

THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY,

INCLUDING
ZOOLOGY, BOTANY, AND GEOLOGY.

(BEING A CONTINUATION OF THE 'ANNALS' COMBINED WITH LOUDON AND
CHARLESWORTH'S 'MAGAZINE OF NATURAL HISTORY'.)

CONDUCTED BY
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VOL. XV.—SIXTH SERIES.  
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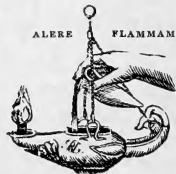
1895.

“Omnes res creatæ sunt divinæ sapientiæ et potentiæ testes, divitiæ felicitatis humanæ:—ex harum usu *bonitas* Creatoris; ex pulchritudine *sapientia* Domini; ex œconomiâ in conservatione, proportione, renovatione, *potentia* majestatis elucet. Earum itaque indagatio ab hominibus sibi relictis semper æstimata; à verè eruditis et sapientibus semper exulta; malè doctis et barbaris semper inimica fuit.”—LINNÆUS.

“Quel que soit le principe de la vie animale, il ne faut qu’ouvrir les yeux pour voir qu’elle est le chef-d’œuvre de la Toute-puissance, et le but auquel se rapportent toutes ses opérations.”—BRÜCKNER, *Théorie du Système Animal*, Leyden, 1767.

. The sylvan powers
 Obey our summons; from their deepest dells
 The Dryads come, and throw their garlands wild
 And odorous branches at our feet; the Nymphs
 That press with nimble step the mountain-thyme
 And purple heath-flower come not empty-handed,
 But scatter round ten thousand forms minute
 Of velvet moss or lichen, torn from rock
 Or rifted oak or cavern deep: the Naiads too
 Quit their loved native stream, from whose smooth face
 They crop the lily, and each sedge and rush
 That drinks the rippling tide: the frozen poles,
 Where peril waits the bold adventurer’s tread,
 The burning sands of Borneo and Cayenne,
 All, all to us unlock their secret stores
 And pay their cheerful tribute.

J. TAYLOR, *Norwich*, 1818.



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THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY.

[SIXTH SERIES.]

“..... per litora spargite muscum,
Naiades, et circum vitreos considite fontes:
Pollice virgineo teneros hic carpite flores:
Floribus et pictum, divæ, replete canistrum.
At vos, o Nymphæ Craterides, ite sub undas;
Ite, recurvato variata corallia trunco
Vellite muscosis e rupibus, et mihi conchas
Ferte, Deæ pelagi, et pingui conchylia succo.”
N. Parthenii Giannettasii Ecl. 1.

No. 85. JANUARY 1895.

I.—*On two Deep-bodied Species of the Clupeoid Genus
Diplomystus.* By A. SMITH WOODWARD, F.L.S.

[Plate I. figs. 1-4.]

SEVERAL of the doubly-armoured herrings of the genus *Diplomystus** are much deepened in the abdominal region; but none are so remarkable in this respect as *D. longicostatus*, from the Cretaceous of Brazil, and a smaller form from the Upper Cretaceous of Mount Lebanon, which seems to have hitherto escaped notice in collections among specimens of the so-called *Platax minor*. An accurate technical description of the former has already been published by Professor Cope †, but a good figure of a typical specimen is still wanted; no notice of the latter has hitherto appeared, and it will therefore be interesting to point out its characters. Good examples of both species are preserved in the British Museum, and form the subject of the following notes.

* E. D. Cope, Bull. U.S. Geol. Surv. Territ. vol. iii. (1877) p. 808.

† E. D. Cope, "A Contribution to the Vertebrate Palæontology of Brazil," Proc. Amer. Phil. Soc. vol. xxiii. (1886) p. 3.

Diplomystus longicostatus, Cope. (Pl. I. fig. 1.)

The type specimen of this species, now in the collection of Professor Cope, Philadelphia, was discovered by Mr. Joseph Mawson, F.G.S., in the Cretaceous of Itacaranha, near Bahia, Brazil. Other fragments were met with at the same time, and some presented to the British Museum *; but it was not until quite lately that our national collection became enriched by another complete specimen of the fish, discovered by the same indefatigable explorer of the Brazilian Cretaceous. This fossil, which seems to be imperfect in the anterior dorsal region, is shown of the natural size in Pl. I. fig. 1, and partly confirms, partly extends, Cope's original description of the species.

The general form and proportions of the fish are seen to be exactly as already described, while the numbers of the dorsal and anal fin-rays have been correctly given. Now for the first time, however, the pelvic fins are indicated, of very small size, arising opposite the origin of the dorsal, and the pectoral fins are not placed quite so high upon the flank as in the type specimen. The skeleton is obscured in places by a thin film of matrix; but it is clear that there were about twenty-four abdominal vertebræ, as stated by Cope, while the number of caudals is twelve (not ten). The long ribs extend to the ventral border, and the hindermost five or six pairs are attached to rapidly elongating processes, the ribs shortening in proportion as the latter increase. The neural arches are all fused with the vertebral centra; but in the anterior caudals the line of union between each neural arch and its spine can be distinguished. There are also traces of intermuscular bones in the dorsal region. The dorsal and anal fins are imperfect, but the slender caudal lobes are especially well shown. The dorsal ridge-scales are also obscured or destroyed and the contour of the back apparently distorted, but the characteristic ventral ridge-scales appear to be more satisfactorily displayed than previously. In the anterior half of the abdomen these scales are of normal size; but immediately behind the pelvic fins they begin to increase, and the three hindermost scales are relatively gigantic. Each exhibits a long posteriorly directed point, and is apparently smooth.

The new example of *D. longicostatus* thus described was obtained by Mr. Mawson from the beach between Itacaranha and Plataforma; and to complete our knowledge of the species it now only remains to discover the dentition and the squamation of the flank.

* A. S. Woodward, "Notes on some Vertebrate Fossils from the Province of Bahia, Brazil, collected by Joseph Mawson, Esq., F.G.S.," Ann. & Mag. Nat. Hist. [6] vol. ii. (1888) p. 132.

Diplomystus Birdi, sp. n. (Pl. I. figs. 2-4.)

Type.—Nearly complete fish; British Museum.

Sp. Char.—A small deep-bodied species, attaining a length of about 0.06 metre. Dorsal region much elevated, the margin rising to the origin of the dorsal fin, where it is almost angularly bent; caudal region relatively long. Maximum depth of trunk nearly or quite as great as its length from the pectoral arch to the base of the caudal fin; length of head with opercular apparatus equalling about two thirds of the same measurement. Abdominal vertebræ 14 to 16, caudals 18 in number. Dorsal fin arising well in advance of the middle of the back, with about 16 or 18 rays; anal fin not completely behind the dorsal, comprising 25 rays. Dorsal ridge-scales with a prominent median acumination; ventral ridge-scales nearly regular in size, not excessively enlarged, sharply pointed.

Obs. The species thus defined was first observed by the present writer in the collection of the Rev. William Bird, A.M., of Abeih, now in the Museum of the Syrian Protestant College, Beyrout. It may therefore be named *D. Birdi*, in honour of one of the most devoted students of Syrian geology. There are, however, several examples of the fish also in the British Museum, and three of these are shown of the natural size in Plate I. figs. 2-4. The second (fig. 3) is to be regarded as the type specimen. The species seems to have been moderately robust, for the various examples are much distorted by crushing; but the study of a series suggests that the type specimen shows the nearly normal form of the trunk, while the head is better preserved in the original of fig. 2. Figs. 3 and 4 show the small pelvic fins opposed to the origin of the dorsal; and the first has one side of the pectoral arch somewhat displaced backwards. The deeply cleft caudal fin is indicated in figs. 3 and 4. The much-thickened neural spines supporting the dorsal ridge-scales are shown in all the specimens, and intermuscular bones are conspicuous both above and below the vertebral column. The dorsal ridge-scales seem to have been broader than long, with one prominent median point and some apparently also with one or two pairs of lateral denticulations. The squamation of the flanks is shown to have been very thin.

Diplomystus Birdi is most closely related to the associated *D. brevissimus*, but differs in the much deepened form of its trunk and the arched contour of the back.

Formation and Locality. Upper Cretaceous; Haket, Mount Lebanon.

II.—Note on a supposed Tooth of Galeocerdo from the English Chalk. By A. SMITH WOODWARD, F.L.S.

[Plate I. figs. 5-7.]

FOR some years a small Selachian tooth from the English Chalk has been exhibited in the British Museum among the doubtfully determined series of *Notidanus* in the anticipation that it might eventually prove to be an abnormal tooth of this genus. Quite lately, however, two more teeth of precisely the same character have come under the writer's notice from the collection of the late Prince of Mantua; and by the kindness of Mr. R. F. Damon, who has purchased the collection, these remarkable fossils are now made available for study and description. That the form of tooth in question is normal may thus be assumed with considerable certainty; and such being the case, it is of extreme interest as exhibiting no superficial features by which it can be distinguished from the genus *Galeocerdo*, a member of the family Carchariidæ. As is well known, all evidence hitherto obtained as to the occurrence of sharks of this family in Cretaceous formations is very uncertain; and it is only by examining the inner structure of the detached teeth that they can be distinguished from those of Lamnidæ. It is to be hoped, therefore, that an illustrated description of the three new teeth may soon lead to the discovery of additional specimens which can be sliced and microscopically examined.

The teeth are shown of the natural size in Plate I. figs. 5-7, the first or type specimen being exposed from the inner aspect, the others exhibiting the outer face. The crown is very low and its apex turned sharply backwards; the anterior coronal margin is gently arched and marked towards the base with a few feeble denticulations; the apex above the posterior notch is small and narrow; the margin below the posterior notch is much elongated and exhibits from seven to nine conspicuous denticles, decreasing in size backwards. The root is narrow, and the nutritive foramen on the inner side is in a deep vertical groove (fig. 5).

These Cretaceous teeth are much smaller than those of the typical *Galeocerdo* of Tertiary and Recent date, and differ from the majority in their remarkably low crown and the relatively small size of the apex of the tooth. They are most nearly paralleled by the teeth named *Galeocerdo latidens* from the Eocene of Bracklesham; but even the latter exhibit a much more prominent apex and relatively smaller posterior

denticles. They are thus distinctly new and may receive the provisional name of *Galeocerdo Jaekeli*, in compliment to the author of the most important contribution hitherto made to our knowledge of the extinct Carchariidæ*.

EXPLANATION OF PLATE I.

- Fig. 1.* *Diplomystus longicostatus*, Cope. Fish in lateral aspect, probably wanting the anterior dorsal margin. — Cretaceous; Bahia, Brazil. [Brit. Mus. no. P. 7109.]
- Figs. 2-4.* *Diplomystus Birdi*, sp. n. Three fishes in lateral aspect.— Upper Cretaceous; Hakel, Mount Lebanon, Syria. [Brit. Mus. nos. P. 83, P. 96, P. 96 a.]
- Fig. 5.* *Galeocerdo Jaekeli*, sp. n. Tooth, inner aspect.—Chalk; Kent. [Brit. Mus. no. 41706 a.]
- Figs. 6, 7.* Ditto. Two teeth, outer aspect.—Chalk, Kent. [Mantua Collection.]

[All the figures are of the natural size.]

III.—*New Species of Eastern Lepidoptera.*
By Col. C. SWINHOE, M.A., F.L.S., V.P.E.S.

[Continued from vol. xiv. p. 443.]

Noctuidæ.

TRIFINÆ.

Genus ACRONYCTA, Ochs.

Acronycta gastridia, sp. n.

♂. Thorax grey: fore wings greyish white, irrorated with brown atoms; orbicular round and black-ringed; reniform brown, with a thin black bar on each side; basal and antemedial double crenulated black transverse lines; a discal black line, with sharp outward dentations on the veins; an indistinct submarginal whitish dentated band and black points on the margin: hind wings grey, with a darker lunular mark at the end of the cell. Underside: fore wings greyish brown; hind wings greyish white, with a grey lunular mark at the end of each cell.

Expanse of wings $1\frac{1}{2}$ inch.

Murree. One example.

Somewhat akin to the European *A. psi*, Linn.

* O. Jaekel, 'Die eocänen Selachier vom Monte Bolca' (1894), pp. 156-175.

Genus BOMBYCIA, Steph.

Bombycia hodita, sp. n.

♀. Brown: fore wings tinged in parts with pinkish grey; three yellowish dots on costa near the apex; subbasal line indistinct; postmedial line outwardly curved, composed of pale lunular marks with black borders; a pale sinuous submarginal line and black lunular spots on outer margin; orbicular and reniform large, the former indistinct, the latter white and prominent: hind wings blackish brown; cilia of both wings ochreous grey, interlined with brown.

Expanse of wings $1\frac{6}{10}$ inch.

Muree. One example.

Easily distinguishable from *B. meterythra*, Hampson (which is also to be found at Muree), by its large white and very prominent reniform and indistinct brown orbicular, that species having both black with pink centres.

Genus CARADRINA, Ochs.

Caradrina picta, sp. n.

Caradrina picta, Swinh. MS.; Hampson, Faun. Brit. Ind., Moths, ii. p. 263.

♂. Head, thorax, and abdomen blackish brown, with white scales; abdomen with a metallic black and gold mark near base. Both wings bright chestnut, suffused with white scales: fore wings with a broad central dark suffusion; a pale lunule at end of cell; ante- and postmedial lines indistinct, hardly visible, some bright pink marks near apex: hind wings with a large central blackish-brown spot and a discal dark band; an orange and whitish patch at anal angle; both wings with the marginal line dark; cilia with whitish marks. Underside ochreous grey: fore wings with a small brown spot in the cell; a large square brown mark at the end and brown suffusion in the space below: hind wings with a large central brown spot; both wings with a pinkish-brown discal band.

Expanse of wings $1\frac{2}{10}$ inch.

Cherra Punji. In great numbers; all males.

ACONTINÆ.

Genus XANTHOPTERA, Guen.

Xanthoptera magna, sp. n.

Xanthoptera magna, Swinh. MS.; Hampson, t. c. p. 320.

♀. Greenish ochreous: fore wings suffused with dark

reddish orange on the lower and outer portions; a dark brown discal square mark divided by vein 4; a brown band from the hinder margin at two thirds, which runs straight up outside the mark, and includes a row of black and white minute points, and then bends on to the outer margin below the apex; the space between this band and the margin brownish, the hinder margin black: hind wings blackish brown, pale and tinged with ochreous towards the abdominal margin; cilia of both wings ochreous, with a grey inner band; black marginal dots on both wings.

Expanse of wings $1\frac{4}{10}$ inch.

Cherra Punji. Three examples.

Xanthoptera nigridia, sp. n.

Xanthoptera nigridia, Swinh. MS.; Hampson, l. c.

♂. Dark pink-brown: fore wings with the orbicular and reniform large and pale; a black square mark in the disk, as in the last species, but very indistinct; the outer band from just below the apex running into the black patch, and is there lost in the rich black suffusion which covers all the outer and lower portions of the wings; a row of discal, indistinct, very minute, white points; cilia crenulate: hind wings dark brown, nearly black, and fairly uniform in colour; cilia with a pale basal line, then brown with ochreous ends.

♀. Ochreous grey, suffused in parts with brown, with the black discal patch and a brown band running through it to the hinder margin distinct; cilia crenulate as in the male: hind wings ochreous brown, paling towards the base, with black marginal points.

Expanse of wings $1\frac{1}{2}$ inch.

Cherra Punji. One pair.

The markings much resemble those in *X. magna*; the examples, however, are perfectly fresh and in good condition, and the crenulated cilia of this species in both sexes appears to be very distinctive, and in this genus many otherwise totally different species have very similar markings.

PALINDIINÆ.

Genus DORANAGA, Moore.

Doranaga soliera, sp. n.

♂. Antennæ and palpi black: thorax and fore wings reddish brown, the latter with a small patch of white suffusion at the apex, from which there is a diffuse brown band to the centre of the hinder margin; the space outside this

band paler than the rest of the wing, caused by a suffusion of white scales: hind wings ochreous grey, darkest towards the outer border; cilia of both wings ochreous grey, with a pale basal line.

Expanse of wings 1 inch.

Shillong. Four examples.

Allied to *D. leucospila*, Walker, but quite distinct; differs in the shape of the band on fore wings and in the position of the apical patch, which in *leucospila* is prominent, pure white, and subapical, being on the costa, whereas the patch in this species is merely a white smear and cuts off the entire apex.

SAROTHRIPINÆ.

Genus HYBLÆA, Fabr.

Hyblæa hypocyana, sp. n.

Hyblæa hypocyana, Swinh. MS.; Hampson, *t. c.* p. 372.

♂. Dark blackish brown, speckled with black: fore wings with subapical spot on outer margin: hind wings with the usual orange spots indistinct. Underside: fore wings black; costa and two subcostal patches ochreous, hinder margin ochreous white: hind wings black, the entire surface except the outer margin covered with white scales.

Expanse of wings $1\frac{4}{10}$ inch.

Shillong and Cherra Punji. Nine examples.

The abdomen below in two examples has crimson bands, in the others they are absent; but the real difference between this species and *H. constellata*, Guen., is in the white instead of bright orange hind wings below.

STICTOPTERINÆ.

Genus STICTOPTERA, Guen.

Stictoptera anthyalus, sp. n.

Stictoptera anthyalus, Swinh. MS.; Hampson, *t. c.* p. 403.

♂. Greyish brown, slightly tinged with ochreous. Fore wings: double subbasal, antemedial, and postmedial waved blackish lines, edged with pale ochreous grey; a lunular pale ochreous-grey submarginal band; black marginal line interrupted at the ends of the veins; cilia grey, interlined with brown, and with blackish patches opposite the veins. Hind wings brown; cilia grey, with a brown internal line.

Expanse of wings $1\frac{3}{10}$ inch.

Cherra Punji. Many examples.

The hind wings have no hyaline internal space, as is usual with species of this genus.

GONOPTERINÆ.

Genus CAREA, Walker.

Carea albopurpurea, sp. n.

Carea albopurpurea, Swinh. MS.; Hampson, *t. c.* p. 424.

♂ ♀. Head and collar brown: thorax and fore wings white, thorax with some grey hairs; abdomen grey: fore wings white, with the basal and lower portions suffused with purple; an antemedial wavy brown line inwardly edged with white; a discal wavy brown double line, filled in with white, widening upwards and enclosing a rufous patch; a submarginal series of rufous specks; upper portions of cilia brown, lower portion white: hind wings white, with the abdominal area suffused with pale purplish brown.

Expanse of wings $1\frac{1}{10}$ inch.

Shillong. Five examples.

QUADRIFINÆ.

Genus TRISULOIDES, Butler.

Trisuloides luteifascia, sp. n.

Trisuloides luteifascia, Swinh. MS.; Hampson, *t. c.* p. 437.

♀. Blackish red-brown, irrorated with grey; abdomen fulvous on sides and beneath: fore wings with a pale thin discal band, much outwardly curved: hind wings with broad medial orange-coloured band and pale lunules on the margin. Underside: fore wings orange, with blackish-brown costa and outer border and a large square brown mark at end of cell: hind wings brown, with a large orange patch near anal angle.

Expanse of wings $2\frac{7}{10}$ inches.

Cherra Punji. One example.

Genus HYPOCALA, Guen.

Hypocala holcona, sp. n.

♀. Palpi, head, thorax, and fore wings yellowish sand-colour, the latter irrorated with brown and black atoms, without markings, except for some black marginal points;

cilia with a pale basal line; abdomen and hind wings greyish yellow, with a broad brown marginal border, black marginal points, and ochreous-grey cilia. Underside greyish yellow; a grey lunule at the end of each cell, and pale greyish discal bands.

Expanse of wings $1\frac{4}{10}$ inch.

Port Blair, Andaman Islands. Two examples.

Genus PANDESMA, Guen.

Pandesma glenura, sp. n.

♀. Palpi blackish brown, with some pale hairs and pale tips; head and thorax covered with brown, grey, and white hairs: fore wings rich pinkish brown; orbicular and reniform pale, large, the latter ear-shaped, marked with black on its inner side; a pale space near the base; double blackish waved antemedial and postmedial lines filled in with whitish, the former touching the inner edge of the orbicular, the latter touching the outer edge of the reniform; a pale straight and suffused band from hinder margin at two thirds to the apex, where there is a whitish patch; this band is margined outwardly by a pale waved thin band, which is doubly dentated outwards in its middle; marginal lunules black; cilia brownish grey, with a pinkish base: hind wings blackish brown; cilia greyish white, with white tips.

Expanse of wings $1\frac{9}{10}$ inch.

Cherra Punji. One example.

The markings on the fore wings are very beautiful.

Genus PLECOPTERA, Guen.

Plecoptera holostoma, sp. n.

♂. Of a uniform olive-brown colour; palpi and head blackish brown; abdomen with ochreous-grey tip. Fore wings with antemedial and postmedial brown straight lines, the former inwardly and the latter outwardly edged with ochreous, the former erect, the latter inclining slightly outwards and sharply elbowed beyond the cell, inwards on to the costa; a brown spot at end of cell; a submarginal lunular ochreous line, with the lunules filled in with blackish brown; costal and marginal lines ochreous. Hind wings with the commencement of a pale straight line above the anal angle; marginal line ochreous.

Expanse of wings $1\frac{2}{10}$ inch.

Cherra Punji. Three examples.

Genus BANIANA, Walker.

Baniana rigida, sp. n.

♂. Palpi brown; body and wings ochreous grey. Fore wings with three black bands, divided by the veins and margined with white; the first subbasal, inclining outwards from the hinder angle to the subcostal vein; the second postmedial, erect, and ending on the subcostal; the third subapical, consisting of two large spots connected by a small one and with an adjacent line of three spots on the inner side; marginal lunules black; cilia ochreous, with brown marks opposite the veins. Hind wings pale ochreous brown, with a pale discal band, black marginal lunules, and ochreous-grey cilia.

Expanse of wings $1\frac{1}{2}$ inch.

Gilolo. One example.

Allied to *B. polyspila*, Walker; the central erect and complete band very distinctive, in *polyspila* it is distorted and altogether different.

Genus PLUSIA, Ochs.

Plusia æneofusa, sp. n.

Plusia æneofusa, Swinh. MS.; Hampson, *t. c.* p. 576.

♂. Head, collar, and front of thorax orange-yellow, remainder of body brown; anal tuft with some pale hairs. Fore wings bronzy brown, with the lower half and an angular patch on outer margin bright glistening brassy golden; three transverse straight brown lines—antemedial, postmedial, and discal, the two latter rather close together; a submarginal sinuous brown indistinct line. Hind wings brown; cilia brown, with a pale basal line and pale tips.

Expanse of wings $1\frac{1}{2}$ inch.

Darjiling, one example; Cherra Punji, four examples.

Genus POLYCHRISIA, Hübn.

Polychrisia crassipalpus, sp. n.

Plusia crassipalpus, Swinh. MS.; Hampson, *l. c.*

♂. Palpi long and stout, third joint half as long as the second, thinly clothed with hair to the tip; palpi, head, thorax, and fore wings rich chocolate-brown; a black basal streak in the middle, another on hinder margin; antemedial, postmedial, and discal pink double bands nearly erect; a black longitudinal shade running through the lines below the median vein, and on this shade between the first and second lines is a

silvery Y-shaped mark, with a silvery spot on its outer side and a silvery dot above it; a submarginal pale line dentated outwards below the costa; the space between this line and the discal line is blackish, and between it and the outer border pale pinkish; some golden-orange spots above the hinder angle; a black spot near the apex. Hind wings pale brown, whitish towards the base.

Expanse of wings $1\frac{6}{10}$ inch.

Cherra Punji. Two examples.

Genus THERMESIA, Hübn.

Thermesia sthenoptera, sp. n.

♂. Palpi black; body and wings above blackish brown: fore wings with an ochreous dot in the middle of the cell; a small similarly coloured spot at the end; a very indistinct pale subbasal waved line, two more distinct similar discal lines, each terminating on costa in a small ochreous spot; marginal lunules pale, with black inner margins: hind wings with a dentated medial black line on a pale and somewhat ochreous tinted space; a discal whitish waved line and marginal lunules as in fore wing. Underside dull black: fore wings with a white lunule at the end of the cell; a submarginal row of white points: hind wings with a black lunule at end of cell and two dentated discal white lines.

Expanse of wings $1\frac{2}{10}$ inch.

Cherra Punji. One example.

The wings are shaped as in *Badiza ereboides*, Walker; the palpi have the last joint long and smooth, not tufted with long hairs as in that genus.

FOCILLINÆ.

Genus MECODINA, Guen.

Mecodina oxydata, sp. n.

♂ ♀. Pale olive-brown, tinged with ochreous, and irrorated with brown atoms: fore wings crossed by three broad pale brown bands—basal, medial, and discal; the last is accompanied by a pale band formed by a sinuous brown line on its inner side, the space from this band to the margin nearly as dark as the band: hind wings greyish brown, the margin of both wings with black points edged with whitish. Underside ochreous grey: fore wings inwardly suffused with brown, and with a brown discal band; a brown lunule at end of cell:

hind wings without suffusion; a black dot at end of cell; a black discal crenulate line across both wings.

Expanse of wings $1\frac{3}{10}$ inch.

Shillong. One pair.

Genus BADIZA, Walker.

Badiza distorta, sp. n.

♂ ♀. Palpi with the second and last joints with tufts of thick hairs; antennæ with fine bipectinations, which in the middle are thickened on one side for a short distance; body and basal half of wings greyish ochreous. Fore wings with a small white spot in the middle of the cell, a larger one at the end: both wings crossed by a medial white band, containing a sinuous purple line, the band suffused with ochreous on fore wings, margined inwardly with purplish suffusion on hind wings, followed by a broad purple discal band limited outwardly by a submarginal sinuous white line; the marginal space marked with white at apex and hinder angle on fore wings, and suffused with white in parts on the hind wing; marginal lunules black. The female differs from the male in having the basal part of both wings more or less suffused with purple.

Expanse of wings $1\frac{2}{10}$ inch.

Ternate, one male and two females; Gilolo, three males and one female.

The costa of fore wings, which are long and narrow, is rather deeply excavated in the middle, much more so than in *Badiza ereboides*, Walker, and makes the wings upturned, and gives the insect a peculiarly distorted appearance.

Genus OGLASA, Walker.

Oglasa albodentata, sp. n.

♂ ♀. Palpi, head, and collar red-brown: thorax and fore wings purplish pink-grey; a black dot for the orbicular; reniform pale, ringed with brown; antemedial, medial, and post-medial indistinct waved brown lines; a black angular patch on costa near apex, a pale mark on costa on each side of it; a brown streak from the patch to the outer margin (in the male only) and a white, highly dentate, discal line: hind wings blackish brown, with indistinct antemedial, medial, and discal waved black lines, the last with some ochreous spots on the outside of its upper half and a large pinkish-ochreous patch on the margin above the anal angle. The

female is paler than the male; the dentate white discal line of fore wings is absent, and the anal patch and discal line of hind wings are accompanied by a deep black suffusion on the inner side.

Expanse of wings, ♂ $1\frac{6}{10}$, ♀ $1\frac{9}{10}$ inch.

Cherra Punji. Two males and one female.

Genus *SENERATIA*, Moore.

Seneratia odontophora, sp. n.

♂. Palpi, head, and collar orange; body and wings pinkish brown; tip of abdomen ochreous. Fore wings paler than hind wings; a black dot for the reniform; orbicular large, square, blackish, lined with black; transverse lines brown, subbasal, medial, and discal, the last curving outwards and slightly dentate in its middle, all rather indistinct, and outside the discal line are faint indications of other lines (pale and dark), and a brown subapical streak, pale-edged, from costa one fourth from apex to outer margin above the middle, and marginal black lunules. Hind wings with indications of a pale discal band; cilia of both wings dark grey, with a brown internal band.

Expanse of wings $1\frac{9}{10}$ inch.

Cherra Punji. One example.

Genus *BLEPTINA*, Guen.

Bleptina perfusca, sp. n.

♂. Dark brown: fore wings with a pale lunule at the end of the cell; antemedial and postmedial erect straight pale lines and a discal pale much waved line: hind wings with a pale postmedial line corresponding to the second line of the fore wings, and an indistinct discal crenulate line; cilia of both wings with a pale line at its base. Underside brown, with two discal pale lines and pale anteciliary line.

Expanse of wings $1\frac{4}{10}$ inch.

Shillong, two examples; Ternate, one example.

The Ternate example only differs from the others in having the lines and markings above and below more distinct and ochreous tinged, and the costal line ochreous; the markings are identical.

Genus *EGNASIA*, Walker.

Egnasia rectilineata, sp. n.

♂ ♀. Varying in colour in both sexes from orange tinged

with grey to dull greyish olive; a hyaline distorted mark at the end of each cell, more or less lunular in shape in the fore wing, which has a black dot in the middle of the cell and a subbasal waved and outwardly curved brown line; both wings crossed by medial and discal crenulated brown lines, rather close together, the former touching the outside of the hyaline marks on both wings; a marginal black line and black ends to the cilia. Underside: fore wings with a black dot in middle of cell; transverse lines brown; no inner line; medial line waved, discal line straight and slightly bent inwards on to the costa of fore wings; marginal line and cilia as above.

Expanse of wings $1\frac{5}{10}$ – $1\frac{7}{10}$ inch.

Shillong and Cherra Punji. A fine series.

Allied to *E. ephyrodalis*, Walker; markings above somewhat similar, but quite different below, *ephyrodalis* having the discal line highly crenulate.

Egnasia tripuncta, sp. n.

♂ ♀. Greyish ochreous, irrorated with brown atoms. Fore wings with a small white spot in middle of cell and three small black spots with pale rings at the end; transverse lines brown, with pale outer borders, bent inwards above the median vein of fore wings on to the costa; fore wings with three at even distances—subbasal, medial, and postmedial; hind wings with two—antemedial and postmedial—corresponding with the second and third lines of fore wings, a black spot at end of cell, and a black patch at anal angle; both wings with a series of black discal dots and black duplex marginal line.

Expanse of wings 1 inch.

Shillong. Three examples.

Genus CATADA, Walker.

Catada nigrobasis, sp. n.

♂. Purple-brown; palpi and collar black. Fore wings with a deep black patch at base, limited by a pale line from hinder margin a little before the middle to the costa near the base; a brown lunular indistinct mark at the end of cell; an irregular discal transverse line of whitish marks: hind wings slightly darker than fore wings, slightly paler towards the base; both wings with a black marginal line.

Expanse of wings $1\frac{9}{10}$ inch.

Cherra Punji. One example.

Genus ADRAPSA, Walker.

Adrapsa abnormalis, sp. n.

♀. Dark ochreous brown: fore wings with nearly the basal two thirds blackish brown, limited by a sinuous pale line with a small outward bend in its middle; remainder of the wing much paler and ochreous tinged, with a discal band of disconnected and distorted brown spots: hind wings blackish brown, with central and discal pale lunular lines; both wings with marginal lunules black, and cilia with pale basal line. Underside of a uniform pale ochreous brown; a black mark at end of each cell; both wings with a prominent middle black transverse line; pale indistinct sinuous discal line; margin and cilia as above.

Expansion of wings $1\frac{8}{10}$ inch.

Shillong. One example.

HYPENINÆ.

Genus TALAPA, Moore.

Talapa albigutta, sp. n.

♂ ♀. Purplish brown: fore wings with a white comma-like mark at the end of the cell and a black dot in the middle; a deep black square subbasal patch in interno-median interspace, a black streak on costa above it; a black discal transverse line, which passes outside the white cell-mark, curves outwards, and turns in on the costa above it; this line up to the comma mark is accompanied on its inner side by a broad black band; outside it is a highly waved black line marked with different-sized black spots on its upper portions, and a short black apical streak: hind wings brown; both wings with a black marginal dentate line, with black points, marked with white between the veins, with black streaks opposite them on the cilia. The female differs from the male in being much blacker, with the markings indistinct.

Expansion of wings $1\frac{6}{10}$ inch.

Shillong. One male and three females.

Genus HYPENA, Schrank.

Hypena unicipennis, sp. n.

♂. Head, thorax, and fore wings ochreous brown, the last irrorated and striated with black, the irrorations thickened into a blackish spot in the centre of the interno-median inter-

space, and a broad discal transverse band from the hinder angle to the discoidal interspace, where it bends out to the apex; marginal and submarginal points black: hind wings brown, without markings; cilia of both wings ochreous grey, interlined with brown.

Expanse of wings $1\frac{3}{10}$ inch.

Cherra Punji. Two examples.

Hypena castaneipalpis, sp. n.

♂ ♀. Palpi very long, with the tip upturned, bright chestnut-colour, with some brown scales at the sides; thorax and fore wings chestnut-brown, suffused with greyish white, with the exception of the outer border, the suffusion giving a whitish streak at the apex and making the hinder marginal space nearly white; a black dot within the cell, a white dot at the end; a straight brown line from middle of hinder margin angled opposite the end of the cell, where it bends in on to the costa; a row of black points in the disk: hind wings blackish brown; cilia of both wings brown, with ochreous tips.

Expanse of wings $\frac{9}{10}$ inch.

Cherra Punji. Numerous examples.

Thyrididæ.

Genus RHODONEURA, Guen.

Rhodoneura stylophora, sp. n.

♂. Head and body chestnut-red; both wings with the inner two thirds dark chestnut-red, the outer third pale pinkish-ochreous white: fore wings with three very large pale pinkish-ochreous spots or patches along the centre of the dark portion, the outer one ear-shaped; two thin discal bent red lines: hind wings with the apex and hinder angle suffused with red. Underside pale pinkish-ochreous grey, with two black inner dark brown bands on fore wing and one on hind wing; fore wings with a large tuft of metallic-coloured scales in the cell.

Expanse of wings $\frac{8}{10}$ inch.

Cherra Punji. One example.

Rhodoneura tritropha, sp. n.

♂. Orange pinkish, suffused with grey and striated with very fine brown striations: fore wings with three small white spots in a longitudinal row at the end of the cell; the grey

suffusion over all the interior of the wing, leaving the borders pale; some black dots on costa before apex: hind wings with transverse deep black bands, basal and medial, the latter not reaching the costa, and accompanied by a grey band on its outer side, which broadens towards the anal angle, where there is a deep black patch. Underside bright chestnut-pink; a black medial line on hind wings, and with a pretty marbled appearance on both wings formed by black and white marks.

Expanse of wings $1\frac{2}{10}$ inch.

Cherra Punji. One example.

Rhodoneura hebra, sp. n.

♂. Chocolate-brown, striated with a regular network of very fine brown lines, many of the interspaces thereby formed being filled up with white, so as almost to form antemedial, medial, and postmedial transverse bands, which are better defined on the underside, where the ground-colour of the wings is more ochreous, and the spaces between the bands pink, with white suffusion also on the apical portions.

Expanse of wings $1\frac{1}{10}$ inch.

Cherra Punji. One example.

IV.—*Notes on Crustacea*.

By the Rev. THOMAS R. R. STEBBING, M.A.

[Plate II.]

Two new Pedunculate Cirripedes.

Dichelaspis Hoeki, sp. n. (Pl. II. figs. A–D.)

General appearance.—Capitulum compressed, the breadth nearly three quarters of the length; the valves opaque, approaching one another closely at certain points, but nowhere coming in contact; the external membrane translucent, closely speckled almost all over with little clear spots, producing an appearance similar to that of an empty test of a *Globigerina*. The membrane is also traversed by strongly marked lines, some smooth, others wrinkled and denticulate, to a certain extent, though roughly, following the contours of the valves and presumably representing successive stages of the animal's growth. The peduncle is shorter than the capitulum, sometimes very much so.

Scuta.—The occludent segment long, narrow, slightly

curved, acute at the base, the rounded apex closely approaching the excavated margin of the tergum; the basal segment shorter than the occludent, but very much wider, triangular, the longest side slightly convex, lying very near to the inner margin of the occludent segment; the lower side overlapping the basal part of the carina; the inner side slightly convex at the centre. The junction of the two segments is not solidly calcified.

Terga.—The upper part projecting with an obtuse or acute apex towards the occludent margin of the capitulum, the valve widening downwards, so that the outer margin is deeply excavate, while the inner or carinal margin is nearly straight.

Carina.—Strongly bowed, overlapping the terga for more than half their length; the basal part at right angles to the remainder, and externally concave, so that it is not possible to see the two parts of the valve dorsally in one view; the distal border of the base is not emarginate.

Mandibles.—There are five teeth, that at the extremity of the convex margin the largest and remote from the others, the furthest from it of the remaining four being comparatively broad and denticulate.

First Maxillæ.—The notch which follows the principal spines is shallow.

Cirri.—The first and shortest pair are not very remote from the second; the rami have six or seven joints of no great length, carrying numerous spines; the rami of the other pairs have from eight to ten joints apiece, the sixth pair having the smaller number. The setose spines are not numerous.

The one-jointed *caudal appendages* are short and narrow, tipped with a group of seta-like spines of various lengths, and carrying one or two of no great size below the apex. The penis has a group of spines or setæ on the narrow blunt apex, and some setules are scattered over the surface, which in the two specimens dissected was greatly widened at the middle.

Size.—The specimen represented in fig. B is a little over three twentieths of an inch, the peduncle being rather more than one twentieth and the capitulum rather more than two twentieths, the parts to some extent overlapping one another.

The species is named in compliment to Dr. P. P. C. Hoek. The specimens were sent me by my obliging correspondent, W. R. Forrest, Esq., from Antigua, where he found them on the mouth-organs of a Palinurid.

Dichelaspis antiquæ, sp. n. (Pl. II. figs. E–G.)

At the first glance I supposed this species to be merely a variety of the preceding; but upon dissecting a specimen and

examining further I found it impossible to retain that view. The differences are, in fact, rather numerous. The valves occupy a larger proportion of the capitulum and are much less opaque. In consequence of the latter characteristic they allow the "primordial valves" at the umbones of the terga and scuta to be seen much more clearly than they are in the other species. Moreover, the membrane is devoid of the foraminate appearance which it has in *Dichelaspis Hoeki*, and the peduncle is relatively shorter.

Terga.—These, instead of widening downwards, are contracted below.

Carina.—The distal margin of the base is distinctly though not deeply emarginate.

Cirri.—These are all more elongate than in *Dichelaspis Hoeki*, although taken from a smaller specimen. The rami of the first pair have from seven to eight joints, those of the other pairs from twelve to fourteen, the joints themselves being more slender, more elongate, and with more numerous spines than in the preceding species.

The caudal appendages are also longer and more slender, with longer spines at the apex, and none on the margin below it. The penis is not peculiarly widened.

Size.—The specimen represented in fig. E is less than three twentieths of an inch, and the capitulum is not quite two twentieths.

Both in this and in the specimens of *Dichelaspis Hoeki* (figs. B, C, D) there were large numbers of narrowly oval eggs. The young specimen of *Dichelaspis antiquæ* (fig. G) has a capitulum measuring one twentieth of an inch in length. In this specimen the sieve-like appearance of the primordial valves is clearly seen. Fig. G (*sc.*) shows one of the scuta of this specimen, from which it can be seen that up to rather a late stage the two segments remain solidly united.

Mr. Forrest informs me that he took the Cirripedes above described from the maxillipeds of three different Palinurids, one of which weighed twelve pounds, and had a carapace $10\frac{1}{2}$ inches long, a pleon of 11 inches, and antennæ considerably truncated, but still measuring 24 inches in length. Whether the two species of *Dichelaspis* came from different species, or even different specimens, of Palinuridæ, I am not in a position to decide. The *Trichelaspis Forresti*, described in this Magazine in May last as taken on a crayfish, is a guest of *Panulirus argus* (Latreille), which, according to the modern use of the terms, may be more properly called a crawfish.

The synoptical table of the species of *Dichelaspis* given by Dr. Hoek in his Report of the Cirripedia of the 'Challenger' may now be enlarged as follows:—

- I. Carina terminating in a disk.
1. Basal segment of the scutum twice as wide as the occludent segment. Habitat: eastern waters, on a crab *D. Warwickii* (Gray).
 2. Basal segment of scutum three times as wide as the occludent segment; tergum widening downwards. Habitat: West Indies, on a Palinurid *D. Hoeki*, sp. n.
 3. Basal segment of scutum three times as wide as the occludent; tergum narrowing downwards. Habitat: West Indies, on a Palinurid *D. antiquæ*, sp. n.
 4. Basal segment narrower than the occludent segment. Habitat: probably oriental, attached to the skin of a sea-snake *D. Grayi*, Darwin.
 5. Basal segment much narrower than the occludent segment and about half as long. Habitat: Indian Ocean, on a sea-snake *D. pellucida*, Darwin.
- II. Carina terminating in a fork.
- A. Basal segment of the scutum directed towards the centre of the capitulum.
 6. Habitat: Moreton Bay, Australia *D. neptuni* (Macdonald).
 - B. Basal segment of the scutum running parallel to the lower margin of the capitulum.
 - a.* Capitulum almost as long as broad.
 7. Tergum triangular. Habitat: Japan *D. Aymonini*, Lessona.
 8. Tergum divided by a deep notch. Habitat: Mediterranean *D. Darwinii*, De Filippi.
 - b.* Capitulum more than once and a half as long as it is broad.
 9. Habitat: Madeira, attached to a Brachyurous crab *D. Loweii*, Darwin.
- III. Carina terminating in a cup.
10. Scutum divided into two distinct segments. Habitat unknown, apparently attached to a horny coralline *D. orthogonia*, Darwin.
 11. Scutum with a notch only, and indistinctly divided. Habitat: near the Azores, on the spine of an *Echinus*, dredged from 1000 fathoms *D. sessilis*, Hoek.

The ink of the last sentence was scarcely dry or not dry when the post brought me the highly important 'Studien über Cirripeden,' just published by Dr. Carl W. S. Aurivillius. The distinguished author gives descriptions and

figures of nine species of *Dichelaspis*, eight of which are distinct from those above-mentioned. The first in his list is *Dichelaspis Warwickii* (Gray), of which he records the occurrence in the Java Sea at Batavia, on the underside of the cephalothorax of *Limulus moluccanus*. Incidentally he notes that the Mediterranean *Dichelaspis Darwinii* is found on *Palinurus vulgaris*. Of his own species, *Dichelaspis cor*, 1892, *Dichelaspis angulata*, *Dichelaspis aperta*, *Dichelaspis cuneata* have only three valves, the terga being absent, while his *Dichelaspis bullata*, 1892, has only two valves, for here the terga and carina are wanting, as well as the basal segments of the scuta. Dr. Aurivillius gives reasons for not establishing new genera to suit the differences of structure exhibited by these species, and for retaining the name *Dichelaspis*, although its meaning is obviously inapplicable to a species in which the scutum is not divided. It will, however, be very difficult to uphold the name in cases where its meaning does not apply, in face of the fact that Darwin displaced older names on the very ground that they were suggestive of error. The three other new species are all from the Java Sea, and from the branchiæ of a *Palinurus*. The first, *Dichelaspis alata*, is near to *Dichelaspis Warwickii*, the second, *Dichelaspis sinuata*, to *Dichelaspis Lowei*, the carina terminating in a large fork, in which respect the third, *Dichelaspis trigona*, agrees with it.

English Terrestrial Isopods.

In an interesting paper on "The Irish Woodlice" Dr. Scharff has recently recalled attention to the terrestrial Isopoda of the adjacent island as well as to those of Ireland itself. Of seventeen British species he remarks that "twelve are common to Great Britain and Ireland, two are found in Great Britain and not in Ireland, and three in Ireland and not in Great Britain, so that the fauna of Ireland, though poorer in many respects than that of Great Britain, is richer in woodlice by one species." In justice to England, however, it must be noted that Dr. Scharff has overlooked its recorded possession of *Metoponorthus cingendus* (Kinahan). This species has been found by more than one observer in South Devon; and by taking it into account the numbers of the land Isopods on the opposite sides of St. George's Channel are exactly balanced. But England is, in fact, richer in this group than its past record shows. Several years ago I obtained at Ventnor, in the Isle of Wight, a specimen of *Porcellio dilatatus*, Brandt, which I have now had the opportunity of

comparing with French examples kindly sent me by M. Adrien Dollfus. The Ventnor specimen, though a small one, agrees with these in relative breadth and in the characteristic feature of the rounded apex of the telson. It differs, however, in colour, not being dark grey on the back, but rather of a dull yellow, faintly marked longitudinally with two narrow adjacent darkish stripes down the centre. The differences between *Porcellio dilatatus* and the common *Porcellio scaber* are sufficiently clear, yet that they are not overwhelmingly conspicuous may be inferred from the circumstance that the late Professor Milne-Edwards regarded the former as a synonym of the latter. To the well-known *Armadillidium vulgare* (Latreille) the English fauna may now add two other well-marked species of the same genus. During last September at Shirehampton, on the Avon, I found the large *Armadillidium depressum*, Budde-Lund, which is easily distinguished from *A. vulgare* by the broad projection from the epistome above the frontal line. M. Dollfus has obligingly sent me specimens for comparison from Rome, and also one from Clifton, near Bristol, bearing the name of Pocock as the donor. Also during last September in Leigh Woods, at Clifton, I found *Armadillidium nasatum*, Budde-Lund, which has a narrower but otherwise more pronounced projection than that observed in *depressum*. In his 'Catalogue of the Land Isopods of Spain' Dollfus says of this *nasatum* that it is "espèce remarquable par la forte saillie pré-frontale de l'écusson du prosépistome." Many years ago I met with this species at Tunbridge Wells, and supposed it to be a novelty; but from want of the requisite literature on the subject and pressure of other engagements was forced to lay it aside undescribed. It was again recalled to my remembrance by specimens which my nephew, Mr. Mello Saunders, this year collected for me in France.

As the account at present stands there are eighteen species of land Isopods in England to fifteen in Ireland, the only one of the Irish group that has not been found in England being *Trichoniscus vividus*, Koch. It is not unlikely that fresh species will be found in each of the competing districts when more attention is directed to these crustaceans. At present there are many people to whom the information that there is more than one kind of woodlouse comes as a surprise.

Terrestrial Isopods of various genera may be assumed to have tastes much in common, for the small limestone quarry at Shirehampton which yielded *Armadillidium depressum* contained also *Trichoniscus roseus*, *Porcellio scaber*, and *Oniscus asellus*, the specimens of *Porcellio* and *Oniscus* being rather exceptionally fine. Such associations are not uncom-

mon, for the late Professor Kinahan is said to have found a dozen species of Oniscidæ in a garden not sixty yards square.

Some English Marine Isopods.

The paper on the Idoteidæ of the coasts of France, recently published by Mons. Adrien Dollfus ('Feuille des Jeunes Naturalistes,' Nov. 1, 1894), gives a readjustment of the nomenclature in many respects applicable to the species of that family which are found on the English coast. The species assigned to *Idotea* by Bate and Westwood are distributed by Dollfus among three genera—*Stenosoma*, Leach, in which the pleon has all the segments coalesced; *Idotea*, Fabricius, in which the first two segments of the pleon are dorsally distinct and the third is laterally indicated; *Zenobia*, Risso, in which the first three segments of the pleon are dorsally distinct and the fourth is laterally indicated.

Of these three generic names *Zenobia* is undoubtedly pre-occupied, and I therefore propose a change of it into *Zenobiana*; the species called *Idotea parallela* by Bate and Westwood will then become *Zenobiana prismatica* (Risso). Mr. E. J. Miers, in his 'Revision of the Idoteidæ,' has regarded *Idotea acuminata* (Leach) as a head-species, of which Risso's *appendiculata*, Rathke's *capito*, and some others are synonyms or varieties. But, as Dollfus points out, there are considerable differences separating several of these forms, so that *Idotea acuminata* rightfully resumes the name *Stenosoma acuminatum*, long ago given it by Leach, while *Idotea appendiculata* of Bate and Westwood should rather be called *Stenosoma lancifer*, a manuscript name given it by Leach and published by Miers. The *Stenosoma appendiculatum* (Risso) and *Stenosoma capito* (Rathke) are not at present known on the English coast.

Eurydice spinigera, Hansen, may be added to the British fauna, as I have taken it in the harbour of Ilfracombe. In general appearance it is very like the common *Eurydice pulchra*, but attains a larger size and is deeper in colouring, the greater depth of hue being noticeable even in specimens which have been long in spirit. Of distinguishing characters easy to observe may be mentioned the shape of the side-plates, which all have the hind angle acutely produced, and the armature of the last segment of the pleon, which has a distal emargination and a couple of spines at each angle, the inner spine being much larger than the outer.

EXPLANATION OF PLATE II.

- Fig. A. *Dichelaspis Hoeki*, sp. n. A group *in situ* on one of the oral appendages of a Palinurid, magnified.
- Fig. B. A single specimen, magnified; *n.s.*, natural size of the single specimen.
- Fig. C. Mouth and cirri of another specimen.
- Fig. D. *t.*, tergum of another specimen; *c.*, base of carina of the same; *c.a.*, caudal appendage and base of sixth pair of cirri of the same.
- Fig. E. *Dichelaspis antiquæ*, sp. n. A single specimen, magnified. *n.s.*, natural size of the same.
- Fig. F. *c.*, base of the carina of another specimen; *c.a.*, caudal appendage and base of sixth pair of cirri of the last-mentioned specimen.
- Fig. G. Young specimen of *Dichelaspis antiquæ*, magnified; *n.s.*, natural size of the same; *sc.*, scutum of the young specimen, more highly magnified; *t.*, tergum of the same.

V.—*Notes on British Spiders, with Descriptions of new Species.* By the Rev. F. O. PICKARD-CAMBRIDGE.

[Plates III. & IV.]

SINCE my last communication of January 1894 several new species have been added to the British fauna, three of them being, so far as I am aware, hitherto undescribed. Of these three species, here described as new to science, one (*Lycosa spinipalpis*) is a large spider belonging to the group *Trochosa*, and forms a very fine addition to our list. *Pardosa purbeckensis* is also a large species allied to *palustris*, Linn., and nearly as large as *P. amentata*, Clk. The third (*Agræca littoralis*) is one of the smaller of the "*Agræcas*," and, although M. Simon and Prof. Kulcznski have each described a very closely allied species, it is, I believe, different from either.

In any case it is better to describe such as new, rather than attach it doubtfully to some species which may afterwards prove to be quite different.

I have been able, thanks to the kindness of the Rev. O. Pickard-Cambridge, Mr. W. Evans, Mr. G. H. Carpenter, and Mr. C. Warburton, to examine nearly all the examples of the genus *Tetragnatha* which have been taken in England, Ireland, and Scotland, and, as the result of my examination, am able to add four species of this genus to the British list.

Pardosa riparia, C. L. K., drops out of our list for the present, while another species of *Leptyphantes*—closely allied to *tenuis*, Bl.,—*L. tenebricola*, Wid., has been added.

Including, then, only those species which are described or recorded in this paper, we have three species new to science and seven species added to the British list.

Through the courtesy of Mr. W. A. Luff, of Guernsey, I have been enabled to draw up a list of the spiders of the Channel Islands, which will be published in the 'Transactions of the Guernsey Society of Natural Science and Local Research.'

This list will include the names of all species recorded from the year 1863 up to the present time, with localities, the names of the captors, or the authority who vouches for the occurrence of each species.

Though not geographically, nor even geologically, really connected so closely with the British Islands as with the coast of Normandy, it has been deemed advisable to include the Arachnid fauna of these islands in a list supplementary to that of Great Britain.

There are at present 116 species recorded, while one only of these (*Heliophanus Cambridgei*, Sim.) has not been hitherto found on the English side of the Channel.

Several new species have been added to the list by Messrs. Warburton, Luff, and others, noticeably *Salticus formicarius*, Wlk., *Scytodes thoracica*, Latr., and *Asagena phalerata*, Panz.

*Three Species new to Science and Seven new to the
British List.*

Genus *AGRÆCA*, Westw.

Agræca littoralis, sp. n. (Pl. III. figs. 15, a, b, c, d, e.)

Length of adult female 6 millim., or $2\frac{3}{4}$ lines.

Cephalothorax, caput, legs, and sternum pale orange. Abdomen dull brown, with three narrow pale bands converging towards the spinners.

Cephalothorax oval-elongate, with two dusky bands on either side of the deeply indented central stria, formed by suffusion of the lateral striæ.

Eyes small, occupying a transverse oblong area. Posterior row curved, convexity backwards; eyes equal, equidistant, rather more than one diameter apart. Anterior row strongly curved, convexity backwards, occupying a narrower transverse space than the posterior row, almost equidistant; centrals much smaller, a quarter of a diameter apart. Ocular area set with curving black bristles. All eight eyes situate on black spots.

Clypeus very narrow, equal to the diameter of central anterior eyes, its margin set with six or seven curving bristles.

Falces broad, stout, convex, conical, clothed with curving black hairs. Inner margin set with numerous curving hairs; upper margin of fang-groove bearing three teeth, lower margin with two.

Palpus set with stout black spines, bearing at apex a dark simple tarsal claw.

Maxillæ twice as long as labium, broad, parallel-sided, very slightly enlarged and obtusely truncate at apex; fringed with curving bristles and bearing a denser tuft of finer hairs on inner anterior margin and a small black tuft at apex.

Labium oval-quadrate, truncate at apex; fringed with dark bristles.

Sternum slightly longer than broad, convex, clothed with dark hairs, truncate in front, produced behind to a point between the coxæ of posterior pair of legs.

Legs 4, 1, 2, 3, fairly long, clothed with dark hairs. Anterior pairs less spinose.

Femora i. with 2 dorsal, 1 anterior-apical, and 1 dorsal-apical spine.

Femora ii. with 3 dorsal spines.

Femora iii. with 3 dorsal and 3 apical spines.

Femora iv. with 2 dorsal and 3 apical spines.

Patella of all four pairs with a single basal and apical spine.

Tibiæ i. with two pairs of stout spines beneath. *Tibiæ* ii. with two spines 1—1 beneath.

*Protarsi** i. and ii. with two pairs of spines beneath. *Tibiæ* and *protarsi* iii. and iv. with numerous spines on all sides.

Tarsal claws two. *Onychium* bearing a few upturned bristles, but no claw-tuft.

Abdomen oval-elongate, compressed, parallel-sided, thinly clothed with fine dark hairs; dull brown, with a narrow, pale yellow, central dorsal band extending from the base nearly to the spinners, flanked by a pale irregular band, extending from base and converging to the spinners. Ventral area pale yellow. Spinners short, cylindrical, situated in a quadrangle. Superiors slightly longer and further apart; inferiors set one diameter apart at base, having in front of them a lunulate

* Mr. R. I. Pocock, of the Natural History Museum, South Kensington, has suggested *protarsus* instead of *metatarsus*; and, seeing that we enumerate the joints from the basal end and arrive at the sixth joint before the seventh (tarsus), the term *protarsus* seems to describe the joint and its position better than the old term *metatarsus*.

transverse orifice, fringed with hairs, marking the opening of a spiracular vessel.

Epigyne not conspicuous, consisting of a narrow longitudinal fissure, slightly dilated in front, flanked on either side posteriorly by a dark suffused spot. Epigynal area convex, clothed with fine hairs.

M. Simon describes (Ar. de France, vol. iv. p. 308) a single young female of a species (*A. lineata*), which seems very closely allied to the above; while Prof. W. Kulcznski, of Crakow, also describes and figures a species, *A. striata*, Kl. (Ar. Nov. in Montibus Tatricis, 1882), which is certainly very similar. Unless, however, a comparison of types confirms this supposed identity, I shall believe them to be distinct.

An adult female was taken by myself from beneath a stone at Swanage, on the undercliff near Durlstone Head, on May 22, 1894, while immature specimens were taken under stones on the foreshore near Kimmeridge a little later in the year.

Genus LYCOSA.

(*Trochosa*, *Tarentula*.)

Lycosa spinipalpis, sp. n.
(Pl. III. figs. 4, 5, 9, 11, 14.)

Length of male 8 millim. Female, ceph. 4 millim., abd. 6 millim. or $4\frac{1}{2}$ lines.

Cephalothorax deep umber-brown, having a central pale band, formed of golden-yellow pubescence, which extends from the posterior row of eyes to the base of the thorax; within this band at its anterior portion lies a pair of brown longitudinal bars, sometimes connected with the lateral brown areas, sometimes entirely disconnected. Ocular area brown, with a pale patch on either side. Falces deep brown.

Abdomen oval, enlarged towards the spinners, deep brown, with a short central, dorsal, anterior, longitudinal bright pale bar, formed of golden-yellow pubescence, margined with black, and followed to the spinners on either side by a series of small pale spots. Lateral areas thickly speckled with spots of golden-yellow pubescence.

Sternum deep brown.

Legs 4, 1, 2, 3, olive-brown, clothed with golden pubescence. Femora more or less decidedly annulated with dusky black, as also are sometimes the tibiæ, especially in the male sex.

The spinous armature of the legs is as follows:—

Femora i.—2 dorsal, longitudinal; 2 lateral, anterior, apical spines.

Femora ii.—2 dorsal, longitudinal; 1 lateral, anterior, apical spine.

Femora iii.—3 dorsal, longitudinal; 2 lateral, anterior, apical; 1 lateral, posterior, apical spine.

Femora iv.—3 dorsal, longitudinal; 2 lateral, anterior, apical; 1 lateral, posterior, apical spine.

Patella i. and ii., no spines; iii. and iv., 1 posterior central, 1 anterior central spine.

Tibiæ (beneath only) i.—3 pair ventral, longitudinal; 1 anterior, lateral, apical spine.

Tibiæ ii.—3 pair ventral longitudinal (2 rudimentary anterior); 2 lateral, anterior, apical spines.

Tibiæ (above and beneath) iii. and iv.—3 pair ventral, longitudinal; 2 lateral, anterior; 2 lateral, posterior; 1 dorsal, apical spine.

Protarsi (beneath only) i. and ii.—3 pair ventral, longitudinal; 1 ventral, apical; 1 anterior, lateral, central spine.

Protarsi iii. (above and beneath).—3 pair ventral longitudinal; 1 ventral apical; 3 anterior lateral; 3 posterior lateral spines.

Protarsi iv.—8 ventral spines; 3 anterior lateral; 3 posterior lateral spines.

Falces of male similar in general respects to those of *terricola*; no tooth on outer margin of fang near base.

Palpus of male similar in general respects to that of *terricola*, but the radial joint or tibia bears on the inner underside in front a cluster of 12 to 16 stiff, almost straight, stout spines. The tarsal or digital joint has no claw at its apex.

This fine species, apparently new to science, may be readily distinguished in both sexes from the other three species of *Lycosa*, to which it is allied, by its umber-brown hue and pale-speckled abdomen; in the male sex by the cluster of spines beneath the radial joint on the under and inner side.

In the female sex by the epigynal area, which is longer than broad, while the whole area is larger in proportion than that of any of the others, save *terricola*; but in *terricola* the area is broader than long, semicircular.

There is no difficulty whatever in recognizing the males of this species, though it might not be altogether easy to separate the females if they had lost their colour at all. But if it be borne in mind that this species, *robusta*, and *ruricola* exhibit the short pale wedge-shaped bar on the abdomen at base, and that the epigynal area of *ruricola* is very small and incon-

spicuous, while *robusta* is a much larger spider with hoary grey pubescence, there will not be any great fear of a confusion of the three species.

This fine new addition to the British fauna was first met with at the head of Lake Derwentwater in June 1893, where a male and female were taken from beneath a stone. In May 1894, however, numerous examples were obtained under boards, bricks, &c., in damp meadows in Dorset.

The female makes a small cell in the damp earth for the spinning of the egg-cocoon, as do most of the other species of *Lycosa*. I have not received any from other parts of England, but have no doubt that it is abundant in suitable localities throughout the country.

Lycosa robusta, Sim. (Pl. III. figs. 3, 8, 11, 12.)

Length of male, ceph. 5 millim., abd. 5 millim. or $4\frac{1}{2}$ lines; female, ceph. 7 millim., abd. 8.75 millim. or 7 lines.

Pubescence hoary white. Abdomen with pale lanceolate mark. Size variable, but much larger than *L. spinipalpis*. Palpus of male with an apical tarsal claw. Tarsi of first pair of legs of male fusiform, incrassate, clothed with rich black pubescence.

Fang without any tooth on outer margin.

Numerous specimens of this fine addition to the British fauna were taken beneath stones on the undercliff at Swanage, between Durlstone Head and Peveril Point; also under stones in the ravines behind the lighthouse. They construct a large cell in the damp loam, sometimes 2 inches long by 1 broad, and therein construct the immense white egg-cocoon, hatch and tend the young ones. A dozen or more females were taken, but only one adult male, in May 1894 by the author.

Lycosa ruricola, De Geer.

(Pl. III. figs. 1, 6, 10, 13.)

Length of male, ceph. 4 millim., abd. 4 millim. or $3\frac{1}{2}$ lines; female, ceph. 6 millim., abd. 9 millim. or $4\frac{1}{2}$ to $6\frac{1}{2}$ lines.

Pubescence yellow-grey. Abdomen with pale lanceolate mark. Size very variable, but smaller than the preceding species. Palpus of male with an apical tarsal claw. Tarsi of first pair of legs of male cylindrical, slender. Fang with a tooth on outer margin.

Not uncommon in Dorset and other parts of England. Adult in May and June.

Lycosa terricola, Th. (Pl. III. figs. 2, 11, 14.)

Length of male 3.5 millim., abd. 3.5 millim. or $3\frac{1}{4}$ lines; female, ceph. 5 millim., abd. 7 millim. or $5\frac{1}{2}$ lines.

Pubescence yellow. Abdomen with no pale lanceolate mark. Size very variable, but smaller than *L. ruricola*. Palpus of male without any apical tarsal claw. Protarsi i. incrassate. Fang without any tooth on outer margin.

Common in most parts of England. Adult in May and June.

The following table will perhaps be of some assistance to students:—

Males.

- A. Palpus of male bearing a claw at the apex of the tarsal joint. Protarsus i. slender (*ruricola* only).
 - 1. Fang of falces with a small projecting angle or tooth on the outer margin near the base. Tarsi i. cylindrical, slender *ruricola*, De Geer.
 - 2. Fang without angular projection. Tarsi i. fusiform, incrassate *robusta*, Sim.
- B. Palpus of male without any claw at apex of tarsal joint. Protarsus i. incrassate.
 - 1. Tibia (radial joint) of palpus bearing seven or eight stout spines on the under and inner side at apex *spinipalpis*, F. Cb.
 - 2. Tibia of palpus without spines, a few hairs merely *terricola*, Thor.

Females.

- A. Abdomen with pale basal, central, dorsal lanceolate band.
 - 1. General hue olive-brown. Cephalothorax with yellow-grey or hoary-white pubescence. Size larger. Epigynal area smaller.
 - a. Pubescence hoary white. Epigynal area a little larger, with two stout tubercles at base on either side. Average size much larger. *robusta*, Sim.
 - b. Pubescence yellow-grey. Epigynal area smaller, tubercles inconspicuous. Average size smaller. *ruricola*, De Geer.
 - 2. General hue deep umber-brown. Cephalothorax with golden-brown pubescence. Size smaller. Epigynal area larger *spinipalpis*, F. Cb.
- B. Abdomen often with a basal, central, dorsal dusky-outlined lanceolate band; but its area is not paler than the rest of dorsal area. Epigynal area broad, conspicuous, dark red-brown, almost semi-circular *terricola*, Thor.

The males can be recognized without any difficulty whatever, the palpi and the first pair of legs together furnishing most reliable characters. But I am unable to speak so confidently as to the distinguishing features of the females, though I fancy one might with accuracy determine the

identity of freshly caught specimens with the help of the above characters. The form of the epigyne varies so much in different specimens of the same species, that one will not be inclined to place too great reliance upon any characters furnished by it.

The teeth on the upper and lower margins of the fang-groove might, if constant, furnish good characters.

Synonymy.

Lycosa robusta, Sim. 1876.

Trochosa robusta, Kulcz. 1892.

Lycosa ruricola, De Geer, 1778.

Lycosa campestris, Bl. 1861.

Lycosa ruricola, Sim. 1876.

Trochosa ruricola, Cambr. 1881, Thor. 1872, Kulcz. 1892.

Lycosa terricola, Thor. 1856.

Lycosa agretyca, Bl. 1861.

Trochosa terricola, Thor. 1872, Cambr. 1881, Kulcz. 1892.

Lycosa terricola, Sim. 1876.

Genus PARDOSA.

(*Lycosa*.)

Pardosa purbeckensis, sp. n.

(Pl. IV. figs. 1, 4, 7, 8, 9.)

Male, ceph. 3·25, abd. 3·5 millim. or 3 lines; female, ceph. 4, abd. 5·5 millim. or 4½ lines.

Cephalothorax deep sienna-brown, clothed with sooty-black pubescence, having three narrow, longitudinal, bright yellow stripes—one in the centre extending from the caput, where it is attenuate, to the base; the others lying one on either side near the margin, extending from the clypeus to the base.

Falces bright yellow, having a central basal and lateral basal brown streak; the inner and apical margin is also brown.

Legs very long, brown on the upperside, spotted and streaked with black, bright yellow beneath; furnished with long spines and black hair. Protarsi i. in the male are furnished on either side with numerous very long, stiff, oblique bristles. In both sexes the legs are very hairy.

Abdomen deep brown, clothed with sooty-black pubescence and hairs, having an indistinct paler, lanceolate, dorsal central bar at the base, the pale hue being continued, though scarcely

perceptibly, to the spinners. Ventral area black, with a central series and two lateral series of dull pale guttulæ.

Sternum deep sienna-brown, with a pale lozenge-shaped central disk.

Epigyne of female consisting of a large red-brown, shiny, chitinous plate, narrow in front, springing from a transverse oval chitinous cup, dilating posteriorly, forming a large triangular plate, whose posterior angles are produced and slightly procurved. The posterior margin is often a little emarginate, and a broad furrow or depression runs through the middle.

This portion of the structure is exceedingly variable. It is impossible to give a figure which will represent all the forms, differing somewhat as they do in every specimen.

The same variability is noticeable also in the females of the closely allied species, *monticola* and *palustris*.

Palpus of male large. Femoral joint black at base, pale yellow at apex; patella pale yellow; tibiæ black, clothed with long hairs; tarsus deep black, clothed with black hairs, very large (larger in proportion even than in *palustris*), furnished with a claw at apex. The bulbous process at the base of the organs is very prominent, and the organs differ in character from those of closely allied species. It is, however, so difficult to examine this structure that, since there are other infallible characters for determining the identity of the species, it is scarcely worth while to make a very elaborate analysis of them.

This fine *Pardosa* belongs to the group which includes *herbigrada*, *monticola*, and *palustris*. There is, in reality, no difficulty in distinguishing them from each other.

This species, one of the largest of the "*Pardosas*," was exceedingly abundant on the western shores of Poole Harbour in May 1894. They were found very close to the water's edge, lurking beneath the rushes, running swiftly over the herbage during gleams of sunshine. The long hairs on the legs give them quite a feathery appearance, even when running, while the large size and black colour render them very distinct from any other species of the genus. Though more nearly resembling in general appearance *palustris*, yet the form of the epigyne and the slender tarsi of the first pair recall rather *monticola*, while *palustris*, not indeed in general appearance, but both by the form of epigyne and by the dilate tarsi, seems more nearly allied to *herbigrada*.

Pardosa purbeckensis, var. *minor*, F. Cb.

Length of male 5 millim. or $2\frac{1}{4}$ lines; female 5.5 millim. or $2\frac{1}{2}$ lines.

In April 1893 I met with numerous specimens of a spider closely allied to *monticola*, as witnessed by the great similarity of the *epigynal plate*, amongst grass on the shores of the Solway.

These I now find to be identical apparently in every respect, save their small size, with my new species *purbeckensis*.

It is, of course, possible that more specimens might prove the distinctness of the two species; but at present I am unable to find any character which I can consider sufficient for the purpose. There is, however, nothing extraordinary in the difference in size, for there is considerable difference between the climate of Poole Harbour and that of the more or less inhospitable shores of the Solway.

Pardosa palustris, Linn. (Pl. IV. figs. 6, 7, 8, 12.)

Male, ceph. 2·5, abd. 2·75 millim.; female, ceph. 3, abd. 3·5 millim.

The male may be instantly recognized by the pale yellow, tumid, dilate protarsi and tarsi of the first pair of legs, these being clothed with long silky hairs, but no long bristles. The central spur of the palpal organs has a very distinct long cusp at the base, similar to that of *purbeckensis*, but a little more curved.

The *epigyne* is very variable.

Abundant.

Pardosa monticola, Clerck.

(Pl. IV. figs. 5, 7, 8, 11.)

Male, ceph. 2·5, abd. 2·75 millim.; female, ceph. 3, abd. 3·5 millim.

The protarsi and tarsi of first pair of legs of male not tumid or dilate, clothed very sparingly with short silky hairs; no bristles. *Epigyne* very variable; posterior angles, however, always *procurved*, *i. e.* curved forwards.

Abundant.

Pardosa herbigrada, Blk.

(Pl. IV. figs. 2, 7, 8, 10.)

Male, ceph. 2·5, abd. 2·75 millim.; female, ceph. 3, abd. 4 millim.

Protarsi and tarsi of first pair of legs of male tumid, dilate, clothed with silky hairs. Central band on cephalothorax constricted about the middle and dilated again at the caput. *Epigyne* very large.

Rare.

The following table, though by no means exhausting the characters, nor based on those only which are strictly structural, will, I believe, be of some practical use:—

Males.

- A. Protarsi and tarsi of first pair of legs incrassate.
 - 1. Cephalothoracic bands as in female *herbigrada*, Blk.
 - 2. Cephalothoracic bands as in female *palustris*, Linn.
- B. Protarsi and tarsi not dilate, slender.
 - 1. Protarsi i. furnished with numerous very long bristles. Size much larger, 3 lines .. *purbeckensis*, F. Cb.
 - 2. Protarsi i. furnished with short hairs. Size much smaller, $1\frac{1}{2}$ lines *monticola*, Clk.

Females.

- A. Central white band on cephalothorax constricted towards caput and again dilated at its termination. Marginal band very broad *herbigrada*, Blk.
- B. Central yellow band finely attenuate towards caput. Marginal band very narrow.
 - a. Posterior angles of epigynal plate produced and procurved.
 - 1. Size much larger, 4 lines. Black..... *purbeckensis*, F. Cb.
 - 2. Size much smaller, $2\frac{1}{2}$ lines. Grey; abdomen with white spots *monticola*, Clk.
 - b. Posterior angles of epigynal plate uniformly rounded, often dilate, but never pointed, recurved, or procurved *palustris*, Linn.

Synonymy.

Pardosa palustris, Linn. 1758.

- Lycosa exigua*, Bl. 1861 (in part).
- Lycosa tarsalis*, L. K. 1870.
- Lycosa palustris*, Thor. 1872.
- Pardosa palustris*, Sim. 1876.
- Lycosa palustris*, Cambr. 1881, Kulez. 1892.

Pardosa monticola, Clk. 1757.

- Lycosa exigua*, Bl. 1861 (in part).
- Lycosa monticola*, L. K. 1870, Thor. 1872, Cambr. 1881, Kulez. 1892.
- Pardosa monticola*. Sim. 1876.

Pardosa herbigrada, Blk.

- Lycosa herbigrada*, Bl. 1861.

Genus PORRHOMMA, Sim.

Of the eight species noted under this genus in my last communication (Ann. & Mag. Nat. Hist. ser. 6, vol. xiii., Jan. 1894), two at least must be relegated to separate genera.

The species *P. montigena* seems, according to Prof. Kulcznski, not to be *P. montigena*, Sim., but a distinct species. It will therefore resume its specific name *niger*, F. Cb., and enter the genus *Oreoneta*, which this author has formed for its reception.

The species described as *P. adipatum*, L. K., unless there should appear any sufficient reason to the contrary, will fall under the genus *Macrargus*, Dahl.

Thus limited, the genus *Porrhomma* embraces a fairly homogeneous group of spiders.

By an oversight in my last paper a species is described under genus *Porrhomma* (not *Linyphia*, as quoted by Messrs. Evans and Carpenter *), with the specific name *Meadii*. This species had already been described as *microphthalma*, but my anxiety to honour the learned dipterologist who virtually discovered the species caused me to forget the honour due to the author who had long ago given to it the name *microphthalma*; and I have to thank Messrs. Evans and Carpenter for kindly pointing out this error.

The synonymy of this species should therefore run as follows:—

Porrhomma microphthalmum, Cb.

Neriene errans, Blk. (in part), 1864.

Linyphia microphthalma, Cb. Spid. Dor. 1879.

Linyphia incerta, Cb. Spid. Dor. 1879.

Linyphia decens, Cb. Spid. Dor. 1879.

Porrhomma Meadii, F. Cb. 1894.

Porrhomma egeria, Sim. (Pl. IV. figs. 13, 14.)

Length of male 2·5 millim.; female 3 millim. or 1½ line.

Cephalothorax, *falces*, *legs*, and *palpi* bright orange-red. Abdomen dull olive-green or white.

Legs furnished with long spines and hairs similar to those of *microphthalmum*, save those on the femora.

Femora i. with three spines, two on the inner side and a third in front towards the apex. Femora ii. with one single spine about the middle; none on femora iii. and iv.

The female sometimes has four spines on femora i. and two on femora ii., while one specimen had one on femora iii.

Protarsi without any spines.

Caput very high, convex, clothed with short hairs.

Eyes very minute, in some cases almost obsolete. In several specimens of both sexes the central anterior pair of

* 'A List of the Spiders of Edinburgh,' 1894, p. 560, note.

eyes had become entirely atrophied, and not a trace of them remained; in some cases the posterior centrals had disappeared, while in others the central anteriors had coalesced, forming an indistinct dark spot. Anterior row curved, convexity forward; centrals almost in contact, four diameters from laterals. Posterior row curved, convexity backward; centrals two diameters apart, five from the laterals; the four centrals forming a quadrangle a little longer than broad.

Clypeus quite twice the width of the ocular area, clothed with numerous short hairs directed forwards.

This species is closely allied to *myops* and *oblongum*, but can easily be distinguished from either. In *myops* femora i. has two spines only and in *oblongum* one only.

I should myself have been very much inclined to have considered these spiders identical with *myops*, had not M. E. Simon himself, to whom I submitted some examples, declared that they were without doubt *egeria*. I have, however, never seen the male of *myops*, and only a single specimen of the female.

Numerous specimens of both sexes, adult and immature, were taken by myself in the large cavern near Wells called Wookey Hole, in May 1894. It is probable that no daylight has penetrated its gloomy recesses for many thousand years; hence the degeneration of the visual organs in these spiders.

The first British specimens were taken near Rosslyn, in Scotland, in 1893 and 1894 ('A List of the Spiders of Edinburgh,' 1894, p. 560).

For the table of specific characters of *Porrhomma*, vide Ann. & Mag. Nat. Hist., Jan. 1894, p. 100, correcting as follows, to include *egeria* :—

- b. Anterior row of eyes strongly curved, convexity forwards. Eyes of both rows very small and wide apart. Central posteriors two diameters apart, four from laterals.
- 1. Femora i. with two or more spines. *Clypeus* at least twice the height of the ocular area.
 - a*. Femora i. with two spines, ii. with one spine *P. myops*, Sim.
 - b*. Femora i. with three spines, ii. with one spine *P. egeria*, Sim.
- 2. Femora i. with a single spine only, ii. with none. *Clypeus* only one quarter higher than the ocular area. *P. oblongum*, Cb.

Genus TETRAGNATHA, Latr.

Tetragnatha pinicola, L. K.

Males were taken by myself in the Lake Districts in

1892; males and females were also found in the collection of the Rev. O. Pickard-Cambridge.

Tetragnatha Solandrii, Scop.

Taken abundantly at Morden Park during the summer of 1894; specimens were found also in all the collections submitted to me from England, Ireland, and Scotland.

Tetragnatha nigrita, Lendl.

This fine species occurred only in the collection of the Rev. O. Pickard-Cambridge. Males and females.

Tetragnatha obtusa, L. K.

A few examples of this variable species occurred in my own collection and that of the Rev. O. Pickard-Cambridge.

These four species are now recorded for the first time as indigenous to Britain.

Genus LEPTYPHANTES, Menge.

Leptyphantes tenebricola, Wid.

An adult male was found in a tube marked "n. sp.?" taken at Armathwaite, near Carlisle, which certainly belongs to this species as diagnosed and figured by W. Kulcznski in 'Symb. ad Faunam Arach. Tirolensem,' 1887, p. 320, pl. vii. figs. 34, 35. Four or five males were also found in a collection from Scotland.

Notes on Rare Species, and Remarks on Synonyms.

Pardosa riparia, Clk.

The examination of numbers of specimens of *L. prativaga*, and the comparison of them with specimens taken to be *riparia*, C. L. K., has convinced me that we have not this latter species in England, but only the one species *prativaga*.

Immense numbers of this species were met with on May 15, 1894, along the western shores of Poole Harbour, and many others were taken about the same time in other parts of the country.

Drassus minusculus, L. K.

Drassus delinquens, Cb. Spid. Dor. p. 21.

Numerous specimens of both sexes were met with on May 17, 1894, under dry seaweed on the shores of Littlesea, near Studland.

Coryphæus glabriceps, F. Cb.

M. Simon, who has examined the type specimen, declares this species to be identical with his *Gongylidium distinctum*.

Marptusa muscosa, Clk.

Numerous examples of both sexes were taken under the stones of walls upon the downs between St. Aldhelm's Head and Swanage, in Sept. 1894. They were then found in all stages of growth, crouching beneath a small white silken sheet, the latter having an orifice at each end.

Tmeticus niger, F. Cb. (Ann. & Mag. N. H., Jan. 1891).

The synonymy of this species stands as follows :—

Genus OREONETA, Kulcznski, 1894.

Oreoneta niger, F. Cb.

Tmeticus niger, F. Cb. 1891.

Porrhomma nigrum, O. P. C., Proc. Dor. Nat. Hist. Soc. 1891.

Porrhomma montigena, F. Cb. 1894.

Microneta clypeata, F. Cb. (Ann. & Mag. N. H., Jan. 1894).

This species is identical with *Microneta decora*, Cb. (Trans. Linn. Soc. xxvii.).

Dysdera crocota, C. K.

Males and females of this fine spider were taken at Swanage on May 3rd, near Peveril Point.

Agræca inopina, Cb.

Adult females were taken near Peveril Point on May 3rd.

Linyphia furtiva, Cb.

A single adult male was taken in the Branksome Woods, Bournemouth, on June 12th; numerous adult females were taken near Bloxworth in July.

Scytodes thoracica, Latr.

Two young females were taken on an outhouse in Guernsey by Mr. W. A. Luff in 1894.

Salticus formicarius, Wlk.

An adult male was sent me by Mr. Luff during the summer; taken by Mr. Marquand in Guernsey.

Species new to Science.

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|--|--|---|
| <i>Agræca littoralis</i> , F. Cb., p. 26.
Pl. III. | | <i>Pardosa purbeckensis</i> , F. Cb., p. 32.
Pl. IV. |
| <i>Lycosa spinipalpis</i> , F. Cb., p. 28.
Pl. III. | | |

Species added to the British List since January 1894.

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|---|--|---|
| <i>Lycosa robusta</i> , Sim., p. 30. Pl. III. | | <i>Porrhomma egerii</i> , Sim., p. 36.
Pl. IV. |
| <i>Tetragnatha Solandrii</i> , Scop., p. 38. | | |
| — <i>pinicola</i> , L. K., p. 37. | | <i>Leptyphantes tenebricola</i> , Wid.,
p. 38. |
| — <i>obtusa</i> , C. K., p. 38. | | |
| — <i>nigrita</i> , Lendl., p. 38. | | |

Species noted or figured.

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|--|--|---|
| <i>Lycosa terricola</i> , Th., p. 30. Pl. III. | | <i>Agræca inopina</i> , Cb., p. 39. |
| — <i>ruricola</i> , De Geer, p. 30.
Pl. III. | | <i>Linyphia furtiva</i> , p. 39. |
| <i>Pardosa monticola</i> , Clk., p. 34.
Pl. IV. | | <i>Coryphæus glabriceps</i> , F. Cb. p. 39. |
| — <i>palustris</i> , Linn., p. 34. Pl. IV. | | <i>Porrhomma montigena</i> , Sim., p. 36. |
| — <i>herbigrada</i> , Blk., p. 34. Pl. IV. | | <i>Microneta clypeata</i> , F. Cb., p. 39. |
| <i>Dysdera crocota</i> , p. 39. | | <i>Marptusa muscosa</i> , p. 39. |
| <i>Drassus minusculus</i> , p. 38. | | <i>Scytodes thoracica</i> , Latr., p. 39. |
| | | <i>Salticus formicarius</i> , Wlk., p. 39. |

EXPLANATION OF THE PLATES.

PLATE III.

- Fig. 1. *Lycosa ruricola*, De Geer. Palpus of male from outside.
 Fig. 2. *Lycosa terricola*, Th. Palpus of male from outside.
 Fig. 3. *Lycosa robusta*, Sim. Palpus of male from outside.
 Fig. 4. *Lycosa spinipalpis*, sp. n. Palpus of male from outside.
 Fig. 5. Ditto. Female, full figure.
 Fig. 6. *Lycosa ruricola*, De Geer. Female; epigyne.
 Fig. 7. *Lycosa terricola*, Th. Female; epigyne.
 Fig. 8. *Lycosa robusta*, Sim. Female; epigyne.
 Fig. 9. *Lycosa spinipalpis*, sp. n. Female; epigyne.
 Fig. 10. *Lycosa ruricola*, De Geer. Male; right falx.
 Fig. 11. *Lycosa terricola, spinipalpis, robusta*. Male; right falx.
 Fig. 12. *Lycosa robusta*, Sim. Male; tarsus i.
 Fig. 13. *Lycosa ruricola*, De Geer. Male; protarsus and tarsus i.
 Fig. 14. *Lycosa terricola, spinipalpis*. Male; protarsus and tarsus i.
 Fig. 15. *Agræca littoralis*, sp. n.
 a. Female, full figure.
 b. Female; epigyne.
 c. Female; eyes and clypeus.
 d. Female; falces.
 e. Female; maxillæ and labium.

PLATE IV.

- Fig. 1. Pardosa purbeckensis*, sp. n.
 a. Palpus of male from outside. *b*, bulb; *c.s.*, central spur; *d*, apical lamina; *e*, lateral lamina.
 b. Palpus of male from inside.
- Fig. 2. Pardosa herbigrada*, Blk. Palpus of male from outside.
Fig. 3. Ditto. Palpus of male from beneath.
- Fig. 4. Pardosa purbeckensis*, sp. n. Palpus of male from beneath.
Fig. 5. Pardosa monticola, Clk. Palpus of male from outside and beneath.
- Fig. 6. Pardosa palustris*, Linn. Palpus of male from beneath.
Fig. 7.
 a. *Pardosa purbeckensis*, sp. n. Palpus; central spur.
 b. *Pardosa palustris*, Linn. Palpus; central spur.
 c. *Pardosa monticola*, Clk. Palpus; central spur.
 d. *Pardosa herbigrada*, Blk. Palpus; central spur.
- Fig. 8.*
 a. *Pardosa purbeckensis*, sp. n. Protarsus and tarsus i.
 b. *Pardosa palustris*, Linn. Protarsus and tarsus i.
 c. *Pardosa monticola*, Clk. Protarsus and tarsus i.
 d. *Pardosa herbigrada*, Blk. Protarsus and tarsus i.
- Fig. 9. Pardosa purbeckensis.* Female; epigyne.
Fig. 10. Pardosa herbigrada, Blk. Female; epigyne.
Fig. 11. Pardosa monticola, Clk. Female; epigyne.
Fig. 12. Pardosa palustris, Linn. Female; epigyne.
Fig. 13. Porrhomma egeria, Sim.
 a. Female; central anterior eyes atrophied.
 b. Female; central posterior eyes atrophied.
 c. Male; eyes and clypeus, with relative widths.
 d.—1. Left palpus of male. 2. Falciform process.
- Fig. 14. Porrhomma egeria*, Sim.
 a. Female; epigyne.
 b. Female; femur i. with three characteristic spines.

