting to-night. The first of these was the skull and horns of the Square-mouthed Rhinoceros (*Rhinoceros simus?*) shot by Major Gibbons near Lado on the Upper Nile, about 5° N. lat., as already recorded by Mr. Thomas in 'Nature' (vol. lxii. p. 599, Oct. 18, 1900). This discovery, as Mr. Thomas had already pointed out, was of very great interest, as no authentic evidence of the existence of the square-mouthed form of Rhinoceros north of the Zambesi River had been previously produced.

Two mounted heads belonging to two different forms of the Topi Antelope, obtained by Major Gibbons, were likewise exhibited. One of these, obtained on the White Nile, was no doubt the Tiang (*Damaliscus tiang*)¹. The other, obtained on the plains to the south of Lake Albert Edward, was probably the typical Topi (*D. jimela*)², but required further comparison.

Major Gibbons, who was present, then gave the following particulars concerning the two species of Topi Antelope which he had met with:—

I first saw the larger Topi (*Damaliscus jimela?*) some 25 miles south of Lake Albert Edward. As I neared the lake they became quite common and were frequently to be seen in small herds up to 12. It is improbable at least that their range extends south of about 1° S. lat., where, except for the lava valley running from the Kirunga volcanoes northwards, the country is very mountainous and wholly unsuited to the requirements of this class of Antelope. So, too, the great mountain-range stretching high and deep from the N.W. of Kivu along the shores of the Albert Edward to Ruenzori and beyond in all probability has barred their expansion westwards. To the east of the Albert Edward the country, though hilly, is not without plains and valleys, and it is probable that this antelope

¹ Sclater & Thomas, 'Book of Antelopes,' i. p. 63.

² Ibid. p. 67.

is to be found for some distance in the direction of Lake Victoria, though it would seem that its range is not a wide one.

The small form of the Topi (*Damaliscus tiang*) is first met with, both according to native testimony and my own observation, in about 4° N. lat., and is common for a considerable distance northwards. Apparently they exist to the west of the Nile only. Jackson's Hartebeest is common on both sides of the river, and though I have frequently noticed herds of both species grazing on the same plains, I have never seen them intermixed.

The Albert Edward species is the larger animal, and probably 3 or 4 inches higher at the shoulder. The body-skin, both in marking and colouring, is strikingly similar to that of the Tsessebe, and consequently much darker than the Nile species, which lacks the rich colouring and shading of its southern relative.

Mr. Sclater exhibited two native bandoliers or waist-belts just received from Sir Harry Johnston, K.C.B., F.Z.S., formed from the skin of the supposed new Zebra as described by Sir Harry in the letter read at the Meeting on Nov. 20th (see above, p. 774). It was difficult to say exactly from what part of the body these pieces of skin had been taken, but they were probably from the shoulders and hind legs, as described in Sir Harry's letter. However this might be, they appeared to be different from any portions of the skin belonging to the known species of Zebra, and, if the account given by Sir Harry of what was said by the natives on the subject was correct, would certainly indicate the existence of a new species of Zebra in this part of the Congo Forest, or somewhere in its neighbourhood.

Mr. Sclater promised additional particulars on this subject after further examination of the specimens.

The following papers were read:—

1. Notes on the Fauna of the White Nile and its Tributaries.

By Captain STANLEY SMYTH FLOWER, F.Z.S., 5th Fusiliers.

[Received September 13, 1900.]

- | | |
|--------------------------------|---------------------------|
| I. Introductory Notes, p. 950. | VII. Molluses, p. 970. |
| II. Mammals, p. 952. | VIII. Insects, p. 971. |
| III. Birds, p. 956. | IX. Millipedes, p. 972. |
| IV. Reptiles, p. 967. | X. Centipedes, p. 973. |
| V. Batrachians, p. 968. | XI. Arachnids, p. 973. |
| VI. Fishes, p. 969. | XII. Crustaceans, p. 973. |

I. INTRODUCTORY NOTES.

No Europeans having been able to visit the White Nile for many years owing to the Mahdist insurrection, these notes on the animals seen during an expedition up this river may be of interest.

The following itinerary will help to localize the places mentioned in this paper, which are not marked in the ordinary atlases available :—

- 11th March, 1900. Leave Omdurman and proceed up the White Nile.
- 12th. Pass El Duem, and later Kowa.
- 13th. Cross 14° North lat. in morning, pass Goz Abu Goma, and arrive at Abu Zeit.
- 16th. Leave Abu Zeit.
- 17th. Pass Jebel Ain in morning.
- 18th. Reach Renk in evening.
- 19th. Reach Long Tom in evening.
- 20th. Pass Jebel Ahmed Agar.
- 21st. Pass Kaka.
- 22nd. About 5 A.M. reach Fashoda, and about 9 P.M. the Sobat.
- 23rd. Reach the base-camp of the sudd-cutting expedition near Gabt-el-Meghahid; about 5 P.M., mouth of the Bahr-el-Zeraf.
- 24th–26th. Proceed about 50 miles up the Zeraf and back again.
- 27th. Proceed west along the White Nile, pass the mouth of the Bahr-el-Jebel, reach Lake No.
- 28th. Leave Lake No, proceed up the Bahr-el-Ghazal.
- 29th. Visit tributaries of the Bahr-el-Ghazal (the Bahr-el-Arab, proceeding about 12 miles up and back again; the Bahr-el-Homar found unnavigable).
- 30th. On Lake Ambadi, near Meshra er Rek.
- 31st March–2nd April. Return down the Bahr-el-Ghazal to Lake No.
- 3rd April. Proceed up the Bahr-el-Jebel.
- 5th. Pass Heliat Nuer (= Meshra Nuer, or Eljab Dok).
- 8th. Reach neighbourhood of Shambé (=Schambeh), about 7° 20' North latitude, and about 830 miles from Omdurman, and turn back on account of shallow water and want of fuel for the steamer.
- 14th. Get back to mouth of the Bahr-el-Jebel, and 11 P.M. reach Gabt-el-Meghahid.
- 16th. Proceed about 12 miles up the Sobat and down again.
- 17th. Reach Fashoda.
- 26th. Arrive back at Omdurman.

I have to acknowledge my deep sense of obligation to Sir William Garstin, K.C.M.G., and to Mr. C. Crawley for their assistance in noting facts of interest and in securing specimens during the two months I had the privilege of travelling with them on the Nile; and to the officials of the British Museum of Natural History for their invariable kindness in helping me to work out the collections brought home. I am particularly indebted to Mr. Oldfield Thomas and to Mr. W. R. Ogilvie Grant.

The nomenclature of the birds in this paper is according to the British Museum Catalogue, but the Orders are arranged as far as

possible as in the Exhibition Bird Gallery, and not according to the volumes of the Catalogue.

II. MAMMALS.

Family CERCOPITHECIDÆ.

CERCOPITHECUS SABÆUS (L.).

The Grivet Monkey was noted on the 14th and 15th of March at Abu Zeit, and on the 19th of March near Renk; each time in small parties of five or six individuals, sometimes walking on the ground, sometimes in trees. We saw no other species of monkey along the White Nile, but at Gabt-el-Meghahid, through the kindness of Major M. Peake, R.A., and Captain H. N. Dunn, R.A.M.C., I obtained from natives two live specimens of the Red Monkey (*Cercopithecus patas*) and a young Baboon (*Papio anubis* or an allied species), all three said to have been caught in Southern Kordofan.

Family LEMURIDÆ.

Two Lemurs, apparently some species of *Galago*, were obtained by Mr. E. S. Jackson, Welsh Regt., between Jebel Ain and Jebel Ahmed Agar.

Family FELIDÆ.

FELIS LEO (L.).

Lions were met with between Jebel Ahmed Agar and Kaka during March.

FELIS PARDUS L.

A Leopard was shot near Gabt-el-Meghahid, and a young one caught alive near Kaka.

FELIS SERVAL Schreb.

A Serval was shot by Mr. C. Crawley near Kaka on the 18th of April.

GENETTA sp. inc.

A Genet was shot near Gabt-el-Meghahid; the skin is now in the British Museum, but more specimens are required of these animals from various localities before it can be identified. I have also at different times obtained two Genets from the neighbourhood of Omdurman.

Family HYÆNIDÆ.

HYÆNA CROCUTA (Erxl.).

We saw a Spotted Hyæna on the Bahr-el-Ghazal on the 29th March, heard them at night on the White Nile on the 20th April, and a skull was picked up near the Bahr-el-Zeraf.

Family CANIDÆ.

CANIS sp. inc.

On the 17th March, some miles south of Jebel Ain, towards evening, we saw a reddish-brown Jackal or dog by the side of the river. We never heard Jackals howling at night.

Family VESPERTILIONIDÆ.

SCOTOPHILUS NIGRITA (Schreb.).

Two Bats of this species were obtained at Abu Zeit on the 14th March, just after sunset, flying over the river's bank.

VESPERTILIO sp. inc.

One specimen obtained at Abu Zeit, 14th March.

On the 29th March on the Bahr-el-Ghazal a big-eared Bat, with beautiful red-orange-coloured body, ears, and wings, was numerous: unfortunately no specimens were obtained.

Family MURIDÆ.

MUS RATTUS L.

Some young Rats caught in April on board one of the barges employed in the sudd-cutting in the Bahr-el-Jebel were apparently of this species.

Family LEPORIDÆ.

LEPUS sp. inc.

A few pale reddish-brown Hares were seen near Abu Zeit on the 14th and 15th of March. Some skins of these White Nile Hares would, I am told, be acceptable at the British Museum.

Family ELEPHANTIDÆ.

ELEPHAS AFRICANUS Blum.

Wild Elephants were met with on the Zeraf, Jebel, and Ghazal rivers, and on the south bank of the White Nile between the mouths of the Sobat and Jebel. Personally I saw them on ten different days: they were usually accompanied by small white Egrets perched on their backs. One day I had a good view of a frightened Elephant running away, it was amusing watching an Egret trying to keep its position on the great beast's back.

Family GIRAFFIDÆ.

GIRAFFA CAMELOPARDALIS L.

We saw only two Giraffes, on the Bahr-el-Zeraf on the 24th of March.

Family BOVIDÆ.

BOS CAFFER ÆQUINOCTIALIS (Blyth).

On the 3rd of April on the Bahr-el-Jebel we saw two Buffaloes,

grand beasts, they looked very black in colour; and on the 20th of April some of our party came on a large herd between Jebel Ahmed Agar and Long Tom.

BUBALIS sp. inc.

There is not yet enough material collected to ascertain the proper specific name of the Hartebeest of this region; the specimens I have seen seemed to me to be probably *B. jacksoni*.

A few Hartebeests were met with some miles north of Renk, and also on the Bahr-el-Ghazal; they were usually among herds of *Damaliscus tiang*.

DAMALISCUS TIANG (Heuglin).

This Antelope was met with, frequently in large herds, on the White Nile from about a day's steaming to the south of Jebel Ain to near Lake No, and also on the Zeraf and Ghazal rivers. Major Gwynn, D.S.O., R.E., told me he saw the Tiang on the Sobat 70 or 80 miles from its joining the White Nile, but none on the Upper Sobat.

The horns of different individuals vary very little in length, the largest male horns I have noted were $19\frac{3}{4}$ inches along their front curve.

COBUS DEFASSA (Rüpp.).

This Waterbuck was met with along the White Nile to the south of Jebel Ain, and on the Zeraf and Ghazal rivers.

COBUS LEUCOTIS (Licht. et Pet.).

The White-eared Kob was met with along the White Nile from some distance north of Jebel Ahmed Agar southwards to Lake No, and on the Zeraf and Ghazal rivers; it also occurs on the Sobat. Often seen in large herds: the old bucks have beautiful glossy black backs; the young bucks are reddish like the does.

COBUS THOMASI Neumann.

Captain R. M. Sanders, Worcestershire Regt., showed me the skin, skull, and horns of an Antelope he had shot, early this year, between Jebel Ain and Renk, which exactly agrees with the description of this species in the 'Book of Antelopes' (ii. p. 131, pl. xxxix.).

COBUS MARIA Gray.

Mrs. Gray's Waterbuck was only seen on six different days, on the Bahr-el-Jebel, Bahr-el-Ghazal, and on the White Nile between Lake No and the mouth of the Bahr-el-Zeraf; usually in very small herds, twenty was the largest number of individuals seen together. We met with this species only in swampy land, intersected by khors full of water, that a man cannot get about in without risk of being bogged or attacked by crocodiles. The wide

curling horns of *C. maria* look very fine, but the gait of the animal when galloping over the rough ground is very ungainly and awkward looking.

CERVICAPRA BOHOR (Rüpp.).

The Bohor Reedbuck was met with near Jebel Ahmed Agar, and on the Zeraf and Ghazal rivers; singly or in parties of one buck and one or two does. I think this species the most graceful of all the White Nile antelopes.

OUREBIA MONTANA (Rüpp.).

Oribis were met with near Kaka and Jebel Ahmed Agar, singly or in pairs, in the long grass and bush. Both sexes are coloured alike: that is, rich reddish fawn above, paler at the sides, and white underneath; there is no black at all on tail, face, or sides.

GAZELLA RUFIFRONS Gray.

The Red-fronted Gazelle was met with on both banks of the White Nile from Abu Zeit to Kaka.

Colour (sexes alike). Above bright rufous fawn, below pure white, a well-defined and conspicuous black stripe on the side of the body, last three-quarters of tail black: no black marks on face.

HIPPOTRAGUS EQUINUS BAKERI (Heugl.).

Baker's Roan Antelope, locally known as the "Abu Aroof," was met with near Jebel Ahmed Agar and on the Bahr-el-Zeraf.

TRAGELAPHUS sp. inc.

A large long-horned species of Bushbuck was observed by Lieut. Drury, R.N., on the Bahr-el-Jebel.

Family *SUIDÆ*.

PHACOCHÆRUS AFRICANUS (Gm.).

Wart-hogs were met with only on the 22nd April, some miles south of Jebel Ain.

Family *HIPPOTAMIDÆ*.

HIPPOTAMUS AMPHIBIUS L.

The Hippopotamus was first seen a little to the south of 14° North latitude, but did not become plentiful till south of Abu Zeit ford: these Northern animals were rather angular and starved-looking. Except in that part of the Bahr-el-Jebel where the sudd blocks were, we found the Hippopotamus very numerous wherever we went on the White Nile, Zeraf, Jebel, Ghazal, and Arab rivers, particularly in Lakes No and Ambadi. Between the 13th March and the 23rd April we saw Hippopotamuses on 34 days out of 42.

III. BIRDS.

Family CORVIDÆ.

CORVUS SCAPULATUS Daud.

This very fine black-and-white Crow was seen on the White Nile, from within half a day's steaming south of Omdurman to Lake No, and on the Sobat and Bahr-el-Zeraf; it was numerous round native villages and camps. During twelve days I stayed in and about Omdurman in April and May, I did not see a single Crow, but I have met this species further north, at Shendy.

On the 22nd March, in a tree by Fashoda Fort, I saw two Crows of a smaller species, all black.

Family DICRURIDÆ.

BUCHANGA ASSIMILIS (Bechst.).

This Drongo, or King Crow, we noted near Fashoda and Gabt-el-Meghahid.

Family TURDIDÆ.

SAXICOLA CENANTHE (L.).

A Wheatear was shot at Gabt-el-Meghahid in March.

Family TIMELIDÆ.

PYCNONOTUS ARSINOË (H. & E.).

This Bulbul was not uncommon between Jebel Ain and Jebel Ahmed Agar in April.

Family LANIIDÆ.

LANIARIUS ERYTHROGASTER Rüpp.

A specimen of this Shrike was shot near Gabt-el-Meghahid in March.

Family HIRUNDINIDÆ.

COTYLE RIPARIA (L.).

Sand-Martins were seen in large numbers towards evening flying over the water on the Bahr-el-Jebel every day, April 4th to 13th.

HIRUNDO ÆTHIOPICA Blanf.

This Swallow was numerous on the Bahr-el-Jebel in April.

Family MOTACILLIDÆ.

A Pied Wagtail was seen on the White Nile at Abu Zeit on the 14th March, and at Fashoda on the 22nd, and a yellow-bellied Wagtail near Heliat Nuer on the 5th of April; no specimens were procured.

Family FRINGILLIDÆ.

PASSER DOMESTICUS (L.).

The House-Sparrow was noted at Khartoum and Omdurman in March, April, and May.

Family STURNIDÆ.

LAMPROCOLIUS sp. inc.

A beautiful long-tailed Glossy Starling, with bright yellow eye, was very numerous, we must have seen hundreds, from Abu Zeit to Renk, 14th to 18th March.

Family PLOCEIDÆ.

UROBRACHYA TRAVERSI Salvad.

This Weaver-bird was seen in flocks of hundreds in the long dry grass by the White Nile near Kaka. The rich red-brown and black coloration of the wing, with a bright orange patch on it, gives the bird a very handsome appearance when flying.

ESTRELLA PHENICOTIS Swains.

The Cordon Blue Waxbill was very numerous in the bush near Jebel Ahmed Agar. One shot on the 19th of April had iris crimson; bill pink at base, turning brown towards tip; legs and feet very pale pinkish.

Family UPUPIDÆ.

UPUPA EOPS L.

A single Hoopoe was seen on three occasions: between Rink and Long Tom on the 19th March, near Kaka on the 21st March, and at the foot of Jebel Ahmed Agar on the 19th April.

Family CAPRIMULGIDÆ.

Beautiful and strange Nightjars were seen from time to time on the White Nile, Zeraf, and Ghazal; their long streamers were visible against the sky as they flew round the steamer after sunset; no specimens were procured.

Family CORACIIDÆ.

CORACIAS ABYSSINICUS Bodd.

A long-tailed Roller, apparently of this species, was very common about Abu Zeit on the 13th and 14th March.

Family MEROPIDÆ.

MEROPS ALBICOLLIS Vieill.

Only seen on Jebel Ahmed Agar, 19th April.

MEROPS VIRIDIS L.

One shot near Renk, 21st April.

MEROPS NUBICUS Gm.

This beautiful dark-headed red Bee-eater was fairly numerous along the White Nile from Abu Zeit to Lake No, and some were also seen on the Zeraf, Jebel, and Ghazal rivers. It was interesting to see these birds profiting by a bush fire: as the fire crept in a crackling line along the river-bank the Bee-eaters flew in front of it, catching and eating the insects which came out of the grass before the advancing heat. In the sunlight the brilliant colours of the living birds are wonderful; within an hour after death the brilliancy leaves the plumage.

Iris crimson, bill black, legs and feet horn-colour, claws black.

Family ALCEDINIDÆ.

CERYLE RUDIS (L.).

The Pied Kingfisher seems rare on the White Nile; it was only noted on the 19th of March near Renk, on the 27th near Lake No, and on the 22nd of April near Jebel Ain; but is fairly common on the Bahr-el-Ghazal, Bahr-el-Arab, and Lake Ambadi, and is numerous on the Bahr-el-Jebel from its mouth to as far south as we went.

Family COLIDÆ.

COLIUS sp. inc.

These busy little birds were seen in small parties in woods between Jebel Ain and Jebel Ahmed Agar in March and April.

Family BUCEROTIDÆ.

LOPHOCEROS ERYTHORHYNCHUS (Temm.).

This Hornbill was seen near Abu Zeit on the 14th of March, and near Rink on the 18th.

LOPHOCEROS NASUTUS (Linn.).

Capt. H. N. Dunn, R.A.M.C., shot a Hornbill of this species, and one I saw near Gabt-el-Meghabid on the 15th of April probably belonged to it.

Family CUCULIDÆ.

CENTROPUS SENEGALENSIS (L.).

A Cuckoo which I saw from time to time on the White Nile, Zeraf, Jebel, and Ghazal rivers, probably belongs to this species; specimens were shot but unfortunately lost.

Family PSITTACIDÆ.

PALÆORNIS DOCILIS (Vieill.).

These Parroquets were seen at Abu Zeit, where nestlings were obtained alive from natives, on the 14th of March, and near Renk on the 18th.

Family VULTURIDÆ.

Either *Gyps fulvus* or an allied species was seen both on the Zeraf and the Ghazal; and a smaller Vulture, probably *Pseudogyps africanus* (Salvad.), on the Zeraf. *Otogyps auricularis* (Daud.) was noted on the 18th March a few miles north of Renk, and occasionally again further south. The common Egyptian Vulture, *Neophron percnopterus* (Linn.), was seen from time to time along the White Nile from Omdurman to Fashoda, and also on the Zeraf. A Vulture shot on the Zeraf, about seventy or eighty miles from its mouth, on the 25th March was apparently *Neophron monachus* (Temm.).

Family FALCONIDÆ.

CIRCUS MACRURUS (Gmel.).

Harrier shot near Abu Zeit, 14th March: iris golden shot with bronze, eyelid and cere yellow, bill black, legs and feet orange, claws black.

MELIERAX sp. inc.

Seen near Renk on the 19th March, and on the Zeraf on the 24th and 26th.

LOPHOAËTUS OCCIPITALIS (Daud.).

We saw only one specimen of this beautiful dark-crested Eagle, in a tree near Renk, on the 19th of March.

HALIAËTUS VOCIFER (Daud.).

The Vociferous Sea-Eagle was noted on 33 out of the 47 days we were south of Khartoum, along the White Nile from Omdurman to Lake No, and on the Sobat, Zeraf, Jebel, Ghazal, and Arab rivers, and it was numerous on Lake Ambadi. On the 21st March I noted of this species "a noisy bird, often heard calling." From the 23rd March to the 13th April they were generally seen in pairs.

MILVUS ÆGYPTIUS (Gmel.).

The common Nile Kite was noted on 27 out of the 47 days, along the White Nile, Sobat, Zeraf, Jebel, Ghazal, and Arab rivers. On this last river a specimen was shot for identification. This Kite was also noted in Khartoum in March, April, and May.

CERCHNEIS TINNUNCULUS (L.).

The Kestrel was noted at Abu Zeit on the 14th of March, and on the Zeraf on the 24th of March.

Family PHALACROCORACIDÆ.

PHALACROCORAX sp. inc.

Cormorants were seen on the White Nile between Abu Zeit and

Renk in March, and some of a very small species on the Ghazal on 3rd April.

PLOTUS RUFUS Daudin.

Darters were noted on 32 days out of the 47; they were fairly numerous all along the White Nile from Omdurman southwards, and on the Sobat, Jebel, Ghazal, and Arab rivers. On Lakes No and Ambadi they were very numerous indeed, in flocks on the water, on the mud, in the papyrus, and on the small trees. Thirty-five individuals is the most I have counted in a flock.

Family PELECANIDÆ.

PELECANUS ONOCROTALUS (L.).

The Common Pelican was noted on 10 days out of the 47, always in flocks of from fifty to ninety or even more individuals, along the White Nile from Jebel Ain southwards, on lakes by the Bahr-el-Jebel to the south of the Heliat Nuer, and on Lake Ambadi and other sheets of water connecting with the Bahr-el-Ghazal.

PELECANUS RUFESCENS Gmel.

This elegant small Pelican was noted on 28 days out of the 47, either solitary or in small parties, along the White Nile from Omdurman southwards, and on the Zeraf, Jebel, Ghazal, and Arab rivers, and on Lake Ambadi. Two birds of this species were so inquisitive as to swim up to within ten yards of the steamer one day.

Family PHŒNICOPTERIDÆ.

Only once did I see any Flamingoes—on the 22nd of March, near Fashoda, two adults and one halfgrown young one walking together on a sandbank; they were probably *Phœniconaias minor* (Geoffr.).

Family ANATIDÆ.

PLECTROPTERUS sp. inc.

Spur-winged Geese were noted on 13 days out of the 47; on the White Nile from near Omdurman to Fashoda, on the Bahr-el-Jebel, and on Lake Ambadi, where they were numerous.

DENDROCYNNA VIDUATA (L.).

The White-faced Tree-Duck, or "Whistling Teal" as it is commonly called in the Sudan, was first seen on the 23rd of March between the Sobat and the Bahr-el-Zeraf, then again on the 27th on the Nile and on Lake No; on the 29th we saw a few on the Ghazal and flocks of hundreds on the Bahr-el-Arab; on the 30th and 31st we saw them on Lake Ambadi in untold thousands, their whistling noise could be heard all day, as numerous flocks of from fifteen to fifty individuals kept flying along before the gunboat.

On the 2nd of April, when returning through Lake No, we saw some large flocks. On six days out of the twelve we spent on the Bahr-el-Jebel we saw some of these ducks. On the return voyage north we met flocks on five different days between Fashoda and Omdurman, seeing some within half a day's steaming of that city. On the 18th April I shot three; they all had their white faces tinged with fulvous.

CHENALOPEX EGYPTIACUS (Briss.).

Egyptian Geese are very numerous on the White Nile from Omdurman to about Fashoda, on some days we saw thousands; they were hardly ever out of sight along the banks as we steamed along: from Fashoda on to Lake No they were not so numerous; on the Bahr-el-Jebel we met them only at Heliat Nuer and Shambé, and then only a few at a time; on the Ghazal I saw only about six individuals during the six days we spent on it. On the 21st April near Renk by the river's edge we saw a pair with a little party of goslings.

CASARCA RUTILA (Pall.).

On the 11th March near Omdurman a few Brahminy Ducks were seen among the big flocks of Egyptian Geese.

DAFILA ACUTA (L.).

Noted many Pintail on the 11th March near Omdurman, and a few on the 21st March near Kaka.

SPATULA CLYPEATA (L.).

Shovellers were seen only on the 11th and 12th of March at the northern end of the White Nile.

FULIGULA FULIGULA (L.).

A flock of about thirty Tufted Ducks were seen on the 11th March near Omdurman, and one of about twenty on the 17th March near Jebel Ain.

Family IBIDIDÆ.

IBIS ÆTHIOPICA (Lath.).

The Sacred Ibis was noted on 21 days out of the 47 we were south of Khartoum; it was fairly numerous on the White Nile from close to Omdurman to Lake No, and on the Bahr-el-Ghazal, Bahr-el-Arab, and Lake Ambadi; we also saw a few on the Bahr-el-Jebel between Heliat Nuer and Shambé.

HAGEDASHIA HAGEDASH (Vieill.).

PLEGADIS FALCINELLUS (L.)

These two species of dark-coloured Glossy Ibises were seen on the White Nile south of Kowa and its tributaries.

Family PLATALEIDÆ.

PLATALEA sp. inc.

Spoonbills were noted only on 10 days out of the 47: on the White Nile at intervals from near Omdurman to Lake No, and on the Bahr-el-Jebel south of Heliat Nuer.

Family CICONIIDÆ.

DISSURA EPISCOPUS (Bodd.).

This Stork was seen only on the 23rd of March between the Sobat and Zeraf.

CICONIA CICONIA (L.).

On the 11th of March some flocks of about twenty White Storks were seen near Omdurman; the species was again noted on the 13th, and on the 20th, some miles south of Jebel Ahmed Agar, about 5 P.M. we saw a wonderful gathering on a sandbank, there must have been more than a thousand of them. Again on the 19th of April we saw a few of this species near Jebel Ahmed Agar.

EPHIPPIORHYNCHUS SENEGALENSIS (Shaw).

The Great Saddle-billed Stork was noted on 18 days out of the 47, either solitary or in pairs; it is not so familiar as the Maribou or Tantalus, but is not shy and wild like the Shoebill. This species we saw on the White Nile south of Renk, on the Zeraf, Jebel, Ghazal, and Arab rivers, and on Lakes No and Ambadi.

LEPTOPTILUS CRUMENIFERUS (Less.).

The Maribou, or "Adjutant Bird," is about the most noticeable bird of this region; it was observed on 33 days out of the 47: on the White Nile from within a day's journey of Omdurman to Lake No, on the Bahr-el-Zeraf, on the Bahr-el-Jebel from its mouth to as far south as we went (about 7° 20' N. lat.), on the Ghazal and Arab, and on Lake Ambadi. It usually congregates in large parties in the neighbourhood of native camps, or where an animal has been killed. I once counted sixty-nine of these great Storks seated round the carcase of an elephant. In places where there are trees, these birds can be seen perched in their tops.

ANASTOMUS LAMELLIGERUS Temm.

The Gape-billed Stork was noted on 30 days out of the 47; it was usually seen in large numbers busily searching for food in the mud and shallow water, or on the beds of the so-called "oyster" (*Ætheria*), left exposed by the low Nile: it is a gloomy funereal-looking bird. We observed it all down the White Nile from Omdurman to Lake No, and on the Zeraf, Jebel (as far south as we went), Ghazal, and Arab rivers, and on Lake Ambadi. Some of the flocks number many hundreds of individuals. Like the Ibises, this bird perches on trees where there are any.

PSEUDOTANTALUS IBIS (L.).