VI.—*Descriptions of some new Species of Heterocera from the Eastern Islands and Tropical America.* By HERBERT DRUCE, F.L.S.

Agaristidæ.

Agarista proerosia, sp. n.

Male.—Primaries rich reddish brown, crossed about the middle from the costal margin almost to the anal angle by a rather wide cream-coloured band; the veins and several indistinct markings near the base thickly irrorated with metallic steel-coloured scales; the fringe black: secondaries black-brown; a small space on the anal angle cream-colour; the fringe white. Underside of both wings brown, with the white markings as above. Head, thorax, and abdomen

black; front of head, underside of the palpi, and inner side of the tegulæ cream-colour; antennæ and upperside of palpi black; underside of the thorax and anus bright orange.—*Female* very similar to the male.

Expanse 3 inches.

Hab. Key Island (*Mus. Druce*).

Agarista daria, sp. n.

Female.—Primaries black, partly crossed from the subcostal vein by three white bands—the first two quite short, the third extending almost to the anal angle; a waved line of metallic-blue scales between each white band; the fringe black: secondaries pure white, broadly bordered with black; the fringe white. Head, antennæ, palpi, thorax, and abdomen black; four white dots on the front of the thorax; underside of the thorax orange; legs orange and black.

Expanse $2\frac{1}{2}$ inches.

Hab. Lindi (*Mus. Druce*).

This species is allied to *A. occurata*, Swinhoe.

Agarista puciolia, sp. n.

Male.—Primaries dark brownish black, irrorated with metallic scales along the veins at the base, and crossed from the costal margin to near the inner margin by three pale yellow bands—the first near the base, the second about the middle and widest near the inner margin, the third beyond slightly convex; the fringe black, white at the apex and anal angle: secondaries bright chrome-yellow. The outer and inner margin and a band crossing the middle of the wing from the costal dark brownish black; the fringe at the anal angle yellow. Head and thorax black, the thorax with three yellowish-white stripes; abdomen yellow, banded with black; legs yellow; antennæ black, the tips yellow.

Expanse 2 inches.

Hab. Philippine Islands (*Mus. Druce*).

Very distinct from any other species known to me.

Ægocera darocana, sp. n.

Male.—Primaries creamy white, the costal margin and a broken band crossing the wing beyond the middle blue-black, the apex black, irrorated with metallic scales; the fringe white: secondaries pale yellow, broadly bordered with black at the apex. Head and thorax black, the collar cream-

colour; abdomen with some spots at the base; the anus and underside black; the legs black; antennæ black.

Expanse $1\frac{1}{2}$ inch.

Hab. Lindi (*Mus. Druce*).

Zygænidæ.

Syntomis polusca, sp. n.

Male.—Primaries bright glossy bluish black; a small spot at the base, the cell, two spots below the cell, an oval spot on the costal margin, and two small spots beyond the cell all clear hyaline; the fringe black: secondaries yellow, broadly bordered with glossy bluish black. Head, antennæ, and thorax black; abdomen glossy blue-black, banded with yellow at the base and along each side; legs black.

Expanse $1\frac{3}{10}$ inch.

Hab. Philippine Islands (*Mus. Druce*).

Syntomis laomedia, sp. n.

Primaries black, a square spot at the base, the cell, and a row of three elongated spots crossing the wing beyond the cell all hyaline: secondaries deep black, with a small hyaline spot close to the base; the fringes of both wings black. Head, antennæ, thorax, abdomen, and legs black; the abdomen banded with yellow at the base and on the underside nearest the anus.

Expanse $1\frac{1}{4}$ inch.

Hab. Philippine Islands (*Mus. Druce*).

Syntomis chea, sp. n.

Primaries black; a streak at the base, the cell, a large square-shaped spot below the cell, and three oblong spots beyond the cell all hyaline: secondaries black, a spot at the base and a round clot at anal angle both hyaline. Head, thorax, abdomen, and legs black, the fourth segment of the abdomen bright orange-yellow; antennæ black, the tip white.

Expanse $1\frac{1}{2}$ inch.

Hab. Philippine Islands (*Mus. Druce*).

Eupyra sages, sp. n.

Male.—Primaries black, shot with bronze-green from the base to beyond the middle; hyaline white spots the same as in *E. Salmoni*, with the addition of a very small spot between the two nearest the apex: secondaries hyaline white, broadly

bordered with black, with two very minute hyaline white dots close to the apex. Head, thorax, and abdomen black; tegulæ and collar spotted with white; abdomen with a metallic-green band down the middle from the base to the anus, the sides spotted with white; antennæ and palpi black; legs black, banded with white.

Expanse 2 inches.

Hab. Bolivia (*Mus. Druce*).

Cosmosoma demantria, sp. n.

Primaries hyaline, the apex broadly bordered with black, the outer and inner margin edged with black; a spot at the end of the cell and the veins black: secondaries hyaline, the apex, outer and inner margin edged with black; antennæ black, tipped with white. Head, front of the collar, and a small spot on each side bright metallic blue; thorax, abdomen, and legs bright vermilion-red; abdomen with a bright metallic-blue band, extending from the base to the anus; the underside of the abdomen black and white.

Expanse $1\frac{3}{4}$ inch.

Hab. Dominica (*Mus. Druce*).

Eunomia daltha, sp. n.

Primaries hyaline, veins and margins black; the base of the wing black, shot with blue: secondaries hyaline, broadly bordered with black from the apex to the anal angle; a small hyaline spot on the black margin close to the apex. Head and antennæ black, a small white spot on each side of the head; collar metallic blue; tegulæ black, with a white spot at the base and a blue line on the inner side; thorax and abdomen black, the latter banded with blue on each segment; abdomen with some white spots on each side; anal tuft black and red; front of the palpi, underside of thorax, and abdomen white.

Expanse $1\frac{3}{4}$ inch.

Hab. Para (*Mus. Druce*).

Belemnica splendens, sp. n.

Male.—Primaries black, shot from the base not quite to the middle with metallic green, beyond which a dull red band crosses the wing near the apex, but does not reach either margin; the fringe black: secondaries brilliant morpho-blue, bordered with black from the apex to the anal angle; upon the black border are a submarginal row of bright carmine

spots, which become indistinct near the anal angle. Head, antennæ, and palpi black; collar black, spotted with metallic green; thorax black, striped with metallic green; abdomen bright metallic blue, with a narrow black line down the middle from the base to the apex, the underside bright carmine. Underside: both wings black, shot with bright blue at the base; primaries with a wide U-shaped carmine mark in the middle of the wing, but not touching either margin; secondaries broadly banded on the outer margin with carmine.

Expanse 2 inches.

Hab. Bolivia (*Mus. Druce*).

Arctiidæ.

Ischnognatha striata, sp. n.

Male.—Primaries brownish black, the veins yellow; a wide pale yellow band crosses the wing beyond the middle from the costal margin to the anal angle: secondaries bright yellow, broadly bordered with black on the costal, outer, and inner margins. Head yellow; thorax and abdomen black, front of the thorax and sides of the abdomen banded with yellow; underside of the abdomen yellow; anus, antennæ, and legs black.

Expanse $1\frac{3}{4}$ inch.

Hab. Costa Rica.

Cratoplastis romula, sp. n.

Male.—Primaries greyish black, the veins slightly paler near the base; a large oval semihyaline white spot at the end of the cell; the fringe dark grey: secondaries semihyaline white, broadly bordered with bluish black on the costal margin, at the apex, outer and inner margin. Head and anus bright orange; antennæ, thorax, and abdomen greyish black; a greyish-white line extends from the base of the abdomen almost to the anus; legs greyish black.

Expanse $1\frac{1}{2}$ inch.

Hab. Costa Rica.

Eucereon darantasia, sp. n.

Female.—Primaries dark brown; the veins, a line beyond the cell, and a waved submarginal line pale brown; a whitish spot in the middle of the cell; the fringe dark brown: secondaries dusky semihyaline from the base to about the

middle. Underside of both wings dusky black, almost without markings. Antennæ and palpi black; head, thorax, abdomen, and legs dark brown; tegulæ dark brown, edged with chrome-yellow; anus chrome-yellow on the upperside.

Expanse 2 inches.

Hab. Costa Rica.

Eucereon rububa, sp. n.

Male.—Primaries dusky white, clouded with dark brown about the middle, at the apex, and along the outer and inner margin: secondaries semihyaline white, clouded with brown at the apex and very slightly along the outer margin. Head, antennæ, palpi, thorax, abdomen, and legs all black.

Expanse $1\frac{1}{4}$ inch.

Hab. Costa Rica.

Pseudapistosia saduca, sp. n.

Male.—Primaries dark brown, crossed from the costal to the inner margin with four bands of pale greyish brown, the two bands nearest the outer margin broken into small lines near the anal angle: secondaries dusky hyaline white, the veins dark brown, the apex and outer margin dark brown. Head white; palpi, antennæ, and legs dark brown; thorax and basal segments of the abdomen dark brown; abdomen chrome-yellow, each segment edged with brown.—*Female* very similar to the male, but altogether darker in colour, and with the base of the abdomen banded with yellow; the underside of the abdomen in both sexes deep black.

Expanse, ♂ 2, ♀ $2\frac{1}{2}$ inches.

Hab. Mexico (*Mus. Druce*); Costa Rica.

In the Mexican specimens before me the secondaries of the females are darker in colour than those from Costa Rica.

PERICOPINÆ.

Eucyane rhætia, sp. n.

Male.—Primaries deep black, dark blue at the base, crossed beyond the middle by a narrow white band, which extends from the costal margin to the anal angle; the fringe white at the apex, black on the outer margin: secondaries black, shot with bright dark blue at the base and along the inner margin; a row of four very minute white spots close to the anal angle; the fringe white. Head, antennæ, palpi, and thorax black; abdomen above dark blue, on the underside dark red; legs black, banded with white.—*Female* similar to the male, but

larger, not shot with blue at the base of the primaries; a round red spot about the middle of the costal margin on the primaries.

Expanse, ♂ 2, ♀ 3 inches.

Hab. Bolivia (*Mus. Druce*).

Eucyane dejanira, sp. n.

Primaries black, crossed about the middle from the costal to the inner margin by a wide white band; a large red round spot on costal margin on the inner side of the white band, but not joined to it; the fringe black: secondaries blue-black, with a wide white band partly crossing the wing near the apex; the fringe white at the apex and near the anal angle. Head, antennæ, thorax, and legs black; abdomen blue-black above on the underside; the three anal segments are edged with reddish brown.

Expanse $2\frac{1}{4}$ inches.

Hab. South Brazil (*Mus. Druce*).

Eucyane ruscia, sp. n.

Male.—Primaries black, crossed from the middle of the costal margin to the anal angle by a wide orange-yellow band: secondaries blue-black, with three orange-yellow spots on the middle of the outer margin; the fringe of both wings black; head, palpi, antennæ, and thorax black; abdomen blue-black.

Expanse $2\frac{1}{4}$ inches.

Hab. Bolivia (*Mus. Druce*).

Pericopsis meta, sp. n.

Primaries black, crossed about the middle by a wide uneven pale yellow band, which becomes narrow near the apex; a row of small yellow spots close to the apex, and a submarginal row of small spots extends from the apex to the anal angle; the fringe black: secondaries pale yellow; the veins black, each vein being broadly edged with black on both sides; the outer margin narrowly edged with black. Head, antennæ, thorax, and legs black; abdomen dark brown above, pale yellow on the underside.

Expanse 3 inches.

Hab. Colombia (*Mus. Druce*).

Anthomyza Swainsoni, sp. n.

Anthomyza tiresia, Swains. Zool. Ill. ser. 2, vol. iii. t. cxxiv. fig. 1;
Dunc. Nat. Libr., Exot. Moths, p. 97, t. iv. fig. 2 (nec Cramer).

Hab. South-east Brazil (*Mus. Druce*).

The species figured by Swainson and Duncan is quite distinct from that figured by Cramer, and requires to be named. The specimens before me are identical with both figures above quoted.

Anthomyza brotes, sp. n.

Male.—Primaries deep black, crossed by two pale yellow bands, the first about the middle, the second beyond near the apex, the veins crossing the yellow bands black; four small white dots at the apex and two close to the anal angle; the fringe black: secondaries pale primrose-yellow, very broadly bordered with black; the veins black; a spot at the apex and four small dots on the outer margin near the anal angle all white. Head, antennæ, and thorax deep black; abdomen blackish brown, on the underside pale cream-colour; legs black above, yellowish white on the underside.—*Female* very similar to the male, but slightly larger.

Expanse, ♂ 3, ♀ $3\frac{1}{4}$ inches.

Hab. British Guiana (*Mus. Druce*).

Anthomyza praxila, sp. n.

Male.—Primaries black, with three white spots on the costal margin close to the base and a triangular yellow mark on the inner margin near the base; a wide semihyaline band crosses the wing about the middle from the costal margin almost to the inner margin, but not quite reaching it, beyond which a narrow semihyaline band partly crosses the wing near the apex; a submarginal row of seven white spots extends from the apex to the anal angle: secondaries semihyaline from the base to about the middle; the outer half of the wing deep black, with a marginal row of large white spots extending from the apex to the anal angle. Head, antennæ, thorax, and upperside of abdomen black, the underside yellowish; the base of the thorax banded with white.—*Female* similar to the male.

Expanse, ♂ ♀, $3\frac{1}{2}$ inches.

Hab. Colombia (*Mus. Druce*).

Anthomyza Buckleyi, sp. n.

Male.—Primaries brownish hyaline; the base, a band crossing the wing at the end of the cell, the apex, costal, outer, and part of the inner margin all black; the costal margin close to the base spotted with yellowish white; a triangular yellowish-brown mark on the inner margin; four white dots on the apex and two on the outer margin near the anal angle:

secondaries brownish hyaline, bordered with black from the apex to the anal angle, and a submarginal row of white dots; the veins and fringes of both wings black. Head, antennæ, thorax, and abdomen black; the collar and tegulæ spotted with white; underside of the abdomen pale yellowish brown.

—*Female* very similar to the male, but paler hyaline.

Expanse, ♂ $3\frac{4}{10}$, ♀ 4 inches.

Hab. Ecuador (*Mus. Druce*).

Laparidæ.

Xenosoma gigantea, sp. n.

Primaries and secondaries semihyaline white; primaries slightly shaded with yellow at the base and along the inner margin; the fringe of both wings white. Head, underside of thorax, and legs pale yellow; antennæ black; thorax and abdomen yellowish white.

Expanse $2\frac{3}{4}$ inches.

Hab. British Honduras (*Mus. Druce*).

Notodontidæ.

Tifama (?) *dardania*, sp. n.

Female.—Primaries: the base and the costal margin nearly to the apex dark brown, shading inwardly to about the middle of the wing to bright reddish brown, where it is thickly irrorated with white scales; from the middle of the wing to the outer margin pale primrose-colour; the apex almost pink; two small dark yellow spots on the middle of the outer margin; the fringe primrose-colour, excepting at the apex, where it is almost pink: secondaries greyish brown, shading to pale primrose-colour on the outer margin; the fringe primrose-colour. Head and antennæ reddish brown; collar pale yellow, shot with reddish brown; tegulæ silver-grey; thorax and abdomen brown, the sides of the abdomen and the anus yellow; legs brown.

Expanse 3 inches.

Hab. Costa Rica.

Heterocampa argentata, sp. n.

Primaries silvery grey; the costal margin, inner margin, and veins near the inner margin spotted with black; a rather large black spot close to the anal angle; the fringe alternately black and grey: secondaries pale greyish fawn-colour, dusky at the apex and round the outer margin; a small

black spot at the anal angle. Head, thorax, and tegulæ silvery grey; antennæ yellowish brown; abdomen greyish fawn-colour; legs grey.

Expanse $2\frac{1}{4}$ inches.

Hab. Costa Rica.

Nystalea sambana, sp. n.

Female.—Primaries dusky grey, with several reddish-brown spots at the apex; a black curved line crosses the wing near the base from the costal to the inner margin; a large silvery-grey patch at the anal angle, extending partly along the inner margin: secondaries pale grey, broadly bordered from the apex to the anal angle by darker grey; the fringe silvery grey. The head, collar, and tegulæ yellowish brown; thorax silvery grey; abdomen dusky grey; underside pale grey; anus yellowish brown.

Expanse $2\frac{3}{4}$ inches.

Hab. Costa Rica.

Nystalea denea, sp. n.

Male.—Primaries greyish fawn-colour; two small black dots at the end of the cell, from which a black line bordered with reddish brown and with a small white streak in the middle extends to the outer margin; a dark brown spot and streak on the inner margin close to the base; several faint brown marks near the anal angle: secondaries dusky fawn-colour, darkest at the apex and round the outer margin; the fringe pale greyish fawn-colour. The head and front of the thorax reddish brown; antennæ yellowish brown; tegulæ and thorax greyish fawn-colour; the base of the abdomen yellowish, the upperside of the abdomen blackish grey, underside paler; the anal tuft greyish fawn-colour.—*Female* very similar to the male, but larger and rather darker in colour.

Expanse, ♂ $2\frac{1}{2}$, ♀ 3 inches.

Hab. Costa Rica.

VII.—*On some new and rare Crustacea from Scotland.* By THOMAS SCOTT, F.L.S., Naturalist to the Fishery Board for Scotland, and ANDREW SCOTT, Fisheries Assistant, University College, Liverpool.

[Plates V. & VI.]

IN the following notes we propose to record some interesting Scotch species of Copepoda, including, among others, a few that appear to be undescribed, and also a curious form

discovered in Germany some years ago by Dr. Poppe, but which has not hitherto been known to occur in the British seas.

Leptopsyllus intermedius, sp. nov. (Pl. V. figs. 1-11.)

Description of the Species.—Female. Length $\cdot 58$ millim. ($\frac{1}{43}$ of an inch). Body elongate, slender. Anterior antennæ eight-jointed, short, moderately stout; the first five joints gradually decrease in length, the fifth and sixth are equal; the seventh is shorter than any of the others, while the last is equal to the combined lengths of the two joints immediately preceding. The antennæ are provided with numerous moderately long setæ, and a stout filament springs from the upper distal edge of the fourth joint. The subjoined formula shows the number and proportional lengths of the joints—

Proportional lengths of the joints ..	22	13	10	9	6	6	4	10
Number of the joints	1	2	3	4	5	6	7	8

Posterior antennæ and mouth-organs somewhat similar to those of *Leptopsyllus Robertsoni*, T. and A. Scott, but smaller; the end joint of the distal branch of the mandible-palp is also proportionally shorter (fig. 4). The outer and inner branches of the first pair of swimming-feet, which are both two-jointed, are nearly of equal length (fig. 5). The second and third pairs resemble those of *Leptopsyllus Robertsoni* (fig. 6). In the fourth pair the outer branches are two- and the inner branches one-, or indistinctly two-jointed (fig. 7). The basal joints of the fifth pair are coalescent and form together a broad lamelliform plate, subtriangular in outline; the margin on each side from the apex to the secondary joint is slightly convex, and immediately behind the secondary joints the margins are produced into broad and somewhat rounded lobes, each lobe being furnished with a moderately stout seta; the secondary joints are very small (fig. 8). Caudal stylets fully twice the length of the last abdominal segment and equal in breadth to nearly half the length; they are each furnished with a terminal spine nearly as long as the stylet (fig. 10). One ovisac containing a few large ova.

Male. The male is similar to the female, except that the anterior antennæ are modified and hinged for grasping, and resemble in structure those of *Leptopsyllus Robertsoni*. The basal joints of the fifth pair of thoracic feet, which are also coalescent, are considerably shorter than those of the female, and terminate in two broadly convex lobes, one on each side of the median line; each lobe is fringed with minute hairs; the secondary branches are very small (fig. 9).

Habitat. In pools near low-water mark on the shore at Musselburgh, Firth of Forth; not uncommon.

Remarks. This may be distinguished from any other species of *Leptopsyllus* known to us by the structure of the anterior antennæ and of the fourth and fifth pairs of thoracic feet.

Mesochra spinicauda, sp. n. (Pl. V. figs. 12-25.)

Description of the Species.—*Female.* Length .58 millim. ($\frac{1}{4\frac{2}{3}}$ of an inch). Body elongate, cylindrical, slender. Anterior antennæ slender, rather longer than the first cephalothoracic segment, seven-jointed; the second joint much longer and the fifth shorter than the others. The formula shows the proportional lengths of all the joints—

Proportional lengths of the joints..	6 . 20 . 6 . 8 . 4 . 8 . 11
Number of the joints	1 2 3 4 5 6 7

The first joint of the posterior antennæ is short, the second elongate and nearly twice the length of the last joint; secondary branch very small, articulated to the lower proximal half of the second joint (fig. 15). The mandible-palp consists of a single moderately long narrow joint, which bears a few marginal and terminal setæ (fig. 16). The armature of the maxilla somewhat resembles that of the mandible, and the maxilla-palp is a narrow cylindrical process furnished with a few setæ at its truncate apex and bearing a small lateral lobe, which forms the base of a slender hair. Posterior foot-jaws large; terminal joints very small and forming the base of long slender claws (fig. 19). Inner branches of the first pair of swimming-feet somewhat longer than the outer branches and composed of two nearly equal joints; the first joint of the outer branches is about twice the length of the second, while the second and third are nearly of equal length (fig. 20). The second, third, and fourth pairs are slender and elongate; the inner branches of the fourth pair, which, like those of the preceding pairs, are composed of two nearly equal joints, extend beyond the second joint of the outer branches, and each of the joints bears two minute spines placed widely apart on the inner margin, while the outer margin is partly fringed with small setæ (fig. 21). Fifth pair foliaceous; the inner portion of the basal joints is produced into a subtriangular lobe that extends slightly beyond the secondary joints, and terminates in a stout setiform elongate spine; the inner margin of the basal joints is also provided with a fringe of minute hairs and with a slender seta near the apex; the outer

angles of the same joints are furnished with a long slender seta; the secondary branches are small and bear each four setæ on the outer margin and apex, the apical seta being longer than the others, while the upper two are small (fig. 22). Caudal stylets short; the end of each stylet is prolonged interiorly into a stout spiniform process, and bears a few setæ exteriorly (fig. 24). One ovisac, with a number of moderately large ova.

Male. The male closely resembles the female in general form, but the anterior antennæ are eight-jointed and strongly hinged, the second joint is much longer, and the third and fifth shorter than any of the others. The fifth pair of thoracic feet are nearly as in the female; the sixth pair of appendages (the appendages of the first abdominal segment) are small, subquadrate in outline, and are each armed with a stout spine and two setæ on the apical margin, as shown in the drawing (fig. 23).

Habitat. In pools near low-water on the shore at Musselburgh, Firth of Forth; frequent.

Remarks. The posterior foot-jaws with their extremely long terminal claws form a prominent character in this species and one by which it was readily distinguished from the other Copepoda among which it occurred in the shore-gathering from Musselburgh. The peculiar appearance of the caudal stylets which is represented in the full-sized drawing (fig. 12) is also a marked character; the setæ, as shown in the drawing referred to, extend upwards at an obtuse angle from the terminal spine, to which they seem to be attached when viewed laterally; and this peculiar appearance was observed in all the specimens obtained. The structure of the first pair of swimming-feet resembles somewhat that of the same pair in *Mesochra Robertsoni*, Brady, and in some species of *Attheyella*.

Mesochra MacIntoshi, sp. n.

(Pl. V. figs. 26, 27; Pl. VI. figs. 1-7.)

Description of the Species.—*Female.* Length .6 millim. ($\frac{1}{12}$ of an inch). Body elongate, cylindrical, very slender. Anterior antennæ rather longer than the first cephalothoracic segment, eight-jointed, the penultimate joint being considerably shorter than any of the others, as shown by the formula—

Proportional lengths of the joints	11	. 22	. 16	. 11	. 8½	. 8½	. 4	. 9
Number of the joints	1	2	3	4	5	6	7	8

Posterior antennæ three-jointed, second and third joints elongate and subequal, the first short, about half as long as the second; secondary branch very small, one-jointed, and articulated to the lower distal end of the first joint of the primary branch. Mandibles narrow, cylindrical, armed with a few moderately long teeth; basal portion of mandible-palp stout, somewhat dilated, and furnished with a small one-jointed branch at the apex (fig. 4, Pl. VI.). Posterior foot-jaws small, the first two joints moderately stout, the last very small and forming the base of a slender and comparatively short claw (fig. 26, Pl. V.). The first pair of swimming-feet resemble those of *Mesochra Lilljeborgii*, Boeck, except that the end joints of the inner branches are proportionally longer, being equal to about half the length of the first joint (fig. 5, Pl. VI.). Outer branches of the second, third, and fourth pairs elongate; inner branches short, two-jointed (fig. 6, Pl. VI.). Fifth pair foliaceous, small; the basal joints are subquadrangular, and their width equal to nearly twice the length; but the slightly produced inner portion is triangular and furnished with two setæ on the inner margin and one at the apex; secondary joints subquadrate, being nearly as broad as long, and bearing six setæ, arranged at slightly irregular intervals round the outer margin and end; the second seta, counting from the inside, is much longer than any of the others (fig. 7, Pl. VI.). Caudal stylets short, length rather greater than the width, each provided with several setæ, the principal seta being equal to nearly three fourths of the length of the animal.

No males of this species were observed.

Habitat. In pools near low-water mark on the shore at Musselburgh, Firth of Forth; not uncommon.

Remarks. This very slender Copepod does not resemble a typical *Mesochra*, but from its general form seems rather to belong to that peculiar group represented by *Cylindropsyllus* and *Leptopsyllus*. In the structure of its various appendages, however, it is a true *Mesochra*. The first pair of swimming-feet closely resemble those of *Mesochra Lilljeborgii*, differing only in the proportionally greater length of the end-joint of the inner branches. The small clawed posterior foot-jaws and the peculiar form of the fifth pair of thoracic feet are, however, very good and distinct specific characters, independent of the elongate and slender form of the animal.

The species is named in compliment to Prof. W. C. M'Intosh, the Scientific Director of the Fishery Board for Scotland.

Pseudowestwoodia pygmæa, sp. n. (Pl. VI. figs. 8-16.)

Description of the Species.—*Female.* Length $\cdot 4$ millim. ($\frac{1}{25}$ of an inch). Very like *Westwoodia nobilis* (Baird) in general appearance, but smaller. Anterior antennæ short, seven-jointed; the first two basal joints are moderately stout, the fourth, fifth, and sixth are subequal in length and much shorter than the others, as shown by the formula—

Proportional lengths of the joints. .	12	12	11	4	4	5	8
Number of the joints	1	2	3	4	5	6	7

Posterior antennæ slender and similar to those of *Pseudowestwoodia Andrewi*, T. Scott*. The basal joint of the mandible-palp is slender and elongate, but the two end-joints are very short and are furnished with several setæ. The maxillæ are small, the distal half is only about half the width of the comparatively broad basal portion, and is armed with several spine-like teeth, while three narrow processes spring from the large notch formed by the sudden contracting of the exterior margin; these processes are subequal in length and reach to about the middle of the biting part; they are each furnished with several small setæ; the two inner processes are also armed with an elongate slender spine (fig. 10). Anterior foot-jaws small, provided with a strong terminal claw, and also with three narrow processes on the distal half of the inner margin, each of which bears a few small terminal setæ (fig. 11). Posterior foot-jaws somewhat similar to those of *Pseudowestwoodia Andrewi*, but rather more robust. The first pair of swimming-feet are also similar to those of that species, but the inner branches have the first joint proportionally longer and are armed with two stout and elongate terminal spines; the longest of the two is about twice the length of the other and fully half as long as the entire length of the inner branch; the end-joint of the inner branches has a pseudo-division extending across the middle of it (fig. 13). The second, third, and fourth pairs are nearly as in *Pseudowestwoodia Andrewi* (fig. 14). Fifth pair small; the basal joint has a somewhat semicircular outline, but the width is greater than the length, and the inner portion is scarcely produced beyond the base of the secondary joint; there are five stout setæ arranged round the distal part of the margin, the middle seta being considerably longer than the others; the exterior angle of the basal joint extends into a narrow

* See 'Twelfth Annual Report of the Fishery Board for Scotland,' part iii. p. 257, pl. ix. figs. 21-29.

process twice as long as broad and furnished with a long slender terminal seta; the secondary joints are small, subovate, with irregular margins, and carry five setæ—one at the apex, one on the inner margin, and three on the outer margin; the apical seta is longer than the others (fig. 15). Caudal stylets very short.

Habitat. Cromarty Firth; near Dunbar, at the mouth of the Firth of Forth; Port Erin, Isle of Man.

Remarks. This small species closely resembles *Pseudowestwoodia Andrewi* in size and in general appearance, but differs distinctly from it in the structure of the anterior antennæ and of the first and fifth feet. It appears to have an extensive distribution.

Pseudowestwoodia major, sp. n. (Pl. VI. figs. 17–20.)

Description of the Species.—Female. Length $\cdot 6$ millim. ($\frac{1}{4\frac{1}{2}}$ of an inch). In general appearance closely resembling the species just described, but larger (fig. 17). Anterior antennæ eight-jointed, the first two stout, the others more slender; the two end-joints are subequal and shorter than any of the other six joints. The proportional lengths of all the joints are shown by the formula—

Proportional lengths of the joints..	15	15	18	12	8	8	5	6
Number of the joints	1	2	3	4	5	6	7	8

The posterior antennæ and mouth-organs are somewhat like those of the last species, but the second joint of the posterior foot-jaws bears a small seta near the middle of the inner margin, and both the outer and inner margins are partially fringed with minute hairs; there are also two setæ at the base of the terminal claw. The first pair of swimming-feet have the first joint of the inner branches proportionally more elongate than that of the same pair in either of the other two species of *Pseudowestwoodia*, the first joint of the inner branches in this species being equal to fully twice the length of the outer branches; the end-joints, like those of the inner branches of the first pair in the species just described, have a pseudodivision across the middle, while the armature of both the inner and outer branches is very strong (fig. 19). The second, third, and fourth pairs are very similar to those in the other two species. Fifth pair large, foliaceous; basal joint nearly as long as broad; the inner portion, which reaches to the extremity of the secondary joint, bears five stout setiferous spines round the broadly and irregularly curved apex; the exterior angle is not produced, but is

bluntly rounded and furnished with one moderately long and a few minute setæ; the basal joint is also fringed with small setæ round the outer margin and end; secondary joint sub-cylindrical and provided with five spiniform and coarsely plumose terminal setæ (fig. 20). Caudal stylets very short.

Habitat. Vicinity of Granton and of Dunbar, Firth of Forth; rare.

Remarks. This species is considerably larger than either of the other two *Pseudowestwoodias*, and hence the specific name we have adopted for it; it differs from both, particularly in the structure of the anterior antennæ and in the form of the fifth pair of swimming-feet; the inner branches of the first pair are also observed to be distinctly more elongate, even without dissection. All the three species closely resemble *Westwoodia nobilis* (Baird) in general appearance, and may, on that account, have been overlooked by students of the Copepoda.

Huntemannia jadensis, S. A. Poppe.
(Pl. VI. figs. 21, 22.)

1884. *Huntemannia jadensis*, Poppe, "Ein neues Copepoden Genus aus der Jade," Abhandl. d. nat. Ver. zu Bremen, Bd. ix. p. 57.

1885. *Huntemannia jadensis*, Poppe, "Die Freilebenden Copepoden des Jadebusens," *op. cit.* Bd. xi. p. 167, Taf. vii. figs. 10-20.

We have much pleasure in recording this curious species for the first time for Britain. It was obtained in brackish pools just beyond high-water mark of ordinary spring tides, at the head of West Loch Tarbert, Argyllshire; several specimens were obtained. These West Loch Tarbert specimens agree in every particular with Dr. Poppe's description and figures, except that the outer branches of the first pair of swimming-feet are three- instead of two-jointed, as shown by our drawing (fig. 22); but this difference may be due to local variation. The anterior antennæ are five-jointed, stout, and strongly setiferous (fig. 21).

The following is Dr. Poppe's definition of the genus:—

"*Huntemannia*, nov. gen.—Körper vollständig gegliedert, mit einem spitz ausgezogenen Rostrum versehen. Vordere Antennen beim ♀ fünfgliedrig, beim ♂ zu Greiforganen umgewandelt. Hintere Antennen zweigliedrig, mit eingliedrigem Nebenast versehen. Erstes Fusspaar zweiästig, von den nachfolgenden Fusspaaren abweichend mit zweigliedrigem Aussenast und eingliedrigem Innenast. Die drei folgenden Fusspaare mit rudimentärem Innen- und zweigliedrigem Aussenaste. Das iii. Fusspaar beim ♂ von dem des ♀ abweichend. Mandibularpalpus einästig. Un-

terer Maxillarfuss schwächig, mit einem Greifhaken versehen. Furcalanhänge beim ♂ und ♀ verschieden gestaltet. Zwei Eiersäcke."

Thalestris mysis, Claus.

This very distinct species was during the last summer observed by us for the first time in the Firth of Forth. The large foliaceous fifth pair of swimming-feet are closely and obliquely striate, the striæ being quite distinct. *Thalestris mysis* appears to be comparatively rare in Britain; there are few Scotch records for it, and its occurrence in the Forth is therefore of interest.

EXPLANATION OF THE PLATES.

PLATE V.

Leptopsyllus intermedius, sp. n.

- Fig. 1.* Female, seen from the side, $\times 80$ (A, front view of ovisac).
 2. Anterior antenna, $\times 500$. 3. Posterior antenna, $\times 500$.
 4. Mandible and palp, $\times 500$. 5. Foot of first pair of swimming-feet, $\times 380$. 6. Foot of second pair, $\times 380$. 7. Foot of fourth pair, $\times 380$. 8. Fifth pair, female, $\times 253$. 9. Fifth pair, male, $\times 253$. 10. Abdomen and caudal stylets, dorsal view, $\times 80$. 11. Male spermatophore, $\times 380$.

Mesochra spinicauda, sp. n.

- Fig. 12.* Female, seen from the side, $\times 80$. 13. Anterior antenna, female, $\times 380$. 14. Anterior antenna, male, $\times 380$. 15. Posterior antenna, $\times 380$. 16. Mandible and palp, $\times 380$. 17. Maxilla, $\times 380$. 18. Anterior foot-jaw, $\times 380$. 19. Posterior foot-jaw, $\times 380$. 20. Foot of first pair of swimming-feet, $\times 380$. 21. Foot of fourth pair, $\times 380$. 22. Foot of fifth pair, female, $\times 380$. 23. Foot of fifth pair, male (A, appendage to first abdominal appendage), $\times 380$. 24. Abdomen and caudal stylets, dorsal view, $\times 80$. 25. Male spermatophore, $\times 380$.

Mesochra MacIntoshi, sp. n.

- Fig. 26.* Posterior foot-jaw, $\times 760$. 27. Abdomen and caudal stylets, dorsal view, $\times 80$.

PLATE VI.

Mesochra MacIntoshi, sp. n.

- Fig. 1.* Female, seen from the side, $\times 80$. 2. Anterior antenna, $\times 253$. 3. Posterior antenna, $\times 253$. 4. Mandible and palp, $\times 380$. 5. Foot of first pair of swimming-feet, $\times 383$. 6. Foot of fourth pair, $\times 253$. 7. Foot of fifth pair, $\times 380$.

Pseudowestwoodia pygmaea, sp. n.

- Fig. 8.* Female, seen from the side, $\times 80$. 9. Anterior antenna, $\times 380$.

10. Maxilla, $\times 380$. 11. Anterior foot-jaw, $\times 380$. 12. Posterior foot-jaw, $\times 380$. 13. Foot of first pair of swimming-feet, $\times 253$. 14. Foot of fourth pair, $\times 253$. 15. Foot of fifth pair, $\times 330$. 16. Abdomen and caudal stylets, dorsal view, $\times 126$.

Pseudowestwoodia major, sp. n.

Fig. 17. Female, seen from the side, $\times 64$. 18. Anterior antenna, $\times 253$. 19. Foot of first pair of swimming-feet, $\times 253$. 20. Foot of fifth pair, $\times 190$.

Huntemannia jadensis, S. A. Poppe.

Fig. 21. Anterior antenna, female, $\times 253$. 22. Foot of first pair of swimming-feet, $\times 253$.

VIII.—Notes on the Palæozoic Bivalved Entomostraca.—
No. XXXI.* *Some Devonian Species*. By Professor T.
RUPERT JONES, F.R.S., F.G.S., &c.

[Plate VII.]

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3. *Primitia nitida* (Roemer), figs. 1 and 2.
4. *Primitia lavigata*, sp. n., fig. 3.
5. *Entomis serratostrata* (Sandberger), fig. 6.
6. *Barychilina* (?) *semen*, sp. n., fig. 5.
7. *Beyrichia strictisulcata*, sp. n., fig. 11.
8. *Bollia varians*, sp. n., figs. 8–10.
9. *Drepanella serotina*, sp. n., fig. 12.
10. *Streptula* (?) *annulata*, sp. n., fig. 13.

I. Introduction.

In the 'Jahrbücher des Nassauischen Vereins für Naturkunde,' Jahrgang xlii. 1889, Dr. Fridolin von Sandberger, treating of the lower division of the Devonian System in Nassau, enumerated certain fossil Entomostraca from the Lower Spirifer-Sandstone of Offdillen (or Offdilln), in the north part of the Dillenburg District, at pages 33, 34, 37, 38, and 95, namely:—

* No. XXX. was published in the Ann. & Mag. Nat. Hist. ser. 6, vol. ix. 1892, pp. 302–307.

1. *Beyrichia strictisulcata*, Sandberger, MS.
2. — (*Bollia*) *obliqua*, Sandb. MS., corrected in 1890 to *devonica*, Jones.
3. — (*Strepula*) *annulata*, Sandb. MS.
4. *Primitia sacculus*, Sandb. MS.

Dr. F. von Sandberger some time since favoured me with either specimens or drawings of these and some other Devonian forms, namely:—

5. *Bollia varians*, Sandberger, MS. Dillenburg.
6. *Drepanella serotina*, Sandb. MS. Dillenburg.
7. *Entomis nitida* (F. A. Roemer). Altenau, Harz.
8. — ? *semen*, Sandb. MS. Brünn, Moravia.
9. — *serratostrata* (Sandb.). Cabrières, France.
10. — ? *laevigata*, Sandb. MS. Armenia.
11. *Aparchites reticulatus*, sp. n. Armenia.

II. Description of the Species.

1. *Aparchites reticulatus*, sp. n.
(Pl. VII. figs. 4 a, 4 b, 4 c.)

Length. millim.	Height. millim.	Thickness of carapace. millim.
1·1	·65	·5

Somewhat scaphoid and leperditoid in shape, but without distinct dorsal angles, and thicker at the smaller than at the other end*. This has evidently alliances with the Lower-Silurian *Aparchites mutus*, Jones (*Cytheropsis concinna*?, Jones, Ann. & Mag. Nat. Hist. ser. 3, vol. i. 1858, p. 254, pl. ix. fig. 3; *Primitia muta*, Jones and Holl, *op. cit.* vol. xvi. 1865, p. 425; *Aparchites mutus*, Jones, *op. cit.* ser. 6, vol. iii. 1889, p. 385), with the Devonian *A. mitis*, Jones (Contrib. Canad. Micropal., Part III., 1891, p. 91, pl. xi. fig. 15); and with the Upper-Silurian *Aparchites concinnus*, Jones (*Cytheropsis*, Ann. & Mag. Nat. Hist. ser. 3, vol. i. 1858, p. 249, pl. x. figs. 3, 4; *Primitia*, *op. cit.* vol. xvi. 1865, p. 424, collated with *P. minuta* † (Eichwald), Quart. Journ. Geol. Soc. vol. xlvi. 1890, p. 7, pl. iii. figs. 18–23).

* The greater convexity at the higher end of the valve is an unusual feature. It occurs in *Primitia scitula*, Jones, and in *Bythocypris indianensis*, Ulrich. The lower and more compressed end of the carapace is the anterior end in most of the Ostracoda; but the above-mentioned species and others seem to be exceptions to this rule.

† Such of these individuals as have a slight mid-dorsal depression belong to E. O. Ulrich's new genus *Leperdit[i]ella* ('Lower-Silurian Ostracoda of Minnesota,' 1894, p. 636). A good account of *Aparchites* is given at p. 643 of this memoir.

The foregoing have a smooth surface, as is usual with this genus; whereas the specimen under notice has a minutely reticulate ornament. It occurs with *Primitia lævigata* (fig. 3) in a micaceous and calcareous shale, thin, hard, brittle, and brownish, from the Arpatschai Valley in Armenia; collected by Dr. G. Sievens during a journey in the Caucasus (see Dr. Fr. v. Sandberger's note in the 'Neues Jahrb. f. Min., &c., 1873, p. 58), where these and probably other species are associated with *Spirifer calcaratus*, J. Sow. (= *Sp. Verneuli*, Murchison), and *Rhynchonella cuboides*.

The reticulation much resembles that of *Bythocypris? favulosa*, Jones, Americ. Geol., December 1889, p. 338, figs. 1 and 2. The latter is figured with its convex border upwards, and is more oblique and much narrower.

2. *Primitia mundula*, Jones, var. *sacculus*, nov.
Sandberger, MS. (Pl. VII. fig. 7.)

Length.	Height.
millim.	millim.
·8	·5

Beyrichia mundula, Jones, Ann. & Mag. Nat. Hist. ser. 2, vol. xvi. 1855, pp. 90 and 174, pl. v. fig. 23, and pl. vi. fig. 26 ("simplex, var."), and figs. 28-31.

Primitia mundula, Jones and Holl, ibid. ser. 3, vol. xvi. 1865, p. 419.

Primitia mundula, Jones, Proceed. Geol. Assoc., "Palæoz. Biv. Entom.," 1869, pp. 8, 10, and 13, figs. i. and ii.

Primitia mundula, Jones, Ann. & Mag. Nat. Hist. ser. 6, vol. iii. 1869, pp. 375 and 378, pl. xvi. figs. 1 and 2, 4-9, pl. xvii. fig. 1, and woodcut, fig. 2, p. 376.

Primitia mundula, Jones, Americ. Geologist, December 1889, p. 337.

Primitia mundula, var., Jones, Quart. Journ. Geol. Soc. vol. xlv. 1890, p. 5, pl. iv. fig. 7.

Primitia mundula and varieties, Jones, Contrib. Canad. Micropalæont., Part III., 1891, p. 64, pl. x. figs. 8 and 9, and p. 72.

Primitia mundula, Krause, Zeitsch. Deutsch. geol. Gesell. vol. xliii. 1891, p. 495, pl. xxx. figs. 5-7.

Primitia mundula and varieties, Jones, Quart. Journ. Geol. Soc. vol. xlix. 1893, pp. 291 and 299, pl. xii. figs. 2-6, and pl. xiii. figs. 11-15.

This hollow cast of the right-hand valve of *Primitia* is rather more oval than the typical form (see Ann. & Mag. Nat. Hist. ser. 6, vol. iii. p. 376, woodcut, fig. 2, and pl. xvi. fig. 9). Among the many varieties that have been noticed, modifications in the outline of the valves and in the dimensions of the sulcus are frequent. In this instance the sub-oblong valve (its edges seem to be fully represented in the intaglio cast) has the ends not quite equal in curvature, but more so than in the type-form; and the sulcus stretches

further across the valve. It is not very different from *P. nitida*, figs. 1 and 2 of the accompanying Plate.

This specimen occurs (with *Spirigerina reticularis*?) in a dark grey, fine-grained, Lower-Devonian sandstone, belonging to the Spirifer-Sandstone of Offdillen, in the north part of the Dillenburg District, Nassau. It is the form referred to as *Primitia sacculus* by Prof. F. von Sandberger in the 'Jahrbüch. Nassau. Naturk.,' Heft 42, 1889, pp. 33, 34, 37, 38; and from Prof. v. Sandberger's information I gather that a similar form occurs in the Lower Devonian at Stadtfeld, in the Eifel.

There are other Primitian forms in this hand-specimen, rather obscure, but longer and more reniform than fig. 7; and *Beyrichia strictisulcata*, fig. 11, is present in some abundance.

3. *Primitia nitida* (F. A. Roemer).

(Pl. VII. figs. 1 *a*, *b*, 2 *a*, *b*.)

	Length. millim.	Height. millim.	Thickness of carapace. millim.
Fig. 1:	1·3	1·0	·5
Fig. 2:	2·0	1·4	1·0

Cypridina nitida, F. A. Roemer, Palæontographica, vol. iii. part ii. 1852, p. 28, pl. iv. figs. 20 *a*, *b*.

Suboblong, rounded at the ends, boldly curved on the ventral and nearly straight on the dorsal border; surface convex, more so behind than before, black and shining, but minutely pitted with a delicate reticulation, such as is seen on *P. mundula* (Ann. & Mag. Nat. Hist. 1889, iii. pl. xvi. figs. 2 *a* and 6 *a*), and much smaller than fig. 4 *c* of the present Plate. It bears also the usual sulcus, more exactly mid-dorsal (fig. 2 *a*) than in *P. mundula*, and reaching to the centre of the valve, where it slightly expands (fig. 1 *a*), and in a larger (older?) shell it has contracted in its middle and left a round pit where it terminated (fig. 2 *a*). These features are liable to much modification, and Roemer's representation of the little tubercle and pit at the end of the furrow may be sufficiently accurate, as, indeed, is his general description.

P. nitida has nearly the shape of *P. mundula* (Ann. & Mag. Nat. Hist., Sept. 1855, pl. vi. fig. 29 *a*), but has a more reniform outline, longer sulcus, and apparently no marginal rim.

The two specimens here figured occur with several others in a piece of black limestone (with *Pterinea ventricosa*, Goldfuss, and *Cardiola retrostriata*, Buch), belonging to the Upper-Devonian Goniaticen-Kalk, at Altenau, in the Harz. It was sent by F. A. Roemer to Fr. von Sandberger, but does not seem to contain the specimen figured by Roemer.

4. *Primitia laevigata* (Sandberger, MS.), sp. n.
(Pl. VII. figs. 3 a, b.)

Length. millim.	Height. millim.	Thickness of carapace. millim.
·9	·55	·4

Scaphoid in outline, with straight back, obliquely curved ventral margin, semicircular hinder and contracted front margin, sloping upwards (broken). Sulcus on the anterior third, relatively large. Surface gently and uniformly convex, smooth, as far as shown by the small remaining patches of the test.

This occurs, together with *Aparchites reticulatus* (fig. 4), in the little piece of thin Upper-Devonian limestone from Armenia, referred to at page 61.

5. *Entomis serratostrata* (Sandberger).
(Pl. VII. figs. 6 a, 6 b.)

Length. millim.	Height. millim.	Thickness of carapace. millim.
1·6	·95	·6

Ann. & Mag. Nat. Hist. ser. 6, vol. vi. 1890, p. 320 (for synonyms),
pl. xi. figs. 1 a, b, 2 a, b.

The form of these little fossil valves is so often and so much modified by pressure that it is difficult to define their exact shape. The specimen here figured is probably as near to the original form as any we have met with.

It occurs (with *Spirigerina reticularis?* and *Pterinea ventricosa?*) in a dark grey Upper-Devonian Limestone (weathering ferruginous), from Cabières, near Montpellier, France.

6. *Barychilina? semen*, Sandberger, MS., sp. n.
(Pl. VII. figs. 5 a, 5 b.)

Length. millim.	Height. millim.
·95	·6

This little oval striated valve has the aspect of being a near relative to *Entomis serratostrata*, but it has no furrow, only a central pit, and its superficial ornament differs in having rows of definite meshes between the striæ, some rectangular in single rows, and some in double rows, with a line of angular (vandyke) junction. This ornament reminds us of that of *Entomis (Barychilina?) variostrata*, Clarke (Ann. & Mag.

Nat. Hist., October 1890, p. 323, pl. xi. fig. 6 *b*). Possibly this species (*ibid.* figs. 5–8) should be separated from *Entomis*. Fig. 8 *a* has a resemblance to the form distinguished by E. O. Ulrich as *Barychilina* (Journ. Cincinn. Soc. N. H. vol. xiii. 1891, p. 199, pl. xiii. figs. 1–4), which has longitudinal and sinuous striæ, with pitted interstices, unequal and thick valves, without a mid-dorsal furrow, though Ulrich's fig. 2 *a* seems to have a trace of it. *E. variostriata* in its younger stages has the definite Entomidian sulcus, and, as other species of this genus occasionally exchange the furrow for a pit, it would not be necessary to make a separate genus on that ground. The different style of ornament, however—prickly ridges in one and meshed interstices in the other—may be a reason, as well as the coarser growth of the valves.

Some of the Devonian *Entomides* appear to have had simple and smooth striæ (for instance, figs. 9 and 18, pl. xi., Ann. & Mag. Nat. Hist. ser. 5, vol. iv. 1879); but *E. serratostriata* had prickles along its costulæ or raised striæ (see page 521, Ann. & Mag. Nat. Hist. ser. 6, vol. vi. 1890), indications of which are little pits in the hollow casts or impressions (intaglio) of the valves, and not filling the breadth of the interspaces. *E. variostriata*, on the contrary, shows a square meshwork (fig. 6 *b*, pl. xi., *op. cit.*), of relatively large pattern, filling the space between the striæ.

Among the more or less modified specimens of *E. serratostriata* (Ann. & Mag. Nat. Hist. ser. 5, vol. iv. 1879, p. 104, pl. xi.) fig. 9 shows the pit only; in figs. 2 and 14 a faint trace of the sulcus accompanies the central spot; and in fig. 9 both are absent. The collocation, however, and general mutual resemblance of the numerous specimens support the idea that they are congeneric and specifically the same.

In well-preserved specimens *E. variostriata*, Clarke (*ibid.* vol. vi. 1890, p. 323, pl. xi. fig. 8 *a*), has the pit instead of the sulcus, whilst figs. 5–7 show the sulcus only. So also in *Primitia* we may have—(1) the furrow, (2) furrow and pit, (3) pit only.

On account of the different style of ornament and the coarser growth of the valves there is reason for making the separate genus (*Barychilina*); and, even if it has no sulcus at right angles with the hinge-line, but only a central pit, we find that some allied genera have similar modifications.

Barychilina semen is from the Devonian Limestone with *Clymenia annulata*, Münster, at Hadiberg, near Brünn, Moravia.

7. *Beyrichia strictisulcata*, Sandberger, MS., sp. n.
(Pl. VII. fig. 11.)

Length.	Height.
millim.	millim.
·66	·43

This oblong *Beyrichia* is allied to *B. Klædeni* by its well-developed three ridges, which, as in somewhat similar forms, stand out nearly equal, equidistant, and almost parallel. It is sufficiently distinct, however, to bear Prof. von Sandberger's proposed name of *strictisulcata*.

It occurs, together with *Atrypa* and *Primitia sacculus*, in the dark grey, fine-grained sandstone at Offdillen above mentioned, and is fairly abundant.

8. *Bollia varians*, Sandberger, MS., sp. n.
(Pl. VII. figs. 8-10.)

	Length.	Height.
	millim.	millim.
Fig. 8 :	·93	·5
Fig. 9 :	·96	·43 (distorted)
Fig. 10 :	·73	·36

This characteristic *Bollia* is longer and more nearly oblong than the majority of the published figures of this genus. The form most closely allied is *Bollia ungula* (Claypole, MS.), Jones, Amer. Geologist, December 1889, p. 338, figs. 10-13. The chief differences are :—(1) in the Nassau specimens here figured the inner, semicircular, or horse-shoe ridge is not so thick and is more open ; (2) the dorsal end of one half of the horse-shoe forms a knob in figs. 8 and 10 ; (3) the second ridge is larger and more distinct than in *B. ungula*, though (as in the Pennsylvanian examples here referred to) its ventral portion is sometimes evanescent.

B. unguoidea and *subæquata*, Ulrich, and *B. semilunata*, Jones, are shorter, rounder, and otherwise different ; so also is *B. Hindei*, Jones, in which both tops of the horse-shoe ridge are contracted to knobs ; and this is a feature with one of the tops in both *unguoidea* and *subæquata*.

The specific characters of these German specimens (figs. 8-10) are well marked, and the unstable features of the curved ridges support Prof. von Sandberger's suggested name of *variens* for this species, which is rather rare in the Lower Devonian of Offdillen, Dillenburg, Nassau.

9. *Drepanella serotina*, Sandberger, MS., sp. n.
(Pl. VII. fig. 12.)

Length.	Height.
millim.	millim.
·76	·46

For an account of the genus *Drepanella* see Ulrich's memoirs (Journ. Cincinn. Soc. N. H. vol. xiii. 1890, p. 117, and Geol. Surv. Minnes., Last Report, vol. iii. 1894, p. 670). The present form may look upon *D. ampla*, Ulrich (1890, p. 120, pl. viii. fig. 2), as a near ally, although the sickle-shaped ridge on the ventral region is shortened to a straight thick ridge, and the two pointed knobs above are represented by two unequal roundish tubercles. Hence the species is different for the German form; and von Sandberger's name *serotina* may well be adopted for this *late*, if not *last*, representative of the genus.

Drepanella seems to have been an outcome of *Bollia* rather than of *Beyrichia*; but its evolution is not a matter for discussion at present.

From the Lower Devonian of Offdillen, Dillenburg, Nassau.

10. *Strepula? annulata*, Sandberger, MS., sp. n.
(Pl. VII. fig. 13.)

Length.	Height.
millim.	millim.
·63	·36

This very curious little unique form was found on a large block of the *Orthoceras*-Schiefer (Lower Devonian) at Offdillen; and fig. 13 is copied from the drawing supplied by Prof. von Sandberger. The outer ridges and central elevations are not quite comparable with the features of any known *Strepula*, but to that genus the present example seems to have the nearest affinity.

EXPLANATION OF PLATE VII.

[The figures 1-7 are magnified 20 diameters, excepting figs. 4c and 5b, which are $\times 60$. Figs. 8-13 $\times 30$ diam.]

- | | |
|--|------------------|
| Fig. 1. <i>Primitia nitida</i> (F. Roemer). a, left valve; b, edge view. | } Altenau, Harz. |
| Fig. 2. The same, an older individual. a, left valve; b, edge view. | |
| Fig. 3. <i>Primitia levigata</i> , sp. n. a, left valve; b, edge view. | } Armenia. |
| Fig. 4. <i>Aparchites reticulatus</i> , sp. n. a, right valve; b, edge view; c, portion of ornament. | |

- Fig. 5. *Barychilina?* *semen*, sp. n. *a*, right? valve; *b*, portion of ornament. Moravia.
 Fig. 6. *Entomis serratostrata* (Sandb.). *a*, left valve; *b*, edge view. France.
 Fig. 7. *Primitia mundula*, var. *sacculus*, nov. Hollow cast of right valve.
 Fig. 8. *Bollia varians*, sp. n. Right valve.
 Fig. 9. The same. Left valve.
 Fig. 10. The same. Right valve.
 Fig. 11. *Beyrichia strictisulcata*, sp. n.
 Fig. 12. *Drepanella serotina*, sp. n.
 Fig. 13. *Strepula?* *annulata*, sp. n.

} Offdillen, Dillenburg, Nassau.

IX.—*Descriptions of new Coleoptera from New Zealand.*
 By Captain THOS. BROWN.

[Continued from vol. xiv. p. 428.]

List of Species.

Group PSELAPHIDÆ.

- Pselaphus ventralis*.
Bryaxis Hectori.
Sagola rugifrons.
 — *spinifer*.
 — *eminens*.
Euplectus tumipes.
 — *parvulus*.
 — *modestus*.
 — *arohaensis*.
 — *foveiceps*.
 — *semiopacus*.
 — *pusillus*.

Group SILPHIDÆ.

- Silphotelus nitidus*.
Bæosilpha rufescens.
Mesagyrtes scabripes.
Choleva marginalis.
 — *suturalis*.

Group COLYDIDÆ.

- Coxelus thoracicus*.

Group BOTHRIDERIDÆ.

- Bothrideres obsoletus*.

Group LATHRIDIIDÆ.

- Lathridius sulcifrons*.
Corticaria clarula.

Group COPRIDÆ.

- Saphobius tibialis*.

Group LUCANIDÆ.

- Mitophyllus cylindricus*.
 — *angusticeps*.

Group MELOLONTHIDÆ.

- Psilodontria viridescens*.
Pæcilodiscus pulcher.
Odontria obscura.

Group ELATERIDÆ.

- Lomemus puncticollis*.
Zeaglophus pilicornis.

Group DASCYLLIDÆ.

- Cyprobium terrenus*.
Veronatus amplus.
Cyphon McKerrowi.

Group MELYRIDÆ.

- Dasytes nigripes*.

Group CIOIDÆ.

- Cis fulgens*.
 — *pygmæus*.
 — *lobipès*.

Group OPATRIDÆ.	Group CRYPTORHYNCHIDÆ.
Paraphylax binodosus.	Psepholax crassicornis.
Group TRACHYSCELIDÆ.	Dendrostygnus calcaratus.
Chærodes fuscatus.	Schylus nigricollis.
Group DIAPERIDÆ.	Scelodolichus politus.
Menimus lævicollis.	— squamosus.
Group TENEBRIONIDÆ.	Group COSSONIDÆ.
Demetrius carinulatus.	Pentarthrum Philpotti.
Group CISTELIDÆ.	— antennale.
Omedes apterus.	Group SCOLYTIIDÆ.
Group SALPINGIDÆ.	Acrantus opacus.
Salpingus ornatus.	Group ANTHRIBIDÆ.
Group OTIORHYNCHIDÆ.	Anthribus flavipilus.
Catoptes spermophilus.	Group LAMIIDÆ.
— æqualis.	Somatidia pcticorne.
Group ERIRHINIDÆ.	Group EUMOLPIDÆ.
Pactola humeralis.	Atrichatus æneicollis.

Group Pselaphidæ.

The more complex genera have been divided into sections, each distinguished by one or more easily seen characters. This arrangement, I am well aware, is not perfect, but it will be an aid to the discrimination of the numerous species now found to exist. The numbers prefixed to many of the names refer to the 'Manual of New Zealand Coleoptera.'

PSELAPHUS.

Sect. I.—Eyes moderately large and prominent.

226. <i>P. pauper</i> , Sharp.	1867. <i>P. citimus</i> , Broun.
227. <i>P. pilistriatus</i> , Broun.	1868. <i>P. meliuseculus</i> , Broun.
1156. <i>P. dulcis</i> , Broun.	2462. <i>P. Cavelli</i> , Broun.

Sect. II.—Eyes small or abortive.

1696. <i>P. cæcus</i> , Broun.	1697. <i>P. delicatus</i> , Broun.
2462. <i>P. sculicollis</i> , Broun.	<i>P. ventralis</i> , Broun.

BRYAXIS.

Sect. I.—Antennæ 11-articulate in both sexes.

228. <i>B. inflata</i> , Sharp.	240. <i>B. grata</i> , Sharp.
229. <i>B. Sharpi</i> , Broun.	242. <i>B. nasuta</i> , Broun.
2346. <i>B. platynota</i> , Broun.	1478. <i>B. punctata</i> , Broun.
231. <i>B. micans</i> , Sharp.	1479. <i>B. calcarata</i> , Broun.
233. <i>B. piciceps</i> , Broun.	1869. <i>B. latipennis</i> , Broun.
238. <i>B. deformis</i> , Sharp.	1155. <i>B. ignota</i> , Broun.

Sect. II.—Antennæ 10-articulate in the males; ninth joint large, prolonged outwardly.

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|--|---|
| 232. <i>B. platyarthra</i> , <i>Broun.</i> | 2464. <i>B. conspicua</i> , <i>Broun.</i> |
| 1347. <i>B. rudicorne</i> , <i>Broun.</i> | 2465. <i>B. costata</i> , <i>Broun.</i> |

Sect. III.—Ninth joint large, oblong or elongate.

- | | |
|---|--|
| 237. <i>B. crassicornis</i> , <i>Broun.</i> | 1476. <i>B. glabrata</i> , <i>Broun.</i> |
| 239. <i>B. impar</i> , <i>Sharp.</i> | 1477. <i>B. nemoralis</i> , <i>Broun.</i> |
| 243. <i>B. fulvitaris</i> , <i>Broun.</i> | 1873. <i>B. foveatissima</i> , <i>Broun.</i> |
| 234. <i>B. dispar</i> , <i>Sharp.</i> | <i>B. setifer</i> , <i>Broun.</i> |

Sect. IV.—Ninth joint large, quadrate.

- | | |
|---|------------------------------------|
| 236. <i>B. mundula</i> , <i>Broun.</i> | <i>B. diversa</i> , <i>Broun.</i> |
| 1870. <i>B. decens</i> , <i>Broun.</i> | <i>B. Hectorsi</i> , <i>Broun.</i> |
| 1872. <i>B. forficulida</i> , <i>Broun.</i> | |

Sect. V.—Ninth joint large, subtriangular.

- | | |
|--|--|
| 235. <i>B. impressifrons</i> , <i>Broun.</i> | 1871. <i>B. Munroi</i> , <i>Broun.</i> |
| 1645. <i>B. sylvicola</i> , <i>Broun.</i> | <i>B. allocera</i> , <i>Broun.</i> |
| 1699. <i>B. fraudulenta</i> , <i>Broun.</i> | |

Sect. VI.—Joints 4 to 8 transverse.

1154. *B. pagana*, *Broun.*

Sect. VII.—Ninth joint transverse, tenth large.

241. *B. altula*, *Broun.*

SAGOLA.

Sect. I.—Claws of posterior tarsi as large as the tarsi themselves.

251. *S. notabilis*, *Broun.*
2466. *S. macronyx*, *Broun.*

Sect. II.—Dilated sides of thorax marked off by the anterior prolongation of the lateral foveæ.

- | | |
|---|---|
| 250. <i>S. pulcher</i> , <i>Broun.</i> | 1579. <i>S. brevitarsis</i> , <i>Broun.</i> |
| 252. <i>S. deformipes</i> , <i>Broun.</i> | 1883. <i>S. parallela</i> , <i>Broun.</i> |
| 2468. <i>S. robusta</i> , <i>Broun.</i> | <i>S. citima</i> , <i>Broun.</i> |
| 1574. <i>S. excavata</i> , <i>Broun.</i> | |

Sect. III.—Head with laterally distended hind angles like *Cucujus*.

- | | |
|--|--|
| 1157. <i>S. genale</i> , <i>Broun.</i> | 1873. <i>S. castanea</i> , <i>Broun.</i> |
| 1875. <i>S. insignis</i> , <i>Broun.</i> | <i>S. eminens</i> , <i>Broun.</i> |

Sect. IV.—Head with hind angles as wide as the eyes, genæ nearly straight.

- | | |
|--|---|
| 246. <i>S. major</i> , <i>Sharp.</i> | 1877. <i>S. sobrina</i> , <i>Broun.</i> |
| 1882. <i>S. ruficeps</i> , <i>Broun.</i> | 2467. <i>S. mimica</i> , <i>Broun.</i> |
| 1576. <i>S. osculans</i> , <i>Broun.</i> | <i>S. pertinax</i> , <i>Broun.</i> |

Sect. V.—Head rounded and narrowed behind.

- | | |
|--|--|
| 1575. <i>S. sulcator</i> , <i>Broun.</i> | <i>S. lineata</i> , <i>Broun.</i> |
| 1581. <i>S. duplicata</i> , <i>Broun.</i> | 247. <i>S. prisca</i> , <i>Sharp.</i> |
| 1876. <i>S. hirtalis</i> , <i>Broun.</i> | 248. <i>S. misella</i> , <i>Sharp.</i> |
| 1878. <i>S. rectipes</i> , <i>Broun.</i> | 249. <i>S. parva</i> , <i>Sharp.</i> |
| 1580. <i>S. bipunctata</i> , <i>Broun.</i> | |

Sect. VI.—Head rounded behind, anterior femora notched in the males.

- | | |
|---|--|
| 1480. <i>S. terricola</i> , <i>Broun.</i> | 1879. <i>S. insolens</i> , <i>Broun.</i> |
| 1577. <i>S. fovealis</i> , <i>Broun.</i> | 2471. <i>S. flavipes</i> , <i>Broun.</i> |
| 1583. <i>S. convexa</i> , <i>Broun.</i> | <i>S. rugifrons</i> , <i>Broun.</i> |

Sect. VII.—Head broad, hind angles obtuse.

- | | |
|---|--|
| 1578. <i>S. elevata</i> , <i>Broun.</i> | 253. <i>S. denticollis</i> , <i>Broun.</i> |
| 1881. <i>S. fulva</i> , <i>Broun.</i> | |

Sect. VIII.—Head with obtuse hind angles, genæ nearly straight.

- | | |
|--|--|
| 1884. <i>S. anisarthra</i> , <i>Broun.</i> | 2472. <i>S. elongata</i> , <i>Broun.</i> |
| 1880. <i>S. punctata</i> , <i>Broun.</i> | <i>S. spinifer</i> , <i>Broun.</i> |

Sect. IX.—Head with a fringed lamina underneath in the males, not narrowed behind.

2469. *S. laminata*, *Broun.*
 2470. *S. immota*, probably female of 2469.

Sect. X.—Body slender, head broad behind.

1582. *S. tenuis*, *Broun.*
 2473. *S. gracilis*, *Broun.*

EUPLECTUS.

Sect. I.—Head trigonal, front (sometimes middle) femora incrassate; species resembling *Dalma* in miniature.

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|--|--|
| 1700. <i>E. eminens</i> , <i>Broun.</i> | 1650. <i>E. obnissus</i> , <i>Broun.</i> |
| 1889. <i>E. scruposus</i> , <i>Broun.</i> | <i>E. tumipes</i> , <i>Broun.</i> |
| 1647. <i>E. patruelis</i> , <i>Broun.</i> | <i>E. parvulus</i> , <i>Broun.</i> |
| 1894. <i>E. personatus</i> , <i>Broun.</i> | <i>E. modestus</i> , <i>Broun.</i> |
| 1649. <i>E. ovithorax</i> , <i>Broun.</i> | |

Sect. II.—Head large, antennal tubercles very large and considerably elevated.

2475. *E. lævifrons*, *Broun.*

Sect. III.—Tubercles moderately elevated, eyes prominent, thorax with median groove.

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|---|--|
| 255. <i>E. trisulcicollis</i> , <i>Broun.</i> | 1895. <i>E. unicus</i> , <i>Broun.</i> |
| 2476. <i>E. spinifer</i> , <i>Broun.</i> | 2477. <i>E. Munroi</i> , <i>Broun.</i> |

Sect. IV.—Thorax with median groove, eyes not prominent.

- | | |
|---|---|
| 1648. <i>E. monticola</i> , <i>Broun.</i> | 1646. <i>E. crassipes</i> , <i>Broun.</i> |
| 1651. <i>E. vacuus</i> , <i>Broun.</i> | 258. <i>E. opacus</i> , <i>Sharp.</i> |

Sect. V.—Thorax without median groove, eyes moderate.

- | | |
|--|---|
| 254. <i>E. convexus</i> , <i>Sharp</i> . | 1652. <i>E. incomptus</i> , <i>Broun</i> . |
| 1888. <i>E. validus</i> , <i>Broun</i> . | 261. <i>E. brevitarsis</i> , <i>Broun</i> . |
| 1654. <i>E. U-impressus</i> , <i>Broun</i> . | 257. <i>E. longulus</i> , <i>Broun</i> . |
| 1655. <i>E. cereus</i> , <i>Broun</i> . | <i>E. arohaensis</i> , <i>Broun</i> . |
| 1896. <i>E. patronus</i> , <i>Broun</i> . | |

Sect. VI.—Head and thorax distinctly punctured, the latter with median groove.

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| 256. <i>E. asper</i> , <i>Broun</i> . | 2479. <i>E. coxalis</i> , <i>Broun</i> . |
| 1701. <i>E. auripilus</i> , <i>Broun</i> . | 1886. <i>E. mœrens</i> , <i>Broun</i> . |
| 1892. <i>E. clevedonensis</i> , <i>Broun</i> . | 1893. <i>E. Sandageri</i> , <i>Broun</i> . |
| 2478. <i>E. obscurus</i> , <i>Broun</i> . | <i>E. foveiceps</i> , <i>Broun</i> . |

Sect. VII.—Head and thorax rather narrow, punctate; thorax nearly oviform, with median groove; tubercles small and shining.

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|---|--|
| 262. <i>E. ovicollis</i> , <i>Broun</i> . | 1897. <i>E. verticalis</i> , <i>Broun</i> . |
| 1898. <i>E. antiquus</i> , <i>Broun</i> . | 1348. <i>E. tuberigerus</i> , <i>Broun</i> . |
| 2480. <i>E. inscitus</i> , <i>Broun</i> . | <i>E. pusillus</i> , <i>Broun</i> . |
| 1887. <i>E. lepiphorus</i> , <i>Broun</i> . | <i>E. semiopacus</i> , <i>Broun</i> . |

Sect. VIII.—Tubercles almost contiguous; terminal joint of antenna very large.

2483. *E. claviger*, *Broun*.

Sect. IX.—Head broadly trigonal; tubercles convergent in front and on the same plane as the thick lateral margins.

259. *E. sculpturatus*, *Broun*.

Sect. X.—Body rather broad, smooth; thorax with three disconnected foveæ near base; eyes large and prominent.

263. *E. foveolatus*, *Broun*.

Sect. XI.—Head large, subquadrate, with peculiar sculpture.

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|--|---|
| 260. <i>E. frontalis</i> , <i>Broun</i> . | 1890. <i>E. allocephalus</i> , <i>Broun</i> . |
| 1653. <i>E. mirificus</i> , <i>Broun</i> . | |

Sect. XII.—Hind body acuminate posteriorly, its last two segments quite unfolded and nearly horizontal.

1891. *E. acuminatus*, *Broun*.
2482. *E. caudatus*, *Broun*.

I may here add that in the memoir read before the Entomological Society of London by Dr. Sharp on the 2nd November, 1874, six New Zealand species of *Bryaxis* were described; but the author considered that ultimately it would be correct to establish two new genera for their reception. It is certain therefore that the thirty-six species now known, and which I have divided into seven sections, will have to be located in at least three distinct genera.

Sagola has forty-four species, but one of these (*S. gracilis*) is, I think, the exponent of a new genus.

As regards the numerous species referred to *Euplectus*, I may state that I would have placed the nine species in Sect. I. in a new genus had I not been deterred by an allusion to the genus *Adalmus*, the characters of which are unknown to me. These nine species may prove to belong to Herr Reitter's genus, so I merely indicate their relationship. The species placed by itself in Sect. II. is, I believe, the representative of another genus, whilst those in Sects. VIII., IX., X., XI., and XII. will, I feel sure, require either four or five new genera for their systematic location. I have already made nine new generic names for this group, and with that I must be content for the present.

Pselaphus ventralis, sp. n.

Slender, narrowed anteriorly, very sparingly and finely pubescent, shining; red, the tarsi, antennæ, and palpi yellowish red.

Head elongate, oviform, finely sculptured; when examined from above the central channel seems to occupy half the whole area, and it appears to be longitudinally divided behind; when looked at sideways a groove can be seen along the vertex. *Eyes* small but distinct, with coarse facets. *Thorax* oviform, longer than broad, free from sculpture, somewhat laterally compressed near the posterior angles. *Elytra* hardly longer than broad, much narrowed towards the shoulders, with distinct sutural striæ. *Hind body* larger than the elytra, basal segment horizontal and broadly marginated. *Legs* elongate; femora clavate; tibiæ slender, slightly and gradually expanded towards the extremity.

Antennæ elongate, first joint minutely sculptured and longer than the next two; second quite as long as and stouter than the third; joints 4 to 8 about equal, each evidently longer than broad; ninth and tenth longer than broad, only moderately thick; eleventh large, oblique at one side, pointed. *Maxillary palpi* slender, quite the length of the antennæ; fourth joint curvate, its clavate portion about a third of the entire length.

Underside red, the base of the abdomen covered with greyish sponge-like pubescence. *Metasternum* with a sort of raised lamina in front, nearly vertical or depressed behind, so that there seems to be a cavity between the widely separated hind coxæ. Basal *ventral segment* broadly and deeply depressed; the depression extends from base to apex, and it appears to be limited behind by a slender carina.

The stature is greater than that of *P. delicatus* (No. 1697), the eyes are slightly larger, and the thighs are medially inflated. In No. 1697 there is a transverse depression at the base of the first dorsal segment; the hairs on the surface are more distinct and much more numerous; the sculpture and channel on the head are indefinite; the base of the first ventral segment is fringed with yellow hairs, and the central impression is only of moderate size and depth, and does not attain the apex. *P. Cavelli*, which also has swollen femora, can be easily separated.

♂. Length $\frac{7}{8}$, breadth quite $\frac{1}{4}$ line.

Mount Pirongia. Four individuals, December 1893.

Bryaxis Hectori, sp. n.

Nitid, nearly glabrous; sanguineous, the legs paler red, palpi and tarsi yellowish.

Head subquadrate, with two obvious interocular foveæ and a broad frontal impression. *Eyes* prominent. *Thorax* of about equal length and breadth, the middle widest, without sculpture. *Elytra* oblong, slightly rounded laterally, moderately convex, with fine sutural striæ. *Hind body* short, much deflexed, more evidently (yet only finely) pubescent than the rest of the body. *Legs* of moderate length and thickness, the tibiæ nearly quite straight.

Antennæ 10-articulate, as long as the head and thorax; the basal two joints of about equal length; third rather shorter than second, distinctly narrowed towards the base; fourth and sixth small, moniliform; fifth larger than the contiguous ones; seventh and eighth transverse, not broader than the fifth; ninth subquadrate, only very slightly longer than broad; tenth ovate, quite as long as the preceding one. The two enlarged terminal joints are darker and more coarsely and densely pilose than the others.

Underside rufescent. *Metasternum* broadly impressed. Basal ventral segment largest, bituberculate near apex; fifth broadly depressed at the base.

♂. Length $\frac{5}{8}$, breadth $\frac{1}{4}$ line.

Tarukenga, near Rotorua. Two males.

Named in honour of Sir James Hector, the Director of the Colonial Museum.

Sagola rugifrons, sp. n.

Rufescent, legs and elytra rufo-testaceous; tarsi and palpi yellow; pubescence conspicuous.

Head smaller than thorax, considerably narrowed behind

the eyes, subopaque, distinctly punctured and finely transversely rugose in front; the tubercles rather small and flat, frontal channel moderately broad but not deep, almost as broad between the tubercles as at its termination in line with the back of the eyes; it is not very distinct when viewed from behind, owing to the fine transversely disposed pubescence; there are two elongate foveæ on the vertex. *Eyes* prominent. *Antennæ* long and stout, pubescent; first joint red, cylindric, punctate, about the length of the following three conjointly; joints 2, 4, and 5 nearly equal, longer than broad; third moderately small, longer than broad; 6 to 8 equal, hardly longer than broad, narrowed apically; ninth and tenth transverse; eleventh short, but with a distinct terminal appendage. *Thorax* cordate, with a large impression behind the middle; two minute foveæ near the base, and a large lateral fossa in front of each posterior angle. *Elytra* oblong, slightly narrowed towards the base, with well-marked sutural and intrahumeral grooves; they are not distinctly punctate. *Hind body* hardly longer than the wing-cases, the two basal segments much depressed at the base, the first with minute brassy scales. *Legs* robust. *Front femora* with a deep semi-circular notch near the base; the middle pair slender at the base, clavate or subangulate underneath. *Tibiæ* stout, the front pair slightly arched externally, the outer extremity narrowed or impressed; the intermediate thick, conspicuously pubescent, much bent inwardly near the extremity; the posterior slightly bent near the apex. *Tarsi* moderately slender.

Underside simple; head pubescent behind the middle.

♀. *Elytra* shorter, subquadrate, more narrowed towards the base. *Legs* robust; femora not notched; middle tibiæ stout, not bent, only a little narrowed externally near the apex, curved outwardly. *Abdomen* rather larger, the first visible dorsal segment without minute scales.

The intermediate tibiæ of No. 252 (*S. deformipes*) are much thicker, the tarsi are nearly twice as thick, and the head and thorax are totally different. The form and sculpture of the head, in conjunction with the structure of the legs, will enable *S. rugifrons* to be recognized without trouble.

Length $1\frac{1}{8}$ – $1\frac{1}{4}$, breadth $\frac{3}{8}$ line.

Mount Pirongia, March 1894. One of each sex.

Obs. The discovery of this species, in which there can be no doubt regarding the sexes, is important. It seems to prove that the head of the female in this genus in form and superficial appearance does not differ from that of the male; it also shows that the presence of minute scales on the basal dorsal segment is characteristic of the male.

Sagola spinifer, sp. n.

Elongate, rather narrow, shining, red; elytra paler; legs yellow or reddish yellow; tarsi and palpi yellow; pubescent.

Head not broad, slightly narrowed behind; genæ nearly straight; tubercles rather small, obviously separated except at the extreme front; frontal channel broad and deep, almost parallel-sided, extending to beyond the middle of the eyes; there are two conspicuous foveæ behind; its surface is not distinctly punctured. *Eyes* large. *Thorax* about as long as it is broad, widest near the middle; with a large angular antebasal impression; two minute foveæ near the basal margin and a large fovea at each side occupying the space between the posterior angle and the middle. *Elytra* oblong, almost parallel-sided, with the common sutural and intra-humeral impressions, the latter more or less evidently divided into two parts; pubescence elongate. *Hind body* rather longer than the elytra, fourth segment about as long as the third, but not marginated; the basal segment with minute brassy scales. *Legs* moderate; front tibiæ slightly curved externally, the middle pair straight, the posterior gradually expanded, and with a spiniform appendage lying along the inside near the extremity. *Tarsi* moderately short.

Antennæ pubescent; first joint stout, cylindric; second hardly longer than broad; third small; joints 4 to 7 nearly equal, 8 to 10 transverse, eleventh appendiculate.

Underside red, shining, pubescent. *Head* simple, with the usual broad groove behind the mentum. *Metasternum* rather long and convex, with a broad central channel. The middle *coxæ* are rather widely separated and the mesosternal carina is indistinct. *Abdomen* elongate, basal segment with a small ridge between the *coxæ*; segments 2 to 5 about equal, the hind margin of the fifth continuous with that of the upper surface; sixth somewhat retracted.

This species may be placed near No. 1880. It can be easily identified by an examination of the hind tibiæ.

Var.—*Thorax* evidently longer than broad, almost oviform.

♂. Length 1, breadth $\frac{1}{4}$ line.

Mount Pirongia. Three examples found during December 1893 and March 1894.

Sagola eminens, sp. n.

Subdepressed, red; elytra and legs paler, tarsi and palpi reddish yellow; pubescence yellow, coarser and more erect on the hind body than elsewhere.

Head very broad behind, its hind angles directed outwards, so that the back part is wider than the thorax; its surface is very finely and distantly punctured, the small flattened tubercles more distinctly; frontal channel deep, extending as far as the back of the eyes; there are two foveæ behind. *Antennæ* rather long and stout; first joint twice as long as broad; second thick, longer than broad; fourth and fifth quite as long as broad, usually distinctly longer than broad; joints 6 to 8 moniliform; ninth and tenth transversely quadrate; eleventh conical; third small, quite as long as broad. *Thorax* cordate, widest near the front, much narrowed behind, with a large impression behind the middle, two small foveæ near the base, and a large impression at each side extending from the posterior angle to near the middle. *Elytra* but little longer than broad, with distinct sutural and intra-humeral grooves. *Hind body* longer and broader than the wing-cases. *Legs* moderately stout; *tibiæ* slightly arched and expanded apically; *front tarsi* with the basal two joints, taken together, shorter than the terminal one; *claws* small.

Underside chestnut-red, pubescent. Basal segment of *abdomen* with a carina which fits in between the coxæ; sixth conical, compressed or foveolate at each side. *Head* apparently depressed in the centre, with distinct yellow hairs there; the genæ or hind angles are concave, and a second cavity extends inwards towards the middle. *Mentum* concave in front.

The head is like that of *Dryocora Howittii*. The most nearly allied species is *S. insignis*, but this is larger, with longer and stouter antennæ; these, in *S. insignis*, differ in structure, joints 4 to 8 not being longer than broad, and they are more rounded. If the head of No. 1875 be looked at from behind, the usual basal foveæ seem to be absent or obsolete; they are, in fact, represented by little more than a pair of marginal notches. The eyes of *S. eminens* are larger. The frontal channel in No. 1875 (*S. insignis*) seems to attain the hind margin of the head when examined sideways.

♂. Length $1\frac{1}{4}$, breadth $\frac{3}{8}$ line.

Tarukenga, near Rotorua, three examples; Mount Pirongia, one.

Euplectus tumipes, sp. n.

Subdepressed, clothed with fine decumbent yellowish pubescence, and with a few erect slender setæ; red, the elytra, legs, and antennæ paler, the tarsi and palpi fulvous.

Head subtrigonal, widest in line with the prominent eyes; the interocular foveæ are not well limited and are confluent or

prolonged anteriorly, the front is depressed; the vertex is convex and angularly produced; it is punctate, with very slender hairs. *Thorax* hardly longer than broad, oval, the middle widest; its surface more or less finely punctate, there is a large angular impression on the middle near the base; at each side an elongate fovea extends from the hind angle to beyond the middle; the central channel is extremely narrow, and extends from the base to the apex. *Elytra* longer than broad, wider than the thorax, indefinitely punctured; the sutural striæ are broad and deep near the base, between each of these and the broad elongate impression inside the shoulder there is a sort of costa; the humeral angles also are a little raised. *Hind body* shorter than the elytra, the three apical segments deflexed; the basal with a large transverse median depression; each side of this is indistinctly elevated. *Legs* stout, the front thighs incrassate and arched above; the middle and hind tibiæ rather slender and slightly curved externally, the anterior a good deal swollen inwardly near the middle and densely ciliate below.

Antennæ rather short; second joint nearly as long as the first, not bead-like; third very little longer than broad; joints 4 to 8 transverse and differing but little; the seventh, however, is slightly larger than the following one; ninth and tenth evidently larger than the preceding ones, ninth slightly larger than tenth; eleventh large, ovate, acuminate.

Underside: head with erect setæ; prosternum subcarinate along the middle; metasternum impressed; fifth ventral segment with a median impression; coxæ contiguous, the posterior large and prominent.

Barely half the bulk of *Dalma pubescens*. The antennal tubercles are not much raised and are obviously separated; interposed between each of these and the eye there is a smaller elevation. The basal portion of the thorax is more distinctly sculptured than the disk. An examination of the anterior tibiæ will lead to its recognition.

Length $\frac{3}{4}$, breadth quite $\frac{1}{4}$ line.

Hunua Range, Drury. One, April 1893, probably a male.

Euplectus parvulus, sp. n.

Rufous, elytra, legs, and antennæ paler; tarsi and palpi yellow; body subdepressed, narrowed anteriorly, rather closely clothed with short and thick hairs or setiform scales, as well as slender hairs; the pubescence on the head and thorax more scanty, longer, and quite slender.

Head narrower than the thorax, but not much shorter,

being nearly as long in front of the antennæ as it is behind them; its surface is closely and minutely asperate or punctate; the interocular foveæ are not large nor are they perceptibly prolonged forwards; the front is rather flat near the small distant tubercles. *Eyes* moderate. *Antennæ* rather short and slender; second joint smaller than the first; third slightly longer than broad, narrowed towards the base; joints 4 to 8 nearly alike; ninth nearly twice the size of the small bead-like eighth joint; tenth also transverse and rather larger than the preceding one; eleventh large, acuminate. *Thorax* about as long as it is broad, oviform, base and apex of about equal width, broadest behind the middle; disk not quite smooth, the sides more distinctly punctate or asperate, but not at all coarsely; the well-marked central channel does not attain the apex; near the base, in the middle, there is a large angular depression; the large fovea near each hind angle is somewhat prolonged forwards, and there is a more or less distinct transverse groove in front of the base. *Elytra* subquadrate, longer and broader than the thorax, indistinctly sculptured; the sutural striæ and intrahumeral impressions are moderate; the slightly raised space between these seems to have a short basal stria, which is quite distinct from the others. *Hind body* rather shorter than the elytra; the basal segment is slightly shorter than the second or third, and has a shallow median transverse impression; the apical segments are deflexed. *Legs* moderate; *front femora* incrassate, nearly straight along the front or lower face, the opposite one much swollen or arched; *tibiæ* slightly arched externally, not thick; *tarsi* slender.

E. tumipes has a broader head, larger and more prominent eyes, a broader and more anteriorly narrowed thorax, with a narrower discoidal groove.

Length $\frac{3}{4}$, breadth $\frac{1}{4}$ line.

Maketu, Hunua Range. One, probably a female.

Euplectus modestus, sp. n.

Body moderately elongate, shining, obsoletely punctate; dark red, tarsi and antennæ reddish yellow.

Head slightly narrowed behind the eyes; it is depressed across the middle, and the interocular foveæ seem to form part of the depression; the back part appears raised; it is angularly produced in the middle; the antennal tubercles are not conspicuous, and the intervening space is nearly on the same level. *Eyes* moderate, only slightly convex. *Thorax* about as long as broad, widest near the middle, quite as much

narrowed in front as it is behind; the central groove does not reach the apex, and it is a little expanded in the middle; near the base a transverse impression connects the centro-basal angular fovea and the large one at each side. *Elytra* oblong, slightly narrowed towards the shoulders; the sutural and intralumeral impressions are well-marked; close to the base there are two punctiform marks. *Hind body* not longer than the elytra, the basal three segments marginated and nearly equal, the first depressed across the base, fourth deflexed and as long as the third, fifth simple. *Legs* moderately elongate, not thick, the anterior femora most robust.

Antennæ slender, the basal two joints nearly equal as to length; third nearly as long as the second, but much more slender; 4 to 7 differ but little; eighth rather smaller; ninth and tenth larger than the preceding ones, scarcely transversal; eleventh large, acuminate.

Underside rufescent. *Head* simple, studded with erect setæ, which are thickened at the extremity; the frontal portion is short. Front and middle *coxæ* contiguous, the posterior nearly so at the base. *Segments* 2 to 4 subequal; first densely pubescent, covered by the femora, with a central prominence between the *coxæ*; fifth hardly as long in the middle as at the sides; the terminal one with a fine suture, so that there seems to be a supplementary segment.

This species must be placed with No. 1700 and its allies; from these it may be distinguished by the slender antennæ and sculpture. The pubescence is short and slender.

Length $\frac{7}{8}$, breadth nearly $\frac{3}{8}$ line.

Invercargill. One, received from Mr. A. Philpott, March 1894.

Euplectus arohaensis, sp. n.

Subdepressed, not narrow, moderately nitid; red, the legs and antennæ paler; tarsi and palpi yellowish; pubescence yellow, rather dense, short, and decumbent; there are also many erect, elongate, slender setæ.

Head large, widest behind, apparently impunctate; the large interocular foveæ unite with the frontal depression; the tubercles are small and widely separated, and the frontal channel is bounded by the slightly raised front edge of the forehead. *Eyes* rather small. *Thorax* hardly longer than broad, the middle widest, the apex scarcely as wide as the base; it is impunctate; in front of the base there is an angulate impression which unites with the fovea at each side; there is no central longitudinal groove. *Elytra* hardly longer than broad, narrowed towards the shoulders; the sutural and

intrahumeral striæ are well-marked and broad, the shoulders are slightly raised, or seem to be so. *Hind body* quite the length of the elytra, narrowed posteriorly. *Legs* only moderately stout; the *tibiæ* nearly straight, the intermediate on the inside, a little above the extremity, with a small but distinct process directed inwards.

Underside rufous, shining, finely and sparingly clothed. *Metasternum* with a broad longitudinal channel. *Abdomen* sometimes dusky; first segment covered by the femora, 2 to 5 become shorter; sixth medially emarginate and with the extreme apical portion hollowed out. The middle and hind *trochanters* are prominent and distinctly spined.

Antennæ about the length of the head and thorax; second joint more slender than and nearly as long as the first; third a little longer than the fourth; fifth rather larger than those next to it; 6 to 8 small, bead-like, about equal; ninth not much larger than the preceding one; tenth transverse, larger than ninth; eleventh largest, conical, acuminate.

♀. *Tibiæ* unarmed. *Metasternum* unimpressed. *Abdomen* simple. *Trochanters* not acuminate.

Belongs to Sect. IV. of the accompanying table. The male characters differentiate it from all its allies.

Length quite $\frac{3}{4}$, breadth $\frac{1}{4}$ line.

Mount Te Aroha. I was fortunate enough to find about a dozen examples, representing both sexes, March 1894.

Euplectus foveiceps, sp. n.

Rufescent; legs and antennæ yellowish red; densely clothed with yellow, small, depressed pubescence and elongate slender setæ.

Head narrowed anteriorly, slightly rounded behind, punctate or asperate, the sculpture rendered indefinite by the minute brassy hairs, somewhat flattened, but not channelled in front; when examined sideways one well-marked central fovea can be seen. *Thorax* cordiform, not longer than broad, sculptured like the head; the angular depression in front of the base is prolonged forwards as a broad discoidal groove; the lateral foveæ are not distinctly connected with the transverse basal impression. *Elytra* quadrate, indistinctly sculptured; the sutural striæ are well marked; there appear to be one or two other ill-defined grooves on each elytron. *Hind body* as broad as the elytra, rather longer; the basal three segments equal. *Legs* simple.

Underside chestnut-red, shining, pubescent.

Antennæ moderate; second joint oblong, evidently smaller

than the first; third slightly longer than broad; 4 to 8 differ but little, except that the fifth is a little larger than the contiguous ones; ninth transverse, about half the size of the tenth; eleventh large, acuminate.

♂. *Metasternum* with a broad depression behind the middle. *Posterior coxæ* prominent, but not spined. Basal ventral *segment* covered by the femora and with a prominence between the coxæ; second and third with a transverse median elevation; fourth with a slight depression across the middle; fifth but little shorter than the preceding one; sixth large, not distinctly impressed.

From all the species in Sect. VI. this may be separated by the less evident punctuation and the single fovea on the vertex.

Length $\frac{3}{4}$, breadth $\frac{1}{4}$ line.

Ligar's Bush, Papakura. One of each sex.

Euplectus semiopacus, sp. n.

Brick-red, rather pale; elytra and legs reddish yellow; head and thorax closely punctured and opaque; elytra and abdomen slightly nitid; form elongate, but not parallel; pubescence very short and slender, rather dense, but not conspicuous.

Head, including the eyes, nearly as broad as the thorax, rounded behind; rather plane above, with two minute indistinct interocular foveæ; there is no distinct frontal depression. *Eyes* large and convex. *Thorax* oviform, rather longer than broad; with a rather shallow antebasal transverse impression, ending in an elongate fovea at each side; the dorsal longitudinal channel is only moderately impressed. *Elytra* oblong, slightly rounded laterally, indistinctly sculptured; sutural striæ distinct, the intrahumeral impressions not perceptibly prolonged backwards. *Hind body* as long as the wing-cases, rather narrower, the basal three segments about equal; the first broadly depressed at the base; fourth somewhat swollen or convex along the middle. *Legs* moderate.

Antennæ rather short; second joint only slightly longer than broad; third of similar proportions, but not rounded; 4 to 8 small, about equal, bead-like; ninth and tenth transverse, the latter the broader; eleventh conical, pointed.

Metasternum broadly canalicate behind.

E. ovicollis (No. 262) is very similar; but the thorax is a little shining, quite glossy, and almost impunctate in front;

its discoidal punctuation is not so close, and the eyes are not so large and prominent.

Length $\frac{5}{8}$, breadth nearly $\frac{1}{4}$ line.

Maketu, Hunua Range. One of doubtful sex.

Euplectus pusillus, sp. n.

Elongate, subopaque, reddish; legs and antennæ paler; pubescence dense, depressed, short, yellow.

Head small, longer than broad, narrowed anteriorly; obviously and closely punctate, without distinct foveæ or impressions. *Eyes* of moderate size. *Thorax* longer than broad, oviform, not so dull as the head, similarly sculptured; the elongate fovea at each side and the channel along the middle are united in front of the base by a transverse impression; none are deep. *Elytra* quadrate, as long as the thorax, apparently impunctate; the sutural striæ are broad, the impressions inside the shoulders are not prolonged backwards. *Hind body* rather longer than the elytra, the basal three segments about equal, the first slightly depressed across the base. *Legs* stout, simple.

Antennæ short; second joint nearly as large as the basal one; third small, slightly longer than broad; fourth small, bead-like; 5 to 10 transverse, the ninth not greatly exceeding the eighth, tenth nearly twice the bulk of the preceding one; eleventh large, acuminate.

Underside glossy, chestnut-red; ventral segments 2 to 4 nearly equal and rather large; fifth broad, not much shorter than the fourth; sixth also broad, with more pubescence than the others; first hidden by the femora.

This small species must be placed near *E. antiquus*, which, however, has less prominent eyes and shorter tarsi; it is more shining than *E. pusillus*, its thorax is rather longer and narrower, and the hind angles of the head, instead of being obtuse, are slightly prominent.

Length $\frac{1}{2}$, breadth $\frac{1}{8}$ line.

Tarukenga, near Rotorua. Two examples.

Var.—Head with an ill-defined longitudinal channel behind and obsolete interocular foveæ. Basal dorsal segment with a fovea-like depression at the middle of the base, the fourth more unfolded. Genæ parallel-sided. Antennal tubercles equally small, but more shining.

This was found on Mount Te Aroha in March 1894, and I daresay will prove to be a distinct species; but as I have but one example, of the female sex, I treat it as a variety at present.

Group Silphidæ.

SILPHOTELUS, gen. nov.

Body suboblong, moderately convex, nearly glabrous. *Head* comparatively large and broad, not at all trigonal. *Eyes* large, rotundate, lateral, barely free from the thorax, finely faceted; their inner margin is not well defined; just inside each eye there is a minutely sculptured swelling; this is limited from the vertex by a distinct depression, causing these organs at first sight to appear very much larger than they really are. *Antennæ* 11-articulate, almost filiform, elongate, inserted close to the front of the eyes; their two basal joints cylindric, about equally stout, the second the shorter; joints 3 to 8 slender, gradually decreasing in length, the third evidently longer than the following ones; ninth and tenth short, broader than the preceding ones; eleventh nearly twice the bulk of the tenth; these three terminal joints do not form a distinct club. *Maxillary palpi* moderately elongate; basal joint minute, second narrow at the base; third oblong, quite as long as the second, and not broader than the apex of that joint; fourth rather longer than the preceding one, quite half its width, almost aciculate. *Thorax* transverse, with distinct lateral margins, base feebly bisinuate; apex of about the same width as the head, subtruncate, not very obviously marked off from the head. *Scutellum* triangular. *Elytra* ample, scarcely at all wider than the thorax at the base, finely margined and but little curved at the sides; apices nearly quite truncate, so that the pygidium is usually exposed. *Legs* slender; tibiæ simple, with fine setæ only. *Tarsi* narrow; in the male the basal joint of the front and middle pair are a little dilated, but quite oblong; second subquadrate; third moderately small, its apex slightly emarginate, not lobate; fourth elongate; posterior tarsi narrow and elongate.

Underside.—*Mentum* broad and truncate at the base, narrowed anteriorly. Fore part of the *head* like that of *Choleva*. *Prosternum* nearly truncate in front. *Anterior coxæ* almost contiguous; the middle pair rather widely separated, the hind pair nearly approximated, the trochanters large. The *mesosternum* has a rather broad process. *Metasternum* large; in front it is much rounded and finely margined; it extends between the middle coxæ, and there it is on nearly the same plane as the mesosternal process. *Epipleuræ* quite linear behind. *Abdomen* on a lower level than the sternum, composed of six segments, the apical narrow.

The type is a minute and curious creature. The head, as seen from above, is more like that of a water-beetle than that of a *Silpha*; at each side, in front of the eye, there is a narrow excision; this, I believe, enables the antenna to be placed over the head. The ventral segments are retractile, so that the pygidium is often concealed above. The antennæ are somewhat similar to those of a *Corticaria* (*C. pacata*, for example); their eighth joint is not at all abbreviated. The genus may be placed near *Choleva*, though I fail to detect more than four joints to the tarsi.

Silphotelus nitidus, sp. n.

Shining, variegated fuscous, with only a few minute setæ behind; the legs, the first two joints of the antennæ, and the thoracic lateral margins pale reddish brown; apices of elytra paler.

Head nearly smooth. *Antennæ* sparingly pilose, very gradually dilated apically. *Thorax* much broader than long, slightly curvedly narrowed anteriorly; in front of the middle the side margins and channels are more distinct than they are near the base; the apex and base are not marginated; the posterior angles are rectangular, the anterior are not prominent; the disk seems smooth, but towards the sides a fine punctuation may be seen. *Elytra* distinctly, rather finely, and not very regularly punctured, their sculpture less apparent after the middle; there are no well-marked sutural striæ. *Legs* with fine yell owish setæ; tibiæ straight.

Underside fuscous, sparingly and finely pubescent. The metasternum nearly smooth in the middle, its sides rather coarsely and closely punctured. The last ventral segment bears a few slender elongate pale hairs.

Length $\frac{5}{8}$, breadth $\frac{3}{8}$ line.

Hunua Range. Five examples found during two years amongst decaying leaves on the ground.

BÆOSILPHA, gen. nov.

Body broadly oval, narrowed posteriorly, moderately convex, obviously pubescent. *Head* small, immersed to the eyes, narrow in front. *Eyes* convex. *Mentum* transversely quadrate. *Maxillary palpi* short; terminal joints very broad and securiform, the others small. *Labial palpi* indistinguishable. *Antennæ* quite the length of the head and thorax, 11-articulate, stout; basal two joints equally elongate; third and fourth longer than broad, smaller than the preceding one; sixth rather shorter than fifth; eighth little more than half

the length of, but nearly as broad as, the contiguous ones; joints 7 to 11 moderately dilated. *Thorax* transverse, much curvedly narrowed anteriorly; front angles obtuse, the posterior nearly rectangular. *Scutellum* small. *Elytra* of the same width as the thorax at the base, gradually narrowed behind. *Pygidium* covered. *Legs* short. *Femora* not clavate. *Tibiae* with small terminal spines, the middle and hind pair more or less finely spinulose externally. *Tarsi* elongate, slender, five-jointed.

Prosternum deeply emarginate at apex. *Anterior coxæ* prominent and contiguous; middle pair distinctly separated, not at all prominent; the posterior subcontiguous. *Meso-sternum* with a fine curved central carina. *Metasternum* of moderate length, transversely convex. *Epipleuræ* broad at the base, linear behind. *Abdomen* composed of five nearly equal segments.

The sternal structure differs much from the *Choleva* allies. The broad hatchet-shaped apical joints of the maxillary palpi are characteristic. Though *Camiarus* has nearly similarly formed palpi, the flanks of the prosternum are not hollowed, as they are in *Bæosilpha*.

Bæosilpha rufescens, sp. n.

Shining, reddish; tarsi and palpi yellow; pubescence yellow, conspicuous, but not coarse.

Head nearly vertical in front, smooth. *Antennæ* inserted near the inner and front margins of the eyes, pubescent; joints 7, 9, and 10 equally broad, seventh rather larger than these others. *Thorax* nearly twice as broad as it is long, its base feebly bisinuate, the anterior angles rounded and depressed, margins indistinct; the surface apparently quite smooth. *Elytra* with lateral margins, the sutural striæ definite; their sculpture is moderately fine, appearing punctiform or irregularly transversely strigose, according to the way in which it is examined.

Underside rufescent, shining; abdomen finely sculptured and bearing distinct yellow hairs; the metasternum smooth.

Length 1, breadth quite $\frac{1}{2}$ line.

Mount Pirongia; one example, March 1894. A second specimen was found at Tarukenga, near Rotorua. Both were taken from decaying leaves on the ground.

MESAGYRTES, gen. nov.

Body oblong-oval, moderately convex, closely covered with depressed pubescence. *Antennæ* not as long as the head and

thorax, 11-jointed; club 4-jointed. *Tarsi* 5-articulate, the two hind pairs elongate and slender; the anterior widely dilated, each of the three basal joints being about twice as broad as long; the first and second are emarginate at the extremity, the third is broadly cordiform, the fourth is small, the fifth is elongate and slender. *Tibiæ*: anterior considerably expanded towards the extremity, oblique there, with a short spine at the inner angle, and with five or six minute denticles on the outside below the middle; the other two pairs multi-spinose externally.

The eighth joint of the antennæ is not abbreviated, as in *Choleva* and its allies. In *Agyrtes* the antennal club is five-jointed, and, as is not the case in *Choleva*, the tibiæ are externally spinose; the proper place for *Mesagyrtes* is, without doubt, between these two genera. The *eyes* are rotundate and convex, and are quite free from the lateral margins of the head.

Mesagyrtes scabripes, sp. n.

Oblong-oval, subopaque, fuscous, densely covered with peculiar yellow pubescence; legs red, palpi and tarsi paler; antennæ pale reddish, club infusate.

Head abruptly narrowed in front of the eyes, flat between these, very finely sculptured. *Thorax* about one third broader than long, widest at the base, more rounded and narrowed before the middle than it is behind, its base is truncate; the anterior angles are rounded, the posterior almost rectangular; it is finely marginated, and the surface is closely and very finely sculptured. *Scutellum* distinct, triangular. *Elytra* of the same width as the thorax at the base, very little narrowed posteriorly; each elytron has a fine, slightly sinuous, sutural stria; the whole surface is finely and closely sculptured; the sculpture, however, is not well defined.

Antennæ finely pubescent, inserted close to the front of the eyes; first joint rather stouter and longer than the second, both elongate; third and fourth longer than broad, the latter the shorter; sixth shorter than fifth, but not at all transverse; seventh obconical, distinctly broader than the sixth, but not so broad as the next one; joints 8 to 10 transverse, eleventh longer than the tenth.

Underside fuscous, with fine dense clothing. *Prosternum* emarginate in front; anterior coxæ contiguous. *Mesosternum* medially carinate in front, its process on a higher plane, moderately broad, and separating the middle coxæ. *Metasternum* slightly flattened in the middle. The *hind coxæ* nearly touch. *Femora* broad.

The clothing is remarkable ; the hairs are arranged in lines, with single ones proceeding obliquely from the central ones.

Nos. 283, 284, 285, and 286 must be placed in this genus.

♂. Length $\frac{1}{8}$, breadth quite $\frac{1}{2}$ line.

Hunua Range, Drury. One example.

Choleva marginalis, sp. n.

Oval, not narrow, moderately convex, slightly nitid ; fuscous, the legs, the apical and two or three basal joints of the antennæ nearly chestnut-red, the front and middle tarsi paler ; pubescence dense, very slender, cinereous ; on the elytra there are some short erect setæ.

Thorax transverse, much curvedly narrowed anteriorly ; base and apex subtruncate ; the posterior angles just perceptibly overlapping the shoulders, its surface very finely sculptured. *Scutellum* distinct, broadly triangular. *Elytra* gradually attenuated posteriorly, apices subtruncate, exposing the pygidium ; with well-marked sutural striæ and close transversely strigose sculpture ; the lateral margins are well developed from the shoulders to the hind thighs. *Antennæ* stout, pubescent, the basal three joints equally elongate ; fourth and fifth a little shorter and rather stouter ; sixth rather longer than broad, not quite so broad as the seventh ; eighth transverse, not very small, not much narrower than the contiguous ones ; tenth a little smaller than the preceding one.

♂. *Legs* stout, femora thick ; the *front tibiæ* with a distinct spine at the inner extremity and a smaller one at the outside ; the intermediate strongly curvate, with a distinct spine at the inner apex, a smaller one outside, and two or three finer ones higher up ; the posterior with elongate terminal spines, and eight or ten much finer ones along the outer edge. *Anterior tarsi* with the basal three joints strongly dilated.

Underside shining, chestnut-brown, finely clothed, the middle of the metasternum obtusely raised.

The nearest species are *C. lugubris*, Sharp, and *C. fulvitaris*. From the former it differs by the shorter and broader form and by the presence of slender spines on the hind tibiæ ; from the latter it may be distinguished by the more slender and less evidently pubescent middle tibiæ, shorter scutellum, less opaque surface, and by the more expanded elytral margins.

♂. Length $1\frac{3}{8}$, breadth $\frac{5}{8}$ line.

Mount Te Aroha, two examples ; Papakura, one. Found on the ground amongst fallen leaves.

Choleva suturalis, sp. n.

Narrow, subopaque; pubescence slender, dense, ash-coloured; nigro-fuscous, the tibiæ, palpi, and the basal two or three joints obscure red.

Thorax nearly twice as broad as it is long, base and apex nearly straight, slightly curvate, and narrowed towards the front. *Scutellum* minute. *Elytra* twice as long as broad, gradually narrowed posteriorly, slightly impressed near the middle; sutural striæ distinct, the sutural region from near the apex to beyond the middle appears slightly convex; apices individually rounded. *Legs* stout, intermediate *tibiæ* curved, the spines of the posterior shorter than the basal joint of the tarsi; front *tarsi* with the three first joints dilated, fourth small. *Antennæ* stout, longer than the head and thorax, the basal three joints elongate; fourth and fifth elongate, but shorter than the preceding one; sixth quadrate; seventh at least a third longer than the sixth; eighth evidently smaller than fifth; ninth and tenth nearly similar to the seventh.

Sculpture close, consisting principally of transverse linear marks, that of the elytra more distinct than in *C. relata*.

This is without doubt most nearly allied to No. 2350 (*C. relata*), but the thorax is more transverse and its anterior angles are less contracted and depressed. The scutellum is much smaller, the sutural region and apices of elytra are different, and the body is even narrower.

♂. Length $1\frac{1}{8}$, breadth quite $\frac{3}{8}$ line.

West Plains, Invercargill. One of each sex sent by Mr. A. Philpott, together with a female of No. 2350, in which the sixth joint of the antennæ is transverse.

[To be continued.]

X.—On the Brush-tailed Porcupine of Central Africa.

By OLDFIELD THOMAS.

IN 1887 the British Museum received, in the first and most valuable collection presented by Emin Pasha, three skins of a Brush-tailed Porcupine, which, in the absence of proper West-African specimens for comparison, I referred* to *Atherura africana*, Gray. Since then the skulls have been extracted from the type and other specimens from the West Coast, and the Museum has also received additional material from that region, among which the most noteworthy is a very

* P. Z. S. 1888, p. 15.

fine skull from Sierra Leone, collected long ago by Mr. T. Whitfield, but only recently rendered available for comparison.

The additional material shows, as is not surprising, that Emin's specimens, while excessively like *A. africana* in their external appearance, differ so much in cranial characters as to necessitate their specific distinction.

The species may be called

Atherura centralis, sp. n.

Size, colour, and other external characters very much as in *A. africana*, except that the spines are rather more fimbriated, and those of the sides are more frequently tipped with white.

Skull longer and slenderer, with a flatter, less inflated, and narrower frontal region and better defined postorbital processes. Anteorbital foramina higher than broad, the converse being the case in *A. africana*; posterior edge of the base forming their lower boundary level with or in front of the front edge of the anterior cheek-tooth, whether *mp*.⁴ or *p*.⁴; posterior edge of palate level with the middle of the last molar in place, whether *m*.² or *m*.³, according to age.

Teeth remarkably small and delicate, the length of the upper molar series scarcely more than half the diastema, while in the allied species this measurement is about two thirds of the diastema. The small size of the teeth is, of course, the reason for the relatively different position of *p*.⁴ and the anterior zygoma-root.

Dimensions of the type, marked by Emin as a male (in skin):—

Head and body (c.) 500 millim.; (tail imperfect); hind foot 60.

Skull: basal length 86, basilar length from henselion 78; greatest breadth 46; nasals, length 28; interorbital breadth 26·8; intertemporal breadth 24·5; anteorbital foramen, height 10, width 8, distance between most distant points of the two foramina 35; palate length from henselion 41·7; diastema 27·7; upper molar series (crowns) 15·3. Length of lower jaw, bone only, 59; condyle to angle 21·6; length of lower molar series 16·8.

Hab. Monbuttu, Central Africa. Coll. Dr. Emin Pasha.

Type: B.M. 87.12.1.98.

The main cause for distinguishing the Central- from the West-African *Atherura* lies in the extremely small size of the molar teeth, a characteristic equally observable at all ages. This latter is a point which has to be especially noticed in studying the teeth of porcupines, owing to the peculiar manner in which wear affects the size of the teeth:

XI.—*Notes from the St. Andrews Marine Laboratory (under the Fishery Board for Scotland).*—No. XV. By Prof. M'INTOSH, M.D., LL.D., F.R.S., &c.

1. On the Ova and Larvæ of *Gadus virens*, L.
2. On the Ova and Larva of the Turbot (?).
3. On an Egg resembling that of *Arnoglossus megastoma*, Donovan.
4. On *Lumpenus lampetræformis*, Walb.
5. On *Rhombus (Zeugopterus) norvegicus*, Günther.

1. *On the Ova and Larvæ of Gadus virens, L.*

In the 'Tenth Annual Report of the Fishery Board' * a few remarks were made on the ova of this species, which hitherto had escaped observation, notwithstanding that both adults and young fishes were common off the eastern shores. In the spring of 1892 Mr. Duthie, the energetic Fishery Officer at Lerwick, forwarded a few unfertilized ova; but the capsules alone remained on reaching the laboratory, the diameter of the most perfect of these being 1·1430 millim., a size which, it is noteworthy, corresponds very closely with that of the living egg, as will subsequently be shown. In the Eleventh Annual Report of the Board † a further note was made, some living eggs having been forwarded to the laboratory from Shetland by Mr. Duthie. As far as possible these were examined and figured by Mr. J. M. Anderson, M.A., B.Sc., during my absence; but their vitality was impaired, and though one or two almost hatched, yet no free larva was seen.

Various efforts had been made to secure these eggs off the east coast of Scotland by sending a man on board steam-liners and other vessels, and by the examination of the green cod captured by the herring-boats off the Forth. Ripe males were occasionally found, but no ripe females. By various inquiries Dr. Fulton (whose ready help on this and other occasions has greatly aided such work) ascertained that one of the most promising places was Gairloch, Ross-shire; and accordingly a man was sent there in the second week of February. He found that in a single haul of the gill-nets off the mouth of the loch (near the Minch) occasionally as many as 640 green cod, besides cod and other fishes, were secured. Many ripe fishes were at once obtained, and the water in the loch teemed with the ova of this species. The first series of ova, fertilized on the 15th February at 2 P.M., passed through the early stages on this and the 16th, and on the 17th were in the

* P. 287.

† P. 242.

mulberry stage. The blastoderm had made considerable progress on the 19th, and on the 20th February, at 3 P.M., when they reached the Marine Laboratory here, the blastopore had closed and eight or nine muscle-plates had formed. Kupffer's vesicle was present in some. Many of the embryos showed minute black specks along the body, and in one a black chromatophore occurred in each eye. The yolk presented a slightly wavy aspect, which was rendered evident by careful adjustment of the focus; and the same feature was noticed in the examples of last year. The eggs are extremely buoyant, and measure 1.1430 millim., a size which exactly corresponds with the empty capsules formerly alluded to, but it is considerably larger than those sent last year from Shetland.

Next day (21st February), at 4 P.M., the black pigment in some was more distinct along the body, being grouped chiefly at the sides, yet in front a few specks invaded the median region behind the eyes. In others, however, the pigment occurred posteriorly over the body generally. Though the tail was somewhat longer than in the figure of last year*, the muscle-plates were less distinct. The alar expansion was little marked, except in the pectoral region. An abnormal egg showed a deviation of the notochord to the right, and Kupffer's vesicle was also on one side of the median line. On the 22nd February all the organs were more clearly outlined, the muscle-plates were more numerous, the lenses more distinct, and the pigment dotted all over the body. The early condition of the auditory organs in this form is interesting; and, in addition to what is given in the "Researches" †, it may be stated that in the green cod, after the solid thickening of the sensory layer of the epiblast has formed, the lumen, instead of being spherical, is elongated antero-posteriorly, the slit being somewhat spindle-shaped. No cellular elements in the auditory cysts can be made out in the living forms—probably from the extreme delicacy and transparency of the tissues. Kupffer's vesicle is still present in some. A solid longitudinal bar occurs in the region of the heart and a curved transverse line behind it. The comparative narrowness of the body of the embryo is a feature at this stage. The temperature at this time was low, so that development went on slowly. On the 23rd February the tail extended further round the yolk, which, moreover, had a peculiar oleaginous aspect, occasionally with a few streaks in its substance, and it was not much diminished. The noto-

* Eleventh Ann. Rept. Fishery Board for Scotland, pl. ix. fig. 2.

† M'Intosh and Prince, Trans. Roy. Soc. Edinb. vol. xxxv. pt. iii. pp. 760 and 761 (1890).

chord was undifferentiated and Kupffer's vesicle still visible. The black pigment was more distinct and some chromatophores were slightly stellate. A few pigment-specks occurred on the yolk at the sides of the alar expansions. The slits in the otocysts were now ovoid and proportionally shorter than yesterday. One or two otoliths, as a rule, were present.

On the 25th February the otocysts formed broadly ovoid chambers with two otoliths. The heart showed internal papillæ, but no trace of movement. The pectoral expansions were larger and the notochord distinctly cellular. The pigment spots were stellate, and some stretched beyond the line of the body into the yolk. The gut formed a pale band. The following day (26th) distinct contractions occurred in the trumpet-shaped heart, the lumen of the gut was distinct, the alar expansions had increased, and Kupffer's vesicle had disappeared, except a trace in one example. The black chromatophores were larger—eight or nine occurring on the head. Very little pigment existed on the yolk—only a few stellate patches close to the embryo. The tail almost encircled the yolk.

A considerable number were hatched on the 27th February, or twelve days after fertilization, the larvæ floating, as usual, with the yolk-sac uppermost. They differed in the distribution of the pigment from the larval cod, for the chromatophores were scattered and did not form the characteristic bars of the latter species, as indeed may be observed before extrusion. On the following day (28th February) the lumen of the gut was smaller than at first, probably from contraction, and the liver formed a granular swelling on each side in ventral veins. The pectoral folds were large. The yolk still showed a somewhat wavy structure, and many of the chromatophores had become finely ramose, especially on the head. The larval fishes became more active on the 1st March, darting forwards on slight irritation, a feature familiar in salmon-rearing and so often noticed during the development of marine fishes, and which was emphasized so conspicuously in the Hatchery at Dunbar, where the larval plaice, as soon as they had strength, kept their snouts to the current. The otocyst now showed a double margin, and a strand indicating the œsophagus extended in front of the lens, and the liver was slightly larger. Two minute vesicles occurred on the body opposite the pectoral fins, and appeared to be the ends of the segmental ducts. The notochord reached as far forward as the eye, and posteriorly its point was nearer the caudal border. Embryonic fin-rays extended a short distance outward from the notochord in the tail. The rectal cone had moved slightly downward.

A second series, fertilized on the same day (15th), arrived at the Laboratory on the 2nd March. These ova had been kept in open vessels on the spot, and conveyed here in the larval condition, viz. about the second day after extrusion. No difference of moment was noticeable.

On the 3rd March the larval green cod for the most part floated on the water with the yolk-sac uppermost, but were active when interfered with. The liver had increased in size and the urinary vesicle was more evident. The eyes showed minute black pigment-specks and were slightly silvery. The chromatophores were everywhere more finely ramose, and were dotted over the head and body, being best marked over the pectorals, above the alimentary canal, in the region of the segmental ducts, and on the trunk a short distance behind the yolk-sac. In some, indeed, an approach was made to the pigment-bars of the cod. Occasionally the yolk presents a minute oil-globule on one side, as an abnormality; but, after all, there is no great gulf between the yolk which possesses an oil-globule and that which does not.

The head of the larval fish on the 5th March stood out more clearly from the diminished yolk, the pigment had increased in the eyes, the gall-bladder was present, and the chromatophores were more conspicuously ramified. The pigment on the trunk behind the yolk-sac was sometimes grouped in two bars. The embryonic caudal rays were now longer, a few reaching the margin. The pectoral fin was carried more or less erect. The lateral sense-organs corresponded with those in the cod. The larvæ were more active, though still floating with the yolk-sac uppermost.

On the 7th March the grouping of the pigment behind the yolk-sac was more distinct and all the organs were advanced. The mouth was slightly open and the mandible projected outward. The embryonic rays in the caudal region passed further forward in the broad marginal fin. The rectum was still high, and a considerable amount of yolk was present. The development was comparatively slow, and though some specimens lived till the 13th March, the only changes were the diminution of the yolk and the more general distribution of the black chromatophores over the surface of the body. When viewed from the ventral aspect, however, most showed a somewhat regular arrangement of pigment along the sides.

The green cod thus closely approaches the cod in its development, but the arrangement of the pigment distinguishes it from a very early stage. In the later stages of larval life, however, the one approaches the other. In the postlarval condition, and especially in the young state, the eye of the

green cod is somewhat larger proportionally, probably from the shorter snout, and the mandible of the cod is longer. In the subsequent stages the presence of a barbel in the cod, the increase of the black pigment on the body and fins of the green cod, and the absence of the characteristic spots of the cod are diagnostic features.

2. *On the Ova and Larva of the Turbot (?)*.

In the Reports of the Fishery Board various remarks have been made concerning the reproduction and development of the turbot. It was also alluded to in the Trawling Report, for on the 10th July, 1884, the ripe ova of a turbot were procured off the Isle of May, and though these are preserved in spirit, the oil-globule is rendered distinct by treating with equal parts of spirit, 2 per cent. acetic acid and camphor.

An examination of various ovaries of the turbot, kindly forwarded by Dr. Fulton, and many from Iceland and other parts on the pontoon at Grimsby in 1891, gave some knowledge of the more or less ripe ovarian egg, one with yolk-spheres being figured in the Tenth Annual Report*. Mr. Holt, on the 18th June, 1892, found a ripe female on the pontoon at Grimsby, but was unable to procure a ripe male. The ova ranged from $\cdot99$ to $1\cdot06$ millim. In another ripe example he ascertained that after formation of the perivitelline space the diameter remained precisely the same, while he considered the usual diameter to be $1\cdot01$ millim. The oil-globule never varies more than from $\cdot20$ to $\cdot21$, the latter being the usual dimensions. Few of the turbot that had been examined at Grimsby the previous year were very ripe towards the end of June, though many had a few translucent eggs here and there.

On the 28th April, 1894, an egg was procured in the bottom-net in St. Andrews Bay which differs from any hitherto described and corresponds with what was previously seen in the ovary of the turbot. The diameter is $1\cdot0668$ millim., while the pale oil-globule is $0\cdot21$ millim., both measurements agreeing with those communicated by Mr. Holt. The blastopore has closed and Kupffer's vesicle is present. The tail has not advanced beyond the yolk, which shows a few wrinkles or folds at the margin. The perivitelline space is considerable. No lenses or otocysts are present. The yolk is dotted over with traces of pigment-specks, one or two lie over the oil-globule, and they also occur on the body. No

* Fishery Board for Scotland, pl. xiv. fig. 1.

tint is visible under a lens, but under a low power of the microscope the parts mentioned have a yellowish hue.

Next day (29th April) the embryo was distinctly yellowish under a lens, the most conspicuous chromatophores being over the yolk and the oil-globule. Kupffer's vesicle had disappeared, and the tail extended beyond the yolk, which had considerably diminished, as if progress were rapid. The otocysts were indicated by two ovoid translucent structures, and the heart was faintly outlined. The larval fish emerged before 8 A.M. on the 1st May, and measured 2.74 millim. The head, body, and yolk-sac were dotted all over with canary-yellow chromatophores, and at 11 A.M. a few had a tendency to throw out processes. The yolk-sac was more finely reticulated than in the topknot*, the minute vesicles or papillæ being much smaller, while they were not conspicuous on the body. Moreover, no ramifying dark chromatophores existed at the border of the marginal fin, dorsally and ventrally. The oil-globule was situated about the posterior third of the yolk-sac, a position corresponding with that in the topknot. The olfactory sacs, lenses, and otoliths were present, but no pigment existed in the eyes. When viewed from the ventral surface the pectoral thickenings were distinct, and the heart formed a papillose tube inclined to the left. Traces of segmental ducts occurred at the sides of the notochord, with enlargements in the pectoral region. The alimentary canal terminated somewhat bluntly posteriorly, and granules lay in the centre a short distance within the tip. A band from the urinary vesicle and the end of the gut passed to the fin-border a short distance behind the yolk, the distinction in this respect between the present species and the topknot, as figured by Prof. Prince, being marked. The preanal portion of the fin was very small. The notochord was multicolumnar. The larva was very buoyant, keeping quite to the surface of the water, so that currents wafted it readily about in a vessel; and, moreover, it soon wriggled forward at short intervals.

The development of this form is comparatively rapid, and, so far as can be observed, it most nearly approaches the turbot.

3. *On an Egg resembling that of Arnoglossus megastoma, Donovan.*

An egg was met with in considerable abundance in the tow-nets opposite the curing-station at Gairloch, Ross-shire, on the 21st March, 1894. It had a diameter of 1.2573

* Researches, *ibid.* pl. xvii. fig. 4.

millim., and the oil-globule measured $\cdot 3810$ millim. It thus differs from the egg of the hake (*Merluccius vulgaris*) as given by Raffaele in being considerably larger and in having a larger oil-globule ($\cdot 94$ to $1\cdot 03$ millim., and oil-globule $\cdot 27$ millim.). It is somewhat larger than that of the sail-fluke (*Arnoglossus megastoma*) described in the Tenth Annual Report of the Fishery Board * ($1\cdot 1430$ millim., and oil-globule $\cdot 3048$ millim.), to which it had a superficial resemblance. The surface of the zona radiata, however, is marked with minute translucent vesicles, so that it appears to be variolated, thus differing from the rugose zona of the sail-fluke, which agrees with the brill and lemon-dab in being everywhere covered with raised lines or ridges.

On arrival at the Marine Laboratory on the 2nd March the embryo was about half round the yolk, with lenses and numerous muscle-plates. Kupffer's vesicle was still present. Shortly afterwards black chromatophores appeared over the oil-globule and along the sides of the body. The perivitelline space gradually increased in size from the diminution of the yolk. One larva, apparently from an earlier egg, escaped on the 3rd March. Its yolk-sac was minutely dotted with vesicles connected by intervening lines, as in the larva of the topknot, and the large oil-globule was situated posteriorly as in *Arnoglossus*, and in lateral view it had a slightly flattened outline. A small preanal portion of the marginal fin was present. The notochord was multicolumnar. The heart was visible on the left side. No pectoral expansion was yet present. The black chromatophores were nearly uniformly distributed over the body from the head to within a short distance of the tip of the tail. None appeared on the anterior part of the head, and none on the marginal fin, whereas in the larval sail-fluke (*Arnoglossus*) they occurred towards the free edge of the marginal fin dorsally and ventrally. Absolute reliance, however, cannot be placed on a feature of this kind, since considerable variation may exist. This larva floated passively in the vessel till the 6th March, and the yolk-sac had considerably diminished.

Though the spawning-period of the sail-fluke was somewhat later, viz. towards the end of May in 1892, I should have been disposed to connect this egg therewith were it not for the structure of the zona and the difference in size. Further investigation, however, may clear up the relationships. Nothing is said about the condition of the capsule of the egg of the hake by Raffaele, and the present egg is also larger.

* P 292, pl. xvi. figs. 1-10.

The hake is a common species in Gairloch, but nothing is known of the sail-fluke, though it probably also occurs in the loch.

4. *On Lumpenus lampetræformis*, *Walb.*

This species was one of the additions to the British fauna made during the trawling expeditions for the Royal Commission under Lord Dalhousie in 1884, the first specimen being described and figured, with his usual care and accuracy, by the late Dr. Francis Day*, who laboured so long and so ably amongst British and Indian fishes.

The occurrence of a perfectly fresh specimen of a female caught by a hook south-east of the Carr lightship on the 23rd February, 1894, gives an opportunity of making a few remarks on the coloration and other features.

The synonymy of the species is sufficiently referred to in Collett's excellent account, from examples procured in the Norwegian North-Atlantic Expedition, 1876-78 †. The only name that may be referred to is that adopted by Dr. Günther in his 'Catalogue' ‡ and 'Introduction to Fishes' §, viz. *Stichæus*. The total length of the present specimen is 9½ inches. The general colour is speckled greyish brown, with a faint olive hue, the whole dorsum being minutely dappled in this way. The specks over the dorsum and sides are small, while about seven larger touches occur on each side above the white line of the belly. Collett|| observes:—"Colour pale yellowish brown, relieved with a number of greyish-brown spots, extending laterally along the body; the abdomen above spotless and of a somewhat more silvery appearance. These spots vary considerably in size; most middle-sized examples are marked with a row of eight, stretching along the sides below the mesial line, and occasionally, too, with a similar series above, the spots composing it, which sometimes extend beyond the bases of the dorsals, alternating with those in the lower row, the interspace always exhibiting spots and cloudings, the former frequently confluent." The lozenge-shaped tail is prettily marked with seven vertical bars of the same hue. The pectorals have a faint greenish-yellow tinge towards the tip. The ventrals are white; Collett states they are without markings of any kind in the northern examples. The first part of the dorsal fin is somewhat lower than the succeeding, and has six rays

* Proc. Zool. Soc., June 17, 1884, pl. xli.

† Christiania, 1880, p. 71.

§ P. 495.

‡ Vol. iii. p. 280.

|| *Op. cit.* p. 76.

and two olive-brown bands, with a small third in front. The rest of the dorsal is bordered with olive-brown, and touches slant from above downward and backward at intervals. Collett describes the dorsal as "marked with oblique transverse bands." The anal is pale, with white rays. The irides are olive-brown, with a golden lustre. The cheeks are minutely dotted with the same pigment. The beautifully regular rows of scales are visible to the naked eye, but more clearly under a lens.

In the original British specimen the tail was thus described by Dr. Day:—"Caudal with one elongated ray above and another below, the five intermediate ones being somewhat concave, the remainder being shorter. Most probably this elongation is a sexual one, this fish being a male." Mr. Sim* found the caudal of his examples acuminate, as stated by Collett, and such is the condition in the present example. On examining the type-specimen in the University Museum here, it is apparent that the caudal rays have been dried and are more or less adherent. Not one ray, however, but several rays, dorsally and ventrally, are longer, the intermediate rays being shorter, though to a less extent than Dr. Day figures. These median rays seem to be more slender and to shrink more in spirit, so that if the longer rays were obliquely spread out (*i. e.* dorsally and ventrally), and also the shorter external rays which pass from the base of the caudal over and under these, a different outline would readily be formed—indeed, it would approach that of the female. This interpretation, of course, is apart from the possible injury to these median rays in the original specimen. Further, on examination of the well-preserved female here described a somewhat similar appearance is observed, the longer dorsal and ventral rays projecting and the median receding; yet the form of the fin in the fresh condition is like a broad lancet or spear-head. The foregoing observations therefore are given as a caution in regard to the apparently divergent condition of the caudal in the specimen first procured.

The ovaries were slightly developed and small, the eggs measuring $\cdot 02286$ to $0\cdot 3048$ millim., most ranging themselves round the latter diameter. They were therefore at a comparatively early stage, thus proportionately corresponding with those procured from the Moray Firth by Mr. Sim, in which the roe was "well advanced at the end of April, much more so than the milt of the males." The ripe eggs are unknown.

Since the first recorded British specimen Mr. G. Sim has

* Journ. Linn. Soc., Zool. vol. xx. p. 38.

obtained it frequently from trawlers working on the so-called "witch"-ground of the Moray Firth, and has written an interesting account of its habits, food, and distribution. Mr. Thomas Scott, Naturalist to the Fishery Board for Scotland, has also met with various examples off the Firth of Forth. The species therefore is probably an inhabitant of the deeper water all along the eastern coast of Scotland. Dr. Günther*, again, records it from the west coast of Scotland, but he overlooks the original description of it as a British fish by Dr. Day. Mr. Sim seems to think that it is fossorial, but no certainty exists, though allied forms have this habit.

Collett states that *L. lampetræformis* is known to occur on the coast of Greenland, Iceland, Spitzbergen, and the shores of North-western Europe as far south as the Cattegat. But few examples of the species have been hitherto obtained from Greenland and Iceland. Off Spitzbergen, however, it has been repeatedly observed, individuals having been taken on each of the Swedish expeditions to the Polar Sea, and its range extends as far north as 80°. Along the coast of Norway, from Finmark to the Christiania Fjord, it would appear to be rather a common fish, and he mentions having taken a dozen at a single haul of a net in the Porsanger Fjord, West Finmark.

Two other species of the genus, viz. *L. medius* and *L. maculatus*, occur in northern waters, the former from Greenland and Spitzbergen, the latter from the same region as well as the shores of Norway and the eastern coast of North America. In *L. maculatus* the anterior part of the dorsal is somewhat differentiated, being furnished with short sharp spines and only a trace of fin-membrane.

5. On *Rhombus* (*Zeugopterus*) *norvegicus*, Günther.

A fine example of this comparatively rare form came from the same region as the preceding specimen, viz. south-east of the Carr lightship, on the 6th April, 1894.

The species was first described and figured as British by Mr. Couch † under the name of *Rhombus cordina*, Cuv., or Ekström's topknot, from a specimen obtained in the Bristol Channel in 1863. Dr. Günther, who pointed out the distinction of the British form procured off Shetland, and also that of Fries and Ekström, from the *Pleuronectes cordina* of Cuvier, gave it the name of *Rhombus norvegicus* ‡. No additional

* Proc. Roy. Soc. Edinb. vol. xv. p. 211.

† 'Fishes,' vol. iii. p. 175, pl. clxvii.

‡ Cat. Fishes, iv. p. 412.

specimen was obtained till 1887-88, when Dr. John Murray found several off the west coast, and thus the late Mr. G. Brook made no additional remarks on it in his interesting "Synopsis of the Topknots," published in 1887*. Two of Murray's specimens were $3\frac{1}{2}$ inches long, the third less. Mr. Holt † lastly procured an example, $3\frac{1}{2}$ inches long, in 30-31 fathoms, off St. John's Point, Donegal Bay, in 1891, the soundings being sand, gravel, and rock.

The present example is $3\frac{3}{8}$ inches, or 85 millim., long, and is a female with developing ovaries. As Couch observes, the elongation of the body, in contrast with the other British topknots, is characteristic; but in this instance it cannot be said that the body is proportionally thinner than in the other forms—it is quite as thick. The scales are more distinct than in Müller's topknot, and probably also than in the others, considerably larger in proportion, and are more elongated antero-posteriorly on the sides of the body. The free edge of the scale is also conical, instead of forming a nearly straight spinous edge. This bluntly conical edge is beset with a row of slightly curved spines, usually numbering about thirty-five or thirty-six, and more or less uniform in size, though the median are generally a little larger, besides a series of shorter spines—best marked at the apex of the cone—which occur between and behind the others. On the white surface the shape of the scales is the same, but the median teeth appear to be a little larger. These scales invade the base of the caudal on the right or white side, as Couch says, as far as they do on the left; but the fin-rays beyond, both in this and the other fins, have none. The character of the armature of the scale thus differs quite from the condition in the other forms, in which eight or nine spines occur, the median, moreover, greatly exceeding the others. The scales which cover the left surface of the fin-rays are more elongate and show considerable variation in regard to the symmetrical position of the terminal spines, the character of which, however, remains the same. The ridge between the eyes formed a simple curve, spread out in front and behind, and thus, though agreeing with Couch's figure, differed from the examples from the west coast, in which the ridge is described as \sim -shaped ‡. The lateral line deviated from the figure of both authors, since, though it inclined a little upward on approaching the pectoral, the abrupt upward curve did not commence till it reached a line falling within the tips of the pectoral rays,

* Proc. Roy. Phys. Soc. Edinb. 1887, p. 362.

† Report Roy. Dubl. Soc.

‡ Proc. Roy. Soc. Edinb. xv. p. 218.

as both authors state in their descriptions. The teeth in the mandible and maxillæ form fine, almost villous rows. None could be made out on the head of the vomer.

The dorsal fin begins distinctly in front of the eye, and the first few rays have no scales. Couch observes that it commences barely in front of the upper eye. About four or five of the terminal rays posteriorly pass to the right (lower) surface, and Couch states that in this and the anal fin the terminal regions on the right are "not so near the caudal as in the other species." The processes certainly appear to be smaller. The longest rays occur about the posterior one-sixth of its course, a feature not shown in Dr. Günther's figure*. The pelvic fins overlap, though they are quite separate from, the commencement of the anal, the longest rays of which occur opposite the longest rays of the dorsal. About the same number of rays pass to the right (lower) side as in the case of the dorsal. The right pectoral is considerably shorter than the left.

The colour of this example was remarkable, since a general roseate hue pervaded the left side, and was visible after six weeks' preservation in spirit. No mention is made of such a hue in previous notices. The entire left side is also marbled with touches of brown of varying shades, some being dark, others light, and no regularity appears to exist in their distribution, except that there is a tendency to transverse bars when the body is viewed obliquely. A marked black band occurs at the base of the tail, with a dark spot beyond it, and both dorsal and anal fins have a series of dark touches. The same exist in the caudal, in which they have a somewhat crescentic arrangement. Couch observes that "the upper surface is yellowish brown, mottled with darker brown over the head, body, and fins, with less tendency to defined spots than in the other species." Günther, again, states that it is "brownish, marbled with darker; a large blotch at the commencement of the straight portion of the lateral line and a transverse band on the tail behind the dorsal and anal fins are the most conspicuous markings. The rays of the vertical fins are irregularly annulated with blackish brown."

The ovarian eggs were small, ranging from 0·34 to 0·152 millim. and under, so that the spawning-period was probably not nearer than July. This conjecture proves to have been near the truth, since Mr. H. C. Williamson on July 6th procured in the Moray Firth another example, in which he noticed more or less ripe transparent eggs.

* Proc. Roy. Soc. Edinb. xv. pl. iv. fig. C.

XII.—On the Type of the Genus *Massospondylus*, and on some Vertebræ and Limb-bones of *M. (?) Browni*. By H. G. SEELEY, F.R.S.*

IN 1854 the museum of the Royal College of Surgeons received from the Harrismith district, on the border of Natal in the Drakensberg range, a series of bones presented by Dr. R. J. N. Orpen and Mr. Joseph Millard Orpen. No further remains of this animal have since been recovered. Mr. J. M. Orpen, Member of the Legislative Assembly, Cape of Good Hope, on August 5, 1889, wrote for me the following further memorandum on the locality from which they came:—“The spot where I obtained some large bones of a saurian about 1853, which my father sent home, was on a hill capped by sandstone on the east boundary of the farm Beaucherf, in the district of Harrismith, on the watershed of the Drakensberg. Below the sandstone is a chocolate-coloured shale. I think more of the bones would be found on the spot by excavating. The fossils were on the east face of the beacon-hill which is north-west of Beaucherf House.” I was unable to visit this locality, and the genus rests still upon the materials collected by Mr. Orpen, which have never been figured.

Fifty-five fragments or bones, numbered 331–386, were selected by Sir R. Owen and briefly described in the ‘Descriptive Catalogue of the Fossil Organic Remains of Reptilia and Pisces contained in the Museum of the Royal College of Surgeons of England’ (4to, London, 1854), pp. 97–100. They were then regarded as indicating three or more genera or species of large extinct carnivorous reptiles, combining in their vertebræ and bones of their extremities both Crocodylian and Lacertilian characters, with an indication of a structure of the sacrum like that seen in Dinosauria. The species were named *Massospondylus carinatus*, *Pachyspondylus Orpeni*, and *Leptospondylus capensis*. They were grouped under the Lacertilia in 1854. In Owen’s ‘Palæontology,’ 2nd ed. 1861, p. 300, *Massospondylus* is mentioned under the Crocodylia and placed in the suborder Amphicoelia or Teleosauria. A later reference to the type is made in Quart. Journ. Geol. Soc. vol. xxxvi. 1880, p. 415, where all the genera are compared with the Anomodont reptile *Platypodosaurus*, but only to indicate differences.

An examination of the remains shows that they are not all

* Read before the Geological Society of London as Part 6 of “Contributions to Knowledge of Saurischia,” June 22, 1892.

referable to one individual. The presence of portions of three pubic bones of different sizes indicates at least three individuals; but those bones show no divergence of character. There are three vertebræ, which are of different type from the majority of the remains, and probably belong to other species. Most of the bones, however, are referable to the species *Massospondylus carinatus*. The early dorsal vertebræ, of which the centrums are preserved, have, when taken by themselves, enough resemblance to the Teleosaurian type to explain Sir R. Owen's recognition of a Teleosaurian affinity. But the pubis of *Zanclodon*, which I examined in 1878 at Stuttgart and Tübingen, proved to be identical in type with *Massospondylus*, and therefore fixed the systematic position of the genus among the Megalosaurian Saurischia. Some other parts of the skeleton approximate to *Zanclodon*, but the differences are considerable. The ilium conforms to the Triassic type, as represented by *Zanclodon*, *Aëtosaurus*, &c., in having the vertical plate of the bone high and more developed posteriorly than anteriorly; but it does not develop descending pedicles to give attachment to the pubis and ischium, approaching in this respect to the type of *Cetiosaurus*.

My conclusions also diverge from the College of Surgeons Catalogue in the following osteological determinations. The vertebræ of *Massospondylus carinatus*, which were regarded as probably from the tail, I believe to be cervical, from their resemblance to the cervical vertebræ of *Zanclodon*. The dorsal vertebræ show a similar affinity. It seems to me not improbable that the caudal vertebræ named *Pachyspondylus Orpeni* are the tail of this species of *Massospondylus*, though it is impossible, in the absence of history of the specimens, to make the identification with certainty. There is one sacral vertebra, which Professor Owen recognized as having some Dinosaurian characters. It is the only evidence of the sacrum preserved. There is a close resemblance in form between the ischium and scapula in animals of this type. The bone 349, regarded as a left scapula, seems to me to be the ischium; no. 350, termed upper part of the same scapula, I regard as distal end of the same ischium. A similar bone, 359, is named ischium; another example, 357, was referred with doubt to the proximal end of the humerus. The bone 351, named lower end of left scapula, I regard as the proximal end of the pubis; and the bone 352, which is compared to the scapular end of a right coracoid, is also the proximal end of a pubis.

Pachyspondylus and *Leptospondylus*, in the absence of further evidence of their characters, may be held for the

present in abeyance, though the specimens exist on which definitions might be based.

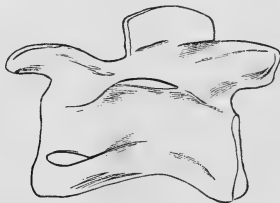
Vertebral Column.

Few vertebræ were collected; they represent the cervical, dorsal, sacral, and caudal regions. Since the bones belong to two or three individuals of different sizes, caution is necessary in using them as evidence for the reconstruction of the form and proportions of the animal. The cervical vertebræ are most elongated; but the dorsal vertebræ are more compressed from side to side than the cervical at the articular ends, and they have the centrum shorter. The single sacral centrum is shorter than the dorsal and has the body of the vertebra more depressed. The caudal vertebræ, on the other hand, are longer than the sacral, have larger articular faces than the dorsal, and carry chevron-bones.

Cervical Vertebræ. (Fig. 1.)

The specimen numbered 331 (fig. 1) was regarded as a vertebra probably from the tail; I interpret it as cervical. Compared with the figure of the cervical vertebra of *Zanclodon** it is seen to be almost identical in plan, the obvious difference being that the neural spine is a little more posterior in position in *Massospondylus* and that the transverse plate, extending outward like a film, which makes the upper tubercular articulation for the rib, has a more posterior position.

Fig. 1.



Left side of a cervical vertebra. About $\frac{1}{3}$ nat. size. No. 331.

The aspect of the vertebra is somewhat elongated, with a strong low neural spine, strong zygapophyses (low in position and deeply cleft), with the centrum compressed from side to

* 'Popu ar Science Review,' n. s. vol. iv. pl. ii. fig. 3.

side, and moderately elevated long parapophysial facets for the rib, below the middle of the sides of the anterior face for the centrum. The body of the vertebra is $4\frac{3}{10}$ inches long at the base and hardly more than 4 inches long at the neural canal, showing that the cervical vertebræ were carried in a curve which was convex on the anterior or ventral surface, from which it follows that the neck was elevated. The anterior face of the centrum is slightly distorted, but appears to have been circular, $1\frac{7}{10}$ inch in diameter. The surface appears to have been concave and bordered by a sharp margin, but it is imperfectly excavated. At the base of the articular surface is an appearance as though there may have been a narrow, thin, intercentral ossification, not unlike that seen in *Pareiasaurus*. A somewhat similar bevelling, which I should attribute to a like cause, is seen below the posterior articular margin, and may account for the original identification of the vertebra as caudal. The posterior end of the centrum is rather larger. A sharp, straight, median ventral ridge extends concavely from front to back along the base. The sides of the centrum are greatly constricted and consist of inferior portions, which converge downward from the lower articulation for the rib, and superior portions, which are nearly vertical and parallel. The centrum is thus constricted in the middle to less than half its width at the ends. This constriction or excavation is greatest below the transverse process, which is given off just above the neuro-central suture. That process has a long base, is directed outward and a little downward; it is compressed from above downward, is slightly convex above and rather concave below. There is no evidence of a pneumatic foramen on its underside.

The neural arch, in harmony with the slender centrum, is chiefly remarkable for the low truncated neural spine and strong cleft divergent zygapophyses. Seen from above the anterior and posterior ridges of the zygapophyses approximate almost in the form of a capital X, owing to the lateral transverse constriction above the transverse processes being similar to that of the centrum. The neural spine is $1\frac{4}{10}$ inch above the zygapophysial ridge; its vertical anterior border is in a line with the middle of the transverse process. Superiorly it is gently convex from front to back. Its short posterior border is rather in advance of the slight notch for the intervertebral nerve. From the base of the neural spine the zygapophyses diverge as compressed wedge-shaped processes, separated throughout their length, with the articular facets inclined, so that the anterior pair look inward and upward. These facets are slightly convex. The process is concave on

its under surface from front to back and convex from side to side.

Nos. 332, 333, 334, 335 are probably cervical vertebræ; but their condition of preservation contributes nothing to knowledge of the type, and I believe they pertain to another species.

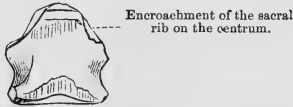
Dorsal Vertebræ.

The dorsal vertebræ have the centrum only preserved, though in the specimen numbered 336 the base of the neural arch is seen. These vertebræ, owing to the lateral compression of the centrum and the attachment of the neural arch along the whole length of the centrum, have a Teleosauroid aspect; they measure $2\frac{7}{10}$ inches in length. The measurement on the neural canal exceeded that on the ventral border, showing that the back of the animal was arched upward in the antero-posterior direction. The articular ends are laterally compressed, being higher than wide, vertically ovate, 2·2 inches high by 1·7 broad, flattened but slightly concave. The transverse measurement in the middle of the centrum is about $\frac{8}{10}$ inch. The base is markedly concave from front to back and notably convex from side to side. There is only a slight indication of the transverse widening of the neural arch. This vertebra apparently is figured in Cat. Foss. Rept. Brit. Mus. pt. iv. p. 249, 1890*.

Sacral Vertebræ. (Fig. 2.)

The specimen 346 (fig. 2) I regard as referable to *Massospondylus carinatus*. It was referred to *Puchyspondylus Orpeni*

Fig. 2.



Encroachment of the sacral rib on the centrum.

Ventral aspect of sacral vertebra. No. 346.

in Sir R. Owen's Catalogue of the Royal College of Surgeons. It is depressed, broadly convex on the base, with an oblique

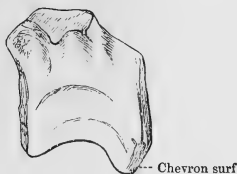
* The genus there rests partly upon teeth from India named *Massospondylus Hislopi*, from Maleri Gondwana beds, and the *Massospondylus* (?) *Rawesi*, from the Lameta beds. I am not aware that any teeth from South Africa of the type of *Massospondylus* have been found. The teeth of *Rhopalodon* are not unlike those attributed to *Massospondylus Hislopi*. The Indian bones of Anomodonts hitherto known, however, are from the Panchet rocks.

vertical truncation of the anterior parts of the sides, so as to leave only a narrow vertical median strip of the centrum to meet the sacral vertebræ, which was placed in front. This is due to the encroachment of the sacral ribs, which were situated at the junction of the two vertebræ, as in most of the Old-World Saurischia and as in *Deuterosaurus*. The encroachment of the sacral ribs, no less than the short length of the centrum, indicates that the sacrum was consolidated early in life. The centrum is less than 2 inches long, $1\frac{3}{10}$ inch deep, $1\frac{7}{10}$ inch wide.

Caudal Vertebræ. (Fig. 3.)

The vertebræ which have been regarded as caudal all retain the transverse processes above the level of the base of the neural canal. The centrum (fig. 3) has a conspicuous lateral compression in the middle, rounded base, and large facets for the chevron-bones. The articular surface is conically concave

Fig. 3.



!Right side of centrum, early caudal vertebræ. $\frac{1}{3}$ nat. size.
No. 338 reversed.

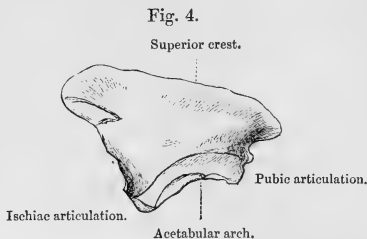
in front and more flattened behind, with a rather small neural canal and depressed neural arch, with the neural spine inclined backward. The spine diminishes in height as the vertebræ diminish in size. The caudal vertebræ are referable to more than one individual.

Pelvis.

Sir R. Owen identified the ilium 358 and the ischium 359. He remarks that the left ilium terminates anteriorly in a short obtuse process in advance of the acetabulum; but it is supposed that its anterior part has been broken away, and the bone in form and proportions was said (1854) to most resemble the iliac bone of *Iguanodon*. Notwithstanding some uncertainty in determination of the ilium in allied animals in Sir R. Owen's later writings, these remarks appear to indicate that the pelvic affinities of the animal were rightly appreciated.

Ilium. (Fig. 4.)

The form of the ilium (fig. 4) is, so far as I am aware at present, without close parallel in any carnivorous member of the same group.



Left ilium, inner lateral aspect. $\frac{1}{6}$ nat. size. No. 358.

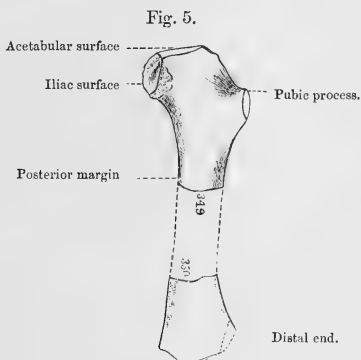
The bone is subtriangular, with a long, superior, slightly convex iliac crest, which terminates in a small preacetabular process and a larger postacetabular process. The length of the crest is 9 inches; it is gently curved from front to back, so that there is a slight reflexion outward of the extremities of the bone. Assuming that the sacral vertebra and ilium belong to the same animal or animals of similar size, this length would indicate that there were not fewer than three or more than four vertebræ in the sacrum. The vertical height from the articular surface of the acetabulum in front is $3\frac{1}{2}$ inches, and the corresponding height from behind is 6 inches, so that in general configuration the form of the ilium approaches most nearly to *Aëtosaurus ferratus* (Fraas); but the preacetabular process is less developed, as are the descending processes of the ilium for the pubis and ischium. The acetabular arch between the limits of the ischium and pubis is $3\frac{1}{2}$ inches long; it is 2 inches wide in front and $1\frac{1}{2}$ inch wide behind. The surface is divided into two portions, an external and an inner: the external portion is convex from the outer margin inward and increases in width as it extends posteriorly; the inner portion is somewhat shorter and concave in width as well as in length.

I suppose the superior crest to have been more or less parallel to the vertebral axis, so that the thickened rounded posterior angle of the ilium was thrown downward and did the major work of supporting the femur. The ischiac suture is slightly worn; it is about $1\frac{3}{10}$ inch wide and 1 inch long

and has a subquadrate form. The articulation for the pubis is semicircular, $2\frac{1}{2}$ inches wide and 1 inch long, the convexity being in front.

The Ischium. (Fig. 5.)

There are several examples of ischium—nos. 349, 350, 357, and 359; the last was identified by Sir R. Owen as the body of the left ischium. There is no certain evidence of the length of the bone, though its form and general characters are obvious. I regard the specimen 349-50 (fig. 5) as having been a foot long, and believe that it was articulated obliquely to the ilium. Its proximal end is concave on the posterior border and becomes straight distally; its anterior border is divided into two parts by a tuberosity near the proximal end, which was directed inward. This tuberosity has the form of the anterior



Restoration of the ischium based upon two fragments. $\frac{1}{2}$ nat. size.

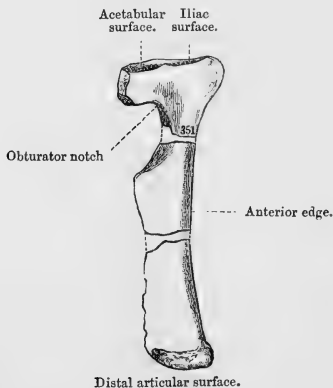
acromial crest of a scapula, and makes the anterior outline of the length of the bone concave. The proximal anterior margin above the tuberosity is thin and fractured. Thus the ischium is nearly 3 inches wide at the proximal extremity; $1\frac{1}{2}$ inch of the surface is for articulation with the ilium, and the anterior smooth concave part is a portion of the acetabular border. The width at the tuberosity is a little greater and at the posterior fracture the bone is 2 inches wide. The distal extremity of no. 350 must have been more than 3 inches wide, and terminated in a flat oblique cartilaginous surface. If that be taken as indicating the horizontal base of the bone,

then the ischium must have been directed backward, so that its posterior border was inclined at an angle of about 45° . The subacetabular process, which I have described, at $2\frac{1}{2}$ inches below the articular surface was directed inward, so as to enclose a pelvic basin, as in other Saurischia.

Pubis. (Fig. 6.)

The hind bone of the pelvis (fig. 6) is represented in the College of Surgeons Museum by several specimens, some of which have hitherto escaped attention, and remain as originally received, without numbers. Nos. 351 and 352 are the proximal extremities of the pubic bone, showing the articular surfaces. The notch beneath the acetabular margin is morphologically the remains of the foramen in the pubic bone of *Belodon*, which appears to have become modified in a way that can only be compared with the condition in *Zanclodon*

Fig. 6.



Pubis, inner side. $\frac{1}{2}$ nat. size. Restored from three fragments.

and *Staganolepis*. In the drawers are preserved the middle portion of the pubis as well as its distal end, so that the bone is now known from all its parts, though these cannot be actually fitted together into a single specimen. This is less important, since the left pubis of *Euskelesaurus* figured by Mons. Paul Fischer as a pelvic bone of a Dinosaurian exactly

parallels the conditions of the several fragments of the bone in *Massospondylus*.

The transverse width of the head of the bone is less than 4 inches in the largest specimen and more than 3 inches in the smallest, and the transverse width at the notch below the articular head is about $1\frac{3}{4}$ inch. The bone is about $1\frac{1}{2}$ inch thick proximally and the surface is divided into two portions, one for articulation with the ilium, and the other is part of the acetabulum. This acetabular portion is truncated posteriorly and compressed on the underside, as though it had extended in an antero-posterior direction to meet the acetabular part of the ischium.

The middle portion of the shaft is twisted at an angle of about 45° to the articular head, directing the expanded distal plate of the bone inward. The inner margin is fractured. I infer that the pubes approximated towards each other posteriorly, converging by the thin inner border, which thus became posterior, and that the bones each had a nearly straight though slightly concave border, which was anterior and external. The middle portion of the shaft preserved is nearly 4 inches long and fully 2 inches wide to the fracture. The distal portion of the pubis is about $5\frac{1}{2}$ inches long, less than 2 inches wide proximally, and $2\frac{1}{4}$ inches wide distally, with the distal extremity truncated and thickened. It has a cartilaginous border $\frac{1}{2}$ inch deep on the inner side, and has the anterior extremity of the fragment directed a little outward. Hence I conclude that the pelvic girdle was constructed upon the same plan as in other Saurischia, in which the ischium and pubis are flattened elongated bones. The form of the pubis seems to be conclusive in indicating affinity with the Triassic Saurischia of Europe.

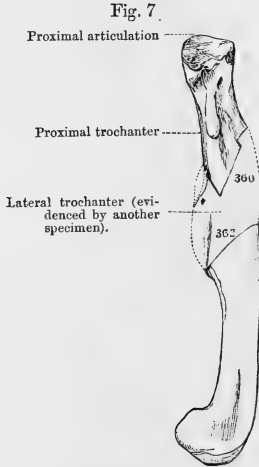
The Hind Limb.

The hind limb is known from the femur, tibia, metatarsus, and phalanges; its characters are in harmony with the indications of the pelvis. The femur, however, is more slender than might have been expected, and rather conforms to the type of *Palaeosaurus* than that of *Zanclodon*. The tibia is similar in its characters.

The Femur. (Fig. 7.)

The femur (fig. 7) was relatively short and strong. It is known from the proximal end 360, the distal ends 361 and 362, and the middle of a shaft which preserves much of the internal lateral trochanter. The distal end shows the base of the

lateral trochanter to be $8\frac{1}{2}$ inches from the distal extremity. The middle of the shaft shows the trochanter to have had a length of not less than 3 inches. The proximal fragment, 4 inches long, shows no trace of the lateral trochanter. These measurements prove that the femur was more than 16 inches long; I assume it to have been probably not less than 18 inches long.



The proximal head of the bone was directed inward, and measured about 4 inches transversely from the rounded head, which was at right angles to the shaft. Its superior surface is flattened, moderately convex from within outward, and slightly concave from front to back. There is no indication of a twist in the shaft, and I infer the proximal and distal ends to have been approximately parallel to each other.

The head of the bone is compressed from above downward, flattened on the underside, and convex on the superior surface. Below the head the bone becomes stouter, so that while the thickness of the head is $2\frac{2}{10}$ inches, and of the neck about $1\frac{6}{10}$ inch, the thickness at the fractured lower extremity exceeds 2 inches, where the width from within outward is $2\frac{3}{10}$ inches.

The fragment of the shaft showing the lateral trochanter appears to belong to a smaller individual. It shows that the trochanter was longitudinal, compressed, and directed downward to a depth in that specimen of about $\frac{8}{10}$ inch, recalling the condition in *Paleosaurus* and *Zanclodon*.

The distal fragment at its proximal extremity is 2 inches wide, and rather thicker, owing to the breakage occurring at the base of the lateral trochanter. The bone widens distally to 4 inches. The external border is rather more concave than the internal border. The thickness is about $1\frac{6}{10}$ inch where the elevation below the trochanter has subsided; but at the distal extremity the development of the condyles gives the bone a thickness of $2\frac{8}{10}$ inches. The distal condyles are, as usual, a large internal, vertically ovate, prominent process and a smaller external condyle, external to which is the usual oblique external infero-lateral area, though much less compressed than usual, so that it produces a convex inflation of the external distal side of the bone. There is a deep groove between the two condyles, and this divides the distal articular end in a broad U-shape into two nearly equal but unsymmetrical parts. In this respect also the bone is intermediate between *Paleosaurus* and *Zanclodon*.

The Tibia. (Figs. 8 and 9.)

The bone no. 363 is the proximal end of a right tibia (fig. 8) more perfect than 365, which is the corresponding proximal end

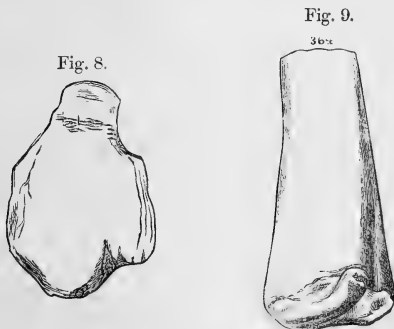


Fig. 8.

Fig. 9.

365

Fig. 8.—Proximal end of right tibia, seen from above.

Fig. 9.—Anterior aspect of the distal end of the left tibia. $\frac{1}{3}$ nat. size.

of the left tibia; 364 is the distal end of a left tibia (fig. 9), probably from the same individual as 365. On the hypothesis

that these bones are portions of one animal, the tibia would not be less than 15 inches long. Both proximal and distal ends of the bone are typically Saurischian, and may be compared with *Palæosaurus* and *Agrosaurus*, but are well distinguished by the shaft being less constricted and the distal end more compressed from front to back. The length of the proximal fragment is about $6\frac{1}{2}$ inches, while the distal fragment measures $5\frac{1}{2}$ inches. The proximal articular surface has the usual subtriangular form and is inclined a little backward; its extreme length is $4\frac{3}{10}$ inches and extreme width over 3 inches. The internal border is convex, though the convexity is broken by two angles. The posterior surface has the usual intercondylar notch, and the outer side is longitudinally channelled by the fibular groove, which helps to define the cnemial crest, which is moderately compressed from side to side. The anterior margin is at first slightly convex and the posterior margin concave, as it extends downward. The transverse width at the fracture is about $1\frac{8}{10}$ inch. The distal end at its superior extremity is about $1\frac{1}{2}$ inch wide, but the distal articular surface has widened regularly, so that the bone is about $1\frac{8}{10}$ inch from back to front, and $2\frac{1}{2}$ inches from side to side, supposing the slight notch in connexion with the astragalus to be towards the fibular border.

The distal articulation is irregularly four-sided, the anterior border being shorter than the posterior border, which is obliquely truncated by the short inner border. The distal surface is divided into two portions, anterior and posterior, by a wide groove, there being a descending area for a talon towards the antero-external side. These limb-bones have large internal cavities. The forms of the ends only indicate a generic difference from *Palæosaurus* and *Agrosaurus*, in neither of which is the bone relatively so wide transversely.

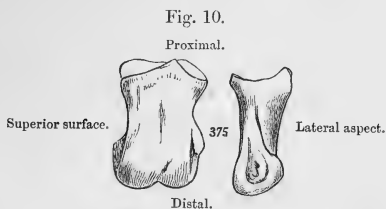
Bones of the Foot.

All the bones of the foot which are preserved appear to belong to the same limb. They make known the metatarsus and phalanges, but do not afford any evidence of either the number of digits or number of phalanges in a digit.

The first metatarsal no. 374 is short and broad, about $2\frac{1}{4}$ inches long by $1\frac{3}{4}$ inch wide. Other metatarsals appear to indicate that the longest did not exceed 6 inches in length; but they are all represented by fragments. They have the proximal ends deep, the form of the bone slender, with the distal end but little expanded. No. 367 has a depth of $2\frac{1}{2}$ inches at the proximal end, but only $\frac{9}{10}$ of an inch at the

distal fracture; and no. 371, which has nearly this width at its proximal fracture, is $1\frac{3}{10}$ inch wide at the distal end. The distal extremities are rounded from above downward, sometimes with a slight concavity in the middle, and with lateral pits for ligaments.

The phalanges are as wide as the metatarsals. No. 375



A metatarsal phalange. $\frac{1}{3}$ nat. size.

(fig. 10) is $1\frac{7}{10}$ inch wide at the proximal end and $1\frac{1}{2}$ inch at the distal end, $2\frac{3}{10}$ inches long, and 1 inch thick at its extremities, with all its surfaces slightly concave except the pulley-shaped distal end, at the sides of which are the usual concave pits. No. 378 is smaller, being only $1\frac{7}{10}$ inch long, but the reduction in thickness is not in proportion to the less length and breadth. No. 379 is rather more slender and has the sides more concave. These phalanges indicate a strong broad foot. The terminal claw-phalanges 382, 383, 384, 385 present two types; 383 (fig. 11) and 385 have the posterior articular surface, which



A claw-phalange. $\frac{1}{3}$ nat. size.

is deeply concave, raised above the ground by a deep inferior callosity, while in the other two there is no callosity. The depth of the posterior end of no. 383 slightly exceeds $1\frac{1}{2}$ inch; an oblique ridge descends the articular surface. The claw is compressed from side to side, convex above, concave below, tapering downward in front, but imperfectly preserved for a length of $2\frac{1}{2}$ inches; it may have lost half an inch. A small lateral groove runs along the middle of the side. The thickness of the bone posteriorly is only about $\frac{1}{2}$ inch. No. 382,

which wants the inferior callosity, is less compressed from side to side. These remarkably compressed claws are a character of some importance in defining the genus *Massospondylus*. They distinguish it readily from *Euskelesaurus*, just as the absence of the proximal externo-anterior trochanter distinguishes the femur, and the comparatively small size of the head of the bone distinguishes the tibia from that genus, which is also separated by the form of its distal end.

The Humerus. (Fig. 12.)

The humerus is a broad flat bone with transversely expanded ends and a slender shaft, which, in its general form, approximates towards that figured by Sir R. Owen as *Dicynodon tigriceps*. There are, however, many approximations in the skeletons of Saurischia and Anomodontia. I infer that the length of the bone did not exceed 11 inches, so that it would be much shorter than the femur. No. 354 (fig. 12) is the proximal end of the right humerus, no. 356 is the distal

Fig. 12.

Proximal articular surface.



Distal articulation.

Restoration of the right humerus. $\frac{1}{2}$ nat. size. The middle of the shaft, which is lost, may be shorter than the dotted space between the two ends. No. 354.

end of the right humerus, apparently the same bone. The proximal end of the bone is transversely expanded, the articular end being directed inward and thickened, as in *Palaeosaurus*, while the radial crest is similarly directed downward; but the shaft of the bone appears to have been relatively wider and the distal end to have been modified by greater transverse expansion. The width of the proximal end, as

preserved, is about $5\frac{1}{2}$ inches, the articular head of the bone is about 5 inches wide. The extremity is convex from within outward, and forms two eminences on the superior surface, one at the innermost angle and the other an inch further outward, each being an inch wide, with an inch interspace between them. The radial crest is not suddenly bent down, as in *Belodon*, but curves outward and downward, so that the superior surface is convex transversely and the inferior surface concave towards the radial crest. The remarkable lateral position of the radial crest, well defined from the head above, is a distinctive character; it extends vertically down the shaft for $2\frac{1}{2}$ inches, and is half an inch thick at its lower extremity; it gives to the bone a width of less than 3 inches, and an inch lower down, at the fracture, the width is about $1\frac{1}{2}$ inch. This condition is closely approximated to by an undescribed humerus in the Royal Museum at Stuttgart referred to *Zanclodon levis*; but there the radial crest is relatively thinner, being $\frac{1}{2}$ inch thick in a proximal fragment which is $18\frac{1}{2}$ inches long, and the concave external outline below the radial crest is less marked. The thickness of the humerus of *Massospondylus* towards the middle of the shaft is $1\frac{4}{10}$ inch. This end of the bone may also be compared with the bone figured by Mr. J. W. Hulke as humerus of *Hylaeosaurus* *.

The distal end of the bone is compressed from front to back; but there is no evidence to show whether the proximal and distal ends were in the same plane, as would seem probable. The distal fragment is a little over 3 inches long at the fracture and nearly 2 inches wide; it is $3\frac{6}{10}$ inches wide towards the distal articulation, which is transversely extended, rounded, with the articulation extending about $\frac{1}{2}$ inch on to the ventral aspect, and truncated on the internal border. The shaft is compressed towards the external and internal margins, and is broadly concave in the middle of its length, so that two slight rounded ridges extend downward, diverging towards the inner and outer angles of the articular surface. On the superior side there is a moderate compression on the external border. The compression of the distal end is in harmony with that of the Stuttgart humerus already referred to.

There is no evidence of the scapular arch, of the ulna and radius, or other bones of the anterior extremity. The relatively large size of the humerus suggests ordinary quadrupedal movement.

* Quart. Journ. Geol. Soc. 1874, vol. xxx. pl. xxxi.

The specimen 386, which is compared in the College of Surgeons Catalogue to a segment of the lower jaw of a Teleosaur, does not show any characters which I recognize as justifying its reference to the jaw; and the bone seems to me more likely to be a segment from a large chevron-bone of an undescribed Saurischian.

From these evidences of the structure of the vertebral column, pelvis, hind limb, and humerus, it seems to be probable that the unknown parts of the skeleton will also show a general resemblance to the types found in the Trias of Europe, such as *Palæosaurus* and *Zanclodon*.

I express my thanks to the President and Council of the Royal College of Surgeons for permission to draw these bones.

On some Vertebræ and Limb-bones from the Telle River, Cape Colony, provisionally described as Massospondylus (?) Browni (Seeley).

Mr. Alfred Brown, of Aliwal North, obtained a small series of bones from the Telle River, north of the Witte Bergen, in the Mattisi country, which are of some interest. They comprise the right and left femora, one and a half cervical vertebræ in contact with each other, a dorsal vertebra, three small caudals, together with five fragments of metatarsal bones, six claw-phalanges, and fourteen digital phalanges of the foot, which appear to indicate five digits decreasing in size from the innermost outward.

In general character the bones approximate most closely to *Massospondylus*, but they are much smaller than the bones of *M. carinatus*. The extremities of the limb-bones are less expanded, and there is a twist and curvature in the femur of which the remains of *Massospondylus carinatus* give no evidence. The neck-vertebræ are similarly elongated, the dorsal vertebra is similarly compressed. The phalanges are somewhat depressed, but not to the same extent as in the species already described. The claw-phalanges are of similar character. It is possible that the remains may hereafter show generic differences; but at present it is not inconvenient to refer this fossil provisionally to *Massospondylus*, as a new species, which may be named *M. Browni*.

The geological horizon is apparently above the coal of Cape Colony, in the Stormberg beds, to which the bones are referred by Mr. Brown.

Cervical Vertebrae.

Two cervical vertebrae were found in natural articulation with each other, but only the anterior half of the second is preserved. They appear to be the axis and the third cervical; the axis is $2\frac{1}{2}$ inches long, remarkably slender, probably narrowed a little by side to side compression; otherwise it presents a resemblance to the Würtemberg fossil, which I regard as the axis of *Zanclodon Quenstedti*. No odontoid ossification is shown in the South-African specimen, and the posterior zygapophyses are in a less elevated position and more extended transversely. The neural spine appears to be but slightly developed. The sides of the neural arch converge upward and forward from the flat inclined posterior zygapophyses, which diverge outward and backward, as in *Zanclodon*. They extend as far back as the posterior articular face of the centrum, forming, as in *Zanclodon*, a **W**-like notch when seen from above, owing to a slender process being developed between them in the median line. The posterior zygapophyses measure in transverse extension $1\frac{1}{4}$ inch; they are triangular in section, being flattened on the underside, on the inner side, and below. The inferior flattening extends laterally for fully $1\frac{1}{4}$ inch, because the zygapophyses extend transversely outward beyond the middle of the centrum for half the length of the vertebra. The centrum is compressed from side to side, is most constricted at the anterior third, has the lateral portions nearly vertical, and the base formed of two inclined surfaces which meet in a sharp median ridge; but posteriorly the surfaces are rounded. Anteriorly the angles between the lower part of the side and the base are prominently developed, and may have given attachment to slight ribs, though no facets are seen. The face of the centrum in front is subpentagonal and appears to be flattened. The neural canal is much wider than high. There are no indications of anterior zygapophyses. The greatest width of the centrum in front exceeds $\frac{3}{4}$ inch, the least width where most constricted is $\frac{3}{8}$ inch, and the width behind, as preserved, is $\frac{3}{4}$ inch. The height of the vertebra in the middle, as preserved, is $1\frac{3}{8}$ inch. Except in the transverse extension of the zygapophysial processes beyond the inferior part of the neural arch and centrum, there is no character of importance to distinguish this vertebra from the axis of *Zanclodon*.