The African Tantalus was noted on 17 days out of the 47: on the White Nile from near Omdurman southwards, on the Jebel Ghazal, and Arab rivers, and on Lake Ambadi. Like the Maribous, these birds are but little frightened of men and their ways; I have seen them not fly away till the steamer was within about twenty yards of them. They are very handsome birds, with, as a rule, such beautifully clean-looking white plumage and cheerful ruddy faces. They often congregate in flocks; the largest number of individuals I have counted in a flock was forty-three.

Family BALENICIPITIDÆ.

BALENICEPS REX Gould.

The Shoebill or Whaleheaded Stork is termed in Arabic "Abu Markūb," *i. e.* father of a slipper. On the 28th March we first came on this species, a solitary specimen, in a marsh near Lake No; on the 29th while steaming up the Bahr-el-Ghazal we saw three or four; on the 30th a few more on Lake Ambadi, one was shot and the skin preserved; on the 31st we saw many, as the following extract from my diary shows:—"Whaleheaded Stork: saw perhaps forty or fifty in the course of the day; we tried hard to shoot another specimen with our rifles, but nobody managed to hit one; it is very curious that while all the other birds here (never having been shot at) are comparatively tame and easy to approach within fifty yards or less, the *Baleniceps* is very shy, usually flying off at about three hundred yards or even further, and it was very seldom we got a shot at them under two hundred yards, which from a moving steamer is not easy. They were to be seen usually singly, sometimes two or three within a score of yards of each other, standing about on the edges of the marsh, always in the same attitude; in the motionless way in which they stand, their solitariness, and their flight, they are more like a heron than a stork; in fact, at a distance, unless you can see the bill, it is impossible to tell them, when on the wing, from the Goliath Heron. They were most numerous by Lake Ambadi, but occurred at intervals all along the Bahr-el-Ghazal." On the 3rd of April we saw two near the mouth of the Bahr-el-Jebel, on the 5th one near Heliat Nuer; on the 7th we saw seven during the afternoon, either singly or in pairs, as usual seen standing motionless in the swamp, and very shy; and on the 8th we saw one within about thirty miles north of Shambé.

Notes on specimen shot, Lake Ambadi, 30th March:—

Iris very pale yellow. Eyelids and skin between bill and eye blue-grey like the feathers of the head, but the lower eyelid has a patch of small white feathers on it. Bill horn-colour, upper mandible being greyish towards base. Legs, feet, and claws black.

Family ARDEIDÆ.

ARDEA PURPUREA (L.).

The Purple Heron I only saw on three days on the White Nile (between Jebel Ain and Jebel Ahmed Agar), but it was numerous in the papyrus-swamps on the Bahr-el-Jebel and Bahr-el-Ghazal.

ARDEA GOLIATH Cretzschm.

The Goliath Heron was noted on 30 days out of the 47: all along the White Nile from Omdurman to Lake No, on the Zeraf, Jebel, and Ghazal rivers, and on Lake Ambadi. It is a very noble-looking bird. It was always seen solitary, never in parties. Its harsh loud cry is one of the most familiar noises heard when traveling in this region.

NYCTICORAX sp. inc.

A Night-Heron was noted on the White Nile south of Kaka, on the Sobat and Bahr-el-Zeraf, and in flocks of a hundred or more individuals in the papyrus-swamps of the Bahr-el-Jebel and Bahr-el-Ghazal and on Lake Ambadi.

Examples of at least six more species of Herons were seen on the White Nile, but no specimens were shot.

Family GRUIDÆ.

GRUS GRUS (L.).

A flock of this species of Crane seen near Goz Abu Goma on the 13th of March, and near El Duem on the 25th of April.

ANTHROPOIDES VIRGO (L.).

A flock of Demoiselle Cranes seen near Goz Abu Goma on the 13th of March, and a large flock near Jebel Ain on the 17th of March.

BALEARICA PAVONINA (L.).

The lovely Crowned Crane was noted on 26 days out of the 47: on the White Nile from near Omdurman to Lake No, frequently in flocks of several hundred individuals. On the 17th April I saw some scores of these beautiful birds feeding in and around the entrenchments of Fashoda Fort. We saw some near the mouth of the Sobat. On the Zeraf they were very numerous near its junction with the Nile, but, curiously, after going 20 or 30 miles upstream we saw none. On the Bahr-el-Jebel we saw only a few individuals near the furthest point south we reached. On the Ghazal and Arab rivers and on Lake Ambadi they were numerous, going about in pairs. The wild, somewhat trumpet-like call which these Cranes utter as they take to the wing is very fine.

LISSOTIS MELANOGASTER (Kaup).

Specimens of this Bustard were shot on the Bahr-el-Ghazal on

the 2nd of April, and near Kaka on the 18th. Notes on the former specimen:—Iris golden. Bill greenish. Length, wing $14\frac{1}{2}$ inches, tail 7 inches, tarsus 6 inches; bill, culmen $1\frac{3}{4}$ inches, tip to gape $2\frac{1}{3}$ inches.

EUPODOTIS ARABS (L.).

“Oubāra” of the Arabs. This large Bustard was occasionally seen on the White Nile, Zeraf, and Ghazal rivers.

Family *ŒDICNEMIDÆ*.

ŒDICNEMUS sp. inc.

Thickknees were seen near Kaka on the 21st March, near Gabt-el-Meghabid 15th April, near Fashoda 17th April, and were numerous on the Zeraf and Ghazal rivers.

Family *CURSORIIDÆ*.

PLUVIANUS ÆGYPTIUS (L.).

Only seen on Lake Ambadi on the 31st March, and on the Bahr-el-Jebel on the 14th April.

Family *PARRIDÆ*.

PHYLLOPEZUS AFRICANUS (Gm.).

This white-faced red Jacana was seen solitary or in little flocks of four or five individuals, occasionally on the White Nile from Long Tom southwards, and frequently on Lake Ambadi and the Zeraf, Jebel, Ghazal, and Arab rivers.

Family *CHARADRIIDÆ*.

HOPLOPTERUS SPINOSUS (L.).

This Plover was noted on 25 days out of the 47: on the White Nile from near Omdurman to Lake No, and on the Zeraf, Jebel, Ghazal, and Arab rivers.

HIMANTOPUS HIMANTOPUS (L.).

Stilts were seen near El Duem, Abu Zeit, Jebel Ain, &c. on the White Nile, a little south of Heliat Nuer on the Bahr-el-Jebel, and on the Bahr-el-Arab.

RECURVIROSTRA AVOCETTA (L.).

Noted Avocets on the 12th of March a little north of El Duem.

NUMENIUS ARQUATUS (L.).

NUMENIUS PHÆOPUS (L.).

Both Curlews and Whimbrels noted in the northern part of the White Nile in March.

Family LARIDÆ.

HYDROCHELIDON HYBRIDA (Pall.).

A Tern seen at El Duem, and elsewhere, was probably of this species. At least two other species of Terns were observed, but no specimens were procured.

RHYNCHOPS FLAVIROSTRIS Vieill.

Flocks of red-billed Skimmers were seen on five occasions: near Rink, near Fashoda, on Lake No, and between Heliat Nuer and Shambé.

Family PERISTERIDÆ.

TURTUR AMBIGUUS Bocage.

This Turtle-Dove seems very numerous in suitable localities along the White Nile, from a little south of Kowa to the last woods near Lake No, also on the Sobat, Zeraf, and Ghazal rivers. On the Bahr-el-Jebel, owing to the general absence of trees, we only occasionally saw any doves.

Iris golden; bill black; legs and feet pink; claws dark horn.

CHALCOPELIA AFRA (L.).

This beautiful little Pigeon is numerous in the woods and flies very swiftly; it was noted from Abu Zeit southwards along the White Nile and also on the Bahr-el-Zeraf.

Family PTEROCLIDÆ.

PTEROCLES QUADRICINCTUS Temm.

Captain Dunn, R.A.M.C., shot a Sand-grouse of this species near Gabt-el-Meghahid in March.

On the White Nile from a little south of Omdurman to Abu Zeit, 12th to 16th March, we saw large flocks (in some cases there must have been thousands of individuals) of Sand-grouse come down to the river, usually about 9 A.M. No specimens were shot, so I could not identify the species.

Family PHASIANIDÆ.

NUMIDA PTILORHYNCHA Licht.

"Gedad" of the Arabs. These Guinea-fowl were seen on the White Nile near Goz Abu Goma, Abu Zeit, Jebel Ain, Renk, Jebel Ahmed Agar, Kaka, Gabt-el-Meghahid, &c., and on the Bahr-el-Zeraf. At daybreak and towards sunset flocks of from twenty to over a hundred individuals may be seen drinking at the river's edge. They are excellent eating.

IV. REPTILES.

Family PELOMEDUSIDÆ.

STERNOTHERUS ADANSONI (Schweigg.).

This Water-Tortoise was found on the White Nile from Abu Zeit southwards, and on the Zeraf and Ghazal rivers.

The British Museum contains a specimen collected by Consul Petherick on the Upper Nile.

Family TRIONYCHIDÆ.

CYCLANORBIS SENEGALENSIS (D. & B.).

Remains of this Turtle were found lying on the banks of the White Nile as far north as Renk, and on the Bahr-el-Zeraf.

Family CROCODILIDÆ.

CROCODILUS NILOTICUS Laur.

Crocodiles were noted on 30 days out of the 47 we were south of Khartoum. We first saw them about 20 miles to the north of El Duem, but they did not become numerous till south of Abu Zeit ford. From Jebel Ain onward to about Fashoda, Crocodiles were seldom out of sight, often in large numbers: for instance on 17th March I counted 21 individuals lying at one spot on the tail of an island, and on 18th April 22 basking on one sandbank. On the Bahr-el-Zeraf small Crocodiles were numerous, I caught one alive. We also saw some Crocodiles on the Lake No end of the White Nile, on the Bahr-el-Jebel, Bahr-el-Ghazal, Bahr-el-Homar, and Lake Ambadi; they were probably as numerous on these rivers as on the White Nile, but the thick masses of reeds prevented one seeing them, and on the Bahr-el-Jebel the Crocodiles were, curiously, very shy and we could not get within shooting distance of them.

Most of the Crocodiles seen were under 12 feet in length, but some must have approached 15 feet; the largest specimen I actually measured, killed by natives near Fashoda, was 14 feet long. The only really large ones we saw were on the Bahr-el-Jebel, between Heliat Nuer and Shambé; on the 7th April I saw two or three that I estimated to be perhaps 20 feet in length.

Family GECKONIDÆ.

HEMIDACTYLUS BROOKII Gray.

Four Geckoes of this species were caught at Gabt-el-Meghahid in April.

Family VARANIDÆ.

VARANUS NILOTICUS (Linn.).

This large Lizard was met with on the Zeraf and Jebel rivers. A specimen from the Zeraf measured in total length 5 feet

1½ inches; snout to vent 2 feet 5½ inches; tail (tip broken) 2 feet 8 inches.

VABANUS OCELLATUS Rüpp.

Two specimens obtained, White Nile.

Family SCINCIDÆ.

MABUIA STRIATA (Peters).

One specimen of this Skink caught at Fashoda on the 22nd of March.

Family GLAUCONIIDÆ.

GLAUCONIA CAIRI (Dum. et Bibr.).

A little Snake caught at Gabt-el-Meghahid is apparently of this species, but unfortunately its somewhat shrivelled condition prevents its being determined for certain.

Family BOIDÆ.

PYTHON SEBÆ (Gmel.).

A young Python of this species was caught on the bank of the White Nile, near the mouth of the Bahr-el-Jebel, 14th April. Ventrals 280. Anal entire. Subcaudals 72. Scales in 93 rows.

Family COLUBRIDÆ.

TROPIDONOTUS OLIVACEUS (Peters).

Three specimens were caught in the sudd region of the Bahr-el-Jebel in April.

CHLOROPHIS EMINI (Günth.).

Three Snakes of this species were caught in the sudd on the Bahr-el-Jebel in April.

PSAMMOPHIS SIBILANS (Linn.).

A specimen of colour-variety E (Blgr. Cat. Snakes, iii. p. 161) was caught at Gabt-el-Meghahid in April: it had 1 præ- and 2 postoculars, temporals 2+2, 8 upper labials (4th and 5th enter eye), ventrals 183, subcaudals 100, and was in total length about 685 mm.

V. BATRACHIANS.

Family RANIDÆ.

RANA MASCARENSIS Dum. et Bibr.

One specimen caught a few miles south of Jebel Ain on the 22nd April; this was the first and only batrachian I (or any of our party) saw during the whole time we were south of Khartoum. It was coloured olive and bronze, with indefinite markings.

VI. FISHES.

Mr. G. A. Boulenger, F.R.S., has kindly determined the following fishes, specimens of which I collected and sent to the British Museum.

1. POLYPTERUS SENEGALUS.

Specimens were obtained on the Bahr-el-Zeraf, Bahr-el-Jebel, and Bahr-el-Ghazal. On the 8th of April two were caught with rod and line, by dangling a little piece of meat on a hook just under the surface of the water in a little shallow muddy backwater of the Jebel.

2. POLYPTERUS BICHIR.

On the 7th April a specimen was caught by hand on the Bahr-el-Jebel, frightened by the approaching steamer it had jumped out of the water on to the sudd.

Colour (in life). Olive-green, darker on the top of the head and along back, pale lemon-yellow below. Lips and underneath of head washed with pink. Tentacle red. Red lights about gills and pectoral fins. Body about vent, and ends of ventral, anal, and caudal fins, tinged with bright red. Iris yellow.

3. HETEROTIS NILOTICUS.

Sometimes called the "White Nile Salmon," and said to be very good eating, but I have not tried it personally. Specimen caught at Gabt-el-Meghahid on the 15th of April:—Total length over all 2 feet 3 inches; depth (at vent) $5\frac{3}{4}$ inches.

4. GYMNARCHUS NILOTICUS.

A specimen of this large eel-like fish was caught near the junction of the Ghazal and Homar rivers on the 29th March; it measured in total length 3 feet $9\frac{1}{2}$ inches.

5. TILAPIA NILOTICA.

A "Boultee" was caught at Gabt-el-Meghahid on the 15th April, and on the 29th March when steaming down the Bahr-el-Arab a large one jumped on board the gunboat: we ate it, but the flesh was not nice, being soft and "muddy."

6. SYNODONTIS SCHALL.

This Siluroid seemed numerous on the Bahr-el-Zeraf, specimens were caught on hook and line from the steamer while tied up to the bank.

7. BAGRUS DOCMAC.

Bahr-el-Zeraf, caught as above.

8. CLARIAS LAZERA.

Bahr-el-Zeraf, caught as above.

VII. MOLLUSCS.

Thanks to the kind assistance of Mr. Edgar A. Smith, I have been able to identify at the British Museum most of the shells collected on the White Nile: they are referable to eleven species.

Family VIVIPARIDÆ.

1. VIVIPARA UNICOLOR Olivier.

One specimen from Abu Zeit.

Family STENOGYRIDÆ.

2. LIMICOLARIA CAILLAUDI Pfr.

Many specimens of this beautifully marked tall spiral shell were picked up at Fashoda, and a few at other places between there and Jebel Ain.

Family AMPULLARIIDÆ.

3. AMPULLARIA WERNEBI Philippi.

Shells of this species were very numerous, scattered about the banks of the White Nile at Abu Zeit, Fashoda, &c., and also along the Bahr-el-Zeraf and Bahr-el-Ghazal. This species attains to a larger size in this region than any African freshwater shell was previously known to; I have measured a specimen nearly 5 inches (125 mm.) across in its largest diagonal diameter.

4. LANISTES PURPUREUS Jonas.

This sinistral shell we found numerous along the Bahr-el-Zeraf.

5. LANISTES CABINATUS (Olivier).

Of this sinistral shell we obtained specimens at Fashoda and other places on the White Nile, and also on the Bahr-el-Zeraf.

Family CYRENIDÆ.

6. CORBICULA FLUMINALIS Müll. jr.

One specimen from Abu Zeit; both Sir Samuel Baker and Consul Petherick also obtained examples of this species from the White Nile waters.

Family UNIONIDÆ.

7. UNIO TERETIUSCULUS Philippi.

This small Mussel we got at Abu Zeit.

Family IRIDINIDÆ.

8. MUTELA ROSTRATA Rang.

A very elongated Mussel from the White Nile, south of Abu Zeit.

9. *MUTELA RUBENS* Lamarck.

Some small Mussels also found to the south of Abu Zeit are probably young specimens of this species.

10. *MUTELA* sp. inc.

A very large Mussel, with beautiful iridescent pink inside, which we found at Fashoda and other places on the White Nile, does not entirely agree with any specimen in the British Museum collection, but is closely allied to *Mutela petersi*, Martens.

Family *ÆTHERIIDÆ*.11. *ÆTHERIA* sp. inc.

This shell, commonly spoken of as the "White Nile Oyster" (but not really an oyster), is probably *Ætheria lamarckii*. It is excessively numerous, forming large beds along the river, especially about El Duem, Kowa, and Abu Zeit. These being left dry by the unusually low Nile were frequented by hundreds of birds.

VIII. INSECTS.

HEXAPODA.

Owing to the loss of my killing-bottles &c. early in the expedition, only a very small collection of insects was brought back; Sir George Hampson, Bt., has kindly identified the following Moths.

Family *PYRALIDÆ*.

GLYPHODES SERICEA Drury. Caught on Bahr-el-Ghazal in March.

Family *NOCTUIDÆ*.

SPHINGOMORPHA CHLOREA MONTEIRONIS Ruth. Also caught on the Bahr-el-Ghazal in March.

Of Beetles, the most remarkable owing to its numbers was a small species of *Adoretus* (family *Rutelidæ*), which on the Bahr-el-Ghazal, on the nights of the 1st and 2nd April, swarmed on board the steamer in incalculable thousands and was a great nuisance, crawling up our sleeves, down our necks, and into our food and beds. A remarkable "long-nosed bug" (*Pyrops* sp. inc.) was caught near Heliat Nuer on the 9th April, and a large *Belostoma* at Fashoda. Beautiful little Fireflies were a noticeable feature on many evenings on the Zeraf, Jebel, and Ghazal rivers, darting hither and thither over and through the reeds.

But it was certain flies that most attracted our attention.

Family *TABANIDÆ*.

TABANUS DORSIVITTA Walker. The Seroot Fly.

Colour. Eyes rich dark brown. Back of thorax olive-brown, with four dark longitudinal lines. Abdomen: upper surface, centre

very pale olive-brown with on each side a black longitudinal line, sides rich reddish brown. Underneath head and thorax pale grey. Underneath abdomen pale reddish brown, except centre of last three segments which are dark brown. Legs: basal segments grey, remainder reddish brown, except front pair, which are black underneath and marked with black above distally. Antennæ black. Biting-organ: anterior shorter portion white, posterior or longer portions black. Wings transparent, reddish-brown veins.

We first met the Seroot on the 16th March a few miles south of the Abu Zeit ford, on the 17th and 18th we again observed it. On the 23rd at Gabt-el-Meghahid it was numerous, as it was also on the Zeraf and Ghazal rivers, but none were noted on the Bahr-el-Jebel. On the return journey it was troublesome on the Sobat and on the White Nile to a little north of Kaka.

The Seroot is most persistent in its attacks all through the day, but especially late in the afternoon, when it only leaves off in time for the Mosquitoes to come on. The Seroot bites one even through one's shirt and at the knees through cord riding-breeches; if driven off there is no after effect from the bite, but if allowed to remain biting for long the wound becomes irritable and slightly swollen next day.

TABANUS sp. inc.

A second, larger species of Seroot was occasionally met with, with a black abdomen. In size it agrees with *Tabanus biguttatus*, but the female has a whitish thorax instead of yellow as in that species, of which I think it may be a variety.

Mosquitoes.

Both going and coming back along the White Nile we met very few Mosquitoes between Omdurman and the Sobat; on the Zeraf from March 23rd to 25th they were not numerous; on March 26th in the White Nile they first became troublesome; and on the 27th in Lake No were a great nuisance, rendering sleep almost impossible except under curtains of extra fine mesh; though so small, these Mosquitoes are very venomous. On the Ghazal from March 28th to April 1st they swarmed in the papyrus, but in places where there was a break in the swamps there were very few and it was possible to sleep in comfort. On the Bahr-el-Jebel from 3rd to the 13th April we never had any peace from them from about sunset till a couple of hours after sunrise. Nowhere in the East have I met Mosquitoes in such numbers, or so venomous and persistent in attacking one: not only the English officers, but also the Egyptian and Soudanese soldiers and Nubian boatmen suffered much from them.

IX. MILLIPEDES.

ARCHISPIROSTREPTUS sp. inc.

Three specimens Gabt-el-Meghahid, and two near mouth of Zeraf: the only Millipedes met with.

X. CENTIPEDES.

SCOLOPENDRA MORBITANS L.

Three Centipedes, each about 50 mm. (2 inches) long, obtained at Gabt-el-Meghahid. It is very interesting to find this widely distributed species here: at first I thought it might have been brought up among our baggage, but Mr. R. I. Pocock tells me it has only once been met with in Egypt and never before in any part of the Soudan.

XI. ARACHNIDS.

Family BUTHIDÆ.

BUTHUS EMINI Pocock, A. M. N. H. (6) vi. p. 98, pl. i. fig. 2 (1890).

Three Scorpions from Gabt-el-Meghahid. The type specimen was obtained by the late Emin Pasha on the shore of the Victoria Nyanza.

Family PISAURIDÆ.

EUPHROSTHENOPS BAYONIANUS Brit. Cap.

A Spider probably of this species, which was described from Angola, was obtained at Gabt-el-Meghahid.

Family HETEROPODIDÆ.

SPARASSUS sp. inc.

Specimens of this Spider were caught at Gabt-el-Meghahid and on board the gunboat 'Abu Klea.'

Family ATTIDÆ.

MARPESSA (=MARPTUSA) sp. inc.

An apparently undescribed species of Jumping Spider was numerous on board the gunboat 'Abu Klea.' A male and female have been presented to the British Museum.

XII. CRUSTACEANS.

Family POTAMONIDÆ.

POTAMON sp. inc.

This Crab, of which only one specimen was obtained, apparently belongs to a new species, and will be described by Dr. J. G. de Man in a future communication.

It was found on the sudd in the Bahr-el-Jebel.

2. An Account of a Large Branchiate Polynoid from New Zealand, *Lepidonotus giganteus* Kirk. By W. MALCOLM THOMSON, B.A. (N.Z.). With an Introduction by Professor W. BLAXLAND BENHAM, D.Sc., M.A., F.Z.S., Otago University.

[Received November 19, 1900.]

(Plates LX.-LXII.)

INTRODUCTION. By Prof. BENHAM.

In introducing to the zoological world a new author, I think it is only just, both to members of the Society and to my pupil, Mr. Thomson, to state that, though the paper has been written and the drawings executed by him, I have throughout constantly supervised his work, so that I can confirm all his statements of fact, to which, too, I have here and there added a note.

In the course of an examination of a collection of Annelids obtained during a recent experimental trawling expedition, carried out by the Fisheries Department of the New Zealand Government—during which provision was generously made for the collection of zoological material,—I had occasion to identify a large species of *Lepidonotus*, the subject of the present paper. I soon discovered that this *Lepidonotus giganteus* of Kirk [8] had been previously described under the name *Aphrodita squamosa* by Quatrefages many years before; and a question arises as to the strict application of the laws of nomenclature.

The commonest Polynoid on the coasts of Britain is *L. squamatus* L.; and it appears to me that on the grounds of clearness and convenience—which, after all, are the foundations of any system of nomenclature—it would be desirable to depart in this instance from the strict letter of a law which, if applied, might lead to some confusion between the old established *L. squamatus* L. and the New Zealand species *L. squamosus* Q.

It is true that in faunistic accounts these two names would probably never actually clash, for the British species does not occur on the coasts of New Zealand. But it is not impossible that *L. squamosus* may occur in Arctic seas, side by side with *L. squamatus*; for in a collection of Polynoids made within the Arctic circle, and handed to me by Prof. D'Arcy Thompson (for identification—which, however, I had to return to him unidentified, on leaving Oxford), I remember a large specimen of about the same size and colour as the subject of the present note. But as I have no literature here upon Arctic Annelids, I am unable to ascertain whether the Arctic species is identical with our Southern form; yet, if the "Bipolar Theory" be true, it is not impossible that it may be: then confusion between the two names would arise.

I have therefore retained the name given by Kirk, who

recognized its proper genus; in preference to the specific name conferred by Quatrefages, who had most unaccountably referred it to *Aphrodita*.

The most striking and interesting feature about the Annelid is the very definite, subelytral groove along the back (Plate LX. fig. 3) with the row of tubercles for the support of the overlapping moieties of the elytra, so that the groove is constantly open for the respiratory current. I am not aware that anything so definite has been hitherto noted in any Polynoid, and I suggest the term "respiratory channel" for it.

The definite "exhalant aperture," too, formed by the emarginations of the last pair of elytra (Plate LX. fig. 1) complete the utility of this channel. The presence of such an aperture formed in this way is mentioned and figured by Huxley for *L. squamatus*, in his 'Manual of Anatomy of the Invertebrates,' 1877, p. 228. The peculiar hair-like character of the neuropodial bristles—suggesting the felted hairs of *Aphrodita*—are also a peculiarity of the species, especially in their number and softness of texture.

DESCRIPTION OF THE SPECIES. By W. MALCOLM THOMSON.

General appearance.—The specimens measured in a preserved condition ranged in length from 80 mm. downwards and in breadth from 35 mm. Average specimens were about 68 mm. long by 25 mm. broad. In shape the animal is a very regular oval, the anterior end being rather narrower than the posterior. The upper surface of the body is strongly convex, both in the longitudinal and transverse planes, the ventral surface being flat or even inclined to be convex, but with the usual median groove. The dorsum is completely covered by the large imbricate elytra, of which there are twelve pairs (Plate LX. fig. 1). Between the first pair a small median notch allows the protrusion of the palps and tentacles. There is a smooth tract over the mesial moiety of the series of the elytra, bounded on each side by a row of oblong transverse ridges representing the areolæ or areas of attachment of the elytra (Plate LX. fig. 1, *a*). The median moiety of each elytron constituting this tract is coloured a warm brown, and this colour is continued outwards behind the areola (Plate LX. fig. 1, *c*), the anterior surface of which is coloured light buff and is smoother than the general surface. The median tract ceases at the last pair of elytra, the inner margin of each of which is notched, so as to produce a small oval aperture with distinct, upturned lips: this aperture is the exhalant respiratory pore, to which we shall return. The posterior and lateral surfaces of an elytron are beset with numerous spiny processes and also with fine hairs. The margin of the body, as seen from above, is formed by a fringe of hairs constituted by the successive bundles of notopodial bristles. These hair-like bristles and the processes of the elytra collect a considerable amount of mud and afford a foothold for foreign organisms, which no doubt aid in the concealment of the animal.

Here and there along the sides of the body the tips of the dorsal cirri may be seen protruding. The tips of the stout neuropodial bristles are also visible at certain points (Plate LX. fig. 1, *ch.*).

When the body is viewed from below, the eye is at once caught by the stout parapodia (Plate LX. fig. 2) and by the large mouth. The body consists of 27 segments, including the peristomium and the pygidium, which do not carry typical parapodia; of which, therefore, there are only 25 pairs. Each parapodium is provided with a ventral cirrus, and just at the point of attachment of the foot with the body there occurs a prominent nephridial papilla (Plate LX. fig. 2, *neph.*) These become less marked towards the anterior end, and are absent from the first four or five pairs of parapodia¹ (the rudiments show up more clearly in some specimens than in others). Each papilla springs from the body, from the corner of a little square area raised into ridges, these areas forming a band down each side of the body. The middle of the body is occupied by a smooth surface, marked with fine transverse lines. Down the median line is a reddish-brown line seen, by transparency, lying in the mid-ventral groove, and representing the ventral nerve-cord. The colour is probably due to hæmoglobin, which has been demonstrated by Prof. Ray Lankester [1] in the nerve-cords of *Aphrodita aculeata*. The mouth is very conspicuous and is bounded by four large thick lips, of which one is posterior and transverse, two are lateral and obliquely placed, while the fourth, median anterior, is wedged in between the oblique lips. The actual position of the mouth seems to be between the second and third pairs of parapodia; in other words, the mouth has moved backwards from its primary position, so that three segments with their appendages lie in front of the mouth, a phenomenon which we are accustomed to meet with in Arthropods². The mouth is thus further back than is represented in most of the figures of *Lepidonotus* available.

The median anterior lip hides the base of the median tentacle and is separated from it by a deep groove, so that it cannot be mistaken for a facial tubercle.