The anterior part of the third vertebra is chiefly remarkable for two features—first, the greatly increased width of the centrum, which is $1\frac{1}{6}$ inch. This is partly the result of

lateral thickening of the anterior terminal ridges at the sides, apparently to form facets for the attachment of ribs, though these facets are not well defined. Secondly, the prolongation forward of prezygapophyses, which extend $\frac{3}{4}$ inch in advance of the face of the centrum, diverging as they extend outward to a width of $1\frac{3}{8}$ inch. The upper articular surfaces of these processes are flat, as though to allow of some lateral movement, and the lower surfaces are convex. The extremities of the facets curve downward, as though there were also some degree of upward and downward movement of the slender neck. There is the same median ridge on the base of the centrum and similarly inclined parts form its base. It is possible that the cervical vertebræ were of unequal length.

Dorsal Vertebra.

Only one dorsal vertebra is preserved. It is relatively shorter than in *Zanclodon*, for while the atlas is four fifths as long as that of *Z. Quenstedti*, this dorsal vertebra is less than half as long. The centrum measures $1\frac{1}{2}$ inch from front to back, is compressed from side to side, with the sides flattened and rounded at the base. The compression may be slightly increased by distortion and fossilization. The anterior and posterior faces are much deeper than wide, measuring $1\frac{1}{4}$ inch deep by $\frac{7}{8}$ inch wide, the width being a little greater in front. The neural arch is compressed and defined from the centrum by a longitudinal suture at the base of the neural canal, as in *Massospondylus carinatus*. At the anterior border of the base of the neural arch is the vertically ovate facet for the head of the rib, which is flat and just raised a wafer thickness above the level of the bone. It is fully $\frac{1}{2}$ inch deep. The transverse processes are directed outward and upward, more so than in the anterior vertebræ of *Iguanodon*; so that in place of the usual horizontal platform a concave channel appears to lie on each side between them and the narrow neural spine, which is $1\frac{1}{8}$ inch from front to back and $\frac{1}{8}$ inch thick. The usual buttresses appear on the sides of the neural arch, the anterior being a slight ridge ascending from the middle of the summit of the rib articulation; and the posterior, which is longer and more concave, ascends from the hinder margin of the centrum. These ridges are still separated by more than $\frac{1}{4}$ inch on the underside of the short transverse process, which extends out $\frac{3}{4}$ inch beyond the neural spine and rises $2\frac{1}{2}$ inches above the base of the centrum. The neural spine extends as far back as the flattened posterior face of the centrum and as far forward as the margin of the facet for the head of the rib.

Both anterior and posterior zygapophyses are broken away, as is the upper part of the neural spine. This is the first example in which the neural arch of a dorsal vertebra has been found preserved in a South-African Saurischian.

The upward direction of its transverse processes recalls the condition in *Belodon* and *Staganolepis*, but is more marked than in either. It makes no approximation apparently to the American *Ceratosaurus*, in which Professor Marsh's figure does not indicate any transverse process at all in the dorsal region. It differs from *Megalosaurus* not only in the ascending transverse process, but in the relatively lower situation of the articulation for the head of the rib.

Caudal Vertebrae.*

The only caudal vertebrae collected are three small specimens from towards the extremity of the tail, which are somewhat elongated and slightly decrease in length. The earliest of the three is about an inch long, somewhat distorted by pressure, with the articular face in front less than half an inch in diameter. The underside of the centrum is marked with two parallel ridges, separated by a groove, and the anterior face is flattened, with a slight oblique area at the basal margin, which may indicate a chevron attachment. The sides are concave in length, convex from above downward. The neural spine is not preserved, and the neural arch is narrow and appears to extend along the centrum. The zygapophyses are not preserved.

The other two vertebrae are rather shorter; they show indications of slight transverse tubercles. The articular faces are concave; the sides are convex vertically, as is the base transversely. The association of these specimens rests upon their being collected together. When the articular faces of the three vertebrae are put together they form a curve which is concave on the underside, as though the tail hung downward.

Bones of the Foot.

The proximal ends of five small metatarsal bones are the only part of those bones collected. When placed together in contact they have a transverse width of less than $\frac{3}{8}$ inches. The innermost has a vertically ovate articular surface, an inch deep and half an inch wide. It was probably oblique in

* There are no characters which would indicate the association of these vertebrae with the cervical and dorsal, as parts of the same animal; and I only notice them as collected at the same time.

position, like the metatarsal in the foot of a crocodile, resting upon the second. That bone is triangular at the extremity, being inclined and flattened internally, flattened at the base, short on the outer side, which is more vertical and grooved. The third appears to have been the stoutest; it has the proximal end subquadrate, somewhat convex, and each of the lateral margins is concave, except the external margin. The fourth bone is much more compressed from side to side; its articular surface is somewhat oblique and rounded. The fifth bone is very small. All the bones after the first show ligament-grooves on the underside. There is on the whole a steady decrease in size from the first to the fifth, if the bones are rightly identified; but the remains are very imperfect and chiefly interesting from their reputed association.

The Phalanges.

These appear to belong to two limbs, since there are not fewer than six terminal claw-phalanges, and probably fragments of eight are preserved. The digital phalanges preserved may probably be referred to five digits, in which case there would be no claw-phalange preserved for the fifth digit; and three claw-phalanges may possibly be referred to the other limb. As arranged, the bones in the first digit are stoutest, three in number, in the second digit four in number, in the third five, fourth four, and in the fifth two at least are preserved. The phalangeal bones are stout, of moderate length, not depressed, but with rather a tendency towards lateral compression.

In the first digit the first phalange is $1\frac{1}{4}$ inch long, with the pulley-shaped distal end $\frac{1}{2}$ inch wide, and the bone almost as deep. A ligament-pit is developed on each side of the distal pulley. The bone is flattened.

The claw-phalange is imperfect; it was about $\frac{3}{4}$ inch deep at the proximal end, where it is less than $\frac{1}{2}$ inch wide. The length, as preserved, is less than $1\frac{1}{4}$ inch, and was probably not less than $1\frac{1}{2}$ inch. The phalange is compressed from side to side. The lateral surface is divided into two nearly equal parts by a longitudinal groove on each side, above which the surface is convexly rounded, and about half as wide as the inferior portion, which is somewhat flattened on the underside. In harmony with this form the proximal articular surface is somewhat triangular; the bone is convex both below and above it.

In the second phalange the bones are somewhat smaller, rather more depressed, especially the last phalange. The

total length of the four bones placed together in contact is rather less than 4 inches. The claw-phalange is somewhat broader on the upper surface, and, besides being generally smaller, is relatively less deep. The groove on the side of the phalange is chiefly developed on the inner margin; on the outer side it is short and shallow. There is no inferior thickening, but a slight thickening above the articular surface, which is wider below than above.

The third digit I regard as including five phalanges and as having a length of $4\frac{1}{4}$ inches. These bones are more elevated than in the other digits and somewhat narrower from side to side. They preserve the same general character, but the fourth phalange, if rightly referred to this limb, is small and short, being less than $\frac{5}{8}$ inch long and $\frac{1}{2}$ inch wide. The claw-phalange is very similar to that in the first digit.

What I suppose to be the fourth digit is very slender, and the first two phalanges are much compressed from side to side, though the compression may be partially due to squeezing. The first is $\frac{9}{10}$ inch long, fully $\frac{3}{8}$ inch wide at the distal end, and about as high. The second is $\frac{5}{8}$ inch long and somewhat narrower at the distal end. The third phalange is $\frac{1}{3}$ inch shorter and more depressed; but this depression seems to me to characterize the penultimate phalange in each digit. The claw-phalange, as preserved, has lost the extremity and is much compressed from side to side. It is about $\frac{1}{4}$ inch wide and more than $\frac{1}{2}$ inch deep. It may have been $\frac{7}{8}$ inch long when complete.

The fifth digit can only be restored conjecturally. A small bone, which has the aspect of being a proximal phalange, is $\frac{5}{8}$ inch long, as deep as wide, expanded at both ends, the distal end being almost hemispherical, without any trace of the vertical median channel which characterizes all the other digital phalanges. The fourteenth phalange is different in shape to any other, and may have been a depressed penultimate phalange or have belonged to another limb. The distal end shows no trace of the usual vertical superior groove, and it is only slightly indicated on the underside. There are slight ligamentous pits at the sides of the articulation, which appear to indicate that the digit terminated either in a claw or another phalange, which is not preserved.

So far as they admit of comparison, these bones are very similar to those which have been attributed to *Massospondylus carinatus*, especially the claws, and the phalanges only differ in being rather better ossified. A similar type of digital phalange is observed in the fossil described from Eagle's

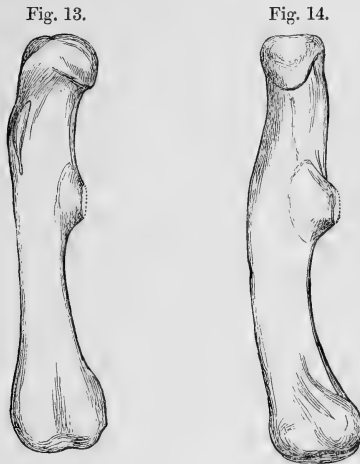
Crag as *Hortalotarsus*, in which the proportions of such of the foot-bones as can be compared are almost identical. This is the more interesting, since that fossil is manifestly very unlike *Massospondylus* in the form of the distal end of its tibia, and on that basis is referred to a different genus.

Femur. (Figs. 13 and 14.)

Mr. Brown collected both the right and left femora, which are fully $9\frac{1}{2}$ inches long. Both bones are slightly distorted, and the right femur is obviously compressed at the proximal end, while the left is somewhat compressed at the distal end. The bone is Megalosauroid in type, in having the articular head bent inward at an angle to the distal end, so as to look inward and forward; it is rounded from within outward, and at about $\frac{5}{8}$ of an inch below the proximal extremity on the inner side there is an impressed area continuous with the shaft which defines the head of the bone. The external trochanter is but slightly developed; it forms a ridge on the externo-anterior border, fully $1\frac{1}{2}$ inch below the proximal articulation. It is but slightly elevated, widens as it descends, and is traced for fully an inch in length. Seen from the side the bone has a sigmoid curve, owing to the proximal head being bent forward, the body of the bone curving forward and upward and the distal end being directed backward and downward. The greatest measurement of the proximal end from within outward and its greatest transverse measurement is $1\frac{3}{8}$ inch. The internal lateral trochanter is compressed from side to side as usual, and directed vertically inward and downward; it is $1\frac{1}{2}$ to $1\frac{3}{4}$ inch long, and approaches within less than 3 inches to the proximal end and 5 inches from the distal end. The bone is rather compressed in the shaft from side to side, so that it is deeper than wide, nearly vertical on the external side, flattened in front at the distal end. The distal extremity is well rounded from front to back, with two well-developed condyles, divided from each other by a moderately deep notch. The depth of the bone is here $1\frac{3}{4}$ inch in the left femur. The internal condyle appears to be the larger; there is a compression on the hinder border of the external condyle. The breadth of the distal end of the bone, as preserved, is nearly $1\frac{3}{4}$ inch.

The distinctive features of this femur are, first, the ovate form of the articular head seen from above, which has some resemblance to *Massospondylus*; but the proximal end is not so broad as in *Massospondylus carinatus*, nor is the distal end

so much expanded; the condyles are less developed backward, and the inner lateral trochanter appears to be more proximal in position. The external proximal trochanter is rather better marked than in *Massospondylus carinatus*, but rather less marked than in *Euskelesaurus*. The inner lateral trochanter is not quite so near to the proximal end as in *Belodon* or *Palaeosaurus*, the bone in the latter genus being



Massospondylus (?) Browni.
 Fig. 13.—Right femur, anterior aspect.
 Fig. 14.—Right femur, internal aspect.

more slender, more compressed above the external trochanter, and otherwise of different character. On the whole, the bone approximates nearest to *Massospondylus*, indicating an animal about three fifths of the dimensions of the type, with the femur not more than half the diameter of the larger bone at its extremities.

It is not certain that these remains may not be referable to *Hortalotarsus*. That could only be determined by discovery of the tibia or other distinctive element. While there is this possibility that the remains may belong to the Eagle's Crag genus, I prefer, in the absence of evidence, not to affirm the identity. The differences from *Massospondylus* are sufficiently obvious to prevent inconvenience from recording the species as *(?) Massospondylus Browni*.

I am indebted to Mr. Brown for the opportunity of making this description.

XIII.—*Adris sikhimensis*, a new Form of the Ophiderid Group of Noctuid Moths. By A. G. BUTLER, Ph.D. &c.

FOR some years past we have had a single example of a moth in the Museum collection which I felt certain was distinct from the widely distributed *A. tyrannus*; but, as Mr. Hampson was inclined to the belief that it was merely an instance of individual variation, I abstained from describing it.

Mr. Moore's collection has now added three other examples from Darjiling, clearly demonstrating the fact that the Sikhim form differs constantly in certain characters from the widely distributed form of the East. I therefore no longer hesitate to name it.

Adris sikhimensis, sp. n.

General character and pattern of *A. tyrannus*, from which it differs in having the primaries much more largely suffused with moss-green; the sinus at the inner margin of these wings considerably longer; the curved black band on the secondaries with its upper portion constantly much wider and the large black reniform patch with its inferior lobe much enlarged, reducing the acuteness of the external indentation; the third joint of the palpi terminates in a decidedly smaller expansion than in any example of *A. tyrannus*.

Expanse of wings 100–118 millim.

Darjiling.

I believe this to be a perfectly distinct representative form of *A. tyrannus*; for although individuals vary in some of the characters which I have pointed out, there is nevertheless a wide difference between the nearest forms of the two types.

BIBLIOGRAPHICAL NOTICE.

A Monograph of the Land and Freshwater Mollusca of the British Isles. By JOHN W. TAYLOR. Part I. Leeds, October 1894.

IT is now thirty-two years since the late Dr. J. Gwyn Jeffreys published his account of the land and freshwater shells of the British Islands. It formed the first volume of his well-known and admirable 'British Conchology,' and has generally been accepted by the conchologists of this country as the standard work upon this branch of science. Other treatises have since been published, but none of these, with the exception of Lovell Reeve's 'Land and

Freshwater Mollusks of the British Isles,' pretend to the completeness and originality of Jeffreys's work.

The long interval since the publication of that book, and the numerous changes which have been made in classification and in nomenclature, are an answer to the question whether another treatise on this subject was wanted.

Judging from the part of Mr. Taylor's work before us, it would appear that the subject will be treated in a far more exhaustive manner than has ever been attempted previously. We know from the 'Journal of Conchology' that the author was accumulating material at least ten years ago, and therefore, as ample time in the preparation of a work of this kind is so indispensable to ensure thoroughness, we may anticipate a very full and detailed account of the subject.

From a prospectus accompanying this part, it appears that the work is to be completed in two volumes. The first will be devoted to a general treatment of the subject, the different forms and characters of the shell, the morphology of the animal, and descriptions of the structure and functions of the various organs; geological and geographical distribution, habits, parasites, enemies, uses, development, &c. The second volume will contain an account of the species individually.

Part I. consists of 64 pages of text, illustrated with 136 process blocks and one coloured plate as a frontispiece.

It commences with a definition of conchology and a few remarks upon the limitation of the subkingdom Mollusca. The following eight pages are devoted to classification, the scheme adopted being that elaborated by Professor Ray Lankester in the 'Encyclopædia Britannica.'

Nomenclature is then discussed, and instruction given in the formation of generic and specific names. In talking of synonymy our author informs us that for *Limnæa peregra* "over three hundred names have been catalogued, all specifically synonymous!" We sincerely trust that he will not burden his readers with a complete list of them.

Thirty-six pages are occupied with various points in connexion with the shell. Its structure and chemical composition, the numerous forms it assumes, and the various kinds of surface-ornamentation (sculpture) which adorn it are all explained, the descriptions being assisted with explanatory figures. The names associated with the various parts of shells are expounded, and the manner in which they are measured is also indicated. The rest of the part is occupied with some remarks upon species and varieties, and the various causes which tend to their production.

The matter contained in this part, although having special reference to the land and freshwater Mollusca, has a general bearing on the science of conchology as a whole. It contains very few new observations, but constitutes a clear and instructive *résumé* of the subjects treated of.

There are many students and collectors of British land and fresh-

water shells in this country who have not the opportunity of consulting scientific libraries, and to these a book like the present is particularly welcome.

The printing, paper, and general appearance of the work are all that can be desired; the figures, as a whole, are very good indeed, but to state beneath each by whom the specimen was collected appears rather unnecessary, being practically of no interest whatever to the general student, although perhaps gratifying to the individuals named, especially when the same illustration is employed several times and the personal information is repeated in each instance. The coloured plate, produced by chromo-lithography, is also very successful; the outlines of the different forms represented exhibit great accuracy, and the coloration is not exaggerated.

Considering the need of such a work, the style in which it is issued, and the completeness aimed at, there seems every probability of its gaining a wide circulation, and, in fact, superseding all previous works on the subject.

MISCELLANEOUS.

On the Embryology of Gebia littoralis *. By P. BUTSCHINSKY,
of the University of Odessa.

So long ago as the year 1882 a segmentation of the ova of *Callianassa*, belonging to the family Thalassinidæ, was described by C. Mereschkowski †. I am now in a position to furnish a complete account of the development of *Gebia littoralis*. The definite facts which I have obtained supplement in many respects the conception of the embryonic development of the Decapods as it is generally represented.

The ova of *Gebia* ‡ possess a great abundance of food-yolk. The initial segmentation takes place with them in the interior of the ovum; the first segmentation nucleus divides, together with the accumulation of protoplasm surrounding it, into two, four, and eight segmentation nuclei. All these nuclei travel towards the surface of the ovum. The food-yolk takes no share in this process; it commences to collect more closely round the nuclei, and partly unites

* I shall publish in Russian a complete memoir on the development of *Gebia* in the 'Mémoires de la Société des naturalistes de la Nouvelle-Russie à Odessa.'

† C. Mereschkowski, "Eine neue Art von Blastodermbildung bei den Decapoden," Zool. Anz. v. Jahrg. no. 101 (1882).

‡ For fixing the ova I have employed boiling Perenyi's and Kleinenberg's solutions, or alcoholic sublimate solution. The best staining reagents are Grenacher's borax-carmin, Kleinenberg's hæmatoxylin, and hæmatin-alum. The objects after being saturated with evaporated photoxylin and stained, were placed in a mixture of chloroform and paraffin at a temperature of 40°-45° C., and then in pure melted paraffin.

with the unsegmented central yolk-mass, but in part separates entirely therefrom. With further multiplication of the blastoderm cells the division in the yolk diminishes and soon completely disappears. Finally we get a blastula stage, consisting of a superficially situated uniform layer of cells and an internal yolk-mass.

I must here remark that at this time some of the cells migrate into the yolk and give rise to a small number of yolk-cells (vitellophaga). These latter undergo a regressive metamorphosis and soon disappear almost entirely.

The rudiment of the embryo subsequently appears on the ventral side of the ovum in the shape of a thickening of the blastoderm. In the region of this rudiment there may be observed three separate swellings or thickenings—a posterior thickening in the shape of small groups of cells (caudal section), and, a little later, the anterior paired rudiment of the optic lobes.

The formation of the germinal layers commences very early from the cells, which, in consequence of the speedy multiplication of the blastoderm cells, appear in the region of the posterior thickening. It must be remarked that the entrance of the cells into the yolk takes place either in the shape of compact masses or of a sac-shaped depression.

On further multiplication the cells of the posterior thickening become dispersed in the shape of a fan, for many of them penetrate deep into the yolk, while others, fewer in number, spread out on the ventral surface. The former, on all sides separating equally one from another, commence to permeate the yolk. Subsequently, on the appearance of the thoracic appendages, all these cells pass through the yolk and collect their scattered units on the surface of the yolk-mass. They form the commencement of the endoderm layer.

As regards the middle layer, this is also formed from the above-mentioned cells of the posterior thickening, which spread out upon the ventral surface. To these must further be added those cells which arise, owing to the multiplication of the ectoderm cells, upon the lateral thickenings of the embryo. The mesoderm cells at first lie upon the ventral surface, and collect for the most part in the protuberances, which subsequently give rise to the limbs. On its first appearance the mesoderm layer has a paired structure, and consists of cells arranged in two longitudinal rows.

The nervous system already commences in the *Nauplius*-stage to develop from in front backwards in the shape of paired thickenings of the ectoderm. In the stage which is just commencing to lead an independent existence we may count eighteen ganglia, of which the last is double.

The eyes are developed from the anterior thickenings of the ectoderm, which for a very long time present the appearance of an undifferentiated aggregation of cells; and it is only at the period of

the formation of the whole of the limbs that the outer layer is divided off in the shape of more columnar cells. Subsequently, in the stage which is ready to emerge from the egg, we observe the appearance of the refractile nuclei and the pigment-mass in this ectodermal rudiment.

It is interesting to note that at this stage I have observed a formation of the ectodermal invagination in the base of the second antenna. This invagination approaches the closed mesoderm sacs. It is probable that this structure becomes the antennary gland.

At this period I also observed the formation of a pair of ectodermal invaginations into the branchial chamber, which gradually become modified into sacs.

As regards the mesoderm cells, these form no regular somites, but are quite irregularly distributed. Besides the muscles, the heart and the generative organs are also formed from these cells.

Until the appearance of the pigment in the eye, the heart arises at the boundary between the thorax and abdomen. Here there appears the earliest rudiment of the heart upon the dorsal side in the form of a paired aggregation of the mesoderm cells. Cells are protruded from the ventral side of these masses, and form the ventral wall of the groove. The dorsal side of the heart remains for a certain time open and covered by the ectoderm. The mesoderm cells of the back soon appear from these same lateral masses, and thus the oval sac of the heart is constituted.

The sexual organs arise in the latest stages of embryonic life, and are situated as a paired mesodermal rudiment in the region of the mid-gut beneath the heart. Here certain mesoderm cells rapidly increase in bulk, and give rise to the commencement of the genital cells.

The formation of the stomodæum takes place earlier than that of the proctodæum. Both arise as invaginations of the ectoderm. The mid-gut is produced from the cell-material of the endoderm, and its development proceeds from two primitively separate endodermal rudiments. The posterior rudiment has the form of two shells (cups), and lies in intimate relation to the invagination of the hind gut. The lips of the posterior shell are directed forwards. Simultaneously a similar aggregation of endoderm cells is also formed in the region of the stomodæum. The lips of the anterior shell, on the contrary, are directed backwards. At this time the inner lips of the anterior and posterior shell fuse together, and thus there are formed two rudiments, which are composed of columnar cylindrical cells. Their edges grow towards each other, although at the moment of the escape of the embryo from the egg they have not yet united, so that a portion of the dorsal and ventral walls of the mid-gut still consists of scattered cells. At this time there may already be observed in the posterior endodermal sac a division in a longitudinal direction, which leads to the formation of the first hepatic sacs.

The latest changes are accomplished after the escape of the embryo of *Gebia littoralis* from the egg.—*Zool. Anzeiger*, xvii. Jahrg., no. 452, July 16, 1894, pp. 253-256.

On Gill-like Organs in certain Species of Sipunculus.
By Dr. W. FISCHER, of Bergedorf.

That the tentacles in Sipunculidæ possess the faculty of respiration was formerly a matter of almost universal belief. Lately, however, at least in respect of certain genera, many doubts have been expressed as to this. It had already been pointed out by Brandt*, that in the case of *Sipunculus nudus*, L., the extraordinary thickness of the layers of connective tissue in the tentacles would militate against the view that respiration could be effected by means of these organs. The same conclusion is also deduced by Ward†, who had the opportunity of observing the living *Sipunculus nudus* in an aquarium at widely different times and in very various situations. This author states that he has seldom seen the tentacles extruded and never for a longer period than from one to two seconds; in the retracted condition he does not believe that they can be of any importance whatever for the purpose of respiration. Moreover, he adds that since no connection can be shown to exist between the blood-vascular system and the cœlome, the peripharyngeal vascular ring and the two short contractile vessels would present far too small a surface to the body-cavity to be able to convey sufficient oxygen from the blood-vascular system to the latter.

If it was thus impossible in the case of *Sipunculus nudus* to concede to the tentacles the possession of a respiratory faculty, it was natural to suppose that the skin might possibly be able to discharge this function. In his paper on *Sipunculus nudus*, Andræ‡ had already described dermal canals, which traverse the entire body and lie in the region of the cutis close beneath the cuticle and hypodermis; the author terms these structures integumentary canals (Integumentalcanäle). He found them generally packed with ova and blood-corpuses, and he maintains that the dermal layer, which separates them from the exterior, is sufficiently thin to enable an exchange of gases to take place between the cœlomic fluid and the sea-water. Ward, too, agrees with this

* Alex. Brandt, "Anat.-histologische Untersuchungen über *Sipunculus nudus*, L.," Mémoires de l'Acad. imp. des Sciences de St. Pétersbourg, 1870, tom. xvi. no. 8.

† H. B. Ward, "On some points in the Anatomy and Histology of *Sipunculus nudus*, L.," Bull. Mus. Comp. Zool. xxi. (1891) pp. 143-182 (3 pls.).

‡ Andræ, "Beiträge zur Anatomie und Histologie des *Sipunculus nudus*," Zeitschrift f. wiss. Zoologie, Bd. 36, pp. 201-208.

view: "The numerous dermal canals," he writes, "which run close beneath the cuticle and hypodermis, are undoubtedly of greater value for respiration and offer a far larger surface for the direct transmission of oxygen to the cœlomic fluid than the entire vascular system"*. The integumentary canals, as has been shown by Vogt and Yung†, are in connection with the general body-cavity, of which they are evaginations, so that their contents are met with again in the cœlome; they are found in the integument of almost all species of the genus *Sipunculus*. I believe that I have discovered a confirmation of this view in a specimen of *Sipunculus mundanus*, Selenka and Bülow, which was obtained by Herr Pässler near Esmeralda, in South America, and handed over to the Hamburg Natural History Museum.

This worm at once excited my astonishment by the possession of long, tuft-like processes from the integument of the middle portion of the body, such as I had never observed before in a species of *Sipunculus*. These structures are from 1 to $1\frac{1}{2}$ mm. in length, and are consequently distinctly visible even to the naked eye. On examination with a lens it is seen that these appendages are situated upon linear elevations of the integument, which are inclined at a somewhat acute angle to the longitudinal axis of the body. Transverse sections showed that the tufts in question are prolongations of the integumentary cavities which traverse the cutis. Their contents are the same as those of the cavities, and they possess a very thin skin, so that I do not hesitate to regard them as organs of a branchial nature. They correspond in shape to the pectinate gills of the body-segments of certain Annelids.

I have observed similar conditions in the case of *Sipunculus australis*, Kef., which differs from all other species of the genus *Sipunculus* in the possession of wart-like papillæ on the proboscis and in the glans (Eichel), which have hitherto been termed "dermal bodies" ("Hautkörper"). Dermal bodies, however, are always packed with glands or else with nerve-layers, while the warts of *Sipunculus australis* contain extraordinarily wide integumentary canals, or even several of these structures, and are consequently in no way comparable to true dermal bodies, but might rather be interpreted as rudimentary branchial processes.—*Zoologischer Anzeiger*, xvii. Jahrg., no. 457, September 24, 1894, pp. 333-335.

* [Ward's actual words are:—"The numerous dermal canals close under the hypodermis of *S. nudus* are unquestionably of great value in respiration, and the region of the introvert, which is distinguished by thin cuticular and muscular layers, actually not so thick as the walls of the tentacular fold, presents a far greater surface for the transmission of oxygen directly to the cœlomic fluid than the entire vascular system" (*loc. cit.* p. 164).—TRANSL.]

† Vogt and Yung, 'Lehrbuch der prakt. vergl. Anatomie,' Bd. 1.

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[SIXTH SERIES.]

No. 86. FEBRUARY 1895.

XIV.—*On the Luminosity of Midges (Chironomidæ).* By PETER SCHMIDT, of the Zoological Laboratory of the Imperial University at St. Petersburg*.

FOUR years ago it was shown by I. D. Kusnezoff †, in a little memoir of a bibliographical character, that the luminosity of Midges (Chironomidæ) had already been observed in the last century.

For we find in Pallas ‡ the following lines, taken from a letter written by Carl Hablitz from Astrabad (Persia):—“Besides this luminous insect (*Lampyris*), which is of very frequent occurrence on the shore of the Bay of Astrabad, I have likewise had occasion to observe that in the dark a light also emanates from the gnats (*Culex pipiens*, L.). In fact, I noticed this last autumn and in the spring of the present year, since these insects had established themselves in multitudes on board our ships.”

It appears to be scarcely open to doubt that the above quotation refers not to the luminosity of *Culex*, but to that of *Chironomus* §, since, on the one hand, no single subsequent or previous statement exists as to the luminosity of the first-

* Translated by E. E. Austen from the ‘Zoologische Jahrbücher.—Abtheilung für Systematik, Geographie und Biologie der Thiere,’ Bd. viii. Heft 1 (Jena, 1894), pp. 58–66.

† “Zur Frage nach dem Leuchten der Dipteren,” Westnik Estestwosnanija, St. Petersburg, 1890, no. 4, pp. 167–171 (in Russian).

‡ ‘Neue Nord. Beitr. zur physik. u. geogr. Erd- u. Völkerschreibung,’ Bd. iv. 1783 (referred to by Osten-Sacken, Ent. Mo. Mag. vol. xv. 1878, no. 170, p. 43).

§ As Kusnezoff also presumes: *vide loc. cit.* p. 167.

mentioned Dipteron, while, on the other, almost all the species of *Chironomus* are extremely similar to the true gnats (Culicidæ) in outward appearance, and in a superficial determination may easily be mistaken for them.

For a very long time the observation in question remained altogether unnoticed and unconfirmed. It was not until the year 1874 that the interesting fact was discovered for the second time by W. D. Alenizyn, a member of the well-known Aralo-Caspian Expedition, by whom it was published in a communication addressed to our Naturalists' Society of St. Petersburg*.

During his sojourn on the Sea of Aral, and in the neighbourhood of the mouth of the Amu Daria, Alenizyn was able to observe that a multitude of actively luminous midges settled on board ship. He also had an opportunity of collecting these insects in alcohol, and of subsequently determining them to be a species of *Chironomus*.

The next statement on the subject of the phenomenon which we are discussing is to be found in foreign literature. In the year 1871 two luminous female specimens of *Chironomus* were observed by Dr. Brischke on the River Kadaune, in Pomerania, and were determined by him to belong to *Chironomus tendens*, F.†

In the year 1884 luminous midges were observed on Lake Issykkul by Prof. Ssorokin, the botanist, by whom specimens were collected and forwarded in alcohol to St. Petersburg. On arrival they were examined by I. D. Kusnezoff, but, in consequence of the bad state of their preservation, it was impossible to determine them precisely ‡.

In addition to these statements from literature, I am able to adduce a verbal communication from Herr I. K. Tarnani, according to which luminous midges, probably also belonging to the Chironomidæ, were likewise observed near Taganrog, on the Sea of Azov. The specimens of the insects which were collected by Tarnani have unfortunately been lost.

During the past year (1893) our Entomological Society received a luminous *Chironomus* in a dry condition, forwarded by Herr Christoph from Sarepta (Saratow).

The foregoing paragraphs are sufficient to show that the luminosity of midges is a phenomenon which is of somewhat widespread occurrence, although seldom observed by specialists.

* In the Society's 'Trudy,' vol. vi. 1875, p. xi.

† "Leuchtende Dipteren," Deutsche ent. Zeit. Jahrg. xx. 1876, Heft 3. Entom. Monatsblätter v. D. Kraatz, Berlin.

‡ I. D. Kusnezoff, *loc. cit.* p. 170.

For my own part, I had the good fortune to be myself a witness of this interesting manifestation while staying at Lake Issykkul in the summer of 1892. Unfortunately I arrived at the lake too late to be able to witness the phenomenon in the height of its brilliancy; for, according to the statements of the inhabitants of Prshewalsk, the luminous midges are most abundant at the beginning and in the middle of June, while I did not reach the spot until the commencement of July. This is my explanation of the fact that it was only with a considerable amount of trouble that I discovered and obtained six specimens of the luminous insects in the shrubs growing on the shore of the lake, for otherwise, according to the descriptions of the inhabitants, they frequently appear in such multitudes that entire shrubs appear as if aglow.

The specimens observed by me, of which one proved to be a male and the remaining five females, shone very brightly, with a somewhat greenish phosphorescent light, which was entirely similar to that of *Lampyrus*, but materially differed therefrom owing to its continuity and regularity.

Even when touched or actually thrown into alcohol the insects still continue to shine, and apparently are able neither to diminish their light nor to cause it to cease. In alcohol the midges remain luminous for from three to four hours, as was also previously found to be the case by Alenizyn.

Unfortunately the only preservative fluid which I had with me was 70° alcohol, and I was consequently obliged to be content with bringing the specimens which I had collected to St. Petersburg in the spirit.

Since the phenomenon that I had observed interested me in the highest degree, I proceeded in St. Petersburg to make a closer examination of my specimens, and also consulted the material brought back by Ssorokin and Alenizyn*.

As a matter of fact, the collection forwarded by Ssorokin proved to be in a perfectly useless condition: the antennæ, legs, and in part also the wings of the majority of the specimens were broken off, and their colour and markings appeared to be greatly altered, so that it was not worth while to attempt either a determination or description of the insects, or even an investigation of them by means of sections.

On the other hand, the collection, although such a small

* The former was kindly handed over to me by Herr J. N. Wagner, Keeper in the Zoological Museum of the University of St. Petersburg, the latter by Herr J. A. Portschiunsky from the collections of our Entomological Society. I venture to take this opportunity of expressing to both of these gentlemen my warmest thanks.

one, brought back by myself, and the fairly large series obtained by Alenizyn, afforded several specimens which were perfectly well preserved.

On commencing the investigation I was thoroughly convinced that the luminous species of *Chironomus* with which I had to deal were new, and I consequently intended, with the help of the tables contained in Schiner's classical work 'Fauna Austriaca: Diptera,' to determine their systematic position only approximately. My astonishment may therefore be imagined on finding in these tables a diagnosis which corresponded with the majority of the specimens down to the smallest details.

For it appeared that both all the midges brought back by myself from Lake Issykkul, as well as the majority of those collected by Alenizyn, belong to *Chironomus intermedius*, St., a species which, in the opinion of Schiner, is merely a variety of the extremely common *Chironomus plumosus*, L., since the two forms are distinguished one from another only by size, and also in this respect transitional forms are found between them*.

It is therefore possible that also certain females examined by me, which exceed the stated dimensions of *Ch. intermedius*, St., are to be regarded as belonging to *Ch. plumosus*, L.

I have determined certain smaller specimens among Alenizyn's insects as *Chironomus tendens*, Fb., but am not altogether convinced of the accuracy of this determination.

Besides the above, the same collection contained several specimens of quite small midges, which proved to belong to a species of *Corethra*, and yet are stated by Alenizyn † to be actively luminous—a fact which is quite new to science.

Unfortunately I was not in a position to confirm my determination by a comparison of the specimens examined by me with any determined by a competent dipterologist.

Nevertheless I find a confirmation, although an indirect one, of my opinion that the insects which I collected myself at Lake Issykkul are really nothing else than *Chironomus intermedius*, St., in the fact that on dredging in the lake ‡ I found a few specimens of the extremely characteristic larva of *Chironomus plumosus*, L. The larvæ, which were likewise preserved in alcohol, proved on closer investigation to be absolutely identical with Réaumur's description and

* *Vide* Schiner, *op. cit.* Bd. ii. p. 601.

† According to a communication from Herr J. A. Portschesky.

‡ In Kara-szu Bay, near Prshewalsk,

figures *; it is well known, however, that the larvæ of the midges vary according to the individual species even much more than do the imagines, and this favours the belief that *Chironomus plumosus*, L., or *Ch. intermedius*, Fb., the form which is so closely allied to it, really occurs at Lake Issykkul.

For the rest, however, the agreement of the diagnosis with the insects examined by me is so striking that I have no doubt whatever as to the correctness of my determination.

It consequently follows from my investigation that the luminous midges belong to species which are the commonest and widely distributed, as had also once before been found to be the case by Dr. Brischke (*vide suprâ*).

We now have to discuss the explanation of their luminosity.

From the purely biological standpoint luminosity in animals in general can be referred to two causes.

In the first place animals are luminous, which for this purpose are provided with special luminous organs, and in which this function plays one part or another in their life-history, though the precise rôle may not always be manifest to us—such as, for instance, our own *Lampyris*, several exotic insects, luminous crustaceans and fishes living at great depths in the sea, &c.

In the second place, there are animals which are luminous by means of luminous micro-organisms living upon them or in them, which indeed, as is well known, also occasion the luminosity of decaying substances (meat, fish, wood, and similar bodies). In this instance we have to distinguish two cases:—

1. The micro-organisms may be harmless to the animal and we must consequently regard them as “room-parasites” (Raumparasiten), or even as commensals (since they perhaps also benefit the animal by their luminosity, by attracting its prey to it). The bacteria of the medusa *Pelagia* and of the mollusk *Pholas*, discovered by R. Dubois †, may serve as a case in point.

2. The micro-organisms may occur as veritable parasites, injurious to their host. Of this, however, we are at present acquainted with only a single instance, which was brought forward by A. Giard ‡, namely the luminosity of *Talitrus*.

* Réaumur, ‘Mém. pour serv. à l’hist. des Insectes,’ vol. v. p. 38, tab. v. figs. 1-5.

† R. Dubois, “Sur le rôle de la symbiose chez certains animaux marins lumineux,” *Compt. Rend. Acad. Paris*, t. cvii. 1888, p. 502.

‡ A. Giard, “Sur l’infection phosphoresc. des Talitres et autres Crustacées,” *Comptes Rendus*, Sept. 23, 1889, p. 503; *Ann. & Mag. Nat. Hist.* (6) iv. pp. 476-478 (1889); referred to in *Centralbl. f. Bact. u. Parasitenkunde*, Bd. vi. 1889, p. 645 (I quote according to Héricourt, “Les microbes lumineux,” *Revue Scient.* t. xlv. 1890, no. 15, p. 465).

In the year 1889 the naturalist referred to observed a strongly luminous *Talitrus* on the sea-shore near Wimereux. A specimen of this animal, which hitherto had never been observed to possess luminous properties, shone so brightly even by moonlight that it was distinctly recognizable at a distance of several metres. The light was of a greenish hue, and came from the interior of the body, which glowed, not in its various parts, but over the entire surface, even to the tips of the antennæ and feet, while the eyes alone formed two black dots upon this luminous background. The luminous individual moved very slowly upon the sand, instead of jumping about energetically like the other non-luminous members of the same species. On examining a foot belonging to the luminous crustacean under the microscope, it was found that it swarmed with micro-organisms (*Micrococcus phosphoreus*?) between the muscles, and that the muscles themselves were seriously injured by them, which was a sufficient explanation of the sluggish movements of the creature. Giard also succeeded in infecting with these luminous micro-organisms the healthy non-luminous crustaceans, and in thereby inducing luminosity in them. The animals became luminous in less than three days, continued to be so for from three to six days, then commenced gradually to become languid and motionless, and perished, as was also the case with the original specimen, after from three to four days more, while their bodies still continued to be luminous for some hours.

It appears to me that the luminosity of the midges (Chironomidæ) can, with the greatest probability, be regarded as belonging to the same category as the case above recorded, which, so far as I am aware, is at present entirely unique; this view is supported by the following points:—

1. The luminosity appears not in peculiar specially luminous species, but in the most common and widely distributed forms*.

2. The luminosity is (both in accordance with my own observations, as also with the statements of Alenizyn and Ssorokin) not localized at any one point, but embraces the entire body and all its appendages (legs and antennæ). The luminosity is also entirely independent of the will of the animal, and still persists for a long time even in alcohol (*vide supra*). I have even found a *Chironomus* which was caught in a spider's web and already partially sucked dry by the

* The luminous specimens of the species of *Corethra* brought back by Alenizyn likewise appear to belong to one of the most ordinary forms; but I did not succeed in determining them more precisely.

spider (the head was bitten off), and nevertheless its body was luminous, although not so brightly as in the case of the living insects.

3. The luminous insects are very sluggish, whereby they differ considerably from our own midges belonging to the same species. In his communication on the subject of the luminous insects observed on the Sea of Aral, Alenizyn writes as follows * :—"I have observed no independent movements on the part of the insects; those that I took in my hands remained perfectly motionless. On being touched a few individuals appeared to make indistinct movements, but they usually fell down when this was done, and, since they collected for the most part on the outside of the ship's bulwarks, they thus dropped into the water." Almost the same statement is also made by Ssorokin as to the luminous Chironomidæ on Lake Issykkul †, and from my own experience I can but confirm his words. According to the statements of the inhabitants the luminous insects are very rarely seen in flight, but always sit almost motionless on the branches of the bushes, a fact of which I was likewise able to convince myself. It is sufficient to hold a small box, a glass, or simply one's open hand beneath the luminous insect, and to shake the branch slightly, whereupon the midge falls down into the box or into the hand, and does not even attempt to fly away. Altogether the luminous insect conveys the impression of a sickly and, at any rate, an abnormal individual.

4. Neither by Kusnezoff ‡, who examined the collection forwarded by Ssorokin, nor by myself by means of making sections (borax-carmine and paraffin) were any structures whatever discovered resembling luminous organs. The fairly well-preserved midges which were obtained by Alenizyn (my own are in a much worse state of preservation, since I had carried them in tubes with ordinary corks, in consequence of which the spirit probably evaporated to a certain extent) exhibit in the sections only a strongly developed fat-body with its typical widely areolate cells.

5. The males are luminous as much as the females, and, consequently, the luminosity can scarcely be of service from a sexual point of view; it is self-evident that the luminosity cannot either serve as a lure, since the midges are not predaceous insects.

The analogy between the first three points and the above-quoted observations of Giard is so obvious that it scarcely

* *Loc. cit.* vol. xii.

† I. D. Kusnezoff, *loc. cit.* p. 170.

‡ *Loc. cit.* p. 170.

needs further discussion. This analogy, as also the last two points, tends, however, to show that the cause also of the luminosity is the same as in the case of *Talitrus*, and that, consequently, we are here likewise confronted with an infection by luminous micro-organisms.

In order to convince ourselves of the justice of this assumption, manifestly the simplest plan would be, as Giard has done, directly to demonstrate the presence of the micro-organisms.

Herein, unfortunately, owing to the fact that the state of preservation of the objects leaves so much to be desired, I have not succeeded.

I have attempted to employ various staining reagents for bacteria (methylene-blue-eosin, gentian-violet, Gram's and the Gram-Günther method), but without obtaining a distinctly positive result.

It is true that in many cells of the fat-body, enclosed in plasma, granules were to be seen which took a strong stain; but whether these are micro-organisms or merely some kind of concretions or decomposition-products of the cells, it is impossible to determine, so long as one is not in a position to examine a fresh specimen, or, at least, preparations for the purpose of comparison derived from the ordinary non-luminous *Chironomus*.

Manifestly the best proof would be the success of attempts at infection, as in the case of *Talitrus*.

As yet, therefore, we must forego, for a while, the final decision of the interesting question as to the causes of the luminosity of the midges, since all the points adduced are to be regarded really as only indirect, not as direct, proofs; and if I have ventured to decide in favour of the bacterial cause of a phenomenon which has at present received so little investigation, it is on account of two reasons:—

1. Because I am convinced that the arguments which have been adduced are still fairly weighty ones, and render the bacterial origin of the luminosity at least in the highest degree possible.

2. Because I considered that any explanation of the interesting phenomenon whatever, based upon facts, is at any rate better than none.

It was also my purpose once more to direct the attention of naturalists to the phenomenon in question, and thereby, perhaps, to stimulate someone to make a closer investigation.

It appears to me to be possible that the luminous midges also occur in Western Europe, as is already shown by the observation of Brischke, isolated at present though it be.

Above all, however, Russian naturalists have good opportunity to make closer acquaintance with the phenomenon, since in our territories in certain localities (*e. g.* on Lake Issykkul) it may be observed not as an exception, but rather as the rule.

The question as to the causes of the luminosity of the midges appears to me to possess a high biological interest and to be worth an exhaustive investigation, even for the reason that, should my hypotheses be confirmed, this phenomenon would constitute the second instance of bacterial-pathological luminosity in animals.

St. Petersburg,
March 1894.

XV.—*Description of a new Eagle-Ray from Muscat.*

By G. A. BOULENGER, F.R.S.

Rhinoptera Jayakari.

Teeth in nine rows, those of the median row of the upper jaw eight times as broad as long, and nearly twice as broad as those next to them; median teeth of the lower jaw six times as broad as long and once and a half as broad as those next to them. Disk once and three fourths as broad as long. Head as long as broad; snout emarginate; the width of the mouth nearly equals its distance from the end of the snout. Skin smooth. Tail two fifths of the total length. Blackish above, whitish beneath.

	millim.
Total length	740
Length of disk	450
Width of disk	750
Length of head	130
Width of head	130
Diameter of eye.....	15
Width of mouth	85

A single male specimen, a skin; presented to the British Museum by Surgeon-Major A. S. G. Jayakar.

By its dentition this species stands nearest to the Atlantic *R. Jussieui*, Cuv. (*brasiliensis*, J. Müll.), which is only known to me from the descriptions; but it can be easily distinguished by its short tail, the tail of *R. Jussieui* being more than twice as long as the disk.

XVI.—On the Devonian *Ichthyodorulite*, *Byssacanthus*.

By A. SMITH WOODWARD, F.L.S.

AMONG the remarkable Palæozoic fish-spines still awaiting determination, the Devonian fossil *Byssacanthus* is one of the most interesting. It was originally described by Agassiz* as related to the contemporaneous Elasmobranch fin-spine *Onchus*, differing from the latter in the great expansion of its hollow base. The typical specimens, ascribed to two species both by Agassiz † and E. von Eichwald ‡, were obtained from the Devonian of the Government of St. Petersburg, Russia. Another form was described by Barrois in 1875 § from the Upper Devonian of Couvin, in the Ardennes; while some difficultly determinable spines (perhaps Cephalaspidian cornua) from the Old Red Sandstone of Bromyard, Herefordshire, were also placed under the generic name *Byssacanthus* in Agassiz's work already cited ||.

The specimens from Herefordshire may be neglected as worthless; and the present writer has not yet had the privilege of examining the fossil described by Dr. Barrois. A study of all the examples of the typical *Byssacanthus*, however, now to be seen in the Museums of Jurjeff (Dorpat) and St. Petersburg has convinced the writer that a slight advance can already be made in determining its affinities. The following notes are thus published in the hope of directing attention to the subject.

The most satisfactory specimens, all nevertheless fragmentary, are preserved in the Geological Museum of the University of Jurjeff (Dorpat); and, by the kindness of Professor Loewinson-Lessing, one duplicate example has now been exchanged with the British Museum. All these were obtained from the Devonian of Livonia (in association with *Psammosteus*, *Heterosteus*, *Homosteus*, and *Asterolepis*), and they appear to belong to the type-species of the genus, *Byssacanthus crenulatus*.

The spine exhibits a small central cavity even in its more constricted part, and its expanded basal portion is correctly described as hollow; but, as shown by the specimen in the

* L. Agassiz, 'Poiss. Foss. Vieux Grès Rouge' (1845), pp. 111, 116.

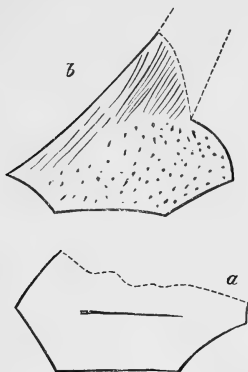
† *Loc. cit.*

‡ E. von Eichwald, 'Lethæa Rossica,' vol. i. (1860) p. 1598.

§ C. Barrois, "Sur le *Byssacanthus Gosseleti*," Comptes Rendus Assoc. Franç. 1874 (1875), pp. 381, 382.

|| *Op. cit.* p. 111 (= *Onchus arcuatus*, L. Agassiz, 'Poiss. Foss.' vol. iii. p. 7, pl. i. figs. 3-5).

British Museum (no. P. 7031), these two cavities are entirely separated. The slightly hollow spine, in fact, is fixed upon a ridge-shaped plate, and the concavity of the latter is not directly continued into the central canal of the former. Other specimens afford still further information, and one of the best at Jurjeff is roughly outlined in the accompanying diagram.



Byssacanthus crenulatus, Agassiz; outline of imperfect plate, (a) from below, (b) from the side, of the natural size.—Devonian; Livonia. [University of Jurjeff (Dorpat).]

This fossil, though wanting the upper part of the spine and imperfect on one side of the base, proves that *Byssacanthus* was originally fixed to (and continuous with) the keel of a plate, which had well-defined boundaries for articulation with adjoining plates. It seems to have been bilaterally symmetrical, though this is not absolutely certain; and its outline when viewed from below (fig. a) bears a remarkable resemblance to that of the anterior median dorsal plate of the *Asterolepidæ*. If there is any justification for this comparison, the spine is shown to have been directed backwards. The superficial ridged ornament of the spine terminates below and passes into a tubercular ornament on the basal plate.

The ridge of the plate is scarcely thickened, and the tissue is very dense in all parts of the fossil, exhibiting only minute vascular spaces when viewed in section with a lens. The visceral aspect of the plate is quite smooth, though pierced with minute vascular canals, and fractured surfaces show that its

innermost layer is formed of superposed delicate lamellæ. A transverse section of the spine in the British Museum examined microscopically exhibits neither bone-cells nor distinctly recognizable vascular dentine. The small vascular canals are surrounded by concentric lamellæ of seemingly structureless tissue; and the only appearances suggestive of the canaliculi of vascular dentine are observed in the series of prominences which are thrust from the central core into the distinctly separable outermost layer of the spine. There is no thick zone of lamellæ concentric with the median cavity, such as is described by Rohon in *Onchus* *; but some are concentric with the wavy border of the peripheral layer already mentioned, and it is unfortunate that the precise nature of the latter cannot be discerned in the section examined.

Byssacanthus is thus proved to be not an ordinary Elasmobranch spine; and it is extremely probable that the fossil belongs to a totally distinct group. At present the writer would compare it with the spinous plate of the Ostracoderm *Ceraspis* †, though this is distinguished by its remarkable thickness of coarsely cancellated tissue, and we as yet have no information concerning its microscopical structure. Among known Ostracodermi the histology of *Byssacanthus* is most nearly paralleled by that of the Pteraspidiæ; and the recognition of the other elements which must have entered into the same armature as the spinous plate will be awaited with interest.

XVII.—On *Thecodontosaurus* and *Palæosaurus*.

By H. G. SEELEY, F.R.S.‡

THE well-known memoir by Dr. Henry Riley and Mr. Samuel Stutchbury on three distinct Saurian animals discovered in 1834 in the Magnesian Conglomerate on Durdham Down, near Bristol, was communicated to the Geological Society in 1836, and published in the Transactions of the Society in 1840. Those fossil animals from the Trias became known as *Thecodontosaurus antiquus* (Trans. Geol. Soc. 2nd ser.

* J. V. Rohon, "Die Obersilurischen Fische von Oesel," Mém. Acad. Imp. Sci. St. Pétersbourg, [7] vol. xli. no. 5 (1893), pp. 41-45, pl. ii. fig. 58.

† C. Schlüter, Sitzungsber. niederrhein. Gesell. Bonn, 1887, p. 120; A. S. Woodward, Catal. Foss. Fishes Brit. Mus. pt. ii. (1891) p. 233.

‡ Read before the Geological Society of London, June 22, 1892, as Part 5 of "Contributions to Knowledge of the Saurischia of Europe and Africa."

vol. v. pl. xxix. figs. 1 and 2), *Palæosaurus cylindrodon* (l. c. fig. 4), and *Palæosaurus platyodon* (l. c. fig. 5). The separation of these genera has not been uniformly adopted, though they appear to have been founded upon good characters. In *Thecodontosaurus* the serrations upon the cutting-margins of the teeth are inclined obliquely upward, somewhat like the condition in *Dimodosaurus*. In *Palæosaurus* the corresponding serrations are at right angles to the cutting-margin of the tooth, as in *Megalosaurus*. Therefore the dental characters suggest a possible reference of the fossils to distinct families. But the nature of the serration has not always been accurately represented, since in the British Museum Catalogue of Fossil Reptiles, part i. p. 174, fig. 3, the lateral serrations on the tooth of *Palæosaurus platyodon* are shown as though they were directed obliquely upward; and, in harmony with this figure, the species is referred to the genus *Thecodontosaurus*.

Messrs. Riley and Stutchbury made no attempt to divide the bones which they found between their two genera.

Sir R. Owen, in 1841-42, in the Report of the British Association, recognized a resemblance between the teeth of *Thecodontosaurus*, which he describes correctly, and the teeth of *Rhopalodon* of Fischer, which are serrated in a different way*, though there may be no implication that the serrations are identical, since, while *Thecodontosaurus* is said to have the serrations directed vertically upward, the tooth-crown in *Palæosaurus* is said to be traversed by "two opposite finely serrated ridges, as in *Thecodontosaurus* and *Rhopalodon*."

The authors who first made these animals known described, in addition to teeth and jaw, vertebræ, ribs, chevron-bone, and bones which were regarded as coracoid, humerus, radius, ischium, femur, tibia, fibula, metatarsal or metacarpal bones, and claw-phalanges. Sir R. Owen (l. c.) grouped the more important bones under the genus *Palæosaurus*. He recognizes resemblances in the vertebræ to *Teleosaurus* and *Rhynchosaurus*, in the humerus to *Rhynchosaurus*, and in the femur to Crocodiles and *Megalosaurus*. The tooth in both genera is regarded as Lacertian in form, and Thecodont in implantation. The pectoral and probably the pelvic arch are regarded as Lacertian. The double-headed ribs and other vertebral characters, and the proportions of the limbs, are interpreted as Crocodilian.

These animals were afterwards referred to a distinct order under the name Thecodontia; and when they were redescribed in Sir R. Owen's 'Palæontology,' ed. 2, 1861, p. 275, the

* [Trans. Roy. Soc. vol. B cvi. 1894, pl. lxiii. fig. 2.]

comparison with *Rhopalodon* was omitted. An affinity is recognized with Dinosaurs and Crocodiles in the articulation of the ribs by a head and tubercle. The sacrum is said to include at least three vertebræ; and there are said to be obscure indications of a clavicle.

In 1869-70 (Quart. Journ. Geol. Soc. vol. xxvi. p. 42) Prof. Huxley adduced evidence that these animals might be conveniently classed under the Dinosauria, and he doubted their generic separation. In revising the state of knowledge at that time he regarded the teeth of one as Scelidosauroid and of the other as Megalosauroid. All the bones are spoken of as Thecodontosaurian, without attempt to refer them to the two generic types. The coracoid of Messrs. Riley and Stutchbury was interpreted as a fragmentary ilium, and the radius as a tibia. Prof. Huxley may be inferred to have doubted the identification of the ischium, since it is mentioned, like the coracoid and radius, in inverted commas; but no other interpretation is suggested.

Professor v. Zittel has kept these genera separate (Handb. d. Palæontologie, iii. pp. 721, 722), and has given a good figure of the serrations upon the tooth of *Palæosaurus*.

After examining the collection exhibited in the Bristol Museum, I regard the ischium of 1836, which is still embedded in the matrix, as an imperfect example of a humerus. From this it would follow that the deposit contains two types of humerus as well as two types of teeth.

If the specimen of humerus originally figured in 1840 (*l. c.* pl. xxx. fig. 1) is associated with the jaw with vertically serrated teeth as *Thecodontosaurus*, then the humeri nos. 118 and 37, Bristol Museum, and the specimen in question (no. 66) may be the type of another genus, such as is indicated by the teeth of *Palæosaurus*.

If the ilium which Prof. Huxley figured (Quart. Journ. Geol. Soc. vol. xxvi. pl. iii. fig. 7) is accepted as the type ilium of *Palæosaurus*, then the iliac bones preserved in the slab numbered 63 must be referred to two species. That which shows the external aspect of the left ilium is not unlike the specimen just referred to, except that it is smaller. It has the same general form as the ilium of *Zanclodon Quenstedti* (Phil. Trans. Roy. Soc. vol. B xlvi. 1889, p. 283). There is the same kind of open acetabular arch, the same prolongation forward of the pubic pedicle, a like convexity of the superior iliac crest, which has similar anterior and posterior extension. The only differences which could be regarded as specific are that the Bristol fossil has the ischiac pedicle relatively rather wider, and the posterior process of the crest

of the ilium rather longer and deeper, though these differences are no more than might be attributed to age. Since the teeth of *Zanclodon* appear to be of the same general type as that of *Palæosaurus platyodon*, there is strong probability that this ilium is rightly referred to *Palæosaurus*.

The second example in slab 63 is a mould from the internal surface of an ilium. It closely resembles in contour the ilium of an alligator. The acetabulum appears to be more nearly closed than in the first specimen, and the anterior contour of the pubic process is convex from above down, instead of being straight, and it appears to be relatively wider than the ischiac process. Hence, although the bones are right and left, are similar in size and general form, and occur in proximity in the same slab, it cannot be inferred that they belong to the same individual or the same species of *Palæosaurus*.

There is a slab in the Bristol Museum containing a bone which is broken at each of its four extremities, at present without number, which may possibly prove to be the ilium of *Thecodontosaurus* when divested of matrix.

The bones have unfortunately become scattered, so that the unique treasures, which derive their chief value from being naturally associated portions of skeletons, can never again be brought together. The Bristol collection is by far the most important. Some of the bones, like the scapula and femur, differ considerably in size. The bones retained at Bristol comprise dorsal, sacral *, and caudal vertebræ, scapula, and apparently the coracoid, humerus, ulna, metacarpals, ilium, femur, tibia, fibula, metatarsals, and phalanges. The bones which are fairly complete are the ilium, femur, tibia, humerus, and ulna; and upon them the dimensions of the animals must be based.

The Vertebræ.

The vertebræ are short and slender relatively to the length of the limb-bones; and the tail gives no indication of large size of the bodies of the vertebræ, which is seen in some *Saurischia*.

There is a somewhat elongated specimen in the Bristol Museum named cervical vertebra, which does not show any typical characters of that region of the skeleton. The remaining ten vertebræ are dorsal and caudal. It is impossible to distinguish the genus to which they belong, though the characters of the sacrum make it probable that they belong

* I have not seen the sacrum. It is figured in *Quart. Journ. Geol. Soc.* vol. xxvi. pl. iii. figs. 9, 10.

to *Palæosaurus*. The vertebræ already figured are indicated by the numbers 17, 18, 19, 25, 27, and 38. The new materials show that the caudal vertebræ steadily decrease in length as they diminish in size, and that the neural spine is inclined backward, and finally disappears, though the zygapophyses persist in the smallest vertebræ preserved.

Fig. 1.



A dorsal rib of *Palæosaurus*, showing capitular and tubercular articulations. In slab no. 63 (Brist. Mus.). $\frac{1}{3}$ nat. size.

A slender dorsal rib is preserved in slab 63 (fig. 1), which shows the tubercular and capitular facets to be nearly equal, each about $\frac{3}{10}$ inch wide, and divided by a notch which is somewhat wider. The rib appears to have been directed downward, as though it were an early dorsal. The specimen numbered 32 is stouter, has larger articular facets, and a greater depth over the articulation; only about 3 inches of its length is preserved. These ribs are compressed from front to back and are flattened on the external curved surface. The fossil described as a clavicle has much the aspect of a rib.

The dorsal vertebra no. 13 Brist. Mus. has the characteristic excavation beneath the transverse process, which is margined by anterior and posterior buttresses, which diverge as they descend. The centrum is $1\frac{4}{10}$ inch long. Its articular face is flattened, with a margin slightly rounded; it is 1 inch deep and somewhat narrower. The sides of the centrum are gently concave in length, with a flattened aspect; the base is rounded from side to side. The zygapophysial processes are well developed.

No. 14 Brist. Mus. shows the anterior position of the parapophysial facet for the head of the rib. It also shows that the neural spine is compressed from side to side and elevated, though only preserved for a height of $\frac{8}{10}$ inch. Below the neural arch the centrum shows on the side a longitudinal concave impression.

No. 10 Brist. Mus. is a dorsal vertebra showing a thick vertical neural spine and strong transverse processes, which appear to be notched out in the anterior margins, as among Crocodiles.

The caudal vertebra no. 17 Brist. Mus. has the centrum $1\frac{3}{10}$ inch long, $\frac{8}{10}$ inch high in front, and $\frac{7}{10}$ inch high behind. The measurement from the hinder border of the base of the

centrum to the summit of the neural spine is $1\frac{8}{10}$ inch. It is interesting as preserving the chevron-bone in natural articulation and for showing that the posterior facet for this bone is twice as wide as the anterior facet. The proportions of the centrum are Crocodilian rather than Saurischian.

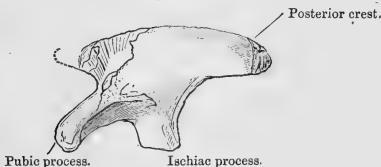
The caudal vertebra in slab 63 Brist. Mus. is $1\frac{2}{10}$ inch long. The articular faces of the centrum are about $\frac{6}{10}$ inch deep anteriorly and posteriorly. The vertebra is posterior in position to no. 17, for the transverse process has become reduced to a tubercle. The height to the summit of the neural spine is $1\frac{6}{10}$ inch. (See fig. 3, c.)

No. 19 Brist. Mus. includes three small caudal vertebræ in which the neural spine is lost. The centrams are each about $\frac{9}{10}$ inch long. The postzygapophyses are received between the prezygapophyses, indicating a vertical movement. The contour between the zygapophyses longitudinally is concave.

Ilium of Palæosaurus. (Figs. 2 and 3.)

The iliac bones already referred to which occur in the slab no. 63 are associated with a caudal vertebra, double-headed ribs, proximal end of a tibia, a fragment of fibula, and other remains. The anterior angle of the ilium is small and appears to be imperfect, and the posterior angle is worn. The gently convex superior crest is $3\frac{1}{2}$ inches long as preserved. Its middle part approximates towards the sacrum, owing to the

Fig. 2.



External aspect of left ilium of *Palæosaurus*.
Brist. Mus. no. 63. $\frac{1}{3}$ nat. size.

outward reflexion of the anterior angle, which makes the superior contour of the crest of the bone concave in length. The posterior angle of the crest is much more prolonged than the anterior angle, so that one half of the bone is behind the posterior border of the acetabulum. The superior and inferior edges of this process converge, but they are subparallel and

the process is about $\frac{8}{10}$ inch deep. The anterior process is indistinctly defined, and was produced somewhat forward to a point which was not in advance of the pubic process.

The acetabulum is an arch with its anterior side inclined forward at an angle of 45° ; the posterior side is shorter and more vertical. The pubic process which forms the anterior border is $1\frac{3}{10}$ inch long and margins the front of the acetabulum, with a long oblique ridge.

The hinder border of the acetabulum is at first sharp, but as it ascends it is reflected upward, so as to be flattened or concave on the underside of the posterior process of the ilium. The acetabulum is perforated by an arch which is similar in contour to the external outline of the acetabulum. This specimen differs from that figured by Professor Huxley in being smaller, in a more acute notch between the anterior process of the ilium and the pubic process, in the much less excavation of the notch between the pubic and ischiac processes, in the relatively greater length of the pubic process and of the anterior process of the ilium, which characters may possibly be more than individual variation.

Fig. 3.



Natural impression from the internal surface of the right ilium of a species of *Palaeosaurus*. A caudal vertebra (*c*) in the same slab is drawn posterior to the ilium. Brist. Mus. no. 63. $\frac{1}{3}$ nat. size.

An example of a right ilium on slab 63, which shows the internal aspect (fig. 3), does not display any marks of attachment to the vertebræ, resembling in this *Megalosaurs* rather than *Crocodiles*. It is as large as in an alligator about 10 feet long. There is the same large development of the posterior process of the ilium seen in all *Triassic Saurischia*, which is also present in existing *Crocodiles*, but the margins of the posterior process appear to approximate more rapidly, so as to terminate in a rounded extremity. Only the crest of the ilium is preserved, and this shows that the anterior angle was reflected outward, making the bone concave in length. All the lower portion of the ilium is indicated by a mould of the

bone which is lost, which is convex from front to back and does not show a very distinct outline between the pubic and ischiac processes. The anterior border of the ilium is convex from above downward, and the notch between it and the anterior process of the ilium is more open than in the other specimen. The bone is larger, has the pubic process stronger, and the notch between the processes evidently less excavated, so that it appears to indicate a distinct type of animal.

? *Ilium* of Thecodontosaurus.

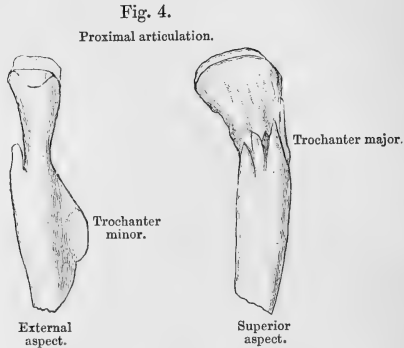
Another type of ilium, if correctly identified, is referable to a different genus. With this type of ilium I should be disposed to associate the humerus originally figured by Riley and Stutchbury (*l. c.* pl. xxx. fig. 1) and the fragments of jaw referred to *Thecodontosaurus*. I have not seen any form of femur which could be attributed to *Thecodontosaurus*, and the bulk of the remains are referable to *Palæosaurus* both on the grounds of osteological affinity between the several parts of the skeleton and of association.

Femur of Palæosaurus. (Fig. 4.)

The femur no. 67 is the type figured by the original describers of *Palæosaurus*. As preserved it is more than 10 inches long, is exposed on the ventral aspect, and has a slight sigmoid curve. The proximal articular surface is transversely truncated and the head of the bone is convexly rounded and directed inward. The transverse measurement through the head of the bone outward is $2\frac{2}{10}$ inches; below the head the bone contracts and the lateral contour is concave. The infero-lateral trochanter, regarded as the trochanter minor, begins about 2 inches below the proximal end. It is a longitudinal plate, compressed from side to side, about 2 inches long; a slight ridge is prolonged from it down the shaft towards the inner condyle. Below the lateral trochanter the shaft becomes slightly narrower. It widens again in its lower third, where the direction of the bone is a little downward, so that the superior surface is convex. The inferior surface of the head of the bone is convex from side to side, and the inferior surface of the distal end is concave both in length and breadth. The lateral position of the trochanter minor necessarily gives an aspect of great depth in that position, and the bone has an inflated aspect at the inner side about the trochanter. The distal end of the bone is flattened on the inner side, but rounded. The transverse width at the

terminal fracture was at least $2\frac{3}{10}$ inches. The bone appears to have been reconstructed.

Many other specimens indicate portions of femora, and are catalogued under the numbers 68, 69, 72, 75, 37, 82, 89, and 99. Some of these are free from matrix and show the characters of the femur in detail.



Left femur of *Palæosaurus*. Brist. Mus. no. 68. $\frac{1}{3}$ nat. size.

No. 68 (fig. 4) is the proximal end of a femur which shows both the external and lateral trochanters. The head of the bone is compressed from above downward, flattened superiorly, and more convex on the underside. It is less directed inward than in the type, fully $1\frac{7}{10}$ inch broad, and $\frac{9}{10}$ inch thick. The internal border is concave, the external border convex. At $1\frac{7}{10}$ inch from the proximal end, where the head of the bone has contracted somewhat both in breadth and thickness, is the small external trochanter major, which is a small spur directed upward, scarcely separated from the shaft, suggesting in this respect the similar trochanter in *Zanclodon*, though in characters of the head of the bone *Palæosaurus* is less Megalosaurian. The inferior lateral trochanter is in the corresponding position to that of *Zanclodon*. It is $2\frac{4}{10}$ inches from the proximal end, and therefore less like *Dimodosaurus*. The external trochanter is much less distinctly defined than is usual in Saurischians. By means of three rugosities it extends transversely across the upper surface of the head of the bone.

No. 69 illustrates the character of the distal end*. The

* Three distinct specimens are indicated under this number.

distal condyles are rounded from back to front, flattened on the inner side, and oblique on the external border. The bone is $1\frac{8}{10}$ inch thick at the condyle. This larger condyle is separated by a concavity which extends on to the base of the articular surface from the smaller external condyle, beyond which is the oblique compressed external border of the bone. The transverse width of the distal end is $2\frac{5}{10}$ inches. The specimens of femur differ considerably in size and character; some apparently indicate bones not more than 6 inches in length and more slender than others, as though different species were mixed together.

The Tibia of Palæosaurus. (Fig. 5.)

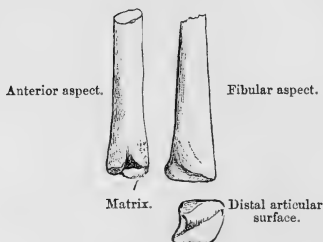
The tibia figured in 1840 still remains the only complete specimen. It is apparently in less excellent preservation at the distal end than when originally drawn, and without the aid of a second specimen its characters might have remained in uncertainty. The specimen no. 76 is 7 inches long, very slender in the middle of the shaft, and expanded at both extremities. The transverse width of the proximal end is $2\frac{3}{10}$ inches as exposed, measuring obliquely from the anterior border of the cnemial crest to the inner posterior angle of the articulation. The width of the bone behind is about $1\frac{1}{2}$ inch, and its external lateral measurement is about as much. As in the specimen 77 *a* figured by Professor Huxley, the external border has a distinct fibular concavity; but the forms of the proximal articular surfaces of the two specimens are different. The cnemial crest is elevated slightly above the articular surface for the femur. The posterior margin of the proximal femoral articulation of the tibia is rounded in the usual way, as though for contact with the condyles of the femur. The shaft is slightly more than $\frac{1}{2}$ inch wide in the middle, the distal end is $1\frac{2}{10}$ inch wide, notched on the anterior border, and has a subquadrate form.

There is a remarkable general resemblance between this bone and the tibia which I have described as *Agrosaurus* (Quart. Journ. Geol. Soc. 1891, vol. xlvii. p. 164), in which, however, the expansion of the proximal end appears to be relatively greater; and the notch at the distal end appears to be in about a line with the cnemial crest, while in *Agrosaurus* it is obviously lateral and on the fibular side.

No. 53 (fig. 5) is a fragment a little over 3 inches long, showing the distal end of a more slender tibia, in which the bone wants the transverse expansion which characterizes the type species no. 76. The distal end is subquadrate, about

$\frac{9}{10}$ inch in each measurement, and slightly oblique, as in *Agrosaurus*. It is shown to be a right tibia by the manner in which the surface from which the astragalus has become lost is excavated on its external border, as in *Agrosaurus*; so that the

Fig. 5.



Distal end of the left tibia of *Palæosaurus*. Brist. Mus. no. 53.
 $\frac{1}{4}$ nat. size.

astragalus must have been subquadrate, but, as in many Saurischians, deepest on the fibular border. There is an indication by an ascending groove of a small ascending talon, making some approach to *Dimosaurus*.

The tibia on slab 63 shows less than 6 inches of its proximal end, which is only 2 inches wide, and has the cnemial crest defined by a small superior cavity, which is continued downward by the fibular groove on the external aspect. The shaft of the bone is about $\frac{8}{10}$ inch wide in the middle, and appears to be expanding slightly towards the distal fracture.

The Fibula of Palæosaurus. (Fig. 6.)

A bone which I regard as being the left fibula agrees closely with the tibia in its length, is of about the same dimensions as the tibia no. 76 in the shaft, though but little expanded at the proximal and distal ends. It may have belonged to a species with rather more robust bones, such as is indicated by the slab tibia, no. 63. The distal extremity, which is exposed in lateral view, is strong and moderately expanded, like the distal end of the tibia no. 76, which it resembles in size. It has a convexly truncated distal end, which is about $1\frac{2}{10}$ inch wide. The bone is somewhat imperfect in fracture, but has a slender shaft $\frac{1}{2}$ inch wide, with subparallel sides; the oblique proximal end widens to about

1 inch, chiefly prolonged on the posterior margin. The proximal end has therefore the aspect of being inclined a little backward, and compressed at the articulation. It

Fig. 6.



Lateral aspect of the fibula of *Palæosaurus*. Brist. Mus. no. 42.
 $\frac{1}{4}$ nat. size.

appears to be flattened from side to side. The proximal articulation appears to be at right angles to that of the distal end.

No tarsal bones are preserved.

The Metatarsus of Palæosaurus.

The metatarsus is represented by several bones. No. 79 is a left metatarsal $4\frac{1}{4}$ inches long, $\frac{1}{2}\frac{9}{10}$ inch wide at the distal extremity, and $\frac{1}{2}$ inch wide above the distal articulation. Its proximal end is stout, fully an inch wide, oblique to the distal end, and inclined outward.

The type specimen is $3\frac{1}{2}$ inches long, $\frac{8}{10}$ inch wide at the distal end, $\frac{4}{10}$ inch wide in the lower third, and $1\frac{1}{10}$ inch wide at the proximal end, which, as usual, is concave on the under surface and oblique. No. 83 is a little smaller, the metatarsal being 3 inches long, with the proximal end $\frac{4}{10}$ inch wide and $\frac{9}{10}$ inch deep. These measurements are such that the bones might all belong to one foot, and they are provisionally referred to *Palæosaurus*.

The number of phalanges preserved is small; the longest, $1\frac{4}{10}$ inch long and $\frac{9}{10}$ inch wide, is a flattened bone, concave on the external border and straight on the inner border. Its articular surfaces are particularly well ossified, and rounded distally in pulley shape, like those of the metatarsal bones. Another phalangeal bone is $1\frac{1}{10}$ inch long. These measurements are in harmony with those usual in allied animals. I have nothing to add to the account of the claw-phalanges given by Riley and Stutchbury.

No. 87 is compressed from side to side, is about 2 inches long, and presents a type very similar to the claws of *Dimodosaurus*, but less wide.

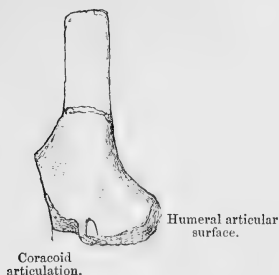
From the close similarity of form which these metatarsal and phalangeal bones offer to the bones of the foot in Crocodiles, I am led to believe that the animals were plantigrade. The ease with which a joint is made by the astragalus does not seem to necessarily imply a vertical position for the metatarsus, although that pulley-joint is found in birds. The metatarsus of most birds is not adapted for application to the ground in the same way as the wide metatarsus formed of separate bones which is found in these Saurischia.

The Shoulder-girdle in Palæosaurus.

Various examples of the scapula and coracoid occur, but they are all very imperfect. The principal specimens are numbered 89, 90, 91, 97, 59. Notwithstanding the imperfection of preservation, there is no doubt that the scapula was comparatively slender and short. It expanded a little at the free end, had both the anterior and posterior margins concave, widened greatly towards the coracoid, where it extended transversely forward. The different specimens vary a good deal in the width of the shaft. One of the smallest specimens, no. 90, very imperfect on the anterior coracoid end, and obviously broken at the extremity of the blade, is 6 inches long. As preserved the coracoid end is 2 inches wide, with an indication of a notch in the middle, which I take to mark the limit of the foramen towards the articular portion of the bone. The blade narrows in the middle to $\frac{9}{10}$ inch, and expands towards the free end, probably to more than $1\frac{1}{2}$ inch. No. 91, which has the form of the blade of a scapula, is 1 inch wide in the narrow part and 2 inches wide at the free extremity. It, however, shows no indication of the proximal end, and I cannot affirm that the bone is certainly a scapula, for its form is not unlike what might be expected in the blade of a pubis.

No. 97 is an instructive fragment (fig. 7), showing the articular end of the scapula in an uncompressed condition.

Fig. 7.



Scapula of *Palæosaurus*. Brist. Mus. no. 97. $\frac{1}{3}$ nat. size.

The principal specimen, no. 89, is exposed on the internal aspect, and consequently shows no indication of the articular surface and only a slight film of the coracoid and a portion of the impression from which the bone is lost. The scapula is concave in length on the posterior surface, with a sharp anterior border, which was reflected outward in the region in which the thickening of the anterior crest of the scapula is usually found. The bone does not appear to have been more than $5\frac{1}{2}$ inches long; it is $1\frac{1}{2}$ inch wide towards the free end, 1 inch wide in the middle, $2\frac{7}{10}$ inches wide towards the humeral articulation; but it is fractured in front, and probably had a width of $3\frac{1}{2}$ inches. The coracoid is very imperfectly indicated in this and the other specimens in which it appears to be partially preserved. The substance of the coracoid is $\frac{3}{20}$ inch thick, which is only half the thickness of the fractured anterior margin of the scapula. There is some indication that the surfaces of scapula and coracoid, which contributed to make the articulation for the humerus, met each other at an angle. Both these surfaces exceed an inch in length. There is a slight eminence on the surface on the cast in the region of the coracoid, which may indicate a foramen. It seems probable that the scapulæ here referred to belong to different species; and it might be anticipated that *Palæosaurus* will have a comparatively large and strong articulation in the shoulder-girdle when compared with *Thecodontosaurus*. It is possible that the bone no. 90 may pertain to the latter genus

if it is to be regarded as scapula, while 89 and 97 may be referred to *Palæosaurus*.

Humerus of Thecodontosaurus.

The specimens 95 and 96 are portions of the same bone, and are the type of the humerus of *Thecodontosaurus*, which is remarkable for the comparative straightness of its inner side, the concavity of its external border, and the relatively small proximal expansion given to the bone by the radial crest, which appears to be equalled by the width of the distal end, though the radial crest is imperfectly preserved. This humerus is remarkably flattened, and has the proximal and distal articulations in the same plane. The bone is exposed, so as to show the superior surface at the proximal end, and the inferior aspect at the distal end. The bone is much straighter, less twisted, more expanded transversely at the distal end, and less expanded in the radial crest than any Saurischian humerus known to me; and it differs in all these characters from the other humeri found in the same deposit. The length of the bone is $6\frac{1}{2}$ inches; the least width of the shaft, $\frac{6}{10}$ inch, is above the middle. The greatest width of the articular part of the head of the bone exceeds an inch; the head is slightly tumid and directed upward; while the radial crest, which is not conspicuously separate from the shaft, increases the width on the radial side to about 2 inches. There appears to have been a smooth, sharp, short margin between the articular head and the compressed vertical tuberosity of the outer border of the crest, which was about $\frac{1}{2}$ inch long.

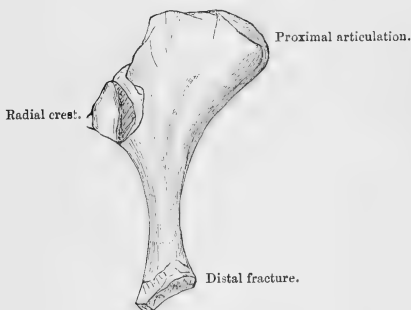
The distal end widens to about $2\frac{2}{10}$ inches. The external margin is prolonged in a convex curve on to the distal margin. The distal articular surface is concave from side to side, and therefore saddle-shaped, seeing that it is rounded from above downward. Above the articular surface the bone is slightly impressed, as though by the ulna. The contours of the bone at first sight approximate to those of *Belodon*; but the resemblance is superficial, since in that genus it is the internal border of the bone which is concave and the external which is nearly straight. There can be no doubt that, in so far as the bone diverges from ordinary Saurischia, it approaches towards existing Lizards.

Humerus of Palæosaurus. (Figs. 8 and 9.)

Besides the Thecodont type, there is the badly preserved bone originally described as ischium, which is a large right

humerus. It has lost both proximal and distal ends, but has the radial crest preserved, showing a type in which the proximal end of the bone was greatly expanded relatively to the distal end; and this type conforms to the Saurischian plan. It is very well represented by the humerus 118, which is similarly imperfect distally and has lost the radial crest, but preserves the articular head. The right humerus no. 37 also has the articular head and radial crest imperfect, but preserves the distal end of the bone. These specimens appear to be referable to more than one species; but the plan of the bone is the same in them all, so that an idea of the form of the humerus in *Palæosaurus* may be gathered from them.

Fig. 8.



Inferior aspect of a right humerus of *Palæosaurus*, showing the proximal articulation; imperfect distally. Brist. Mus. no. 118. $\frac{1}{3}$ nat. size.

The transverse width of no. 66 at the base of the radial crest is $3\frac{1}{2}$ inches; but since the head of the bone is broken away, the transverse measurement was probably not less than 4 inches. The shaft is $\frac{7}{8}$ inch thick, and the compressed tuberosity of the radial crest is $1\frac{9}{10}$ inch long. The large radial crest extends for a considerable distance down the length of the shaft, and the length of the bone, of which indications are preserved, amounted to 7 inches, without evidence of the extremity of either proximal or distal end.

No. 118 is a smaller bone (fig. 8), with a transverse width of the shaft of about $\frac{6}{10}$ inch, which is similar in size to no. 37. The complete proximal outline of the articular head is convex. The head is directed inward at an angle of 45° to the length of the shaft, and appears also to be twisted at an angle of 45° to

the distal end. It is about $1\frac{1}{2}$ inch long. Beyond this articular surface the unusually expanded radial crest is exposed, so that it is reflected downward, forming an open angle with the head. The measurement from the inferior border of the radial crest to the proximal articular surface is $3\frac{1}{2}$ inches, and the extreme width of the proximal end, as preserved, $3\frac{3}{4}$ inches. This expanded proximal surface is concave from side to side, with a median depression prolonged distally till it passes into the ridge which divides the distal end into a narrow oblique internal area, and a wide flattened external area, inclined to the inner surface at a great angle. The proximal articular surface, compressed from above downward, becomes narrower from within outward, and appears to have much the same relation to the radial crest as the corresponding parts of the humerus in Crocodiles. The radial crest at its outer inferior border is fully $\frac{3}{10}$ inch thick, and the length of its inferior border, as preserved, is about $2\frac{7}{10}$ inches. At the distal fracture the bone is about $1\frac{1}{10}$ inch wide and $\frac{3}{10}$ inch thick, and thickest on the inner border.

Fig. 9.



Distal articulation.

Right humerus of *Palaeosaurus*, showing part of the distal articulation; the proximal end is imperfect. Brist. Mus. no. 37. $\frac{1}{3}$ nat. size.

No. 37 (fig. 9) appears to indicate the length of the bone as being $6\frac{1}{4}$ inches, with the articular ends less perfectly ossified than in *Thecodontosaurus*; the large radial crest is prolonged for about halfway down the length of the humerus. There appear to be two condyles at the distal end, which measure about $1\frac{8}{10}$ inch from side to side as preserved. There is a

concavity above the distal condyles, and the bone has a compressed aspect on this inferior surface. The condyles are rounded, moderately developed; the internal condyle is broken. The bone has the usual slight sigmoid curve; it thickens towards the proximal articulation. The measurement from the proximal articular surface to the inferior angle of the radial crest is $3\frac{3}{10}$ inches. This bone is similar to the humerus of *Zanclodon* figured by Plieninger in all its characters, except that its radial crest appears to have a rather greater transverse width.

Ulna. (Fig. 10.)

A specimen, no. 46 (fig. 10.), originally figured by Riley and Stutchbury as the tibia, may be the ulna of *Palæosaurus*. The absence of curvature in the bone is not opposed to its being so identified, and the development of the proximal olecranon process is an approximation to *Pareiasaurus*, which is also found in *Stegosaurus* (Marsh, Am. Journ. Sci. vol. xix. pl. viii. fig. 3).

Fig. 10.

Proximal end.



Distal end.

Lateral aspect of the ulna. Brist. Mus. no. 46. $\frac{1}{3}$ nat. size.

The ulna is about $4\frac{8}{10}$ inches long, concave on the anterior and posterior outlines, $1\frac{1}{10}$ inch wide, with the distal end convex from front to back, without sign of excavation of the distal end.

The proximal end is $1\frac{1}{2}$ inch wide, with the articular surface slightly concave from front to back, margined by a distinct anterior edge like that seen in other examples of the Saurischian ulna, with the articular surface inclined to look upward and forward. There is a wide compressed

olecranon crest, which extends proximally above the articulation, somewhat like the cnemial crest of the tibia in *Dimodonsaurus*. The middle of the shaft is $\frac{1}{2}$ inch wide. On the supposition that the specimen is exposed on its internal aspect, the condition of the distal end would present nothing remarkable. The relative shortness of the bone as compared with the humerus of *Palæosaurus* seems to me in harmony with what might be expected from the known proportions of the fore and hind limbs.

The only element of the fore limb, besides the ulna, which can be recognized with any probability is a small metacarpal, which is much more slender than the metatarsal bones and more perfectly rounded at the distal extremity, and it is shorter.

In all parts of *Palæosaurus* which can be compared with *Zanclodon*, such as the ilium, humerus, femur, and scapula, there is a strong resemblance, though the differences are marked in the tibia and details of the femur, especially the distal end, so that it does not follow that the pubis and ischium were quite the same in both generic types. The proportions of *Palæosaurus* appear to have been those of a Crocodile, though the tail was probably shorter. The femur may be taken at $10\frac{1}{2}$ inches long and the tibia at 7 inches; so that it is difficult to believe that the body of the animal was lifted off the ground by the limbs. The humerus is 7 inches long and the ulna nearly 5 inches long. The Crocodilian character and size of the ilium are remarkable in relation to this shortness of the limbs, as showing persistence of character in the iliac bone, and presumably of habit in the animals thus characterized.

I desire to thank Mr. Swayne and Mr. E. Wilson for the facilities afforded me in examining the collection of bones in the Bristol Museum.

After these notes on English Triassic Saurischia were written and in the hands of the Geological Society of London, Professor Marsh published notes on Triassic Dinosaurs in the 'American Journal of Science' in June 1892. The text which refers to the Bristol specimens is limited to a few lines; the fossils being classed under the genus *Thecodontosaurus*, which is compared with the American genus *Anchisaurus*.

Professor Marsh figures the base of the skull of [*Thecodontosaurus*] *platyodon*, of which no example is known in this country in any museum.

Figures are also given of the bones of the left fore leg of the same species, in which are shown the scapula and coracoid, the humerus, radius, ulna, two carpal bones, and five metacarpals. There are three digits bearing claws with two, three, and four phalanges; the fourth digit has three minute phalanges, and in the fifth a hypothetical phalange is indicated. The claws decrease in size from the first to the third. No such specimen exists in this country. The forms of the bones are similar to those which I have attributed to *Palæosaurus platyodon*, with which they correspond in proportion, though, as the figure is one-fourth natural size, the animal appears to be slightly smaller than that of which I have given particulars. It is unexpected to find so Crocodilian a type of limb with the metatarsals extended as though they were carried vertically.

As the Bristol Museum specimens all came from a working long since closed, it would be interesting to learn the source from which these important new materials have been obtained.

XVIII.—*Descriptions of Four new Species of Terrestrial Mollusca from South Africa.* By JAMES COSMO MELVILL, M.A., F.L.S., and JOHN HENRY PONSONBY, F.Z.S.

[Plate XII.]

Zingis delicata, sp. n. (Pl. XII. figs. 1, 1 a.)

Z. testa imperforata, depresso-orbiculari, tenui, nitida, corneo-succineata; anfractibus sex, apud suturas impressis, fere lævibus, sub lente infra suturas et circa regionem umbilicarem transversim tenuissime striatis, striis mox evanidis, longitudinaliter irregulariter oblique liratis, ultimo anfractu apud medium lævissimo; apertura ovata; peristomate tenui, axi columellari albescente, paullum incrassato.

Long. 9, lat. 16 mill.

Hab. Knysna (Cox).

An extremely beautiful, imperforate, transparent species, of a dark brown warm amber colour; thin, fragile, depressed orbicular in form, six-whorled, with much flattened spire and apex; apparently quite smooth and shining, but with the aid of a lens the surface below the suture is seen to be very finely

transversely striate, and this is also the case round the umbilical region, the striæ towards the middle of the last whorl soon ceasing; the mouth is thin, simple; aperture rotund-ovate, columellar axis slightly thickened, white.

Several specimens.

Helix (Trachycystis) Alcocki, sp. n. (Pl. XII. figs. 2, 2 a.)

H. testa anguste umbilicata, depresso-conica, apice mammillato, ad peripheriam obtusangulata; anfractibus sex, ventricosulis, undique transversim tenui-striatis, striis sericeis, longitudinaliter epidermide evanida cunctis, oblique costulatis, ultimo, apud peripheriam præcipue, setifero; apertura lunata, compressa; peristomate tenui, simplici, apud marginem columellarem paululum reflexo.
Long. 4, lat. 8 mill.

Hab. Kowie (*Crawford*).

Several specimens of a little shell apparently distinct from its allies. In the setose epidermis it resembles *H. trichosteiroma*, M. & P., and is also near *H. Loveni* (Kr.), but is more depressed than that species.

Achatina Churchilliana, sp. n. (Pl. XII. fig. 3.)

A. testa pyramidato-fusiformi, solidiuscula, apud apicem obtusa; anfractibus septem, tumidulis, ad suturas subimpressis, supra, apud suturas, indistincte granato-striatis, infra applanatis, lævibus, epidermide tenui cinereo-ochracea tectis, anfractu ultimo producto; apertura oblonga; peristomate simplici.
Long. 3, lat. 1.50 unc.

Hab. Natal (*G. C. Churchill, Esq.*).

This plain-looking *Achatina* is doubtless one of the *natalensis* group, but we cannot identify it with any of the hitherto described species. The limits of variation in this genus have not, so far, been studied, and the local forms merit more attention than they have yet received. The label attached to the specimen, now unique, in the Owens College Museum, Manchester, is as follows:—" *Bulimus*. G. C. Churchill, Esq. Port Natal."

We have much pleasure in connecting with this shell the name of our friend Mr. Churchill, of Clifton, Bristol, so well known in botanical and other scientific circles.

Cyclostoma foveolatum, sp. n. (Pl. XII. figs. 4, 4 a.)

C. testa anguste sed profunde umbilicata, effuso-pyramidata, cinerea; anfractibus quinque, ventricosis, nunc unicoloribus, nunc vittis

transversis bi- vel tri-cingulatis (ultimo rapide accrescente), transversim obscure angulato-costatis, simul ac ad basin, circa umbilicum, et confertim (præcipue circa anfractum ultimum) punctis vel foveis interstitialibus regularibus transversim clathrato-succinctis; apertura rotunda, ochracea; peristomate albo, continuo, simplici, parum reflexo; operculo paucispirali, normali.

Long. 17·50, lat. 15 mill.

Hab. "S. Africa."

This particularly interesting form seems uniformly to differ from both the protean *C. ligatum*, Müll., and all other allies in the deep transverse interstitial pitting, especially conspicuous on the penultimate and last whorls, and giving a character to the shell at first sight. We have seen several specimens, all precisely similar in character, but differing in marking, some being plain and ash-coloured, without any transverse banding. That this banding is present (though often obscured) in all specimens is, however, evident by the markings showing through the ochraceous interior; the peristome is white, continuous, slightly reflexed. The specimens we have seen have the ordinary normal operculum of *ligatum* &c.

We also give additional figures of *Natalina Chaplini* and *Dorcasia inhluzana*, supplementary to those in our last paper (Ann. & Mag. Nat. Hist. ser. 6, vol. xiv., August 1894, plate i.).

EXPLANATION OF PLATE XII.

- Figs.* 1, 1 *a.* *Zingis delicata.*
Figs. 2, 2 *a.* *Trachycystis Alcocki.*
Fig. 3. *Achatina Churchilliana.*
Fig. 4. *Cyclostoma foveolatum.*
Fig. 4 *a.* Ditto, showing sculpture (enlarged).
Figs. 5-5 *b.* *Natalina Chaplini.*
Figs. 6, 6 *a.* *Dorcasia inhluzana.*

XIX.—On a New and Natural Grouping of some of the Oriental Genera of Mygalomorphæ, with Descriptions of new Genera and Species. By R. I. POCCOCK.

[Plate X.]

THE spiders which form the subject of the present paper have been recently referred by Mons. E. Simon * to three distinct

* Hist. Nat. des Araignées, i. pt. 1, pp. 132, 174.

sections of his subfamily Aviculariinae, namely the Phlogiæ, Selenocosmiæ, and the Pœcilotheriæ, which may be tabulated in the following order:—

1. PHLOGIÆ.—**Orphnæcus*, Luzon; *Chilobrachys*, Ceylon; *Phlogius*, Indo- and Austro-Malaya; *Coremiocnemis*, Pinang.
2. SELENOCOSMIÆ.—**Loxomphalia*, *Phoneyusa* (syn. *Harpaxotheria*), *Hysterocrates*, *Harpactira*, **Pelinobius*, Ethiopian Region; **Encycocrates*, Madagascar; **Ephebopus*, loc. ?; *Selenocosmia*, Indo-Malaya; **Lampropelma*, Ins. Sangir; **Haplopelma*, Borneo; **Cyriopagopus*, Tenasserim; *Haploclastus*, S. India; and, possibly, *Omothymus*, Pinang.
3. PÆCILOTHERIÆ.—*Pœcilotheria*, S. India, Ceylon; *Scodra*, W. Africa.

It is to be supposed that the above were regarded as natural groups; and since the Pœcilotheriæ were treated quite apart from the rest of the Old-World genera and in connexion with the Neotropical group of Aviculariæ, we may conclude that these two groups were looked upon as related to each other, and that the Indian genus *Pœcilotheria* was not regarded as having any near relationship with other Oriental forms. Moreover, the above-given arrangement of the genera indicates, I take it, that the Oriental genera of Selenocosmiæ are more nearly allied to the African genera of the same group than they are to the Oriental Phlogiæ. But, after working over some of the material of the Aviculariidae contained in the British Museum, the conclusion has been forced upon me, firstly, that Simon's sections are largely artificial, and, secondly, that the genera referred to them may be otherwise grouped, so as to form assemblages which may be regarded as natural, inasmuch as they agree, (1) in the possession of constant characters, and (2) in their geographical distribution.

In the first place it may be stated that none of the Oriental genera appear to me to be especially related to the Ethiopian, or, to put it more accurately, the genera composing either of the two groups into which the Oriental genera fall are more nearly related *inter se* than any one of them is to any Ethiopian genus known to me. This conclusion serves at once to separate off the Ethiopian genera, which I do not propose to deal further with here, except to state that I provisionally divide them into the following three sections:—

* Genera that are unknown to me in nature are marked with an asterisk.

- a. *Scodra*.
- b. *Loxomphalia*, *Phoneyusa* (sic), *Hysterocrates*, *Pelinobius* *.
- c. *Harpactira*.

But I do not yet wish to express any opinion regarding the relationship of these groups to each other or to any other section of the Aviculariidae.

Turning now to the Oriental forms, we find that they fall into two distinct sections, which I propose, at least provisionally, to regard as families. They may be grouped as follows:—

1. ORNITHOCTONIDÆ.—*Ornithoctonus*, Poc., Mergui; *Omothymus*, Thorell, Pinang; *Phormingochilus*, nov., Borneo; *Citharognathus*, nov., Borneo; *Melopæus*, nov. (= *Selenocosmia*, Simon, in part), Siam.
2. SELENOCOSMIDÆ.—*Haploclastus*, Sim., S. India; *Pæcilotheria*, Sim., S. India, Ceylon; *Chilobrachys*, Karsch, S. India, Ceylon; *Musagetes*, nov., Burma to Mergui (? *Phlogius* of Simon and Thorell, in part); *Lyrognathus*, nov., Assam; *Coremiocnemis*, Simon, Pinang; *Selenotypus*, nov., Queensland; *Selenocosmia*, Auss., Java &c.; *Phlogius*, Simon, Austro-Malaya; *Psalmopæus*, nov., East Indies.

These two families are based mainly upon the presence of the stridulating-organs that they possess between the outer surface of the mandible and the inner surface of the coxa of the palp. One of these organs, which was briefly described many years ago by Prof. Wood-Mason, is found well developed in all the genera of Selenocosmiidæ, with the single exception of *Haploclastus*, where the club-shaped rods are wanting; and the other, which has already been described by myself in 'Natural Science' for January 1895 †, is found with but little structural variation in all the genera of Ornithoctonidæ. Of course I have not been able to establish the presence of either of these organs in genera that are unknown to me; but analogy leads me to suppose that either one or the other will be found in *Haplopelma*, *Lampropelma*, *Cyriopagopus*, and

* Mons. Simon appears to me to have fallen into error over the determination of some of these genera. For instance, the type of *Phoneyusa* is not *Greefi* of Karsch, as he states, but *belandana* of Karsch (cf. Berl. ent. Zeitschr. 1884, p. 348), because this was the *only* species referred to the genus when the latter was first established. But since, according to Simon, *belandana* is congeneric with his species *antelope*, which is the type of *Harpaxotheria*, it necessarily follows that *Harpaxotheria* is synonymous with *Phoneyusa*. This leaves the so-called genus of which *Greefi* of Karsch is the type without a name. I hesitate, however, to supply this apparent deficiency, on the ground that the material at my disposal seems to indicate that *Greefi* is congeneric with the type of *Hysterocrates*.

† "Musical Boxes in Spiders." Fig. 9 of this paper should have been described as a *Musagetes*, and not as a *Phormingochilus*.

Orphnæcus. And if one may be permitted to guess, I would suggest that the first-named will perhaps fall into the Ornithotonidæ and the last three into the Selenocosmiidæ.

No organ resembling either of those mentioned above is found in any genus that I have examined of the following Neotropical groups:—Aviculariæ, Eurypelmateæ, Theraphosæ, and Homœommateæ; nor yet in the African genera above enumerated. The South-African *Harpactira*, however, has a peculiar arrangement of hairs on the outer surface of the mandible, there being a dense scopula above and a naked space below it; but upon this naked area there is one or more curved rows of hairs which have evidently been derived from the fringe which borders the lower edge of the mandible.

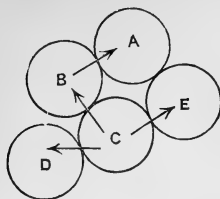
Family Selenocosmiidæ, nov.

With the exception of *Haploclastus*, which will, perhaps, have to be separated from it, this new family is tolerably compact. It is characterized by the possession of a stridulating-organ, composed of a series of thickened rods, upon the inner surface of the coxa of the palp, and of a corresponding series of spiniform hairs or of spicules upon the lower half of the external surface of the mandible. The fovea on the carapace is generally small, linear, transverse or crescentic, with the concavity forwards (it is larger in *Psalmopæus*). The legs are either without spines or with merely a few short ones at the apex of the protarsi or tibiæ. In the male, so far as is known, there is no spur on the tibia of the anterior legs. This, at least, is the case in the male of *Pæcilotheria*, *Chilobrachys*, *Musagetes*, *Phlogius*, and *Selenocosmia*.

Yet, although thus intimately allied, the genera with which I am acquainted fall readily into the following sections:—

- A. *Pæcilotheria*.
- B. *Chilobrachys*, *Musagetes*.
- C. *Selenocosmia*, *Phlogius*.
- D. *Coremiocnemis*, *Lyrognathus*, *Selenotypus*.
- E. *Psalmopæus*.

The mutual affinities of these sections are at present puzzling, and it is impossible to represent them accurately in a dichotomous synoptical table. It seems to me that A is related to B, B to C, C to D, C to E, and E to A. I venture therefore to attempt to express this roundabout relationship by the following diagram:—



At present I am disposed to think that, on the whole, the most primitive of these groups is C or D. For example, the strikers on the mandible in C are much less specialized than in A or B, since they are clearly nothing but long thickened hairs, whereas in A and B the hairs have been modified into granuliform spicules or genuine rigid spines. Moreover, A appears to be more specialized than B in the great development of its scopulæ, which, I take it, is a criterion of specialization. In the same way E is more specialized than C, and thus approaches A; and, lastly, if the larger size of the fourth leg is a primitive character, as seems not unlikely, the group D is more primitive than C.

N.B.—The species coming from British India, Burma, and Ceylon, which are here briefly described, I propose to discuss at greater length on some future occasion.

Synopsis of the Genera.

- a. Coxa of palp furnished inside with scattered irregularly arranged longer and shorter spines and spiniform setæ; without a fringe below the suture; mandible with a few irregularly arranged, long, stout, but apically filiform setæ, mixed up with the inferior fringe of red hairs. . . *Haploclastus*, Sim.
- b. Coxa of palp furnished inside with a cluster or row of club-shaped rods.
 - a¹. The outer surface of the mandible furnished below and behind with long stout setæ, as in *Haploclastus*; the inner surface of the coxa of the palp without so definite a fringe below the suture, the "keys" composed of a thick cluster of club-shaped rods (except *Psalmopæus*).
 - a². Legs of the fourth pair noticeably stronger than those of the first and clothed distally with long erect setæ; tarsal pads of the fourth leg completely divided by a row of setæ.
 - a³. The fourth leg stouter than the first, its protarsal pad entire and extending, at least on the inner side, almost up to the

- base of the segment; pad on protarsus of third covering almost the whole of the segment. *Lyrognathus*, nov.
- b*³. The fourth leg scarcely stouter than the first; its protarsal pad divided and situated on the distal fourth of the length of the segment; protarsal pad of third covering about half or two thirds of the segment.
- a*⁴. Eyes of anterior row straight, the lateral only a little smaller than the median, the posterior lateral of largish size; fovea small, narrower than ocular tubercle; labium narrower, only a little wider, than the ocular tubercle. . . *Coremiocnemis*, Sim.
- b*⁴. Eyes of the front row recurved, the lateral a little behind the median and only about half their size; the posterior lateral eyes also minute; ocular tubercle high, not wide, narrower than the fovea, which is very deep and strong; labium very large, nearly twice as wide as the ocular tubercle *Selenotypus*, nov.
- b*². Legs of the fourth pair shorter and thinner than those of the first, and normally hairy.
- a*⁵. Pads on the legs narrower, those on the third protarsus covering only half the segment; pad on tarsus of fourth wholly or partially divided by setæ; mandible without an external scopula, but with many spiniform setæ below; keys on the coxa of palp numerous; fovea on the carapace shallow and crescentic. *Selenocosmia*, Auss., and *Phlogius*, Sim.
- b*⁵. Pads and hairs on the legs developed almost as in *Pacilotheria*; protarsus of third leg scopulate to the base; pad of the fourth tarsus entire; mandible with external scopula and only a few spiniform setæ; keys composed of a single series of rods; fovea deep and straight transversely *Psalmopæus*, nov.
- b*¹. The outer surface of the mandible furnished below and behind with a cluster of granules or short spines, which increase in length towards the lower edge, which bears, in addition, a few longer spines; the "keys" on the coxa of the palp composed of a single series of rods, between which and the suture there lies a thick fringe of long hairs.
- a*⁶. Pads on the feet very wide; the tarsal pad of the fourth undivided; fovea small, transversely linear; with one or more tubercles amongst the keys on the coxa of palp *Pacilotheria*, Sim.
- b*⁶. Pads on the feet narrower; the tarsal pad of the fourth wholly or partially divided by

setæ; keys on the palp and strikers on the mandible more numerous; no tubercles mixed up with the keys on the palp.

*a*⁷. Claws of the legs toothed *Chilobrachys*, Karsch.

*b*⁷. Claws of legs simple, unarmed *Musagetes*, nov.

Genus PÆCILOTHERIA, Simon.

Synopsis of the Species.

- a*. Femora of all the legs brown or black beneath, at least not striped; fringes of hairs on the maxillæ and mandibles brighter red; carapace adorned with very distinct fine whitish lines, radiating from the fovea; sides of the upper surface of the abdomen blacker, the median band shorter and generally indistinctly divided into two series of large pale spots; the tubercle on the coxa of the palp lying in the middle of the line of keys *sulfusca*, sp. n.*
- b*. Femora of some or all of the legs white or yellow beneath and ornamented with strong black stripes; carapace without distinct radiating whitish lines, but (at least in the female) with a pair of brown bands, which extend from the ocular tubercle to the posterior border; the pale band on the abdomen larger and defined by a narrowish brown border, from which brown stripes extend externally on to the paler sides of the abdomen; fringes round the mouth less brightly coloured, often blackish; the tubercles on the maxillæ at the end of the line of keys.
- a*¹. Black bands on the under surface of the femora of the first and second legs narrow, only a little wider than the yellow area above them; these femora clear lemon-yellow, the others greyish white. *fasciata* (Latr.) †.
- b*¹. Black bands on the under surface of the anterior two pairs of femora very wide, at least twice the width of the pale area above them.
- a*². The anterior two pairs of femora yellower; the under surface of the femora, patellæ and tibiæ, and proximal end of protarsi of the second and third pairs of legs yellowish or greyish white, with a broad black band on the femora and tibiæ; only a very small black stripe at the base of the four femora; with two tubercles on the inner surface of the

* Of this species, which appears to be the commonest of the genus, the British Museum has thirteen specimens (male and female) from Ceylon. I have little doubt that hitherto it has been confounded with *P. fasciata*.

† I have seen five specimens (male and female) of this species from Ceylon. These are, I think, referable to the species figured by Koch, Walckenaer, and Seba.

- maxilla; scopula on fourth protarsus covering only about one fourth of the segment *striata*, sp. n. *
- b². The anterior two pairs of femora much whiter beneath; the under surface of the third and fourth legs not distinctly banded, covered with long hairs of a brownish-grey tint; the black stripe at the base of the femora larger; the maxilla with only one tubercle on its inner side; pad on fourth protarsus covering half the segment *vittata*, sp. n. †

Genus MUSAGETES, nov.

I select *M. Masoni* as the type of this genus. The species known to me may be recognized by the following table:—

- a. The keys distally increasing in size, strength, and distinctness, proximally fusing almost indistinguishably with the fringe above them; strikers on the mandible arranged in definite parallel rows. *fumosus*, sp. n.
- b. The keys proximally increasing in size and distinctness, distally becoming crowded together, smaller, and more or less blending with the fringe above them; the strikers on the mandible not arranged in definite rows.
- a¹. The keys distally lying two or three layers deep, the cluster much wider at this end than at the other, the row close to the internal (lower) fringe composed of short distinct rods. *Andersonii*, sp. n.
- b¹. The key cluster narrower at its distal end than in the middle, and composed of only about one row of longer and shorter hairs, which blend with the fringe.
- a². The upperside of the femora of the palpi and legs much darker than the rest of the segments; the lower surface of the coxa, trochanter, and femur of the palpi and first and second legs internally black, externally ochre-yellow, the two colours meeting but not blending in the middle of the segments *bicolor*, sp. n.
- b². All the appendages of a normal and uniform pattern of colouring.
- a³. Legs longer; body and legs clothed with chocolate-brown hairs, relieved by pale stripes on the legs *Masoni*, sp. n.
- b³. Legs shorter; body and limbs clothed with pale yellowish hairs; legs not striped. *Hardwickii*, sp. n.

Musagetes Andersonii, sp. n.

Selenocosmia javanensis, Pocock, "On the Fauna of the Mergui Archipelago," Journ. Linn. Soc., Zool. xxiv. p. 317 (1892).

Colour.—Trunk and limbs covered above and below with

* A single female specimen from Pinang (Hardwicke Coll.).

† A single male example from S. India.

a clothing of uniformly brownish-yellow hairs; the longer setæ of very much the same tint.

Carapace oval, considerably longer than wide, not very high anteriorly, the radiating grooves well-marked; the fovea strong, crescentic, a little wider than the ocular tubercle; tubercle of medium size, scarcely a trace of any clypeal border; distance between anterior eyes and anterior edge equal to about twice a diameter. *Eyes* of anterior row slightly procurved, large, subequal, and equidistant from each other, the distance between them distinctly less than the diameter of a median eye; eyes of posterior row straight, the two on each side not very unequal in size, the lateral considerably smaller than the anterior lateral.

Mandible with 14 teeth along the outer edge of the lower border, which is granular behind; keys on the maxilla about four rows deep distally, the rows near the oral (internal) fringe quite distinct from the fringe below the suture: proximally the keys are arranged in two distinct rows near the middle of the segment; one row, close to the external fringe, is composed of small spiniform setæ, the other, nearer the oral fringe, of stout distinct rods, which rapidly decrease in length towards the base of the segment.

Labium nearly square, only a little wider than long, with its sides slightly converging, densely spinulose, its width much greater than that of the ocular tubercle and greater than that of the fovea. *Sternum* a shade longer than wide, as wide between the coxæ of the first as of the third legs; distance between the posterior impressions almost equal to the width of the labium.

Legs long and slender, the first stouter than the fourth, but a little shorter, all of them attenuate, with narrow scopulæ; scopula on protarsus of third covering nearly the whole of the segment, that on the fourth covering about half the segment and divided; that on the fourth tarsus divided by a band of setæ in its basal half; patella and tibia of fourth shorter than of first and equal to length of carapace; protarsus of fourth just exceeding width of carapace and about equal to the length of the protarsus and tarsus of the second leg; patella of second and of fourth about equal; tarsus of fourth a little longer than of first. Spinners as long as tibia of fourth.

Measurements in millimetres.—Length of carapace 23·5, width 20; length of sternum 10·2, width 10; length of labium 3·5, width 4; length of palp 45, of first leg 70, of second 62, of third 56, of fourth 74·5.

Loc. Mergui (*Dr. John Anderson*). A single female example.

Musagetes Masoni, sp. n. (Pl. X. fig. 6.)

This species, of which the British Museum has a considerable number of specimens from Silhet, much resembles *M. Andersonii* in general features.

The carapace, mandibles, and bases of the limbs are clothed with yellowish-brown hairs; the legs with blackish-brown hairs relieved by paler lines, especially noticeable on the patellæ, and by a spot of the same colour upon the distal extremity of the femur and following three segments; the lower surfaces of the trunk and limbs are deep velvety blackish brown.

The legs closely resemble those of *Andersonii*, but the fourth do not appear to be quite so long, *e. g.*, the protarsus is noticeably shorter than the width of the carapace; moreover the scopulæ of the front legs are rather wider than in *Andersonii*.

Total length 40 millim.; length of carapace 19·5, width 17·5.

Musagetes Hardwickii, sp. n.

A smaller species than *M. Masoni*, with yellowish-brown colouring and shorter legs, the patella and tibia of the fourth being less than the length of the carapace (which is about equal to these segments in the first leg), and with the fourth protarsus also much shorter than the width of the carapace.

Total length 33 millim.; length of carapace 17·5, width 14·5.

Loc. Burdwan, India (Hardwicke coll.).

Musagetes bicolor, sp. n.

This species is based upon a handsome male example obtained by Mr. E. W. Oates in Kijouske (Upper Burma). The colouring of the appendages is perhaps its most striking feature.

Musagetes fumosus, sp. n. (Pl. X. fig. 7.)

A uniform brownish-black colour all over, with the fourth legs longer than the first apparently, the patella and tibia of the first being only a little longer than of the fourth, the protarsus of the fourth shorter than the width of the carapace.

Total length 37 millim.; length of carapace 17·5, width almost 15.

Loc. North India (probably Assam). A single dried female.

In addition to the above it is probable that the Burmese species referred to *Phlogius* by both Simon and Thorell,

namely *P. soricinus*, Thor., and *P. flavopilosus*, Sim., will fall into this genus, and also *Mygale stridulans* of Wood-Mason, the type of which I hope is still in the Museum at Calcutta. The figure of *stridulans* is not accurate enough to do more than show that the anterior legs are stronger than the posterior, which seems to prove that specimens which Mr. Peal has subsequently sent to England from Assam as *stridulans* are not in reality that species; for these specimens, for the opportunity to examine which I am indebted to Mr. O. E. Janson, are referable to my genus *Lyrognathus*, with very strong hind legs.

Genus LYROGNATHUS, nov.

Lyrognathus crotalus, sp. n.

This species is based upon a spider from Assam which offers the characters pointed out in the generic diagnosis. I may further add that the carapace is moderately high in front, is much longer than wide, and has a crescentic fovea. The scopulæ on the legs are very well developed, especially that on the fourth postarsus, and all are entire, except that on the tarsus of the fourth, which is completely divided.

The cluster of keys on the maxilla blends both proximally and distally, and externally with the external fringe of hairs, the two together occupying nearly the whole of the area between the suture and the internal or oral fringe; the keys lying next the oral fringe are the longest of all, distinct from the rest, and strongly clavate. There appear to be only 8, or perhaps 9, teeth, which posteriorly decrease in size, on the internal side of the lower edge of the mandible.

Total length 26 millim.; length of carapace 13·5, width 10.

In some of its characters, *e. g.* in the approximate equality in length of the protarsus and tibia of the fourth leg, and the much greater length of the patella and tibia of the fourth than of the first, as well as in the large size of the scopulæ, this genus approaches *Cyriopagopus* of Simon from Tavoy. But in the latter the scopula on the fourth protarsus is divided by a line of setæ, and occupies only the distal third of the segment.

Genus COREMIOCNEMIS, Simon.

Coremiocnemis, Simon, Hist. Nat. Araignées, 1892, p. 146.

Coremiocnemis validus, sp. n. (Pl. X. fig. 5.)

Apparently resembling the type, *C. cunicularius*, from

Pinang (Ann. Soc. Ent. Fr. 1892, p. 279), in the structure of its legs, but differing in size (*cf.* measurements), colour, and probably in many other characters.

♀. *Colour* reddish brown, clothed with yellowish hairs.

Carapace not high, flattish, a little longer than wide; *eyes* decreasing in size in the following order—ant. median, ant. lateral, post. lateral, post. median; fovea strongly crescentic, small, narrower than the ocular tubercle.

Labium much wider than long; its width less than half the length of the posterior edge of the maxilla, and only a little greater than the width of the ocular tubercle. *Sternum* wide, oval, width between the posterior impressions about equal to the length of the labium.

Mandible with strikers composed of a relatively small number of stout, apically filiform setæ situated close to the fringe of red hairs, and passing above into fine whitish hairs; the area on which the fang closes bounded externally with 15 teeth, and granular behind.

Palp with the keys or notes composed of a thick cluster (3 or 4 rows) of clavate apically-pointed rods.

Legs unarmed, except for a few (1 or 2) spines at the apex of the protarsi; long and slender; scopulæ normal, that on the protarsus of the third covering two thirds of the segment; that on the tarsus of the fourth divided by a very fine line of setæ; patella and tibia of fourth longer than of first; protarsus of fourth longer than protarsus and tarsus of first.

Measurements in millimetres.—Length of carapace 20, width 17·5; length of abdomen 25, of palp 35, of first leg 55, second leg 48, third leg 46·5, fourth leg 68, of posterior spinner 11·5.

Loc. East Indies. A single specimen.

Genus SELENOTYPUS, nov.

Selenotypus plumipes, sp. n. (Pl. X. figs. 2-2b.)

♀. *Colour* a uniform reddish brown, covered with brownish-red hairs, those on the three distal segments of the posterior legs long.

Carapace considerably longer than broad, radiating grooves conspicuous; head-region high; fovea very strong, crescentic, the area around it slightly depressed, wider than the ocular tubercle; ocular tubercle elevated, not wide, running right up to the edge of the carapace, so that there is no true clypeus, the distance between the anterior median eye and the front edge of the tubercle nearly or perhaps quite twice the diameter of the eye; the anterior eyes about equidistant from each other, the distances being about equal to the diameter of the

lateral or half the diameter of the median; eyes of posterior row recurved, the lateral separated from the anterior lateral by at least twice their diameter, and much smaller than them; the median nearly as large as the lateral, and very distinctly separated from them.

Labium very wide, densely spinulose, its width almost equal to half the posterior length of the maxilla, and nearly twice as great as the distance between the posterior sternal impressions.

Sternum oval, only a little longer than wide.

Mandible not scopulate externally, but furnished behind with a depressed setose area; strikers composed of a large number of stout spiniform, but apically filiform, setae, lying above behind and fusing with the fringe, the groove for the fang granular behind and bordered externally with 12 stout teeth; the *keys* on the maxilla composed of a long cluster of numerous club-shaped rods, which proximally and distally decrease in size and blend with the hairs of the fringe lying above them.

Legs unspined, except on the apices of the protarsi; length 4, 1, 2, 3, the fourth longer than the first by nearly twice the length of the former's tarsus; all the legs rather slender; scopulae narrow, that on the third protarsus covering about half the segment, that on the fourth protarsus covering about one third of the segment and completely divided; scopula on fourth tarsus divided by a very narrow band of setae; patella of first and of fourth about equal; tibiae very unequal; protarsi of fourth longer than tarsus and protarsus of first, and just about equal to the width of the carapace, the patella and tibia of fourth slightly exceeding the length of carapace; the long hairs on the posterior legs straight and not woolly.

Posterior spinner a little longer than the fourth tarsus, its apical segment one third longer than the second.

Measurements in millimetres.—Length of carapace 21, width 17; length of abdomen 31, width 19; length and width of sternum 8·8; width of labium 4·3, length 2·3; length of palp 41·8, of first leg 62, of second 53, of third 50·2, of fourth 74; first leg: femur 14·5, patella 9, tibia 10·5, protarsus 9, tarsus 6; fourth leg: femur 16·2, patella 9, tibia 12·2, protarsus 17, tarsus 8·2.

Loc. Major's Creek, Townsville in Queensland. One example.

This spider was discovered by Mr. Dodd S. Clarke at a distance of two feet below the surface of the ground. It was kindly presented to the British Museum by Mr. Florence O'Driscoll.

Genus PSALMOPŒUS, nov.

*Psalmopœus Cambridgii**, sp. n. (Pl. X. figs. 3-3b.)

♀. *Colour* (possibly faded): upperside of trunk and limbs clothed with greyish-yellow hairs; the lines on the limbs with whitish hairs; a reddish-yellow pad on the upperside of the tarsi and a stripe of the same colour on the protarsi; lower surface of carapace and coxæ chocolate-brown; the long fringes on the appendages yellowish red; the fringe on the mandible and maxillæ blood-red; the upperside of the abdomen marked with a darker median band.

Carapace moderately high in front, a little longer than wide, the radiating grooves strongish; the *fovea* strong, deep, transverse, a little narrower than the tubercle; *tubercle* large, wide, projecting slightly beyond the anterior border, which is thus convex at this spot; distance between front edge of tubercle and median eye about equal to diameter of latter. *Eyes* of front row about straight, equidistant, median the largest and separated by a space which is less than their diameter; posterior lateral a little smaller than anterior lateral; length of carapace a little less than that of patella and tibia of fourth leg, width equal to length of protarsus and half the tarsus of the same leg.

Sternum oval, noticeably longer than wide, equally wide between the coxæ of the legs of the second and third pairs; distance between the posterior impressions less than the width of the tubercle, equal to that of the fovea, and greater than that of the labium. *Labium* as long as wide, parallel-sided, densely spinulose, separated from the sternum by a very deep smooth groove.

Mandible with a well-developed external velvety pad of long simple hairs, naked below, the strikers consisting of a small number of apically filiform spiniform setæ arranged on the lower edge behind the red fringe; the margin granular behind, armed internally with eleven large teeth.

Maxilla scantily clothed with setæ below the suture; the keys composed of a single curved row of fourteen stout rods; proximally these rods are short and stout, but distally they become gradually longer, thinner, and more club-shaped, and ultimately pass into the hairs of the thick fringe, each is tipped with a minute hair.

Palp with its trochanter and base of femur furnished externally and internally with a scopula of short brown hairs.

Legs long, the first pair the longest, the second as long as the fourth, unarmed except for a few small spines at the apices of the tibiæ; the tibiæ, protarsi, and tarsi furnished

* In honorem amici mei, F. O. P. Cambridge.

externally and internally with thick fringes of long silky hair, the femora also, especially the anterior pair, with a strong external fringe; all the scopulæ wide, well-developed, and entire, except that on the fourth protarsus, which is divided and extends over the distal third of the segment, the scopula on the lower surface of the third protarsus covering nearly the whole of the segment.

(Spinners fractured.)

Measurements in millimetres.—Length of carapace 20, width 18.5; length of palp 38, of first leg 69, of second and fourth about 63, of third 52.

A single female specimen, ticketed 'East Indies,' possibly from Pinang, since the specimen was taken from a bottle which also contained an *Omothymus*.

Family *Ornithoctonidæ*, nov.

Mandible furnished externally and below with a dense pad (scopula) composed of short feather-like hairs; the area below this pad smooth, but bearing at the base a small number of large, curved, barbed setæ, which spring from the scopula above. The adjacent surface of the maxilla sparsely setose, but armed above and below the suture with tuberculiform spines. Pads on the tarsi large and entire. Tibiæ and protarsi of legs apically spined.

Synopsis of Genera.

- a.* Legs of the fourth pair measured from base of femur longer than those of the first and noticeably stouter; their tibiæ thicker than their femora, and, like the protarsi, spinulose . . . *Citharognathus*, nov.
- b.* Legs of the fourth pair not longer than those of the first, and thinner; their tibiæ much narrower than their femora.
- a*¹. Legs short and robust; width of anterior and posterior tibiæ more than a third of their length; ocular tubercle small; clypeus wide *Ornithoctonus*, Poc.
- b*¹. Legs longer and thinner; width of anterior and posterior tibiæ less than a third of their length.
- a*². Carapace high; ocular tubercle small, high, not much wider than long; clypeus longish *Melopæus*, nov.
- b*². Carapace lower; ocular tubercle low, very wide, nearly twice as wide as long; clypeus short.
- a*³. Sternum oval, as wide between the first coxæ as between the third (tarsal pads wider, protarsal pads shorter, protarsi slenderer) *Omothymus*, Thor.
- b*³. Sternum narrowed in front, much wider between the third than between the first coxæ *Phormingochilus*, nov.

Genus OMOTHYMUS, Thorell.

Omothymus, Thor. K. Sv. Vet.-Akad. Handl. xxiv. no. 2, p. 11 (1891).

Type, *O. Schiædtei*, Thorell, from Pinang.

The British Museum has specimens (male and female) of this genus. The female from Pinang is probably to be named *Schiædtei*; possibly also the male, which has no nearer locality than East Indies, is the same species. At all events it does not differ apparently in any characters that are to be relied upon from the male of *Schiædtei* as described by Thorell.

Genus ORNITHOCTONUS, Poc.

Ornithoctonus Andersonii, Poc.

Ornithoctonus Andersonii, Poc. Journ. Linn. Soc., Zool. xxiv. pp. 317, 318, pl. xxii. figs. 1-3 (1892).

Loc. Mergui; also Burma (Mus. Brit.).

Genus MELOPŒUS, nov.

This genus is based upon several specimens in the British Museum from Siam and Hong Kong, which I believe are referable to the species described by Simon as *Selenocosmia albo-striata**. The male is unknown to me, but according to Simon it has a short process upon the tibia of the first leg.

Genus PHORMINGOCHILUS, nov.

Phormingochilus Everetti, sp. n. (Pl. X. figs. 4-4b.)

♀. *Colour*. Carapace, mandibles, and limbs covered with a yellowish-ashy clothing of short hairs; the long setæ reddish grey, black at the base; the abdomen reddish yellow, with an obscure median blackish band, from which blackish stripes pass laterally; lower surface of abdomen, the sternum, and the coxæ blackish; fringes of blood-red hairs on the maxillæ and mandibles.

Carapace somewhat as in *Selenocosmia* but lower, the radiating grooves conspicuous; the fovea shallowish, its anterior and posterior walls nearly contiguous, transverse, straight, not so wide as the ocular tubercle; *tubercle* low, very wide, wider than long, distance between it and the front edge of the carapace equal to about half the length of the tubercle. *Eyes* of anterior row procurved, anterior edge of the median on a level with the middle of the lateral; lateral elliptical; median circular and a little larger, evenly spaced, the distances between them about equal to the small diameter of one of the lateral; posterior row straight, the median small, the lateral elliptically elongate, smaller than anterior lateral.

* Actes Soc. Linn. Bord. xl. p. 161 (1886).

Mandible armed below with about 11 teeth, which are larger in front and behind, and mixed up in the middle with small teeth, continuous with the granules which cover the hinder half of the area.

Labium smallish, much wider than long, narrower than the ocular tubercle, separated by a deep groove from the sternum, densely spinulose like the internal angle of the base of the maxilla.

Sternum considerably longer than wide, widest between the coxæ of the third leg, narrower forwards, distance between the posterior impressions about equal to the width of the ocular tubercle.

Legs 1, 4, 2, 3, long and slender, the first pair stouter as well as longer than the fourth; patella and tibia of first longer than of fourth, and a little longer than the carapace, the length of which is a little greater than the patella and tibia of the fourth; tarsus and protarsus of first equal to width of carapace, shorter than those of fourth by one third of the tarsus; tarsus of first the longest, of second and fourth about equal; tarsus of palp longer than that of first leg, and measured to apex of scopula longer than tibia of palp; protarsi of first only slightly longer than that of third; tibiæ of first and fourth about equal; patellæ of third and fourth almost equal, and shorter than that of the second; *scopulæ* wide, entire, except that on protarsus of fourth, which is divided and covers rather more than one third of the segment, that on the third covering more than half. Posterior spinners about equal in length to the protarsus of the third; second segment shorter than first or third, which are about equal.

Measurements in millimetres.—Carapace, length 28·5, width of tubercle 4·5, length 3·2; abdomen (somewhat shrivelled), length 26, width 18; length of sternum 12·5, width between coxæ of third legs 10, between those of first legs 8. Appendages: length of palpi 50, of first leg 81, of second 74, of third 65, of fourth 79; posterior spinner 12·5.

Loc. N.W. Borneo (probably mainland opposite Labuan). One specimen obtained by A. Everett, Esq., in 1888.

Phormingochilus tigrinus, sp. n.

♀. *Colour.*—Carapace clothed with yellowish-red hairs, redder at the sides; abdomen reddish, with strongly defined, lateral, fuscous spots and stripes and a median fuscous band; the lower side of the body, and of the coxæ and femora, a very deep blackish green; scopulæ olive-green; the long setæ on the limbs and trunk reddish.

Carapace a little wider than in *Everettii*, the width being
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about equal to the distance lying between the posterior edge of the tubercle and the hindermost point of the posterior border, whereas in *Everettii* it is distinctly less; moreover, the slope from the tubercle, along the middle line, to the posterior edge is gradual, whereas in *Everettii* there is a very noticeable and abrupt alteration of level in front of the fovea; in the eyes of the anterior row the lateral are larger and closer to the median and to the posterior lateral, which are also relatively larger than in *Everettii*.

Sternum wider than in *Everettii*, the length only just exceeding the width, which, between the coxæ of the second leg, is greater than the length of the tibia of the palp; whereas in *Everettii* the sternum at this spot is, if anything, less than the tibia of the palp; distance between the posterior impressions less than the width of the tubercle.

Legs as in *Everettii*, except that the first is a little shorter than the fourth (the two measured along the upperside from the base of the proximal end of the trochanter to the apex of the claws); the femur and trochanter of the first shorter than the carapace (just about equal in *Everettii*); the first leg only excelling the length of the third by a little more than its tarsus, whereas in *Everettii* the excess amounts to the tarsus and nearly half the protarsus.

Measurements in millimetres.—Length of carapace 18·5, width 16·5; length of abdomen 17, of palp 32, of first leg 53, of second 47·5, of third 44, of fourth 54, of posterior spinner 8·5.

Loc. Kuala Lama, N. Borneo (*A. Everett, Esq.*). One specimen.

With this specimen was the following note in Mr. Everett's handwriting:—"Found in a bird's nest, in which it had killed the young bird. Under surface of feet iridescent, with fine metallic-blue and green reflections. The small spider was taken on the large one." The said small spider proves to be a *Scytodes* of some kind or other.

I separate this species from *Everettii* on the characters mentioned in the diagnosis. The specimen appears to be mature, so there are no reasons for supposing that the species has been based upon immature characters.

In addition to the types of the two above-described species the British Museum has a third specimen, a male, from Borneo, which is, I think, probably the male of *Everettii*. The palpi and legs are very long, as in the male of *Omothymus*—the palpi being about $2\frac{1}{2}$ times the length of the carapace, with the tibia twice the length of the patella. The carapace, which

measures 15.5 millim. long and 13 wide, is much flatter than in the females. The tarsus of the palp is apically truncate, the bulb is furnished with a stout shortish process, which seems to be semicircularly curved when viewed from the outside, its internal edge being carinate.

Unlike the male of *Omothymus*, there is no trace of a process on the tibia of the first leg.

Genus CITHAROGNATHUS, nov.

Citharognathus Hosei, sp. n. (Pl. X. figs. 1-1 b.)

♀.—*Colour*. Carapace, abdomen, and limbs clothed with yellowish-grey hairs; the abdomen and posterior legs finely spotted with black spinules, the former with an obscure, median, fuscous, longitudinal stripe and transverse fuscous stripes parting from it: legs apically redder, the long setæ on legs and abdomen yellowish red; apices of femora, patellæ, tibiæ, and protarsi whitish; lower side chocolate-brown.

Carapace low, head-region but little elevated, much longer than wide, the radiating grooves shallow; the fovea straight, conspicuous, with anterior and posterior walls nearly in contact, not so wide as the ocular tubercle; ocular tubercle about one third wider than long, its front edge close to edge of carapace; the width of the clypeus not more than half the diameter of anterior median eye; the anterior lateral eye separated from the edge by a space which is distinctly less than its long diameter. *Eyes* large, the anterior row pro-curved, the median the largest, the distance between them equalling about half their diameter and equalling the distance between the median and lateral; the lateral not much more than half the size of the median, elliptical; the posterior lateral about as large as the anterior lateral and the same shape, the distance between them a little less than their short diameter; posterior median largish and closer to the lateral than to the anterior median.

Mandible furnished below with a series of 14 teeth bounding the internal edge of the inferior area; this area granular behind.

Labium small, wider than long, its sides converging forwards, its anterior border lightly concave, spinulose. *Sternum* wide, a little longer than wide, as wide between the coxæ of the first as of the second; distance between the posterior impressions a little greater than the width of the labium.

Abdomen large, closely covered above with short backwardly directed spinules.

Legs 4, 1, 2, 3, the patella and tibia of the first a little

shorter than those of the fourth, and about equal to the length of the carapace; the tibia about three times as long as wide, armed at its distal end externally and internally with a row of small close-set spines; the scopulæ covering the protarsi below, except for a fringe of hairs at the base: second leg like the first, except shorter, its coxa noticeably shorter than that of the first: third leg stout, with its protarsus, tibia, patella, and the distal end of the femur closely studded with spiniform setæ; the tibia a little wider than the tibia of the first, its width half its length; its protarsus as long as that of the first, slightly bowed at the base above, its basal third below not covered with the scopula: fourth leg much like the third, but considerably longer and much stouter; the tibia the widest segment, wider in the middle than at the two ends, lightly convex when viewed from the side or from above, a little more than twice as long as broad and a very little shorter than the protarsus, which is slightly bowed at the base and has its distal half covered below by a divided scopula; the tarsal scopulæ are all wider than the tarsi, and the claws are, so far as can be seen, unarmed.

Palpi stretching past the middle of the tibia of the first leg; the tarsus (not including claws) about equal to the patella and slightly shorter than the tibia.

Spinners about as long as the tibia of the first leg; the first and second segments subequal, the third the longest.

Measurements in millimetres.—Length of carapace 17·5, width 14; length of abdomen 26, width 16; length of palp 29, of first leg 48·5, of second 44, of third 41, of fourth 53, of posterior spinner 9.

Loc. Sarawak (type); Baram. Collected by C. Hose, Esq.

EXPLANATION OF PLATE X.

- Fig. 1.* *Citharognathus Hosei*, sp. n.; carapace, nat. size. 1*a.* Ditto, posterior leg, nat. size. 1*b.* Ditto, sternum, nat. size.
Fig. 2. *Selenotypus plumipes*, sp. n.; carapace, nat. size. 2*a.* Ditto, posterior leg, nat. size. 2*b.* Ditto, sternum, nat. size.
Fig. 3. *Psalmopæus Cambridgii*, sp. n.; carapace. 3*a.* Ditto, external surface of mandible. 3*b.* Ditto, inner side of maxilla.
Fig. 4. *Phormingochilus Everetti*, sp. n.; carapace of ♀, nat. size. 4*a.* Ditto, sternum of ♀, nat. size. 4*b.* Ditto, external view of mandible of ♂.
Fig. 5. *Coremiocnemis validus*, sp. n.; ♀, posterior leg.
Fig. 6. *Musagetes Masoni*, sp. n.; external view of mandible.
Fig. 7. *Musagetes fumosus*, sp. n.; external view of mandible.

XX.—List of the Freshwater Fishes collected by Mr. A. Everett on Palawan and Balabac. By G. A. BOULENGER, F.R.S.

SMALL as it is, the collection of freshwater fishes made by Mr. Everett on the islands of Palawan and Balabac is of great interest, as affording the first information on this part of the fauna of these islands, which, as first pointed out by Mr. Everett, shows a mingling of Bornean and Philippine elements, with a marked predominance of the former. All that was previously known of the fishes of Palawan is contained in a short list of marine and estuarine species quite recently published by Vaillant (N. Arch. Mus. (3) v. 1893, p. 57).

The Philippines proper (east of Mindoro Straits) are believed to be particularly poor in Cyprinoids, only four species being on record, viz.:—*Dangila philippina*, Heck., *Cyrene cyanoparia*, Heck., the correct habitat of both of which is, however, still somewhat doubtful; and *Barbus (Puntius) Montanoi*, Sauvage*, and *Rasbora philippina*, Gthr., from Mindanao. It is therefore gratifying to find three out of the thirteen species recorded below belong to that family. Siluroids, which likewise appear to be scantily represented in the Philippines, are unfortunately not at all represented in this collection.

1. *Gobius giuris*, Ham. Buch.

Palawan.

Freshwaters and coasts of India to Southern China and the whole Malay Archipelago.

2. *Gobius grammepomus*, Blkr.

Palawan.

Inhabits the whole Malay Archipelago.

3. *Sicydium cynocephalum*, C. & V.

Palawan.

Recorded from Borneo, Sumatra, Java, Bali, Flores, Celebes, and Batjan.

4. *Eleotris aporus*, Blkr.

Palawan, Balabac.

Freshwaters and coasts of Borneo, Sumba, Batjan, the Moluccas, and the Fiji Islands.

* With which Günther's *Barbus maculatus*, var., is no doubt identical.

5. *Eleotris butis*, Ham. Buch.

Palawan.

Freshwaters and coasts of India to Southern China and the whole Malay Archipelago. Recorded from Palawan by Vaillant.

6. *Eleotris fusca*, Bl. Schn.

Palawan.

Coasts of the Indian Ocean (ascending rivers) to Polynesia.

7. *Asterropteryx Everetti*, sp. n.

Depth of body equal to length of head, $3\frac{1}{2}$ to $3\frac{3}{4}$ times in total length. Head longer than deep; diameter of eye equal to length of snout, $\frac{1}{4}$ length of head; interorbital width $\frac{2}{7}$ to $\frac{1}{3}$ length of head; maxillary extending to below anterior border of eye. Dorsal VI, I 9; longest rays of first dorsal $\frac{2}{5}$ to $\frac{2}{3}$ length of head, of second dorsal $\frac{2}{3}$ to $\frac{3}{4}$. Anal I 11; longest rays $\frac{2}{5}$ to $\frac{2}{3}$ length of head. Pectoral $\frac{4}{5}$ length of head. 27 or 28 scales in a longitudinal series, 8 or 9 between origin of dorsal and origin of anal. Pale olive-brown; a small black humeral spot; caudal faintly barred; dorsals black in the male, with round white spots, greyish in the female.

Total length 65 millim.

Six specimens from Palawan.

This species is nearest allied to *A. compressus*, Krefft, from Queensland.

8. *Ophiocephalus melanosoma*, Blkr.

Balabac.

Recorded from Borneo and Banka.

9. *Barbus palawanensis*, sp. n.

Section *Barbodes*, Blkr. Depth of body $2\frac{3}{4}$ to 3 times in total length, length of head $3\frac{3}{4}$ to 4 times. Snout rounded, not prominent, a little longer than diameter of eye, which is $4\frac{1}{2}$ to 5 times in length of head; rostral barbel $1\frac{1}{2}$ to $1\frac{3}{4}$ as long as diameter of eye, a little shorter than maxillary barbel. Dorsal III 8; spine strong, feebly serrated, its stiff portion about half length of head, opposite to inner ventral ray, and equally distant from end of snout and caudal fin. Anal III 5; longest ray about $\frac{3}{5}$ length of head. Scales 24–25 $\frac{4\frac{1}{2}}{4\frac{1}{2}}$; $2\frac{1}{2}$ scales between lateral line and base of ventral. Olive above, yellowish beneath; three more or less distinct round blackish spots on each side, the first just above the lateral line between the origin of the dorsal and the base of the ventral, the second

just above the lateral line above the origin of the anal, the third on the lateral line in front of the base of the caudal.

Total length 160 millim.

Three specimens from Palawan.

Very closely allied to *B. maculatus*, C. & V., and *B. Montanoi*, Sauv.

10. *Rasbora Everetti*, sp. n.

Depth of body equal to length of head, 4 times in total length. Snout as long as or a little longer than diameter of eye, which is 4 times in length of head; interorbital width 3 times in length of head; no barbels. Dorsal II 7, originating halfway between end of snout and base of caudal and above inner ventral ray. Anal II 5. Pectoral $\frac{4}{5}$ or $\frac{5}{6}$ length of head, not reaching ventral. Scales 27-28 $\frac{4\frac{1}{2}}{2\frac{1}{2}}$; one scale between lateral line and base of ventral. Olive above, silvery white beneath; some of the scales black-edged; a blackish band from the shoulder to the base of the caudal; posterior border of caudal blackish.

Total length 100 millim.

Two specimens from Palawan.

This species is nearest allied to *Rasbora calliura*, Blgr., recently discovered by Mr. Everett in Sarawak. It differs in the form of the caudal fin, the lobes of which are not unusually prolonged, and in the coloration.

11. *Nematabramis Everetti*, Blgr.

This fish was described by me a year ago from specimens obtained in Sarawak and North Borneo by Mr. Everett. I am now able to record its occurrence on Palawan.

12. *Muraena polyuranodon*, Blkr.

Palawan.

Coasts of Borneo, Sumatra, Java, Celebes, and the Moluccas, ascending rivers.

13. *Doryichthys pleurostictus*, Ptrs.

Palawan.

Previously known from the freshwaters of Luzon.

XXI.—*Diagnoses of Two new East-African Mammals*.

By OLDFIELD THOMAS.

Neotragus Haggardi, sp. n.

About the size of *N. hastatus*, Pet., but the skull with the muzzle shorter and much more compressed across the region of the lacrymal vacuities.

Horns longer, much stouter and more prominently ringed

than in any other species of the genus. Rings about eight in number, sharply defined, and very different from the low and little-defined rings of *N. hastatus*, *scoparius*, &c. Postero-external aspect of the horns angular or even developed into a longitudinal keel. Direction of horns more nearly in the line of the nasal bones than in the allied species, their anterior profile slightly curved backwards basally, forwards terminally, but the curvature is so slight as to be hardly worth mentioning.

Dimensions of the typical skull (σ):—

Basal length 142 millim.; greatest breadth 76; muzzle to orbit 86; nasals 57×20 ; palate length 91; gnathion to front of *p.*² (alveolus) 46.

Horns: length in a straight line 130; basal circumference 63; greatest basal diameter 21.

Hab. Lamu, British East Africa.

Type: B.M. 87.3.9.2. Presented and collected by Consul J. G. Haggard.

This species is based on three skulls, which, when they were received in 1887, I very doubtfully referred to *N. hastatus*, Peters, the Zambezi Oribi, a reference which has caused it to be known by the latter name to East-African sportsmen generally*. Now, however, that the Museum has obtained some Oribis from Nyasa, representing Peters's species, I am enabled to see that the Lamu animal is really quite distinct.

Further details, with figures, will be given in the 'Book of Antelopes.'

Mr. Haggard and Mr. Jackson both agree in stating that the Swahili name of this antelope is "Taya."

Anomalurus cinereus, sp. n.

Similar in size, character of fur, and proportions of ears to *A. orientalis*, Pet., to which it is evidently most nearly allied, but the general colour above, instead of being brown, is ashy grey, and below pure white instead of rufous; the extreme bases of the belly-hairs are, however, still pale slaty grey. The pale colour of the chest runs forwards as far as the chin, instead of stopping on the throat, and on each side it extends upwards as a prominent white half-collar to the ears. Hairs at back of bases of ears brown, without the usual ashy tips.

Hind foot 62 millim.

Hab. Upper Rovuma River, towards Lake Nyasa.

Type: B.M. 95.1.17.1. Collected by the Rev. J. Hainsworth, and presented to the National Museum by Canon H. B. Tristram, F.R.S.

* Cf. Jackson, 'Badminton Big-Game Shooting,' ii. pp. 285 and 300 (1894).

XXII.—*An Analysis of the Mammalian Generic Names given in Dr. C. W. L. Gloger's 'Naturgeschichte' (1841).* By
 OLDFIELD THOMAS.

IN Gloger's work on Natural History, which, although the titlepage bears the date 1842, was really published in 1841*, a large number of mammals were given new generic names; and it is the purpose of the present paper to analyze these names and to see how far they demand recognition, as they have hitherto been practically overlooked by mammalogists.

Fortunately examination proves that very few of them supersede names now in use; but in any case it seems advisable that the names should be systematically analyzed, the synonyms sorted, and the valid ones put forward for the acceptance of such zoologists as, like myself, believe that the sooner we reinstate, at any inconvenience to ourselves, the names which are technically correct, the sooner zoological nomenclature will attain some stability.

In the present case, although Gloger's work contains no less than seventy-three new generic terms for mammals, apart from those given to other animals, yet scarcely half a dozen are of any importance, as will be shown below. Gray alone, to whom I owe the reference, with his usual extraordinary knowledge of out-of-the-way literature, has occasionally quoted Gloger's generic names, but by other mammalogists they seem to have been systematically ignored.

The names themselves are for the most part given to each genus as a whole, commonly without mention of species, and often with the old generic name appended, the author, like Illiger and others, assuming a right to change such names as he thought barbarous or unclassical. In these cases therefore no further subdivision of the genera will bring Gloger's names into use, as whatever species may be the type of the earlier and quoted generic names will remain the type for Gloger's substituted one.

The work of preparing the present paper has been much

* At least, so far as the mammals are concerned. This statement is based on the fact that in the number of 'Isis' for May 1841 (Heft v. p. 379) there is a review of Gloger's "Hefts 1 and 2, pages 1-160," which were therefore clearly published at this date. Even so far as regards the remaining parts of the volume, although not criticized until May 1842 (Heft v. p. 394), they are there spoken of as "Hefts 3 and 4, pages 161-400, 1841," a fact which must be borne in mind by ornithologists who may be interested in the question, although it may be a mere misprint. The mammals extend to p. 174, but there are no names affected by this question in the fourteen last pages.

facilitated by Gloger's commendable plan of italicizing the new names, although in some few cases the italics have been wrongly applied.

The following is a complete list of the new names, those which are not simple synonyms of earlier ones being printed in italics and examined more fully below. Where no type is mentioned, Gloger's name was either applied to the genus as a whole or there was only one species in it.

Page.	Name.	Synonym of	Remarks.
34.	<i>Hylanthropus</i> .	<i>Anthropopithecus</i> , Blainv. 1839.	
34.	<i>Symphalangus</i> .	Siamanga, Gray, 1843.	
35.	<i>Salmacis</i> .	Macacus, Lac. 1801.	Macaques generally.
36.	<i>Rhinalazon</i> .	<i>Nasalis</i> , Geoff. 1812.	
38.	<i>Maimon</i> .	Mormon, Less. 1840.	Mandrill and Drill, as opposed to other Baboons.
41.	<i>Cercoptochus</i> .	Cacajao, Less. 1840.	Ouakaris generally.
43.	<i>Iropocus</i> .	Avahis, Jourd. 1834.	
49.	<i>Chiropetes</i> .	Cheirodeles, Horsf. 1824.	
50.	<i>Synotis</i> .	<i>Synotus</i> , Keys. & Blas. 1840.	
54.	<i>Thalassarctos</i> .	<i>Thalarctos</i> *, Gray, 1825.	
55.	<i>Syaretus</i> .	<i>Aretonyx</i> , F. Cuv. 1825.	
55.	<i>Arctelurus</i> .	<i>Ælurus</i> , F. Cuv. 1825.	
57.	<i>Melitonyx</i> .	Mellivora, Storr, 1780.	
57.	<i>Mydaon</i> .	Mydaus, F. Cuv. 1825.	
58.	<i>Rhinozolis</i> .	<i>Conepatus</i> , Gray, 1837.	
72.	<i>Odmælurus</i> .	<i>Genetta</i> , G. Cuv. 1817.	
74.	<i>Ozolictis</i> .	<i>Ictidonyx</i> , Kaup, 1835.	
75.	<i>Rhinogale</i> .	<i>Helictis</i> , Gray, 1831.	
82.	<i>Asagis seu Notagogus</i> .	Marmosa, Gray, 1821 †.	
82.	<i>Peralopex</i> .	<i>Thylacinus</i> , Temm. 1827.	
83.	<i>Ascogale</i> .	<i>Phascologale</i> , Temm. 1827.	
85.	<i>Cercartetus</i> .	<i>Pseudochirus</i> , Og. 1836.	
85.	<i>Psilogrammurus</i> .	<i>Trichosurus</i> , Less. 1828.	
85.	<i>Cercoptenus</i> .	<i>Acrobates</i> , Desm. 1817.	
85.	<i>Xenochirus</i> .	<i>Petaurus</i> , Shaw, 1791.	
89.	<i>Macroschus</i> .	<i>Sciurus</i> , Linn. 1758.	For the Guerlinguets, type <i>S. æstuans</i> , a renaming of <i>Macroxus</i> .
95.	<i>Acosminthus</i> .	<i>Acomys</i> , Geoff. 1840.	
95.	<i>Peromyscus</i> .	<i>Sitomys</i> , Fitz. 1867.	Type, " <i>Cricetus myoides</i> , Gapper."
97.	<i>Lagurus</i> .	<i>Eremiomys</i> , Poliak. 1881.	
97.	<i>Dicrostonyx</i> .	<i>Cuniculus</i> , Wagl. 1832, <i>neq</i> Briss.	
100.	<i>Enchomys</i> .	<i>Echimys</i> , Desm. 1817.	
106.	<i>Pygeretmus</i> .	<i>Platyceromys</i> , Brandt, 1844.	Type, " <i>Dipus platyurus</i> ."

* Though this name may, and, in fact, should be emended to *Thalassarctus*, Gray, and not Gloger, must be considered its author.

† Med. Repos. xv. p. 308 (1821). This name must take the place of *Micoureus* (Less. 1842) for the group of opossums of which *Didelphys murina* is the type.

Page.	Name.	Synonym of	Remarks.
106.	<i>Beloprymnus</i> .	<i>Alactaga</i> , F. Cuv. 1836.	
106.	<i>Scarturus</i> .	<i>Scirtomys</i> , Brandt, 1844.	
112.	<i>Dryoryx</i> .	<i>Tamandua</i> , Gray, 1825.	
112.	<i>Eurypterna</i> .	<i>Cyclopes</i> , Gray, 1821*.	
113.	<i>Pseudotroctes</i> .	<i>Dasypus</i> , Linn. 1758.	Type, "Encoubert, <i>Ps. setosus</i> ."
114.	<i>Arizostus</i> .	<i>Xenurus</i> , Wagl. 1830.	Type, "Cabassu, <i>A. gym-nurus</i> ."
114.	<i>Zonoplites</i> .	<i>Tatusia</i> , F. Cuv. 1822.	
114.	<i>Polygomphius</i> .	<i>Prionodon</i> , F. Cuv. 1822.	
119.	† <i>Gamphotherium</i> .	<i>Mastodon</i> , G. Cuv. 1806.	Type, <i>Mastodon angustidens</i> .
124.	† <i>Trimenodon</i> .	<i>Lophiodon</i> , G. Cuv. 1822.	Type, " <i>L. tapirotherium</i> " †.
125.	<i>Dicerorhinus</i> .	<i>Ceratorhinus</i> , Gray, 1867.	Type, <i>Rh. sumatrensis</i> .
125.	<i>Opsiceros</i> .	<i>Atelodus</i> , Pom. 1853.	Type, <i>Rh. bicornis</i> .
127.	† <i>Potamotherium</i> .	<i>Hexaprotodon</i> , Falc. & Cautl. 1836.	Type, <i>Hippopotamus sivalensis</i> .
130.	<i>Capriscus</i> .	<i>Sus</i> , Linn. 1758.	Type, <i>Sus papuensis</i> .
130.	<i>Chcerelaphus</i> .	<i>Babiroussus</i> , Gray, 1821.	
131.	<i>Dinochærus</i> .	<i>Phacochoærus</i> , G. Cuv. 1817.	For <i>Ph. æthiopicus</i> , as opposed to <i>Ph. africanus</i> .
134.	<i>Dromedarius</i> .	<i>Camelus</i> , Linn. 1758.	For <i>C. dromedarius</i> , <i>Camelus</i> being restricted to <i>C. bactrianus</i> .
137.	<i>Lagonebrax</i> .	<i>Tragulus</i> , Pall. 1779.	
138.	† <i>Thaumatherium</i> .	<i>Sivatherium</i> .	
138.	† <i>Aboloceros</i> .	?	"Fossil stag-like animals, allied to the Giraffe."
140.	<i>Passalites</i> .	<i>Coassus</i> , Gray, 1843.	
140.	<i>Dorcelaphus</i> .	<i>Cariacus</i> , Less. 1842.	
143.	<i>Alcelaphus</i> §.	<i>Alces</i> , Ham. Sm. 1827.	
144.	<i>Tarandus</i> .	<i>Rangifer</i> , Ham. Sm. 1827.	
148.	<i>Criotaurus</i> .	<i>Ovibos</i> , Blainv. 1816.	
154.	<i>Oritragus</i> .	<i>Oreotragus</i> , Gray, 1846.	
154.	<i>Minytragus</i> .	<i>Neotragus</i> , Ham. Sm. 1827.	
163.	<i>Pelagocyon</i> .	<i>Monachus</i> , Flem. 1822.	
163.	<i>Stemmatopus</i> .	<i>Cystophora</i> , Nilss. 1820.	
163.	<i>Physorhinus</i> .	<i>Macrorhinus</i> , F. Cuv. 1824.	
164.	<i>Pontoleo</i> ; <i>Platyrrhynchus</i> .	<i>Otaria</i> , Péron, 1816.	For <i>O. jubata</i> only.
166.	† <i>Halibutherium</i> .	<i>Halitherium</i> , Kaup, 1838.	
166.	<i>Hydropithecus</i>	See below.
169.	<i>Lissodelphis</i> .	<i>Tursio</i> , Wagl. 1830.	
169.	<i>Argocetus</i> .	<i>Delphinapterus</i> , Lacép. 1804.	
170.	<i>Rhamphocetus</i> .	<i>Delphinorhynchus</i> , Lacép. 1804.	
170.	<i>Dipterocetus</i> .	<i>Oxypterus</i> , Raf. 1814.	
174.	<i>Ptychocetus</i> .	<i>Balenoptera</i> , Lacép. 1804.	

Of the above names the great majority, as already mentioned, are simply synonyms of earlier ones, and can only become of importance should any of these prove to be un-

* Med. Repos. xv. p. 305. *Cyclothurus*, Gray, 1825, auctorum.

† Fossil.

‡ Presumably *L. tapiroides*, Cuv.

§ *Nec* De Blainville, 1816.

tenable, owing to their being preoccupied in other groups. But the following cannot be dismissed so easily, as they represent the first names for proposed new groups, and, whether these are valid or not, must be more closely considered:—

Page.	Name.	Type.	Remarks.
34.	Symphalangus.	S. syndactylus.	Antedates <i>Siamanga</i> , Gray, 1843. Must be adopted if the Siamang is considered generically distinct from the other Gibbons.
95.	Peromyscus.	"Cricetus myoides, Gapper."	Antedates <i>Sitomys</i> , Fitzinger, 1867, which has been recently revived in place of <i>Vesperimus</i> , Coues, 1874. Must be used for the North-American White-footed Mice*.
97.	Lagurus.	"L. migratorius," = Myodes lagurus, Pall.	Equals <i>Eremiomys</i> , Poliakoff, 1881, which it antedates.
97.	Dicrostonyx.	No type mentioned, but, from the description, the name is clearly given to the Arctic Lemmings, commonly known as <i>Cuniculus</i> , Wagl. <i>Cuniculus</i> , however, in this sense, though dating from 1832, is preoccupied by Brisson, so that Gloger's name must stand for the genus.
106.	Pygeretmus.	P. platyurus.	Equals <i>Platyercomys</i> , Brandt, 1844, which it supersedes.
106.	Scarturus.	"Dipus tetradactylus, Licht."	Equals and supersedes <i>Scirtomys</i> , Brandt, 1844.
111	†Gamphotherium.	Mastodon angustidens.	Species placed in <i>Mastodon</i> by Lydekker †; but as a subgenus <i>Gamphotherium</i> would antedate both <i>Trilophodon</i> , Falconer, 1857, and <i>Tetrabelodon</i> , Cope, 1884.
125.	Dicerorhinus.	Rhinoceros sumatrensis.	Supersedes <i>Ceratorhinus</i> , Gray, 1867.
125.	Opsiceros.	Rhinoceros bicornis.	Supersedes <i>Atelodus</i> , Pomel, 1853 §.

* Mr. Gerrit S. Miller, to whom I am indebted for much assistance in connexion with this paper, has pointed out to me that the name *americanus*, revived by Coues (Am. Nat. 1879, p. 784), and again by Allen (Bull. Am. Mus. N. H. iii. p. 294, 1891), for the common white-footed mouse, from Kerr's *Mus agrarius americanus*, 1792, is quite untenable, as Kerr himself, four pages before in the same work (Linn. An. K. p. 227), has described a *Mus americanus*, clearly a wholly different animal, so that the name is effectually barred for the white-footed mouse. The familiar and appropriate name *leucopus* will therefore again deserve adoption, combined with, as shown above, the generic name of *Peromyscus*. Gloger at the same time adds another synonym to *Peromyscus leucopus* by renaming the species *P. arboreus*.

† Fossil.

‡ Cat. Foss. Mamm. B. M. iv. p. 28 (1886).

§ *Diceros*, Gray, Med. Repos. xv. p. 306, antedates *Opsiceros*, but is preoccupied by Lamarck, 1805, and others.

Page.	Name.	Type.	Remarks.
130.	Capriscus.	<i>Sus papuensis</i> .	No reason for separation from <i>Sus</i> .
131.	Dinochœrus.	<i>Phacochœrus æthiopicus</i> .	No reason for separation from <i>Phacochœrus</i> .
134.	Dromedarius.	<i>Camelus dromedarius</i> .	No reason for separation from <i>Camelus</i> .
140.	Passalites.	<i>P. nemorivagus</i> .	Antedates <i>Coassus</i> , Gray, 1843. But other earlier names may have to come in for this and the next genus.
140.	Dorcelaphus.	" <i>Cervus virginianus</i> ."	Equals and antedates <i>Cariacus</i> , Lesson, 1842.
154.	Oritragus.	<i>O. oreotragus</i> .	Antedates <i>Oreotragus</i> , Gray, 1846.
166.	Hydropithecus.	" <i>Manatus simia</i> , Ill."	Formed for an indeterminable animal seen by Steller.

It will thus be seen that the changes necessitated by the recognition of Gloger's work are both few and unimportant. The genera hitherto known as *Sitomys*, *Cuniculus*, and *Platycercomys* have to bear wholly strange names; *Cariacus* and *Coassus*, as dating from Lesson, 1842, and Gray, 1843, are antedated, unless still earlier references are found for them, and several subgenera of greater or less validity need different titles to those by which they are usually referred to.

With regard to the most important of the animals affected, the American Deer, it unfortunately happens that the difficulties in the way of deciding between the rival claims of *Mazama*, Raf., *Panalladon**, Raf., *Odocoileus**, Raf., *Elephalces*, Brookes, *Passalites*, Glog., and *Dorcelaphus*, Glog., are so great that I am compelled to leave the question open for the decision of such other zoologists as may find time to attack this intricate subject.

But all the other cases are quite clear, and in bringing them forward and abolishing the remainder of Gloger's long list of names it is hoped that the happy day may be a little hastened when we shall have got back to the earliest names for all mammalian genera, so that younger generations of workers will grow up knowing the proper names, and will not have to suffer the endless inconvenience that our own has had to bear.

* I owe these names to Mr. T. S. Palmer, of the Department of Agriculture, Washington, who has been investigating this and kindred questions.

XXIII.—*Descriptions of new Coleoptera from New Zealand.*
By Captain THOS. BROUN.

[Continued from p. 88.]

Group *Colydiidæ*.

Coxelus thoracicus, sp. n.

Oblong, opaque, ferruginous; clothed with short, erect, pale and dark setiform squamæ; legs and antennæ paler red.

Head granulate; epistome nearly smooth, separated from the sides by oblique depressions; the setæ rather slender, yellow. *Eyes* small, with apparently an external swelling behind and below each. *Antennæ* finely pubescent, first joint scarcely discernible from above, second rather large, third slightly longer than fourth, the following five short; tenth abruptly enlarged, eleventh not so broad as the preceding one. *Thorax* subquadrate, slightly curvedly narrowed towards the prominent front angles, nearly straight and but little narrowed posteriorly; marginal channels rather shallow, the sides less explanate behind than in front; the disk is without well-marked impressions, but, close to the basal margin, there is a linear transverse impression which, in front of the scutellum, becomes a sort of fovea; the granules on its surface are rather distinctly separated from one another, they are not large. *Elytra* with coarser setæ than the thorax, their sculpture quite serial and regular; there is a small scutellar depression only; the base is medially emarginate, but nearly truncate towards the sides, so that the humeral angles are almost rectangular. *Tibiæ* with short slender setæ.

Underside dull, bearing fine yellowish setæ; metasternum granulate, the rest of the sculpture more or less indefinite; fourth ventral segment depressed behind.

Var.—Body piceous; legs and antennæ pale brick-red; granules on thorax coarser; size larger ($1\frac{1}{4} \times \frac{1}{2}$).

Length $1\frac{1}{8}$, breadth $\frac{3}{8}$ line.

Wellington. Discovered by Mr. J. H. Lewis on the underside of wet stones just above high-water mark.

Obs. I have selected two or three diagnostic characters of each species as an aid to identification:—

No. 350.—Thorax uneven, elytra without depressions, tibiæ with coarse setæ.

No. 351.—Like No. 350, tibiæ with fine hairs only.

No. 352.—Larger than No. 350, eyes more prominent, thorax with a slight median channel and depressed near posterior angles.

No. 1357.—Setæ erect, rather slender, quite yellow, short and slender on tibiæ.

No. 1711.—Thorax with four dorsal impressions; setæ yellow, not scale-like, fine and hair-like on tibiæ.

No. 1931.—Sides of thorax considerably dilated anteriorly, surface rather flat and with feeble impressions only.

No. 1932.—Elytra with rather acute and slightly produced apices.

No. 1933.—Thorax oviform, with a narrow central groove.

No. 1934.—Distinguished from No. 1711 by the squamiform setæ on elytra.

No. 2354.—Elytra on top of posterior declivity, at the suture, with a raised black spot; the patch of setæ behind each eye very prominent.

No. 2355.—Small; antennæ piceous.

No. 2356.—Four hind tibiæ acutely prolonged at inner extremity.

No. 2499.—Elytra with regular series of small distinctly separated tubercles; body rather elongate.

C. thoracicus.—Thorax and elytra without discoidal depressions; setæ coarse.

Vitiacus incertus, var. of *V. costatus*.

The sculpture of the *elytra* between the suture and the first costa seems to consist of two series of small tubercles or granules (*V. costatus*, when examined sideways, presents the same appearance); the third costa or elevation is absent, but the curvate elevation proceeding from the apex, but quite distinct from the lateral margin, is well developed.

The *front coxæ* are placed close to the base of the prosternum; before each there is a large depression; they are separated by a rather narrow process. The *mesosternum* has a broad longitudinal depression in the middle. The sutures between the *ventral segments* are very deep and broad. The intermediate and posterior *coxæ* are much more widely separated than the anterior. The *labrum* is prominent and red.

This may be treated as a varietal form of *V. costatus* (Man. N. Z. Coleopt. p. 1087) until further material of both becomes available for comparison.

Length $1\frac{3}{8}$, breadth $\frac{5}{8}$ line.

Mount Te Aroha. Two, amongst leaves, March 1894.

Group **Bothrideridæ**.*Bothrideres obsoletus*, sp. n.

Elongate, glabrous, slightly nitid; black, antennæ and tarsi pitchy red.

Head rather finely punctured. *Eyes* large and prominent. *Antennæ* pubescent; first joint thick and subglobose; second smaller, third longer than broad; 4 to 8 short, nearly equal to one another; ninth larger than the preceding one, tenth nearly thrice the width of the ninth, eleventh rounded apically. *Thorax* of about equal length and breadth, distinctly narrowed behind the middle; near the centre there is a large impression; this has a small lanceolate mark in the middle; there are three small basal impressions, the one in front of the scutellum is linear; the disk is finely punctured, quite obsoletely in the middle; the punctuation, however, becomes more distinct towards the sides. *Elytra* elongate, broader than the thorax, narrowed posteriorly, the shoulders with well-defined margins; their striæ are sharply marked, but only obsoletely punctured; interstices rather broad and flat, finely and indistinctly punctate, the third, fourth, and fifth and the suture are more or less evidently cariniform behind. *Legs* elongate and slender.

Underside with fine scanty greyish pubescence. *Prosternum* moderately coarsely punctured, its flanks nearly smooth. *Metasternum* more closely sculptured. The *abdomen* finely and sparingly punctured.

Two other species occur in New Zealand (Nos. 367 and 1951); *B. obsoletus* may be easily distinguished by the very much finer sculpture.

Length $2\frac{1}{4}$, breadth $\frac{3}{4}$ line.

West Plains, Invercargill. Mr. A. Philpott forwarded two examples for examination on the 29th March, 1894.

Group **Lathridiidæ**.*Lathridius sulcifrons*, sp. n.

Suboblong, moderately convex; fusco-piceous; femora reddish, the tibiæ and antennæ nearly testaceous, tarsi yellowish; head and thorax opaque, elytra slightly nitid.

Head broad, much narrowed anteriorly, its punctuation close, rather coarse, but not deep; with a central longitudinal groove. *Antennæ* feebly pubescent, their first joint large, red, second oviform; joints 3 to 8 slender, the third rather shorter than the fourth; club elongate, its middle joint

shorter than the others. *Thorax* subquadrate, rather broader than long, widest in front, gradually narrowed backwards, but with a slight incurvature near the middle of each side; the apex has a slight sinuosity behind each eye, the front angles are obtuse, the posterior are nearly rectangular, the disk is moderately transversely convex, but the sides are explanate; its sculpture is like that of the head. *Elytra* large, much broader than the thorax, their sides a little rounded and broadly margined; they are punctate-striate, the punctures are distinct and close, but the sutural striæ are nearly effaced behind; interstices simple, the outer one, near each shoulder, is, however, more costiform than any of the others. *Tarsi* slender, their basal joint evidently shorter than the second, third longest.

Underside piceous, slightly shining, moderately finely punctured; the hinder portion of the head is depressed, but the sides are raised; the metasternum is large, with a strongly curved, slightly elevated suture near the middle coxæ; abdomen with deep broad sutures, the basal segment as long as the following three, and more distinctly sculptured than those are.

No. 1603 (*L. puncticeps*) is, I think, the nearest ally. This is much larger, with large prominent eyes. The groove on the head may be best seen from the side; the furrow on the thorax is hardly visible from behind and is widely interrupted in the middle.

Var.—*Elytra* castaneous.

Length 1, breadth quite $\frac{3}{8}$ line.

West Plains, Southland. Discovered by Mr. A. Philpott.

Corticaria clarula, sp. n.

Subovate, rather elongate, shining, red, legs and antennæ fulvous; pubescence yellow, slender and depressed, but on the elytra erect and conspicuous, and intermingled with elongate erect fuscous setæ.

Head distinctly punctured. *Eyes* large and prominent. *Antennæ* with outstanding hairs; basal joint stout, longer than broad; second much more slender and rather shorter than the first; 3 to 8 decrease in length; ninth and tenth longer than broad, dilated inwardly; eleventh oval, longer than tenth. *Thorax* rather longer than broad, narrowed in front and behind, the middle of each side prominent; it is distinctly punctured, the sides more closely than the disk; between the middle and the base it is broadly transversely depressed, close to the base there is a deep groove which

extends right across, the basal margin appears asperate and cariniform. *Scutellum* punctate, rounded behind. *Elytra* large, subovate, distinctly but not coarsely punctured; near each shoulder there is a rather broad oblique impression; the sutural region is very slightly depressed, but just below the top of the hind slope the depressions or striæ are deeper, and at this point the suture is more distinct than it is elsewhere. *Legs* stout, finely pilose. *Tarsi* yellow, but infusate near the extremity; first joint longer than the second and very slightly prolonged below it; third quite as long as the basal two, thickened apically; claws rather large and curved, with basal lobes.

This most nearly resembles No. 423.

Var.—Elongate setæ on hind body more slender and quite yellow. One was found near Howick several years ago.

Length $\frac{3}{4}$, breadth $\frac{3}{8}$ line.

Hunua Range, Drury. One, on the ground, June 1893.

Group Copridæ.

Saphobius tibialis, sp. n.

Body broadly oval, subopaque, clothed with short, sometimes bent or curled, fulvous setæ; fuscous, legs red, antennæ and tarsi paler.

Head moderately bidentate in front, distinctly and closely punctured. *Thorax* twice as broad as long, its sides nearly straight, but curvedly narrowed in front; its sculpture is not close and cannot be termed punctiform; it consists of oviform ring-like impressions, with a minute puncture in the middle of each. *Elytra* gradually curvedly narrowed from the shoulders backwards; they are feebly striate; the interstices are broad and plane, with dense, excessively minute, granular sculpture.

Tibiæ finely setose, the anterior rather long, slightly curved and feebly tridentate externally, the apex almost quite truncate and considerably prolonged inwardly, so as to be twice the width of the middle portion.