Returning to the dorsal surface (Plate LX. fig. 3), after the removal of the elytra it is seen that the upper surfaces of the parapodia are produced towards the centre of the back as broad, flat ridges, of which the usual alternate ones carry the elytra. These ridges are oblong or rectangular in shape, with distinct edges, and are separated by

¹ The absence of nephridial papillæ from the more anterior segments in Polynoids was remarked by Bourne [3] for *L. clavus*, in which papillæ are stated to be absent from the first 8 segments, as is also the case in several species recorded recently by H. Johnstone [9].

² This shifting of the mouth in Annelids back through one or more segments occurs in Amphinomidæ, Acetidæ, in *Chrysopetalum*, and in *Aphrodita*; but it has been but little remarked upon in connection with the same phenomenon, to which Lankester was the first to draw attention, in the case of Arthropoda.

Its occurrence in these families of Annelids, all of which are undoubtedly much modified as compared with the typical annelid, is of interest and of theoretical importance.—W. B. B.

narrow transverse grooves, which lead inwards to a median dorsal groove or channel lying between the ridges of the right and left sides. This channel is incompletely divided into two, longitudinally, by a series of firm, truncated tubercles, which posteriorly form a single median row, but anteriorly a double row, enclosing a spindle-shaped raised area, the channel passing forwards outside the tubercles (Plate LX. fig. 3). The result is that the channel bifurcates anteriorly; but on the second segment there are again a couple of median tubercles (Plate LX. fig. 3 & Plate LXI. fig. 4), and the channel is thus carried forwards right to the base of the prostomium (Plate LXI. fig. 4). Posteriorly, the tubercles cease on segment xix, while the channel continues backwards to segment xxii. The tubercles serve to support the mesial moieties of the elytra, thus leaving a clear subelytral channel, which, from its function, may be termed the dorsal "respiratory channel." Towards the posterior end the channel becomes deeper, and is closed by the transverse union of the parapodial ridges of the last elytriferous segment. The channel thus ends just under the aperture mentioned above, formed between the last pair of elytra.

Looking more closely at the parapodial ridges, a number of small processes are observable, at their outer ends and especially towards the margins of the transverse canals. These processes may be as many as twenty in number on a cirriferous segment, rather fewer on an elytriferous segment (Plate LXI. figs. 7 & 8). They are little finger-shaped evaginations of the body-wall, rarely branched, and evidently serve as gills¹. Unfortunately there were no living specimens obtainable, so that we could not verify the following inferences, but the appearances seem to justify them:—currents of water are brought by ciliary action² into the transverse canals; the water is filtered by the bunches of notopodial hairs, and passes thence over the branchiæ, oxygenating the blood; the water then passes into the dorsal median canal and finds its way out by the posterior aperture.

Haswell, in his *Monograph of Australian Aphroditea* [2], mentions that both Williams and Quatrefages record a respiratory current in *Aphrodita* and *Hermione*, caused by the rhythmical movements of the elytra under the felt coating of the back. But he adds:—"In species in which the felt-like dorsal covering does not exist, this function would appear to be in abeyance, and in *Polynoë* and allied genera, so far as I have observed, the elytra remain perfectly motionless while the animal as a whole is at rest."

It is suggested that, in *L. giganteus*, while probably no actual movement of the elytra is necessary to produce the stream, yet, by means of the "respiratory channel" and the dorsal tubercles

¹ Compare Buchanan's figure 4 in illustration of *Eupolyodontus cornishii*, in *Q. J. Micr. Sc.* vol. xxxv.

² Oilia have been observed by several naturalists on the sides of the parapodia in Polynoids; but Mr. Thomson did not examine the histological structure of the body-wall in the present annelid.—W. B. B.

supporting the mesial regions of the elytra, a continuous stream of water may, nevertheless, be passed over the back, thus producing the same result as the rhythmical movements observed in *Aphrodita*. This is interesting as showing how the same need has been met in animals of different structure by adaptations of different kinds. The apparatus in this species seems to have attained a considerable degree of perfection, and in the literature at our disposal I can find no reference to any similar arrangement.

In this dorsal view further points of interest may be noted. When the elytra were removed in a female, a pale pinkish substance was observed, especially above the bases of the notopodial bunches of hair. This, when examined under the microscope, was found to consist of numerous ova which did not seem to have been fertilized; for neither were polar bodies to be seen, nor were any eggs segmented, while they all presented the large vesicular nucleus characteristic of the unfertilized ovum. It would seem, therefore, that the ova are all passed up under the elytra (the female contained a great number of eggs in the cœlom), and are there fertilized by sperms carried in by the respiratory current. According to a statement made by Haswell, development must also take place there to a certain extent.

The elytriferous segments are 2, 4, 5, 7 &c., 21-23, the elytophore being a special part of the parapodial ridge. The alternate parapodia carry dorsal cirri with bulbous tips, long enough to protrude freely (as much as 3 mm.) beyond the edges of the elytra. The base of the cirrus is extremely muscular (Plate LX. fig. 3 and Plate LXI. fig. 7), and they are evidently capable of considerable movement. The dorsal cirri of the first, *i. e.* the peristomial segment, are without this muscular base and resemble the prostomial tentacles in appearance.

One more point to be noted in this view of the dorsal surface is the anus, which lies just beyond the end of the dorsal respiratory channel, separated from it by the transverse ridge already referred to. The two ventral pygidial cirri represent the ventral cirri of the pygidium, and are directed backwards, as are also the dorsal cirri of three pairs of parapodia immediately anterior to the pygidium. Thus four pairs of these tactile organs may be seen curling up round the edge of the elytra at the extreme posterior end. It seems rather remarkable that there should be such a good supply of "feelers" at this end, and indicates that it is the habit of the animal to explore crannies and holes among stones &c., from which it must often make its exit backwards.

The Head.—The head consists of prostomium and peristomium (the first segment), the whole being retractile to a slight degree under the next segment, which bears the first pair of elytra (Plate LXI. fig. 4). The prostomium is irregularly oval, convex above, well defined posteriorly. Its base is, in the preserved specimens, overhung by the first "dorsal tubercle," which belongs to the peristomial segment. There are two pairs of eyes—a posterior larger, and an anterior smaller eye on each side,—which are so

close together that at first sight a single pair only appears to exist, but its anterior limit is not distinctly marked, as it is produced into the cylindrical bases of the three tentacles¹. The length up to the base of the median tentacle is about equal to the breadth ($2\frac{1}{4}$ mm. by $2\frac{1}{2}$ mm.). The median tentacle is slightly longer than the lateral, and its base is depressed very slightly below those of the lateral pair, which thus form a shallow V-shaped groove behind it. The median tentacle is about 6 mm. long; the lateral pair being 5 mm. each, measured to the posterior end of the base. Arising between the prostomium and peristomium, on the lower surface of the head, is a pair of palps about 9 mm. long, which just below the tip narrow suddenly to a fine point; they bear 7 to 9 longitudinal rows of papillæ, which take a somewhat spiral course.

The peristomium bears a pair of considerably modified parapodia. Each consists of a conical base bearing two cirri, a dorsal and a ventral, which resemble the tentacles (Plate LXI. fig. 4). On the anterior dorsal surface of the base a very small bunch of hair-like bristles protrudes, corresponding to the notopodial hairs of succeeding segments.

On the ventral surface of the head the mouth has been already sufficiently described; only one point remains to be noticed, namely, that the ventral cirri of the second segment are elongated and bulbous below the tip, just like the preceding pair. They are generally inclined towards the mouth, and are termed the buccal cirri. In some specimens the ventral cirri of the next segment showed a tendency to swell below the tip, more marked than in those further back (Plate LX. fig. 2).

Elytra.—A reference to fig. 1 will give a better idea of the arrangement of the elytra than any description. They are attached to the body by a considerable area, the "areola," of an oblong form and of considerable breadth. The corresponding area on the body is the elytriphore (Plate LX. fig. 3), and lies obliquely transverse on the flattened parapodial ridge mentioned above. The colour of a typical elytron is a warm brown behind a line taken transversely across about its middle, the colour advancing forwards somewhat at the inner end (indicated by dots in Plate LXII. fig. 10). The part covered by the preceding elytron is light buff, and this colour extends backwards over the anterior slope of the areolar ridge.

The elytra vary considerably in size and shape according to their position, the terminal ones being smaller. Plate LXII.

¹ In *Lepidonotus* it is usually stated that the "prostomium is produced into the base of the lateral tentacles"; as a matter of description this is true, but, from the comparative anatomy of the group, it appears that the cylindrical "prolongation" (marked *b.z.* in the figure) should be regarded as the base of the tentacle fused with the anterior margin of the prostomium: this margin is in the present annelid just indicated by a faintly marked, oblique line; and if this be compared with the prostomium of *Harmothoe* and others, this interpretation seems reasonable.—W. B. B.

fig. 10 gives a drawing of an elytron from the middle of the left side, which may be described as being typical of the rest. The measurements of the transverse diameters are 9 mm. by 21 mm. The general shape is transversely oval, but with a shallow sinus in the elongated anterior border. All the elytra bear a number of processes arranged around the external and posterior edges and also on the neighbouring surface. The margins have further a fringe of small hairs almost all round, which are visible in Plate LXI. figs. 5, 6, and Plate LXII. figs. 9, 10. Plate LXII. fig. 9 is an enlarged view of the part of fig. 10 between *L.* & *e.* The appearance presented is curious, as two types of processes are seen. The margin is produced into a number of very slender, rounded, hair-like processes (Plate LXII. fig. 9, *h*), and immediately within these there is a series of stout, more or less cylindrical spines, ending in a point and bearing conical thorn-like outgrowths just below the apex (Plate LXII. fig. 9, *e*). Occasionally there are short and much more thorny processes (Plate LXII. fig. 9, *e*¹). The bases of the spines are bluntly conical, and appear from a surface view to be simply embedded in the elytra. The spines arising from the flat surface further away from the margin are much stouter, with fewer outgrowths, and arise from the surface of the elytron by broad, star-like, spreading bases (Pl. LXII. fig. 9, *st.b.*). Many of them also have a little patch of pigment near the tip and a small vesicle, for neither of which could any function be guessed¹. The surface of the elytra abounded in similar, but smaller, star-like bases, bearing, however, only incipient processes. The spines, especially the rooted ones, were more numerous on the posterior elytra than on those situated further forwards.

The first and last pairs differ in form from the remainder and from one another. Of the first pair, the right member is almost circular in outline; the left is similar but has a wide notch in its anterior border (Plate LXI. fig. 5, *n.*). The hinder margin of the notch is covered by the edge of the elytron of the right side, with which the anterior boundary of the notch forms an angle, lying in the middle line, and evidently intended to allow freer protrusion of the head or its appendages, which in preserved specimens are seen below the notch (Plate LX. fig. 1).

Each elytron of the last pair has a pear-shaped outline (Plate LXI. fig. 6); the broader end is directed backwards and the narrower is overlapped by the preceding elytron. The mesial edge, just in front of the constriction between the two regions, is upturned, so as to form a lip; so that when the pair is *in situ*, an oval aperture is formed, which overlies the hinder end of the dorsal subelytral respiratory channel; this aperture is shown in Plate LX. fig. 1, *ex.ap.*

Parapodia.—Of these there are twenty-five typically constructed pairs, each of which consists of neuropodium and notopodium, the former being much the larger. The notopodium is a mere lobe

¹ It will be noted that this paper is simply an account of purely superficial anatomy.

of the neuropodium, lying on its dorso-anterior face rather than directly dorsal (Plate LX. fig. 2 and Plate LXI. figs. 7, 8); it has thus lost its direct connection with the dorsal cirrus which springs from the "basipodium" or common base of the two parapodial lobes (Plate LXI. fig. 7). As before mentioned, the base of each parapodium, elytriferous or cirriferous, is produced dorsally towards the median line as a broad flat ridge with distinct and almost overlapping edges (Plate LX. fig. 3 and Plate LXI. figs. 7, 8). Round the outer edges of the ridge, and especially at the base of the dorsal cirrus, are numerous branchial outgrowths with thin walls. The neuropodium bears a short but rather stout and pointed ventral cirrus. The notopodial bristles are hair-like; the notopodials are typical chætæ.

Both neuropodium and notopodium have large setigerous sacs, but there are no acicular papillæ noticeable, such as Bourne has observed in *L. clavus* and *L. squamatus* [3].

Chætæ.—The neuropodial chætæ are large and stout, and number about 30 to 35 in each foot; they have a very slight S-shaped curve towards the tip, which is somewhat tapered but blunt (Plate LXII. fig. 11). The upper, or convex, surface is smooth all the way along; on the lower, or concave, side there is a smooth region just below the tip, followed by a short spinulose region covered with rows of minute filiform spines, but bearing no comb-like plates. Below this the chætæ is marked by fine transverse lines, some distance apart and gradually disappearing towards the embedded end of the bristle. These neuropodial chætæ are arranged in the sac in horizontal rows, the topmost row containing the longest chætæ, and the lower rows successively shorter. There are generally five or six rows, with about six in each row.

The notopodial chætæ, on the other hand (Plate LXII. figs. 12 a, 12 b) are more slender and more numerous than the neuropodial. The appearance of the bunch *in situ* is much like that of a short, but rather broad, camel-hair brush. Examined under the microscope, each bristle is seen to consist of two distinct portions of about equal length. The proximal half is smooth and hand-like, but broader in the centre than at either end. The distal half has a median, narrow, smooth axis with a serrated portion on each side, though often only one side is to be seen; this portion is of almost uniform breadth, tapering gradually to a very fine point deprived of serrations.

Pharyngeal Teeth.—The protruded pharynx terminates in a wide aperture, transversely elongated and bounded by a dorsal and a ventral lip, each of which carries a series of papillæ (Plate LXII. fig. 13). Of these, there is a median and 6 lateral on each side on each lip, but the median papilla is not distinguishable from the rest by any other peculiarity than its position. Each papilla is like a very squat T; the base is broad, the bar is also broad and oval, terminating in a point at each end, as can be seen in fig. 14 on the left side. The papillæ diminish in size rather suddenly on the right and left of the series.

Within the lips are seen the four dark brown teeth or jaws ¹, a dorsal pair and a ventral (Plate LXII. fig. 13); but in this front view only the terminal claw-like tip of the tooth can be seen, its base, hidden in a muscular cushion (*e*), can only be seen by slitting up the wall of the pharynx.

Each tooth springs from a wide, somewhat triangular base of greenish-brown colour, less hard than the actual tooth, and marked by a series of concentric lines like a lamellibranch shell. The right and left tooth of each pair are connected by what is, no doubt, a secondary formation of calcareous material deposited on the convex side of each claw (*e*); this additional matter increases in thickness backwards, till the two touch and fuse.

The outer margin of the base of the tooth dips down into an elongated slit-like pit between itself and the muscular cushion (*e*). This cushion is continued anteriorly into a small, reflexed, papilla-like structure fitting against the concave side of the claw-like tip of the tooth; the latter projects—when at rest—into a pit anteriorly, immediately behind the lip, which is now seen to be in reality the hinder end of the thin-walled, eversible buccal region (*g*).

The ventral teeth are almost identical with the dorsal pair.

It may be as well to mention that the base of the tooth (*a*) is hollow, and occupied by a mass of muscle after the fashion usual in annelidan jaws or teeth; further, the internal root of the claw-like tooth is produced into a longer and narrow plate for the attachment of muscles, but which is not represented in the drawing, as it is embedded deep in the wall of the pharynx.

Localities.—Specimens were received from Otago Harbour on the east coast of the South Island of New Zealand, captured under stones and also taken from the stomachs of fish. Others were obtained from various stations along the east coast of the South Island, as far north as Tasman Bay, where they were brought up in the trawl from depths of 10–30 fathoms. The specimens named by Kirk [8] were collected in Wellington Harbour, North Island. It is evidently of wide distribution along our coasts.

Those from different localities varied considerably in colour: some were uniformly dark coffee-brown, above and below; while others were yellowish white below, and a warm brown dappled with light buff on the dorsal surface.

The elytra are in some specimens thickly covered with muddy particles attached to the spines, the notopodial hairs being

¹ I would suggest the word "stomatognath" as a convenient term by which to refer to the various chitinous, or calcified, or siliceous "teeth" or "jaws" occurring as specialized thickenings of the lining of the stomodæum, such as the teeth or jaws of Annelids, including Leeches; the "teeth" in the gastric mill of Crustacea; the elements of the "mastax" of Rotifers; the individual members of the radular apparatus of Mollusca; and possibly, also, the horny teeth of Cyclostome fishes. The word was used by me some years ago, in a course of advanced lectures on the Annelida that I gave in the University of Oxford; and it appears to me that some such word would be useful in referring to these and kindred structures.—W. B. B.

similarly muddy. In other individuals, however, the body was clean, indicating differences in the character of the habitat.

The whole form of the animal shows that it moves by walking or creeping rather than swimming; and several facts indicate that it lives among stones and mud, seeking prey rather in the dark than in the open. For example, the head (at any rate in the dead specimens) is completely withdrawn beneath the elytra, only the tips of the tentacles and palps showing. The eyes are right at the back of the head, and consequently are of no use unless the head were protruded at least 4 mm. The anterior pair of eyes, too, is much reduced (Plate LXI. fig. 4). Further, the lateral and posterior edges of the body are provided with numerous elongated movable feelers, protruding far enough to feel anything before it touches the side of the body. Unfortunately this is all guesswork, and can only be verified by observations of animals in the living state.

Under the name "*Aphrodita squamosa*" this annelid has been described by Quatrefages [4]. He puts it in his fourth division of the genus *Aphrodita*, with the following characters:—"Espèces dont les poils sont beaucoup trop courts pour former une voûte dorsale, et dont les élytres sont par conséquent à découvert." He made this division solely for this animal, of which he had only one specimen, and he characterizes it as follows:—

"Aphrodite écailleuse: *A. squamosa*.

"Caput parvum, distinctum, elytris prominentibus occultatum. Antenna media brevis, crassa, truncata (?). Antennæ laterales duplo longiores, graciliores. Cirri tentaculares breves. Corpus 27 annulis compositum, mediocre elongatum. Pedes quasi uniremes, prominentes. Elytra 24, maxima, rugosa, robusta, corpus totum obtegentia. Cirri superes longiusculi, in mamilla crassa, compressa affixi. Pili breves, in penicillum crassum de pedunculo conico orientes. Pro branchiis tubercula plus minusve conica, sparsa.

"Hab. la Nouvelle Zélande. C. M."

Quatrefages goes on to give a more detailed description of the specimen, which leaves no doubt that it is identical with the subject of the present paper. His specimen was 11 cm. long and 4 cm. broad, which is larger than any I have had in my hands, although a badly preserved one reached 10 cm. in length. The median tentacle in his specimen was, as he suspected, broken off short at the base. His 27 segments were completed by the anal segment, which bears, as he says, no parapodia. All the other points are in perfect agreement with the description given above; and further points in his description complete this harmony between the accounts. He says:—

"Le long de la ligne médiane du dos règne une sorte de gouttière où la peau est plus lisse qu'ailleurs, et où l'on ne distingue plus de traces de la division du corps en anneaux." But he makes no mention of the dorsal tubercles.

Having thus shown this identity, I must now show that Quatrefages has placed this animal in the wrong genus. According to his

own table of genera [5] it is evident that he employs the existence of jaws as a character distinguishing *Lepidonotus* and *Polynoë* on the one hand from *Aphrodita* on the other. If he had followed his own table, he should have put the animal in the genus *Polynoë*; but the "pili breves, in penicillum crassum" evidently caused him to overlook the existence of jaws. Further, in comparing the diagnoses of the two "families" Aphroditidæ and Polynoidæ, in the Monograph by Prof. McIntosh, recently published by the Ray Society, it is apparent that our specimen differs from the Aphroditidæ (*a*) by the possession of lateral tentacles, (*b*) by the want of a facial tubercle, and (*c*) by the possession of jaws and papillæ on the pharynx; also (*d*) by the want of felt and (*e*) of the long stiff ventral bristles [6]. On the other hand, the following is McIntosh's diagnosis of the genus *Lepidonotus* [7]:—

"Body short, more or less linear. Anterior part of the cephalic lobe produced into the bases of the median and lateral tentacles. Palpi smooth or with papillæ in five longitudinal rows. Three comparatively short alimentary cæca directed forwards into the peri-pharyngeal space. Elytra 12 pairs, covering the dorsum entirely, and occurring on the segments bearing feet thus: 1, 3, 4, 6, 8, and so on to 20, 22. Bristles of the superior lobe slender, serrate, shorter than the inferior, which have a smooth portion below the slightly hooked tip, and then a spinulose region beneath. Nerve-trunks in the granular layer of the epiderm, between the powerful oblique muscles."

From this it is evident that our animal belongs to the genus *Lepidonotus*, the only point of difference being that the rows of papillæ on the palps are 7 or more instead of 5.

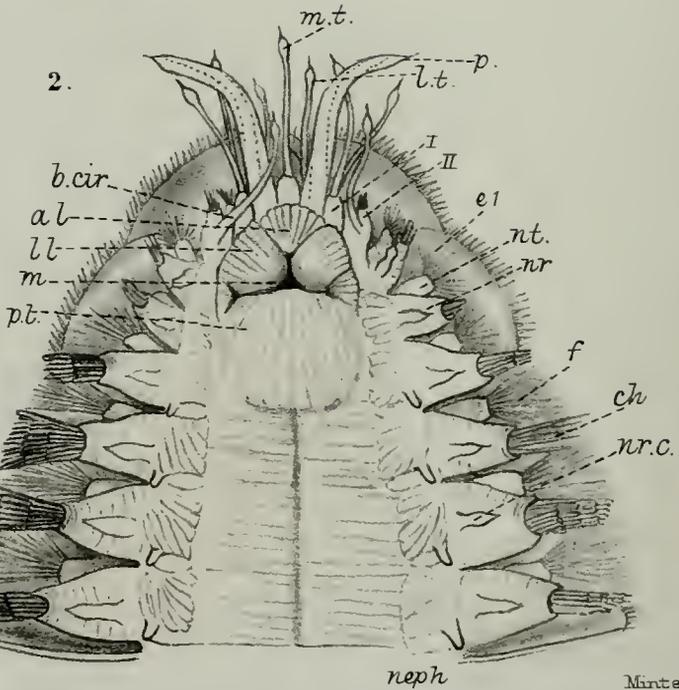
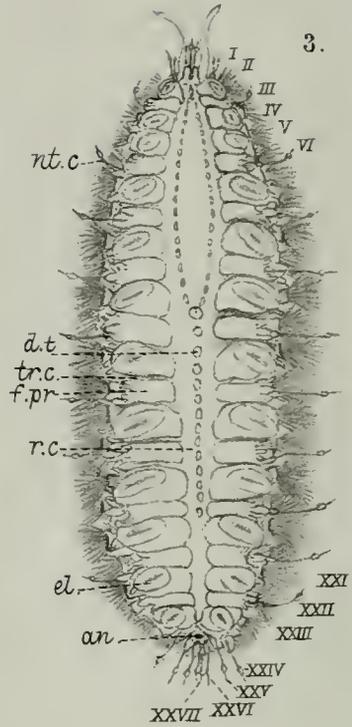
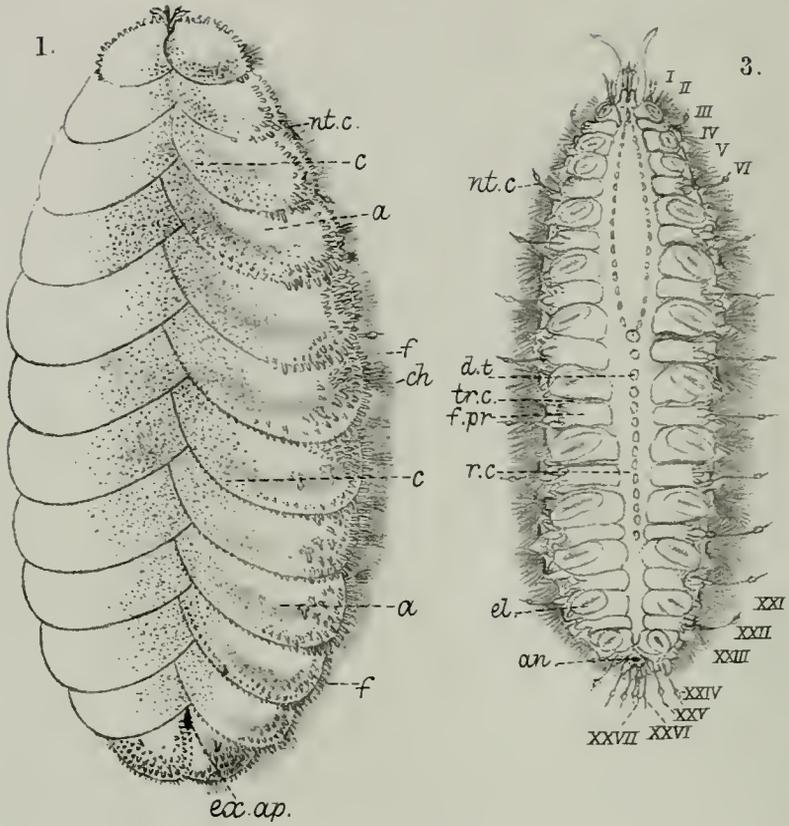
A comparison of the above account of this worm with that given, in brief and without figures, by Mr. Kirk [8] makes it quite evident that Quatrefages's "*A. squamosa*" is identical with Kirk's *L. giganteus*; and it is not to be wondered that the latter author overlooked the description by Quatrefages, as the worm is so palpably not a member of the genus to which he ascribed it.

Dunedin, Aug. 24, 1900.

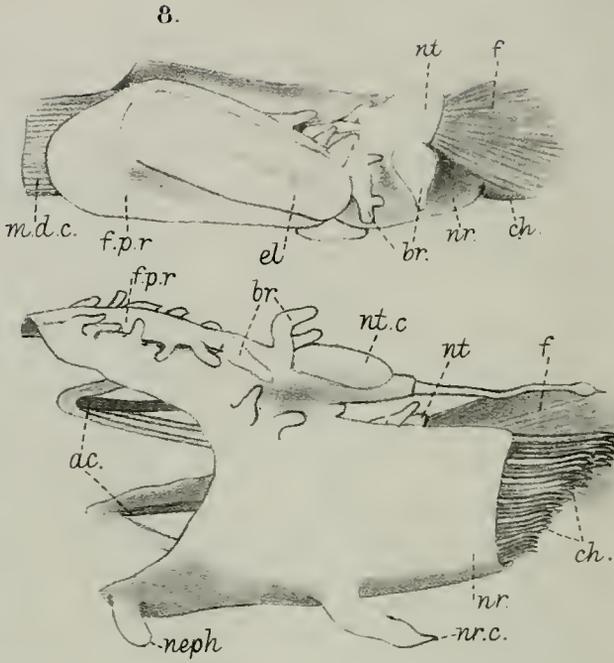
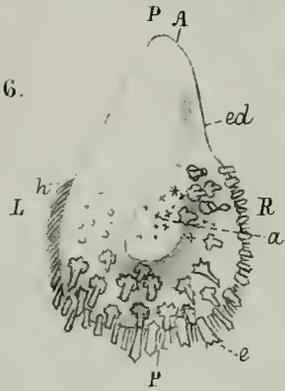
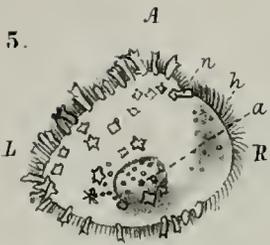
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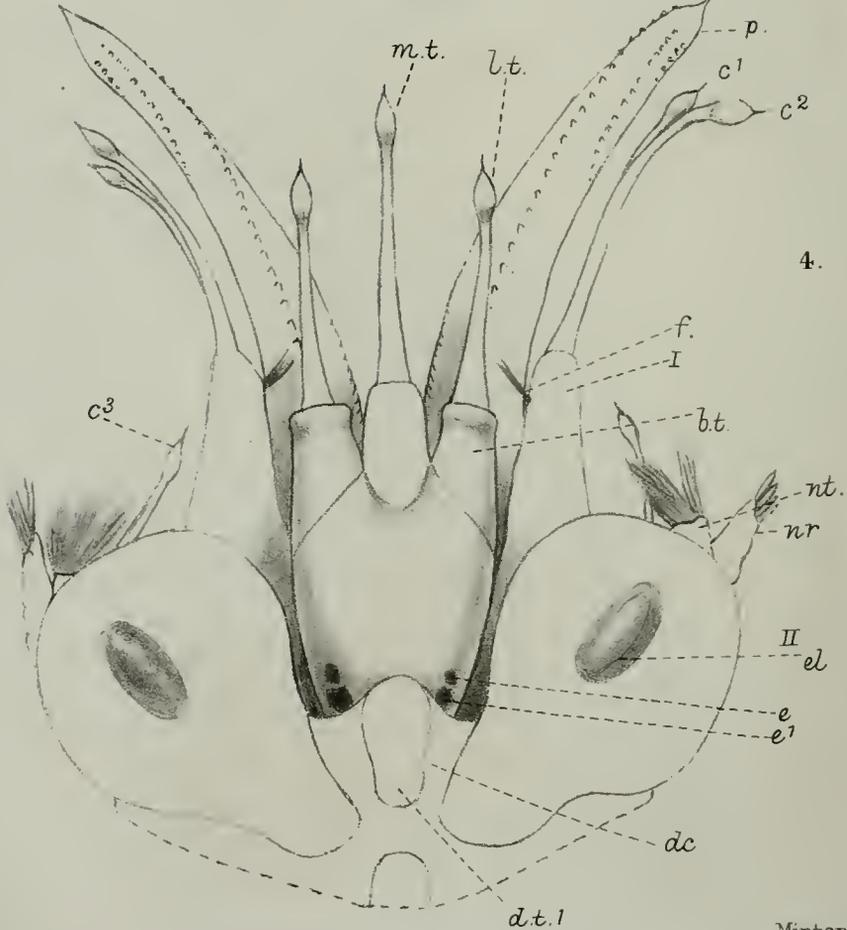








7.