This is intermediate between *S. squamosus* and *S. setosus* as regards size. The inner apical dilatation of the front tibiæ is more abrupt, *i. e.* shorter in the longitudinal direction and more prolonged laterally, than in any other species known as yet.

♂. Length $1\frac{1}{4}$, breadth $1\frac{3}{8}$ line.

Mount Pirongia, one example; a second was found near Mr. Kusab's saw-mill at Ohaupo, January 1893.

Group *Lucanidæ*.*Mitophyllus cylindricus*, sp. n.

Subparallel, moderately transversely convex, a little shining; red, the tarsi and antennæ paler; sparingly clothed with decumbent yellow hairs.

Head short, closely punctured, the forehead almost quite truncate, and with a more or less distinct margin. *Mandibles* short, much curved apically. *Eyes* prominent, rotundate, finely but distinctly faceted. *Antennæ* short, their basal joint with pale slender setæ; club short, finely pubescent, its third joint shorter and thicker than the second. *Thorax* one third broader than long, slightly narrowed towards the front, its sides minutely crenate and hardly at all curved; base feebly sinuate, with obtuse angles, the anterior subacute; the surface is moderately closely and coarsely punctured. *Scutellum* punctate. *Elytra* parallel-sided, as wide as the thorax at the base, the shoulders slightly rounded; their sculpture is somewhat ill-defined, consisting of shallow striæ and punctures; the spaces between the punctures are more or less raised transversely, so that the surface appears a little rugose. *Legs* pilose; front tibiæ curvate and finely denticulate or crenate externally, with an apical spine, and a straight one between it and the middle; the intermediate arched and asperate, but without any distinct central spine; the posterior nearly straight.

The unspotted surface, subcylindrical outline, and small size will prevent its being mistaken for any of its allies.

♀. Length $3\frac{3}{4}$, breadth $1\frac{1}{2}$ line.

Wellington. Mr. J. H. Lewis found two specimens under the bark of a *Rimu*; one of these he sent to me.

Mitophyllus angusticeps, sp. n.

Subovate, slightly convex, opaque; smoky black, tarsi piceous, antennæ and palpi pitchy red; sparingly and irregularly clothed with elongate, depressed, pale testaceous scales.

Head very elongate and narrow, coarsely punctured, quite closely behind the eyes. *Mandibles* rather short and flat, bifid at apex. *Eyes* subdepressed, free, remote from the thorax. *Antennæ* short, the basal joint long and curvate, with a few elongate, erect, pale setæ; seventh slightly produced inwardly; club finely pubescent, its terminal joint thickest. *Thorax* nearly twice as broad as it is long, base bisinuate and wider than the front, its sides only moderately rounded, the angles obtuse; it is more finely punctured than

the head, more closely near the sides than on the disk; the squamæ are irregularly disposed, so that large areas are bare. *Scutellum* punctate and squamose. *Elytra* oblong, their punctuation, like that of the thorax, more regular, but not quite serial. *Front tibiæ* closely and finely denticulate, with a prominent external tooth near the apex and another below the middle; the intermediate with a central tooth, the posterior have none. *Tarsi* feebly pubescent, the terminal joint of the anterior about as long as the preceding four; the hind pair short, claws much bent.

This is a peculiar species. The head is even longer and narrower than that of *M. gibbosus* (No. 1666). The squamosity does not form distinct spots.

♀. Length $3\frac{3}{4}$, breadth $1\frac{3}{4}$ line.

Wellington. One from Mr. G. V. Hudson, numbered 195.

Group Melolonthidæ.

PSILODONTRIA, gen. nov.

Body subdepressed, ovate-oblong, nearly glabrous. *Clypeus* quadrate, with strongly elevated borders, truncate, or only slightly rounded in front. *Eyes* moderately convex. *Labrum* emarginate. *Maxillary palpi* moderately elongate, terminal joint subcylindrical. *Antennæ* 8-articulate, basal joint slender, but clavate at apex; second half the size of the first; third one half longer than broad; fourth shorter, obliquely articulated; fifth very transverse; club elongate, compressed, formed of three leaflets. *Thorax* transverse, marginated, base bisinuate. *Scutellum* large. *Elytra* oblong, partially covering the pygidium. *Legs* long, robust; *anterior tibiæ* bidentate, the female with an additional obtuse tooth above the middle. *Tarsi* longer than the tibiæ; claws slender, with a membranous appendage underneath.

Posterior coxæ briefly spiniform inwardly. Intermediate coxæ separated by a narrow *process*; this is horizontal, but on a lower plane than the coxæ themselves; it is curved towards the breast, but does not extend forwards beyond the coxæ.

In sternal structure the genus approaches *Odontria*, but the bare polished upper surface distinguishes it. From *Pyronota* it differs by the absence of the conspicuous sternal process, which fits in between the anterior coxæ, by the short, curved, hind coxal spines, more robust legs, longer club, and flatter surface.

Psilodonthria viridescens, sp. n.

Shining, smooth, pale green; legs and antennæ infuscate, club black.

Head smooth behind the median suture, distantly but distinctly punctured in front. *Thorax* about a third broader than long, rather more narrowed in front than it is behind, the sides near the middle obtusely angulate; anterior angles blunt and less depressed than in *Pyronota*, and the base less sinuate; posterior angles rectangular or nearly so; near each side there are a few fine punctures, but the disk appears to be impunctate. *Elytra* oblong, striate, the striæ with rather fine punctures; interstices broad, only slightly convex, with some minute punctures, and appearing feebly rugose. *Tarsi* (anterior) inserted in line with the apex of the second tooth; the spine on the inside of the *tibia* but little developed; middle and hind tibiæ asperate, bearing coarse grey setæ and armed with distinct spines at the inner extremity.

The *pubescence* is variable. The forehead bears some fine erect hairs; there are others along the sides of the body, and, in some cases, a few scattered quite indistinct ones may be noticed on the elytra.

Underside fuscous, shining, sparingly punctate, with numerous elongate grey setæ.

♀. *Antennæ* and tarsi shorter; legs not so stout.

Var.—*Thorax* feebly rufescent; the legs, antennæ, and palpi rufo-testaceous; the sides of the thorax not angulate.

♂. Length 3, breadth $1\frac{1}{4}$ line.

Ashburton. Mr. W. W. Smith, to whom we are indebted for the discovery of this species, informs me that he found three males and a female under stones near a creek which flows towards the centre of the broad river-basin.

Obs.—*Pyronota*. On examining two species (*P. festiva*, Fabr., and *P. lugubris*, Sharp) I found that Hope's diagnosis is incorrect. He describes the antennæ as nine-jointed; in reality their structure is as follows:—

Antennæ 8-articulate; first joint clavate at apex, second about half as long as first, third and fourth cylindrical (the latter the shorter), fifth short; club triarticulate.

PÆCILODISCUS, gen. nov.

Allied to *Stethaspis*. The *sternal process* is horizontal, but does not extend forwards beyond the intermediate coxæ; in front it is vertical. The *posterior coxæ* differ from those of

Stethaspis in being flatter and less curved and acuminate externally towards the front. The *metasternum* is depressed and grooved along the middle. The *abdomen* is shorter. The *tarsi* and claws are similar.

Pæcilodiscus pulcher, sp. n.

Subovate, moderately convex, nearly glabrous, shining, variegate.

Head green, with coarse shallow punctures in front, behind with quite fine and distant ones; forehead marked off by a sinuous suture, the frontal and lateral margins reddish and somewhat reflexed; clypeus widely emarginate. *Thorax* metallic green on the middle, more or less infuscate behind; each side has a broad pale testaceous space, and an irregularly formed pallid mark extends from the front towards the centre of the disk; it is about a third broader than long; the sides are rather finely margined, they are almost gradually narrowed from the base forwards, rather more narrowed but not abruptly before the middle; the base is strongly bisinuate and appears rounded in the middle, the apex is widely emarginate; the posterior angles are nearly rectangular, but obtuse, and are quite as wide as the shoulders, the anterior are more acute; its surface is moderately punctured, with a shallow interrupted median groove, and near each side there is an ill-defined impression. *Scutellum* green, with red margins; it is large and bears a few punctures. *Elytra* suboblong, slightly narrowed towards the shoulders, distinctly margined, apices quite rounded; they are punctate-striate; the interstices are convex, the second is straight and becomes flat towards the extremity, the fourth and sixth unite behind; these, like the margins, are more or less greenish yellow, the rest of their surface is infuscate green. *Legs* elongate, femora fuscous, tibiæ viridescent.

Underside fuscous, clothed with greyish hairs similar to those along the side of the upper surface; coxæ pallid.

This beautifully variegated insect recalls to mind some tropical Cetoniidæ. The *antennæ* are broken off from the fourth joint; the first is stout and elongate, with white setæ; the next two are hardly longer than broad; the fourth rather longer.

Length $6\frac{1}{2}$, breadth $2\frac{3}{8}$ lines.

Gow's Creek, Switzers, Central Otago, altitude about 4000 feet. One individual, found by Mr. John Frances, December 1892, was forwarded to me for examination by Professor Hutton. The type was presented by its discoverer to the Canterbury Museum.

Odontria obscura, sp. n.

Ovate, moderately broad; opaque, fuscous, head reddish brown and a little shining; legs testaceous, the tarsi and palpi rather darker; pubescence elongate and slender, decumbent, greyish yellow, intermingled with coarser erect infusate hairs, which, however, are nearly or quite absent on the hinder portion of the elytra.

Head rotundate, its punctuation coarse and rugose in front, not so close behind; clypeus strongly curved, not in the least truncate or emarginate, with raised margins. *Thorax* one half as long as it is broad, narrowed anteriorly, nearly straight behind the middle; moderately finely and not closely punctured; near the middle of the base the clothing is pallid, dense, and slender. *Scutellum* nearly impunctate behind, densely pilose in front. *Elytra* widest behind, only obsoletely striate; on each elytron there are four or five dark streaks; the intervals are moderately finely punctured. *Pygidium* with rather small shallow punctures, with erect hairs, some of which are much finer than the others. *Legs* of normal structure.

Underside infusate; the sternum dull, punctate, and bearing elongate slender pubescence; abdomen a little shining, unspotted, the sides and the apex of the fourth segment testaceous; fifth segment very short, broadly lobed in the middle at the apex; its pubescence is short and subdepressed.

♂. *Antennæ* with the basal joint as long as the following three; second joint as broad as it is long, third scarcely longer than fourth, fifth less than half the size of the club; this is not very elongate, and is composed of three equal leaflets.

♀. *Antennæ*: fourth joint shorter than third, fifth very short, not wider than the apex of the fourth.

The description of *O. cinnamomea* is not applicable to this species; it is, however, the nearest ally.

Length $6\frac{1}{4}$, breadth $3\frac{3}{4}$ lines.

Wellington. Discovered by Mr. J. H. Lewis.

[To be continued.]

MISCELLANEOUS.

On some Insects collected in the State of Chihuahua, Mexico. By T. D. A. COCKERELL, Entomologist of the New Mexico Agricultural Experiment Station.

THE species recorded below were collected by the writer partly in May 1893, under the circumstances mentioned in Ann. & Mag. Nat. Hist., July 1893, and partly during an hour or two spent at Juarez on Aug. 26, 1893. The latter locality is on the northern boundary of the State, just across the river from El Paso, Texas. Montezuma, the locality for some of the species, is the name of a station-house on the Mexican Central Railway.

The whole of the territory now considered strictly belongs to the arid Sonoran region—a region, however, which is more diverse in its fauna and flora than might be expected from the unusually uniform physical features. This diversity is perhaps to be accounted for by the fact that it is the meeting-ground of the Neotropical and Nearctic species, which mingle in different proportions according to the trend of the valleys, the altitude, and so forth. Once the Mexican tableland is left for the tropical sea-coast, the absolute dominance of the Neotropical fauna is beyond question; but on the plateau it cannot be said that the Nearctic forms occur to the exclusion of the Neotropical, although they certainly appear to have the upper hand. The warfare, if we may so term it, is carried on under peculiar conditions, owing to the inhospitable nature of the country, and the contest becomes largely one of endurance. Thus certain plants, such as the *Argemone*, may intrude into a zone (the mid-alpine) of which they are not typical, simply from their ability to flourish in waste and arid land. The same may be said of certain Cactaceæ, which at 8000 feet in Colorado look incongruous by the side of pines, spruces, and poplars.

The collections now enumerated may throw a little new light on these matters, being in many cases apparently the first records of the species from Mexico.

COLEOPTERA.

I am indebted to Mr. H. F. Wickham for the identification of these.

Coccinellidæ.

1. *Hyperaspis lateralis*, Muls.

Juarez.

2. *Scymnus tenebrosus*, Muls.

Juarez. (Houston, Texas; Arizona: Wickham.)

3. *Scymnus* near *cinctus*, Lec.

Juarez. A fine red-brown species.

Elateridæ.

4. *Anelastes Drurii*, var. *Latreillei*, Lec.

Samalayuca. (New Mexico, Arizona, &c.: Wickham. The species goes to the mid-alpine in Colorado.)

Malachiidæ.5. *Collops 4-maculatus*, Fabr.

Juarez. (Eastern U. S. to Texas and Arizona: *Wickham*.)

Scarabæidæ.6. *Trox scutellaris*, Say.

Between Montezuma and Ojo Caliente. (Mo. to Tex., Kans., New Mex., Ariz.: *Wickham*. See also Horn, Tr. Am. Ent. Soc. 1874, p. 3. Localities in Mexico are given in Biol. Centr.-Am.)

Cerambycidæ.7. *Tylosis maculata*, Lec.

Juarez. (Santa Fé, N. M.: *Boyle*. Albuquerque: *Wickham*. Arizona, Texas: *Leng*, in Ent. Amer. 1886, p. 118. Originally described from a specimen collected by Dr. Wizlizenus in New Mexico, probably west of Santa Fé.)

Chrysomelidæ.8. *Pachybrachys*, sp. n.

Juarez. (New Mexico: *Wickham*.)

9. *Metachroma*, prob. sp. n.

Juarez.

10. *Diabrotica*, sp.

Juarez. Appears intermediate between *D. vittata*, Fb., and *D. trivittata*, Mann., having antennæ like the former and legs like the latter.

11. *Diachus auratus*, Fab.

Juarez. (Common all over the western U. S., Colo., Ariz., New Mex., Calif., Vanc. I., &c.: *Wickham*.)

12. *Epitrix parvula*, Fab.

Juarez. (Mesilla Valley, N. M.: *Ckl.* U. S. and West Indies: *Wickham*.)

13. *Cassida pallidula*, Boh. (*texana*, Cr.).

Juarez. (Mesilla Valley, N. M.: *Ckl.* Albuquerque, N. M.: *Wickham*. It breeds on *Solanum elaeagnifolium*, and its distribution may probably coincide with that of the host-plant. The larva, found at Las Cruces on Aug. 24, 1894, is green, with lateral spines.)

Dermestidæ.14. *Trogoderma sternale*, Jayne.

Juarez. (Las Cruces, N. M.: *Ckl.*.)

Tenebrionidæ.15. *Argoporis bicolor*, Lec.

Between Montezuma and Ojo Caliente. (Arizona: *Wickham*.)

Anthicidæ.

16. *Notoxus serratus*, Lec.Juarez. (Las Cruces, N. M., Chaffee Co., Colo.: *Ckll.*)

Curculionidæ.

17. *Anthonomus inermis*, Boh.

Juarez. ("California.")

18. *Macrorhoptus* near *hispidus*, Dietz.

Near Santa Rosalia, on a malvaceous plant.

ORTHOPTERA.

Gryllidæ.

19. *Gryllus mexicanus*, Sauss.

Montezuma.

Acridiidæ.

20. *Haldemanella robusta*, Bruner.Montezuma. (Arizona: *Bruner*, Pr. U. S. Nat. Mus. 1889.)21. *Hippiscus* (*Xanthippus*) *zapotecus*, Sauss.

Montezuma.

The above three were kindly identified by Prof. L. Bruner, of Lincoln, Nebraska.

HYMENOPTERA.

The æculeate species, except the ants, were identified by Mr. Fox, of Philadelphia; the others went to the U. S. Department of Agriculture. Mr. C. Robertson assisted me with some of the bees.

Apidæ.

22. *Diadasia diminuta*, Cress.Juarez. (El Paso, Tex., Las Cruces, N. M.: *Ckll.* Colo.: *Cress.*)23. *Melissodes agilis*, Cress.Juarez. (Texas: *Cresson.*)24. *Perdita albipennis*, Cress.Juarez. (Las Cruces, N. M.: *Ckll.* Colo., Tex.: *Cresson.*)25. *Perdita hyalina*, Cress.Juarez. (Las Cruces, N. M.: *Ckll.* Colo.: *Cress.*)

Andrenidæ.

26. *Cilissa*, sp. n.?

Juarez.

27. *Colletes*, sp.

Juarez.

28. *Colletes consors*, Cr.

Juarez. (Colo., Texas: Cresson.)

29. *Colletes americana*, Cr., ♂.

Juarez. (Eastern States.)

30. *Augochlora pura*, Say.

Juarez. (Mesa Co., Colo.: Ckll. North to Canada.)

Philanthidæ.31. *Cerceris Kennicottii*, Cress.?

Juarez.

Scoliidæ.32. *Myzine hamata*, Say.Juarez. (Las Cruces, N. M.: Townsend, Ckll. Cresson gives this as equivalent to *M. interrupta*, Say, from Pennsylvania.)**Mutillidæ.**33. *Sphærophthalma Fowi*, Ckll.

Juarez. (Not known from any other locality.)

Formicidæ.

The ants were kindly identified by M. E. André.

34. *Tapinoma analis*, André.

Terrazas. (Only known from this locality.)

M. E. André has recorded *Dorymyrmex pyramicus* as found by me at Montezuma; but this is an error—the specimens were from El Paso, Texas. It may be well also to mention that I collected *Ectatomma concentricum* at Moneague, Jamaica, not Kingston, as M. André has it.

Myrmicidæ.35. *Aphænogaster Cockerelli*, André.

Montezuma. (Only known from this locality.)

36. *Atta octospinosa*, Reich.

Montezuma. (Torreon, Mexico: Ckll. Apparently not found in the U. S. Dalla Torre cites "Am. Mer.")

37. *Pogonomyrmex barbatus*, Sm.

Between Montezuma and Ojo Caliente; Ortiz. (Las Cruces, N. M.: Ckll. Texas, Arizona: Cresson. Dalla Torre cites Mexico.)

Cynipidæ.

38. *Eucoila*, sp.

Juarez.

39. *Holcaspis*, sp.

Juarez.

Both of these were new to Coll. U. S. Nat. Mus.

Braconidæ.

40. *Bathystomus*, sp.

Juarez. (The genus does not seem to occur in the U. S.)

41. *Idiasta*, sp.

Juarez.

Both of these new to Coll. U. S. Nat. Mus.

Chalcididæ.

42. *Eurytoma*, sp.

Juarez.

43. *Glyphe*, sp.

Juarez.

Both of these new to Coll. U. S. Nat. Mus.

LEPIDOPTERA.

Pieridæ.

44. *Pieris protodice*, Bdv. & Lec.

Juarez. (North to Canada.)

Nymphalidæ.

45. *Synchloë lacinia*, Geyer.

Juarez. (Neotropical, and north to Las Cruces, N. M.)

45 a. *Synchloë lacinia*, aberr. *rufescens*, Ckl.

Juarez.

Lycænidæ.

46. *Lycæna exilis*, Boisd.

Juarez. (Garfield Co., Colo., Las Cruces, N. M., Santa Fé, N. M. (one only): Ckl. Texas, Fla., Ariz., Calif.: W. H. Edwards.)

Hesperidæ.

47. *Pholisora catullus*, Fabr.

Juarez; identified by Dr. Skinner. (Colorado &c.)

Psychidæ.

48. *Oiketicus Townsendi*, Riley, MS., Towns.

Juarez. (Also Las Cruces, N. M., on tornillo, apple, and locust. Townsend only described the larva; the male moth has the cell

conspicuously dark brown, with a pale streak along its upper margin; otherwise it is not so very different from the description of *O. Abbotii* as given by Neumægen and Dyar, In. N. Y. Ent. Soc. 1894, p. 118.)

Noctuidæ.

Kindly identified by Prof. J. B. Smith.

49. *Carneades insignata*, Walk.

Montezuma. Prof. Smith gave me this name; but in his Catalogue (1893) he places it as a synonym of *C. insulsa*, Walk., which extends to Nova Scotia.

50. *Cirrhobolina mexicana*, Behr.

Montezuma. (Colo., New Mex., Ariz., Tex.: *Smith*. The species belongs to the arid region, but it is of a Neotropical type.)

Geometridæ.

Kindly identified by Mr. Hulst.

51. *Semiothisa californiata*, Pack.

Montezuma. (Las Cruces, N. M.: *Ckll.* Calif., Texas, Kansas, Nebraska: *Packard*.)

52. *Phibalapteryx intestinata*, Gn.

Montezuma. (Extends to Maine and Canada: *Pack*.)

HOMOPTERA.

Membracidæ.

53. *Stictocephala festina*, Say.

Juarez. (Las Cruces, N. M.: *Ckll.* Florida: *Say*.)

Coccidæ.

54. *Ceroplastodes niveus*, Ckll.

Montezuma. (Not known from elsewhere; the genus has one other species, from the Mesilla Valley, N. M.)

55. *Ceroplastes irregularis*, Ckll.

Between Montezuma and Ojo Caliente. (Mesilla Valley, N. M.: *Ckll.*)

I will take this opportunity of giving some fresh information about *C. irregularis*, based on the study of Mesilla Valley specimens. It is found on *Atriplex canescens*, and when alive is much whiter and more regular than my original types, which were old and injured by drying. The female with the wax removed is $4\frac{1}{2}$ millim. long, nearly the shape of *Lecanium hemisphericum*: the dorsum is rounded, smooth and shiny, and has no boss; the sides show irregular gibbositities; the caudal spine or tail is short and stout, but distinct.

On March 13, 1894, females were found with eggs, which are pink in colour. The number of eggs laid by one female is very great; I estimated them at a thousand. From the Mesilla Valley specimens I bred some numbers of a Chalcidid parasite, the *Aphycus ceroplastis* of Howard.

Looking over the above list of Chihuahua State insects, it will be seen that the Nearctic types largely preponderate, and that some few are even boreal. But it is proper to state that several of the species taken have not yet been identified; and as the specimens were mostly submitted to specialists who are much more familiar with the Nearctic than the Neotropical fauna, it may be assumed that the unnamed species were probably largely Neotropical. Consequently, had everything found been named, the percentage of Neotropical types might have been larger.

The localities cited are all over 3000 feet above sea-level; Juarez is about 3700 feet, Montezuma about 4500 feet, Damalayuca about 4200 feet, Ojo Caliente about 4200 feet, Ortiz about 3800 feet.

Las Cruces, New Mexico, U.S.A.,
Nov. 13, 1894.

On the Nutrition of Two Commensals (Nereilepas and Pinnotheres).
By M. HENRI COUPIN.

It is a well-known fact that in the whelk-shells inhabited by hermit-crabs the annelid *Nereilepas fucata* is very frequently found. This worm takes up its abode in the first whorls of the spire—that is to say, in a chamber which is almost completely closed by the posterior portion of the crab. It is, however, very well developed, in no way foul, and is, so to speak, resplendent with health. Herein there is nothing that need astonish us, as it is admirably protected against injuries and enemies from without. But the question arises, as to how it is able to obtain food. It is generally supposed that it is contented with consuming the excrement of the hermit-crab, which is voided in the very spot in which it is found. With a view to ascertaining if this is really the case I made various observations and experiments, which show that this hypothesis has no foundation in fact.

Let us actually examine a hermit-crab having a *Nereilepas* as its co-tenant. The crab has two principal modes of feeding. Under ordinary circumstances it is content to devour the particles which are brought into contact with its mouth by the rapid movements of its appendages: the refuse of these matters after digestion passes to the exterior in the shape of a cylindrical roll, more or less elongated, about 1 millim. in diameter, and easily to be distinguished from the fæces of the worm, which are filiform. If the worm devoured these evacuations, it is very evident that they would not be seen to pass out of the shell. During the whole of the time that

this feeding lasts the annelid gives no external sign of life: it awaits the favourable moment.

But the procedure is different when we give the crab a morsel of large size, as, for instance, a half or a quarter of a cockle (*Cardium*). Well pleased with this prize, the crab is seen to masticate it forthwith with animation; it even protrudes a portion of its body, and feeds, if I may be permitted to use the expression, like a glutton. But almost immediately, between the cephalothorax and the bases of the limbs on the right side, the anterior portion of the worm is seen to make a slow forward movement. The creature, without hesitation, proceeds to explore its comrade's mouth; on encountering the morsel of cockle there, it nips it forcibly with its powerful mandibles and thenceforth does not relax its hold. Retracting its body, it draws the booty to itself. Then one of two things happens: either the hermit-crab also clings to the prey, without noticing, moreover, the cause of its impending loss, and the annelid redoubles its efforts so effectually that the fragment is finally torn in two; whereupon the worm drags its portion into the interior of the shell, to devour it unmolested. Or else the crab lets go its prey, and the annelid carries it off bodily; in this manner I have seen the worm take away a *Cardium* almost whole, so that it could not even make it pass through the narrow orifice left between the crustacean and the shell. By dragging very hard, however, the annelid almost always succeeded in accomplishing its purpose.

There is no need to believe that the worm perceives the near presence of prey by smell, for, as I have been able to determine by withdrawing it from the shell, its organs of sense are greatly dulled. It is curious to find that it is the hermit-crab itself that, unconsciously of course, informs its comrade of the presence of prey of considerable size; the irregular movements in which the crustacean indulges indicate to the annelid that it is time to show itself; the worm is never seen to emerge at any other time. Another fact of interest to be noted is the indifference of the crustacean with regard to the robber with which it lives and which, to use a popular expression, comes to "snatch the morsel out of its mouth." I have often seen the annelid, after the hermit-crab had inadvertently let its prey fall, introduce its head and the foremost annuli of its body between the maxillipeds and right into the mouth of the crustacean. Apparently nothing would have been easier for the latter than to ingest the worm and to rid itself of it once for all; but it left it absolutely alone. The *Nereilepas* profits by the opportunity to devour the fragments of food that still remain in the mouth of the crab, and to carry them off into its retreat.

The above observations were made in aquaria. There is no doubt, considering their frequency, that the phenomena take place in the same way in a state of nature at the bottom of the sea. The annelid feeds upon the large substances that the hermit-crab intends to devour. But perhaps it will be asked whether, in addition, the worm does not eat, if not the whole, at least a portion of the fæces

of the crustacean. The following experiment proves that this is not the case.

To a hermit-crab that has been starved by fasting for some days there is given a *Cardium* impregnated with carmine. Immediately the annelid, which is likewise starving, shows itself, it is made to withdraw by being touched with a brush: it is driven away in this manner each time it returns. During this time the crab devours the *Cardium* and the carmine. After a few hours there is seen in the basin the excrement of the crustacean stained a vivid red. To ascertain whether the annelid has eaten a portion of the fæces, we break the shell and dissect the worm: I have never discovered carmine in its alimentary canal.

Nereilepas, therefore, does not devour the excrement of the hermit-crab. This discovery, it seems to me, is interesting from the point of view of the nature of the association between the crab and the annelid. In the opinion of P.-J. van Beneden this is a case of commensalism. Now, according to the definition of the celebrated zoologist, "the commensal does not live at the expense of its host: all that it desires is a home or its host's leavings; the parasite instals itself with its neighbour temporarily or permanently; with or without the latter's consent, it extorts from it board and, very often, lodging." This last definition applies admirably to the case of *Nereilepas*. The creature evidently injures the hermit-crab, since it abstracts a considerable portion of the latter's food: it is a veritable parasite, in the sense in which the word is understood in ordinary language.

Pinnotheres, another commensal, which is equally well known, leads us to identically the same conclusion. On dissecting the stomachs of specimens of *Pinnotheres* and those of the *Acephala* with which they live I have discovered the presence of the same substances, composed for the most part of lower forms of plant-life. There is not, as certain rash hypotheses would endeavour to make us believe, a division of the particles into two groups: the animal particles for the *Pinnotheres* and the vegetable ones for the mollusk. On the contrary, the *Pinnotheres* diverts for its own benefit a portion of the food-matter intended by the mollusk for itself. Although the injury may be very slight, it exists none the less. It matters little whether the food-matter be abstracted in the alimentary canal itself, as is done by *Tania*, *Echinorhynchus*, and many Nematodes, or at the entrance of the mouth; on the same grounds that the Helminthes, which do not attack the tissues, are parasites of their host, *Pinnotheres* is a veritable parasite of its mollusk, as is *Nereilepas* of the hermit-crab. This is the conclusion at which it was my desire to arrive; by the study of other commensals it will doubtless be strangely extended.—*Comptes Rendus*, t. cxix. no. 13 (September 24, 1894), pp. 540-543.

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[SIXTH SERIES.]

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XXIV.—*On the Genus Alicia* (Cladactis), with an Anatomical Description of *A. costæ*, Panc. By J. E. DUERDEN, A.R.C.Sc. (Lond.), Curator of the Museum of the Institute of Jamaica.

[Plate LX.]

WHILE investigating, in conjunction with Prof. Haddon, the anatomy and relationships of a collection of sea-anemones from Port Phillip, Australia, it became necessary, in order to determine the systematic position of one of them—*Cystiactis tuberculosa*, Quoy & Gaim.,—that a study of the genus *Alicia* should be made. No specimen in this genus, so far as we are aware, has ever been submitted to microscopic examination, a condition which is now absolutely necessary before the relationship of any form of sea-anemone can be determined.

The genus *Alicia* was founded by J. Y. Johnson (1861) for a new form of sea-anemone—*Alicia mirabilis*—from Madeira. Andres (1884), disregarding Johnson's priority, places this species under the genus *Cladactis*, founded by Panceri in 1868 for a Mediterranean Actiniarian, *Cladactis costæ*. Verrill (1869), quite independently, founded a genus of the same name for a new Panaman species, *Cladactis grandis*. Prof. Haddon and Miss Shackleton (1893) restore Johnson's *Alicia* in place of *Cladactis*, and add a new species, *Alicia rhadina*, which they regard as undoubtedly allied to *Actinia pretiosa*, Dana, from Fiji. They therefore show the genus *Alicia* to include the following:—*A. mirabilis*, Johns.

(the type species); *A. costæ*, Panc.; *A. grandis*, Verr.; *A. pretiosa*, Dana; *A. rhadina*, Hadd. & Shackl. Unfortunately only the second species, *A. costæ*, is available for microscopic investigation; but until this is done the generic relationship of the others, founded entirely upon external characters, must be assumed.

Johnson thus defines his genus *Alicia*:—"Base adherent at pleasure; greatly exceeding column. Tentacles simple. Margin of disk simple, without spherules. Column beset with stalked appendages."

His figures and description of *A. mirabilis* appear sufficiently clear to enable one to recognize the species, while the character of the genus—"Column beset with stalked appendages"—is sufficient as an external feature to separate it from all other previously described genera, and would certainly include Panceri's and Verrill's species.

Verrill, however, has evidently mistaken the relationship of the disk and column in the genus. He speaks of the disk as "broad, with a naked area or 'fosse' between the tentacles and the margin," and the marginal tubercles as "elongated, pedunculated, the end divided into two to six rounded lobes." In *A. costæ* this naked area or "fosse" is certainly the distal portion of the column, as is well shown in Andres's figure, and from the fact that the sphincter muscle occurs in this place.

The genus has generally been placed under the family Bunodidæ, from the fact that the column possessed what were regarded as tubercles mainly disposed in vertical series. The characters of the family Bunodidæ are now defined by McMurrich (1889) as the following:—"Actiniæ adhering to foreign bodies by a flat contractile base. Column occasionally smooth, but usually provided with tubercles, either simple or compound. No cinclides. Sphincter muscle is strong and circumscribed. Perfect mesenteries usually numerous, those of the first cycle, with the exception of the directives, being gonophoric. No acontia. Tentacles smooth, cylindrical, and entacmæous." Hertwig (1888) considers "the endodermal sphincter [circumscribed] must occupy the first place in the diagnosis." The *Cystiactis* we had under consideration from Australia has, from Quoy and Gaimard's figure, always been taken to be one of the Bunodidæ, on account of possessing what appeared to be tubercles disposed in a vertical series. Histologically, however, we found it to differ from that family in the salient character of having a well-developed diffuse endodermal sphincter in place of a circumscribed one, and also in the fact that the so-called tubercles are really hollow

vesicles. Hence arose the necessity of examining if the various species of *Alicia*, to which *Cystiactis* bears some external resemblance, agreed with it or the typical Bunodidæ. The sphincter of *A. costæ* is shown on Pl. IX. fig. 1, from which it will be seen that it is a somewhat weakly developed, but greatly elongated, diffuse endodermal muscle. A section through a vesicle is shown in fig. 2, exhibiting a hollow structure. Since our Australian form and *A. costæ* agree in such an important essential as the sphincter, and also in the nature of the outgrowths on the column, it becomes necessary that a new family should be established for their reception and others closely allied to them, as they are obviously different from any of those at present described. I propose the family name Aliciidæ, after the genus *Alicia*, with the following characters:—

Fam. Aliciidæ.

Hexactinæ with a large flat contractile base. Tentacles simple, cylindrical, and entacmæous. Column with simple or complex hollow processes or vesicles over the greater part of its surface, arranged mostly in vertical rows. No cinclides. Sphincter muscle endodermal and diffuse, variable in amount of development. Perfect mesenteries few or numerous. No acontia.

The family, as thus defined, includes the genera *Alicia* and *Cystiactis*, and possibly others, such as *Bunodeopsis*, &c.

The relationships of the Actiniaria are still in a very unsatisfactory condition, and will be so until a greater number have been examined anatomically. It is therefore somewhat premature to discuss the position of the Aliciidæ. External characters alone would place them near the Bunodidæ; but they are now shown to be separated by such an important character as that of the sphincter muscle.

The genus *Cystiactis* will be more fully discussed in a paper shortly to be published by the Royal Dublin Society.

Genus ALICIA.

Tissues very delicate. Tentacles elongated, more or less retractile. Column with the distal vesicles pedunculated and much divided, the proximal vesicles simpler and more or less sessile. Sphincter muscle feebly developed. Mesenteries not very numerous; two pairs of directive mesenteries.

Should *A. mirabilis*, Johns., when histologically examined, be found to differ fundamentally from the foregoing definition,

then, as it is the type of its genus, it will retain the name *Alicia*, and *A. costæ*, Panc., will be referred to its original genus *Cladactis*, with the definition given above.

Alicia costæ, Panc.

The description of the external characters is sufficiently well given by Andres, who also devotes a beautiful plate to the species. The following details refer only to the histological features.

Column.—The column is thin and delicate, somewhat thicker in the region of the sphincter muscle, but very thin in the vesicular region. The ectoderm is regular and covered on the outside with a delicate cuticle. The sphincter region of the ectoderm is crowded with elongated nematocysts, showing very distinctly the internal spiral thread; somewhat above and below this region the nematocysts are arranged in groups, as in the tentacles. In the vesicular region the ectoderm is much thinner and nematocysts are rare.

The mesogloea varies in thickness, as does the ectoderm. It is homogeneous in structure, except for the presence of a few minute cells.

The endoderm is very thin throughout and shows a weak endodermal muscle.

Vesicles (Pl. IX. fig. 2).—The stem or peduncle of the vesicle shows a regular ectoderm with a thin cuticle, but without any nematocysts; the mesogloea is thicker than that of the enlarged portions, and the endoderm forms a weak basal muscle. The distal portions of the vesicles possess a thicker ectoderm, with a few nematocysts. The ectoderm seems largely made up of elongated unicellular glands, which stain deeply. It is probable that the vesicles are partly glandular in function. They are not batteries of nematocysts. The mesogloea is very thin, and the endoderm contains markedly the pigment granules which give the bright coloration to the vesicles in the living animal.

Tentacles (Pl. IX. fig. 3).—The walls of the tentacles are very thin, with small batteries of nematocysts arranged at intervals all over the surface. The nematocysts are large, elongated, and show the spiral thread distinctly. Accompanying them are deeply staining unicellular glands. The mesogloea appears only linear in section. The endoderm is about half the thickness of the ectoderm and evenly arranged. A very weak ectodermal muscle can be distinguished in transverse sections and an endodermal one in longitudinal sections.

Disk.—In the disk the ectoderm is very thick and shows

few or no nematocysts. The mesogloea is very thin and the endodermal muscle very weak, except towards the periphery of the disk. Here, close to the tentacles, the disk in spirit-specimens has a deep fold; the mesogloea is plaited somewhat as at the sphincter muscle, and the endodermal muscle is clearly seen. Nematocysts occur in the fold.

Œsophagus.—The ectoderm of the œsophagus possesses numerous large elongated nematocysts, which do not stain; the mesogloea has increased considerably in thickness and the endoderm has what seem to be glandular cells. A weak endodermal muscle is present. There is no indication of a groove opposite the directives.

Sphincter Muscle (Pl. IX. fig. 1).—The sphincter muscle is weak, endodermal, and diffuse in character. It is very elongated, extending from just below the tentacles to where the vesicles commence. The mesogloea is thrown into delicate plaits to support it.

Mesenteries (Pl. IX. fig. 4).—The mesenteries are few and regular in arrangement. There are six pairs of perfect mesenteries, two pairs of these being directives. Alternating with the perfect mesenteries are six pairs of secondary mesenteries, and with these again twelve pairs of tertiaries. In structure they are very thin and delicate, except where the retractor muscle is developed. Here the mesogloea is thickened and becomes plaited in a more or less delicately dendriform manner to support the weak muscle-fibres. There is also a weak muscle on the side opposite the retractor, and in the lower part of the column the muscle and plaitings of the mesogloea are about equally developed on each side. The endoderm is feebly developed and has small deeply staining cells.

Gonads.—In the specimens examined there were no gonads present.

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EXPLANATION OF PLATE IX.

Reference letters.

<i>ect.</i> = ectoderm.	<i>mes.</i> = mesogloea.
<i>end.</i> = endoderm.	<i>nem.</i> = nematocyst.
<i>end. mus.</i> = endodermal muscle.	<i>sph. m.</i> = sphincter muscle.
<i>gld. c.</i> = gland-cell.	<i>rec. m.</i> = retractor muscle.

- Fig. 1.* Longitudinal section of the portion of the column of *Alicia costæ*, Panc., between the tentacles and the commencement of the vesicles, showing the diffuse endodermal sphincter muscle, considerably folded. Magnified 33 times.
- Fig. 2.* Section through one of the large vesicles. Slightly magnified.
- Fig. 3.* Transverse section through a flattened portion of an extended tentacle, showing the arrangement of the nematocysts in limited areas. Magnified 33 times.
- Fig. 4.* Transverse section of a middle portion of a mesentery in the region of the œsophagus. Magnified 33 times.

XXV.—*On some new Species of Coleoptera in the Museum of the Hon. Walter Rothschild.* By Dr. K. JORDAN.

1. *Trichius ornatus*, sp. n.

♂ ♀. *Tr.* obscure viridis, infra æneo-nitens. Caput sæpe parum purpurascens; clypeo latitudine parum longiore, præcipue in ♀, grosse punctato; fronte et vertice in ♂ minute sat sparsim, in ♀ dense subreticulato-punctatis, duabus maculis frontis, duabusque lateralibus elongatis verticis luteis. Antennæ pallide rufis, articulo primo apice viridescente, clava maris ea feminae parum longiore. Palpi rufi.

Prothorax longitudine parum latior, apice rectus, basi rotundatus, lateribus pone angulos anticos prominentes, in ♂ minus quam in ♀ rotundatus, leviter sinuatus, retrorsum gradatim (♂) vel rotundatim (♀) parum ampliatus, angulis posticis rotundatis; sulco mediano longitudinali, sulcis transversis uno apicali, altero basali, limbo laterali medio angustiore, utrinque macula disci obliqua postmediana, altera minore subapicali, tertia laterali mediana cum limbo ac sæpe cum macula prima connexa, luteis, his maculis impressis; disperse, (♂) minute, (♀) crasse punctatus.

Scutellum triangulare, longitudine latius, marginibus exclusis luteum.

Elytra latitudine sexta parte longiora, leviter striato-punctata, interspatiis tertio cæteris multo latiore et primo parum elevatis; vitta mediana longitudinali longitudine ac latitudine variante, in humeris sæpe dilatata, rufa; linea longitudinali interspatium secundum occupante, guttis septem in utroque elytro luteis—1^a basali mediana, 2^a basali marginali, 3^a dorsali antemediana in

punctos divisa, 4^a, 5^a, 6^a lateralibus æquidistantibus, 7^a ad angulum suturalem sita.

Pygidium utrinque macula plus minus magna lutea signatum, (♂) subcirculariter, (♀) irregulariter strigulosum, (♀) lateribus etiam parum punctatum.

Infra luteo-notatus, variabilis, luteo-pilosus, sat rude punctatus; abdomen (♂) medio sensim depressum, segmento anali (♀) emarginato. Pedes luteo-rufi, viridi-nitentes.

Long. 15 mm., elytr. 7½, lat. 6½.

Hab. Khasia Hills, Assam. Six males, six females.

Resembles in outline *Tr. Jansoni*, Gestro [Ann. Mus. Civ. Gen. (2^a) x. p. 854, t. ii. fig. 12, 1892 (Burma)], but otherwise it is quite different.

2. *Trichius discolor*, sp. n.

♂. Caput nigrum, ante oculos fascia transversa rufa, intra oculos densissime longitrorsum irregulariter strigulosum, ante pronotum et ad marginem oculorum punctulatum; clypeus latitudine parum longior, lateribus sat reflexis rectis, angulis anticis autem valde rotundatis, sublævis. Antennæ rufæ, clava funiculo longiore.

Prothorax rufus, tenuiter nigro-limbatus, lateribus reflexo-marginatis, postice rotundatus, a medio antrorsum angustatus, pone angulos anticos prominentes subrectos vix sinuatus; dorso utrinque pone medium parum depressus, disco paucis strigulis luniformibus instructus: puncto nigro impresso marginali antemediano, macula indistincta basali laterali obliqua eodem colore, præterea sulculo marginali, linea mediana pro parte, ac utrinque puncto discoidali luteis.

Scutellum triangulari-semicirculare, medio excluso punctulatum, nigrum.

Elytra rufa, marginibus angustis et plaga magna mediana disci nigris; hæc plaga duo puncta, unum medianum dorsale, alterum postmedianum laterale, lutea includit: irregulariter punctato-striata, striis dorsalibus postice evanescentibus; apex singuli elytri valde, fere regulariter, rotundatus.

Pygidium atrum, splendens, utrinque plaga lutea notatum, paucis punctis instructum.

Infra niger, luteo-signatus; metasternum lateribus macula rufa notatum. Pedes rufi, genibus et tibiæ apice nigris leviter ænescentibus, pauce punctati; dentes tibiæ anticarum sat parvi.

♀. A *mare* differt: splendens; clava antennarum nigra; clypeo fortius sculpturato; prothorace punctis magnis lateribus densis instructo, linea media magis impressa, macula basali laterali nigra multo majore triangulari; elytris magis regulariter et fortius punctato-striatis, apice haud lævibus, atris, macula basali, altera subapicali rufis, gutta mediana lutea majore; pygidio rufo, supra

lævi, macula laterali minuta; corpore infra rufo, sternis lateribus nigro-signatis ac luteo-guttatis.
 Long. 11 mm., elytr. 6, lat. $4\frac{1}{2}$.

Hab. Khasia Hills, Assam. One male, one female.

3. *Calodema plebeius*, sp. n.

♀. Caput viridi-cæruleum, impressionibus levibus irregularibus punctisque sat densis grossis instructum, vertice medio sulco profundo notato. Antennæ viridi-æneæ, apice obscuriores. Prothorax elytris latior, apice basi fere duplo angustior, lateribus rotundatis ante basin latioribus; basi utrinque latius sinuatus quam in *C. regali*; convexus, medio canaliculatus, disco antice leviter biimpressus, alteris impressionibus utrinque versus latera pone medium sitis, dense fortiter subumbilicatum punctatus, punctis antice sparsioribus minutioribus; cum elytris ruber, limbo apicali medio triangulariter dilatato et lobi antescutellaris apice viridi-æneis, margine laterali apicali angustissimo cyaneo sicut margine basali laterali.

Scutellum transversum, rotundatum, excavatum, læve, viridicyaneum. Elytra prothoracis colore, margine basali angusto ænescente, sutura angustissima nigrescente, postice cum margine apicali angusto et signaturis elytrorum obscure cyaneis: macula parva communi postbasali fere V-formi, fascia transversa postmediana in sutura latiore (ubi circiter dimidio latitudinis elytri), in medio disci parum constricto, ad marginem lateralem angustata, macula parva transversim triangulari anteapicali suturali; sat conspicue striato-punctata, parum rugulosa, interstitiis pro parte subconvexis; margine apicali bidentato versus suturam subangulato-convexo.

Subtus cyanea, leviter viridescens. Prosternum magis elevatum quam in *C. regali*; sternum lateribus et abdomen dense fortiter punctata. Segmenta 2^{um}-4^{um} lateribus macula parva irregulari rubra, totum segmentum ultimum (macula parva basali, margine angusto apicali exceptis) etiam rubrum. Pedes sat fortiter punctati, cyanei, tibiis tarsisque ænescentibus.

Long. 40 mm., elytr. (sut.) 30, lat. (proth.) 27, lat. (hum.) $25\frac{1}{2}$.

Hab. Cairns, North Queensland. One female.

I have compared this insect with specimens of the three *Calodema*-species hitherto known—*C. regalis*, Cast. & Gory, *C. Ribbei*, Foll., and *C. Wallacei*, Deyr.—and find that it is different from them; in its broad prothorax it recalls somewhat *C. Ribbei*, and resembles in the red colour of the upperside *C. Ribbei* and *C. Wallacei*.

4. *Crioprosopus amœnus*, sp. n.

♀. *Cr. ater*, splendens, rubro- ac rubrescenti-ochraceo-signatus.

Caput antice depressione trapeziformi, intra antennis præter sulcum medianum utrinque irregulariter sat profunde sulcatum ac rudibus punctis instructum, vertice dense punctatum. Antennæ corpore parum longiores, basi excepto griseo-pubescentes; articulis 1° basi impressione transversa, supra altera longiore leviori notato, inæqualiter punctato, 3°-5° canaliculatis.

Prothorax corallinus, macula oblonga mediana parva postmediana atra, ante eam striola subnigra: fortiter, fere æqualiter convexus, utrinque dorso impressione mediana parva, lateribus ante dentem conicum amplior quam post dentem, sed hic vix gibbosus, disperse punctatus, basi utrinque fere lævis.

Scutellum triangulare, impunctatum, latitudine vix longius. Elytra basi prothorace (cum dentibus) parum latiora, retrorsum attenuata, humeris rotundatis, sed haud valde obliquis, minute punctata, basi transverse rugulosa; maculis duabus pallide rubrescenti-ochraceis transversis intra marginem elevatam lateralem et suturam, hanc non attingentibus, extensis: 1^a postbasali majore parte atra basali elytri angustiore, ad marginem lateralem versus basin dilatata, ad suturam rotundata, 2^a minore suboblonga antice magis quam postice rotundata, ante quartam partem apicalem elytri sita; angulo apicali suturali recto, exteriori dentato.

Prosternum transverse rugulose punctatum. Processus mesosternalis antice perpendicularis, margine superiore antice convexo medio subtuberculiformi. Metasternum lateribus dense, versus medium multo sparsius sed rudius punctatum. Abdomen rubrum, segmento 1° atro, cæteris marginibus nigrescentibus, ultimo sat dense punctato late leviter emarginato.

Pedes atri, femoribus medio corallinis, tibiis quatuor posticis compressis subsulcatis sat grosse punctatis.

Long. 32 mm., elytr. 23, lat. 10½.

Hab. Bebedero, Costa Rica (Underwood coll., 1894). One female.

A very conspicuous insect, which is not nearly allied to any other species of *Crioprosopus*.

5. *Sternotomis transversonotatus*, sp. n.

♀. *St. niger*, infra pube luteo-ochracea, supra nigra, capite hic et inde, antennis basi pedibusque subglauca vestitus, pronoto luteo-, elytris lacteo-signatus.

Caput utrinque macula anteoculari ac gutta in medio frontis sita luteis notatum, omnino punctulatum; fronte antice transverse impressa, medio convexa, sat profunde canaliculata, canaliculo in vertice leviori, pone elevationem intra-antennalem postice sulco transverso arcuato sat profundo determinatam in impressionem profundam punctiformem dilatato; oculis luteo-glaucocinctis; tuberculis antenniferis magis quam in *St. amœna*, Westw., elevatis, dense punctulatis. Antennæ corpore parum longiores, griseo-tomentosæ, basi subglauçæ, articulo primo cicatrice rudi instructo.

Prothorax longitudine latior, basi profunde sat anguste constrictus, disco ante hoc sulcum magis elevato quam in *St. Murrayi*, Chev., et *St. amœna*, Westw., antice sulculo transverso recto supra in medio haud retrorsum arcuato, dente laterali robusto, supra punctis rudibus ac linea mediana antice sensim impressa instructus; nigro-velutinus, sulco basali et utrinque macula antemediana suboblonga transversa luteis.

Scutellum albo-luteum, rotundatum. Elytra basi prothorace (cum dentibus) vix latiora, humeris leviter productis rotundis; in utroque elytro tribus maculis lacteis: 1^a laterali ad humerum incipiente retrorsum latiore, totum latus occupante, limbo tenui excepto, intus pone medium emarginata; 2^a basali a humero versus suturam descendente, suturam ac medium elytrorum haud attingente, parum latiore quam spatium nigrum intra maculas 1^{am} et 2^{am}; 3^a suboblonga dorsali postmediana.

Processus prosternalis angustus, postice declivis, versus basin rotundato-declivis, sulcatus, antice fere perpendicularis, apice rotundato autem parum producto. Processus mesosternalis etiam sat angustus, supra parum convexus, apice leviter productus ac medio angusto paulo emarginatus, cum processu prosternali pilis longis vestitus. Abdomen lateribus luteo-ochraceum, medio glaucum.

Long. 30 mm., elytr. 21, lat. 10.

Stanley Pool, Congo. One female.

When a series of this peculiar species is procured, we shall probably find that the colour of the tomentum of the underside is liable to variation.

The elytra appear less triangular than in the allied species (*St. amœna*, Westw., *crux-nigra*, Hope, *Murrayi*, Chev., &c.), as they are narrower at the base.

The structure and pattern of the pronotum, the form and pattern of the elytra, and the structure of the sternal intercoxal processes distinguish this species from its allies.

6. *Ceroplesis Harrisoni*, sp. n.

♀. *C. niger*, elytris rufo-testaceo-fasciatus. Structura (haud signatura) *C. fissa*, Har., similis, multo robustior; prothorace dente laterali majore, pronoto fortiter punctato-rugato, antice transversim plicato, basi sat fortiter biplicato, sulco brevi antebasali mediano lævi instructo; elytris basi fortiter rugato-punctatis; processu mesosternali minus elevato, fere æqualiter declivi, cum processu prosternali brunneo-nigro-piloso.

Elytra nigra, fascia prima antemediana parte basali nigra angustiore, secunda postmediana illa parte æquilata, tertia quartam partem apicalem elytrorum occupante, ac limbo laterali tenui (basi excepta) rufo-testaceis signata; fasciis *nigris* submediana et altera antepicali æquilatis in sutura sæpe parum latioribus.

Long. 30 mm., elytr. 21, lat. 10½.

Hab. Congo (from between Stanley Pool and Lukolele, and from Upoto). Three females.

Named in honour of the Rev. F. G. Harrison, who procured this and many other interesting and rare insects during his journeys on the Congo between the Stanley Pool and Lukolele.

XXVI.—*A Revision of the Jurassic Bryozoa.*—Part I. *The Genus Stomatopora.* By J. W. GREGORY, D.Sc., F.G.S.

I. *The Specific Characters of the Cyclostomata.*

The diagnosis of species of Cyclostomatous Bryozoa has always been regarded as a difficult and unsatisfactory task. The Cheilostomata offer nine useful characters, some of which appear to be very reliable. In this group the form of the zoarium, the shape of the orifices and of the zoecia, the structure of the front wall, the characters of the oecia or gonocia, the arrangement of the avicularia and vibracula, the distribution of the spines and maculae, and the superficial ornamentation give a combination of characters which enables species to be defined with considerable precision. Unfortunately in the typical Cyclostomata only the least trustworthy of these characters are available. We have to rely only on the form of the zoarium, the length of the zoecia, the size and position of the mouth, the shape of the oecia (when present), and the ornamentation of the wall. The zoecia in the Cyclostomata are, however, so very simple in structure that their characters are far less reliable than in the more specialized subclass, the Cheilostomata. It seems therefore at first sight almost impossible to diagnose species while even the genera appear to vary to a hopeless extent.

Two opposite methods of treatment have therefore been adopted for the Cyclostomata. On the one hand, numerous species have been founded on insignificant and individual variations; on the other, many authors have thought that this subclass affords an illustration of the theory of the "persistence of type," that was once applied, but has been discontinued in the case of many other groups. They have therefore abandoned the effort to separate species of different ages; they have lumped together the forms of such different geological horizons that, if their example be followed, the study of the group becomes valueless.

To find a mean between these extremes is not easy. The

general facies of the Cyclostomatous faunas of the various geological systems is, however, strikingly different; this can at once be seen by a comparison of lists of the genera. If the genera vary it is almost certain that the species must do so likewise. The specific characters are variable and slight. But if we examine good series of specimens, and compare the normal types of the zoëcia and equivalent zoëcia in the two zoaria, then certain fairly constant differences appear. Thus, if we take a Jurassic specimen in which the zoarium contains, say, two hundred zoëcia, and compare it with one of a closely allied recent species with as many zoëcia, it is not improbable that one zoëcium in each may be found to be identical. But that does not seem sufficient reason for ignoring the constant differences between the majority of the zoëcia in each. The embryos and young forms of different species of Mollusca are often indistinguishable; but that does not lead malacologists to merge the species when there are definite differences in the adults. The variations in the zoëcia of a zoarium of a bryozoon is an analogous case to this; some zoëcia are young and immature, others are cramped and malformed. To draw up a diagnosis which shall accurately describe each zoëcium in a colony, and shall at the same time be sufficiently definite to characterize the species, is impossible. Nevertheless, if we take the normal adult zoëcia and compare equivalent ones in different species, there seems sufficient reason for supporting the practical validity of species in this group.

II. *Revision of the Species.*

The genus *Stomatopora* affords a very convenient illustration of the difficulties, but yet of the possibilities, of the diagnosis of the Cyclostomata. It is, moreover, the first genus represented in the Jurassic that comes under consideration in the preparation of a catalogue of the Jurassic Bryozoa. It may be useful to publish a synopsis of each of the leading genera as they are finished.

Family Tubuliporidae.

Genus STOMATOPORA, Bronn, 1825.

Alecto, Lamouroux, 1821.

Aulopora, pars, Goldfuss, &c.

Diagnosis.—Tubuliporidae with the zoëcia forming flat adnate zoaria, composed of uniserial lines. These branch

dichotomously or irregularly, and sometimes anastomose into a reticular web. The peristome is flush or slightly raised. Zoëcia tubular or subpyriform.

Type species: *S. dichotoma* (Lamouroux).

1. *Stomatopora dichotoma* (Lamx.).

Alecto dichotoma, Lamouroux, 1821, Exp. méth. Polyp. p. 84, pl. lxxxi. figs. 12-14.

Stomatopora dichotoma, Bronn, 1825, Pflanzenth. pp. 27, 43, pl. vii. fig. 3.

Aulopora dichotoma, Goldfuss, 1831, Petref. Germ. Bd. i. p. 218, pl. lxxv. fig. 2 (? non 2 a).

Stomatopora antiqua, Haime, 1854, Mém. Soc. géol. France, sér. 2, t. v. p. 162, pl. vi. fig. 7.

Stomatopora Haimei, Terq. & Piette, 1865, ibid. sér. 2, t. viii. p. 124, pl. xiv. figs. 29, 30.

Stomatopora dilatans montlivaltiformis, Vine, 1883, Rep. Brit. Assoc. 1882, p. 251.

Stomatopora Terquemi, Haime, 1854, op. cit. p. 164, pl. vi. fig. 4.

Stomatopora Waltoni (non Haime), Vine, 1884, Quart. Journ. Geol. Soc. vol. xl. p. 787.

Stomatopora spirata, Walford, 1889, ibid. vol. xlv. p. 564, pl. xviii. fig. 6.

Stomatopora porrecta, Walford, 1889, ibid. vol. xlv. p. 565, pl. xviii. figs. 7, 8.

Diagnosis.—*Zoarium* typically forming a loose irregular network; the lines radiate from the centre and repeatedly branch dichotomously. Eight or ten zoëcia may occur between two points of bifurcation. Such series are often curved (var. *spirata*, Walf.). Young forms consist of a single line, which may at first branch very sparingly (var. *porrecta*, Walf.). Crowded growths occur.

Zoëcia regularly cylindrical.

Peristomes well raised, varying in height from half to one and a half times the diameter of the zoëcia. Surface punctulate and transversely wrinkled. The wrinkling is best seen in young zoëcia. The normal zoëcia vary in length from one and a half to three times the diameter.

Oëcia small; appear as small hemispherical tubercles; diameter about half that of the zoëcia; punctulate.

Distribution.—England: Lower Lias to Cornbrash. Foreign: Sinemurian to Kimeridgian; France and Germany.

2. *Stomatopora dichotomoides* (d'Orb.).

Alecto dichotomoides, d'Orbigny, 1849, Prod. Pal. t. i. p. 288.

Stomatopora dichotomoides, d'Orbigny, 1852, Pal. Franç., Terr. Crét. t. v. p. 834.

Stomatopora Bouchardi, Haime, 1854, Mém. Soc. géol. France, sér. 2, t. v. p. 164, pl. vi. fig. 6.

Stomatopora jurensis, Étallon, 1861, Mém. Soc. Émul. Doubs, sér. 3, t. vi. p. 211.

Stomatopora corallina (? d'Orb.), id. 1861, *ibid.* p. 210.

Stomatopora Waltoni (pars.), Vine, 1884, Quart. Journ. Geol. Soc. vol. xl. p. 787, fig. 2 *b* (non 2 *a*).

Diagnosis.—*Zoarium* of uniserial zoecia branching dichotomously or irregularly. Typically it is very loose. Long unbranched series occur. Crowded varieties with tufted ends to the branches also occur.

Zoecia at first regularly cylindrical, but soon becoming pyriform or subpyriform; obscurely transversely ridged; surface punctulate.

Peristomes slightly raised, usually not on the median line.

Oecia unknown.

Distribution.—England: Inferior Oolite to Corallian. Foreign: Bajocian to Corallian; France, Germany, and Austria.

3. *Stomatopora Waltoni*, Haime.

Stomatopora Waltoni, Haime, 1854, Mém. Soc. géol. France, sér. 2, t. vi. p. 162, pl. vi. figs. 3 *a* and *b*.

Alecto bajocensis, d'Orbigny, 1849, Prod. Pal. t. i. p. 288.

Diagnosis.—*Zoarium* of uniserial zoecia forming delicate, radiating, and very divergent lines; these branch repeatedly, occasionally interlace, and end in loose tufts.

Zoecia long, cylindrical, and very thin; transversely ridged.

Peristomes have thickened rims, but are not reflexed.

Distribution.—England: Fuller's Earth to Cornbrash. Foreign: Bajocian, France.

4. *Stomatopora Smithi* (Phillips).

Cellaria Smithi, Phillips, 1829, Geol. Yorks. pt. i. p. 143, pl. vii. fig. 8.

Hippothoa Smithi, Morris, 1843, Cat. Brit. Foss. p. 39.

Alecto Smithi, d'Orbigny, 1849, Prod. Pal. t. i. p. 317.

Diagnosis.—*Zoarium* hippothoiform, uniserial; branches crowded and irregular; entirely adherent.

Zoecia pyriform; long slender proximal ends; front wall well raised, rounded, and punctate; orifice small, circular, surrounded by a low rim.

Peristomes slightly raised. Flat regular rims surround each of the zoecia.

Distribution.—Adherent to *Cardium citrinoidum*. Cornbrash, near Scarborough. Only the type specimen known.

5. *Stomatopora intermedia* (Münst.).

Aulopora intermedia, Münster, 1831, in Goldfuss, Petref. Germ. Bd. i. p. 218, pl. lxx. fig. 1.

Stomatopora intermedia, Bronn, 1849, Ind. Pal. p. 1202.

Alecto intermedia, d'Orbigny, 1850, Prod. Pal. t. ii. p. 25.

Diagnosis.—*Zoarium* forming a crowded network.

Zoëcia cylindrical, very short.

Peristomes raised and much thickened.

Distribution.—Corallian, France and Germany.

Synopsis of Species.

I. *Zoëcia* regularly tubular.

Peristomes well raised; zoëcia short *dichotoma*.

Peristomes slightly raised; zoëcia long *Waltoni*.

Peristomes thickened *intermedia*.

II. *Zoëcia* pyriform *dichotomoides*.

III. *Zoëcia* hippothoiform *Smithi*.

III. *Relations of the Jurassic Species.*

The four main characters used in the diagnosis of these species are as follows:—The elevation of the peristome (*p*); the shape of the zoëcia (*c*); the size, and especially the length, of the zoëcia (*l*); and, last and not least, the arrangement of the zoarium (*r*). In order to show the relations of these Jurassic species to those of later periods formulæ are very convenient. Each of the characters may be represented by a letter, and numbers adopted for the principal variations.

Thus, let *p* stand for peristome; if it is flush it may be indicated by 0, if well raised by 2, and if slightly so by 1.

In the subjoined formulæ the signs denote as follows:—

	Peristome.	Shape of Zoëcia.	Length of Zoëcia.	Zoarium.
	<i>p</i> .	<i>c</i> .	<i>l</i> .	<i>r</i> .
0	Flush.	Cylindrical.	Short.	Uniserial; long thin series.
1	Slightly raised.	Fusiform.	Median.	Uniserial; branches tufted at ends.
2	Well raised.	Pyriform.	Long.	Uniserial; branches tend to become double at ends.
3	Highly raised.	Hippothoiform.	Very long.	Multiserial.

Intermediate variations may be indicated by the use of dashes beside the figures.

Thus we may represent the different series as follows:—

S. dichotoma series.

	<i>p.</i>	<i>c.</i>	<i>l.</i>	<i>r.</i>	
<i>S. dichotoma</i> (Lamx.)	2	0	1	1	Jurassic.
<i>S. granulata</i> , M.-Edw. (non auct.)	2'	0'	1	1	Cretaceous.
<i>S. divaricata</i> , Reuss	2'	0'	1'	0''	Miocene.
<i>S. trahens</i> , Couch (<i>S. granulata</i> , Johnst.)	2''	0''	1	2	Recent.

S. dichotomoides series.

	<i>p.</i>	<i>c.</i>	<i>l.</i>	<i>r.</i>	
<i>S. dichotomoides</i> (d'Orb.)	1	2	1	0	Jurassic.
<i>S. plicata</i> , d'Orb.	1	2'	1	0	Cretaceous. (Or- namentation differs.)
<i>S. vesiculosa</i> (Mich.)	1	2''	1	0	Miocene.

S. Waltoni series.

	<i>p.</i>	<i>c.</i>	<i>l.</i>	<i>r.</i>	
<i>S. Waltoni</i> , Haime	1	0	2	0	Jurassic.
<i>S. longiscata</i> , d'Orb.	1''	0	2	0	Cretaceous.
<i>S. Reussi</i> , n. nom.*	2	0	2	0	Miocene.

Each of these three sets of formulæ shows a gradual increase in the degree of development of the distinguishing characters. This fact is clearly brought out by the formulæ. In some species the later types, however, are simpler than their Cretaceous representatives, for the genus attained its maximum in the Mesozoic, and has been on the wane throughout the Cainozoic. The different stages may be called either species or varieties. It probably does not matter which name is adopted, so long as the differences between them are marked and the forms grouped together in series round the best-known type.

XXVII.—*Descriptions of Two new Species of Pieridæ captured by Captains Cayley Webster and Cotton in New Georgia, Solomon Islands.* By H. GROSE SMITH.

Delias georgiana.

Male.—*Upperside.* Anterior wings white, with the costal margin, costal and subcostal nervures black; the third sub-

* *Aulopora divaricata*, Reuss (non Roemer), Foss. Polyp. Wien. Tert. 1847, p. 53, pl. vii. fig. 18.

costal nervule very broadly black; the apical area broadly black, the inner edge of which is irrorated with white and extends rather obliquely as far as the extremity of the lowest median nervule, whence to the posterior angle it becomes linear; between the veins near the apex are five white streaks, of which the third is the longest and broadest, the others being more or less irrorated with black scales. Posterior wings white, with the outer fourth from the apex to the inner margin black, the black area being widest in the middle and its inner edge irregular and irrorated with grey scales.

Underside. Anterior wings white, with the black area more extended than on the upperside, and invading the upper part of the cell, where, towards the base, it is irrorated with white and tinged with yellow; the upper discocellular nervule is black; the rows of white spots in the apical black area are much larger and more distinct than on the upperside and six in number, with a narrow marginal whitish streak between the two lowest median nervules. Posterior wings with the basal two thirds yellow, shading into white towards the apex; the outer third black, with a submarginal row of six greyish-white bars, angulated externally in the middle.

Head and thorax black, clothed with long white hairs; abdomen white.

Expanse of wings $2\frac{1}{4}$ inches.

Belongs to the group of *Delias isse*, Cram.

One specimen only. In Mr. Grose Smith's collection.

Appias gisco.

Male.—Upperside. Both wings pale yellow, with very broad black margins. On the anterior wings the basal fourth is densely irrorated with grey scales; the black area extends broadly along the costa and covers the apical and outer marginal fourth, terminating on the inner margin at three fourths distance from the base; its inner edge on the disk is deeply indented between the veins. On the posterior wings the outer fourth from a little above the apex to a little above the anal angle is black, with its inner edge rather irregular and irrorated with yellow scales.

Underside as above, but on the anterior wings the basal area is yellow, clouded with grey. On the posterior wings the inner three fourths is orange-yellow, slightly darker orange on the costal margin; the outer fourth being brown-black as above.

Antennæ black; head and thorax dark grey; abdomen grey above, yellowish grey below.

Expanse of wings 2 inches.

Belongs to the group of *A. panda*, Godt., to the female of which on the upperside it bears considerable resemblance.

One specimen only. In Mr. Grose Smith's collection.

XXVIII.—*Descriptions of new Species of Land-Shells from New Guinea.* By EDGAR A. SMITH.

THE species about to be described were collected by Mr. William E. Armit during an exploring expedition on the north-east coast of British New Guinea, on Mount Maneau, on the mainland, and on Mount Moratau, Goodenough Island; also at the back of Cloudy Bay, on the south coast. It is to be regretted that the exact locality of the species can only be given in one or two instances.

1. *Nanina amblytropis* *.

Testa orbicularis, subacuta carinata, spira brevi convexe conoidea, anguste perforata, supra fusca, haud nitida, subtus pallidior, corneo-lutescens, polita; anfractus 6, lente crescentes, leviter convexiusculi, inferne ad suturam impressi, submarginati, lineis incrementi obliquis arcuatis, prope suturam subplicatis, striisque microscopicis radiantibus et minute rugulosis sculpti, ultimus ad peripheriam acute angulatus, subtus nitens, haud microscopice striatus, lineis incrementi modo sculptus; apertura obliqua, angulatim sublunata, intus albidula vel livido-alba; peristoma tenue, margine columellari leviter incrassato, superne expanso, foramen umbilicale semiobtegente.

Diam. maj. 23 millim., min. 20, alt. 13; apertura 7 alta, 11½ lata.

I am inclined to think that this species does not exceed the dimensions given above. The spire is convex and terminates in an obtuse apex. The sculpture consists, besides the lines of growth, of exceedingly fine wrinkly striæ in the same direction. It is this minute striation which produces the dull surface. Underneath, where they are not present, the shell is highly glossy.

2. *Nanina lissorhophe* †.

Testa *N. Cairni* ‡ similis, sed spira minus conoidea, anfractibus

* ἀμβλύς, blunt; τροπίς, keel.

† λισσός, smooth; ραφή, a seam or suture.

‡ Ann. & Mag. Nat. Hist. 1887, vol. xix. p. 417, pl. xv. fig. 5.

lentius accrescentibus, lineis incrementi confertis, fortioribus sculpta, anfr. ultimo infra carinam haud concave impresso, subtus striis concentricis vix visibilibus.

Diam. maj. $25\frac{1}{2}$ millim., min. 22, alt. 13; apertura 9 alta, 13 lata.

This species is seen at a glance to be distinct from *N. Cairni*, which it resembles in colour and the width of the umbilicus. The sculpture of the upper surface is quite different. The close striæ stop short just below the suture, which is consequently margined beneath with a smooth border.

3. *Rhysota Armiti*.

Testa perforata, orbicularis, carinata, supra saturate fusca, versus apicem livido-purpurea vel rufescens, haud nitida, infra polita, olivaceo-fusca, versus umbilicum pallidior, subflavida; spira depresso conoidea, ad apicem obtusa; anfractus 6, lente accrescentes, vix convexiusculi, lineis incrementi oblique arcuatis tenuissimis minute subrugulosis sculpti, ultimus oblique rugosus et irregulariter indentatus, ad peripheriam acute angulatus, infra, concentricè substriatus, lineis incrementi tenuibus ornatus, versus labium inferius leviter inflatus vel saccatus; apertura obliqua, sublunata, saturate livido-fusca; peristoma intus incrassatum, carneum, margine columellari supra umbilicum breviter expanso et reflexo.

Diam. maj. 45 millim., min. 39, alt. 22; apertura $13\frac{1}{2}$ alta, 23 lata.

This species is allied to *R. hercules* of Hedley, but is separable on account of its smaller size, the less elevated spire, the slightly more acute keel, the less convex whorls, the rather more distinct concentric striation on the lower surface, and the peculiar inflation of the base. In colour the two species are rather similar, but *R. hercules* is greener beneath and has a rosy or pink peristome, which, in the present species, is of a flesh-colour and not so pink. Slight differences of sculpture are also discernible; but these are more readily seen by a comparison of the two forms.

4. *Helix (Hadra) stirophora* *.

Testa depresso subglobosa, ad peripheriam obtuse carinata, late umbilicata, saturate castanea; spira convexè conoidea, ad apicem obtusa; anfractus $5\frac{1}{2}$, convexiusculi, lineis incrementi striati, ultimus antice breviter descendens; apertura late lunata, obliqua, saturate fusco-purpurea; peristoma undique mediocriter expansum et reflexum, pallide purpurascens, margine columellari albo, latius expanso.

Diam. maj. 34 millim., min. 28, alt. 23; apertura 13 alta, 17 lata.

Hab. Cloudy Bay.

* *στειροφόρος*, keeled.

This species recalls the small form (var. *semicastanea*) of *H. bipartita*, but is distinguished by the obtuse keel, wider umbilicus, less elevated spire, colour, &c.

5. *Helix (Dorcasia) subplicifera*.

Testa depresso globosa, mediocriter umbilicata, solidiuscula, pallide fuscescens, subtus pallidior, lineis incrementi oblique curvatis, in anfr. ultimo subpliciformibus, sculpta; spira brevis, conoidea, ad apicem obtusa; anfractus 5, convexi, sublente accrescentes, sutura profunda sejuncti, primus minute punctatus, ultimus antice descendens; apertura obliqua, late lunata, dilutissime rufescens; peristoma albidum, anguste expansum et reflexum, margine columellari superne dilatato, umbilicum partim obtegente.

Diam. maj. $20\frac{1}{2}$ millim., min. 17, alt. 14; apertura intus $8\frac{1}{2}$ alta, 9 lata.

This species bears some resemblance to *H. argillacea*, Férus., when viewed from above. It is, however, less globose, more depressed, more widely umbilicated, has a smaller aperture, and is more plicately sculptured. Only the apical whorl is punctate.

6. *Helix (Chloritis) ephamilla* *.

Testa *H. Leei* simillima, sed plerumque paulo major, spira leviter altiore, apertura latiore, livida, labro latius expanso, umbilico vix granulato.

Diam. maj. 34 millim., min. 27, alt. 23; apertura intus 13 alta, 14 lata.

This form may be the var. *papuensis* of *H. Leei*, which is referred to by Mr. Hedley (Proc. Linn. Soc. N. S. W. 1891, vol. vi. p. 83), and it is with considerable hesitation that I venture to distinguish it specifically from that species. Besides the differences above mentioned, it may also be remarked that the colour of the peristome is reddish in *H. Leei* and livid in the present species, becoming much darker in some specimens at the umbilicus. All the examples are clothed with an olivaceous epidermis, beset with very short stiff bristles. These are generally more or less worn off, but their position is indicated by minute pitting all over the surface. A curious difference in the relative weight of the different parts of the shell is shown by the position it assumes when placed on a flat surface with the aperture downwards. In *H. Leei* the peristome rests upon the surface, the spire being lateral, whereas in *H. ephamilla* the apex is vertical and the lip stands erect.

* ἐφάμιλλος, rivalling.

7. *Helix (Chloritis) perambigua*.

Testa *H. ephamilla* similis, sed epidermide lævi, haud setosa amicta, spira paulo altiore, anfractu ultimo minus inflato, peristomate minus expanso.

Diam. maj. 32 millim., min. 25, alt. 23; apertura intus 12 alta, 15 lata.

There are two specimens of this species, agreeing in form and epidermis, but differing in size and colour. The larger one, the dimensions of which are given above, is purplish red at the apex, like *H. ephamilla*, the rest of the shell being livid beneath the epidermis. The smaller example is only 22 millim. in its greatest diameter and of a purplish red throughout. The epidermis, however, is quite smooth, with the exception of the lines of growth, as in the larger specimen. The aperture in the latter is bluish, and purplish red in the small example.

The general resemblance of this species to *H. ephamilla* is so remarkable that, unless carefully observed, its distinctness would be passed by unnoticed. It seems to me, however, that the differences referred to sufficiently separate the two forms.

8. *Helix (Cristigibba) Musgravei*.

Testa *H. semirasa* similis, sed minor, fascia angusta unica nigrescente supra ornata, superficie minute et confertim punctata; peristomate albido.

Diam. maj. 14 millim., min. 12, alt. 6½.

Hab. Back of Cloudy Bay.

This species, *H. semirasa*, and *H. leptochila* are closely related. *H. semirasa* resembles the present species in form, but differs in size, sculpture, banding, and colour of the peristome. *H. leptochila*, Canefri, from the Molucca Islands, is larger, has a broader colour-band above, a rosy peristome, and, judging by the figure, is of a different form. In this species the pitting of the surface (indication of a pilose epidermis) is very minute and close, but in *H. semirasa* it is comparatively scattered and remote. No mention is made by Canefri of this kind of sculpture upon *H. leptochila*; but, being difficult of observation, it may have been overlooked.

XXIX.—*Descriptions of new Coleoptera from New Zealand.*
By Captain THOS. BROUN.

[Continued from p. 203.]

Group *Elateridæ*.

Lomemus puncticollis, sp. n.

Elongate, not parallel, slightly nitid; smoky black, legs yellow, basal three joints of antennæ a little rufescent; the pubescence on the elytra ash-coloured and slender for the most part, but near the shoulders and on the thorax it is yellow and conspicuous.

Head densely and distinctly punctured; the forehead rounded in front, its edge smooth, but not sharply defined. *Thorax* longer than broad, slightly and gradually narrowed anteriorly; posterior angles not divergent; its surface densely and moderately coarsely punctured, with a feebly marked longitudinal groove down the middle. *Elytra* moderately narrowed posteriorly, apices slightly dehiscent; evidently striate; the striæ not perceptibly punctured, they are more or less obsolete near the base, but the sutural ones are deepened behind; interstices finely transversely rugose; near the base the sculpture is almost granular.

Antennæ serrate, reaching backwards to beyond the middle thighs, with fine pubescence only; second and third joints short, and conjointly about a third shorter than the fourth, which is rather longer than the fifth; joints 4 to 10 with the outer angles a little prolonged.

♀. Subparallel, not narrow; pubescence cinereous, with scarcely any yellow; thorax but little narrowed towards the front; antennæ nearly filiform, the second and third joints as long as the fourth, rufo-fuscous.

Var. (♂).—Shoulders and thoracic angles fusco-testaceous.

The dense and very obviously punctured thorax and obsoletely punctate elytral striæ differentiate this from *L. flavipes*, Sharp, whilst the even curvature of the forehead and larger size show that it cannot be the *L. similis* of the same author.

♂. Length $2\frac{3}{4}$, breadth $\frac{3}{4}$ line.

Ngatira, on the Rotorua railway. One pair.

ZEAGLOPHUS, gen. nov.

Head rather small. *Forehead* curved in front, without

distinct margins, nearly horizontal; when seen from the side the middle appears somewhat angulate and depressed. *Clypeus* inflexed-perpendicular. *Labrum* moderately large, its basal suture distinct. *Antennal cavities* shallow, widely separated. *Eyes* large. *Antennæ* elongate and slender, filiform; basal joint short and stout, second abbreviated. *Tarsi* elongate, slender, simple; fourth joint of the posterior more than half the length of the third, the basal joint rather longer than the fifth.

Chin-piece well developed, much curved, so that an evident gap exists between it and the rather acute anterior angle of the thorax. *Prosternal sutures* not distinctly duplicate. *Prosternal process* hastate, narrow, of only moderate length, nowhere more than half the width of the space between the coxæ; it is on an abruptly lower plane (nearer the breast), and is ridged along the middle. *Mesosternal cavity* deep and sharply limited, oviform, without margins, hardly extending beyond the front of the middle coxæ; the space between these latter flattened or impressed. *Intercoxal suture* well marked. *Coxal lamina* simple, its trochanteral portion about twice as long as the femoral.

The type of this genus displays such peculiarities of structure that it cannot be placed in any genus known to me. It should, I think, be placed near *Chrosis*.

Zeaglophus pilicornis, sp. n.

Elongate, moderately attenuate posteriorly, only slightly convex; pubescence fine, ash-coloured, not dense; shining, black; tibiæ and tarsi fuscous.

Thorax about as long as broad, much narrowed anteriorly, its sides behind the middle gradually but considerably explanate and flattened; posterior angles rather short, thick, not at all divergent; the apices, indeed, are almost turned inwardly; the lateral portions are distinctly punctate, the disk is much more finely and quite distantly. *Elytra* evidently striate, the outer striæ distinctly punctured, the posterior sculpture irregular and ill-defined; interstices with fine serial punctures, not rugose.

Underside pitchy black, with depressed greyish pubescence, moderately finely and closely punctured; the flanks, as well as the middle of the prosternum, however, bear larger and more distant punctures; the metasternum is convex.

Antennæ more than half the length of the body, not serrate, with long outstanding, conspicuous, fuscous setæ or hairs; first joint short and stout, rather shorter than the third;

second very short, barely half the length of the following one; fourth obviously longer than the third, about as long as the succeeding ones.

This species may be easily distinguished from all the other New-Zealand Elateridæ by a glance at the form of the thorax; the explanate sides are marked off behind by a carina, which extends forwards from the inner extremity of each hind angle.

Length 4, breadth 1 line.

West Plains, Invercargill. Mr. Alfred Philpott sent me a specimen (a female, I believe) which he found during August 1893.

Group *Dascyllidæ*.

Cyprobium terrenus, sp. n.

Oblong-oval, nitid, densely clothed with conspicuous yellowish hairs; colour variable, reddish or fusco-castaneous; the legs and antennæ rufescent.

Head short and broad, closely punctured. *Antennæ* elongate; basal joint very broad, second rather thicker but much shorter than the third. *Thorax* strongly transverse, the base much rounded, the sides little more than half the length of the middle; its surface is moderately finely but distinctly and rather closely punctured. *Scutellum* large, triangular, punctate. *Elytra* moderately coarsely punctured, more finely behind.

Underside castaneous, closely sculptured and pubescent. *Mentum* quite as long as broad. *Labial palpi* not furcate; the terminal joint, however, though inserted at the apex of the penultimate, has a tendency to extend inwards. *Prosternal process* acuminate in front, scarcely reaching beyond the coxæ at either extremity. *Mesosternum* in front at the middle with a small almost diamond-shaped depression having raised margins.

On comparison with the typical species (*C. nitidus*) this is seen to be larger and more oblong; the sculpture of the thorax, instead of being nearly obsolete, is well defined, that of the elytra is deeper and coarser.

Length $2\frac{1}{2}$, breadth $1\frac{3}{8}$ line.

Mount Pirongia, Waikato, March 1894.

C. nitidus and *C. undulatus* were taken off shrubs, but this species was found on the ground amongst leaves. The pubescence is liable to removal by the least friction.

Veronatus amplus, sp. n.

Subopaque, ferruginous, very finely and closely punctured, covered with fine short yellow pubescence.

Head large, the genæ obtusely dilated behind the eyes and extending outwardly a little beyond them; it is rather convex; between the eyes there is a large, scarcely elevated, triangular space, the apex of which extends backwards; this part is less closely sculptured and pubescent than the portion behind it. *Antennæ* filiform, reaching backwards beyond the middle thighs, their first joint thick, second very short, the third about one third shorter than the fourth. *Thorax* twice as broad as long, its sides finely margined and nearly straight, the front angles much rounded, the posterior better defined but obtuse; the middle of the base and apex are broadly rounded; there is an indistinct central groove near the middle; halfway between the dorsal stria and the side there is a distinct transverse depression; the pubescence is unevenly distributed. *Elytra* very indistinctly tricostate, with some large ill-defined impressions near the sides; the clothing is so arranged as to cause a somewhat maculate appearance.

This is much larger than No. 567; the thoracic depressions and more rounded and differently sculptured head will lead to its recognition. The *mandibles* are short, and during repose are curved inwards just in front of the labrum; this is more exposed than in *V. longipalpis*. The sides of the thorax appear broader and flatter. The membranous space between the forehead and labrum is larger.

Length $5\frac{1}{4}$, breadth $2\frac{1}{8}$ lines.

Nelson. One example was caught on Mount Arthur by Messrs. Cheeseman and Urquhart.

Cyphon McKerrowi, sp. n.

Oviform, not narrow, convex, shining; black, thorax reddish yellow, elytra with a large pale yellow spot on the sides before the middle and two small contiguous ones close to the suture near the apex; pubescence ash-coloured on the dark parts, yellow elsewhere; legs and antennæ variegated fuscous.

Head finely punctured. *Thorax* strongly transverse, the middle of the base and apex obtusely rounded, its surface finely and distantly punctured. *Scutellum* large, triangular. *Elytra* not impressed, finely punctate, with an indistinct sutural stria on each near the middle. *Antennæ* stout, third joint barely half the bulk of the fourth, the latter rather longer than the fifth.

Underside nigro-fuscous, densely clothed with greyish pubescence.

Subocular line indistinct, the genal space moderately broad and smooth.

This is the prettiest and most distinctly marked species that has as yet been found in New Zealand.

Length $1\frac{3}{4}$, breadth 1 line.

Waiorongamai, about four miles from Te Aroha.

Named in honour of Mr. James McKerrow, F.R.A.S., who, as a member of the Council of the New Zealand Institute, has done much to facilitate scientific research.

Group *Melyridæ*.

Dasytes nigripes, sp. n.

Narrow, subparallel, glossy, æneous; antennæ and legs black, these latter slightly tinged with green; pubescence dense, short, depressed, almost brassy.

Head nearly as large as the thorax, narrowed behind, feebly impressed between the eyes; distantly, finely, yet quite distinctly punctured. *Eyes* large and prominent. *Antennæ* subserrate, joints 3 to 10 differ but little, eleventh much narrowed near extremity. *Thorax* about as long as broad, constricted in front, much narrowed near the base; the sides therefore appear swollen near the middle; its punctuation closer and more distinct than that of the head; there is a broad impression near the base. *Scutellum* broad. *Elytra* slightly depressed before the middle, moderately coarsely punctured, and, except near the shoulders, transversely rugose. *Tarsi* as long as the tibiæ.

This is of a more glossy brassy tinge than No. 1611 (*D. Cheesemani*); the clothing is more conspicuous and of a greyish yellow, and the sculpture is more distinct.

Length $1\frac{3}{4}$ -2, breadth $\frac{3}{8}$ line.

Wellington. Taken off tussocks on the hills near the coast by Mr. J. H. Lewis in January 1894.

Group *Cioidæ*.

Cis fulgens, sp. n.

Glossy, glabrous, rufo-piceous; the antennæ, palpi, and tarsi yellowish; club fuscous and opaque.

Head small; the strongly raised protuberances near the eyes are widely separated in the middle, which is smooth and shining. *Eyes* large and very prominent. *Antennæ* short,

basal joint stout, second also stout, but only about half the length of the first; third slender and more elongate than the succeeding ones; joints 8 to 10 form the club. *Thorax* large, as long as it is broad, its sides margined and slightly rounded; the surface finely, rather indistinctly, and distantly punctured. *Elytra* scarcely wider than the thorax at the base, their sides a little rounded, so that they are widest near the middle; they are a good deal narrowed posteriorly, and they are apparently without sculpture of any kind.

This is a rather small, convex, oblong-oval species, which should be placed near *C. perpinguis* and *C. obesulus*; from these it may be separated by its convex eyes, obsolete sculpture, and narrower shape.

Length $\frac{5}{8}$, breadth nearly $\frac{3}{8}$ line.

Mount Te Aroha. One, March 1894.

Cis pygmæus, sp. n.

Nude, shining, fuscous; thorax pale yellowish grey, irregularly mottled with brown; the legs and antennæ somewhat testaceous.

Head simple, pale, finely and distantly punctured. *Thorax* rather broader than long, the sides finely margined and slightly rounded; posterior angles rectangular; it is remotely and finely punctured. *Elytra* much longer than the thorax; they are rather more distinctly punctured than it is, but not at all closely. *Tarsi* stout.

This is the smallest species I am acquainted with. The bald surface and fine sculpture will lead to its recognition. It is just possible that the maculation of the thorax may not prove to be a constant character.

Length $\frac{1}{2}$, breadth $\frac{1}{4}$ line.

Mount Te Aroha. Found amongst leaves on the ground. Mr. J. H. Lewis at the same time found a second specimen, which I am unable to separate, the only noticeable difference being the darker unspotted thorax.

Cis lobipes, sp. n.

Cylindric, not narrow, moderately shining, clear red; the antennæ, tarsi, and palpi yellow; legs pale red; the yellow setæ on the elytra are erect and conspicuous; they are not, however, scale-like, as in *C. recurvatus*; those on the thorax are slender and decumbent.

Head simple, punctate. *Antennæ* with joints 5 to 7 small and transverse, the third and fourth longer than broad; the

three joints of the club are rather broad and infusate. *Thorax* hardly any longer than broad, its sides much rounded, so that the angles are obtuse and ill-defined; it is closely and comparatively coarsely punctured. *Scutellum* small. *Elytra* of the same width as the thorax throughout, vertical and obtusely rounded behind; closely, rather coarsely, and somewhat rugosely punctured. *Tibiæ* a good deal expanded towards the extremity, the anterior with three or four minute denticles; the intermediate have a sort of lobe on the outside near the apex; this lobe is finely pectinate.

The anteriorly rounded thorax, robust rough-looking body, and lobate tibiæ distinguish this from all but *C. Fultoni*.

Length $\frac{3}{4}$, breadth $\frac{3}{8}$ line.

Howick.

One individual has been in my possession for several years. I delayed its description in the hope that others might be found.

Group *Opatridæ*.

Paraphylax binodosus, sp. n.

Suboblong, opaque, chestnut-red; the head sometimes piceous, the tarsi and palpi red, antennæ dark obscure red; densely clothed with decumbent scale-like hairs and erect setæ; the elevated parts and the sides of the thorax with pale tow-like clothing; on the elytra the hairs are slightly variegate, mostly pale brown and yellowish grey; the tibiæ have one or two dark marks.

Head impunctate, the curved interantennal suture directed forwards at the sides. *Eyes* prominent, oblique, lateral, coarsely faceted, almost quite truncate in front. *Antennæ* elongate, setose, the fourth joint distinctly shorter than the third; joints 4 to 9 longer than broad. *Thorax* transverse, narrowed towards the base, the sides broad and nearly flat, so that the disk appears as if it were abruptly elevated and uneven; in front at the middle there are two large prominent elevations, separated by a broad deep channel; there is no distinct sculpture visible when it is denuded, but in its natural state it is rough and uneven with coarse scaly matter. *Elytra* subquadrate, deeply depressed and emarginate at the base; the shoulders rounded; these, owing to the coarse sappy matter and setæ, seem elevated; the series of punctures appear small as seen through the clothing; when the latter has been scraped off the sutural row on each is seen to consist of closely placed punctures; the three or four other series are directed obliquely towards the shoulders, but near the

scutellar region there are some irregular punctures; the posterior declivity is nearly vertical and very much narrowed; the two rows of punctures on each side of the suture do not form striæ; in perfect specimens there are several setose elevations on and near the sides, but the sutural portion is plane. Scutellar region with grey pile.

Underside densely clothed, mentum punctate; front coxæ rufous, the others pale castaneous; the intermediate segments of the abdomen with deep and, when examined from behind, sinuous sutures.

This differs from the typical species (No. 644) by the more elevated disk and flattened sides of the thorax, by the more prominent frontal elevations and the hair-like elytral clothing. From No. 645 it may be separated by a glance at the antennæ; these in *P. varius* have shorter joints; joints 4 to 9 are not longer or but little longer than they are broad, according to sex.

Length $2\frac{3}{4}$, breadth $1\frac{5}{8}$ line.

Capleston, Westland. Three individuals were found by Mr. Cavell.

Group Trachyscelidæ.

Chærodes fuscatus, sp. n.

Variete, mostly fuscous; the legs, antennæ, palpi, front of head, the lateral and basal margins of the thorax, and sometimes the sides of the elytra testaceous.

Head coarsely and rugosely sculptured. *Thorax* transverse, its sides finely margined and strongly rounded; apex incurved, anterior angles obtuse, the posterior subacute; its punctuation distinct, but irregular, the sides nearly smooth. *Scutellum* broad, smooth. *Elytra* rather broader than the thorax, shoulders rounded, apices obliquely narrowed; the lateral margin is bent inwards at the shoulder, but does not extend beyond the hind angle of the thorax; their surface is covered with a coarse rugose punctuation, which, though close on the disk, becomes more open and less rugose towards the sides. *Legs* thickly setose, the anterior tibiæ with oblique terminal lobes extending as far as the third tarsal joint.

Underside sordid testaceous, sparingly setose.

This is smaller than the typical species and is more nearly allied to *C. concolor*, Sharp. The body is nearly glabrous and a little shining. The thorax is more closely and the elytra more rugosely punctured than my specimens of *C. concolor*, and the middle tibiæ seem to be more densely covered with greyish setæ. The numerous examples I have seen

exhibit no well-marked variations. Nos. 647, 648, and 649 occur amongst algæ along the east side, whereas *C. fuscatus* was found on the opposite coast.

Length $3\frac{1}{4}$, breadth 2 lines.

Manukau Harbour and New Plymouth.

Group Diaperidæ.

Menimus lævicollis, sp. n.

Convex, oval, shining, minutely pubescent; nigro-piceous, legs and antennæ pale red, lateral margins and front of head rufescent.

Head distinctly but not coarsely punctured. *Thorax* transverse, gradually and a little curvedly narrowed towards the front, the margins there thinner than at the base; distantly, quite minutely, and indistinctly punctured; base subtruncate, apex slightly bisinuate. *Scutellum* short, not smooth. *Elytra* attenuated and narrowly marginated posteriorly, of the same width as the thorax at the base, slightly wider behind the shoulders, with numerous almost regular rows of moderately coarse punctures, these become finer behind and are least regular near the base; a few minute grey hairs can be detected. *Legs* with yellowish pubescence.

Underside distinctly punctate, sparsely pubescent. *Prosternum* nearly smooth and a little concave along the flanks; its process moderately narrow, horizontal, and attaining the base. *Mesosternum* slightly raised and rather smooth in the middle.

The specimens I possess cannot be referred to *M. dubius*, which they most resemble, because the punctuation of the head and elytra is evidently coarser and the eyes are rather smaller, though not at all minute, as in some species. It may be distinguished from *M. Batesi*, Sharp, by the rather shorter form and obsolete thoracic sculpture. In one example the femora are yellow.

Length $1\frac{3}{4}$, breadth $\frac{7}{8}$ line.

Tarukenga. Ten individuals found on the underside of decaying logs.

Obs. In this genus the prosternal process passes over the mesosternum and touches, or nearly touches, the suture between the middle coxæ when the body is bent; when relaxed and straightened the mesosternum is uncovered. There is no saltatorial power.

Group *Tenebrionidæ*.

DEMTRIUS, gen. nov.

Body elongate. *Palpi* short, terminal joints securiform. *Mentum* subquadrate, rather longer than broad. *Tibiæ* with small apical spines. *Tarsi* narrow, simple, finely setose below. *Mandibles* bifid at apex. *Eyes* transverse, extending below the surface, not deeply emarginate; the thickened lateral margins of the forehead touch the eyes. *Prosternal process* of moderate breadth, reaching just beyond the hind margin of the prosternum. *Trochanters* small but distinct. *Antennæ* thick, inserted in round cavities near the inner and lower margins of the eyes, 11-articulate; first joint nearly concealed above, third rather longer than broad but not much longer than the fourth; joints 4 to 8 each a little shorter, but only very slightly thicker than the preceding; ninth and tenth transverse, only a little broader than the eighth; eleventh short, oblique at apex.

From *Lorelus* it differs by the shape of the eyes, the less broadly securiform terminal joints of the palpi, more slender femora, the more widely separated front and middle coxæ, broader epipleuræ, and by the simple penultimate joints of the tarsi.

Demtrius carinulatus, sp. n.

Elongate, subdepressed, nearly glabrous, having only very minute, hardly noticeable, grey setæ; piceous black, the legs, antennæ, and palpi pitchy red.

Head narrower than the thorax, curvedly narrowed in front of the eyes; the margins of the forehead reddish; it is moderately finely and not closely punctured. *Thorax* transversely quadrate, very slightly rounded and narrowed towards the anterior angles; behind the middle the sides are almost quite straight, posterior angles rectangular; lateral margins well developed, with distinct channels inside; base and apex subtruncate; its surface moderately, not closely, and somewhat irregularly punctured. *Scutellum* broad. *Elytra* broader than the thorax at the base, quite twice its length, their margins more explanate near the shoulders and behind than in the middle; their surface finely punctate and indistinctly rugose; they have broad shallow striæ; the interstices are slightly and irregularly elevated, the third, fifth, and seventh are more distinctly raised than the others, and become almost carinate behind. *Legs* nearly bare. *Antennæ* finely pubescent.

Underside more or less coarsely punctured, the abdomen much more finely; fourth ventral segment rather shorter than the third, fifth transversely impressed at the base; prosternum truncate in front, the flanks marked off by oblique sutures; prosternal process bisulcate between the coxæ.

Length 3, breadth $\frac{7}{8}$ line.

Invercargill. Mr. Alf. Philpott sent me a specimen, and Mr. T. F. Cheeseman, the Curator of the Auckland Museum, found a mutilated example on Mount Arthur several years ago.

Group Cistelidæ.

Omedes apterus, sp. n.

Oblong-oval, slightly convex, almost glabrous, fuscous; the legs and antennæ testaceous.

Head rounded and narrowed behind, finely but distinctly and irregularly punctured; between the eyes there is a broad depression; the space between the forehead and labrum is very short, almost linear. *Labrum* reddish, pilose. *Eyes* large, but not protruding beyond the lateral outline of the head; they are touched by the raised antennal orbits and they are quite transverse. *Antennæ* pubescent, reaching the hind thighs, third joint longer than the first, twice the length of the second. *Thorax* broader than long, finely margined; the sides rounded before the middle, nearly straight behind; posterior angles rounded, base bisinuate; its disk with rather fine, shallow, irregular punctures; there are two rounded foveæ near the middle and two smaller ones close to the basal margin. *Scutellum* triangular, transverse, red. *Elytra* finely margined, shoulders somewhat narrowed; each elytron has eight series of rather fine punctures; there is an additional scutellar row, the sutural two almost form striæ and are recurved at the apex; there is a slight longitudinal impression inside the shoulder; the interstices are minutely and densely sculptured and have a few very fine punctures.

Tarsi pubescent, the basal two joints of the anterior narrowed towards the base, the second slightly shorter than the first, third short and broad, with a short membrane underneath; fourth with a large semitransparent membrane, extending nearly halfway under the fifth; posterior pair elongate.

Most nearly resembles *O. fuscatus*; the terminal joint of the maxillary palpi more transverse and cultriform; scutellum shorter and broader; hind angles of thorax more obtuse;

elytra not depressed between the middle and the base; thorax shorter, the surface more shining; body apterous.

Length 3, breadth $1\frac{1}{2}$ line.

Wellington. One, sent by Mr. J. H. Lewis.

Group *Salpingidæ*.

Salpingus ornatus, sp. n.

Glossy, nearly nude; head and thorax fusco-rufous; elytra nearly black, each with a testaceous curvate mark extending from the shoulder to the middle, but not united to the opposite one, and a large subapical but less definite spot; antennæ red, but with three or four terminal joints piceous; legs fuscous.

Head coarsely punctured. *Eyes* large and prominent. *Thorax* as long as broad, widest near the front, a good deal narrowed behind, anterior angles rounded; it is coarsely punctured, some of the punctures are longitudinally confluent. *Elytra* oblong, wider than the thorax at the base, their sides but little rounded: they are slightly flattened before the middle, with irregular series of coarse punctures; the inner three on each elytron scarcely extend beyond the middle, the fifth is more prolonged, the hind portion is quite smooth.

This is certainly nearly allied to *S. perpunctatus* (No. 702); the thorax is a little longer, not so broad near the front; the sides are obliquely narrowed there and the intervals between the punctures are not so large; the marks on the elytra are different and their punctuation is less regular.

Length 1, breadth $\frac{3}{8}$ line.

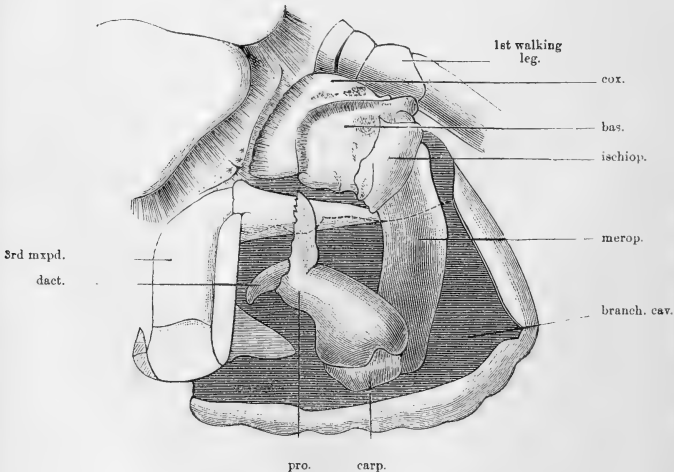
West Plains, Invercargill. Two examples from Mr. A. Philpott.

[To be continued.]

XXX.—*On an Abnormal Crab* (*Cancer pagurus*). By JAMES R. TOSH, M.A., B.Sc., St. Andrews Marine Laboratory.

IN June of 1894 a crab with a strange malformation was brought to the Marine Laboratory, St. Andrews, by one of the fishermen. Prof. McIntosh desired me to figure it. The greater part of the right chela was out of sight, being situated in the branchial chamber, only the first three joints, a small

part of the fourth, and the tip of the sixth being visible above the ventral part of the carapace. The first joint alone was normal in size, the next two were a little less than normal, the next two five times and the last two six times less than normal. The dactylopodite was not opposable to the beak of the protopodite, but curved downward into the branchial cavity as a more or less rigid process. It had apparently taken the direction of least resistance. It bore no serrations. The same blackish hue occurred at the tips of dactylopodite and protopodite as in those of the functional chela. All the articulations in the limb were more or less immovable. The specimen was an average-sized female, and, to judge from the state of the ovaries, which were nearly ripe, had suffered very little from the condition of the claw. In the figure the dotted line represents the posterior edge of the shell, which has been removed to show the limb. It may be supposed that at the last moult this chela had been injured in some way, probably a few joints knocked off, and that, before it was restored, the shell had overgrown and imprisoned it: certainly it has never been functional.



In *Ann. des Sci. Nat.* 1893, sér. 2, tome xv., M. Jules Richard describes a number of cases of abnormality in crustacean appendages. These fall into two classes: the first

contains a single case of abnormality by reversion to a simple type of limb occurring in one of the mouth-appendages of a specimen of *Platyarcinus pagurus*. Those of the second class are cases of "monstruosité par excès:" they are usually confined to the chela; but in such cases the limb is more or less functional. Possibly the example described above is unique.

XXXI.—*Descriptions of Two new Fishes obtained by Mr. C. Hose in Sarawak.* By G. A. BOULENGER, F.R.S.

Plotosus abbreviatus.

Band of teeth in each premaxillary thrice as broad as long; vomerine teeth large, molar-like, in a large crescentic patch; a broad band of molar-like mandibular teeth, with an outer series of large obtusely conical ones. Depth of body 8 times in total length, length of head 4 times. Head $1\frac{1}{2}$ as long as broad, its depth $\frac{3}{5}$ its width; diameter of eye 11 times in length of head, $3\frac{1}{2}$ times in interorbital width; nasal barbel extending to præopercle, maxillary barbel to opercle. First dorsal 14, its depth $\frac{2}{3}$ length of head; confluent dorsal, anal, and caudal with 190 rays (D. 90; C. 18; A. 82). Pectoral with $12\frac{1}{2}$ soft rays, ventral with 14; pectoral spine a little longer than dorsal, $\frac{2}{5}$ length of head. Uniform dark olive above, whitish beneath.

Total length 420 millim.

A single specimen, from the mouth of the Baram River.

Rasbora Hosii.

Depth of body $3\frac{1}{3}$ to $3\frac{1}{2}$ times in total length, length of head 4 times. Snout as long as diameter of eye, $3\frac{1}{2}$ times in length of head; interorbital width half length of head; no barbels. Dorsal II 7, originating a little nearer base of caudal fin than end of snout, nearer to base of ventrals than to origin of anal fin, and opposite to the eleventh scale of the lateral line. Anal II 5. Pectoral nearly as long as head, not reaching ventral. Scales 28–29 $\frac{4\frac{1}{2}}{2\frac{1}{2}}$; one scale between lateral line and base of ventral. Caudal as long as head. Olive above, silvery beneath, the dorsal and lateral scales with a blackish edge; caudal edged with blackish.

Total length 110 millim.

Two specimens, from the Baram River.

XXXII.—*A new Species of Lepton from Guernsey.*

By GEORGE W. CHASTER.

DURING the examination of a large quantity of material dredged last summer off Guernsey by Mr. E. R. Sykes, B.A., F.Z.S., I met with several examples of a minute bivalve which appears to be new. Subjoined is a brief description.

Lepton Sykesii, sp. n.

Shell minute, nearly oval, with a tendency to a subrhomboidal outline, rather convex, inæquilateral, very thin and hyaline, sculptured with numerous regularly disposed concentric striæ; epidermis inconspicuous or absent; umbones large, but not projecting; margins rounded; teeth, in each valve an extremely minute erect cardinal placed beneath the umbo and an anterior and posterior lateral.

Length 1 millim., height rather less.

From the fry of *L. squamosum* and *nitidum* this species is readily recognized by the want of prominence of the umbones and by the sculpture, and from *L. sulcatulum* and *Clarkie* by the different shape and hinge. In outline it somewhat resembles the young of *Lasæa rubra*, though the teeth and sculpture are very unlike.

I have great pleasure in associating the name of my friend Mr. Sykes with the species.

XXXIII.—*On Charaxes azota of Hewitson, a rare Butterfly of which the Type Specimen is not in Hewitson's Collection.*

By A. G. BUTLER, Ph.D., F.L.S., &c.

IN 1877 Mr. Hewitson described a female *Charaxes* under the name *Philognoma azota* in the 'Entomologist's Monthly Magazine,' vol. xiv. p. 82. It was obtained at Delagoa Bay by Mr. and Mrs. Monteiro, and was, apparently, so nearly related to the female of *Charaxes protoclea*, that it could hardly be expected that Mr. Hewitson, with his broad views respecting the variability of Butterflies, would have considered it worthy of a name. However, the fact remains that he did give it the appellation of *Philognoma azota*.

The following year Mr. Hewitson, in the same volume of the Magazine, described a form believed to be the male of

what he now recognized as a true *Charaxes*. His type of the latter, still in his collection, was received from Nyasaland, and obtained by Mr. Thelwall.

In 1892 a specimen of the true male of *C. azota* was received from Delagoa Bay, through the Rev. Henri A. Junod, and in 1894 Mr. Whyte brought home a collection from Zomba in which was a male corresponding with Mr. Hewitson's example, and clearly proving that the forms from Delagoa Bay and Nyasa are as distinct as *C. azota* itself from *C. protolela*. They may then be distinguished as follows:—

C. azota.

Tawny border of primaries without defined spots from inner margin to second median branch, whence it separates into two series of tawny spots, of which the inner row consists of five and the outer of six.

Outer tawny border of secondaries occupying nearly half the wing, its inner edge straight.

Shining central or postmedian band on under surface, especially on secondaries, very narrow; ground-colour bright rufous-brown.

Delagoa Bay.

C. nyasana.

Tawny border of primaries with well-defined black spots at centre of each division, but undivided into spots to above third median branch, so that the inner series of the furca consists of two and a half and the outer of three and a half tawny spots.

Outer tawny border of secondaries occupying only two fifths of the wing, its inner edge acutely zigzag from the median vein to the costa.

Shining central band of all the wings very broad below, the ground-colour dull smoky rufous-brown.

Nyasaland (Zomba).

C. azota was described shortly before Mr. Hewitson's death, and it is possible that the female type may never have been actually purchased from Mrs. Monteiro, who (in her work on Delagoa Bay) gives an illustration of it; at any rate, it is not in his collection, and was not there when Mr. Kirby catalogued it. The male from Nyasa, however, is in the series of *Charaxes*, though only labelled with its locality, and corresponds tolerably closely with the specimen brought home by Mr. Whyte, thus clearly proving the Nyasa form to be constant in its characters.

XXXIV.—*On the Cistelidæ and other Heteromerous Species of Japan.* By G. LEWIS, F.L.S.

[Plate VIII.]

THIS paper is written to follow that of the Tenebrionidæ, published in the Ann. & Mag. Nat. Hist. ser. 6, vol. xiii. pp. 377–400, and 465–485, 1894; and in some notes given here at the end of the CEdemeridæ will be found some references to the synonymy which is necessary to bring the paper of last year up to date. Of the families now treated of, Marseul in 1876 enumerated nearly fifty species, and about forty more have been described by other authors, including myself, and these, with the additions recorded here, bring the entire number to about 175. The Pyrochroidæ have been chiefly dealt with separately in a paper in the Ann. & Mag. Nat. Hist. ser. 5, vol. xx. pp. 167–174, 1887, and the Mordellidæ, Rhipiphoridæ, Meloidæ, and Cantharidæ remain to be worked out before the Heteromerous series is complete so far as my Japanese collection is concerned.

The collections in the National Museum of the later families in the Heteromera have not been of material use to me; they are not so rich in named specimens as in the Tenebrionidæ, but I am again much indebted to Mr. G. C. Champion for both the loan of typical specimens and for a continuance of the kindly assistance given to me last year. It will be noticed also from the number of genera I have been obliged to establish that this section of the Heteromera has been less studied, owing partly no doubt to the greater paucity of material in collections than in the genera of the earlier series, and this too after using, as other authors have done, names sunk in the Munich Catalogue as synonymic.

In the list of species at the end of this paper a reference is again given to the year of the 'Zoological Record' in which some isolated descriptions may be found. This only applies to species to which the full reference is not given here or in Marseul's memoir of 1876 or the Munich Catalogue of 1869.

Allecula cryptomerice, sp. n.

Elongata, opaca, nigra; antennis, palpis pedibusque rufis vel obscure brunneis; thorace leviter punctulato; elytris punctato-striatis, interstitiis impunctatis convexis.

L. 16–17½ mill.

Elongate, rather parallel at the sides, black, opaque; the head sparingly and unevenly punctured; the thorax obscurely punctulate, with a faint median channel, nearly as long as broad, bisinuous at base; the scutellum almost

smooth; the elytra deeply punctate-striate, interstices impunctate and convex; antennæ, mouth-organs, tibiæ and tarsi reddish brown, thighs darker.

This fine species is longer and much more parallel in form than *A. fuliginosa*, Mäklin; the thorax much less transverse and the punctures in it are so fine and sparse that in certain lights it appears smooth.

Hab. Chiuzenji, Nikko, and Mayebashi. Apparently local; found running at night on large decaying trunks of *Cryptomeria japonica*.

Allecula fuliginosa, Mäklin.

Allecula fuliginosa, Mäkl. Act. Fenn. x. p. 566 (1875).

Allecula obscura, Har. Abh. Ver. Brem. v. p. 132 (1876).

Allecula velutina, Mars. Ann. Soc. Ent. Fr. vi. p. 322 (1876).

Hab. Nagasaki, Kioto, and other places; very abundant.

Allecula melanaria, Mäklin.

Allecula melanaria, Mäkl. Act. Fenn. x. p. 569 (1875).

Allecula rufipes, Mars. 1876, nec *rufipes*, Fabr. 1801.

Hab. Yokohama and Nagasaki; taken very commonly at both places.

Allecula noctivaga, sp. n.

Elongata, brunneo-nigra, opaca, griseo-pubescentis; capite thoraceque densissime punctulatis; elytris punctato-striatis, interstitiis dense et minute punctatis, marginibus externis anguste rufis.

L. $6\frac{1}{4}$ – $6\frac{1}{2}$ mill.

Elongate, brownish black, opaque; the head densely and evenly punctulate; the thorax even more densely punctulate and opaque, somewhat quadrate, nearly as broad before as behind; the scutellum reddish brown, punctulate; the elytra more than three times the length of the head and thorax, parallel for two thirds the length, then gradually narrowing to the apices, outer margin dull red, striæ deep and punctate (especially the fourth), interstices densely and minutely punctured; the antennæ and legs reddish brown, thighs darker before their apices.

Hab. Kashiwagi. Two examples, 22nd June, 1881.

Allecula simiola, sp. n.

Parum elongata, rufo-brunnea, subnitida; capite thoraceque dense punctatis; elytris marginibus internis et externis rufis.

L. $6\frac{3}{4}$ – $7\frac{1}{2}$ mill.

Rather elongate, reddish brown, somewhat shining, clothed

with tawny pubescence; the head rather densely punctured and relatively wide between the eyes; the thorax wider than long, widest posteriorly, hind angles obtuse, punctured somewhat similarly to the head, but a little more densely before the scutellum, median impression faint; the scutellum reddish, punctulate; the elytra not parallel laterally, but widest behind the posterior coxæ, punctate-striate, interstices obscurely punctulate, narrowly red on the sutural and outer edges, dorsal region darkest; the antennæ, mouth-organs, and legs wholly reddish brown.

Larger, with a wider head and thicker antennæ, but otherwise very similar to *A. tenuis*, Mars., 1876 (nec *tenuis*, Fairm., 1894).

Hab. Kashiwagi and Nikko; one example at each place.

Allecula æneipennis, Harold.

Allecula æneipennis, Har. Deutsche ent. Zeitschr. p. 80 (1878).

Distinguished from all in this series by the green or blue colouring of the elytra.

Hab. Fukushima, Kashiwagi, Nikko, and Chiuzenji. An abundant species where it occurs. Tokio, the locality given by Harold, is probably an error, as I found it only at intermediate and high elevations.

Hymenorus veterator, sp. n.

Elongatus, brunneo-niger, pubescens, parum nitidus; capite thoraceque distincte punctatis; elytris punctato-striatis, apicalibus vage rufis; antennis pedibusque rufis.

L. $6\frac{1}{2}$ mill.

Elongate, brown-black, with tawny pubescence, somewhat shining; the head rather closely punctured; the thorax transverse, widest before the base, arched anteriorly, punctured like the head, bisinuous at the base, distinctly impressed before the scutellum; the elytra rather long, not quite parallel at the sides, punctate-striate, interstices obscurely punctulate and transversely rugose, apices vaguely reddish; the antennæ and legs clear red.

Hab. Nikko and Maiyasan near Kobé. Three examples only, taken in August.

Cistela Haagi.

Pseudocistela Haagi, Har. Deutsche ent. Zeitschr. p. 80 (1878).

Harold only knew the female; the male has strongly pectinate antennæ, and the thorax is, in all my specimens, red at and within the posterior angles only. I have one female with the thorax entirely black.

Hab. Nikko, Miyanoshita, and Kashiwagi, in June. In Nagasaki as early as March.

Mycetochares collina, sp. n.

Picea, nigro-pubescent, nitida; elytris 4-maculatis, maculis rufis; pedibus rufis.

L. $4\frac{1}{2}$ – $5\frac{1}{4}$ mill.

Piceous, clothed with black pubescence; the head rather wide, width especially noticeable between the eyes, irregularly and rather finely punctured; the thorax widest near the middle and rounded off to the anterior angles, posteriorly rectangular, punctured like the head, basal foveæ well-marked, with a rather wide antescutellar depression; the scutellum triangular and distinctly punctured; the elytra parallel at the sides, with a lobe-shaped red spot behind the humeral angle and a second transverse spot well before the apex and placed midway between the outer and sutural edges, punctate-striate, striæ not well-defined, owing to the punctuation, interstices vaguely rugose and punctulate; the antennæ red, with joints 6 to 10 usually infuscate; the legs clear red.

Hab. Kashiwagi.

Mycetochares mimica, sp. n.

Nigro-brunnea, griseo-pubescent, nitida; elytris basi bimaculatis; pedibus brunneis.

L. $4\frac{1}{2}$ –5 mill.

Blackish brown, with greyish pubescence; the head narrower than that of *M. collina*, irregularly and rather coarsely punctured; the thorax narrowest anteriorly, punctured like the head, basal fovea not well defined; the scutellum triangular, punctured irregularly; the elytra not parallel at the sides, widest near the middle, sometimes with a small humeral red spot; the antennæ and legs reddish brown.

Resembles *M. linearis*, Ill., a European species.

Hab. Hitoyoshi, Wada-togé, Sapporo and Junsai.

Mycetochares scutellaris, sp. n.

Brunnea, nigro-pubescent, nitida; capite elytrisque infuscatis; thorace obscure brunneo; scutello rufo; antennis pedibusque rufotestaceis.

L. $4\frac{1}{4}$ – $4\frac{1}{2}$ mill.

Somewhat elongate, narrower than either of the last two species, reddish brown, shining; the head somewhat narrow, punctulate, nearly black between the eyes, anterior part and mouth-organs testaceous; the thorax rather finely punctured, brownish, darkest on the disk; the scutellum reddish brown

or bright red; the elytra darker in colour than the thorax, sometimes immaculate, usually with a humeral flavous spot and a second transverse one before the apex, rather parallel at the sides, punctate-striate; the antennæ and legs reddish brown; the antennæ being rather the darkest.

Hab. Konosé. A series taken, 17th May, 1881.

Pytho nivalis, Lewis.

Pytho nivalis, Lew. Ent. xxi. p. 220 (1888).

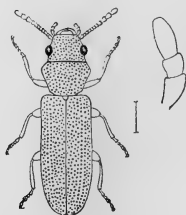
This is the only species at present known from Japan.

Hab. Niohosan, and on the highest altitudes above Nikko, in places where the snow remains in shady spots until the beginning of June.

ISTRISIA, gen. nov.

This genus has most of the characteristics of *Salpingus*. The chief differences are: ten joints of the antennæ moniliform, basal joint nearly as large again as the second; 2-7 almost similar, 8-9 thicker and larger than the basal joint, terminal largest and conical; maxillary palpi, 2 basal joints short, third moniliform, terminal longer but not wider; the legs and tarsi are formed like those in *Salpingus*. The thorax is gradually narrowed at the sides from behind the anterior angle; the elytra not striate. Having only one example, I give an outline of the body, and an enlarged drawing of the palpi (fig. 1).

Fig. 1.



Istrisia rufobrunnea, sp. n.

Elongata, subdepressa, parallela, brunnea, punctata, nitida; thorace basi angustiore; elytris punctatis, haud striatis; antennis pedibusque concoloribus.

L. 5 mill.

Elongate, parallel, very slightly convex, brown, shining; the head rather wide, carinate at the sides from the anterior

part past the antennæ to the eyes, sparsely punctate, triangularly impressed between the antennæ, sides parallel, with the eyes abruptly prominent; the thorax, punctured like the head, widest just behind the anterior margin, then gradually lessening in width to the base, where it is narrower than behind the neck; the scutellum smooth; the elytra punctate, punctures at times vaguely arranged in longitudinal lines; the legs and antennæ palish brown, somewhat lighter in colour than the body.

Hab. Sapporo.

Salpingus niponicus, sp. n.

Nigrescens, nitidus; capite thoraceque punctatis; elytris nigro-brunneis; antennis articulis 1^o-8^m rufis, 9^o-11^m nigris.

L. 2 $\frac{3}{4}$ -3 $\frac{1}{4}$ mill.

Blackish, shining; the head very clearly punctate, punctures rather closely set, eyes prominent; the thorax, punctate like the head, arched at the sides before the narrowed base, usually with a fovea on the middle of the anterior edge; the elytra striate-punctate, interstices smooth, brown, dark brown, or nearly black with humeral angle brown; the antennæ, eight basal joints reddish brown, three apical black; the legs dull brown, tarsi paler.

I did not obtain a species of *Rhinosimus*, but the genus probably occurs in the north.

Hab. Nikko, Chiuzenji, Nishimura, and Junsai.

Lissodema ainunum, sp. n.

Robustum, piceo-nigrum, nitidum; elytris pallide testaceis, basi et medio dorsi infuscatis; antennis parum brevis.

L. 3 $\frac{3}{8}$ mill.

Rather robust, pitchy black, shining; the head somewhat wide and rather roughly punctate, mouth-organs reddish brown; the thorax 4-denticulate laterally and closely punctate, with two basal foveæ; the elytra striate-punctate, pale testaceous, with two lobe-shaped patches at the base and a band across the middle of the dorsum (the band widens out in the sutural area) infuscate; the antennæ and legs reddish brown, the former being shorter and stouter than those of any other of this series.

Hab. Junsai. Two examples only.

Lissodema plagiatum, sp. n.

Longiusculum, nigrum, nitidum; capite thoraceque dense punctatis; elytris macula subhumerali flavo-testacea; tibiis tarsisque pallide brunneis.

L. 2 $\frac{3}{4}$ mill.

Black, shining; the head a little prolonged before the eyes, with two lateral impressions near the bases of the antennæ, mouth-organs palish; the thorax 4-dentate, narrowed at the base behind the posterior denticulation, densely punctured, with one very distinct fovea on each side near the base; the elytra punctate-striate at the base, the striæ gradually becoming punctiform after the middle, behind the humeral angle and extending across the wing-case nearly to the sutural stria is a pale yellowish spot, more or less defined and in one specimen almost absent; the antennæ, joints 1-8 reddish brown, 9-10 black, terminal reddish at the apex only; the legs, thighs infuscate, tibiæ and tarsi pale brown.

This is the most elongate species of this series.

Hab. Junsai. Four or five examples.

Lissodema pictipenne, sp. n.

Breve, nigrum, nitidum; capite parum sparse, thorace dense punctatis; elytris distincte 4-maculatis, maculis flavis; tibiis tarsisque pallide brunneis.

L. $2\frac{3}{4}$ mill.

Black, shining, body somewhat short; the head punctured, punctures clear but not set closely; the thorax, 4-denticulate laterally, little narrowed at the base, with two shallow foveæ; the elytra widest at the middle, punctate-striate, punctures not evanescent at or before the apices, with a transverse, somewhat broad, flavous spot before the base, which reaches from the sutural stria outwards nearly to the edge, and there is a second somewhat oval spot on each wing-case before the apex; the legs, thighs darkish, tibiæ and tarsi pale brown; the antennæ, joints 1-8 obscurely brown, 9-11 somewhat large, infuscate, with the apex of the last reddish.

The somewhat enlarged apical joints of the antennæ distinguish this species from others of the series, except *L. validicorne*.

Hab. Chiuzenji. One example, August 23rd, 1881.

Lissodema lævipenne, Mars.

This species was found originally at Nagasaki, but I met with it afterwards in various places as far north as the plain of Fujan.

Lissodema japonum, Reitter.

Lissodema japonum, Reitt. Deutsche ent. Zeitschr. p. 382 (1877).

“Oblongum, leviter convexum, nitidum, piceo-brunneum, haud metallo-æneum, ore, antennis pedibusque rufo-testaceis; pro-

thorace transverso, confertissime fortiter punctato, ante basin utrinque oblique foveolato, lateribus rotundato, quinque denticulato, basin versus magis attenuato; scutello lævi, elytris thorace paullo latioribus et triplo longioribus, lateribus late rotundatis, supra fortiter seriatim punctatis, interstitiis lævibus."

L. 2.5 mill.

Hab. "Japan." I am much indebted to Herr E. Reitter for an example of this species. I did not meet with it, but I believe it was taken by Herr Hiller at Hagi, north-east of Shimonoseki.

Lissodema beatulum, sp. n.

Parum breve, rufo-brunneum, nitidum; elytris tenuiter striatopunctatis; antennis pedibusque concoloribus.

L. $2\frac{3}{4}$ mill.

Somewhat short, reddish brown, shining; the head bi-impressed between the antennæ, clearly and rather closely punctured; the thorax arched at the sides, from the anterior angle to the base, punctured like the head, with two basal foveæ; the elytra are a little paler in colour than the thorax, especially at the humeral angles, punctures which constitute the striæ are irregular, largest near the bases, and becoming gradually finer towards the apices, interstices flat; the antennæ, joints 9-10 and the terminal, except at the apex, infusate, the others with the legs reddish brown.

Hab. Ooyama and Nishimura in June. Two examples.

Lissodema dentatum, sp. n.

Brunneo-nigrum, nitidum; capite parum dense, thorace dense punctatis, hoc lateribus distincte denticulato; elytris unicoloribus, punctato-striatis; antennis basi pedibusque obscure rufis.

L. $2\frac{3}{4}$ -3 mill.

Brownish black, shining; the head clearly but not thickly punctured, with a small, not always very distinct, fovea between the eyes; the thorax more closely punctured than the head, 4-foveolate, with the lateral denticulations somewhat acute and well defined; the elytra concolorous, punctate-striate, with the rows of punctures along the suture more or less broken; the antennæ, basal joints red, 9-11 infusate; the legs wholly dull red.

Hab. Fukushima and Junsai. A series of specimens from both places.

The two following species have one lateral thoracic tooth very prominent:—

Lissodema validicorne, sp. n.

Parum breve, brunneo-nigrum, nitidum; capite utrinque carinato; thorace subæneo, dense et parum profunde punctato, in medio valde dentato; elytris punctato-striatis; antennis articulis 1^o-6^m flavis, 7^o-11^m infuscatis; tibiis tarsisque brunneis.

L. 2 mill.

This species is rather larger than *L. tomaroides*, and like it has one very prominent tooth on the middle of the lateral edge; but the chief difference is in the antennæ, the four apical joints are nearly black, and the 3-jointed club much more robust.

Hab. Oyayama, June 1st, 1881. One specimen.

Lissodema tomaroides, sp. n.

Breve, brunneo-nigrum, nitidum; capite sparse punctato, utrinque carinato; thorace lateribus in medio valde dentato; elytris in medio latioribus; antennis pedibusque brunneis.

L. $1\frac{3}{4}$ -2 mill.

Rather short, brownish black, shining; the head carinate on either side over the eyes and as far as the antennæ, not closely punctured, especially between the eyes; the thorax closely and more coarsely punctured than the head, the second lateral denticulation from the base is at the middle of the thoracic margin and is very prominent, two anterior teeth obsolete; the elytra widest in the middle, rather browner than the thorax, punctate-striate; the antennæ are slender and relatively shorter than others of this series, and are with the legs pale brown.

Resembles a species of *Corticaria* or *Tomarus*.

Hab. Miyanoshta. Found rather commonly.

Lissodema minutum, sp. n.

Breve, brunneo-nigrum, nitidum; capite utrinque carinato, sparse punctulato; thorace transverso, dense punctato; elytris late ovatis, punctato-striatis; antennis basi pedibusque pallide brunneis.

L. $1\frac{3}{4}$ mill.

This minute species is remarkable in having the thorax distinctly transverse and the elytra broadly oval. The elytra are much broader than the thorax.

Hab. Oyayama. One example, June 1st, 1881.

Eustrophus niponicus, sp. n.

This species is extremely like *E. dermestoides*, Fabr. It differs structurally in being a little narrower in body, thoracic posterior angles much less overlapping, thorax more rounded off behind the eye; scutellum one-fourth smaller; hind tibiæ less stout, with the tarsi longer and less robust. In sculpture the punctuation is less marked, and the carina along the base of thorax much less conspicuous. The pubescence also is more tawny.

Hab. Sapporo. Two examples only.

Holostrophus orientalis, sp. n.

Oblongo-ovalis, rufo-brunneus, pubescens; elytris bifasciatis, disco rufo-bimaculato, apicibus obscure rufis; antennis pedibusque rufo-brunneis.

L. 6-6 $\frac{3}{4}$ mill.

Oblong oval, rather densely clothed with short pubescence; the head wholly red; the thorax, disk, and base more or less widely infuscate, anterior and lateral edge reddish, rather densely punctulate; the elytra black, with a fascia at the base reddish brown, the fascia leaves two round dusky spots on the basal edge, one near the humeral angle, the other midway between it and the suture, posteriorly the fascia is bidentate, the inner dentation being the strongest, on the middle of the dorsum on each side of the suture is a reddish spot irregular in outline, and behind it on the outer elytral edge and extending two-thirds across the wing-case, is a second fascia, the apices of the elytra are also somewhat reddish brown; the antennæ and legs reddish brown, with the thicker joints of the former somewhat dusky. In one example the dusky spots at the base of the elytra join.

Hab. Hitoyoshi on Rakuwayama in May, and at Niigata in September.

Holostrophus dux, sp. n.

H. quadrimaculato simillimus, at multo major et latior; capite rufo; thorace nigro; elytris 4-maculatis; subtus rufo-brunneus.

L. 6 $\frac{3}{4}$ mill.

This fine species in colour and elytral markings is extremely like *H. 4-maculatus*, but it is very much larger and the legs and tarsi are much more robust. The head is red; the thorax black above; the elytra with four red spots, the red spot below the shoulder is narrower and more transverse than that of *4-maculatus*, and it leaves a much wider margin of black on the outer edge, and the anterior edge of the maculation is

obtusely dentate in the middle; the second spot is also relatively narrower and more transverse, and it leaves a wide margin both at the suture and on the outer margin, and it is also further from the apex of the wing-case. Body beneath reddish brown.

Hab. Yuyama.

Holostrophus 4-maculatus, sp. n.

Oblongo-ovatus, subtus rufo-brunneus; elytris 4-maculatis, maculis rufis, macula posteriore transversa; antennis pedibusque rufo-brunneis.

L. $3\frac{1}{2}$ –4 mill.

Oblong oval, clothed with short pubescence; the head piceous or reddish brown; the thorax black, punctulate, sometimes with an obscure reddish spot on the middle of the lateral margin; the elytra black, with a red lobe-shaped spot before the base, which nearly touches the epipleuræ, but on the sutural side leaves a wide interstice, before the apex is a second red spot, transverse in form, sometimes it touches the epipleuræ, and sometimes it is interrupted at the suture, but not usually; the antennæ and legs clear reddish brown.

The punctuation of the thorax is more clearly defined than in that of *H. orientalis*.

Hab. Miyanoshita, Fujisan Plain, and Nikko.

Holostrophus unicolor, sp. n.

Oblongo-ovalis, punctulatus, obscure niger, subtus brunneo-niger; elytris immaculatis; antennis pedibusque dilutioribus.

L. 4 mill.

This species is smaller and narrower than *H. 4-maculatus*, with the upper surface concolorous; the antennæ, palpi, tibiæ, and tarsi reddish brown, with thighs darker. The surface-sculpture in this and the three preceding species is very similar, and the characters suitable for specific distinctions relate chiefly to colour.

I am indebted to Dr. Horn, the author of the genus *Holostrophus*, for indicating, when on a visit here, that my Eastern captures belong to his genus.

Hab. Yuyama in Higo. Three specimens in May.

Orchesia elegantula, sp. n.

Elliptica, fusco-brunnea, pubescens; elytris rufo-brunneis, nigro-fasciatis; antennis pedibusque rufo-brunneis.

L. 5 mill.

Elliptical, dusky brown, pubescent, densely and minutely

sculptured above; the head reddish brown; the thorax reddish brown behind the head, the rest infusate, less pubescent on the reddish part than behind, thoracic foveæ shallow and somewhat triangular; the elytra, margins of the suture infusate, and at the base of the wing-case, and sometimes touching the basal edge, is a dark longitudinal blotch which joins the sutural marking and at about half its length it spreads out towards the lateral edge, over the second segment of the abdomen is a dark undulating fascia which extends quite across the elytra, at the apex is a third dark marking which leaves a very narrow reddish margin on the outer edge; the antennæ and legs reddish brown, with 7-10 joints of the first generally dusky. This species and the next agree with *O. undulata*, Kraatz, in having the last four antennal joints enlarged and forming a club.

The elytral markings of this and *O. imitans* differ from *O. undulata*, Kraatz; otherwise they are not very dissimilar.

Hab. Junsai. Several specimens.

Orchesia imitans, sp. n.

Elliptica, rufo-brunnea, pubescens; elytris trifasciatis, lateralibus in medio nigro-maculatis; antennis pedibusque brunneo-rufis.
L. 4-4½ mill.

Elliptical, reddish brown, densely sculptured, pubescent; the head and thorax unicolorous; thoracic fovea wide and shallow; the elytra, margins of the suture infusate, at the base is a somewhat similar marking to that of *O. elegantula*, but less defined in outline, the middle fascia is broader and in front of it near the lateral edge is a detached dark spot, the apical marking is rather broader and the margin less distinctly red; the antennæ and legs reddish brown, with 7-10 joints of the first dusky.

Smaller than *O. elegantula*, with the thorax usually wholly reddish brown. The detached spot near the middle of the elytral margin is also a conspicuous specific character.

Hab. Ichiuchi, Miyanoshita, and other places; not uncommon in South and Central Japan.

Orchesia ocularis, sp. n.

Elliptica, pallide rufo-brunnea; thorace obscure brunneo vel infuscato; antennis pedibusque concoloribus.
L. 5¼-5½ mill.

Elliptical, rather pale reddish brown; the eyes coarsely granulate, very large, in male nearly meeting above, female with the space between the eyes much wider; the thorax

faintly dusky, especially on the disk, with the fore part reddish, sculpture very clear and rather larger than that of the head; the elytra clear reddish brown, without fasciæ; the antennæ and legs testaceous; the eighth joint of the antennæ is not longer than the seventh, the three terminal joints form a club, which is much stouter than that of *O. Marseuli*.

Hab. Kashiwagi, in June.

Orchesia Marseuli, sp. n.

Orchesia micans, Panz.; Mars. Ann. Soc. Ent. Fr. p. 333 (1876).

This species differs structurally from *O. micans* in being larger and much more elongate, the thorax less broad at the base, and the basal joint of the hind tarsus is more than one-third longer. Marseul's determination rested on indifferent specimens.

Hab. Kashiwagi, Fukushima, Chiuzenji, and Junsai.

Microscapha japonica, Reitter.

Lederia japonica, Reit. Deutsche ent. Zeitschr. p. 30 (1891).

Hab. Kashiwagi and Nagasaki. Rather common in haystack-refuse at the latter place in March.

Microscapha fœnilis, sp. n.

Elliptica, convexa, pubescens, obscure brunnea, supra minutissime strigosa; antennis articulis primo et secundo robustis.

L. $1\frac{3}{4}$ mill.

This species is much broader than *M. japonica* and much darker in colour; the two basal joints of the antennæ are shorter and much stouter. The abdominal segments of the male in both species are very curious; there is a broad channel in the middle bordered by a carina: the channel equally occupies all the segments, but in *M. japonica* it is comparatively shallow.

The two basal joints of the antennæ in this genus are remarkable for their size and length.

Hab. Simabara and Nagasaki. Two examples.

Microscapha lata, sp. n.

Ovalis, convexa, pubescens, piceo-brunnea, nitida; elytris apice perspicue dehiscentibus; antennis pedibusque testaceis.

L. $2\frac{1}{4}$ mill.

This species is at once known from the two preceding by its larger size, greater breadth, and the gaping apices of the wing-cases, and also by the absence of a sternal sulcus in front of the posterior coxæ. The abdomen is only feebly

impressed where in *M. japonica* and *M. fœnalis* there is a conspicuous longitudinal channel, but my examples apparently are both females.

Hab. Kashiwagi. Two examples, 23rd June, 1881.

Synchroa crepuscula, sp. n. (Pl. VIII. fig. 1.)

Elongata, angustata, infuscata, subopaca, pubescens; capite thoraceque minute et dense punctatis; elytris distincte striatis, interstitiis convexis; antennis pedibusque obscure rufo-brunneis.

L. 18 mill.

Elongate, narrow, dusky or blackish brown, somewhat opaque, with short greyish pubescence; the head finely and densely punctured; the thorax, sculptured like the head, narrowest anteriorly, feebly swollen in the middle, widest at the posterior angles, angles obtusely produced, depressions at the base wide and shallow; the elytra, very long and narrow, distinctly striate throughout, interstices convex and finely punctulate; the antennæ, palpi, and legs dull reddish brown. The third joints in all the tarsi are shorter than those of *S. melanotoides*.

This is the finest species of the genus known at present.

Hab. Sapporo and Junsai. Only five specimens.

Synchroa melanotoides, sp. n.

Elongata, elliptica, infuscata, subnitida, pubescens; capite thoraceque parum dense punctatis; elytris striis leviter impressis; antennis pedibusque obscure brunneis.

L. 10-12½ mill.

Elongate, elliptical, dusky brown, somewhat shining, with somewhat long tawny pubescence; the head rather densely but not finely punctured; the thorax narrowest anteriorly and gradually widening to the base, posterior angles not produced, depressions at the base deep, somewhat triangular, and not widening out like those of *S. crepuscula*; the elytra, striæ feebly impressed, interstices punctured like the head and thorax; the antennæ and legs dull brown.

This species somewhat resembles *S. umbrina*, Mels.

Hab. Miyanoshta, Kurigahara, Sapporo, and Junsai. Many specimens.

Serropalpus niponicus, sp. n.

Elongatus, angustatus, brunneus, pubescens; capite thoraceque densissime rugoso-punctulatis; elytris distincte striatis, interstitiis dense rugoso-punctulatis; antennis pedibusque concoloribus.

L. 9 mill.

This species is similar in form and colour to *S. filiformis*,

Mars., but the elytra are wholly and distinct striate like those of the European species *S. barbatus*, Schall. *S. niponicus* differs markedly, however, from the last-named in the elytral interstices being much more rugose and more convex.

Hab. Fukushima. One example, 28th July, 1881.

MIKADONIUS, gen. nov.

This genus should be placed close to *Serropalpus*; the most conspicuous differences consist in the prominent eyes, form of the thorax, and in the shortness of the third joint of the posterior tarsus. Body elongate, parallel laterally; head scarcely as wide as the anterior part of the thorax; eyes prominent, finely granulate; maxillary palpi, last joint cultriform and large, other joints triangular, enlarged on the inner edge; antennæ filiform, long, and slender, first joint stoutest, second much less robust and about half the length, third as long as the basal joint, 4, 6, 7 equal, fifth shorter than the fourth, 8-11 equal and rather longer than the seventh; thorax widest behind, narrowest in front; scutellum somewhat square; legs elongate; tibiæ with two strong and lengthy spurs at the tarsal end; tarsi, the fourth joints of anterior and intermediate pairs short and coequal with those of the third joints of the posterior pair.

Mikadonius gracilis, sp. n. (Pl. VIII. fig. 2, ♂.)

Elongatus, angustatus. griseo-pubescent, vix nitidus, capite thoraceque densissime punctatis; elytris in colore variabilibus; antennis pedibusque testaceis.

L. 7-12 mill. ♂, 9-13 mill. ♀.

Elongate, narrow, parallel at the sides, with grey or tawny pubescence; the head and thorax very closely punctured, the latter narrowest anteriorly, slightly swollen about the middle, widest behind; the elytral sculpture finer and less deep than that of the head and thorax. The sexes differ in colour. Male: mouth-organs, head (except a wide black band between the eyes), undersides of basal joints of the antennæ, legs, underside of the thorax, mesosternum, and first segment of abdomen (partly) testaceous; metasternum and apical joints of the abdomen blackish brown; elytra infusate on the margins, with a pale longitudinal vitta as shown in the figure. Female: mouth-organs, apical joints of antennæ somewhat vaguely, tibiæ, and tarsi testaceous; elytra with a short palish vitta in the middle of the wing-case, but close to the base, and a longer not well-defined second vitta, which commences near the humeral angle and continues down nearly to the apex,

other parts infusate. Some allowance must be made for variation, but my specimens are fairly constant in colour.

Hab. Miyanoshta, Chiuzenji, and Nishimura in June. Ten examples.

EURYZILORA, gen. nov.

The species of this genus is oblong and wide, resembling in outline a species of *Luciola*. Palpi robust, last joint cultri-form; antennæ slender, joints 4-10 scarcely obconical, last joint elongate; head somewhat broad, eyes rather prominent; thorax transverse, arched laterally; scutellum rather wide, semi-circular behind; elytra parallel laterally, depressed, striate; legs and tarsi more robust and shorter, but similar to those of *Zilora*. The last joint of the palpus is long and parallel at the sides as compared with that of *Zilora* (agreeing more with *Phlæotrya*), the genus to which it is in most respects similar.

Euryzilora lividipennis, sp. n. (Fig. 2.)

Oblonga, piceo-brunnea, nigro-pubescentis; thorace 4-foveolato; elytris striatis, lividis; antennis basi pedibusque rufo-brunneis.

L. 11-11½ mill.

Oblong, pitchy brown, with black pubescence obliquely erect; the head rather wide and uneven, irregularly and not closely punctured; the thorax, sometimes reddish in parts,

Fig. 2.



punctured like the head, median channel not well defined, basal fovea shallow, with a second in front of it, but nearer the middle of the disk, deeper; the elytra rugosely striate, interstices rather convex and obscurely punctate or rough, lateral margins narrowly dull reddish brown; the antennæ, three basal joints reddish, others more or less dusky; the legs wholly reddish brown.

Hab. Chiuzenji and Nikko. Three examples only.

Phlæotrya bellicosa, sp. n.

Elongata, parallela, infuscata, opaca; capite in medio impresso; elytris granulatis, obsolete tristriatis; antennis pedibusque obscure brunneis.

L. 20-21 mill.

Elongate, parallel, dusky brown, opaque; the head densely and evenly granulate, with a circular impression between the eyes; the thorax convex above, also densely but more coarsely granulate than the head, with small irregularly set nodules behind the neck and on the disk; the elytra densely granulate like the head, with three striæ more or less visible and wide apart; the antennæ and legs dull dusky brown.

I believe this is the largest species known.

Hab. Buno, Nishimura, Sapporo, and Junsai.

Phlæotrya rugicollis, Mars.

This species has more slender legs than *P. bellicosa* and relatively shorter tarsal joints; the third joint of the hind tarsus is especially noticeable in this respect.

L. $6\frac{1}{2}$ - $11\frac{1}{2}$ mill.

Hab. Maiyasan near Kobe, Kashiwagi, Sapporo, and Junsai.

Dircæa flavitarsis, sp. n. (Pl. VIII. fig. 3.)

Elongata, parallela, fusco-brunnea; elytris bifasciatis; antennis articulo ultimo tarsisque flavis.

L. $11\frac{1}{2}$ -14 mill.

Elongate, parallel, dusky brown, somewhat opaque; the head densely sculptured, usually with a well-marked fovea between the eyes; the thorax margined laterally, fuscous, with a median yellowish pattern, which widens out transversely on the anterior and posterior margins; the scutellum yellow; the elytra finely and very densely granulate, with a reddish-yellow transverse band rather before the middle with dentate-sinuate edges, meeting at the suture, but not touching the outer edges, before the apex is a lobe-shaped yellow spot with its anterior edges only dentate; the antennæ dusky, with the terminal joints flavous; the thighs and tibiæ dusky brown, tarsi yellow.

Hab. Yuyama, Miyanoshita, and Nikko. Found commonly.

Dircæa validicornis, sp. n.

Elongata, elliptica, nigra; thorace canaliculato; elytris 6-maculatis; antennis funiculi articulis sensim crassioribus.

L. 8 mill.

Elongate, elliptical, black, with a bluish tinge above, some-

what shining, with short pubescence; the head rather densely, not coarsely punctured, face nearly flat; the thorax densely sculptured and transversely rugose, median channel rather deep and a little shortened before neck; the scutellum semi-circular in outline; the elytra, finely and densely sculptured, with two lobe-shaped spots on the edge of the wing-case near the middle of the base, two median spots or bands on the space over the intermediate and posterior coxæ, these spots touch the outer margin and leave a wide area near the suture dark, and are emarginate in front and feebly sinuous behind, before the apex are two bands which nearly touch the suture and the outer edge, and have sinuous edges, all the spots orange-red; the antennæ, first and second joints cylindrical, third to the tenth gradually widen and flatten out, joints 8, 9, and 10 are markedly transverse, terminal joint conical in outline, all densely black; the legs black, claws palish.

Except the form of the antennæ, which may be a sexual character only, I can see nothing to separate this species from *Dircæa*.

Hab. Ikenchaiya near Kashiwagi. One example only, June 22nd, 1881.

Dircæa erotyloides, sp. n.

Elongata, elliptica, brunneo-nigra, subnitida; elytris 4-maculatis, maculis flavo-rufis et dentato-sinuatis; antennis pedibusque nigris. L. $8\frac{1}{2}$ – $13\frac{1}{2}$ mill.

Elongate, elliptical, brownish black, somewhat shining; the head clearly punctulate, some points transversely confluent, not foveolate; the thorax longer than wide, widest before the base, densely punctured, transversely rugose, median channel narrow and reaching midway only from the base; the scutellum densely punctured, semicircular in outline; the elytra with four reddish-yellow maculations, each strongly dentate-sinuate and not touching the outer or sutural edges, sculptured like the thorax; the antennæ, legs, and under surface black.

This species resembles *D. 4-guttata*, Payk.

Hab. Nikko, Chiuzenji, and Buno.

Dircæa dentato-maculata, sp. n.

Elongata, parallela, nigra, opaca; elytris flavo-maculatis; antennis (basi excepta) nigris. L. 11– $12\frac{1}{2}$ mill.

Elongate, parallel, black, opaque; the head densely but finely sculptured, usually with a deep frontal fovea; the

thorax arched and narrowly explanate laterally, rugosely punctured, with irregular indentations; the scutellum black, nearly quadrate; the elytra finely and densely sculptured, with four yellow markings or blotches with dentate edges, the anterior ones leave the widest space at the suture, but they each reach equally near the outer margin; the antennæ, three basal joints yellow, the rest black; the palpi and legs black, claws and last joint of the tarsus palish. The abdominal segments are sometimes, although rarely, yellow.

Hab. Nikko and in the forests bordering the Kumagawa, a river which runs through the Province of Higo.

Dircæa obscura, sp. n.

Elongata, parallela, fusco-nigra, pubescens; antennis basi, palpis, ore tarsisque rufo-testaceis.

L. $6\frac{1}{2}$ –8 mill.

This species is somewhat similar to *D. femoralis* in colour, but the head is smaller, the thorax is longer than wide, the elytra less parallel, the thighs infuscate, and tibiæ more slender.

Hab. Nikko, Miyanoshita, and Kashiwagi. Eight examples.

Dircæa parvula, sp. n.

Elongata, parallela, fusco-brunnea, pubescens; antennis basi, thorace antice pedibusque rufo-brunneis.

L. 5– $5\frac{1}{2}$ mill.

This species is extremely like the last, and might even be taken for a small variety of it, were it not for the antennæ being more slender. It differs in colour also, the mouth-organs, palpi, three basal joints of antennæ, anterior thoracic margin, and legs wholly are reddish brown.

Hab. Nikko, Otaru, and Junsai. Three examples.

Dircæa femoralis, sp. n.

Elongata, parallela, fusco-nigra, pubescens; antennis basi et femoribus flavis.

L. 9– $9\frac{1}{2}$ mill.

Elongate, parallel, infuscate, somewhat opaque, with short greyish pubescence; the head densely granulate, with a linear impression before the neck; the thorax wider than long, rounded off anteriorly, punctate-granulate, punctures most conspicuous just behind the anterior margin, with a shallow median longitudinal channel, scutellar fovea well-marked; the elytra, striæ obsolete, finely granulate, and somewhat

rugose, the rugosities formed transversely; the antennæ, two basal joints yellow, others with the palpi dusky; the legs, tibiæ, and tarsi dusky, with the apices of the tibiæ sometimes yellow, thighs wholly clear yellow.

Hab. Yuyama and Kumamoto. Several specimens.

Abdera scriptipennis, sp. n.

Parum elliptica, fusco-brunnea, opaca; thorace rufo-marginato; elytris transversim fasciatis; antennis (basi excepta) nigris. L. 3 mill.

Somewhat elliptical, dusky brown, opaque; the head densely and minutely sculptured; the thorax sculptured like the head, with a narrow margin of reddish brown, widest at the posterior angles; the elytra, apical half of the lateral margin narrowly reddish brown, sutural margin and a fascia over the posterior coxæ, shaped like the letter Z, of the same colour; the antennæ, two basal joints and apex of the terminal joint reddish; the legs dull brown, tarsi rather paler.

It is probable that the colour of this species is variable; it may be placed near *A. flexuosa*, Payk.

Hab. Junsai. One example.

Hypulus cingulatus, sp. n.

Elongatus, granulatus, parum opacus; capite thoraceque nigris; elytris basi late rufis; antennis pedibusque obscure rufo-brunneis. L. 6-8 mill.

Elongate, surface granulate, subopaque, with tawny pubescence; the head sometimes with an impression between the eyes, black; the thorax also black, widest in the middle; posteriorly rectangular, disk convex; the elytra at the base and for about one third of their length dull red, over the hind coxæ there is an oblique band of golden-grey pubescence, and behind it a broad area black, well before the apex is a second golden-grey transverse band with the posterior edge sinuous, apex and area behind the second band black; the antennæ and legs obscure reddish brown.

Hab. Oyayama, Hakone, and Nikko. Chiefly taken from decaying beeches early in May.

Hypulus higonius, sp. n.

Elongatus, obscure rufo-brunneus, griseo-pubescent; capite inter oculos foveolato; thorace angulis posticis haud productis; elytris vage bifasciatis; antennis pedibusque obscure rufo-brunneis. L. 7-7½ mill.

Elongate, dull reddish brown, nearly opaque, clothed with

griseous pubescence; the head slightly but widely impressed before the antennæ, distinctly foveolate between the eyes, neck infusate; the thorax granulate, rounded off anteriorly, hind angles nearly rectangular, on each side near the centre well in front of the scutellum is a dusky, nearly black, blotch not very well-defined in outline; the elytra with two dark vittæ behind the scutellum, each vitta touching the suture at its base, and two similarly coloured marks near the suture in the middle of the dorsal fascia, dorsal fascia infusate and on the area over the hind coxæ, in form dentate-sinuate, the apices also infusate; the antennæ, tibiæ, and tarsi dusky reddish brown, thighs darker. Beneath the meso- and metasterna are darker than the general colour of the body.

This species most nearly resembles *H. acutangulus*.

Hab. Oyayama in Higo, in May 1881.

Hypulus acutangulus, sp. n.

Elongatus, granulatus, subopacus, fusco-brunneus; fronte impressa; thorace angulis posticis acute productis; elytris fasciis dentato-sinuatis, griseo-sericeis ornatis; antennis tarsisque obscure brunneis, femoribus et tibiis infuscatis.

L. 7-7½ mill.

Elongate, dull dusky brown, granulate, with greyish pubescence; the head somewhat widely impressed between the eyes; the thorax much longer than broad, with the hind angles acutely produced, variegated with greyish pubescence, in front of the scutellum is a median longitudinal shallow channel with two longer lateral ones on each side of it; the elytra are longer and narrower than those of *H. ligonius* and darker in colour, the markings are very similar, but the dark band behind the posterior coxæ reaches further posteriorly as well as further in front, and the edges are conspicuously sinuate-dentate, apices infusate; the antennæ and legs infusate.

Hab. Oyama in Sagami and Chiuzenji. Six examples.

BONZICUS, gen. nov.

The characters of this genus correspond in a great part with those of *Melandrya*. Maxillary palpi, second joint long and triangular, third triangular and short, terminal appears truncate if viewed one way and cultriform on the other; the antennæ after the sixth joint are widened and flattened out, terminal joint conical; the thorax bisinuous at the base and emarginate before the scutellum; the elytra without striæ and femora robust.

Bonzicus hypocrita, sp. n. (Pl. VIII. fig. 4.)

Elongatus, niger, subnitidus, parum pubescens; elytris punctatis, haud striatis, azureo-micans; antennis nigris, femoribus apice rufo-flavis.

L. 12-13 mill.

Elongate, black, with short greyish pubescence, somewhat shining, with an azure tint above in some lights, especially on the elytra; the head densely punctate; the thorax widest posteriorly, less thickly punctured than the head, bisinuate at base, emarginate before the scutellum, basal foveæ wide and somewhat deep; the scutellum somewhat rounded off behind, rather closely punctured; the elytra punctured like the thorax, without striæ; the antennæ densely black, with apical joint reddish or testaceous at the tip; the legs black, with the apices of the femora broadly, and the bases of the tibiæ narrowly, reddish yellow or clear yellow. In some examples there is a red patch, more or less diffused, on the elytra around the scutellum, and in such specimens the abdominal segments are margined with red.

During life this insect, running on timber, looks like a spotted *Buprestis*, the yellow colouring of the femora appearing to be lateral spots on the elytra.

Hab. Oyayama, Nikko, Chiuzenji, and Nishimura in June, and Junsai and Sapporo in August. Not rare where there are large decaying beeches.

IVANIA, gen. nov.

This genus is also proposed for a species which corresponds generally with those of *Melandrya*. Maxillary palpi short, and formed like certain species of *Melandrya*, e. g. *rufipes*, Gebl.; antennæ, two basal joints as in *Melandrya*, third flattened and triangular, fourth similar but rather larger, fifth again larger and similar to 6, 7, 8, and 9; tenth less triangular and scarcely as wide, terminal smaller and conical; head rather small, eyes a little prominent, thorax narrowest anteriorly, widest before the base, canaliculate in the middle; scutellum nearly quadrate; elytra 4-striate, striæ with wide interstices.

Ivania coccinea, sp. n. (Pl. VIII. fig. 5.)

Elongata, nigra; thorace infuscato, parte obscure coccineo; elytris 4-striatis, interstitiis dense rugoso-punctatis, in totum coccineis; antennis pedibusque nigris.

L. 8-11 mill.

Elongate, black, with short scarlet pubescence; the head

somewhat densely punctured, foveolate between the eyes; the thorax blackish, more or less scarlet in parts, especially on the ridges, widely canaliculate in the middle, channel open at the base, closed anteriorly, at the sides from the base to about two-thirds of the thoracic length are excavations or deep depressions of irregular outline, pubescence more scattered than on the elytra; the scutellum black; the elytra bright scarlet, with pubescence of the same colour, 4-striate, striæ more or less conspicuous, interstices densely and rather rugosely punctured; the abdomen, antennæ and legs densely black.

Hab. Miyanoshita, Kiga, Chiuzenji, Kashiwagi and other places. This pretty species is by no means uncommon in the forests in June, flying in the sunshine.

Melandrya gloriosa, sp. n.

Elongata, rufo-testacea, pubescens; thorace margine extus et subtus rufo; elytris aureo-viridis, nitidissimis, apice rufis; antennis (basi excepta) pedibusque rufis.

L. $7\frac{1}{2}$ – $13\frac{1}{2}$ mill.

This species is very similar to, but quite distinct from, *M. rufipes*, Gebl. The head rather small, somewhat thickly punctured, black, with mouth-organs and palpi testaceous; the thorax black above, leaving the lateral margin broadly and the under surface wholly red; the elytra brilliant golden green, with the apex red, posterior area striate; the antennæ somewhat infuscate at the base, gradually becoming red-brown towards the terminal joints; the legs and abdominal segments reddish brown.

Hab. Miyanoshita, Hakone, Nikko, also at high elevations in Higo. Abundant at the time of appearance in June.

Melandrya mongolica, Solsky.

Melandrya mongolica, Sols. Hor. Ross. vii. p. 378 (1871); Lew. Ent. xxvi. p. 152; Mannerheim, Bull. Mosc. p. 105 (1853) (indescrip.).

“Nigra, nitida, subtiliter puberula, punctata, thorace antierius angustato, basi utrinque sinuato, profunde, late excavato, medio plus minusve canaliculato, lateribus postice explanatis subreflexis; elytris nigris, subcyanicis vel subvirescentibus, crebre profunde sulcatis, interstitiis sulcorum costulatis; ore cum palpis, antennis pedibusque nigro-piceis, plus minusve rufescentibus.

“L. 9–14 mill.”

Hab. “E. Siberia.” I found it also generally throughout Japan; on the main island and in Yezo.

Melandrya modesta, sp. n.

Elongata, nigra, parum nitida, griseo-pubescent; capite punctulato; thorace tenui et sparse punctulato; elytris nigris vix azureo-micans; antennis pedibusque rufo-brunneis.

L. 8 mill.

Elongate, black, somewhat shining, pubescent; the head punctulate, punctures not closely set; the thorax narrowest in front, widest before the posterior angles, less densely punctulate than the head, median channel feeble, basal foveæ rather wide; the scutellum not transverse, semicircular in outline; the elytra, striæ four in number, outer one shortest, all evanescent well before the base, black but opalescent in certain lights; the antennæ reddish brown, dusky at the base; the legs also reddish brown, with the intermediate and hind femora dusky.

This species somewhat resembles a small example of *M. mongolica*, Sols., but the elytral striæ are incomplete.

Hab. Oyama in Sagami. Two examples.

Melandrya niponica, sp. n.

Elongata, nigra, nitida, griseo-pubescent. *M. canaliculata* forma simillima, at multo major.

L. 14-19 mill.

Elongate, black, shining, with grey pubescence; the head irregularly and somewhat roughly punctured; the thorax rather widely canaliculate in the middle, with two wide depressions before the posterior angles, rather less thickly punctured than the head; the elytra striate, interstices rugosely punctulate; the mouth-organs, palpi, base of antennæ, legs, and the greater part of the under surface obscure reddish brown or piceous.

The large size and greater breadth of the thorax distinguish this from the European species.

Hab. Chiuzenji, and on Niohosan in June. Twenty specimens.

Melandrya atricolor, sp. n. (Pl. VIII. fig. 6.)

Elongata, parum angustata, atrata, nitida; elytris striis evanescentibus; palpis tarsisque brunneis.

L. $9\frac{1}{2}$ -12 mill.

Elongate, black, shining, somewhat narrow and parallel at the sides; palpi, apical joint of antennæ, and tarsi brown; the head irregularly and not densely nor deeply punctured; the thorax widest before the base, narrowest anteriorly, less distinctly punctured than the head, median channel shallow;

the elytra vaguely brownish at the base, striæ distinctly traceable only in certain lights, sculpture similar to that of the thorax.

Hab. Chiuzenji. Six examples in June 1880, only seen once.

Melandrya ordinaria, sp. n.

Elongata, nigra, subnitida, pubescens; capite thoraceque parum dense punctatis; elytris haud striatis, lateralibus obscure rufobrunneis.

L. $8\frac{1}{2}$ – $9\frac{1}{2}$ mill.

Elongate, black, somewhat shining, pubescent; the head distinctly rather closely punctured, impressed between the eyes; the thorax punctured like the head, widest behind the middle, median channel well-defined, shortened only just behind the neck, basal foveæ very small, situated in a wide depression; the scutellum black; the elytra punctured like the thorax, striæ obsolete (traces are seen in one example), with a rather broad lateral band reddish brown; the antennæ black, apex of terminal joint reddish; the legs blackish, tarsi obscurely reddish brown. The elytra are wholly reddish brown in one example.

Hab. Oyayama, Kashiwagi, Mayebara, and Chiuzenji. Nine examples.

Melandrya ruficollis, sp. n. (Pl. VIII. fig. 7.)

Elongata, depressa, parallela, atrata, subnitida; thorace, abdomen apice, rufis; antennis brevibus.

L. 12–17 mill.

Elongate, depressed, parallel, somewhat shining, with short pubescence; the head, surface uneven and irregularly punctured, punctures rather small; the thorax one third wider than broad, rounded at the sides, sinuous at the base, clearly punctured, orange-red, with pubescence of same colour; the scutellum black, rather densely and finely punctured; the elytra, parallel at sides, sculpture close, black, with black pubescence; the abdomen, last segment orange-red; the antennæ, palpi and legs black, the first short, about the length of the head and thorax, with joints 7 to 10 obconical.

Owing to the breadth of the thorax and shortness of the antennæ, the facies of this species at first sight may seem to exclude it from the genus *Melandrya*.

Hab. Ichiuchi, Yuyama (Ichibosa yama) and at Nikko near the temples. Only six specimens.

Melandrya pictipennis, sp. n. (Pl. VIII. fig. 8.)

Elongata, nigra, nitida, pubescens; capite dense punctato; elytris flavo-maculatis, haud striatis.

L. $6\frac{1}{2}$ -7 mill.

Elongate, black, pubescent, shining; the head densely and clearly punctured, sometimes with a fovea between the eyes; the thorax rather less thickly punctured, widest before the base, narrowest anteriorly, basal foveæ wide and shallow, median channel moderately deep; the elytra, without striæ, black, with a wide flavous band over the metasternum, which leaves the outer and sutural edges black, well behind the middle is a second band, which touches the outer edge (but not the sutural) and along the edge it continues on narrowly almost to the apex. A second specimen has the elytral markings different; the base is narrowly pale, the median band is reduced to an elongate lateral spot and the apical dark area has a median flavous region along the suture; the antennæ black, with the apex of the last joint, and three or four others at the base, reddish; the legs also reddish, with infuscate joints.

The example figured is perhaps the most constant colour-form of this variable species. I do not see any reason for not including the species in *Melandrya*, but it may be allied to species placed by Leconte and Horn in *Prothalia*.

Hab. Nikko, Chiuzenji, and Nishimura. I found only four examples.

Penthe japana, Mars.

This species is like *P. obliquata*, in having the scutellum covered with orange-coloured hair. The apical joint of the antennæ is also of the same colour.

Hab. Common in a white arboreal fungus throughout all the islands.

Scotodes niponicus, sp. n.

This species resembles *S. annulatus*, Eschsch., in colour and facies generally, but it is more robust; the sculpture of the elytra is coarser and the tarsi are shorter. The shortness of the tarsus is most conspicuous in the basal joint of the hind foot.

L. $9\frac{1}{2}$ mill.

Marseul did not notice these differences, and assigned it to the European species. I do not know *S. uniformis*, Motsch.

Hab. Miyanoshta, in May. Four or five examples only.

Nothus (Osphyia) orientalis, sp. n.

Elongatus, niger, opacus, pubescens; capite thoraceque punctulatis, griseo-vestitis; elytris late bifasciatis; antennis (basi excepta) nigris vel infuscatis.

L. 6-6½ mill.

Elongate, black, opaque, pubescent; the head with a short and close greyish pubescence, rather closely punctulate; the thorax punctulate and clothed like the head, arched at the sides, very feebly sinuous before the scutellum; the scutellum densely clothed with an ashen pile; the elytra, punctulate, with a very narrow ashen-grey margin along the suture and a broad ashen fascia across the wing-case over the intermediate coxæ and a second, rather narrower, well before the apex; the antennæ, long and slender, three basal joints flavous, 4-7 black, 8-11 infuscate; the legs black, with bases of the tibiæ pale.

Hab. Miyanoshta and Nikko. Ten examples.

OTHNIUS, Leconte, 1861.

Elacatis, Pascoe, 1860.

There are only two species of this genus known from Japan—*O. Kraatzi*, Reit., Deutsche ent. Zeitschr. 1879, p. 226, and *O. ocularis*, Lew., Ent. M. M. ser. 2, vol. ii. 1891, p. 247. This genus is introduced here in the serial position assigned to it by Leconte and Horn in the 'Classification of the Coleoptera of North America,' 1883, p. 391. Pascoe's name was preoccupied. *O. Kraatzi* is common in all the inland forests of Japan, but *O. ocularis* is a tropical form, found as yet only in the region of the Kumagawa in Higo. The habits of the species are noticed, Ent. M. M. 1891, p. 248.

Eutrapela robusticeps, sp. n.

Elongata, æneo-nigra, nitida, hirsuta; capite thoraceque vix grosse punctatis; elytris striatis, interstitiis transversim rugosis; antennis pedibusque nigris.

L. 10 mill.

Brassy black above, the antennæ and legs black, clothed with longish hair, but not so long as that of *E. elongata*; the head rather broad and punctured, punctures large, but not dense; the thorax, anterior margin not raised, about as broad as long, punctured like the head; the elytra punctate-striate, interstices transversely rugose.

In form this species agrees fairly well with *E. elongata*, F.;

the thorax is rounded off anteriorly, the body is similarly hirsute, and the last joint but one of the antennæ is short, like that of the Fabrician species.

Hab. Sapporo. Two examples.

Arthromacra viridissima, sp. n.

Elongata, viridissima, nitida, punctata; antennis pedibusque flavis vel obscure flavis.

L. 9-12 mill.

Elongate, bright metallic green, densely punctate above; the head, eyes rather small and rather prominent, with a semi-circular raised process over the point of the antennal insertion, coarsely and densely punctured, surface somewhat uneven; the thorax punctured like the head, cylindrical, truncate before and behind; the elytra nearly as wide again as the thorax, punctate, with the punctures inclined to be transversely confluent, apices obtusely acuminate; the antennæ, terminal joint as long as the eighth, ninth, and tenth together, testaceous, with terminal and ninth and tenth joints sometimes infuscate, basal joint also sometimes dusky on the upper surface; the legs testaceous, with apical portion of the femur broadly green, and the base of the first tarsal joint narrowly dusky, claws and apical parts of all the tarsi also dusky. Very rarely the legs are wholly pale yellow. The last joint of the palpus is infuscate.

In *Arthromacra ænea*, Say, the elytral striæ are obscurely traceable; in the Japanese species there are no indications of striæ.

Hab. Miyonoshita, Oyama, Tokio, Nikko, and Hitoyoshi. This pretty species is common in certain places in May, occurring in the flowers of *Deutzia* and *Cerasus*.

Arthromacra sumptuosa, sp. n.

Elongata, purpureo-cuprea, nitida; antennis pedibusque obscure nigris.

L. $9\frac{1}{2}$ - $10\frac{1}{2}$ mill.

This species closely resembles *A. viridissima* in sculpture, but the colour is wholly different. In structure it differs in having shorter and more robust antennæ, joints 7-10 being somewhat obconical, not elongate; the thorax is shorter and less cylindrical, with the outline nearly quadrate when viewed from above and the elytra are less acuminate at the apices; the legs and antennæ wholly and obscurely black.

Hab. Chiuzenji. Apparently scarce and local. Six examples.

Arthromacra higonie, sp. n.

Elongata, aureo-cuprea, nitida; thorace clare punctato; antennis pedibusque obscure brunneis vel infuscatis.

L. 9-9½ mill.

Elongate, golden coppery; the head coarsely punctured, with a median fovea between the eyes; the thorax very clearly punctate, cylindrical, with the anterior and basal rim markedly raised; the elytra are sculptured like those of *A. viridissima*; the antennæ and legs obscurely black, with the intermediate and hind tarsi less dark. The antennæ in this species are formed somewhat like those of *A. sumptuosa*, but they are more slender and joints 8, 7, 6 less obconical.

This species is separated from the others of this series at once by the clear punctuation of the thorax, the punctures are clearly separated one from another. In form it is intermediate between *A. sumptuosa* and *decora*.

Hab. Yuyama in Higo, May 8th, 1881.

Arthromacra decora.

Lagria decora, Mars. Ann. Soc. Ent. Fr. 1876, p. 339.

Marseul placed this insect in the genus *Lagria*; it is of a greenish-brassy tint, with the antennæ (apex excepted), tibiæ, tarsi and base of the femora testaceous. The joints of the antennæ are formed like those of *A. higonie*, but they are shorter and less slender.

Hab. Kobé, near the base of Maiyasan. Apparently very local. I took one specimen in 1871 and on returning to the place on the 11th June, 1881, I found seven others.

[To be continued.]

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

January 9, 1895.—Dr. Henry Woodward, F.R.S.,
President, in the Chair.

The following communication was read:—

‘The Formation of Oolite.’ By E. B. Wethered, Esq., F.G.S.

In previous communications the Author has described pisolites formed by the growth of *Girvanella*, and some true oolitic granules having a like origin. He has long entertained the opinion that all oolitic granules are of organic origin, but has not, up till now, been in a position to prove this.

He describes the form of the granules, which frequently exhibit a series of concentric layers of calcium carbonate around a nucleus, and also dark striæ and patches, the former placed more or less at

right angles to the nucleus. The concentric layers often exhibit an irregularity which the Author maintains to be incompatible with their chemical origin. Again, granules are found, made of calcium carbonate occurring in two forms—a clear crystalline portion representing the organic structural part, and an amorphous portion consisting of ordinary carbonate of lime, which is either infilling or secreted material, possibly both.

In discussing the origin of the crusts around the nuclei the Author treats of the radial structure which is so marked a feature in the crust of oolitic granules. This structure has the appearance of light and dark striæ when seen by reflected light: the light are tubules which have grown at right angles to the nucleus, while the dark are secondary formations.

He refers to Rothpletz's description of the oolitic granules of the Great Salt Lake, which are stated to have originated from the growth of lime-secreting algæ, and thinks it possible that the fossil forms are of like origin, though not necessarily due to organisms allied to algæ, and possibly even lower in the scale of life; *Girvanella* was the first type of oolite-forming organism discovered, and it is simply a tubule.

February 6, 1895.—Dr. Henry Woodward, F.R.S.,
President, in the Chair.

The following communication was read:—

'On Bones of a Sauropodous Dinosaur from Madagascar.' By R. Lydekker, Esq., B.A., F.R.S., V.P.G.S.