EXPLANATION OF THE PLATES.

PLATE LX.

Fig. 1. Dorsal view of *Lepidonotus giganteus* (completed on the right side only) (nat. size).

- a*, areola or area of attachment of elytron: coloured in life light buff.
c, dotted portions of elytron: coloured warm, or even dark, brown.
ch., neuropodial chætæ, seen here and there.
ex.ap., exhalant aperture of subelytral respiratory channel.
f, notopodial hairs forming a fringe along each side.
nt.c., notopodial cirrus.

Fig. 2. View of the ventral surface of the anterior seven segments.

I. First, or peristomial, parapodium. $\times 2$.

II. Second, or first elytriferous, parapodium.

- | | |
|---------------------------------|------------------------------------|
| <i>a.l.</i> , anterior lip. | <i>m.t.</i> , median tentacle. |
| <i>b.cir.</i> , buccal cirrus. | <i>neph.</i> , nephridial papilla. |
| <i>ch.</i> , neuropodial chætæ. | <i>nr.</i> , neuropodium. |
| <i>cl.</i> , elytron. | <i>nr.c.</i> , neuropodial cirrus. |
| <i>f</i> , notopodial hairs. | <i>nt.</i> , notopodium. |
| <i>l.l.</i> , lateral lip. | <i>p.</i> , palp. |
| <i>l.t.</i> , lateral tentacle. | <i>p.l.</i> , posterior lip. |
| <i>m.</i> , mouth. | |

Fig. 3. Dorsal view of another individual after removal of all the elytra: showing the median respiratory channel and its lateral affluents. $\times 2$.

I-XXVII. Segments numbered.

- | | |
|---|--|
| <i>an.</i> , anus. | <i>nt.c.</i> , notopodial cirrus. |
| <i>d.t.</i> , dorsal tubercle. | <i>tr.c.</i> , transverse respiratory channel. |
| <i>el.</i> , elytophore. | <i>r.c.</i> , mid-dorsal respiratory channel. |
| <i>f.p.r.</i> , flattened parapodial ridge. | |

PLATE LXI.

Fig. 4. Enlarged view of the head of *Lepidonotus giganteus*, seen dorsally: after removal of elytra. $\times 4$.

I. Peristomial parapodium, bearing the peristomial cirri (*c*¹, *c*²).

II. First elytriferous parapodium.

- | | |
|---|--|
| <i>b.t.</i> , base of prostomial tentacle. | <i>e</i> ¹ , posterior eye. |
| <i>c</i> ¹ , <i>c</i> ² , ventral and dorsal peristomial cirri. | <i>el.</i> , elytophore. |
| <i>c</i> ³ , buccal cirrus, belonging to segment II. | <i>f</i> , notopodial chætæ of peristomial parapodium. |
| <i>d.c.</i> , anterior end of the dorsal respiratory channel. | <i>l.t.</i> , lateral prostomial tentacle. |
| <i>d.t.</i> , first dorsal tubercle, in respiratory channel. | <i>m.t.</i> , median prostomial tentacle. |
| <i>e</i> , anterior eye. | <i>nr.</i> , neuropodium. |
| | <i>nt.</i> , notopodium. |
| | <i>p.</i> , palp. |

Fig. 5. Left elytron of the first pair. $\times 2$.

Fig. 6. The last elytron of the left side. $\times 2$.

Lettering of figs. 5, 6, 9, & 10:—

- | | |
|--|--|
| <i>A.P.</i> , antero-posterior direction. | <i>ed.</i> , prominent, upturned margin forming the edge of the exhalant aperture. |
| <i>L.R.</i> , transverse (left to right) direction. | <i>h.</i> , hairs on the edge of the elytra. |
| <i>a</i> , areola. | <i>n.</i> , notch in the anterior border of the 1st elytron on the left side. |
| <i>c</i> , darker pigmented region (dotted). | <i>p.s.</i> , pigment-spot in a spine. |
| <i>e</i> , spine on the edge with conical base. | <i>s.</i> , star-rooted spine, springing from the surface of elytron. |
| <i>c</i> ₁ , another type of the same, less common. | <i>st.b.</i> , base of ditto. |
| | <i>v.</i> , vesicle in apex of spine. |

Fig. 7. A cirriferous parapodium of the right side drawn from behind (enlarged).

Fig. 8. An elytriferous parapodium drawn from above (enlarged).

Lettering of figs. 7, 8:—

<i>ac.</i> , acicula.	<i>m.d.c.</i> , median dorsal respiratory channel.
<i>br.</i> , branchiæ.	<i>neph.</i> , nephridial papilla.
<i>ch.</i> , neuropodial chæta.	<i>nr.</i> , neuropodium.
<i>cl.</i> , elytrephore.	<i>nr.c.</i> , neuropodial cirrus.
<i>f.</i> , notopodial bunch of hair.	<i>nt.</i> , notopodium.
<i>f.p.r.</i> , flattened parapodial ridge.	<i>nt.c.</i> , base of notopodial cirrus.

PLATE LXII.

Fig. 9. The part of fig. 6, much magnified.

Fig. 10. Large typical elytron from the middle of the left side. $\times 2$.

Fig. 11. Neuropodial chæta of *Lepidonotus giganteus*, much magnified (camera).

Fig. 12*a.* *pr.c.*, proximal half of a single notopodial hair.

Fig. 12*b.* *d.c.*, distal half of the same.

Fig. 13. Anterior end of the protruded pharynx, showing the circle of papillæ (*d*), the paired dorsal and ventral teeth (*b*), supported on the lateral cushions (*e*) of the lining of the pharynx. $\times 4$.

Fig. 14. The dorsal pair of teeth, seen *in situ*, after the retracted pharynx and buccal region have been slit open. $\times 4$.

<i>a</i> , the chitinous expanded base of the tooth.	<i>d</i> , prepharyngeal papillæ.
<i>b</i> , the claw-like terminal tooth.	<i>e</i> , cushion, between which and the base is a deep furrow.
<i>c</i> , secondary calcified junction across the dorsal line.	<i>f</i> , dorsal groove of pharynx.
	<i>g</i> , buccal region.

3. On a new Genus of Flat-fishes from New Zealand.

By H. M. KYLE, M.A., B.Sc., St. Andrews.¹

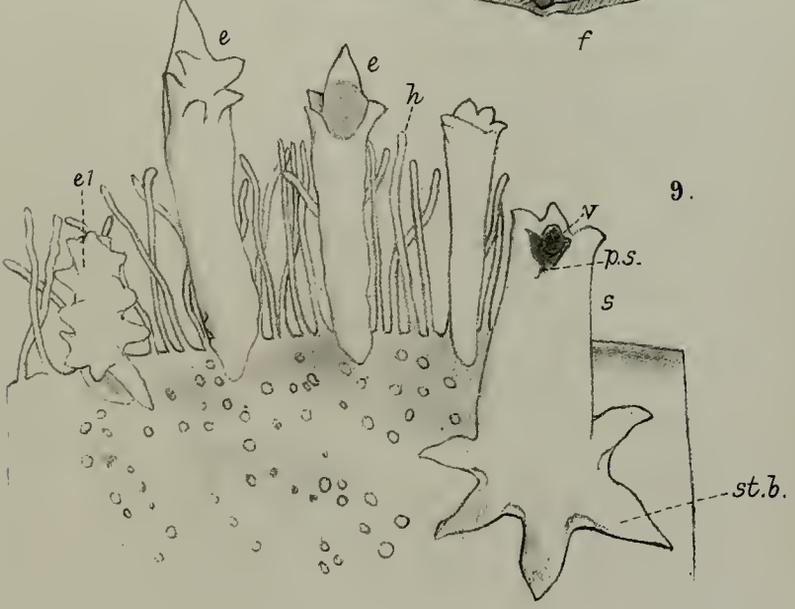
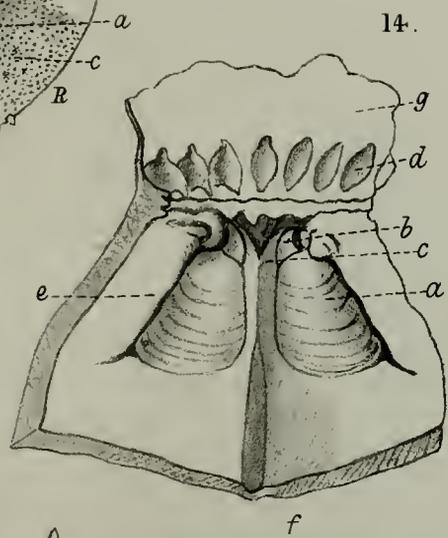
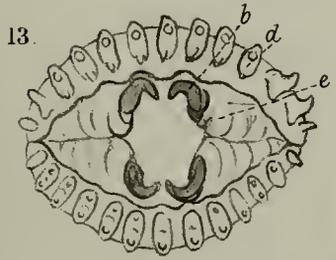
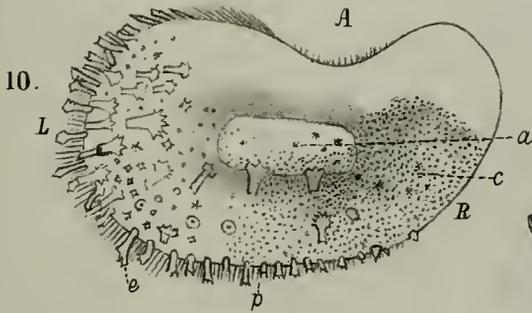
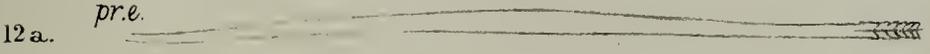
[Received November 26, 1900.]

The new genus of Flat-fishes which it is proposed to establish is founded on a single specimen contained in the collection of Prof. D'Arcy W. Thompson, C.B., of the University College, Dundee. It was presented by Prof. Jeffrey Parker of New Zealand, and had been labelled by him *Rhombosolea monopus*. A cursory glance, however, was sufficient to distinguish it from *Rhombosolea*; and a more careful examination and comparison with the description of the known and already described forms showed that it was different from them all, and merited a place in the classification of the Flat-fishes (*Heterosomata*) as a distinct genus.

It is somewhat precarious perhaps to found a new genus on a single specimen, but it would be absurd to suppose that this specimen was the only one of its kind. To describe this form at present, also, will lead to its earlier detection and differentiation from the other forms of the New Zealand fauna.

It is proposed to call this specimen *Apsetta thompsoni*, the generic term arising from its affinities, which are not with the

¹ Communicated by G. A. BOULENGER, F.R.S., F.Z.S.





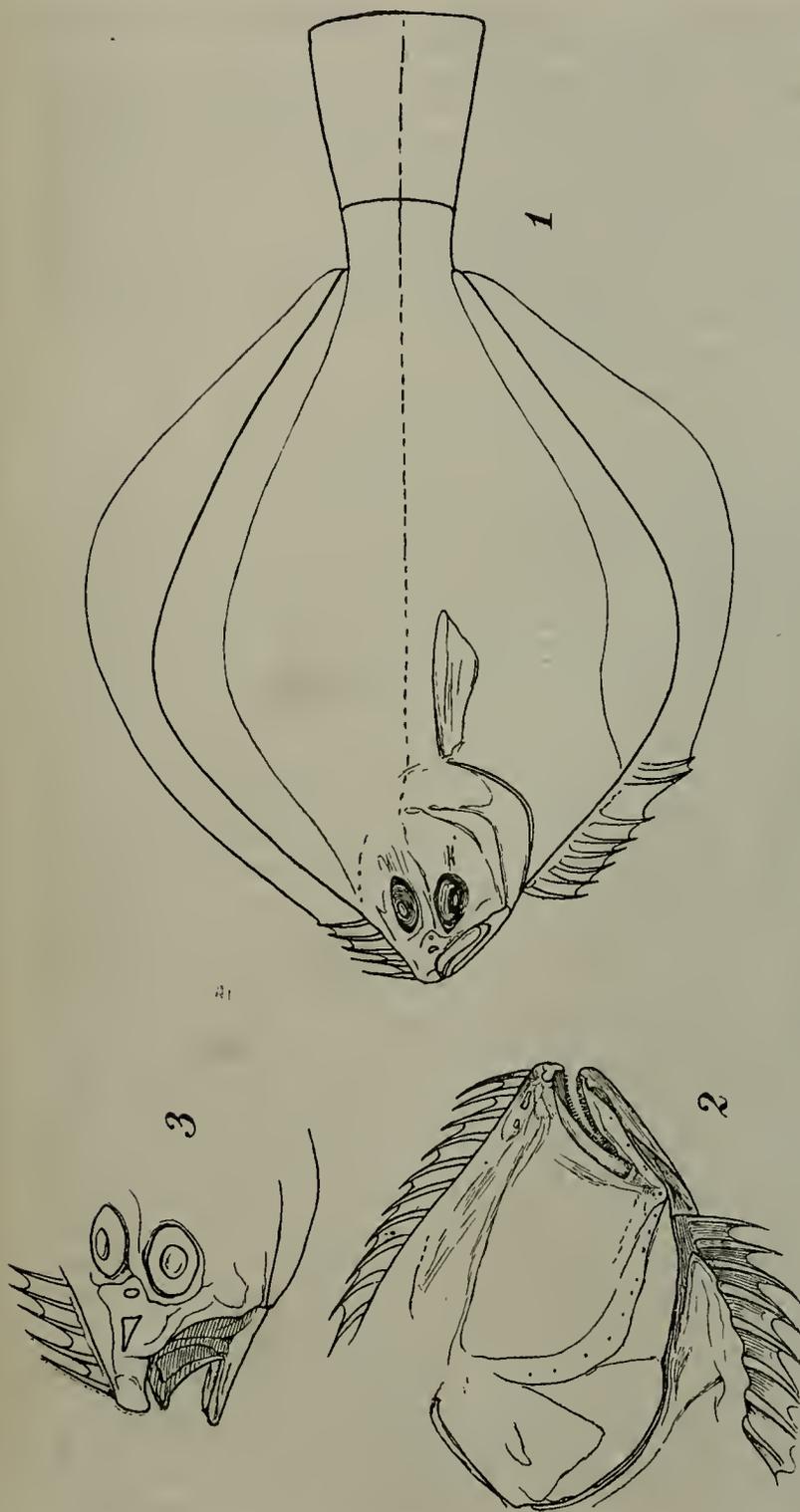


Fig. 1.—Outlines of *Apsetta thompsoni*.
Fig. 2.—*A. thompsoni*, under surface of head, showing the position of the ventral fins.
Fig. 3.—*A. thompsoni*, anterior part of head with mouth open.

H. M. K. ad nat. del.

Turbot group, and the specific term from the name of the naturalist who entrusted me with the specimen.

Characters.—Total length 21·8 cm. Total length without caudal fin 17·5 cm. Greatest height (without dorsal and anal fins) 68 per cent. of total length without caudal fin. Distance of greatest height from the beginning of the caudal fin-rays 57 per cent. of the same dimension. Length of caudal fin 24 per cent. do. Length and height of caudal peduncle 35 per cent. and 50 per cent. respectively of the length of the caudal fin. Distance of snout from base of pectoral fin 28 per cent. of total length without the caudal fin. Length of under ramus of the mandible 10 per cent. of the same dimension.

Br. 7. D. 55. A. 41. P. 10/10. V. 6/6. C. 2+7+7+2=18.
Vert. 10+19=29.

Eyes on the left side. Laminae of olfactory organ disposed longitudinally to the main axis of the body.

The form of the specimen described is rhomboid and somewhat similar to that of the Turbot (fig. 1, p. 987). Beginning at the snout the height increases rapidly until at a distance of one third the total length of the animal the greatest height of the body is attained. This greatest height is more than one half of the total length, or 68 per cent. of the total length minus the caudal fin. From this point the height of the body decreases sharply until at the base of the caudal peduncle it is only 10 per cent. of the total length. The relatively great height with the rapid decrease on each side of the line of greatest height gives the specimen a truncated appearance, and this is further increased by the peculiar disposition of the dorsal and anal fin-rays. The longest of these—25th to 29th dorsal, 15th to 20th anal—are posterior to the greatest height and almost halfway along the total length of the body.

The *dorsal fin* begins anteriorly on the snout, anterior to the maxillary bones. Owing to the greater convexity of the upper or eyed surface of the head, the fin-rays seem to arise more from the blind side. The first three rays are free at the ends. The rays are simple anteriorly, but about the 16th ray they become slightly bifid at the tip, and this condition increases posteriorly until at the hinder end each ray is spread out somewhat like a feather. The *anal fin* is similar, but the bifid rays begin with the fourth anteriorly. Posteriorly the dorsal and anal fins are distinct from the *caudal fin*, which is of a broad truncate form and not quite symmetrical. The *pectoral fin* of the eyed side is about 16 per cent. of the total length, that of the blind side somewhat less. The uppermost ray in each is simple, but the remainder are bifid and feathery at the tips. The *ventral fins* are similar in many ways to those of the Turbot. Both are prolonged anteriorly beyond the base of the clavicles: that of the eyed side lies along the ventral edge and is attached to the *urohyal* anteriorly; that of the blind side does not reach to the *urohyal* and is thus placed somewhat posteriorly to the other, its first ray lying between the

second and third of that of the eyed side. There are 6 rays in each, but the last ray of the ventral of the underside is very short and slender (fig. 2, p. 987).

The ventral fin of the eyed side begins under the gill-cover in a line with the middle of the eye. The extent of its base measured from the first to the sixth ray is 11 per cent. of the total length of the body. The rays are well separated one from another. This fin is joined on to the anal by a continuous membrane whose length along the base is a little less than half the base of the ventral. On the eyed side of this membrane, close to the first ray of the anal fin, is the small genital papilla; on the blind side is the anal opening. There is no projecting anal spine.

The body and head are covered with fine small cycloid scales, those on the head and anterior portion of the body having an oval or circular outline, those on the posterior caudal region being more oblong. With the exception of the caudal none of the fins are scaled, but on the caudal fin the scales extend over the base and between the rays. The *lateral line* is almost straight. Over the abdomen it gradually rises towards the otic region of the head, where it sends off the usual temporal branch and further forward the preopercular branch. It is more easily traced on the blind side of the head than on the eyed side, but even there the anterior branches are not very distinct. Immediately anterior to the nasal openings on the blind side, the most anterior pore of the lateral line can be clearly seen.

It is impossible to tell the original colour of the specimen, which has been in spirit for some years, and both the eyed and the blind side—the latter of which is usually of a light colour or even white in other flat-fishes—have now the same brownish hue. There do not seem to have been any distinct markings on the upper or eyed side, however, since some traces of these are to be seen ordinarily in spirit specimens.

The length of the *head*, measured from the snout to the extreme posterior margin of the opercular bone, is about 23 per cent. of the total length, or 28 per cent. of the total length minus the tail. It is therefore much shorter than the same relative proportions in many of the flat-fishes of the northern hemisphere, *e. g.* Plaice and Turbot, where they are 28 per cent. and 35 per cent. respectively, but it agrees with others, *e. g.* *Arnoglossus* and the Topknots. The upper and under margins of the head continue the outlines of the body, but are inclined somewhat anteriorly, so that the snout projects to a point. The lower eye is in advance of the upper, and both are on the left side. The interorbital space is about half as broad as the eye, and is marked by a moderately prominent ridge, which is continued backward over the head by a slight smooth eminence without tubercles. Anteriorly the interorbital ridge divides into two, forming the anterior boundaries of the eye-sockets. The lower eye is very close to the mouth, whilst the upper eye is about the same distance from the base of the dorsal fin. The contours of the preopercular bone can easily be

made out, and so can those of the subopercular, interopercular, and opercular bones, but not so readily.

The bones forming the *mouth* are much more developed on the blind than on the eyed side—the distances of the tip of the snout from the lower extremities of the premaxillary bones being in the proportion of 4 to 3, the greater being that of the blind side. Similarly, the proportion between the under and upper rami of the lower jaw is as 6 to 5. The under ramus (that of the blind side) is inclined backward from the mouth at a greater acute angle than the upper ramus, so that the latter overlaps the former. This can readily be seen from the under aspect (fig. 2, p. 987). The mouth thus asymmetrical like that of the Plaice group, is also small, the length of the premaxilla of the blind side being 24 per cent. of the length of the head measured from the snout to the posterior margin of the opercular bone. The posterior extremity of the mandible on the upperside is in a vertical line with the anterior extremity of the lower eye. There are no teeth on the upper or eyed aspect of the mouth, but on the lower aspect there are two rows of small sharply-pointed teeth on the mandible and premaxilla. These teeth are closely set and seem movable out and in, those of the premaxilla being more extended than those of the mandible. On the latter, the inner row stops about halfway, and a few teeth placed externally to the outer row continue the double series. There are no teeth on the maxillæ or vomer.

When the maxillæ and intermaxillæ are pulled outward, it is seen that they are overhung by a definite snout (fig. 3, p. 987) formed by the first interspinous ray, which is inclined forward from the anterior margin of the upper eye along the ridge of the head. The nasal organs lie one on each side of the dorsal fin as in the Turbot group: that of the eyed side lies between the interorbital ridge and the maxillary bones in the space between the latter bones and the ethmoid; that of the blind side lies immediately under the second and third rays of the dorsal fin (fig. 2). The posterior nostrils are simple, oval in outline, whilst the anterior are overhung by a triangular flap. The internal structure of the olfactory organ is similar to that of the Plaice group, *i. e.* the epithelial laminae, which are well-developed, are disposed longitudinally to the main axis of the body. There are no secretory sacs. The gill-opening is large and open. The gill-covers, though overlapping the margins of the pectoral arch and ventral fins, are free therefrom. The septum between the branchial cavities is unbroken. The gill-rakers are short, soft, denticulated, and very numerous, set in two rows on each arch, the outer row of the first arch on the eyed side having 29 rakers, the inner row of the same arch about 12. The pharyngeal teeth are small and pointed. The branchiostegal membranes meet but do not cross in the median line. The first three rays on the ceratohyal are slender, whilst the remaining four on the epihyal are long and well-developed.

The internal organs are similar in some respects to those of the Sole group. There are no pyloric cæca. Along the dorsal wall

of the abdominal cavity the œsophagus is continued without visible division into the stomach, and this directly into the somewhat narrower intestine. The first coil of the latter inclines towards the blind side, where it lies along the first interhæmal spine within the secondary abdominal cavity of the blind side. The intestine then bends forward again into the main body-cavity, where it forms a coil ventral to the stomach. It then passes backward into the secondary cavity of the eyed side, where it forms a long coil with many foldings. Its exact posterior limit was not dissected out, but it seemed to occupy the whole of the secondary abdominal cavity. The vent is situated immediately posterior to the sixth or last ray of the ventral fin of the blind side.

The abdominal cavity is comparatively large and is bounded posteriorly by a strong first interhæmal spine. This is continued forward on the ventral edge of the abdomen by cartilage and ligament as in the Turbot group, so that the termination of the spine, *i. e.* the so-called anal spine, does not appear externally. The abdominal vertebræ are of the ordinary type found in the Plaice and Turbot; they do not have hæmapophyses. Secondary ribs are present on the second to the tenth vertebra. Parapophyses and primary ribs are present on the third to the tenth.

It is necessary, in conclusion, to point out the affinities of this form. In a previous paper (18th Annual Report of the Fishery Board for Scotland, part iii. p. 360) the flat-fishes of the New Zealand fauna except *Brachypleura* were grouped together within one subfamily, *Solei-pleuronectinae*. The characters of this subfamily are as follows:—

- (1) Preopercular margin distinct, not hidden by the skin and scales of the head.
- (2) Olfactory laminae arranged longitudinally without median rachis.
- (3) Ventral fins asymmetrical; two or one.
- (4) Nasal organ of blind side lies anterior to the anterior extremity of the dorsal fin(?).
- (5) Mouth asymmetrical, dentition more developed on blind side; gape small; underjaw more prominent.
- (6) Eyes on right side.

The form described here agrees with characters (1), (2), (3), and (5). Further, although not given as one of the characters of the subfamily, one of the ventral fins (that of the eyed side) is joined to the anal fin in all these New Zealand forms. The American form *Oncopterus*, which has been included provisionally within this subfamily, differs from these in this respect. Character (4)—the position of the nasal organ of the blind side—was unknown for the New Zealand forms previously described, and it is possible that these agree with the present form in having the nasal organs one on each side of the dorsal fin. The present form differs from the others, however, in that it has the eyes on the left side. A further difference of importance lies in the formation of the

abdominal vertebræ. The posterior of these in the forms previously described have hæmapophyses, which are absent in *Apsetta thompsoni*.

Whilst the resemblances are sufficiently obvious therefore to demand the inclusion of this form within the *Solei-pleuronectine*, the differences entitle it to be considered a distinct genus.

4. On a rare Cuttlefish, *Ancistroteuthis robusta* (Dall)
Steenstrup. By D'ARCY W. THOMPSON, C.B.

[Received December 18, 1900.]

A large Cuttlefish had been thrown up on the beach at Unalaska shortly before my arrival there in the summer of 1896. It had been preserved in salt, and was very kindly given me by Mr. J. Stanley Brown, of the North American Commercial Company. The specimen is now in the Museum of University College, Dundee. It is plainly identical with *Onychoteuthis robusta* (Dall, MS.) Verrill, and, though not complete and not in a state to admit of dissection, it furnishes some additions to our knowledge, and settles the generic position, of that interesting species.

The following are the measurements of our specimen: length from tail to the free border of the mantle, 62 inches; total length from tail to beak, approximately 70 inches; from the tail to the end of the arms, approximately 8 feet. The breadth across the broadest part of the fins is 27 inches, across the mantle-orifice $12\frac{1}{2}$ inches. Length of fin-attachment 34 inches.

The general shape of the body is almost evenly conical, very slightly attenuated between the fins, which latter extend over just about one half the length of the mantle. The head is rather small and narrow, the eyes not prominent. The broadest part of the fins is about 27 inches from the apex, which they reach, and towards which their trapezoidal outline is sharply narrowed.

The funnel measures, from anterior to posterior edge in the middle line, $7\frac{1}{2}$ inches long, and about $11\frac{1}{2}$ inches from its apex to its basal angle. Its free portion is about 3 inches long, below which point a double muscular fold or "bridle" unites it to the neck. The funnel possesses a large internal valve. The anterior orifice is about 3 inches from the base of the arms; its dorsal margin overlaps the orifice in the form of a hood about $1\frac{3}{4}$ inches in antero-posterior diameter. The lateral grooved surfaces at the base of the funnel are each about $5\frac{1}{2}$ inches long, $1\frac{1}{2}$ inches broad at the base, and about 1 inch broad close to the anterior rounded extremity: they are soft and flattened, and the cartilages within are imperceptible; they have a free edge all round, about a quarter of an inch wide but somewhat broader anteriorly. The corresponding surface in the mantle forms a light-coloured streak with dark edges, with no conspicuous thickening. On the back of the neck is a third similar surface about 8 inches long, and $1\frac{3}{4}$ inches broad

in front, somewhat narrower posteriorly, and with a well-marked median groove, which becomes obsolete in the hinder half of its length. The free lateral borders are half an inch broad in front, and not more than half as much posteriorly. The corresponding surface on the mantle accords with the position of the upper end of the pen; it is a colourless area, about 2 inches broad, and reaches down to the junction of the neck with the mantle-wall. Its edges are somewhat tumid and show remains of a darker pigmentation.

The funnel-organ consists, as in *Enoploteuthis*, of a central pad in the form of a Λ , with the apex forwards, and the limbs, each about 8 inches long and 1 inch broad in the middle, reaching to the base of the funnel; and of two lanceolate lateral pads, rounded at the anterior and more pointed at the posterior extremity, each 4 inches long and $1\frac{1}{2}$ inches broad at their broadest part. The area of each of these pads is colourless, but each is bounded by a narrow and deeply pigmented ridge, which projects outwards as a slight fold.

The orifice of the eye is approximately square, about an inch in diameter, but prolonged anteriorly into a notch or sinus bounded on the ventral side by a smaller, on the dorsal side by a larger, rounded or thickened flap. The sinus is about half an inch long, and approaches to within an inch and a quarter of the edge of the web which unites the ventral and ventro-lateral arms.

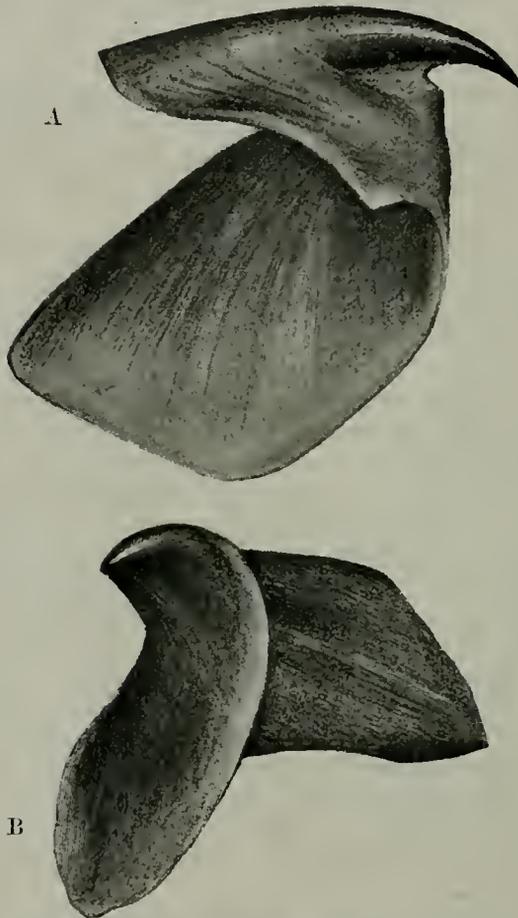
About $2\frac{1}{2}$ inches below the eye, a slight thickened ridge runs, as described by Verrill, around the neck, forming the upper border of the nuchal collar, and from this ridge proceed downwards (or backwards) certain folds or fringes. On a line with the dorsal border of the eye, the first of these fringes, about $\frac{3}{4}$ inch in breadth, runs downwards for $1\frac{1}{2}$ inches and then turns outwards for about the same distance. Nearly opposite the ventral margin of the eye, but somewhat to the ventral side of it, the second fold (not quite so elevated) runs downwards and then outwards, marking off a quadrilateral area about $1\frac{1}{2}$ inches square. The third and last fold, midway between the foregoing and the attachment of the funnel, is a simple vertical fold running downwards for $1\frac{1}{2}$ inches from the aforementioned ridge, but also continued upwards to the base of the ventral arm. This fold is about 1 inch in height posteriorly, gradually diminishing in height but becoming much thicker anteriorly.

The upper mandible (fig. 1, p. 994) is very sharply hooked; the lower has no tooth on its cutting-edge. The radula has the usual seven rows of teeth.

The buccal membrane or "circumoral web" is well developed, expanding to a radius of about 4 inches. Its relations to the arms are as in *Ommastrephes*. That is to say, here (as in *Ommastrephes*) a fringe or web, narrow and delicate, runs up either side of each arm parallel and close to the attachments of the suckers. Four of these fringes on each side of the animal are confined to the arms; the other four, viz., the dorsal ones in the dorsal and dorso-lateral

arms, the ventral ones in the ventral and ventro-lateral arms, converge to unite with the buccal membrane, drawing it outwards at their points of attachment into pouched hollows, above which its free margin is produced into pointed lobes. A similar arrangement is seen in Jatta's figure of *Thysanoteuthis rhombus* Tr., in the Naples Monograph, pl. ix. fig. 6. In *Ommastrephes* the buccal membrane is six-lobed, the anterior and posterior lobes each corresponding to the attachment of two adjacent bridles from

Fig. 1.



A. Upper mandible of *Ancistroteuthis*. Natural size.
 B. Lower mandible of *Ancistroteuthis*. Natural size.

the arms; and each of these lobes is furnished with two small two-rowed clumps of small suckers. Here the suckers are absent, and the attachments of the two ventral fringes are widely separate, so that the buccal membrane is seven-lobed. The fringes above-mentioned, that lie adjacent to the suckers, are narrow in the case of the ventral arms, but considerably broader in the other

three pairs, near the base of which they are each about 1 inch broad.

The muscular folds that connect the bases of the arms externally are as follows:—A fold or web connects the bases of the ventral and ventro-lateral arms, forming the outer wall of a hollow, about 2 inches in depth, within which the tentacle arises. This web is attached to the outer or aboral surface of the ventro-lateral arm, which it crosses to form a similar narrow web or festoon extending to the postero-lateral arm. In the case of the ventral arm it is continued all the way up the dorsal margin in the form of a deep thin frill or keel lying not far distant from the smaller web adjacent to the suckers: a little way from the base this keel is about $1\frac{3}{4}$ inches broad. Corresponding to it on the opposite or ventral margin is a very much narrower keel, which appears, however, only to commence about 4 inches from the base of the arm; above this point it quickly grows to about half an inch in breadth, and extends, slowly narrowing, to about halfway up the arm. In the case of the dorsal arm, there is a very rudimentary keel on the outer side, which does not pass over to join the dorso-lateral arm. The dorso-lateral arm has a well-developed keel on the ventral side, which joins the ventro-lateral arm.

There is yet another series of folds or membranes connected with the bases of the arms, external to the circumoral membrane.

Firstly, a muscular fold runs from the internal aspect of the ventral arm to its fellow on the one hand and to the oral aspect of the ventro-lateral arm on the other, marking off here the oral boundary of a cavity or pouch, which is separated by another similar fold from the cavity out of which the tentacle arises, but out of which comes to the tentacle a special fold of membrane within which appears to lie the tentacular nerve. In *Ommastrephes* the inner of the above muscular folds appears to be absent, the homologous pouch being bounded outwardly by the wall of the tentacular sac and inwardly by the buccal membrane. Another muscular fold, belonging apparently to the same series, unites the inner aspects of the 2nd and 3rd, and 3rd and 4th arms respectively, so that between the bases of each of these pairs of arms is a slight pouched cavity somewhat similar to that from which, between the 1st and 2nd, the tentacle grows.

The suckers are in two rows, and commence on the dorsal arm about 2 inches, and in the others about 3 inches from the base. In the two rows the suckers are obliquely opposite one another, and their bases near the base of the ventral arm are about one inch apart in the case of two opposite suckers, and a little more in the case of two contiguous ones on the same side. There are on the ventral arm about fifty distinct pairs, beyond which for about 2 inches at the distal end of the arm the paired arrangement is not clearly maintained. The suckers on the major portion of the ventral arm are about $\frac{5}{16}$ inch diam., those on the other arms being perceptibly larger, about $\frac{3}{8}$ inch diam., towards the middle of each arm. The ventro-lateral arm has about 29 pairs of suckers, and then for

about 4.5 inches indistinctly paired ones including about 62 small suckers. On the dorso-lateral arm are about 20 pairs of large suckers, beyond which the size of the suckers suddenly diminishes for the last 4 inches, in which there are about 60 suckers, the last few being exceedingly minute. The diminution in size of the suckers is more abrupt in this case than in the other arms. In the dorsal arm there are about 38 pairs of suckers, followed by about 50 less regularly arranged in the last 4 inches.

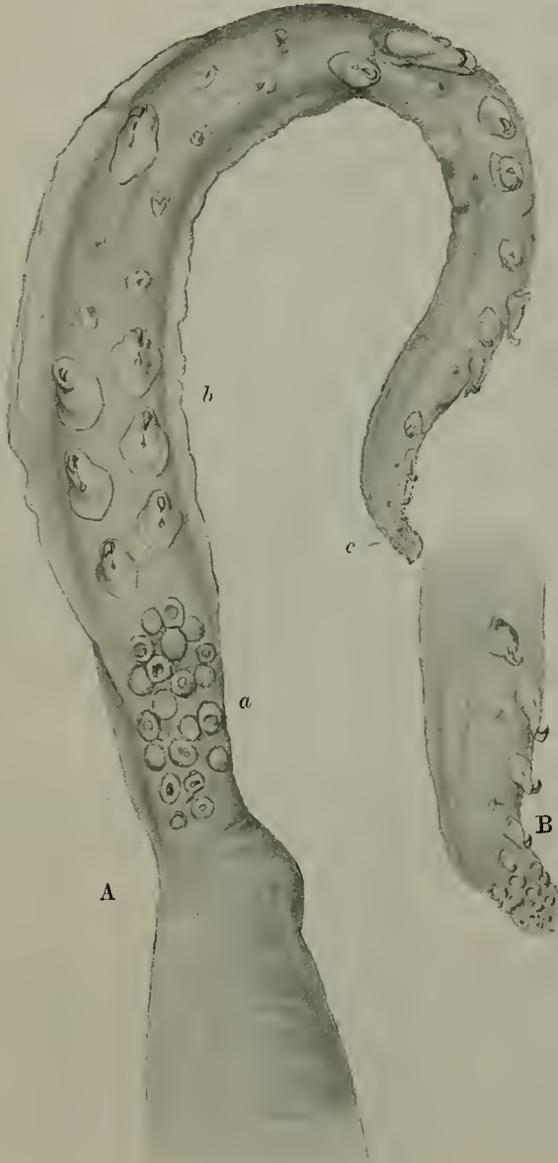
Of the left tentacle only about seven inches is preserved. At its broadest part it is about two and a half inches broad and much flattened. It does not seem to have been recently broken off, but is healed over at its extremity. Of the other tentacle about twenty-three inches is preserved in connection with the body. It is a broad, flattened strap, about an inch and a half in breadth. The distal end of the tentacle, including the tentacular club (which has hitherto remained unknown) is, very fortunately, preserved; it has all the appearance of having been directly continuous with the attached portion, and measures nearly 24 inches in length, the terminal club occupying the last eight inches. The club is laterally compressed, and has on each side a web or frill, just like that which runs parallel to the rows of suckers in the arms: this frill is only about a quarter of an inch broad on the inner side, on which side it may be traced as far as the tip; on the external side it is fully twice as broad, and stops some three inches short of the tip.

The arrangement of the connective organ is as follows:—The first inch and a half or inch and a quarter of the club is occupied by a group of intermixed suckers and pads, in which we can discern an arrangement of six oblique rows containing 3, 4, 4, 4, 3, 3 elements respectively: of these the first or external one has two pads and a sucker between, the last has two suckers and a pad between; the rest consist alternately of suckers and pads exclusively. On the left tentacle, the order of pads and suckers doubtless alternates with this. Beyond this first portion of the connective organ commences a double row of hooks, of which there are about eighteen pairs. In our specimen many of these are missing. Of those that are left the largest belongs to the ninth pair, and beyond it they become much smaller. The lowermost hooks are about three-eighths of an inch long and nearly of equal breadth in their flattened bases. The largest, towards the middle of the club, are about five-eighths of an inch long, and with bases about five-sixteenths of an inch broad. The extreme tip of the club bears a group of thirteen small suckers within a square of about a quarter of an inch. Thus the connective organ is precisely that of *Onychoteuthis*, or of Gray's allied genus, or subgenus thereof, *Ancistroteuthis*.

Of the pen, the horny blade is lost in this specimen, and only the great cone which terminates it posteriorly is preserved. This remarkable object, the nearest approach to a modern belemnite, forms a straight cone $15\frac{1}{2}$ inches long and $1\frac{3}{4}$ inches in diameter

at its base or anterior extremity. It is of a dark-brown colour, in texture somewhat similar to hyaline cartilage, and it is built up

Fig. 2.



A, right tentacular club of *Ancistroteuthis*. $\times \frac{2}{3}$.

a, basal cluster of pads and suckers; *b*, double row of large hooks;
c, terminal cluster of small suckers.

B, extremity of tentacle. $\times 1\frac{1}{2}$.

of ensheathing laminae, cone within cone. In its present state it

does not enable us to add any details of structure to what we already know from Verrill.

The specimens hitherto known of this animal, all more or less imperfect, are three in number, and were all found at Unalaska by Mr. W. H. Dall, in April and May 1872. They are referred to by their discoverer as perhaps identical with *Onychoteuthis bergi*, in a note on large Cuttlefish in the 'American Naturalist,' vol. vii. p. 484 (1873). They were afterwards described by Verrill (with the aid of Mr. Dall's notes) as *Ommastrephes robustus* (Dall, MSS.), in the 'American Journal of Science,' vol. xii. p. 236 (1876), and again as *Onychoteuthis robustus* (Dall, MSS.) in the 'Transactions of the Connecticut Academy,' vol. v. p. 246 (1879). Verrill, though describing the animal as a species of *Onychoteuthis*, pointed out that the pen with its solid terminal cone agreed with that of *Ancistroteuthis*, *Dosidicus*, or *Lestoteuthis*. He closes his discussion as follows: "So far as we can judge, with our present imperfect data, the relationship of *O. robustus* appears to be rather with *Lestoteuthis* than with any other known group. It is possible, however, that its affinities may prove to be closer with *Ancistroteuthis*, when the armature is discovered." In 1881, Steenstrup, in his paper on *Sthenoteuthis* and *Lestoteuthis* (Overs. Vid.-Selsk. Kjöb. 1881, p. 19), pointed out that the animal could not possibly belong to Verrill's *Lestoteuthis*, with its four series of suckers on the arms, and expressed his opinion that it belonged to *Ancistroteuthis*. The tentacular club now described confirms this identification, inasmuch as it is identical with the clubs of *Ancistroteuthis* and *Onychoteuthis*, which two genera are sufficiently discriminated by the characters of the pen.

5. On a new Species of Earthworm from India belonging to the Genus *Amyntas*. By FRANK E. BEDDARD, M.A., F.R.S.

[Received November 20, 1900.]

Having just attempted a revision of the genus *Amyntas*¹ it may seem early to add a new species to that now rather well-known genus. Nevertheless I cannot place an earthworm, which I received too late for incorporation into that revision, and which is a native of India, among any of the known species of *Amyntas*. It came to me, through the kindness of Mr. Nicholson, from Kew Gardens, where it had been imported from the neighbourhood of Calcutta.

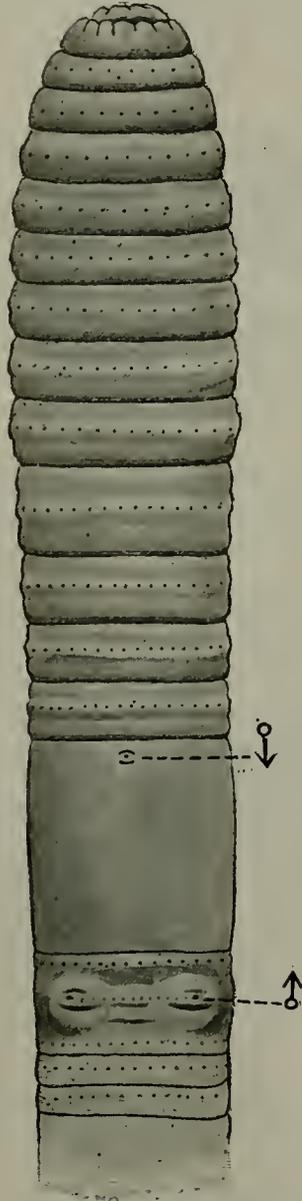
I shall give it a name and explain in the course of my description the reasons which lead me to regard it as a new, or at any rate not fully-described, species. Unfortunately I had only a single example at my disposal, which, however, was alive and could be therefore carefully preserved.

¹ P. Z. S. 1900, p. 609.

***Amyntas alexandri*, n. sp.**

The single specimen measures 145 mm. in length and consists of 133 segments. The six segments lying in front of the clitellum are more or less markedly triannulate.

Fig. 1.

Anterior extremity of *Amyntas alexandri*. $\times 3$.

The *setae* are rather, but not at all markedly, larger upon the anterior segments. I counted 16 upon the first seta-bearing

segment. I have not counted those upon the body generally, as I have been unwilling to injure my only specimen. There are 13 setæ lying between the male pores. At the posterior end of the body the setæ are again rather larger and further apart from each other. This increase in size of the setæ at the end of the body is very strongly marked in such a genus as *Onychochaeta*, but I have not observed it to occur commonly in *Amyntus*¹.

There are *dorsal pores*, but I am unable to state the exact segment at which they commence. They are at any rate visible upon the clitellum.

The *clitellum* extends over segments xiv.–xvi. and includes the whole of those segments. It has no setæ upon it.

The *male pores* are very inconspicuous. They lie as usual in the line of setæ. There are no differentiated genital papillæ anywhere upon the body; but, as is shown in the accompanying drawing (fig. 1, p. 999), there are depressions of a groove-like character which may perform the function of adhesive papillæ. One of these lies in front of each male pore; the other, the longer, lies behind it. They are encircled by rather tumid walls. There is in addition a slight medianly placed furrow in front of and behind the line of setæ.

The *oviducal pore* is single and median and upon segment xiv.

The *spermathecal pores* were not visible externally, but the point of their opening would seem to correspond to that of the male pores.

The *alimentary canal* calls for no special description except to mention that the intestinal cæca are rather long; when fully extended they reach as far forward as the posterior margin of the spermiducal gland, *i. e.* to the xxth segment. They arise as usual in the xxviith segment and taper gradually towards the tip; there is no trace of secondary cæca. The cæca are very much longer than those of *A. trinitatis*.

In front of the gizzard there are three very stout *intersegmental septa*. They are bound together and to the parietes by numerous thin strands of muscle. The septum separating segments viii. and ix. is entirely absent. The gizzard is bound to the septum which follows it by a pair of very stout ventrally placed muscular bands. The first two septa after the gizzard are fairly thick and the size diminishes in the next two or three, all of which, however, are tied to each other and to the parietes by thin muscular strands.

The last *pair of hearts* lie in segment xiii.

The *reproductive organs* show certain features which are of use in the discrimination of the present species from *A. trinitatis*² or *A. heterochaetus*³, which are its nearest allies, especially the former species.

The sperm-sacs in xi. and xii. are not in any way remarkable.

The spermiducal glands (fig. 3) are large, extensively lobulated.

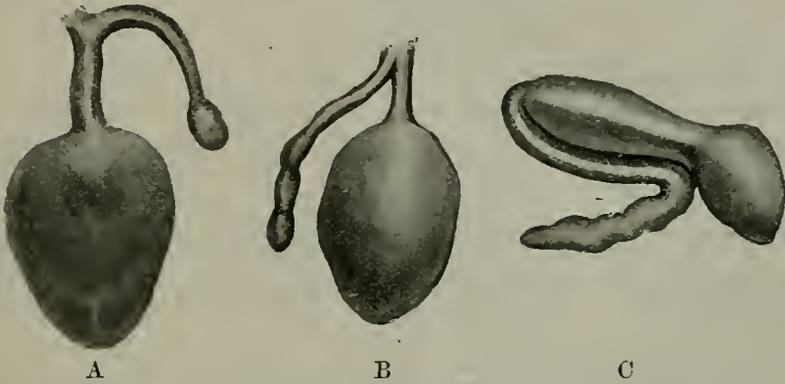
¹ It is to be found, however, in *A. heterochaetus*.

² Beddard, P. Z. S. 1896, p. 206.

³ Horst, Nederl. Arch. f. Zool. iv.

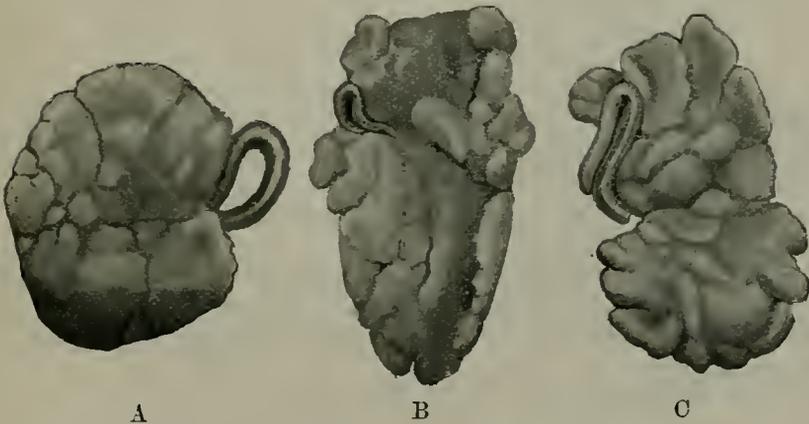
They extend from segment xvii. to segment xx. Anteriorly the glands extend round towards the middle of the body beyond the point of opening of their duct. The whole contour of the gland is thus somewhat ear-shaped. In *A. trinitatis* the glands are longer and of an even diameter throughout. The accompanying drawing (fig. 2) will show the difference between the two species in this respect. The duct of the gland, too, is rather longer in the present species.

Fig. 2.



Spermathecae of : A, *Amyntas heterochaetus*; B, *A. trinitatis*;
C, *A. alexandri*.

Fig. 3.



Spermiducal glands of : A, *Amyntas heterochaetus*; B, *A. trinitatis*;
C, *A. alexandri*.

The spermathecae (fig. 2) are four pairs and lie in segments vi.-ix. Their orifices to the exterior are not so dorsally placed as in *A. trinitatis*. The pouch, too, is distinctly different in form and the relations of its component parts. The duct of the pouch is longer than the pouch and broadens towards the external orifice.

The diverticulum is longer than the spermatheca; it is plainly composed of a duct and of a distal moniliform sperm-receptacle. The two parts are about equi-sized. The accompanying drawing (fig. 2, p. 1001) shows how different are the spermathecæ of *A. alexandri* from those of *A. trinitatis*, which latter are more like those of *A. heterochætus*¹. The salient points of difference between the three species may be thus tabulated:—

	<i>A. heterochætus.</i>	<i>A. trinitatis.</i>	<i>A. alexandri.</i>
Clitellum	xiv.-xvi. or xiv.-xvi.	xiv.-xvi.	xiv.-xvi.
Setæ of anterior segments on either side of ventral line } }	markedly larger.	not larger.	not larger.
Genital papillæ.....	present.	ent.	absent.
Spermathecæ ²	open laterally, with short duct.	open dorsally, with short duct.	open laterally, with long duct
Spermiducal glands ² .	often absent or rudimentary.	large, always present?	large, always present?

It is obvious that these three forms come very near to each other. A rough general description would very readily confuse their points of unlikeness, which appear to me, who have studied all these species, to be unmistakable. The following is a sufficient definition of the new species:—

Amyntas alexandri, n. sp.

Length 145 mm.; number of segments 133. Setæ of most anterior and most posterior segments rather larger. Clitellum xiv.-xvi., without setæ. Male pores separated by 13 setæ. No genital papillæ. Septum viii./ix. absent. Cæca rather large. Last heart in xiii. Sperm-sacs in xi., xii. Spermiducal glands in xvii.-xx., broader anteriorly, much lobate; duct longish, horseshoe-shaped, without terminal sac. Spermathecæ in vi.-ix., with long thick duct longer than pouch; diverticulum longer than spermathecæ, with equi-sized duct and sperm-chamber. Spermathecæ open laterally.

Hab. Calcutta³.

¹ I have distinguished *A. trinitatis* and *A. heterochætus* by the longer diverticulum of the former. I think that this somewhat variable characteristic will hardly do. There is no doubt, however, about the more dorsal position of the spermathecæ in *A. trinitatis*.

² The very accurate drawings (figs. 2, 3) which accompany this paper should render the characteristics of these organs clear.

³ The genus being Malayan, the species may not be really indigenous here.

APPENDIX.

LIST OF ADDITIONS TO THE SOCIETY'S MENAGERIE

DURING THE YEAR

1900.

- Jan. 1. 1 Diana Monkey (*Cercopithecus diana*), ♀. Presented by Dr. S. W. Thompstone.
2. 1 Moor Macaque (*Macacus maurus*), ♂. Deposited.
3. 1 Common Tern (*Sterna fluviatilis*). Presented by J. Newton, Esq.
4. 2 Crossbills (*Loxia curvirostra*). Deposited.
5. 1 Crested Porcupine (*Hystrix cristata*). Deposited.
- 3 Serrated Terrapins (*Chrysemys scripta*). Deposited.
- 1 Prickly Trionyx (*Trionyx spinifer*). Deposited.
- 1 Bull-Frog (*Rana catesbiana*). Deposited.
6. 2 White-eyebrowed Wood-Swallows (*Artamus superciliosus*), ♂ ♀. Purchased.
- 2 Masked Wood-Swallows (*Artamus personatus*), ♂ ♀. Purchased.
- 1 Tawny Owl (*Syrnium aluco*). Presented by Mdm. de Bunsen.
8. 1 White-throated Capuchin (*Cebus hypoleucus*). Presented by Mrs. Vernon.
9. 2 Java Sparrows (*Padda oryzivora*). Presented by Mr. Walter Buchanan.
10. 1 Indian Dial-bird (*Copsychus saularis*). Presented by W. H. St. Quintin, Esq., F.Z.S.
- 2 Whooper Swans (*Cygnus musicus*). Deposited.
- 10 Nose-crested Iguanas (*Iguana tuberculata rhinolophus*). Deposited.
- 1 Starred Tortoise (*Testudo elegans*). Deposited.
11. 1 Blue-and-Yellow Macaw (*Ara ararauna*). Presented by H. W. Stride, Esq.
12. 1 Vulpine Phalanger (*Trichosurus vulpecula*). Deposited.
- 1 Delalande's Gecko (*Tarentola delalandii*). Presented by Mr. May.
13. 1 Hocheur Monkey (*Cercopithecus nictitans*), ♀. Deposited.

- Jan. 13. 2 Spotted Salamanders (*Salamandra maculosa*). Presented by Mrs. Brett.
15. 2 Wagler's Terrapins (*Hydraspis wagleri*). Deposited.
16. 1 Vervet Monkey (*Cercopithecus lalandii*). Presented by A. Althorp, Esq.
- 8 Burrowing-Owls (*Speotyto cunicularia*). Purchased.
17. 1 Woodcock (*Scolopax rusticula*). Presented by W. A. Beauclerk, Esq.
- 1 Short-eared Owl (*Asio brachyotus*). Presented by Dr. A. E. Prest Ilughes.
- 1 Flat-backed Tortoise (*Testudo platynota*). Deposited.
- 10 Reeve's Terrapins (*Damonina reevesi*). Deposited.
- 3 Blanding's Terrapins (*Emys blandingi*). Deposited.
- 2 Long-necked Chelodines (*Chelodina longicollis*). Deposited.
- 1 Indian River-Snake (*Tropidonotus piscator*). Deposited.
- 1 Grass-Snake (*Contia vernalis*). Deposited.
- 1 Moccasin Snake (*Tropidonotus fasciatus*). Deposited.
- 1 Indian Eryx (*Eryx johni*). Deposited.
18. 2 White-headed Sea-Eagles (*Haliaëtus leucocephalus*). Presented by Henry Anger, Esq., F.Z.S.
19. 1 Laughing Kingfisher (*Dacelo gigantea*). Presented by J. Kirkland, Esq.
20. 2 Triangular-spotted Pigeons (*Columba guinea*). Presented by J. Parminter, Esq.
21. 1 Royal Python (*Python regius*). Deposited.
22. 1 Black-headed Bunting (*Emberiza melanocephala*). Bred in the Menagerie.
23. 1 Woodcock (*Scolopax rusticula*). Presented by Charles E. Lambert, Esq.
- 1 Common Snake (*Tropidonotus natrix*). Presented by Miss Ash.
- 1 Tessellated Snake (*Tropidonotus tessellatus*). Presented by Miss Ash.
- 1 Dark Green Snake (*Zamenis gemonensis*). Presented by Miss Ash.
24. 1 Black-headed Lemur (*Lemur brunneus*). Deposited.
- 1 Geoffroy's Cat (*Felis geoffroyi*). Presented by W. A. Gillett, Esq., F.Z.S.
- 1 Blue-tongued Lizard (*Tiliqua scincoides*). Deposited.
26. 1 Bare-eyed Cockatoo (*Cacatua gymnopsis*). Deposited.
- 2 Undulated Grass-Parrakeets (*Melopsittacus undulatus*) (var.). Deposited.
- 2 Black-pointed Teguxins (*Tupinambis nigropunctatus*). Deposited.
- 1 Eyed Lizard (*Lacerta ocellata*). Deposited.
29. 1 Hog-Deer (*Cervus porcinus*), ♂. Born in the Menagerie.
30. 2 Great Anteaters (*Myrmecophaga jubata*), ♂ ♀. Purchased.
- 2 Common Marmosets (*Hapale jacchus*). Presented by Mrs. Nigel Cohen.
- 1 Black-eared Marmoset (*Hapale penicillata*). Presented by Mr. H. Coffey.
- 1 Small Hill Mynah (*Gracula religiosa*). Presented by W. Brindley, Esq.
31. 1 Rhesus Monkey (*Macacus rhesus*), ♀. Presented by Dr. Cox.
- 1 American Bison (*Bison americanus*), ♂. Deposited.
- 1 Blue-fronted Amazon (*Chrysotis æstiva*). Deposited.

- Feb. 1. 1 Lesser White-nosed Monkey (*Cercopithecus petaurista*), ♂. Deposited.
4. 2 Dwarf Chameleons (*Chamaeleon pumilus*). Presented by H. Way, Esq.
5. 1 Alligator Terrapin (*Chelydra serpentina*?). Deposited.
 2 Pennsylvanian Mud-Terrapins (*Cinosternum pennsylvanicum*). Deposited.
 1 Wrinkled Terrapin (*Chrysemys scripta rugosa*). Deposited.
 8 Adorned Terrapins (*Chrysemys ornata*). Deposited.
 1 Floridan Terrapin (*Chrysemys concinna*?). Deposited.
 1 Salt-water Terrapin (*Malacoclemmys terrapin*). Deposited.
 1 Sculptured Terrapin (*Clemmys insculpta*). Deposited.
 4 American Box-Tortoises (*Cistudo carolina*). Deposited.
 1 Annulated Terrapin (*Nicoria annulata*). Deposited.
 1 Prickly Trionyx (*Trionyx spinifer*). Deposited.
 1 N. American Trionyx (*Trionyx ferox*). Deposited.
 5 Carolina Anolis (*Anolis carolinensis*). Deposited.
 1 Undulated Lizard (*Sceloporus undulatus*). Deposited.
 3 American Glass-Snakes (*Ophiosaurus ventralis*). Deposited.
 9 Five-lined Skinks (*Eumeces quinelineatus*). Deposited.
 1 Common Boa (*Boa constrictor*). Deposited.
 2 Striped Snakes (*Tropidonotus ordinatus sirtalis*). Deposited.
 1 Seven-banded Snake (*Tropidonotus septemvittatus*). Deposited.
 1 Testaceous Snake (*Zamenis flagelliformis*). Deposited.
 2 Corn-Snakes (*Coluber guttatus*). Deposited.
 1 Chicken-Snake (*Coluber obsoletus*). Deposited.
 1 American Black Snake (*Zamenis constrictor*). Deposited.
 2 King Snakes (*Coronella getula*). Deposited.
 9 Changeable Tree-Frogs (*Hyla versicolor*). Deposited.
 1 Dusky Toad (*Bufo lentiginosus*). Deposited.
6. 1 Orange-bellied Mangabey (*Cercocebus erythrogaster*). Deposited.
 2 Grooved Tortoises (*Testudo calcarata*). Deposited.
 1 Red Deer (*Cervus elaphus*), ♂. Presented by the Right Hon. the Marq. of Breadalbane, K.G., P.C., F.Z.S.
 1 Spanish Blue Magpie (*Cyanopollus cooki*). Presented by L. Ingham Baker, Esq.
8. 1 Starred Tortoise (*Testudo elegans*). Deposited.
 2 Reeves's Terrapins (*Damonina reevesi*). Deposited.
 1 Serrated Terrapin (*Chrysemys scripta*). Deposited.
9. 1 Entellus Monkey (*Semnopithecus entellus*), ♀. Presented by Mrs. E. J. Gaudie.
 1 Blue Lizard (*Gerrhonotus caeruleus*). Deposited.
 1 Three-striped Boa (*Lichamura trivirgata*). Deposited.
10. 2 Tcheli Monkeys (*Macacus tcheliensis*), ♂ ♀. Presented by Dr. S. W. Bushell, C.M.G., C.M.Z.S. See P. Z. S. 1900, p. 181.
 1 Vulpine Phalanger (*Trichosurus vulpecula*). Presented by Miss Freda Gilder.
 3 Indian Dial-birds (*Copsychus saularis*), 2 ♂, 1 ♀. Purchased.
14. 1 King Vulture (*Gypagus papa*). Presented by H. A. De Lisle, Esq. From the Rio Purus.
 1 Weka Rail (*Ocydromus australis*). Deposited.
 1 Common Snake (albino) (*Tropidonotus natrix*). Deposited.
16. 2 Purple-capped Lories (*Lorius domicella*). Purchased.

- Feb. 19. 1 Marica Gazelle (*Gazella marica*), ♀. Presented by B. T. Finch, Esq., F.Z.S.
20. 1 Red-crested Cardinal (*Paroaria cucullata*). Presented by Miss Power.
- 1 Nilotic Crocodile (*Crocodilus niloticus*). Presented by Rupert D'Oyly Carte, Esq.
22. 1 Undulated Grass-Parrakeet (*Melopsittacus undulatus*), ♀. Received in Exchange.
23. 1 Pinche Monkey (*Midas adipas*). Presented by Mrs. H. V. Holden.
- 1 Indian Darter (*Plotus melanogaster*). Purchased.
- 1 Indian Pied-Hornbill (*Anthrucoceros malabaricus*). Deposited.
- 1 Jackal Buzzard (*Buteo jactal*). Presented by Douglas Mann, Esq.
- 1 Serrated Terrapin (*Chrysemys scripta*). Deposited.
- 2 Speckled Terrapins (*Clemmys guttata*). Deposited.
24. 2 Common Wolves (white var.) (*Canis lupus*), ♂ ♀. Deposited.
- 15 Mississippi Terrapins (*Malacoclemmys geographica*). Deposited.
- 4 Black-headed Terrapins (*Damonia reevesi unicolor*). Deposited.
- 1 Four-lined Snake (*Coluber quatuorlineatus*). Deposited.
26. 1 Vervet Monkey (*Cercopithecus lalandii*). Presented by J. E. Matcham, Esq., C.M.Z.S.
- 1 Serval (*Felis serral*). Presented by J. E. Matcham, Esq., C.M.Z.S.
- 1 Greater Sulphur-crested Cockatoo (*Cacatua galerita*). Presented by Lient.-Col. Hopton.
- Mar. .1. 1 Vervet Monkey (*Cercopithecus lalandii*), ♂. Presented by Dudley B. Myers, Esq.
- 4 Black-bellied Sand-Grouse (*Pterocles arenarius*), 1 ♂, 3 ♀. Presented by G. P. Torrens, Esq., F.Z.S.
2. 1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by Mrs. A. E. Poyer.
3. 1 Common Marmoset (*Hapale jacchus*). Presented by Miss M. C. Glover.
- 1 Purplish Death-Adder (*Pseudechis porphyriacus*). Purchased.
6. 1 Ludio Monkey (*Cercopithecus ludio*). Presented by Mrs. C. Young.
- 1 Brown Capuchin (*Cebus fatuellus*). Presented by Mrs. C. Young.
7. 4 Cockateels (*Calopsittacus novaehollandiæ*), 2 ♂, 2 ♀. Purchased.
8. 1 Persian Gazelle (*Gazella subgutturosa*), ♂. Presented by B. T. Finch, Esq., F.Z.S.
- 1 Alligator (young) (*Alligator mississippiensis*). Presented by J. Turner Turner, Esq.
9. 1 Patas Monkey (*Cercopithecus patas*), ♀. Presented by Cecil Masters, Esq.
- 1 Vulpine Phalanger (*Trichosurus vulpecula*). Presented by Mrs. Walter Crane.
10. 1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by Mrs. Herbert Griffith.

- Mar. 13. 1 Black-faced Ibis (*Theristicus melanopis*). Purchased.
 2 Grey Struthideas (*Struthidea cinerea*). Deposited.
14. 1 Silver Pheasant (*Euplocamus nyctemerus*), ♂. Presented by the Rev. J. O. Coussmaker.
 2 Starred Lizards (*Agama stellio*). Presented by Stanley S. Flower, Esq., F.Z.S.
16. 1 Bennett's Wallaby (*Macropus bennetti*), ♂. Deposited.
17. 1 Greater Black-backed Gull (*Larus marinus*). Presented by W. Baker, Esq.
18. 1 Green Lizard (*Lacerta viridis*). Presented by W. J. R. Elgy, Esq., F.Z.S.
22. 1 Hagenbeck's Mangabey (*Cercocebus hagenbecki*). From the Mobangi River. Presented by the Rev. A. Christopher.
23. 1 Great Bustard (*Otis tarda*), ♂. Presented by E. G. B. Meade-Waldo, Esq., F.Z.S.
 1 Pine-Marten (*Mustela martes*). Deposited.
 1 Snowy Owl (*Nyctea scandiaca*), ♂. Deposited.
 1 Pin-tailed Sand-Grouse (*Pterocles alchata*). Deposited.
 1 Slender-billed Gull (*Larus gelastes*). Deposited.
 2 Martinican Doves (*Zenaida aurita*). Presented by R. Phillipps, Esq.
25. 1 Jaguar (*Felis onca*). Presented by J. C. Rodrigues, Esq.
26. 1 Secretary Vulture (*Serpentarius reptilivorus*). Presented by James D. Logan, Jun., Esq.
27. 1 Spanish Blue Magpie (*Cyanopolius cooki*), ♂. Presented by E. G. B. Meade-Waldo, Esq., F.Z.S.
30. 1 Greater Black-backed Gull (*Larus marinus*). Presented by H. Clinton Baker, Esq.
 4 Marbled Newts (*Molge marmorata*). Presented by G. A. Boulenger, Esq., F.R.S., F.Z.S.
- Apr. 3. 1 Common Hare (*Lepus europæus*). Deposited.
 1 Chacma Baboon (*Cynocephalus porcarius*), ♂. Presented by J. E. Matcham, Esq., C.M.Z.S.
 1 Vervet Monkey (*Cercopithecus lalandii*), ♀. Presented by J. E. Matcham, Esq., C.M.Z.S.
 2 Yellow-billed Ducks (*Anas undulata*). Presented by J. E. Matcham, Esq., C.M.Z.S.
 1 Ludio Monkey (*Cercopithecus ludio*), ♀. Presented by D. J. Jones, Esq.
 1 White-collared Mangabey (*Cercocebus collaris*), ♀. Presented by D. J. Jones, Esq.
4. 1 Common Duiker (*Cephalophus grimmi*), ♀. Deposited.
 1 Small-clawed Otter (*Lutra leptonyx*). Deposited.
 1 Bengal Monitor (*Varanus bengalensis*). Deposited.
 2 Bonnet-Monkeys (*Macacus sinicus*), ♂ ♀. Presented by T. W. B. Lindgren, Esq.
 1 Wedge-tailed Eagle (*Aquila audax*). Presented by Col. R. B. Ingram.
5. 1 Greater Sulphur-crested Cockatoo (*Cacatua galerita*). Deposited.
6. 1 Fennec Fox (*Canis cerdo*), ♂. Presented by Dixon Bey.
 5 Squirrel-like Phalangers (*Petaurus sciureus*). Born in the Menagerie.
 1 Marabou Stork (*Leptoptilus crumeniferus*). Presented by Mr. Justice H. G. Kelly.

- Apr. 6. 4 Spot-billed Ducks (*Anas pæcilorhyncha*). Presented by Sir Ed. Chas. Buck, K.C.S.I., C.M.Z.S.
9. 1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by Mr. T. Packer.
- 2 Masked Wood-Swallows (*Artamus personata*), ♂ ♀. Purchased.
- 2 White-eyebrowed Wood-Swallows (*Artamus superciliosus*?). Purchased.
- 2 Australian Thicknees (*Edicnemus grullarius*). Purchased.
11. 1 Roller (*Coracias garrulus*). Deposited.
12. 1 Lyre-bird (*Menura superba*), ♀. Presented by Messrs. Carrick & Fry. See P. Z. S. 1900, p. 429.
13. 7 Barbary Wild Sheep (*Ovis tragelaphus*), 3 ♂, 4 ♀. Born in the Menagerie.
14. 1 Barbary Mouse (*Mus barbarus*). Presented by the Masters Chapman.
17. 1 Suricate (*Suricata tetradactyla*). Deposited.
- 1 Common Boa (*Boa constrictor*). Deposited.
- 1 Anaconda (*Eunectes murinus*). Deposited.
18. 1 Baboon (*Cynocephalus*, sp. inc.), ♀. Deposited.
19. 1 Barbary Wild Sheep (*Ovis tragelaphus*), ♀. Born in the Menagerie.
20. 5 Common Wigeon (*Mareca penelope*), 5 ♂. Purchased.
- 3 Pochards (*Fuligula ferina*), 2 ♂, 1 ♀. Purchased.
- 3 Tufted Ducks (*Fuligula cristata*), 1 ♂, 2 ♀. Purchased.
- 4 Goldeneyes (*Clangula glaucion*), 2 ♂, 2 ♀. Purchased.
- 1 Pin-tailed Sand-Grouse (*Pterocles alchata*), ♂. Deposited.
- 1 Hybrid Sand-Grouse (bred between *Pterocles alchata* and *P. pyrenaica*), ♂. Deposited.
21. 1 Panolia Deer (*Cervus eldi*), ♀. Purchased.
- 1 Common Boa (*Boa constrictor*). Purchased.
23. 2 Leopards (*Felis pardus*), ♂ ♀. Presented by Mrs. F. L. G. Simpson.
- 2 Upland Geese (*Chloëphaga megallanica*), ♂ ♀. Purchased.
- 2 Gold Pheasants (*Thaumalea picta*), 2 ♀. Purchased.
- 2 Sæmmerring's Pheasants (*Phasianus sæmmerringi*), ♂ ♀. Purchased.
- 1 Cactus Conure (*Conurus cactorum*). Deposited.
- 1 Flap-necked Chameleon (*Chamceleon dilepis*). Deposited.
24. 1 Barbary Wild Sheep (*Ovis tragelaphus*), ♂. Purchased.
- 1 Great Wallaroo (*Macropus robustus*), ♂. Purchased.
- 1 Musky Lorrieket (*Glossopsittacus concinnus*). Purchased.
- 3 Blue-crowned Hanging Parrakeets (*Loriculus galgulus*). Purchased.
- 1 Ural Owl (*Syrnium uralense*). Purchased. See P. Z. S. 1900, p. 429.
- 1 Striped Owl (*Ciccaba virgata*). Purchased.
- 2 Silver Pheasants (*Euplocamus nyctemerus*), 2 ♀. Purchased.
26. 1 Mozambique Monkey (*Cercopithecus pygerythrus*), ♀. Presented by the Lady Ashburnham.
- 9 Natterjack Toads (*Bubo calamita*). Presented by J. B. Thornhill, Esq.
27. 3 White-backed Trumpeters (*Psophia leucoptera*). Purchased.
- 4 Wonga-Wonga Pigeons (*Leucosarcia picata*), 2 ♂, 2 ♀. Purchased.
- 2 Germain's Peacock Pheasants (*Polyplectron germaini*), ♂ ♀. Purchased.

- Apr. 27. 2 Japanese Pheasants (*Phasianus versicolor*), ♂ ♀. Purchased.
 2 Cabot's Horned Tragopans (*Cerviornis caboti*), ♂ ♀. Purchased.
 1 Tawny Owl (*Syrnium aluco*). Presented by Mrs. E. M. Blackwood.
 6 Common Vipers (*Vipera berus*). Presented by A. Old, Esq.
28. 1 Sykes's Monkey (*Cercopithecus albigularis*), ♀. Deposited.
 1 Yak (*Foëphagus grunniens*), ♂. Born in the Menagerie.
30. 1 Yellow-whiskered Lemur (*Lemur xanthomystax*). Presented by J. E. Matcham, Esq., C.M.Z.S.
 1 Grys-bok (*Raphicerus melanotis*), ♂. Presented by J. E. Matcham, Esq., C.M.Z.S.
 1 English Wild Cow (*Bos taurus*). Born in the Menagerie.
 1 Violet-necked Lory (*Eos riciniata*). Presented by H. R. Fillmer, Esq.
 1 Eyed Lizard (*Lacerta ocellata*). Presented by Miss Robinson.
- May 1. 1 Brazilian Tapir (*Tapirus americanus*), ♂. Purchased.
 2 Violet-necked Lorises (*Eos riciniata*). Purchased.
 2 Amherst Pheasants (*Thaumalea amherstie*), ♂ ♀. Purchased.
 2 Siamese Pheasants (*Euplocamus praelatus*), ♂ ♀. Purchased.
 2 Rufous-tailed Pheasants (*Euplocamus erythrophthalmus*), ♂ ♀. Purchased.
 1 Common Boa (*Boa constrictor*). Presented by C. W. Lilley, Esq., F.Z.S.
 1 Egyptian Eryx (*Eryx jaculus*). Presented by C. W. Lilley, Esq., F.Z.S.
 1 Glass-Snake (*Ophiosaurus apus*). Deposited.
2. 1 Grooved Tortoise (*Testudo calcarata*). From Khartoum. Deposited.
 1 Eyed Lizard (*Lacerta ocellata*). Presented by Miss Ash.
 2 Edible Frogs (*Rana esculenta*). From Biskra. Presented by the Hon. Mrs. A. Cadogan.
 1 Three-banded Terrapin (*Cyclemmys trifasciata*). Deposited.
 2 Roofed Terrapins (*Kachuga tectum*). Deposited.
 2 Blackish Sternotheres (*Sternotherus nigricans*). Deposited.
 1 Derbian Sternothere (*Sternotherus derbianus*). Deposited.
 2 Black Sternotheres (*Sternotherus niger*). Deposited.
 1 Hamilton's Terrapin (*Damonia hamiltoni*). Deposited.
 3 Annulated Terrapins (*Nicoria annulata*). Deposited.
 1 Red-striped Ground-Snake (*Abastor erythrogrammus*). Deposited.
 6 Kentucky Blind-fish (*Amblyopsis spelæa*). Deposited.
3. 1 Crowned Lemur (*Lemur coronatus*), ♂. Deposited.
 1 Black Lemur (*Lemur macaco*), ♂. Deposited.
 2 Slender Loris (*Loris gracilis*). Deposited.
 1 Bandicoot (*Perameles* sp. inc.). Deposited.
 3 Wrinkled Terrapins (*Chrysemys scripta rugosa*). Deposited.
 20 Elegant Terrapins (*Chrysemys scripta elegans*). Deposited.
 10 Reeves's Terrapins (*Damonia reevesi*). Deposited.
 1 Radiated Tortoise (*Testudo radiata*). Deposited.
 1 Reticulated Terrapin (*Chrysemys reticulatus*). Deposited.
 2 Argentine Tortoises (*Testudo argentina*). Deposited.
 3 Coralline Snakes (*Coronella gentilis*). Deposited.
 8 Undulated Lizards (*Sceloporus undulatus*). Deposited.
 1 Lesser Sulphur-crested Cockatoo (*Cacatua sulphurea*). Deposited.

- May 3. 1 Common Snake (*Tropidonotus natrix*). Presented by Master R. Macdonald.
4. 1 Cape Hunting-Dog (*Lycan pictus*), ♀. Purchased. See P. Z. S. 1900, p. 659.
- 2 Australian Rails (*Rallus pectoralis*). Presented by Mr. C. F. Fox.
6. 1 Crowned Lemur (*Lemur coronatus*). Born in the Menagerie.
7. 1 Bonnet-Monkey (*Macacus sinicus*), ♂. Presented by Lady Malcolm of Poltalloch.
- 4 Australian Sheldrakes (*Tadorna tadornoides*), 2 ♂, 2 ♀. Purchased.
- 1 Sclater's Cassowary (*Casuarus sclateri*). Deposited.
- 2 Loggerhead Turtles (*Thalassochelys caretta*). Deposited.
- 12 Elegant Terrapins (*Chrysemys scripta elegans*). Deposited.
- 12 Adorned Terrapins (*Chrysemys ornata*). Deposited.
- 17 Lesneur's Terrapins (*Malacoclemmys lesueuri*). Deposited.
- 7 Reeves's Terrapins (*Dumonia reevesi*). Deposited.
8. 2 Prevost's Squirrels (*Sciurus prevosti*), 2 ♀. Purchased.
- 4 Indian Starlings (*Sturnus menzibieri*). Purchased.
- 6 Common Wolves (*Canis lupus*). Born in the Menagerie.
9. 2 Egyptian Foxes (*Canis niloticus*). Deposited.
- 2 Meyer's Parrots (*Psecephalus meyeri*). Purchased.
10. 2 Prevost's Squirrels (*Sciurus prevosti*), 2 ♀. Deposited.
- 2 Cardinal Eeclctus (*Eclectus cardinalis*). Deposited.
- 1 White-crested Tiger-Bittern (*Tigriosoma leucolophum*). Presented by F. W. Marshall, Esq.
- 1 Ring-tailed Coati (*Nasua rufa*). Deposited.
- 1 Common Boa (*Boa constrictor*). Presented by F. H. Preston, Esq.
- 5 Sordid Wood-Swallows (*Artamus sordidus*). Purchased.
- 3 Hairy Armadillos (*Dasypus villosus*). Purchased.
- 6 Sulphury Tyrants (*Pitangus sulphuratus*). Purchased.
- 1 Black-pointed Teguexin (*Tupinambis nigropunctatus*). Purchased.
11. 1 Crowned Lemur (*Lemur coronatus*). Born in the Menagerie.
- 1 Bengal Fox (*Canis bengalensis*). Purchased.
12. 4 Chaplain Crows (*Corvus capellanus*). Presented by B. T. Finch, Esq., F.Z.S.
- 2 Porto-Rico Pigeons (*Columba squamosa*). Purchased.
- 1 Cinereous Vulture (*Fultur monachus*). Presented by W. E. Found, Esq.
- 1 Polecat (*Mustela putorius*). Deposited.
13. 1 Llama (*Lama peruana*), ♂. Born in the Menagerie.
14. 1 Ocelot (*Felis pardalis*). Presented by M. A. French, Esq.
- 4 Blood-rumped Parrakeets (*Psephotus hæmatonotus*). Purchased.
15. 1 Allen's Porphyrio (*Hydrornia alleni*). Captured at Sea. Presented by Capt. J. C. Robinson. See P. Z. S. 1900, p. 659.
- 6 Long-nosed Crocodiles (*Crocodilus cataphractus*). Presented by J. S. Budgett, Esq., F.Z.S.
16. 1 Snowy Owl (*Nyctea scandiaca*), ♀. From Bylott Island, Lancaster Sound. Presented by A. Barclay Walker, Esq.
- 2 African Tantaluses (*Pseudotantalus ibis*). Purchased.
- 2 Black-and-White Geese (*Anseranus semipalmata*). Purchased.
- 2 Plumed Ground-Doves (*Geophaps plumifera*). Purchased.
- 2 Rose-Hill Parrakeets (*Platycercus eximius*). Purchased.

- May 17. 2 Crested Pigeons (*Ocyphaps lophotes*). Purchased.
 2 King Snakes (*Coronella getula*). Deposited.
 1 Coralline Snake (*Coronella gentilis*). Deposited.
 2 American Black Snakes (*Zamenis constrictor*). Deposited.
 3 Ten-lined Snakes (*Contia decemlineata*). Deposited.
18. 1 Garnett's Galago (*Galago garnetti*). Deposited.
 1 Common Teguxin (*Tupinambis teguexin*). Deposited.
 4 Blue Wall-Lizards (*Lacerta muralis cærulea*). From Faraglione, Sicily. Deposited.
- 10 Pennsylvanian Mud-Terrapins (*Cinosternum pennsylvanicum*). Deposited.
 4 Adorned Terrapins (*Chrysemys ornata*). Deposited.
 13 Elegant Terrapins (*Chrysemys scripta elegans*). Deposited.
 6 Lesueur's Terrapins (*Malacoclemmys lesueuri*). Deposited.
 3 Annulated Terrapins (*Nicoria annulata*). Deposited.
 5 Schlagintweit's Frogs (*Rana cyanophlyctis*). Deposited.
 6 Red Newts (*Spelerpes ruber*). Deposited.
19. 1 Serval (*Felis serval*). Presented by R. Barton Wright, Esq.
 2 Long-eared Owls (*Asio otus*). Presented by D. F. Campbell, Esq.
 2 Senegal Touracous (*Turacus persa*). Purchased.
20. 1 Squirrel Monkey (*Chrysothrix sciurea*). Presented by Percy L. Isaac, Esq.
 1 Barbary Wild Sheep (*Ovis tragelaphus*), ♂. Born in the Menagerie.
24. 1 Summer Snake (*Contia æstiva*). Deposited.
 1 Mexican Snake (*Coluber melanoleucus*). Deposited.
25. 1 Common Paradoxure (*Paradoxurus niger*). Presented by E. E. Hewens, Esq.
 6 Menobranchs (*Necturus maculatus*). Deposited.
 5 American Green Frogs (*Rana halecina*). Deposited.
26. 1 Boddaert's Snake (*Drymobius boddaerti*). } Presented by
 1 Chequered Elaps (*Elaps lemniscatus*). } Leon Bern-
 1 Rat-tailed Opossum (*Didelphys nudicaudata*). } stein, Esq.
 1 Diana Monkey (*Cercopithecus diana*). Presented by Mrs. Morris.
 1 Common Squirrel (*Sciurus vulgaris*). Presented by Mrs. Morris.
28. 1 Thar (*Hemitragus jemlaicus*), ♀. Born in the Menagerie.
29. 5 Swinhoe's Pheasants (*Euplocamus swinhoii*). Born in the Menagerie.
 2 Brown Mynahs (*Acridotheres fuscus*). Purchased.
30. 2 Red Howlers (*Mycetes seniculus*), ♂ ♀. Deposited.
 1 Great Kangaroo (*Macropus giganteus*), ♂. Deposited.
 3 Chaplain Crows (*Corvus capellanus*). Presented by B. T. Ffrench, Esq., F.Z.S.
 1 Herring-Gull (*Larus argentatus*). Presented by J. W. Berry, Esq.
 2 Greek Tortoises (*Testudo græca*). Deposited.
31. 1 American Flying-Squirrel (*Sciuropterus volucella*). Deposited.
 1 Red-and-Yellow Macaw (*Ara chloroptera*), ♀. Deposited.
 2 Black-headed Caiques (*Caica melanocephala*). Deposited.
- June 1. 2 Wild Swine (*Sus scrofa*), 2 ♀. Presented by the Lord Carnegie, F.Z.S.
 1 Occipital Blue Pie (*Urocissa occipitalis*). Purchased.
 2. 1 Brown Mock-Thrush (*Harporhynchus rufus*), ♂. Purchased.

- June 2. 1 Chough (*Pyrrhocorax graculus*). Deposited.
3. 1 Thar (*Hemitragus jemlaicus*), ♀. Born in the Menagerie.
- 6 Argentine Tortoises (*Testudo argentina*). Deposited.
- 3 American Box-Tortoises (*Cistudo carolina*). Deposited.
- 1 Black Sternotherere (*Sternotherus niger*). Deposited.
- 1 North-American Trionyx (*Trionyx ferox*). Deposited.
- 3 Changeable Tree-Frogs (*Hyla versicolor*). Deposited.
5. 3 Shaw's Gerbilles (*Gerbillus shawi*). From Biskra, Algeria.
Presented by the Rev. A. E. Eaton.
- 1 Garamantic Gerbille (*Gerbillus garamantis*). From Biskra,
Algeria. Presented by the Rev. A. E. Eaton.
- 1 Japanese Deer (*Cervus sika*), ♂. Born in the Menagerie.
- 3 Goshawks (*Astur palumbarius*). Presented by Tom Simonds,
Esq.
- 1 Common Snake (*Tropidonotus natrix*). Presented by W. H.
St. Quintin, Esq., F.Z.S.
- 2 Mocassin Snakes (*Tropidonotus fasciatus*). Presented by
W. H. St. Quintin, Esq., F.Z.S.
6. 1 Burchell's Zebra (*Equus burchelli*), ♂. Born in the Menagerie.
- 1 Rocky-Mountain Goat (*Haploceros montanus*), ♂. From
British Columbia. Purchased. See P. Z. S. 1900, p. 771.
- 1 Three-toed Sloth (*Bradypus tridactylus*). Purchased.
- 1 Common Squirrel (albino) (*Sciurus vulgaris*). Deposited.
- 1 Large Red Flying-Squirrel (*Pteromys inornatus*). Presented
by A. Dudley Yorke, Esq.
7. 1 Lion (*Felis leo*), ♂. From Kathiwar. Deposited by H.R.H.
the Prince of Wales, K.G.
- 1 Nylghaie (*Boselaphus tragocamelus*), ♀. Deposited by H.R.H.
the Prince of Wales, K.G.
- 2 Four-horned Antelopes (*Tetraceros quadricornis*), ♂ ♀. De-
posited by H.R.H. the Prince of Wales, K.G.
- 3 Indian Gazelles (*Gazella bennetti*). Deposited by H.R.H. the
Prince of Wales, K.G.
- 1 Sykes's Monkey (*Cercopithecus albigularis*). Presented by
C. H. Armbruster, Esq.
- 1 Barbary Ape (*Macacus inuus*). Presented by R. S. Allen, Esq.
- 5 Gentoo Penguins (*Pygosceles tæniatus*). Purchased. See
P. Z. S. 1900, p. 771.
- 2 Cunning Bassaris (*Bassariscus astutus*). Purchased.
8. 1 Japanese Deer (*Cervus sika*), ♂. Born in the Menagerie.
- 1 Allen's Porphyrio (*Hydrornia alleni*). Captured at Sea.
Presented by Miss Wallace.
- 1 Little Egret (*Ardea garzetta*). Presented by J. H. Yates, Esq.
- 4 Bearded Lizards (*Amphibolurus barbatus*). Deposited.
- 5 American Box-Tortoises (*Cistudo carolina*). Deposited.
- 6 Stink-pot Mud-Terrapins (*Cinosternum odoratum*). De-
posited.
- 1 Mississippi Terrapin (*Malacoclemmys geographica*). De-
posited.
9. 1 African Python (*Python seba natalensis*). Presented by
Francis E. Colenso, Esq.
- 1 Green Lizard (*Lacerta viridis*). Presented by Miss Mabel
A. Heaton.
10. 2 Stump-tailed Skinks (*Trachysaurus rugosus*). Deposited.
11. 1 Grivet Monkey (*Cercopithecus griseo-viridis*). Presented by
H. G. F. Stallard, Esq.
- 2 Collared Fruit-Bats (*Cynonycteris collaris*). Received in
Exchange.

- June 11. 1 Orinoco Goose (*Chenalopez jubatus*). Purchased.
 1 Little Guan (*Ortalis motmot*). Purchased.
 1 Blue-fronted Amazon (*Chrysotis æstiva*) (var.). Purchased.
 2 Wandering Tree-Ducks (*Dendrocygna arcuata*). Purchased.
12. 1 Hocheur Monkey (*Cercopithecus nictitans*).
 1 Moustache Monkey (*Cercopithecus cephus*).
 1 Malbrouck Monkey (*Cercopithecus cynosurus*).
 1 Angolan Vulture (*Gypohierax angolensis*).
 10 African Walking-fish (*Periophthalmus koel-reuteri*).
 1 Egyptian Jerboa (*Dipus ægyptius*). Presented by Lady Preston.
- 1 De Filippi's Meadow-Starling (*Sturnella defilippii*). Purchased.
- 6 Undulated Grass-Parrakeets (*Melopsittacus undulatus*). Purchased.
- 4 Anderson's Tree-Frogs (*Hyla andersoni*). Deposited.
 4 Changeable Tree-Frogs (*Hyla versicolor*). Deposited.
13. 2 Palm-Squirrels (*Sciurus palmarum*). Presented by W. B. Bingham, Esq.
 1 Angola Seed-eater (*Serinus angolensis*). Presented by Miss Long.
 3 White Ibises (*Eudocimus albus*). Bred in the Menagerie. See P. Z. S. 1900, p. 771.
 6 Glossy Ibises (*Plegadis falcinellus*). Bred in the Menagerie.
14. 1 Chacma Baboon (*Cynocephalus porcarius*), ♂. Deposited.
 1 Common Squirrel (*Sciurus vulgaris*). Presented by Dr. J. L. Williams.
 1 Yellow-billed Sheath-bill (*Chionis alba*). Captured at Sea, off Cape Horn. Presented by Capt. Bate.
5. 1 Campbell's Monkey (*Cercopithecus campbelli*), ♀. Presented by Miss E. B. Hall.
 1 Negro Tamarin (*Midas ursulus*). Deposited.
 1 Whinchat (*Pratincola rubetra*). Purchased.
 Black Redstart (*Ruticilla titys*). Purchased.
 Meadow-Pipit (*Anthus pratensis*). Purchased.
 Pied Flycatcher (*Muscicapa atricapilla*). Purchased.
 1 Blue-headed Wagtail (*Motacilla flava*). Purchased.
6. 1 Common Squirrel (*Sciurus vulgaris*). Presented by G. S. Johnson, Esq.
 2 King Snakes (*Coronella getula*). Purchased.
18. 1 Smooth-headed Capuchin (*Cebus monachus*). Presented by F. Wallace, Esq.
 2 Yellow-bellied Liothrix (*Liothrix luteus*). Presented by Miss Petrocochino.
 1 Cockateel (*Calopsittacus novæ-hollandiæ*), ♂. Presented by Mrs. Harry Blades.
 2 Green Lizards (*Lacerta viridis*). Presented by the Rev. F. W. Haines.
 4 Viperine Snakes (*Tropidonotus viperinus*). Presented by the Rev. F. W. Haines.
 1 Smooth Snake (*Coronella austriaca*). Presented by the Rev. F. W. Haines.
19. 2 Marbled Newts (*Molge marmorata*). Presented by the Rev. F. W. Haines.
20. 1 Grey Parrot (*Psittacus erithacus*). Deposited.
 1 Yellow-cheeked Amazon (*Chrysotis autumnalis*). Deposited.
 9 Mountain Ground-Doves (*Geotrygon cristata*). Deposited.

- June 20. 4 Ring-necked Parrakeets (*Palæornis torquata*), 4 ♂. Presented by J. M. G. Bate, Esq.
 1 Small Hill-Mynah (*Gracula religiosa*). Presented by Capt. R. Yorke Heriz, R.N.
 2 Peba Armadillos (*Tatusia peba*). Purchased.
 3 Spotted Owls (*Athene brama*). Purchased.
 3 White-throated Finches (*Spermophila albogularis*), ♂. Purchased.
 1 Thick-billed Seed-Finch (*Oryzoborus crassirostris*), ♀. Purchased.
 1 White-eared Conure (*Pyrrhura leucotis*). Purchased.
 1 Loggerhead Turtle (*Thalassochelys caretta*). Purchased.
21. 2 Burriel Wild Sheep (*Ovis burriel*), 2 ♂. Born in the Menagerie.
 1 Thar (*Hemitragus jemlaicus*), ♀. Born in the Menagerie.
22. 1 Hocheur Monkey (*Cercopithecus nictitans*). Deposited.
 7 Brazilian Tortoises (*Testudo tabulata*). Deposited.
 5 American Box-Tortoises (*Cistudo carolina*). Deposited.
23. 1 Indian Desert-Fox (*Canis leucopus*?). From Persia. Presented by Capt. D. J. Leiper.
 1 Orang-outang (*Simia satyrus*), ♂. Deposited.
 5 Silvery Mole-Rats (*Myoscalops argenteo-cinereus*). Deposited.
 3 Chaplain Crows (*Corvus capellanus*). Presented by B. T. Finch, Esq., F.Z.S.
 2 Pied Mynahs (*Sturnopastor contra*). Bred in the Menagerie.
25. 1 Common Duiker (*Cephalophus grinnii*), ♂. Presented by J. E. Matcham, Esq., C.M.Z.S.
 1 Common Duiker (*Cephalophus grinnii*), ♀. Deposited.
 1 Syrian Bear (*Ursus syriacus*). Deposited.
 1 Three-toed Sloth (*Bradypus tridactylus*). Purchased.
26. 1 Bonnet-Monkey (*Macacus sinicus*), ♂. Presented by G. A. S. Bell, Esq., R.N.
 5 Wild Cats (young) (*Felis catus*). From Inverness-shire. Presented by Geo. J. Bailey, Esq.
 1 Cheetah (*Cynælurus jubatus*). Deposited.
 1 Levaillant's Amazon (*Chrysotis levaillantii*). Presented by J. Farmer Hall, Esq., F.Z.S.
 1 Common Viper (*Vipera berus*) (black var.). Presented by G. Allan Marriott, Esq.
27. 6 Wrinkled Terrapins (*Chrysemys scripta rugosa*). Deposited.
 5 Mississippi Terrapins (*Malacoclemmys geographica*). Deposited.
 3 Annulated Terrapins (*Nicoria annulata*). Deposited.
 1 Amboina Box-Tortoise (*Cyclemys amboinensis*). Deposited.
 1 Prickly Trionyx (*Trionyx spinifer*). Deposited.
28. 1 Ring-tailed Lemur (*Lemur catta*). Presented by Miss M. C. Rawcliffe.
 2 Black-faced Kangaroos (*Macropus melanops*), ♂ ♀. Deposited.
 1 Royal Python (*Python regius*). Presented by Mr. Benjamin Stewart.
29. 1 Alpine Newt (*Molge alpestris*).
 9 Black Salamanders (*Salamandra atra*).
 2 Slowworms (*Anguis fragilis*). } Presented by the Rev. J. W. Horsley.
- July 2. 1 Adanson's Sternotherere (*Sternothererus adansonii*). Received in Exchange.
 1 Common Chameleon (*Chamaeleon vulgaris*). Received in Exchange.
 6 Wrinkled Terrapins (*Chrysemys scripta rugosa*). Deposited.

- July 5. 1 Yellow-cheeked Amazon (*Chrysotis autumnalis*). Presented by S. Hawkings, Esq.
 2 Greater Black-backed Gulls (*Larus marinus*). Bred in the Menagerie.
 1 Herring-Gull (*Larus argentatus*). Bred in the Menagerie.
6. 2 Tigers (*Felis tigris*), ♂ ♀. Presented by H.H. the Maharani Regent of Mysore.
 1 Pine-Marten (*Mustela martes*). Presented by C. G. Beale, Esq.
 1 Common Squirrel (*Sciurus vulgaris*). Presented by Cecil Slade, Esq., F.Z.S.
 2 Crimson-crowned Weaver-birds (*Euplectes flaviceps*). Presented by Mrs. Charles Green.
 1 Long-nosed Crocodile (*Crocodilus cataphractus*). Presented by J. A. Robb, Esq.
 1 Four-lined Snake (*Coluber quatuorlineatus*). Presented by W. R. Temple, Esq., F.Z.S.
7. 1 Black-eared Marmoset (*Hapale penicillata*). Presented by Mrs. G. L. Bagnell.
 2 Great Wallaroos (*Macropus robustus*), ♂ ♀. Deposited.
 1 Wrinkled Terrapin (*Chrysemys scripta rugosa*). Deposited.
 1 Burrhel Wild Sheep (*Ovis burrhel*), ♂. Born in the Menagerie.
 4 Natterjack Toads (*Bufo calamita*). Presented by S. S. Flower, Esq., F.Z.S.
9. 1 Common Marmoset (*Hapale jacchus*). Presented by Mrs. Alexander Grant.
 1 Altai Deer (*Cervus eustephanus*). Born in the Menagerie.
 2 Grey-headed Love-birds (*Agapornis cana*). Presented by Mrs. Harry Blades.
 1 Cuckoo (*Cuculus canorus*). Presented by L. W. Wiglesworth, Esq.
10. 1 Patas Monkey (*Cercopithecus patas*), ♀. Deposited.
 1 Isabelline Bear (*Ursus isabellinus*). Deposited.
 1 Sharp-nosed Badger (*Meles leptorhynchus*). Purchased.
 1 Rough Fox (*Canis rudis*). Purchased.
11. 1 Entellus Monkey (*Semnopithecus entellus*), ♀. Deposited.
 2 Brazilian Tortoises (*Testudo tabulata*). Deposited.
12. 1 Himalayan Snow-Partridge (*Tetraogallus himalayensis*). Deposited.
13. 1 Rhesus Monkey (*Macacus rhesus*). Presented by Mrs. Heigham.
 1 Little Bittern (*Ardetta minuta*). Received in Exchange.
14. 1 Brindled Gnu (*Connochætes taurina*), ♀. Born in the Menagerie. See P. Z. S. 1900, p. 771.
16. 1 Bonnet-Monkey (*Macacus sinicus*), ♀. Presented by P. M. Thornton, Esq.
 1 Nutteracker (*Nucifraga caryocatactes*). Purchased.
 1 Senegal Parrot (*Pæocephalus senegalus*). Presented by S. Cordwell, Esq.
17. 2 Larger Hill-Mynahs (*Gracula intermedia*). Deposited.
 1 Missel-Thrush (*Turdus viscivorus*). Presented by J. B. Williamson, Esq.
 2 Striped Snakes (*Tropidonotus ordinatus sirtalis*). Deposited.
 1 Viperine Snake (*Tropidonotus viperinus*). Deposited.
18. 1 Mauve-necked Cassowary (*Casuarus violicollis*). Deposited.
 6 Blanding's Terrapins (*Emys blandingi*). Deposited.
 1 Alligator Terrapin (*Chelydra serpentina*). Deposited.
 1 Guira Cuckoo (*Guira pibirigua*). Purchased.

- July 18. 2 Painted Frogs (*Discoglossus pictus*). Received in Exchange.
 19. 2 Chukar Partridges (*Cacubis chukar*). Presented by Chas. E. Pitman, Esq.
 20. 4 Elephantine Tortoises (*Testudo elephantina*). Deposited.
 1 Clumsy Tortoise (*Testudo inepta*). Deposited.
 1 Cuckoo (*Cuculus canorus*). Presented by Miss Lucy Holland.
 21. 2 Masked Paradoxures (*Paradoxurus larvatus*). Presented by W. T. Lay, Esq.
 1 Humboldt's Lagothrix (*Lagothrix humboldti*). Presented by W. S. Churchill, Esq.
 1 Rhesus Monkey (*Macacus rhesus*), ♀. Presented by Miss A. N. Ball.
 23. 1 White-fronted Capuchin (*Cebus albifrons*), ♂. Presented by W. H. Lacy, Esq.
 3 Crested Pigeons (*Ocyphaps lophotes*). Bred in the Menagerie.
 1 Spotted Pigeon (*Columba maculosa*). Bred in the Menagerie.
 4 Vinaceous Turtle-Doves (*Turtur vinaccus*). Bred in the Menagerie.
 6 Roofed Terrapins (*Kachuga tectum*). Deposited.
 2 Alligator Terrapins (*Chelydra serpentina*). Deposited.
 25. 1 Yellow-bellied Liothrix (*Liothrix luteus*). Deposited.
 2 Common Bluebirds (*Sialia wilsoni*), ♂ ♀. Presented by S. W. Sutherland, Esq., F.Z.S.
 2 Chaffinches (*Fringilla caelebs*), ♂ ♀. Deposited.
 1 Siskin (*Chrysomitris spinus*). Deposited.
 1 Lesser Redpoll (*Linota rufescens*). Deposited.
 3 Linnets (*Linota cannabina*). Deposited.
 1 Yellow-rumped Seed-eater (*Crithagra chrysopyga*). Deposited.
 26. 1 Two-spotted Paradoxure (*Nandina binotata*). Presented by R. H. Gush, Esq.
 1 Levaillant's Amazon (*Chrysotis levaillanti*). Deposited.
 27. 4 Red-collared Lorikeets (*Trichoglossus rubritorques*). Deposited.
 See P. Z. S. 1900, p. 772.
 1 American Box-Tortoise (*Cistudo carolina*). Deposited.
 1 Sculptured Terrapin (*Clemmys insculpta*). Deposited.
 28. 1 Altai Deer (*Cervus eustephanus*), ♂. Born in the Menagerie.
 2 Sulphury Buntings (*Emberiza sulphurata*). Purchased.
 30. 1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by T. Forsyth Forrest, Esq.
 2 Greater Vasa Parrots (*Coracopsis vasa*). Presented by Mr. G. Barfoot.
 3 Glossy Ibises (*Plegadis fulcinellus*). Bred in the Menagerie.
 1 Green Lizard (*Lacerta viridis*). Deposited.
 7 Algerian Skinks (*Eumeces algeriensis*). Presented by G. H. Fernan, Esq.
 1 Spiny-tailed Mastigure (*Uromastix acanthinurus*). Presented by G. H. Fernan, Esq.
 31. 5 Barn-Owls (*Strix flammea*). Purchased.
 1 Silky Cow-bird (*Molothrus bonariensis*). Presented by F. Willes, Esq.
- Aug. 1. 1 Diana Monkey (*Cercopithecus diama*), ♀. Presented by W. Cleaver, Esq.
 2. 2 Praline Snakes (*Coluber prasinus*). Deposited.
 1 Dahl's Snake (*Zamenis dahlí*). Deposited.
 3. 1 Pheasant (*Phasianus cochicus*), ♀. Purchased.
 3 Ring-necked Pheasants (*Phasianus torquatus*), 3 ♀. Purchased.

- Aug. 3. 2 Golden Pheasants (*Thaumalea picta*), 2 ♀. Purchased.
4. 1 Japanese Deer (*Cervus sika*), ♂. Born in the Menagerie.
1 Common Viper (*Vipera berus*). Presented by A. Cooper, Esq., F.Z.S.
6. 1 Chinese Quail (*Coturnix chinensis*), ♀. } Presented by
2 Asiatic Quails (*Perdica asiatica*). } D. Seth-Smith, Esq.,
2 Sparrow-Hawks (*Accipiter nisus*). } F.Z.S.
8. 2 Black-headed Caiques (*Caica melanocephala*). Deposited.
1 Quail (*Coturnix communis*). Presented by Miss F. E. Burt.
9. 1 Blue-and-Yellow Macaw (*Ara urarauna*). Presented by Capt. G. H. Arnot.
1 Gold Pheasant (*Thaumalea picta*), ♂. Purchased.
10. 1 Lesser White-nosed Monkey (*Cercopithecus petaurista*). Deposited.
1 Smooth-headed Capuchin (*Cebus monachus*). Deposited.
1 Polar Bear (*Ursus maritimus*). Deposited.
1 Burrhel Wild Sheep (*Ovis burrhel*). Born in the Menagerie.
1 Black-backed Jackal (*Canis mesomelas*). } Presented by J. E.
1 Leopard Tortoise (*Testudo pardalis*). } Matcham, Esq.,
1 Puff-Adder (*Bitis arietans*). } C.M.Z.S.
11. 1 Lioness (*Felis leo*). Presented by the Rt. Hon. Cecil J. Rho des, P.C., D.C.L., F.Z.S.
3 Little Bitterns (*Ardetta minuta*). Purchased.
1 Algerian Tortoise (*Testudo ibera*). Deposited.
4 Alligator Terrapins (*Chelydra serpentina*). Deposited.
2 Argentine Tortoises (*Testudo argentina*). Deposited.
6 European Pond-Tortoises (*Emys orbicularis*). Deposited.
1 Leopardine Snake (*Coluber leopardinus*). Deposited.
1 Vivacious Snake (*Tarbophis fallax*). Deposited.
2 Egyptian Mastigures (*Uromastix spinipes*). Deposited.
1 Pleurodele Newt (*Molge mullli*). Deposited.
12. 1 Grey Ichneumon (*Herpestes griseus*). Presented by W. A. Gillett, Esq., F.Z.S.
1 Leopard Tortoise (*Testudo pardalis*). Deposited.
13. 5 Rosy-billed Ducks (*Metopiana peposuca*). Bred in the Menagerie.
14. 1 Green Monkey (*Cercopithecus callitricus*), ♂. Presented by L. J. Sparrow, Esq.
1 Black-cheeked Monkey (*Cercopithecus melanogenys*), ♀. Presented by L. J. Sparrow, Esq.
4 Indian Crows (*Corvus splendens*). Received in Exchange.
1 Little Cormorant (*Phalacrocorax javanicus*). Received in Exchange.
3 Dwarf Turtle-Doves (*Turtur humilis*). Received in Exchange.
1 Green-winged Dove (*Chalcophaps indica*). Received in Exchange.
1 Indian Roller (*Coracias indica*). Presented by E. W. Harper, Esq.
1 Bengal Weaver-bird (*Ploceus bengalensis*), ♂. Presented by E. W. Harper, Esq.
1 Manyar Weaver-bird (*Ploceus manyar*), ♂. Presented by E. W. Harper, Esq.
4 Black-throated Weaver-birds (*Ploceus atrigula*), 2 ♂, 2 ♀. Presented by E. W. Harper, Esq.
15. 1 Argali Sheep (*Ovis ammon*), ♀. From the Altai Mountains. Purchased.
2 Black Storks (*Ciconia nigra*). Purchased.
1 Spiny-tailed Iguana (*Ctenosaura acanthura*). Presented by Mr. C. Hagenbeck.

- Aug. 15. 3 South Albemarle Tortoises (*Testudo vicina*). Deposited.
 1 Saddle-backed Tortoise (*Testudo ephippium*). Deposited.
 2 Thin-shelled Tortoises (*Testudo microphyes*). Deposited.
 6 Bungoma River-Turtles (*Emyda granosa*). Deposited.
 1 White-collared Kingfisher (*Halcyon chloris*). Deposited.
 1 Ring-necked Pheasant (*Phasianus torquatus*), ♂. Purchased.
 1 Common Lizard (*Lacerta vivipara*). Presented by S. S. Flower, Esq., F.Z.S.
16. 1 Mozambique Monkey (*Cercopithecus pygerythrus*), ♂. Presented by C. Mackay, Esq.
 1 Roseate Cockatoo (*Cacatua roseicapilla*). Deposited.
 2 Blue-tongued Lizards (*Tiliqua scincoides*). Deposited.
 5 Blue Lizards (*Gerrhonotus caeruleus*). Deposited.
17. 1 Japanese Deer (*Cervus sika*), ♂. Born in the Menagerie.
 3 Pheasants (*Phasianus colchicus*), 1 ♂, 2 ♀. Presented by Capt. G. H. Arnot.
 1 Common Peafowl (*Pavo cristatus*), ♂. Presented by Capt. G. H. Arnot.
 1 Military Macaw (*Ara militaris*). Deposited.
 1 Blue-tongued Lizard (*Tiliqua scincoides*). Deposited.
 1 Blue Lizard (*Gerrhonotus caeruleus*). Deposited.
18. 1 African Buzzard (*Buteo desertorum*). } Presented by
 2 American Kestrels (*Tinnunculus sparverius*). } T. Simonds,
 2 Lesser Kestrels (*Tinnunculus cenchris*). } Esq.
 1 Black Kite (*Milvus migrans*). Presented by T. Simonds, Esq.
 2 Dark Green Snakes (*Zamenis gemonensis*). Presented by W. Hunter, Esq.
 1 Common Lizard (*Lacerta vivipara*). Presented by the Controller of the Returned Letter Office.
20. 1 Larger Hill-Mynah (*Gracula intermedia*). Presented by Geo. Smith, Esq.
 3 Blackish Sternotheres (*Sternotherus nigricans*). Deposited.
21. 2 Prasine Snakes (*Coluber prasinus*). Deposited.
22. 1 Indian Crow (*Corvus splendens*). Presented by E. A. Williams, Esq.
 1 Rose-coloured Pastor (*Pastor roseus*). } Presented by L.
 1 Nonpareil Finch (*Cyanospiza ciris*). } Ingram Baker, Esq.
 1 Indigo-bird (*Cyanospiza cyanea*). }
 11 American Box-Tortoises (*Cistudo carolina*). Deposited.
 10 Common Chameleons (*Chamaeleon vulgaris*). Purchased.
23. 1 Brush-tailed Kangaroo (*Petrogale penicillata*), ♀. Born in the Menagerie.
 1 Occipital Blue Pie (*Urocissa occipitalis*). Purchased.
 1 Raven (*Corvus corax*). Presented by G. St. Leger Hopkinson, Esq.
27. 1 Yellow-fronted Amazon (*Chrysotis ochrocephala*). Deposited.
28. 1 Wapiti Deer (*Cervus canadensis*), ♀. Born in the Menagerie.
29. 2 Collared Fruit-Bats (*Cynonycteris collaris*). Born in the Menagerie.
 1 Germain's Peacock Pheasant (*Polyplectron germaini*), ♀. Presented by A. Yates, Esq.
 1 Rook (*Corvus frugilegus*). Presented by A. Yates, Esq.
 1 Common Boa (*Boa constrictor*). Presented by G. R. Fairbanks, Esq.
30. 2 White Ibises (*Eudocimus albus*). Bred in the Menagerie.
 10 Roofed Terrapins (*Kachuga tectum*). Deposited.
 3 Bungoma River-Turtles (*Emyda granosa*). Deposited.
31. 1 Red-bellied Squirrel (*Sciurus variegatus*). Deposited.

- Aug. 31. 1 Red-bellied Squirrel (*Sciurus variegatus*). Purchased.
 2 Bosch-boks (*Tragelaphus sylvaticus*), ♂ ♀. Presented by Dr. A. MacCarthy Morrogh, M.B., F.R.C.S.
 1 Rufous-necked Wallaby (*Macropus ruficollis*), ♀. Presented by Miss Seymour.
- Sept. 1. 1 Green Monkey (*Cercopithecus callitrichus*), ♂. Presented by Mr. C. A. Gilbert.
 3. 2 Purple Herons (*Ardea purpurea*). Purchased.
 2 Common Cormorants (*Phalacrocorax carbo*). Purchased.
 3 Spoonbills (*Platalea leucorodia*). Purchased.
 1 Ring-tailed Coati (*Nasua rufa*). Presented by G. P. Ashmore, Esq.
 4. 2 Cunning Bassaris (*Bassariscus astutus*). Presented by Miss Franklin.
 1 Cunning Bassaris (*Bassariscus astutus*). Deposited.
 2 Tenrecs (*Centetes caudatus*). Deposited. See P. Z. S. 1900, p. 772.
 5. 1 Nilotic Crocodile (*Crocodilus niloticus*). Presented by Major H. B. Weatherall.
 6. 1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by Miss K. Bishop.
 1 Puma (*Felis concolor*), ♂. Presented by Maurice F. Dennis, Esq.
 2 Chilean Sea-Eagles (*Geranoaëtus melanoleucus*). Presented by Tom Simonds, Esq.
 7. 1 Cardinal Eclectus (*Eclectus cardinalis*), ♂. Deposited.
 2 Westerman's Eclectus (*Eclectus westermani*), 2 ♀. Deposited.
 8. 1 Lion (*Felis leo*). From Uganda. Presented by Capt. Delmé Radcliffe.
 11. 1 Sooty Mangabey (*Cercocebus fuliginosus*), ♂. Presented by Mr. B. Stewart.
 2 Common Badgers (*Meles taxus*). Presented by Mrs. W. A. Gillett.
 2 Indian Fruit-Bats (*Pteropus medius*). Presented by Mrs. W. A. Gillett.
 5 Barred Doves (*Geopelia striata*). Presented by Miss Tyars.
 3 Black-pointed Teguxins (*Tupinambis nigropunctatus*). Deposited.
 2 Antillean Boas (*Boa divinihoqua*). Deposited.
 12. 1 Black-headed Terrapin (*Damonia reevesi unicolor*). Presented by F. J. Bridgman, Esq.
 1 Algerian Skink (*Eumeces algeriensis*). Presented by F. J. Bridgman, Esq.
 1 Common Chameleon (*Chamaeleon vulgaris*). Presented by F. J. Bridgman, Esq.
 13. 1 European Pond-Tortoise (*Emys orbicularis*). Presented by Miss F. M. Weippert.
 14. 5 Undulated Lizards (*Sceloporus undulatus*). Deposited.
 15. 1 Squacco Heron (*Ardea ralloides*). Presented by Mr. A. F. Putz.
 1 Wall-Lizard (*Lacerta muralis*). Presented by Walter Hunter, Esq.
 1 Tessellated Snake (*Tropidonotus tessellatus*). Presented by Walter Hunter, Esq.
 17. 1 Red Tiger-Cat (*Felis chrysothrix*). Deposited.
 1 Leopard (young) (*Felis pardus*). Deposited.

- Sept. 17. 1 Red-footed Ground-Squirrel (*Xerus erythropus*). Presented by Dr. Oswald Horrocks.
 1 Alpine Marmot (*Arctomys marmotta*). Deposited.
 2 Crossbills (*Loxia curvirostra*). Deposited.
18. 1 Grey Ichneumon (*Herpestes griseus*). Presented by Capt. W. H. Rotheram, R.E.
 2 Dusky Ducks (*Anas obscura*), ♂ ♀. Presented by W. H. St. Quintin, Esq., F.Z.S.
 1 Blackbird (*Turdus merula*), ♂. Presented by Mr. A. Sahlin.
 1 Peregrine Falcon (*Falco peregrinus*). Presented by A. L. Jessopp, Esq.
 4 Pheasants (*Phasianus colchicus*), 1 ♂, 3 ♀. Presented by F. Larratt, Esq.
19. 3 Jays (*Garrulus glandarius*). Presented by Dr. R. Bowdler Sharpe, F.Z.S.
 1 Plantain-Squirrel (*Sciurus plantani*). Presented by H. H. Goodwin, Esq.
20. 10 Elephantine Tortoises (*Testudo elephantina*). Deposited.
21. 1 Mona Monkey (*Cercopithecus mona*), ♀. Presented by Mrs. C. Campbell.
 2 Western Yellow-winged Laughing-Thrushes (*Trochalopteron nigrimentum*).
 1 Rufous-chinned Laughing-Thrush (*Ianthocincla rufigularis*).
 1 Slaty-headed Scimitar Babbler (*Pomatorhinus schisticeps*).
 1 Black-throated Ouzel (*Merula strigularis*).
 2 Tickell's Ouzels (*Merula unicolor*).
 1 Spotted-wing (*Psaroglossa spiloptera*). } Presented by E. W. Harper, Esq., F.Z.S.
22. 1 Yellow-crowned Troupial (*Icterus chrysocephalus*). Deposited.
 1 Yellow-backed Troupial (*Icterus croconotus*). Deposited.
 2 Rose-ringed Parrakeets (*Palæornis docilis*), 2 ♀. Deposited.
23. 1 Blue-and-Yellow Macaw (*Ara ararauna*). Presented by Randolph Berens, Esq., F.Z.S.
24. 1 Pink-headed Duck (*Rhodonessa caryophyllacea*), ♂. Purchased.
 1 Ground-Hornbill (*Bucorvus abyssinicus*). Presented by H. Strachan, Esq., F.L.S.
 1 Bell's Cinixys (*Cinixys belliana*). Presented by H. Strachan, Esq., F.L.S.
25. 1 Schmidt's Monkey (*Cercopithecus schmidti*), ♀. Purchased.
 1 Peregrine Falcon (*Falco peregrinus*). Presented by W. R. Bryden, Esq.
 6 Florida Tortoises (*Testudo polyphemus*). Deposited.
 4 Elegant Snakes (*Tropidonotus ordinatus infernalis*). Deposited.
 4 Couch's Snakes (*Tropidonotus ordinatus couchi*). Deposited.
 1 Vivacious Snake (*Tarbophis fallax*). Presented by W. H. St. Quintin, Esq., F.Z.S.
26. 1 Rhesus Monkey (*Macacus rhesus*), ♀. Presented by Mrs. Woods.
28. 1 Plantain-Squirrel (*Sciurus plantani*). Presented by Mrs. A. Jeffery.
 1 Vulpine Phalanger (*Trichosurus vulpecula*). Presented by Mrs. A. Jeffery.
29. 1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by Mrs. Sassoon.
 1 Bristly Ground-Squirrel (*Xerus setosus*). Purchased.
 1 Spix's Macaw (*Cyamopsittacus spixi*). Deposited.
 1 Large Grieved Tortoise (*Podocnemis expansa*). Deposited.

- Sept. 29. 1 Brazilian Tapir (*Tapirus americanus*), ♀.
 2 Snowy Egrets (*Ardea candidissima*).
 6 Ring-necked Lizards (*Tropidurus torquatus*).
 3 Surinam Lizards (*Ameiva surinamensis*).
 2 Tuberculated Iguanas (*Iguana tuberculata*).
 1 Lacertine Crocodilurus (*Crocodilurus lacer-
 tinus*).
 6 Giant Toads (*Bufo marinus*).
- } Presented by
 Capt. Albert
 Pam, F.Z.S.
- Oct. 1. 1 Bonnet-Monkey (*Macacus sinicus*), ♀. Deposited.
 1 Black-backed Jackal (*Canis mesomelas*). Presented by J. E.
 Matcham, Esq., C.M.Z.S.
 1 Chameleon (*Chamaleon vulgaris*). Presented by Mrs. E. Putz.
 2 Pucheran's Guinea-fowls (*Guttera pucherani*). Deposited.
 2 Common Rattlesnakes (*Crotalus durissus*). From Lake Kerr,
 Marion County, Florida. Received in Exchange.
 2 Water-Vipers (*Ancistrodon piscivorus*).
 2 Copper-head Vipers (*Ancistrodon contortrix*).
 1 Hog-nosed Snake (*Heterodon platyrhinos*, var.
niger).
 1 Mocassin Snake (*Tropidonotus fasciatus ery-
 throgaster*).
 1 Mocassin Snake (*Tropidonotus fasciatus*).
 2. 1 Vulpine Phalanger (*Trichosurus vulpecula*). Presented by
 Miss Bartlett.
 1 Blue-faced Amazon (*Chrysotis versicolor*). Presented by
 Miss M. Moon.
 3. 1 Vervet Monkey (*Cercopithecus lalandii*). Presented by Lieut.
 Sullivan.
 2 Greek Tortoises (*Testudo græca*). Presented by Sister Heather
 Grey.
 5. 1 Two-spotted Paradoxure (*Nandinia binotata*). Presented by
 R. G. Pointer, Esq.
 1 Large Grieved Tortoise (*Podocnemis expansa*). Deposited.
 6. 1 Algerian Tortoise (*Testudo mauritanica*). Deposited.
 9. 1 Broad-nosed Lemur (*Hapulemur simus*). Deposited.
 1 Illiger's Macaw (*Ara maracana*). Deposited.
 6 Starred Tortoises (*Testudo elegans*). Deposited.
 1 Electric Eel (*Gymnotus electricus*). Deposited.
 10. 1 Common Water-Buck (*Cobus ellipsiprymnus*), ♀. Deposited.
 11. 1 Brown Capuchin (*Cebus fatuellus*). Presented by Mrs. W. L.
 Gower.
 1 Common Genet (*Genetta vulgaris*). Presented by W. C.
 Tait, Esq., C.M.Z.S.
 1 Dusky Sloth (*Bradypus infuscatus*). Deposited.
 2 Salvin's Amazons (*Chrysotis salvini*). Deposited.
 4 Wrinkled Terrapins (*Clemmys scripta rugosa*). Deposited.
 1 Annulated Terrapin (*Nicoria annulata*). Deposited.
 1 Brazilian Tortoise (*Testudo tabulata*). Deposited.
 12. 2 Yellow-whiskered Lemurs (*Lemur xanthomystax*), ♂ ♀.
 Presented by J. B. Joel, Esq.
 1 Alligator (*Alligator mississippiensis*). Presented by Mrs.
 Bazalgette.
 1 Violaceous Night-Heron (*Nycticorax violaceus*). Purchased.
 13. 4 Indian Fruit-Bats (*Pteropus medius*). Deposited.
 1 Porose Crocodile (*Crocodilus porosus*). Presented by Miss
 Gwendoline Waite.
- } Received in
 Exchange.
- } Presented by

- Oct. 15. 1 Bonnet-Monkey (*Macacus sinicus*), ♀. Deposited.
 1 Missel-Thrush (*Turdus viscivorus*). Purchased.
16. 1 Hagenbeck's Mangabey (*Cercocebus hagenbecki*), ♂. From
 Congoland. Deposited.
 1 Grey-cheeked Mangabey (*Cercocebus albigena*), ♂. Deposited.
 1 Short-tailed Wallaby (*Macropus brachyurus*), ♀. Deposited.
 1 Oldham's Terrapin (*Cyclemys dhor*). Deposited.
 1 Macaque Monkey (*Macacus cynomolgus*), ♀. Presented by
 G. H. Jalland, Esq.
17. 1 Speckled Terrapins (*Clemmys guttata*). Deposited.
 3 Painted Terrapins (*Chrysemys picta*). Deposited.
18. 10 Alligator Terrapins (*Chelydra serpentina*). Deposited.
19. 1 Bonnet-Monkey (*Macacus sinicus*), ♀. Presented by Mr. A.
 J. Smith.
 1 Sooty Mangabey (*Cercocebus fuliginosus*), ♀. Deposited.
 1 Green Monkey (*Cercopithecus callitrichus*), ♂. Presented by
 Mr. C. T. Reaney.
 1 Elephantine Tortoise (*Testudo elephantina*). Deposited.
20. 1 Patas Monkey (*Cercopithecus patas*). Presented by Mrs.
 Creighton Hall.
 1 Ruffed Lemur (*Lemur varius*). Deposited.
 1 Black-headed Lemur (*Lemur brunneus*). Deposited.
 2 One-wattled Cassowaries (*Casuarius uniappendiculatus*). De-
 posited.
 1 Blue-necked Cassowary (*Casuarius intensus*). Deposited.
 2 Coach-whip Birds (*Psophodes crepitans*). Deposited.
 2 Simony's Lizards (*Lacerta simonyi*). Deposited.
 2 Muscat Gazelles (*Gazella mascatensis*). Presented by Capt.
 P. Z. Cox, F.Z.S.
 1 Indian Desert-Fox (*Canis leucopus*). Presented by Capt. P.
 Z. Cox, F.Z.S.
21. 4 Brown's Parrakeets (*Platycercus browni*). Deposited.
 1 Black-faced Kangaroo (*Macropus melanops*), ♂. Deposited.
22. 1 Caffre Bustard (*Eupodotis caffra*). From Port Elizabeth.
 Presented by J. E. Matcham, Esq., C.M.Z.S. See P. Z. S.
 1900, p. 772.
23. 1 Westerman's Eclectus (*Eclectus westermanni*), ♀. Deposited.
 6 Finches (*Spermestes*, sp. inc.). Deposited.
 2 Simony's Lizards (*Lacerta simonyi*). Deposited.
 1 Carolina Anolis (*Anolis carolinensis*). Deposited.
 2 Leopardine Snakes (*Coluber leopardinus*). Deposited.
 2 Vivacious Snakes (*Tarbophis fallax*). Deposited.
 1 Æsculapian Snake (*Coluber longissimus*). Deposited.
 1 Four-lined Snake (*Coluber quatuorlineatus*). Deposited.
 1 Lacertine Snake (*Cœlopeltis monspessulana*). Deposited.
 1 Mocassin Snake (*Tropidonotus fasciatus*). Deposited.
 6 Gold Pheasants (*Thaumalea picta*), 2 ♂, 4 ♀. Presented by
 H. G. Hobbs, Esq.
 1 Hybrid Gold Pheasant (bred between *Thaumalea picta* and
T. amherstiae), ♂. Presented by H. G. Hobbs, Esq.
24. 1 Raven (*Corvus corax*). Presented by T. Sykes, Esq.
 1 Persian Gazelle (*Gazella subgutturosa*), ♀. Presented by B.
 T. Finch, Esq., F.Z.S.
 2 Spotted Eagle-Owls (*Bubo maculosa*). Deposited.
 1 Spotted Slow-Skink (*Acontias meleagris*). Presented by W.
 L. Sclater, Esq., F.Z.S.
25. 2 Common Marmosets (*Hapale jacchus*). Presented by Lady
 Mackenzie.

- Oct. 26. 2 Hog-Deer (*Cervus porcinus*), 2 ♂. Born in the Menagerie.
 2 Severe Macaws (*Ara severa*). Deposited.
27. 1 Carrion-Crow (*Corvus corone*). Presented by Mr. S. T. Henderson.
 1 Bearded Tit (*Panurus biarmicus*), ♂. Presented by A. R. Gillman, Esq., F.Z.S.
 1 Black-cheeked Falcon (*Falco melanogenys*). Purchased.
28. 2 Dwarf Turtle-Doves (*Turtur humilis*). Bred in the Menagerie.
 1 Green Lizard (*Lacerta viridis*). Presented by Dr. Dyer.
30. 2 Patas Monkeys (*Cercopithecus patas*), ♂ ♀. Purchased.
 1 Bush-Dog (*Icticyon venaticus*). Purchased.
 1 Osprey (*Pandion haliaëtus*). Presented by Capt. T. Yendell.
31. 1 Tayra (*Galictis barbara*). Purchased.
 1 Bouquet's Amazon (*Chrysotis bouqueti*). Purchased. See P. Z. S. 1900, p. 772.
- Nov. 1. 1 Bosman's Potto (*Perodicticus potto*). Purchased.
 2 Ruddy Sheldrakes (*Tadorna casarca*), ♂ ♀. Purchased.
 3 Wattled Honey-eaters (*Anthochaera carunculata*). Deposited.
2. 1 Vervet Monkey (*Cercopithecus lalandii*), ♂. Deposited.
 1 Syrian Bear (*Ursus syriacus*). Presented by R. de Rustafjaell, Esq.
 1 Peregrine Falcon (*Falco peregrinus*). From Canada. Presented by T. H. Small, Esq.
3. 2 Knots (*Tringa canutus*). Purchased.
5. 8 Mocassin Snakes (*Tropidonotus fasciatus*). Born in the Menagerie.
6. 2 Grey Squirrels (black varieties) (*Sciurus cinereus*). Purchased.
7. 1 Grey-cheeked Mangabey (*Cercocebus albigena*). Deposited.
 1 Festive Amazon (*Chrysotis festiva*). Deposited.
8. 1 Lion (*Felis leo*), ♀. Presented by Major T. Souter.
 2 Ostriches (*Struthio camelus massaicus*), ♂ ♀. From the Tana Province, E. Africa. Presented by A. Marsden, Esq.
 1 Nilotic Crocodile (*Crocodilus niloticus*). Presented by A. Marsden, Esq.
 1 Bosch-bok (*Tragelaphus sylvaticus*), ♂. Born in the Menagerie.
 1 Sooty Mangabey (*Cercocebus fuliginosus*), ♀. Deposited.
 3 Tenrecs (*Centetes ecaudatus*). Deposited.
 1 Tenrec (*Hemicentetes*, sp. inc.). Deposited.
 1 Hawk-headed Parrot (*Deropterus accipitrinus*). Deposited.
9. 1 Sooty Mangabey (*Cercocebus fuliginosus*), ♂. Presented by Major M^cMicking.
 1 Yellowish Capuchin (*Cebus flavescens*). Deposited.
 1 Moustache Tamarin (*Midas mystax*). Deposited.
 2 Tui Parrakeets (*Brotogeris tui*). Deposited.
 1 Egyptian Jerboa (*Dipus ægyptius*). Presented by Mrs. R. Gurney.
10. 1 Leopardine Snake (*Coluber leopardinus*). Presented by W. J. Wintle, Esq., F.Z.S.
 1 Tessellated Snake (*Tropidonotus tessellatus*). Presented by W. J. Wintle, Esq., F.Z.S.
 1 Barn-Owl (*Strix flamma*). Presented by Lady Hutt.
12. 2 Brown Hyænas (*Hyæna brunnea*), ♂ ♀. Purchased.
 1 Indian Cobra (*Naja tripudians*). Purchased.
 2 Black Kites (*Milvus migrans*). Presented by Campbell B. Hausburg, Esq.
13. 1 Bonnet-Monkey (*Macacus sinicus*), ♂. Presented by D. Nagle, Esq.

- Nov. 13. 1 Barbary Ape (*Macacus inuus*), ♀. Presented by Thos. Pink, Esq.
 1 Common Squirrel (*Sciurus vulgaris*). Presented by Mr. C. W. Labarte.
 2 Auriculated Doves (*Zenaida auriculata*). Presented by Mrs. Aston.
14. 1 Common Fox (*Canis vulpes*). Presented by W. B. Spiers, Esq.
 1 Crab-eating Raccoon (*Procyon cancrivorus*). Deposited.
 2 Vernal Hanging-Parrakeets (*Loriculus vernalis*). Deposited.
 1 Malabar Mynah (*Poliopsar malabaricus*). Deposited.
 1 Grey Monitor (*Varanus griseus*). Deposited.
 3 Giant Toads (*Bufo marinus*). Deposited.
 1 Robin (*Erithacus rubecula*). Presented by Canon Wilberforce.
15. 1 Common Wolf (white var.) (*Canis lupus*), ♂. Deposited.
 2 Rosy Parrakeets (*Palæornis rosa*), ♂ ♀. Deposited.
16. 1 Horned Lizard (*Phrynosoma cornutum*). Presented by H. L. Brackenbury, Esq., F.Z.S.
17. 1 Common Chameleon (*Chamæleon vulgaris*). Presented by Mr. Small.
19. 1 African Civet Cat (*Viverra civetta*). Presented by R. H. Brady, Esq.
21. 1 Bonnet-Monkey (*Macacus sinicus*), ♀. Presented by Mrs. H. Lazarus.
 1 Ocellated Monitor (*Varanus ocellatus*). Deposited.
22. 1 Common Roe (albino) (*Capreolus capræa*), ♂. Deposited.
 1 One-wattled Cassowary (*Casuarus uniappendiculatus*). Deposited.
 1 Axis Deer (*Cervus axis*), ♀. Born in the Menagerie.
 4 Black-backed Jackals (*Canis mesomelas*). Presented by J. E. Matcham, Esq., C.M.Z.S.
23. 1 Puffin (*Fratercula arctica*). Presented by E. T. Norris, Esq.
 1 Yellow-rumped Parrakeet (*Platyercus flaveolus*). Deposited.
 2 Black-bellied Weaver-birds (*Euplectes afer*). Deposited.
 1 Hybrid Canary and Greenfinch. Deposited.
 1 Hybrid Canary and Singing-Finch. Deposited.
 5 Blue Lizards (*Gerrhonotus caruleus*). Deposited.
 5 Undulated Lizards (*Sceloporus undulatus*). Deposited.
24. 1 Rhesus Monkey (*Macacus rhesus*), ♀. Presented by H. A. Loop, Esq.
 1 Egyptian Jerboa (*Dipus ægyptius*). Presented by K. Ricardo, Esq.
27. 4 Ashy-crowned Finch-Larks (*Pyrrhulauda grisea*), 3 ♂, 1 ♀.
 2 Singing Bush-Larks (*Mirafra cantillans*).
 2 Slaty-headed Parrakeets (*Palæornis schisticeps*).
 1 Burmese Slaty-headed Parrakeet (*Palæornis finschi*), ♂.
 1 Golden-eyed Fruit-Pigeon (*Carpophaga cinnamomea*).
 2 Chestnut-bellied Finches (*Munia rubro-nigra*). Deposited.
 1 Salvin's Amazon (*Chrysotis salvini*). Deposited.
- 21 Climbing Anabas (*Anabas scandens*). Deposited.
 1 Striated Snake-head (*Ophiocephalus striatus*). Deposited.
30. 1 Doguera Baboon (*Cynocephalus doguera*), ♂. Deposited.
 3 Alligator Terrapins (*Chelydra serpentina*). Deposited.
 2 Sculptured Terrapins (*Clemmys insculpta*). Deposited.

Presented
by E. W.
Harper,
Esq., F.Z.S.

- Nov. 30. 1 King Snake (*Coronella gehila*, var. *boylii*). Deposited.
 1 King Snake (*Coronella gehila*, var. *californiæ*). Deposited.
 1 Three-striped Boa (*Lichanura trivirgata*). Deposited.
 3 Blue Lizards (*Gerrhonotus cæruleus*). Deposited.
- Dec. 1. 1 Suricate (*Suricata tetradactyla*). Presented by Capt. J. C. Brinton.
 1 Raven (*Corvus corax*). Presented by J. C. Brush, Esq.
 6 American Box-Tortoises (*Cistudo carolina*). Deposited.
 2 European Pond-Tortoises (*Emys orbicularis*). Deposited.
 1 Muhlenberg's Terrapin (*Clemmys muhlenbergi*). Deposited.
 4. 1 Black Rat (*Mus rattus*). Presented by E. Wormald, Esq., F.Z.S.
 5. 2 Bactrian Camels (*Camelus bactrianus*), ♂ ♀. Purchased.
 1 Moose (*Alces machlis*), ♂. Purchased.
 1 Ashy-black Macaque (*Macacus ocreatus*). Deposited.
 1 Rufous-necked Wallaby (*Macropus ruficollis*). Deposited.
 1 Plain-coloured Amazon (*Chrysotis inornata*). Deposited.
 1 Blackbird (pied var.) (*Turdus merula*), ♂. Deposited.
 6 Yellow-legged Frogs (*Rappia horstockii*). Presented by W. L. Selater, Esq., F.Z.S.
 6. 2 Ashy-black Macaques (*Macacus ocreatus*), ♂ ♀. Deposited.
 1 Golden-headed Marmoset (*Midas chrysomelas*), ♂. Deposited.
 1 Red-footed Lemur (*Lemur rufipes*). Deposited.
 1 Mongolian Pheasant (*Phasianus mongolicus*), ♀. Deposited.
 2 Delalande's Lizards (*Nucras delalandii*).
 32 Spotted Slow-Skinks (*Acontias meleagris*).
 2 Puff-Adders (*Bitis arietans*).
 1 Yellow Cobra (*Naja flava*).
 3 Rough-keeled Snakes (*Dasypeltis scabra*).
 5 Rhomb-marked Snakes (*Trimerorhinus rhombeatus*).
 3 Smooth-bellied Snakes (*Homalosoma lutrix*).
 3 Crossed Snakes (*Psammophis crucifer*).
 1 Lineated Snake (*Boodon lineatus*).
 2 Coppery Snakes (*Prosymna sundevalli*).
 1 Oldham's Snake (*Chlorophis hoplogaster*).
 7. 4 Westermann's Eclectus (*Eclectus westermanni*), 2 ♂, 2 ♀. Deposited.
 10. 1 Chimpanzee (*Anthropopithecus troglodytes*), ♀. Presented by Capt. W. G. Ambrose.
 1 Mozambique Monkey (*Cercopithecus pygerythrus*). Presented by W. J. Langton, Esq.
 1 Spur-winged Goose (*Plectropterus gambensis*). Presented by Lady Cardew.
 1 Blue-bonnet Parrakeet (*Psephotus hæmatorhous*). Deposited.
 3 Caspian Terrapins (*Clemmys caspica*). Deposited.
 11. 1 Lesser White-nosed Monkey (*Cercopithecus petaurista*). Presented by Mrs. L. Harold.
 1 Kinkajou (*Cercoleptes caudivolvulus*). Deposited.
 2 Mediterranean Peregrine Falcons (*Falco punicus*). Presented by W. T. Barneby, Esq., F.Z.S.
 1 Heron (*Ardea cinerea*). Presented by W. T. Barneby, Esq., F.Z.S.
 12. 1 Suricate (*Suricata tetradactyla*). Presented by Capt. F. E. Cannot, A.S.C.

Presented by
 J. E. Matcham,
 Esq., C.M.Z.S.

- Dec. 13. 1 Eupatorian Parrakeet (*Palæornis eupatria*), ♂. Deposited.
14. 1 Stairs's Monkey (*Cercopithecus stairsi*), ♀. Presented by Miss J. C. S. Purves.
- 2 Black-tailed Parrakeets (*Polytelis melanura*), ♂ ♀. Purchased.
- 1 Smaller Patagonian Conure (*Cyanolyseus patagonus*). Deposited.
15. 1 Duke of Bedford's Deer (*Cervus xanthopygius*), ♀. Presented by H.G. the Duke of Bedford, F.Z.S.
- 1 Green Monkey (*Cercopithecus callitrichus*). Presented by Miss M. A. Reeve.
17. 1 Cuvier's Gazelle (*Gazella cuvieri*), ♂. From Morocco. Presented by W. T. Barneby, Esq., F.Z.S.
- 1 Maximilian's Parrot (*Pionus maximiliani*). Deposited.
- 1 Ural Owl (*Syrnium uralense*). Deposited.
- 1 Passerine Owl (*Glaucidium passerinum*). Deposited.
- 1 Muhlenberg's Terrapin (*Clemmys muhlenbergi*). Deposited.
- 1 European Pond-Tortoise (*Emys orbicularis*). Deposited.
- 3 Wrinkled Terrapins (*Chrysemys scripta rugosa*). Deposited.
- 1 South-Albemarle Tortoise (*Testudo vicina*). Deposited.
18. 1 Slow Loris (*Nycticebus tardigradus*). Deposited.
- 5 Chestnut-bellied Finches (*Munia rubro-nigra*). Deposited.
- 6 Bungoma River-Turtles (*Emyda granosa*). Deposited.
- 1 Roofed Terrapin (*Kachuga tectum*). Deposited.
- 1 Golden Eagle (*Aquila chrysaëtus*). Presented by H. E. Bury, Esq.
19. 2 Common Cassowaries (*Casuaris galeatus*). Deposited.
- 2 Adelaide Parrakeets (*Platycercus adeluidæ*). Deposited.
- 1 Rose-Hill Parrakeet (*Platycercus eximius*). Presented by Mrs. Stoughton.
20. 4 Plumed Ground-Doves (*Geophaps plumifera*). Deposited.
- 1 Leopard Tortoise (*Testudo pardalis*). Deposited.
21. 3 Ring-tailed Coatis (*Nasua rufa*). Deposited.
- 2 Lettered Aracaris (*Pteroglossus inscriptus*). Deposited.
- 1 Leopard Tortoise (*Testudo pardalis*). Deposited.
- 1 Burmese Tortoise (*Testudo elongata*). Deposited.
24. 2 Bar-tailed Pheasants (*Phasianus reevesi*), ♂ ♀. Purchased.
- 3 Bengal Monitors (*Varanus bengalensis*). Deposited.
- 1 Conical Eryx (*Eryx conicus*). Deposited.
- 1 Indian Eryx (*Eryx johni*). Deposited.
26. 12 European Tree-Frogs (*Hyla arborea*). Purchased.
27. 1 Derbian Zonure (*Zonurus giganteus*). Presented by Major J. W. Jerome.
31. 1 Campbell's Monkey (*Cercopithecus campbelli*), ♀. Presented by W. R. Fowler, Esq.
- 1 Macaque Monkey (*Macacus cynomolgus*), ♂. Presented by Lieut.-Col. G. M. Prichard, I.S.C.
- 3 Viscachas (*Lagostomus trichodactylus*). Deposited.
- 1 Blue-crowned Hanging-Parrakeet (*Loriculus galgulus*). Deposited.
- 4 Starred Tortoises (*Testudo elegans*). Deposited.
- 10 Small-scaled Mastigures (*Uromastix microlepis*). Deposited.
- 7 Verreaux's Guinea-fowls (*Guttera edouardi*). Presented by J. F. Walker, Esq.
- 2 Crested Pigeons (*Ocyphaps lophotes*). Presented by W. L. Prentice, Esq.



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THE END.

THE ZOOLOGICAL SOCIETY OF LONDON.

THIS Society was instituted in 1826, under the auspices of Sir HUMPHRY DAVY, Bart., Sir STAMFORD RAFFLES, and other eminent Savants, for the advancement of Zoology and Animal Physiology, and for the introduction of new and curious subjects of the Animal Kingdom, and was incorporated by Royal Charter in 1829.

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The Society consists of Fellows, and Honorary, Foreign, and Corresponding Members, elected according to the Bye-Laws.

The Gardens in the Regent's Park are open from Nine o'clock A.M. till Sunset.

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The Meetings of the Society for General Business are held at the Office on the Thursday following the third Wednesday in every month of the year, except in September and October, at Four P.M.

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Any FELLOW who intends to be absent from the United Kingdom during the space of one year or more may, upon giving to the Secretary notice in *writing*, have his name placed upon the "dormant list," and will be thereupon exempt from the payment of his annual contribution during such absence.

Any FELLOW, having paid all fees due to the Society, is at liberty to withdraw his name upon giving notice in *writing* to the Secretary.

Persons who wish to become Fellows of the Society are requested to communicate with the undersigned.

PHILIP LUTLEY SCLATER, M.A., PH.D., F.R.S.,
Secretary.

3 Hanover Square, London, W.,
April, 1901.

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OF THE
ZOOLOGICAL SOCIETY OF LONDON
FOR
SCIENTIFIC BUSINESS.
(AT 3 HANOVER SQUARE, W.)
Session 1900-1901.

1900.	
TUESDAY, NOVEMBER 20	TUESDAY, DECEMBER 4 and 18
1901.	
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,, FEBRUARY 5 and 19	,, MAY 7 ,, 21
,, MARCH .. 5 ,, 19	,, JUNE 4 ,, 18

*The Chair will be taken at half-past Eight o'clock in the Evening
precisely.*

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OF THE

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THE scientific publications of the Zoological Society of London are of two kinds—"Proceedings," published in an octavo form, and "Transactions," in quarto.

According to the present arrangements, the "Proceedings" contain not only notices of all business transacted at the scientific meetings, but also all the papers read at such meetings and recommended to be published in the "Proceedings" by the Committee of Publication. A large number of coloured plates and engravings are attached to each annual volume of the "Proceedings," to illustrate the new or otherwise remarkable species of animals described in them. Amongst such illustrations, figures of the new or rare species acquired in a living state for the Society's Gardens are often given.

The "Proceedings" for each year are issued in four parts, on the first of the months of June, August, October, and April, the part published in April completing the volume for the preceding year. Commencing with January 1901 they will form two annual volumes.

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[April, 1901.]

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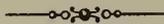
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### 1900.

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