The bones described in the paper were collected by Mr. Last to the east of the town of Narunda, on the north-eastern coast of Madagascar. They include vertebrae, limb-bones, and portions of pectoral and pelvic girdles. These bones are described in detail, and the animal which possessed them is referred to the genus *Bothriospondylus*, Owen: a dorsal vertebra, described in the paper, being taken as the type of the new species.

The identification of the Malagasy reptile with a type occurring in the Jurassic rocks of England harmonizes with the reference of some of the strata of the island to the Jurassic period.

MISCELLANEOUS.

On the Cephalic Lobe of Euphrosine *. By ÉMILE-G. RACOVITZA.

THE cephalic lobe of the Amphinomidæ, in its most complicated condition, is provided with the following organs: an unpaired antenna, inserted near the posterior border, and two pairs of eyes, one of which is situated in front of, and the other behind, the base of this appendage. A pair of antennæ is situated in front of the anterior pair of eyes. On the ventral side, in front of the mouth,

* The investigations were conducted at the Arago Laboratory (Banyuls-sur-Mer).

are found the two lips, while on the dorsal surface, behind the unpaired antenna, is situated the caruncle. The *external antennæ* (*auctorum*) are tentacular cirri by reason of their innervation, and Quatrefages (1865) justly contends that they must belong to a rudimentary segment.

On studying certain series of forms belonging to the family with which we are dealing, two tendencies may be remarked in the modification of the anterior extremity: (1) The parapodia of the first three or four segments travel more and more towards the front, so that their axes tend to lie in the sagittal plane of the body; (2) the mouth and lips travel more and more towards the rear, and the anterior pair of eyes, with the paired antennæ, tends to pass to the ventral surface. It is probable that the second tendency is but a result of the first.

These modifications are exhibited to a very high degree in *Euphrosine*. In this genus the caruncle, the unpaired antenna, and the posterior eyes have retained their dorsal position (they have even been thrust slightly backwards), but the anterior eyes and the paired antennæ are ventral. Between the paired antennæ and the unpaired organ lies a considerable space, occupied by the terminal projection of the anterior extremity, which corresponds to the very small interval that separates the appendages in question in the case of the other Amphinomidæ. Since in *Euphrosine* the first segment is normal, the tentacular cirri appear in their primitive guise of parapodial cirri.

The study of the brain not only justifies the interpretation given to the cephalic lobe of *Euphrosine*, but permits us at the same time to comprehend the true nature of the appendages. I agree with Hatschek (1893) in considering that the brain of the Polychætes provided with cephalic appendages is formed of three distinct regions: the anterior brain innervating the palpi; the middle brain giving off nerves to the antennæ, to the eyes, and furnishing the major portion of the fibres of the commissures; and finally the posterior brain which innervates the nuchal organ.

In *Euphrosine* the brain undergoes the same change of position as the cephalic lobe. The anterior brain is ventral; it gives off two large nerves, which pass each to the corresponding lip. These organs, formed by evaginations of the dermo-muscular layer, are therefore palpi. They cannot be homologous with the buccal pads (*caussinets bucaux*) of the Eunicidæ, as is supposed by Ehlers (1887), but are homologous with the palpi of those animals, as also of the Aphroditidæ.

The middle brain exhibits great elongation and great lateral compression. Its median region, from being dorsal, has become anterior. From its anterior region, which has become ventral, issue the commissures which run their entire course in a plane that is horizontal, and not more or less vertical as in the case of the other Polychætes. From the same region arise the nerves of the anterior eyes and those of the paired antennæ. The nerve of the unpaired antenna and those of the posterior eyes are furnished by the posterior region, which is here dorsal, of the middle brain.

The posterior brain, which, in this form, is distinctly dorsal, is very strongly developed; it gives off two large nerves which pass into the caruncle. The latter organ, which was misinterpreted by Ehlers (1864), has recently been described by McIntosh (1894), who, however, did not recognize its true nature and saw in it nothing but some fibres. Its innervation, however, shows that the caruncle is nothing else than the *nuchal organ*. It is formed, in fact, by three elongated folds of the body-wall. One of these folds is of greater length, and is placed between the other two; its lower edges are united to the inner edges of the lateral folds. Vibratile furrows, which are very distinct and parallel, run the entire length of the folds. There are four of them on the median fold, and only two on the lateral ones. Two of the vibratile furrows pass from the caruncle on to the cephalic lobe, and extend as far as the paired antennæ. I shall describe this arrangement in detail elsewhere. I am likewise unable to dwell here upon the histological structure of the caruncle, which, moreover, does not differ essentially from that of the same organs in other Polychætes. The three folds indicated above are entirely similar to the occipital lappets (ailerons occipitaux) of e. g. *Amblyosillis*. Their union into a single mass only disguises the primitive condition which is still represented in *Euphrosine triloba*, Ehlers.

The glandular organs which, according to McIntosh (1894), are found on each side of the caruncle, are nothing but masses of pigment deposited in the posterior lobes of the brain. Similar masses are also found along the pedal nerves, and also in other Polychætes (e. g. ventral chain of *Eunice*). Veritable glandular organs, however, exist. These are two pyriform masses, constituted by greatly elongated hypodermic gland-cells. These organs belong to the palpi; for if the bodies of the cells are situated behind the brain, their ducts open on the surface of the palpi.

In the genus *Spinther* the tendencies indicated at the commencement of this note have been realized much more completely. The parapodia of the first segment have become united in front of the cephalic lobe. The caruncle has disappeared equally with the palpi and the paired antennæ. The unpaired antenna of the Amphinomidæ alone persists, with its four eyes at its base.

The presence of four of these organs upon the dorsal face and at the base of the unpaired antenna clearly indicates that *Spinther* cannot be the direct descendant of *Euphrosine*. These two genera form two distinct branches from the stem of the Amphinomidæ. The tendency towards radial symmetry which is displayed in *Spinther* as in *Euphrosine* must not be attributed to a direct parental connexion between the two forms. The explanation of the phenomenon is to be sought in a convergent evolution occasioned by a mode of life almost as sedentary as that of fixed animals.—*Comptes Rendus*, t. cxix. no. 26 (December 24, 1894), pp. 1226-1228.

On the Development of the Kidney and of the Cœlome in Cirripedes.

By A. GRUVEL.

In the paper which I have published in the 'Archives de Zoologie

expérimentale,' I stated, in speaking of the relations between the kidney and the cœlome in Cirripedes, that there was *no communication* between the renal sacs and the exterior or the general body-cavity. Herein, as throughout my paper, I took into consideration only the adult forms.

It was interesting to ascertain whether, at a certain stage of development, any communication whatever existed between the kidney and the body-cavity. As I had at my disposal some larvæ and very young examples of *Lepas pecturata*, obtained at the Arago Laboratory, I have been able to make certain investigations upon this subject, the result of which I will briefly detail.

On examining series of transverse sections of larvæ and young specimens of *Lepas pecturata*, we are able to perceive how the reciprocal relations between the kidney and the body-cavity are modified.

In the *Cypris* larva we find an extremely small cavity in direct communication with the exterior by means of a pair of orifices situated upon the palps of the lower lip, and which evidently represents the cœlome as it is met with in the adult. At the very bottom of this cavity—that is to say, on the side opposite to the external aperture—we notice a little cluster of scarcely differentiated cells with a narrow central lumen; this is the beginning of the renal gland.

In proportion as the cœlome enlarges, the lumen of the renal gland increases more and more, and in individuals which are quite young and have scarcely emerged from their larval shell there exists a *distinct communication* between the body-cavity and the kidney. Then, as the animal grows, the renal cells become more and more differentiated, and the sac is entirely reconstituted, destroying the communication which had existed for a time between the two cavities in question.

At a certain period of their development, therefore, Cirripedes, or at least the species that I have been studying (and there is no reason that the conditions should not be the same in the remaining forms), possess a pair of veritable segmental organs, formed by an excretory band scarcely differentiated, it is true, but in direct communication with the exterior.

The accumulative pseudo-kidneys (pseudo-reins d'accumulation) that I have described in the adult would therefore be, at this period of life, genuine organs for the direct elimination of excrementitious products to the exterior.

The body-cavity of the adult would be primitively a simple excretory canal, which has become, so to speak, passive in consequence of the obliteration of the renal sacs, the products of which it still eliminates to the exterior indeed, but in a manner altogether indirect, by the aid of the incessant osmotic exchanges which take place between the general body-cavity and the kidneys of the adult.

We know that in the Crustacea the shell-gland generally opens upon the second pair of maxillæ. In reality the position of the excretory orifice of this gland varies enormously, not only in the different groups, but even according to the genera and species.

Moreover, since the terminology of the mouth-parts in Crustacea is, in the majority of cases, only based upon their relative position, and not upon their development, I do not think it is impossible to regard the true larval kidney of Cirripedes (the pseudo-kidney in the adult) as homologous in a general way with the shell-gland of the other Crustacea.—*Comptes Rendus*, t. exix. no. 26 (December 24, 1894), pp. 1228–1230.

On the Formation of New Colonies by Termites lucifugus.

By J. PÉREZ.

Although the biology of the European and exotic Termites has engaged the attention of numerous zoologists, some of whom are of the highest rank, the origin of the societies of these insects still remains enveloped in complete obscurity. Neither de Quatrefages nor Lespès has observed the swarms of sexual individuals which at certain periods escape from the galleries, and to which has been attributed the mission of founding new colonies. Fritz Müller even goes so far as expressly to deny that they perform such a function. He writes as follows:—"As to the males and females of *Calotermes*, I will not absolutely refuse to admit that they possess the capability of continuing to exist by themselves and of commencing a new settlement. In the case of all species of *Termites*, *Eutermes*, and *Anoplotermes*, however, with whose mode of life I am to some extent acquainted, a winged pair would undertake the foundation of a new colony with precisely the same success as a pair of new-born children deposited upon a desert island" ('*Jenaische Zeitschrift*,' Bd. vii. 1873, p. 458, note 1).

In spite of so absolute a denial on the part of the eminent zoologist just quoted, it is, I think, evident that a social species devoid of the faculty of disseminating itself at a distance would be doomed to fatal and early disappearance. Dissemination must and does exist in the Termites.

When a nest has furnished a swarm of winged males and females there are always to be found in the proximity of the colony, or even about the orifice of exit, a few stray individuals which have lost their wings. They go, as a rule, in pairs, the one following the other very closely. The leader is invariably a female, while her follower is a male. When these couples are captured they speedily perish, unless they are kept under natural conditions, which apparently has never been done.

My own method of proceeding is as follows:—In a large jar containing a certain quantity of earth is placed a block of old dead wood, it matters little whether of oak, fir, or elm. More earth is then added, so as to surround the lower part of the wood to a height of several centimetres. One or more pairs of Termites, which are then placed upon the wood, quickly creep between it and the earth, and take up their abode in some depression, either underneath or upon the sides of the buried portion of the wood. A few drops of water added from time to time, so as to restore the moisture which is lost by evaporation, are sufficient to keep everything in its proper

condition. The jar should remain open, to avoid mould. The insects, moreover, never make the slightest attempt to escape.

Under these conditions the Termites live very well. At the end of from two to three weeks it may be seen that they have selected a domicile between the earth and the wood, and that they have also been feeding. Their abdomens, which were formerly flat, are now slightly convex. They are very lively and extremely active. The narrow space wherein they are living, closed on every side, contains a little fine woody powder, coming from the wood the surface of which has been attacked. Later on they have attacked it more directly at some point or other, and have commenced to excavate in it the commencement of a gallery.

Some pairs obtained on April 29 in the present year were alive and in perfect health on July 4. They had manifestly increased in size, and in their swollen and distended abdomens the intersegmental membranes appeared as fine white borders separating the black disks of the segments. The bulkier abdomens of certain specimens clearly distinguished them as females.

On August 30 the Termites were still thoroughly alive, but somewhat difficult to discover, since they had penetrated deeper into the wood, and were lodged in a globular chamber, to which access was given by a narrow orifice in connexion with the surrounding earth. The white abdominal rings were broader, and the black disks were entirely separated one from another.

On October 15 I found in one of my jars six sexual Termites assembled in the same cavity, which a slight splitting of the wood had revealed. With them were two young workers, which had very recently emerged, since they were of very small size, especially one of them, whose transparent body showed no ingested matter in the alimentary canal. At one point of the wall was attached a large egg. As for the adults, they were still in perfect condition, but were less active than formerly and obstinately shunned the light. The females, however, appeared scarcely more distended than in the month of August, and their abdomens were still far from the monstrous proportions observed in the case of the normal queens of the old nests. This difference is easily explained by the as yet moderate development of the ovaries, which, at the outset of their functional activity, are capable of furnishing only a very limited number of eggs.

Be this as it may, it is already proved by this experiment that the winged Termites issuing from the swarms are perfectly capable of living without the assistance of workers of their own species, and that their pairs develop into king and queen, the founders of a new colony. Thus is to be explained the fact that the winged individuals are always sexually immature, and have never been seen *in coitu*: they do not arrive at sexual maturity until after a somewhat lengthy interval, the duration of which my observations enable me to fix at five or six months.—*Comptes Rendus*, t. cxix. no. 19 (November 5, 1894), pp. 804–806.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SIXTH SERIES.]

No. 88. APRIL 1895.

XXXV.—*Contributions to the Phylogeny of the Arachnida.*—
*On the Position of the Acarina: The so-called Malpighian
Tubes and the Respiratory Organs of the Arachnida.* By
JULIUS WAGNER*.

THE Malpighian tubes and the respiratory organs of the Arachnids have attracted the attention of all students who have devoted themselves to the study of the relationship of the Arachnids to the remaining groups of Arthropods. For this reason, in investigating the embryology of *Ixodes* I directed my attention especially to the development of the Malpighian tubes, and I have come to the conclusion that in the Acarina, as I have shown in my Russian paper (No. 66, p. 89), they are decidedly of endodermal origin, and that their union with the rectum is only a secondary process.

In a similar manner I submitted the development of the tracheæ to a close investigation, and am now in a position to assert that in no stage of the embryonic development of *Ixodes* is a structure to be found which can be regarded as the rudiment of these organs of respiration, and that in reality the larvæ of Acarina have no tracheæ. If we adhere to the well-known view as to the relationship of the Arachnids to *Limulus*, we must unconditionally admit that the common ancestor of the Arachnids had no tracheæ, the stigmata of which were situated upon the cephalothorax; and we may therefore believe that in this respect the relation of the larvæ of the

* Translated by E. E. Austen from the 'Jenaische Zeitschrift für Naturwissenschaft,' Bd. xxix. Heft 1 (Jena, 1894), pp. 123-156.

Acarina to the ancestral forms is closer than that of the adults. There is, however, as is well known, a whole series of forms which are destitute of tracheæ in the adult condition also (*Acarina atracheata*, Kramer, No. 37, p. 218); yet these forms cannot be regarded as the more primitive, since the majority of their number (the family Tyroglyphidæ excepted) are parasites. As a matter of fact, parasitism more than anything else has affected the bodily size of the Acarina: all *Acarina atracheata* are very small, and only exceptionally attain a length of 1 millim.* In all probability the insignificant size of these Acarina occasioned the loss of the tracheæ. The same conditions are found in the case of the larval Acarina, and we are tempted to assume that in the Acarina the formation of the tracheæ has been cenogenetically transferred to the postembryonic period, while they originally possessed tracheæ even in the earliest larval stage. In consideration of yet other indications of the secondary character of Acarine larvæ, such an assumption appears to me to be more credible than the former.

When it is desired to point out the relationship between the Arachnids and *Limulus*, we proceed *inter alia* from the comparison of the lungs of the Scorpion and the branchial feet of *Limulus*, and base our view upon observations on the development of the lungs of the Scorpion and of the Araneæ; the great similarity in structure between the gills of *Limulus* and the lungs of the Scorpion has been demonstrated by MacLeod (No. 42 *b*), while the difference in development between the lungs of Araneæ and the typical tracheæ has been pointed out by Berteaux (No. 8). The tracheæ in the Araneæ arise by means of a further modification of the lung-sacs. While such an explanation of the origin of the tracheæ meets the case in certain orders of Arachnids, it is otherwise with respect to the tracheæ of the Acarina (partly also of the Solifugæ), the stigmata of which are situated upon the cephalothorax (the position of the stigmata in the Ixodidæ is somewhat difficult to determine; yet I consider that we may reasonably assume that this family forms no exception to the general rule). The tracheæ of the Acarina have certainly not been developed by means of the metamorphosis of any appendages; yet in considerations as to their origin the first question that forces itself upon us is whether the common

* An interesting exception is constituted by, e. g., *Tyroglyphus mycophagus*, Még., the females of which, according to Mègnin, attain a size of 1 to 1.25 millim., while according to Moniez (No. 47, pp. 590-591) under favourable conditions of life they exceed 2 millim. in size, and are then capable of producing living young.

ancestor of the Arachnids possessed the cephalothoracic tracheæ, or whether they have been developed independently within the class. The solution of this question is of the highest interest from the theoretical point of view, since the circumstance that the tracheæ, although only in the case of a portion of the Arachnids, arise independently in certain segments, and have not been inherited from the common ancestor of the entire class, constitutes an important, albeit a negative, argument against grouping the Arachnids with the rest of the Tracheata; for it is tantamount to admitting that a characteristic feature of the whole of the Tracheata, which, according to von Kennel (No. 24), is sufficient to prove the common origin of any two groups of Arthropods, can arise independently. It seems to me that, in the present state of our knowledge as to the development of the Arachnids and the structure of the simplest members of the class, we can return a fairly definite answer to this question, to the effect that *the ancestor of the Arachnids had no tracheæ in the cephalothorax*. The entire facts point to the conclusion that the Scorpion is the most ancient form, standing nearest to the ancestors of the Arachnids; and yet neither in its structure nor in its ontogeny do we find the slightest indication that it ever possessed tracheæ which opened upon the cephalothorax. Secondly, we find cephalothoracic stigmata in the case of that somewhat divergent order the Solifugæ, although in this instance abdominal stigmata likewise occur. Thirdly, in the Acarina, which in organization have diverged furthest from the primitive type, the abdominal stigmata have already been entirely lost. From these considerations we can deduce two conclusions:—(1) The tubular tracheæ of the Arachnids, the stigmata of which are situated upon the cephalothorax, are not directly homologous with the tracheæ of the rest of the Tracheata, since they have been developed after the Arachnids branched off; (2) the appearance of the stigmata upon the cephalothorax is connected with the disappearance of those upon the abdomen. This latter fact is perhaps to be explained as being due to the considerable development of the muscles in the cephalothorax of these forms: on the one hand, with increased muscular activity a considerable destruction of organic matter takes place, while on the other the contraction of the muscles promotes aerial ventilation in the tracheæ (*cf.* von Kennel, No. 24, p. 30, on the significance of the position of the stigmata close to the appendages); besides this, the relatively feeble development of the abdomen, which is greatly reduced in the case of the Acarina, has had as a consequence the disappearance of the stigmata thereon;

the position of the stigmata is to be explained by the character or the degree of the development of the corresponding segments of the body.

If the cephalothoracic tracheæ have arisen within the limits of the Arachnida, which are Arthropods of an already fairly well-developed type, we are confronted with a second question as to the organs whence, and the manner in which, they may have been evolved. Von Kennel thinks (No. 25; and No. 24, p. 25) that the tracheæ of *Peripatus*, and consequently of the higher Tracheata also, may be derived from unicellular (mucus-secreting) dermal glands of Annelid-shaped ancestors of *Peripatus*; this view was previously expressed by Moseley (No. 49), and harmonizes with the circumstance that the stigmata in *Peripatus Edwardsii*, Blanch., are distributed over the entire body, as also with the structure of the tracheæ of the Onychophora, in consequence of which it has received of late general recognition (*cf.* Lang's 'Lehrbuch,' No. 38, p. 451). In precisely the same manner we may explain the origin of the tracheæ in the cephalothorax of the Arachnids: they develop likewise from unicellular dermal glands, which were inherited from the same Annelid-like ancestors of the whole of the Tracheata, which explains the apparent similarity in structure between the tracheæ of the Arachnida and of the rest of the Tracheata. We also still find in the aquatic Arachnids a large number of hypodermic glands, which usually open in pores at the base of the setæ; these glands are developed in the Water-mites, and were regarded by the earlier observers (Dujardin) as sacs, serving as respiratory organs. Approximately the same view has, as is stated by Croneberg (No. 11, p. 8), been expressed by Claus in his text-book, and perhaps it was this latter circumstance which occasioned the statement on the part of Lang (No. 38, p. 550) that "in certain Acarina short tubes or pouches in connexion with orifices in the external chitinous covering have been interpreted as rudiments of tracheæ." According to the papers and evidence of Claparède (No. 10, p. 463), Croneberg (No. 11, p. 8), Koenike (No. 30, p. 357), von Schaub (No. 56, pp. 110, 111), and others, the glandular character of these structures admits of no doubt. It appears from the majority of the statements that these glands are destined by means of their secretion to preserve the integument of the Water-mites from drying up on leaving the water (*cf.* the function of the "oil-glands" of the Cheese-mites according to Nalepa, No. 50, p. 205). In *Eylaïs* the excretory ducts of the glands consist, according to Croneberg, of two sections—a peripheral, more strongly chitinized portion,

and a narrower and paler inner division, which Croneberg "never succeeded in following to the end amid the tracheæ and hypodermic cells surrounding it." On reading this description we involuntarily compare it with that of the tracheæ in *Peripatus* furnished by von Kennel: the latter states that the walls of the trunk of the trachea are clothed with a distinctly perceptible layer of chitin, but that those of the actual tracheal tubules are very delicate, scarcely distinguishable amid the surrounding tissues, and in all probability do not consist of chitin, since they are easily soluble in cold liquor potassæ. We may further point out that, according to Croneberg (*loc. cit.*), the excretory duct of the dermal glands of *Eylaïs* and other Hydrachnids, which are situated in the cephalothorax "in front of and behind the first segment of the fourth pair of legs, actually reminds us slightly of the trunk of a trachea;" while according to Fürstenberg (No. 16, p. 192) the "oil-glands," which are undoubtedly homologues of the dermal glands of the Water- and other Mites, have the power of filling themselves with air. The dermal glands of the Mites are, as is self-evident, secondary structures, and it is not from these that the development of the Arachnid tracheæ which we are discussing has proceeded; yet it is perfectly natural to suppose, by analogy with the Acarina, that the aquatic ancestors of the Arachnids, after they were already provided with a firm chitinous covering, also possessed numerous dermal glands of a similar kind. Such an assumption, in my opinion already probable in itself, is strengthened both by comparison with the dermal glands of the Pantopoda, and also partly by data furnished by palæontology. In the Pantopoda, as is well-known, numerous dermal glands open upon the surface of the body, which they entirely envelope in a viscid layer composed of their secretion; as the chitinous covering is considerably developed, the dermal glands are enclosed in special cavities (caverns) within it. These cavities, which open by "pores" upon the surface of the body, were regarded by Zenker (No. 69, p. 383), and after him by Hoek (No. 21, p. 124), as a special respiratory apparatus; yet the investigations of Dohrn (No. 13) have proved that they are only receptacles of the glands. A difference of opinion of this kind led Weissenborn (No. 67, p. 110) to assert "that originally all these cavities contained the dermal glands discovered by Dohrn, but that a portion of them gradually became subservient to respiration, since gas was secreted in the place of fluid." This is regarded by the author in question as a proof that

the dermal glands may become transformed into respiratory organs*.

It is shown by palæontology that the Gigantostraca, which stand very near to the ancestral forms of the Arachnids, occur in the lowest strata of the Silurian system in typical marine deposits, in the upper stratum already in company with *Phyllocarida*, Ostracoda, and Ganoid fishes, and, lastly, in the productive strata of the Coal-measures among remains of land-plants, together with those of Scorpions, Insects, Fishes, and freshwater Amphibia. "We may therefore assume," remarks Zittel (No. 70, p. 647), "that they lived originally in the sea, and subsequently in brackish or perhaps even in fresh water." Korschelt and Heider (No. 31, p. 533) therefore regard it as possible that the Gigantostraca became adapted not only to a freshwater life, but also to existence upon land. With respect to these palæontological data, in order to explain the development of two respiratory organs of the Arachnids which differ in their origin, I find it a very intelligible hypothesis to suppose that certain of the ancestral forms of the Arachnida, all of which were closely allied to the Gigantostraca, passed a certain period of the year or a certain stage of their postembryonic development out of the water; these forms (like the Gigantostraca) possessed branchiæ completely covered externally upon several of the anterior segments of the abdomen, and numerous dermal glands, of which the excretory ducts, which were of some length, gradually became filled with air after the animals left the water, and so temporarily served as the seat of the exchange of gases in the blood.

The dermal glands of the Arachnids, after their function became changed into that of respiration, may have undergone further development in precisely the same manner as the tracheæ of the rest of the Tracheata, since the tracheæ of *Peripatus*, as well as the dermal glands, and consequently the primitive tracheæ of the Arachnids, have been developed from the same (mucus-secreting) dermal glands belonging to the Annelid-like ancestors of all the Arthropods. From these forms the Acarina, Solifugæ, and probably also certain other orders of Arachnids have arisen. Their fascicular †

* For this reason it seems to me strange that Weissenborn states, in combating the theory of the transformation of the gills of *Limulus* into the lungs of the Scorpion, enunciated by Ray Lankester and MacLeod, that, assuming such a transformation to have taken place, "the occurrence of the thoracic stigmata and tracheæ can only be regarded as a formation of new structures which is difficult to explain."

† I would here point out that the rosette-shaped arrangement of the

primitive tracheæ were likewise distributed over the entire body, as in the case of *Peripatus Edwardsii*, Blanch.; it was not until further development was in progress that, for reasons which have been stated with accuracy by von Kennel, out of the numerous tufts only those were left which were situated in the immediate neighbourhood of the appendages.

In the Arachnids, therefore, we find two entirely different structures:—(1) The lung-sacs of the Scorpion and the Araneæ, and (2) the tracheæ of the Acarina (partly also those of the Solifugæ). The respiratory organs of the remaining groups of Arachnids must be homologous either with the first or with the second division; and in this sense the solution of the question as to the homology of the abdominal tracheæ of the Solifugæ is of especial interest. For if it should be found possible to compare them with the lungs of the Scorpions, it would serve to confirm the view which has already been expressed, that the common ancestor of the Acarina, and probably of certain other orders of Arachnids also, possessed at the same time lungs (*i. e.* branchiæ) in the abdomen as well as primitive tracheæ distributed over the entire body. On the other hand, if the abdominal tracheæ of the Solifugæ, like the tracheæ of the Acarina, have arisen from dermal glands, we may assume that there is still a possibility that the ancestral forms possessed two kinds of respiratory organs; but we might then suppose that also in the case of certain other Arachnids (*e. g.* in the Phalangidæ and the Pseudoscorpions) the abdominal tracheæ are not homologous with the lung-sacs of the Scorpions. The solution of the question will be rendered possible by a precise and comparative investigation of the development of the abdominal and thoracic tracheæ of the Solifugæ.

Whatever this solution may be, it may be assumed, on the basis of the considerations already stated, that the Arachnids divided into two branches at an early period: *in the one group the tracheæ became very strongly developed, while the lung-sacs (the modified branchiæ) either in part persisted or entirely disappeared; in the other, the dermal glands transformed into tracheæ altogether aborted, while in compensation for this the lung-sacs underwent very great development (cf. the division founded upon the differentiation of the abdomen into two sections, No. 66, p. 157).*

Since we are discussing the tracheæ of the Acarina, the

dermal glands in *Atax* was described long ago by Claparède (*loc. cit.*); each group of these unicellular glands has a common excretory duct, which opens by a stigma-like orifice.

present is a convenient opportunity to speak of the provisional organ of the aquatic and certain land-mites, which is regarded by Henking (No. 20) as a "primitive trachea" ("Urtrachee"), while Kramer (No. 36) considers it to be a "suspensory apparatus" ("Suspensionsapparat") for the embryos. Henking's view appears to me to be unfounded, since he did not see an actual trachea, penetrating from the organ in question into the body. This paired embryonic organ, which I did not succeed in observing in *Ixodes*, and other observers failed to find in many other forms, merits special attention, since both in its position on each side of the body in the neighbourhood of one of the anterior pairs of thoracic limbs, as well as in its shape, with narrow base and swollen tip, it recalls the embryonic organ lately described by Vejdovsky (No. 65) in *Chernes*. The author in question is of the opinion that, from comparison with *Cyphophthalmus duricornis*, Joseph (No. 22), this organ, which was noticed neither by Metschnikoff (No. 44) nor by Barrois (No. 2) in *Chelifera*, may be compared with rudimentary stalked eyes (*loc. cit.* p. 130). It seems to me that this assumption is ill-founded, since the structure of the organ is but little suggestive of that of an eye; and, besides, the stalked eyes of *Cyphophthalmus*—a form widely distant from the Pseudoscorpioninæ, and at any rate ill-studied—or more correctly the eyes seated upon lateral processes of the body, might have arisen as a secondary character in the species itself, as, for instance, the stalked eyes of certain Ephemeridæ among the Insects have been developed.

In the same way it is possible to institute a comparison with the lateral organs of the Solifugæ (Croneberg, No. 12), perhaps also with those of the Phalangidæ (Faussek, No. 14), and finally with the provisional organs situated in *Thelyphonus* and in *Phrynus* at the base of the second pair of legs (Strubell, No. 63).

Before proceeding to state the views of those specialists who would derive the Tracheata from an ancestral form, I would like to refer to the so-called Malpighian tubes. Since the homology of these organs in all Tracheata is recognized, it is assumed that their origin and also their function is similar; their importance chiefly consists in the fact that they are present in all fully-developed Tracheata, but are absent in the Branchiata. This, at any rate, is the view represented in the text-books of Lang and von Kennel.

As regards their origin, according to my own observations the Malpighian tubes develop in the case of *Ixodes* (and probably in the Acarina in general) from the endoderm. As

to the rectal vesicle, with which both glands subsequently become connected, I cannot express an altogether definite opinion; but the origin of the glands themselves is quite beyond doubt, as I have shown distinctly by means of figures in my Russian paper (No. 66, fig. 52 &c.). With reference to the development of the (Malpighian) excretory tubes in the other Arachnids, we only possess observations upon Scorpions and Araneæ. In the first place it was shown by Kowalewsky and Schulgin (No. 35, p. 46) in the case of *Androctonus ornatus* that the end-gut is invaginated only to the length of the penultimate caudal segment, after which the origin of the Malpighian tubes as outgrowths of the mid-gut at a time when the end-gut was still quite solid was described by Laurie in *Euscorpius italicus* (No. 39, p. 128). These two papers complete one another, and since the end-gut of the Scorpion is very short, and in the first stages of development is distinctly separated from the mid-gut, it seems to me that by means of these memoirs the endodermal origin of the excretory organs is demonstrated with sufficient clearness.

The observations as to the development of the Malpighian tubes in Araneæ are, as is well known, very contradictory. Altogether this question has been touched upon by Barrois (No. 3), Balfour (No. 1), Loey (No. 40), Schimkewitsch (No. 59), Morin (No. 48), and Kischinouye (No. 29). Balfour, who is followed by Schimkewitsch and Morin, considers that these organs arise from evaginations of the end-gut: Balfour's description (No. 1) is very short; early stages in the development of the Malpighian tubes he did not observe. The other two investigators, however, differ from one another in details—a fact which, as it seems to me, deserves attention, and is due either to the difference between the species observed (*Lycosa*, *Theridion*, and *Pholcus*) or to insufficient accuracy in the observations themselves. Schimkewitsch describes in *Lycosa saccata* (No. 59, p. 562) a longitudinal division of the blind end of the proctodeal invagination into an upper portion, which develops further into the cloacal sac (rectal vesicle), and a lower section, the actual rectum, which subsequently sends out two cell-processes, that are originally solid and constitute the first rudiments of the Malpighian tubes. With reference to *Theridion maculatum*, it is stated by Morin (*loc. cit.* pp. 161–162) that the blind extremity of the end-gut expands and becomes the cloacal sac, into which “the ends of the Malpighian tubes open;” the author in question expresses himself more distinctly with regard to *Pholcus phalangoides* (p. 193): “on both sides,” he writes, “of the ‘poche sterco-

rule 'two ectodermal processes arise, which are the first rudiments of the Malpighian tubes.' The difference between the descriptions of the two authors deserves notice, because, to judge from Schimkewitsch's figures (No. 59, pl. xxii. fig. 6: the requisite figures are not given by Morin), on their first appearance the histological structure of the rectal vesicle is not the same as that of the rectum. By Barrois (No. 3) and Kischinouye (No. 29) the Malpighian tubes of the *Aranæ* are derived from the mesoderm; according to Kischinouye the Malpighian tubes are outgrowths of the rectal vesicle, which is of mesodermal origin. They are originally solid, as is stated by Schimkewitsch; the union of the cloacal vesicle with the rectum occurs subsequently.

Finally, according to Locy's observations (No. 40, p. 75) the Malpighian tubes arise as outgrowths from the posterior end ("pre-stercoral tube") of the mid-gut. Unfortunately Locy's description is not illustrated by figures; if, however, we compare those of his sagittal sections that pass through the hinder end of the mesenteron and the rectal vesicle ("stercoral pocket," figs. 55, 56, and 70) with Schimkewitsch's figure alluded to above, we might suppose that, in the description of the latter, the anterior portion of the rectum, from which the Malpighian tubes develop, and in that of the former the posterior end of the "pre-stercoral tube" are identical. This posterior endodermal process seems to be of interest because it corresponds to the hinder process in *Ixodes* (No. 66, p. 100) and to the caudal process of the mid-gut in the Scorpion.

It seems to me that, remembering the above-mentioned resemblance between the descriptions of Schimkewitsch and Kischinouye (namely the statement that the first rudiments of the excretory tubes are solid), and, further, the remark made by the latter to the effect that the proctodæum enters into connexion with the rectal vesicle at a late stage, I can, on the basis of my own observations upon *Ixodes*, and after comparing the same with what is known as to the Scorpion, harmonize the different observations upon *Aranæ* only to the following extent:—In all *Aranæ* the posterior process of the mesenteron, which lies close to the rectal vesicle and develops even before the endoderm grows round the yolk, is more or less distinctly marked; in certain cases the Malpighian tubes arise directly, as (at first compact) outgrowths of the portion of the mesenteron alluded to; in others the two compact rudiments of the Malpighian tubes separate from the posterior end of the mesenteron, which adjoins the rectal vesicle, and fuse secondarily with the latter (as in the case of

Ixodes), so that, unless sufficiently early successive stages are studied, they may be regarded as outgrowths from the rectal vesicle itself. From this point of view the lower half of the 8 in Schimkewitsch's figure represents a portion of the mesenteron; Balfour and Morin did not observe sufficiently early stages*, as can be proved from the fact that they did not notice the formation of the posterior process of the mesenteron, which is distinctly visible in Morin's fig. 30 (in *Theridion maculatum*). A necessary stage has also been missed by Kischinouye, since he has not observed the separation of the rectal vesicle from the anal invagination, which in all probability takes place before the union of the Malpighian tubes with the cloacal expansion (*i. e.* rectal vesicle), as is likewise the case in *Ixodes*; it is probably this circumstance that has also induced the investigator in question to ascribe to the vesicle an independent origin (from the mesoderm).

The difference in the development of the Malpighian tubes is also indicated by their relation to the alimentary canal in the adult Spiders: in some they open into the cloacal expansion (Bertkau, No. 9, pp. 415-416), in others into the posterior process of the mesenteron (Loman, No. 41). Owing to the place at which they open into the intestine (in *Cteniza*, and also in *Epeira*, *Tegenaria*, and *Mygale*), and in consequence of their structure, Loman (No. 41) regards the Malpighian tubes as being derived from the mesenteron. Without attributing great importance to the histological structure of the Malpighian tubes for deciding as to their origin, I nevertheless consider it necessary to point out that in the adult male of *Ixodes calcaratus*, Bir., and in certain larvæ (No. 66, figs. 82 and 83), the cells of the intestinal lobes and of the central stomach portion contained granules of an intense light blue or blue pigment, while this was not the case in the Malpighian tubes.

I therefore consider that, judging from the development of the Malpighian tubes in the Scorpion, in *Ixodes*, and *Agelena*, from their relation to the alimentary canal in the adult Scorpion and in certain Spiders, and, lastly, from their structure in adult Spiders, *the so-called Malpighian tubes in all Arachnids are developed from the endoderm.*

The second resemblance to the Malpighian tubes of the Insects (and Myriopods) is a functional one. Yet it will probably appear on closer investigation that this similarity is by no means so essential as it seems; we are already aware of important differences between these structures in the

* The stages which they studied were probably those immediately following the one shown by Morin in his fig. 29.

Arachnids and other Tracheata. The Malpighian tubes of Insects have frequently been studied, and their function is known to us more thoroughly than that of the Malpighian tubes in the Arachnids, with reference to which we possess only isolated observations. Without submitting the subject to a more minute investigation, I will confine myself to certain statements in literature.

According to Schindler (No. 60, p. 588) the existence of uric acid in the Malpighian tubes of Insects was demonstrated first by Keller, and afterwards by Leuckart; Schindler himself has proved the presence of the ordinary urates (urate of soda and ammonia) in these vessels. Kowalewsky has recently shown (Nos. 32 and 33), by means of a series of experiments upon various Insects, that their Malpighian tubes distinctly excrete indigo-carmine (indigo-sulphate of soda) introduced into the body-cavity, and possess a distinctly perceptible alkaline reaction (for the effect upon litmus, *vide* No. 32, pp. 65-66). A precisely similar energetic behaviour towards indigo-carmine has also been discovered by Kowalewsky in the case of Myriopods (No. 33, p. 205). If we now turn to the Malpighian tubes of Arachnids, this is what we find:—According to the observations of Plateau (No. 52, p. 530), with whom Loman (No. 41) concurs, neither free uric acid nor the typical urates occur in the Malpighian tubes of Spiders*. Kowalewsky, by whom the behaviour of the Malpighian tubes of Insects and Myriopods with regard to indigo-carmine has been so distinctly demonstrated, makes similar statements only with reference to the Araneæ (No. 34, p. 203) †, in which, however, the liver plays the chief part in the excretion of the indigo-carmine; as to the Malpighian tubes of *Scorpio* and *Solifuga*, Kowalewsky is silent; in the Scorpion, on the other hand (and partly also in *Solifuga*), the tubular portion of the coxal gland has a function similar to that of the Malpighian tubes of Insects. The liver of the Scorpion, contrary to that of the Araneæ, has an acid reaction, as in the case of Crustacea. “This reaction of the liver,” says Kowalewsky (No. 34, p. 204), “in conjunction with the presence of a kidney (*i. e.* the coxal gland), which consists of a vesicle and the urinary duct, still further confirms

* Bertkau's statement (No. 9) contradicting this is refuted by Loman. In *Ixodes* the Malpighian tubes and the rectal vesicle are filled with spherocrystals, which are regarded by Mégnin (No. 43) as an alkaline salt of uric acid; uric acid and its salts have similarly been described by Nalepa (No. 50, p. 204) in the Malpighian tubes of *Tyroglyphus*.

† He studied chiefly *Lycosa Latreilli* and *Eucharhia castanea*.

the idea of the close relationship of the Scorpions to the Crustacea.”

The signification of the coxal glands of the Arachnids as excretory organs can scarcely be doubted after the experiments of Kowalewsky upon the Scorpion (Nos. 32, 33, and 34); while in the case of the Insects the rôle of the excretory organs devolves upon the Malpighian tubes and the pericardium cells, and in the Myriopods upon the Malpighian tubes and certain cells of the fat-body, in the Arachnids, besides the latter, the liver and the coxal glands also play a great part. Even if these glands are homologous in the Myriopods and the Arachnids—a question which does not enter into the scheme of my observations—the part played by them in the two classes is nevertheless not the same. The signification of the coxal glands of the Arachnids is evident from the peculiarities observed in *Phalangium* and the Acarina. The coxal glands of *Phalangium* (or, more correctly, the tubular portion of them), which were previously described as Malpighian tubes (Plateau, No. 53, p. 744), were, as is well known, correctly comprehended for the first time by Loman (No. 42 a, pp. 93 *et seq.**), and in this manner it has been proved that the Phalangidæ have no Malpighian tubes. “Apparently,” says Faussek (No. 14, p. 82), “from a morphological standpoint, among all the Arachnida the coxal gland reaches its greatest and fullest development in the Phalangidæ: it attains a very great volume, and its various parts are distinctly defined and strongly developed. At the same time its physiological significance is probably very considerable.” The absence of Malpighian tubes and the presence of coxal glands in *Phalangium* must evidently be regarded as phenomena which are mutually dependent upon each other. Quite the opposite conditions are found in the majority of the Acarina; in this group the Malpighian tubes are relatively strongly developed, but up to the present time the existence of coxal glands has not definitely been proved. The remarks of Winkler (No. 68) and Henking (No. 20) are not sufficiently precise: the statement made by Michael (No. 46, and No. 45, p. 178) is worthy of more attention. This author describes in the Oribatidæ a gland situated at the base of the second pair of legs, and in a general way recalling the coxal glands of the rest of the Arachnida; yet it is precisely these forms that, according to Michael’s description, possess no Malpighian tubes. Michael did not succeed in discovering an orifice to the coxal (“super-

* For the literature on the subject of the coxal glands of *Phalangium* down to the year 1890, see Faussek’s memoir (No. 14, pp. 69–82).

coxal") glands. Long tubular glands have recently been described by Sturany (No. 64, pp. 16-17) in *Trombidium*; the author did not observe either their opening upon the surface of the body or their union with the alimentary canal, and he regards them as homologous with the coxal glands. Yet, judging from his figure (fig. 21), it might be supposed that he himself commits the error with which he reproaches certain other observers, only in the reverse sense, namely, that he regards the Malpighian tubes as coxal glands.

If with respect to their excretory organs the Phalangidæ form the extreme stage in one direction, the Acarina occupy the corresponding position in the other. In this way the Malpighian tubes of the Arachnids in the majority of cases do not correspond either in function with those of the rest of the Tracheata. The rôle of the Malpighian tubes of Insects (and Myriopods) is in the case of the Arachnids fulfilled to a considerable degree by the coxal glands or the liver.

From all that has been stated, it appears to me that the following indisputable conclusion may be drawn:—*the Malpighian tubes of the Arachnids are not homologous with the Malpighian tubes of the rest of the Tracheates*; they are structures analogous to the so-called Malpighian tubes in certain Amphipods. Should this conclusion be confirmed by further observations, it would be an important and positive argument in favour of the separation of the Arachnida from the Antennata.

As regards the wide diffusion of the (Malpighian) excretory tubes in the Arachnids, this is apparently due to the very early occurrence of these organs in the representatives of the Arachnids. While speaking of this I should like to mention certain considerations which might possibly explain the absence of the organs in question in *Limulus*, which in all other respects so closely approaches the Arachnids. If we make a closer examination of the extent to which the so-called Malpighian tubes exist in Amphipods, we find that they occur only in a relatively small number of genera. The majority of these genera belong, as is well known, to the sub-order Crevettina, and *Caprella* alone constitutes an exception to this; but the Læmodipoda must be regarded as belonging to the divergent forms, as is proved by their structure as well as by their mode of life. Among the Crevettina, however, the outgrowths from the posterior process of the mid-gut occur either in forms that live upon the sea-shore (*Orchestia*, *Talitrus*), or in such as love water that is very little salt (*Melita*) and are found chiefly in fresh water (*Gammarus*)*. Since Malpighian

* It is possible that the freshwater species of the genus *Gammarus*

tubes are absent in the majority of the Amphipoda, and since the Amphipods that possess them exhibit the already-mentioned peculiarities in their mode of life *, we may suppose that adaptation to life upon the shore or in water, which is rich in oxygen, has occasioned the appearance of special outgrowths of the mid-gut, which, at least to a certain extent, play the part of excretory organs; such an adaptation might appear independently in the representatives of the various genera *. If we assume the same to have taken place in the case of the ancestor of the Arachnids, in which the posterior outgrowths from the mid-gut, which subsequently became Malpighian tubes, first appeared, we must consider it to have been a littoral form (such as *Orchestia*). I have already touched upon this latter question in considering the respiratory organs of Arachnids †.

The Malpighian tubes of the Arachnids consequently develop from the posterior process of the mid-gut. This process merits attention for its own sake, since neither the Hexapods nor the Myriopods possess it.

A comparison of the different views as to the phylogenetic relationship of the various groups of Arthropods has already been furnished several times by a number of authors (Weissenborn, No. 67; Fernald, No. 15; to some extent Zograff, No. 71; Schimkewitsch, No. 58; and others). I shall therefore notice only certain of the most important papers, the authors of which are opposed to the separation of the Arachnida from the Tracheata. If we glance at the literature of the last ten years we observe that since the appearance of Ray Lankester's papers facts have continually been collected from various sides in support of the relationship between *Limulus* and the Arachnids. The most minute study is devoted to the structure of the lungs of the Scorpion and of the branchiæ of *Limulus*, to the development of these organs, the modification of the appendages in the Araneæ, the structure of the blood-vascular and nervous systems, the

originally lived at the mouths of small rapidly running streams, which flow into the sea, at the point where the river-water, meeting the waves, forms a perpetual surf.

* In *Melita* we find only a single unpaired process of the mid-gut, in the other forms two; yet, as is well known, differences of this kind also occur between the Malpighian tubes of the Acarina.

† In the handbook of Steinmann and Döderlein (No. 62) the following passage occurs (p. 512):—"The majority of the palæozoic Arthrogasters were aquatic forms; the oldest among them, at any rate, were marine; while the later forms, in part those existing at the present day, are without exception adapted to sojourning in the air" (*vide* also p. 500). Why the authors represent this view it is impossible to explain.

development of the nervous system and especially of the eyes, the development of the alimentary canal, the development and the structure of the coxal glands, and so on*. Everything convinces us of the close relationship between *Limulus* and the Arachnids; yet, just as *Peripatus* is no Millipede, so also *Limulus* is no Spider, although Ray Lankester also, by reason of the similarity between it and the Scorpion, attempted to assign it to the Arachnids (No. 55).

On the other hand, palæontological investigations have proved beyond doubt that certain of the palæozoic Xiphosura (the Hemiaspidæ), which (as, for instance, *Prestwichia*), as is shown by the embryology of *Limulus*, were closely allied to the forms from which the Limulidæ are derived, on the one side resembled certain Trilobites, while on the other, owing to the relatively smaller size of the cephalic shield, to the complete segmentation of the pre-abdomen and abdomen, as well as to their caudal spine and probably also the general character of the appendages, they were nearer akin to the Gigantostroaca. If forms such as *Prestwichia* constitute the transition in question, on the other hand, as we are well aware, the Scorpion, on account of the general configuration of its body, the proportionate size of its divisions, and the character of its appendages, shows much closer affinity to the Gigantostroaca than to the Xiphosura; wherefore it must be assumed that also in their internal structure the Gigantostroaca displayed still more similarity to the Scorpion than did the Xiphosura.

Among the scientists by whom the view of the common origin of the existing Tracheates is maintained, von Kennel and Lang are the best known and most influential. The authors in question have defined their views and stated them in detail, the former in a paper (No. 24), the latter in his 'Lehrbuch der vergleichenden Anatomie' (No. 38); both writers, while differing from each other in their ideas as to the relation between the Branchiata and the Tracheates, agree generally in their views as to the origin of the Arachnids. According to von Kennel's supposition, besides other branches, those formed by the Annelids and the Crustaceans (Branchiata) arose from the hypothetical Protrochosphæra, and both branches developed upon parallel lines, but independently. From the various forms or families of Annelids arose the *Peripatus*-like ancestors of the Tracheata, which divided at the very beginning into two branches: of these, one was constituted by the forms of the tracheate Arthropods

* For a precise *résumé* of the comparisons between *Limulus* and the Arachnids, see Kingsley's paper (No. 28).

with a posterior genital aperture and unsegmented mandibles (Insecta and Chilopoda), while the other was composed of those with an anterior genital aperture and with segmented mandibles, and in which, moreover, contrary to what we find in the former, in many instances unbranched tubular tracheæ have persisted (Diplopoda, Pauropoda, Symphyla, Arachnoidea). *Peripatus* forms, in the opinion of this author, a divergent branch from the primitive types ("Peripatiformes"). After von Kennel has thus demonstrated the necessity of dividing the Arthropods into Branchiata and Tracheata, and the possibility of similar characters appearing independently in the organization of Annelids and Crustaceans, he is unwilling to investigate the relation of the Arachnida to the Crustacea (the Merostomata included, *cf.* No. 26, pp. 403 and 405), since he is able to prove the common origin of the whole of the Tracheata (No. 24, p. 18). If we enquire how the latter can be done, we are told that it is proved by the fact that the whole of the Tracheata possess tracheæ and Malpighian tubes*, and that consequently these organs must have been present in the ancestral form also. It is evident that this method of proof contains nothing new or original, and since every naturalist who sought to prove the relationship between Arachnids and *Limulus* had to deal with characters of that kind, there is in my opinion nothing whatever to justify von Kennel in ignoring similar features in the organization of the Arachnids and the Merostomata. If this author had been prepared to handle these conditions, he must of necessity often have had recourse to improbabilities in order to explain the various similar characters; and this he actually does, so soon as he considers the independent appearance of similar features in the Crustacea, which have been developed directly from unsegmented animals, and in the Tracheata, the descendants of the Annelids. I have already touched upon the question of the development of the tracheæ in the Arachnids, and shall return to it again further on; now, however, we are dealing only with the Malpighian tubes, which are regarded by von Kennel (*loc. cit.* p. 23) as nephridia that have been carried inwards with the proctodæal invagination. This view, which owes its origin to a certain functional resemblance between the two structures, is founded by von Kennel only upon the circumstance that *Peripatus*, in which in comparison with the Tracheata the anal invagination is very insignificant, has no Malpighian

* Von Kennel seeks to explain each special exception (*Peripatus*, *Japyx*, *Collembola*, *Acarina*, *Pauropoda* (?), *Tardigrada*).

tubes. Yet if we start from von Kennel's assumption that with the lengthening of the proctodæum "even one or several entire segments are invaginated together with the rudiments of all the organs belonging to them," we may assume with precisely the same justification that other glands also that discharged their secretion through orifices in the integument might be invaginated besides the nephridia. Moreover, it must further be pointed out that in the Aphidæ, which possess no Malpighian tubes, the function of these organs is discharged by the entire surface of the end-gut (Kowalewsky); consequently we cannot found our conclusions upon functional resemblance alone. It is also necessary to remark that von Kennel bases all his assertions either exclusively or chiefly upon the study and the analysis of the organization of *Peripatus* and the Myriopods, whereby he sometimes entirely overlooks the peculiarities of the Arachnids. The fact that the Malpighian tubes of Hexapods and Myriopods develop solely from the ectoderm, which is an important and universally recognized argument against the assumption that those structures are homologous with segmental organs, remains unrefuted. So long as it is not proved that the Malpighian tubes, though it be only in part, are developed from the mesoderm, I venture to side with the view that they arise only through secondary local differentiation of the walls of the end-gut; as is well known, this view is supported by the fact that certain Copepods possess the faculty of excreting uric acid compounds by the walls of their end-gut, as the process also takes place in the Malpighian tubes of Insects*.

Von Kennel's treatise led to the publication of the paper by Zograff (No. 72), wherein the latter in general entirely endorses the views of the former, though he deals chiefly with the relations of the Arthropods to the Annelids, and does not touch upon the question of the phylogeny of the various classes of the Tracheata at all, since this is a problem "that is so ably discussed and almost solved (?) by Prof. von Kennel" (*loc. cit.* p. 294). From this it may be concluded that the author has somewhat modified the view expressed by him in his earlier paper on the development of the Myriopods (No. 71, pp. 70 and 71), though he still continues to be in favour of the theory of the common origin of the whole of the Tracheata. Considering that in his first paper the author writes, "the great similarity between the embryonic development of the Myriopods and that of the Arachnids, which is even greater than the resemblance between that of the former

* Cf. p. 296 *suprà*.

and that of the Insects, compels me to think that the relationship between Arachnids and Crustaceans is a hypothesis which will be untenable in future;” and considering further the fact that the most important observations on the development of *Limulus* and the Arachnids and on the structure of the latter—observations which von Kennel does not touch upon at all—were not published until after the appearance of Zograff’s paper, it is natural that in his last paper the scientist in question should wish to discuss the relations between the Arachnida and the rest of the Tracheata.

Like von Kennel, Lang also (*loc. cit.* pp. 560–562) finds it necessary to assume that the Tracheates divided at an early period into two independent branches; yet in so doing he proceeds not from the position of the genital aperture, a character to which apparently he attaches no great significance, but rather from the comparison of the first three or four pairs of appendages: consequently, in opposition to von Kennel, he contrasts the Arachnids with all the rest (Chelicerata and Antennata). The main reason for uniting the Arachnoids with the Tracheates, and for separating them from the Xiphosura and Gigantostraca, is the same in this case also, namely the presence of the Malpighian tubes and tracheæ in the Arachnoids and their absence in the Xiphosura. The homology of the Malpighian tubes in all Tracheata is placed by the author beyond all doubt, but in his opinion the assumption of an independent appearance of the tubular tracheæ “could only be admitted as a makeshift.” Lang considers that the Scorpion must undoubtedly be regarded as the type nearest allied to the ancestral forms of the Arachnids, while with regard to the Solifugæ he holds such a hypothesis to be probable, though still in need of confirmation (*loc. cit.* p. 558); hence he does not explain why it is that the Scorpion, which has retained the largest number of stigmata and primitive conditions generally in the segmentation of its body and in its organization, possesses the most modified tracheæ, and why in the forms that exhibit the greatest divergence in organization, it is precisely the tracheæ that are less modified (regarding the fascicular tracheæ as the most primitive type) than in the Scorpion and the Solifugæ. This discrepancy, neglected by Lang, has been perceived by Schimkewitsch. The latter regards the Scorpion as a more primitive form than the Spiders, which, however, he considers to be less modified than the Opilionidæ and the Acarina, while he believes that the original respiratory organs of the Arachnids were lungs, though these were developed from unbranched fascicular tracheæ (No. 57, p. 67).

Weissenborn (*loc. cit.* pp. 115–116) disagrees with the opinion of Schimkewitsch, since with the help of it it is impossible to explain the dendriform tracheæ of the Solifugæ, and he proposes another explanation. I may also add that if the Solifugæ are less modified forms than the Spiders we must, on the other hand, not lose sight of the fact that in the same forms of Arachnids we meet with not only lung-shaped and fascicular tracheæ at the same time, but also both distinctly developed kinds of fascicular tracheæ [*e. g.* in *Gibbocellum*, according to the description of Stecker (No. 61)*]. According to Weissenborn the whole of the respiratory organs of Arachnids have arisen from primitive unbranched short tracheal tufts, from which in one direction dendriform tracheal tufts, in another tubular tracheæ with considerable diminution in the number of the stigmata, and in a third lungs were developed. From this it may be inferred that in the opinion of the author the tracheæ of the Spiders with two lungs and the posterior lungs of those provided with four have developed independently of each other from the primitive tracheal tufts of the ancestral form—a theory which, according to Pocock's paper (No. 54), and since the four-lunged *Hypochilus* was recognized as a "Dipneumon," is wholly improbable.

A peculiar view as to the respiratory organs of Arachnids is represented by Bernard (No. 6). This author regards the tracheæ of the Acarina as the most primitive type; the exclusive presence of these organs in the Acarina is in accordance with his theory that the Acarina are a fixed larval stage of the Arachnids. I shall discuss the theory just alluded to later on. The presence of the tubular tracheæ in the Phalangidæ is explained by the very early separation of the latter from the main stem of the Arachnid class; the Solifugæ possess the same tracheæ, since they are very near akin to the primitive type of the Arachnida; the Chernetidæ lastly must be separated into a special group. From the tubular tracheæ have been developed the "fan-tracheæ" ("Fächertracheen," "book-leaf tracheæ" of Bernard, No. 7, p. 521). This is Bernard's view. In connexion with the term "tubular tracheæ," he nowhere states which of the tubular tracheæ, the fascicular or the dendriform, he regards as the more primitive †; he simply contrasts the tube-tracheæ with the

* Stecker (*loc. cit.* p. 339) compares the posterior tracheal tufts in *Gibbocellum* with the abdominal tracheal branches in *Phalangium*.

† [This paper was evidently written before the author had seen Bernard's "Notes on the Chernetidæ," Journ. Linn. Soc., Zool. xxiv. pp. 410–430, pls. xxxi. and xxxii. (Nov. 1893), in which this question is more fully dealt with.—TRANSL.]

fan-tracheæ (*i. e.* the lungs), as appears from the explanation which he appends to the diagram of the position of the stigmata in the Arachnids (*loc. cit.* p. 68). The ancestors of the Arachnids possessed a pair of stigmata upon each segment of the body; as the most material proof of this fact the author regards his discovery in the case of the Chernetidæ of rudimentary stigmata ("vestigial stigmatic scars") upon all the segments of the abdomen, commencing from the fourth. But according to Kingsley (No. 28, p. 239) the structures discovered by Bernard were already known to Siebold (1853), though they are not rudimentary tracheæ, but attachments for the muscles upon the chitinous envelope*. The deductions of this author are on all occasions too hasty. Similarly I cannot say that I agree with his theory as to the development of the tracheæ in the Tracheata in general from the bristle-glands of Worms (No. 7). But I will not stop to pursue this further. I have previously expressed my view as to the development of the tracheæ of Arachnids, of which the stigmata are situated upon the cephalothorax, and in certain cases probably upon the abdomen also (in which cases the latter occurs must be shown by future observations; as regards the former, however, I can only assume that this holds good for the Pseudoscorpions, Solifugæ †, Phalangidæ ‡, and Cyphophthalmidæ). I can now say with Korschelt and Heider (*loc. cit.* p. 635):—"We are consequently inclined to side with those investigators who regard the Arachnids and the rest of the air-breathing Arthropods as two distinct series, and therefore also assume a separate origin of the tracheæ in these two divisions."

If now, on the basis of what I have already stated, which has also appeared in my paper published in Russian, we attempt to cast a glance at the organization of the hypothetical primitive type of the Arachnids (*Protarachnon*), our conception of it must assume the following shape:—

PROTARACHNON.—In the general configuration of its body the animal must recall the fossil *Slimonia*; the body was divided into two sections, the cephalothorax and the abdomen; the segments of the cephalothorax were fused together, but

* [The author here quotes an erroneous supposition of Kingsley's, as is evident from Bernard's "Vestigial Stigmata in the Arachnida," which appeared in this Magazine in August 1894 (*Ann. & Mag. Nat. Hist.* ser. 6, vol. xiv. pp. 149-153: *cf.* especially pp. 150-151).—TRANSL.]

† The structural identity between the thoracic and abdominal tracheæ in *Galeodes* is pointed out by Bernard (No. 7, p. 521).

‡ The position of the stigmata in the Phalangidæ is apparently not yet precisely determined.

the last segment was separated from the remainder by a transverse groove. On the anterior border of the cephalothorax were situated the median eyes, and on the sides of the same region the lateral ones. The chelicerae placed in front of the mouth were feebly developed; the long pedipalpi served the creature for seizing its prey; the first segments of the pedipalpi and of the legs possessed masticatory processes, which bounded the oral aperture on both sides and behind. The last pair of legs served partly for swimming. The six anterior segments of the abdomen, which were provided with lamelliform appendages, were broader than the remainder, but the transition from the one group to the other was gradual; the last segment was expanded and ran out into a point. Among the abdominal appendages the first pair was very feebly developed, while the following pairs concealed small depressions, which were situated upon the ventral surface of the abdomen; into these depressions projected thin-walled branchial processes, proceeding from the surface of the appendages turned towards the abdomen. Upon the surface of the body, the last abdominal segment also not excepted, opened numerous unicellular dermal glands; in the cephalothorax these glands were united into groups, and possessed fairly long thin-walled excretory ducts; a pair of these glands at the base of the pedipalpi was especially strongly developed, and poured out a secretion which assisted in the process of digestion. Three pairs of strongly developed coxal glands were present and opened at the base of the first, second, and third pairs of legs. The genital aperture was situated between the appendages of the first abdominal segment. The form of the metastoma was cordate. The nervous system was suggestive of that of the Scorpion; the ganglion of the last pair of legs was probably not fused with the œsophageal ganglion; the ganglia of the chelicerae, partly also those of the pedipalpi, were situated on both sides of the œsophagus, so that the œsophageal commissures, just as in the existing Arachnids, were not developed. The development of the blood-vascular system was approximately the same as that in *Scorpio*; the anterior extremity of the many-chambered heart extended into the cephalothorax; the anterior aorta formed numerous ramifications beneath the external covering of the cephalothorax; in the abdomen the branchial vessels were strongly developed. The mid-gut was divided into numerous paired lobes, the anterior of which extended into the appendages; two small evaginations, proceeding from the hinder end of the mid-gut, served partly as excretory organs. The end-gut was a short and simple tube devoid of expan-

sions. The endosternite, from which sprang the dorso-ventral bundles of the cephalothoracic muscles, was strongly developed. The Protarachnon was a littoral form, which passed a portion of its life in the water and the remainder upon the land. Oviposition took place in the water; the development was accompanied by a post-embryonic metamorphosis.

From the above description it is evident that the hypothetical Protarachnon must have differed considerably from the primitive type of the other Tracheata. This difference must be acknowledged if the relationship of the Xiphosura to the Arachnida be assumed, since, according to this latter view, from the forms closely allied to the Protarachnon arose the branch of the Gigantostraca, which gave origin to the Xiphosura as a lateral offshoot. *Consequently the ancestral form of the Arachnoidea was an Arthropod, that of the group Peripatus + Myriopoda + Hexapoda, however, a Peripatus-like Land-Annelid.* This latter form differed but little and merely in a quantitative respect from the ancestral form of the whole of the Arthropoda. From the primitive Crustacea the existing Crustaceans as well as the Trilobites have been developed; the Protarachnon and the Gigantostraca, however, are a side-branch of the latter that split off at the commencement of or even before the Palæozoic era. The relation of the Protarachnon and the Gigantostraca to the Trilobites distinguishes the view expressed above from that of Ray Lankester. Without touching upon the relations of the Arachnida to the Crustacea, I will merely remark that this view differs altogether from that of those authors, who separate the Arachnids indeed from the rest of the Tracheata, but do not derive the Crustaceans from well-segmented Annelids (Fernald, No. 15, pp. 493-499; Oudemans, No. 51; and others). To me the paper by Oudemans (No. 51), in which much attention is devoted to the Acarina, is interesting. The author seeks to show the artificiality of the Arthropod type, and demonstrates the necessity of dividing it into certain independent groups. In his opinion the Trilobites + Xiphosura + Gigantostraca + Arachnoidea (not including Acarina and Tardigrada) form a perfectly separate group which commences with a hypothetical form, *Proagnostus*. This *Proagnostus* was the larval form of the whole of the Arachnida (*loc. cit.* p. 51); it differed from the *Nauplius* chiefly in the fact that it consisted of at least six fused postoral segments, and that the formation of the following segments proceeded far from the posterior end of the body. The conclusions of this naturalist are based only upon observations upon the metamorphosis of the palæozoic Trilobites (*Aagnostus*, *Phacops*); yet at this epoch the Gigantos-

traca as well as the Arachnoidea were completely differentiated and the postembryonic metamorphosis no longer pursued its primitive course, as is proved by the embryology of the Scorpion. The author takes cognizance of external characters alone, without touching upon the internal organization of the Arachnida or the Crustacea, or upon embryological facts. Greater interest for us is to be found in the circumstance that Oudemans professes to support Haller's attempt to separate the Acarina into an independent group—Acaroidea, Hall. Besides Haller's reasons, namely the arrangement of the mouth-parts, and in accordance therewith the different number of the appendage-bearing segments, the boundary between the cephalothorax and the abdomen (*i. e.* according to Haller between the second and third pairs of legs), and a hexapod larval stage (“*Caris*-stage”), Oudemans also states his own—the absence of the heart in the Acarina, the absence of the endosternite, and especially the position of the movable finger in the chelæ. The insufficiency of Haller's arguments has been demonstrated in my paper on the development of *Ixodes* (No. 66); as regards the arguments of Oudemans himself, however, only the last of them deserves attention. Yet naturally this one character without others is quite inadequate to separate the Acarina as a special group of the Arthropods. The first two arguments are, as is well known, according to the latest observations, false. If the author's last argument (*loc. cit.* pp. 45–46), namely that in all Crustacea, Pantopoda, and Acarina the movable joint or the finger of the chelæ is situated on the outer side, but in *Limulus* and all Arachnida (except the Acarina) is directed inwards, should be confirmed by further observations, two explanations are here possible. On the one hand, we might suppose, since certain forms of the Gigantostraca had no chelæ, that the alteration in the primitive relation of the two last joints of the feet to one another proceeded independently in the different groups of the Arachnoidea (and of the Crustacea)*; on the other, the chelicerae perhaps change their original position in the movement towards the front, as I have shown to be the case in the pedipalpi (No. 66, p. 67; the common base of the latter moves during development from the longitudinal into the transverse direction with reference to the primitive streak). The first explanation appears to me to be the more probable; in any case, the circumstance that pincers are an ordinary weapon of certain

* Certain Arachnids have, as is well known, no chelæ at all; their loss by these forms (*Araneina*, *Phrynus*, and certain *Acarina*) is only secondary.

appendages of the Crustacea and Arachnida, and in the other Tracheata do not occur at all, is not without importance. In cases in which structures of this kind are found in the latter also it is not the modified terminal segment of the appendage that plays the part of the movable joint, but a strongly developed thorn (a seta); in the contrary event, however, the penultimate segment forms no projecting process.

The Acarina are undoubtedly Arachnida, although greatly modified and divergent from the primitive type. In this divergence are expressed distinct signs of degeneration, and not a cessation in development, as Bernard (No. 5) considers. Bernard regards the Acarina as a fixed larval stage of the Arachnids (probably of the Araneæ); he finds, namely from instituting a comparison between the segmentation of the body in *Tetranychus tiliarum*, Herm., and in the Spiders (p. 281), that in the abdomen of the Acarina certain (seven) segments are wanting. These are situated between the segment bearing the genital aperture and the anal segment (in *Tetranychus* only a single segment is found here instead of the eight segments in the Araneæ). Owing to the absence of these seven segments Bernard demonstrates certain peculiarities in the internal organization of the Acarina; he compares the heart of the Acarina with that of the Araneæ, and finds that in the former precisely that portion of the heart (the first two chambers) is absent which in the Araneæ lies in the middle abdominal segments; he finds, too, that the same is the case with regard to the alimentary canal and the ventral ganglion. The Acarina differ from the Araneæ only in a quantitative, not in a qualitative respect. In Bernard's opinion, his view on the subject of the Acarina is confirmed by Winkler's statement as to a provisional fourth pair of legs (*Gamasus*) and the exclusively tubular, consequently, as Bernard believes, more primitive, tracheæ, the stigmata of which are situated in the cephalothorax far towards the front. My own observations upon the development of *Ixodes* have shown that Bernard's theory rests upon a false basis. The abdomen of the Acarina divides in the embryonic period into a larger number of segments; subsequently this number is reduced through fusion, but not through incomplete development; the segmentation of the body in the adult Acarina possesses no significance at all; further, the primitive genital aperture does not correspond to the definitive one. Bernard's considerations as to the form of the heart, of the alimentary canal, and of the nervous system consequently cannot be accepted. The author's view on the subject of the fourth pair of legs I do not clearly understand; his view as to the

tracheæ is contradicted by the circumstance that it is precisely in the Acarina, which are distinguished from the rest of the Arachnida by the position of the stigmata, that the tracheæ do not appear before the second postembryonic period; in the embryos and the hexapod larvæ they are totally wanting. In the given case, too, as in the speculation on the origin of the tracheæ, Bernard's reasoning is weak, and his criticism of already firmly established facts is insufficient or fails entirely. As I have already stated, like the majority of naturalists, I regard the Acarina as highly degenerate forms, whose degeneration is expressed mainly in the following peculiarities which they exhibit:—(1) The body is unsegmented, and all its sections are fused into one; (2) in connexion with this character the muscles of the body-walls have undergone degeneration; (3) the abdominal section is relatively insignificant; (4) in certain Acarina the claws on the legs are wanting; (5) the heart, when present, is of a peculiar form, in other cases it is absent; (6) the eyes are feebly developed or entirely wanting; (7) the coxal glands are absent; (8) the endosternite is wanting in many cases; (9) in certain cases the tracheæ are absent. Other characteristic features of the Acarina, such as the powerful development of the dorso-ventral bundles of muscles, the complete centralization of the nervous system, the exclusively thoracic position of the stigmata, the great development of the so-called Malpighian tubes, the form of the alimentary canal, the peculiar hexapod larval stage, and, finally, the great diversity of the forms, point to the fact that the Acarina are an extremely specialized type, and likewise deserve attention in analyzing their relations to the other orders of Arachnids.

With reference to this latter question, as also to the mutual relations of the Arachnidan groups in general, it must be admitted that our knowledge of the development, and even of the structure of the individual groups, is too slight to enable us to institute such comparisons upon a sound basis. It is only as a provisional theory that we can advance the one or the other view as to the relations of the various groups of Arachnids to one another. No greater assistance for the decision of the question is afforded by the discoveries of palæontology, since in the case of the majority of Arachnids exceptionally favourable conditions are needed for the preservation of the soft parts; this, too, is probably the explanation of the fact that, *e. g.* in the Mesozoic strata, fossil Arachnids (with the exception of a single doubtful specimen) are entirely wanting; Solifugæ are entirely unknown as petrifications, on the other hand Acarina, Pseudoscorpions,

and Phalangidæ (unquestionable forms) first occur in the Cenozoic deposits (Zittel, *loc. cit.*, adapted from Scudder). As I previously stated, it appears to me very probable that the Arachnida have divided into two branches; of these the one with the Scorpions at its extremity served to give rise to the Pedipalpi and the Araneæ, while from the other, in which forms standing midway between the Pseudoscorpions and the Solifugæ belong to the more primitive types, arose the rest of the Arachnida*. In the case of the former group there exists in the embryonic or even in the postembryonic period a distinctly segmented postabdominal division, while the function of respiratory organs is discharged by lungs (metamorphosed branchiæ) and partly by modifications of these organs (Dipneumones); in the latter no postabdominal division can be distinguished (with regard to *Chelifer*, cf. No. 66, pp. 157-158), the respiratory organs are represented exclusively by tracheæ, which moreover are not infrequently dendriform, while in many cases the stigmata are situated in the cephalothorax.

As to the mutual relations of the various orders in each of the groups mentioned, but especially in the second, we can in the present state of our knowledge of their development only form a partial judgment. In the first group the Araneæ, in the second the Acarina, are most divergent; in this way the relation of the Araneæ to the Scorpions in the first group is the same as that of the Acarina to the Pseudoscorpions and the Solifugæ in the second. If we disregard the little-studied Cyphophthalmidæ (and *Gibbocellum*), we may regard the Phalangidæ as a branch of the primitive stem of the second group of Arachnids, which separated at a very early period; their ancestors were probably very closely allied to certain Anthracomarti (families Architarbidæ and Eophrynidæ) † of the Coal-measures.

* The position of the Tardigrades is, as it seems to me, still altogether indefinite (*cf.* the parallels between the Tardigrades and Insect larvæ, as stated by von Kennel, No. 27).

† The order of Arachnids that occurs in the Coal-measures, the Anthracomarti of Scudder, is apparently an altogether artificial group. This is already indicated by the too considerable difference in the number of the abdominal segments in the various representatives of the group (in certain cases four, in others as many as nine), while a comparison of the various views on the subject of the Anthracomarti also leads to the same conclusion. Karsch (No. 23, p. 558) assumes, on the basis of his own observations, that through *Protolycosa* of the Carboniferous period and the existing *Liphistius*, *Anthracomartus* forms a direct transition to the typical unsegmented Araneæ, while he regards the interesting fossil *Kreischeria* as a form very near akin to the existing Troglidæ. By Haase (No. 17), however, the majority of Scudder's Anthracomarti are

It seems to me that only general observations such as these are possible in the present state of our knowledge of the development of Arachnids. Above all the development of the Solifugæ and Pseudoscorpions must be the subject of further embryological investigations. These must either confirm or overthrow the proposed division of the Arachnida into two branches, and must elucidate the relation of these forms to the Scorpion.

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assigned to the Phalangiidæ, while some are referred to the Pedipalpi, Araneæ, and Chernetidæ. Finally Scudder (Zittel, *loc. cit.*) assumes that the Anthracomarti (*sens. lat.*) were related to the Pedipalpi and the Chernetidæ (the resemblance between *Kreischeria* and the Pseudoscorpions was pointed out by H. B. Geinitz before the appearance of Karsch's paper).

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XXXVI.—*A List of the Scolytidæ collected in Ceylon by Mr. George Lewis, with Descriptions of new Species.* By W. F. H. BLANDFORD, M.A., F.Z.S., F.E.S.

BESIDES the large collection of Scolytidæ made in Japan by Mr. George Lewis, which has formed the subject of descriptive papers by myself, a smaller number were obtained by him in Ceylon and placed at the same time in my hands. They comprise some twenty-seven species, of which fifteen

have been identified with described forms; the remaining species, with the exception of one or two of doubtful character, I now describe. Two are referred to new monotypic genera, one of which, *Craniodicticus*, is interesting and of doubtful relationship.

Previous descriptions of Ceylonese Scolytidæ are due chiefly to Motschulsky and Walker. Those of the former author, though drawn up with some care, do not always indicate the essential diagnostic points, so as to form a reliable guide to identification. Those of Walker are, of course, useless, but his types are in the British Museum collection and a short account of them may be of service. Under the head of Tomicidæ he describes fourteen species (Ann. Nat. Hist. (3) iii. pp. 260, 261). Of these *Apate submedia*, *Bostrichus mutilatus*, *B. vertens*, and *B. moderatus* are Bostrychidæ. *Bostrichus testaceus* and *exiguus* belong to the genus *Xyleborus*. *Platypus minax* has been placed by Chapuis in *Crossotarsus*; *P. solidus* and *latifinis* are true *Platypi*. *Hylurgus determinans* is a Cossonid, *Hylurgus concinnulus* a *Phlæosinus*. *Hylesinus curvifer* belongs to *Diamerus*, Er. (*Acanthurus*, Eichh.). This species is also found in the Andaman Islands, and is probably the same as one of the two described by Eichhoff from Sumatra. *Hylesinus despectus* is a true *Hylesinus*, and *Hylesinus? irresolutus* is an Anthribid.

The following is a list of the species taken by Mr. Lewis:—

- | | |
|---|---|
| * <i>Craniodicticus mucronatus</i> , gen. et sp. n. | * <i>Xyleborus indicus</i> , Eichh. |
| <i>Hylesinus despectus</i> , Walk. | *— <i>interjectus</i> , Blandf. |
| <i>Phlæosinus detersus</i> , Chap. | *— <i>semitens</i> , sp. n. |
| * <i>Cryphalus vestitus</i> , sp. n. | — <i>perforans</i> , Woll. |
| *— <i>fuliginosus</i> , sp. n. | — <i>parvulus</i> , Eichh. |
| * <i>Cosmoderes monilicollis</i> , Eichh. | *— <i>dentatus</i> , sp. n. |
| * <i>Scolytomimus dilutus</i> , gen. et sp. n. | <i>Eccoptopterus sex-spinosus</i> , Motsch. |
| * <i>Dryocetes flavicornis</i> , sp. n. | * <i>Crossotarsus Saundersi</i> , Chap |
| (* <i>Xyleborus Lewisi</i> , Blandf.) | — <i>venustus</i> , Chap. |
| *— <i>asperatus</i> , sp. n. | <i>Platypus solidus</i> , Walk. |
| — <i>fornicatus</i> , Eichh. | — <i>latifinis</i> , Walk. |
| — <i>obliquecauda</i> , Motsch. | *— <i>uncinatus</i> , sp. n. |

The species indicated with an asterisk have not been previously recorded from the island. *X. Lewisi* was not taken by Mr. Lewis, but is inserted on the authority of an example in the collection of the Rev. H. S. Gorham. Two or three undetermined species of *Cryphalus* and one of *Hypothenemus* are omitted.

CRANIODICTICUS, gen. nov.

Caput globosum, exsertum; oculi ovales, lati, emarginati; antennæ breves, lateraliter insertæ, scapo clavato, funiculo paullo longiore, 5-articulato, articulo 1° magno, 2° obconico, ceteris transversis, latitudine haud crescentibus, clava ovali, haud compressa, tri-articulata, articulo 1° magno hemisphærico, sequentibus conjunctim longiore, his transversis latitudine subabrupte decrescentibus. Mentum ad basin angustum, versus apicem dilatatum, lateribus sinuatis; palpi labiales articulis 1°, 2° tumidis, 3° cylindrico.

Prothorax cylindricus, lateribus pro receptione femorum impressis, immarginatis.

Prosternum et mesosternum brevia, metasternum elongatum, episternis angustis. Abdominis segmenta 1^{um} et 5^{um} ceteris singulis longiora.

Coxæ anticæ magnæ, globosæ, distantes; intermediæ distantes. Femora compressa, anteriora medio dilatata; tibiæ breves, extus dilatata, ad apicem oblique truncata, margine externo subtiliter dentato; tarsi tibiis longiores, articulis 2 primis brevibus, 3° paullo longiore ad apicem incrassato, 5° ceteris conjunctim fere æquali.

Craniodicticus mucronatus, sp. n.

Elongatus, cylindricus, nitidus, parcissime pilosus, niger vel nigropiceus, tarsorum articulo ultimo testaceo; capite parce punctato, fronte medio impunctata, pilis cinereis brevibus circumdata; prothorace oblongo, angulis posticis rotundatis, lateribus mox ante basin constrictis inde subparallelis, dorso antice fortiter punctato, punctis posterius sparsis, postice lævi; scutello minuto; elytris prothorace duplo fere longioribus, basi truncata, lateribus subrectis, subdivergentibus, ad apicem abrupte inflexis, margine apicali crenato, subacuminato, ad suturam spinulis duobus truncatis armato, spinula recta majore, supra fortiter punctato-striatis, interstitiis angustis, convexis, in apice fortiter convexe declivi tuberculis piligeris instructis.

Long. 2-2.2 mm.

Hab. Ceylon, Dikoya. Several specimens.

The frontal area has, in addition to the marginal hairs, a very short pubescence in some examples, probably a sexual character. The prothorax is gently curved from base to apex and is slightly constricted behind the apex so as to embrace the base of the head; the punctures extend back along the sides to the hinder third, and the anterior border is, in addition, very finely reticulate and scantily hairy. The base of the elytra is not elevated above the prothorax; it is a singular feature that of the two small cylindrical spines which occur at the sutural angles of the elytra the right one is in all specimens stouter and twice as long as the left.

I can suggest no near relationship for this genus, which in the shape of the prothorax somewhat resembles *Chapuisia*, Dugès. It differs, however, in the structure of the antennal club and the much less elongate tarsi.

According to Mr. Lewis the specimens were taken in one of the creepers known as "jungle-rope."

Hylesinus despectus, Walk.

Hylesinus scobipennis, Chap. Syn. Scol. p. 30.

Hab. Ceylon, Balangoda. One example.

This may be identical with *H. granulifer*, Motsch. Chapuis refers the authorship of his name to Eichhoff, who does not, however, appear to have published any description of it.

Phlæosinus deterrentus, Chap.

Hab. Ceylon, Dikoya. Six specimens.

This species varies in colour from testaceous brown to piceous or black, with the antennæ and tarsi testaceous. It may be identical with *Holonthogaster nitidicollis*, Motsch. As with the preceding species, the authorship is ascribed by Chapuis to Eichhoff.

Cryphalus vestitus, sp. n.

Oblongo-ovalis, opacus, longe pilosus, fusco-piceus, antennis pedibusque fusco-testaceis; fronte punctata, medio transverse carinata, postice alutacea; oculis emarginatis; antennarum clava orbiculari, suturis valde curvatis; prothorace vix transverso, versus apicem angustato, dorso amplo convexo, anterieus tuberculis in plagam vix elevatam, postice rotundatam aggregatis scabrato, posterius granulose punctato; elytris ad medium subparallelis, subtiliter striato-punctatis, striis ad basin impressis, interstitiis planis, rugulosis, pilis seriatis versus apicem longioribus instructis.

Long. 2.2 mm.

Hab. Ceylon, Bogawantalawa. One specimen.

Among the largest species of the genus, and readily distinguished by the long dense pubescence. The transverse frontal carina is probably a sexual feature. The antennal club is large, and the sutures are so strongly curved that the basal joint is orbicular and the rest lunate; its surface is shining and finely alutaceous, with the sutural margins fringed. The greater or less curvature of these sutures has been employed for the separation of the genus into various subgenera; but these are of no value, except for the division of the European species. The curvature is always more marked on the upperside of the club.

Cryphalus fuliginosus, sp. n.

Oblongo-ovalis, opacus, fuligineo-fuscus, brevissime pilosus, antennis pedibusque ferrugineis, earum clava ovali, suturis mediocriter curvatis; prothorace subhemisphærico, antice constricto, lateribus modice, apice fortius rotundato, dorso gibboso, anterius plaga tuberculorum mox ad basin angulatim producta asperato, posterius lateraliter granulato; clytris prothorace sesqui amplius longioribus, ad medium subparallelis, supra convexis, subtilissime striatis, striis impunctatis, interstitiis planis, dense confuse punctatis, breviter fusco-squamosis et serie singula setarum per totum instructis.

Long. 2.1 mm.

Hab. Ceylon, Bogawantalawa. One specimen.

The body is covered with very short, close-lying, smoky brown, hair-like scales. The front has a short median longitudinal carina, and is finely and thinly pubescent. The sutures of the antennal club are less strongly curved above than in *C. vestitus*, and are nearly straight below. The elytral setæ are fine, short and inconspicuous. This species is separable from *C. vestitus* by the absence of long pubescence.

The collection contains two or three species of *Cryphalus*, which I leave undetermined. Eichhoff has described several from India and Burma, all on single specimens, which may be identical with some of these species; but as his types are not accessible, any attempt at identification would be unsatisfactory.

SCOLYTOMIMUS, gen. nov.

Caput rotundatum, obtectum; oculi ovaies, emarginati; antennarum scapus longus, funiculus perbrevis, 6-articulatus, articulis 3^o-6^m transversis, latitudine haud crescentibus, clava permagna, ovalis, compressa, solida, sutura unica obliqua in margine externo incipiente et medium attinente notata; mentum oblongum, lateribus incurvatis, ligula ovali medio inserta, palpis labialibus longis.

Prothorax transversus, semiorbiculatus. Scutellum magnum. Elytra depressa, posterius vix declivia. Abdomen versus apicem ascendens.

Coxæ anticæ approximatae; tibiæ compressæ, extus rotundatae, anticæ extus serratae; tarsi recepti, breves, articulis tribus primis æqualibus.

The antennal club is three times as long as the funiculus, irregularly oval, spongy, and pubescent, with a single conspicuous suture beginning on the outer edge near the base

and running obliquely to the middle of the club, where it ceases. The maxillary lobe is set with fine setiform spines, closer at the tip; the maxillary palpi have the first two joints transverse, the third more than twice as long as broad; the mentum is oblong, narrowed in the middle, with the sides incurved; the labial palpi are inserted close together, the first and third joints are longer than broad.

The genus is intermediate between *Xyloctonus*, Eichh., and *Scolytogenes*, Eichh., and presents the same *Scolytus*-like upward flexure of the abdomen. It differs from the former in the much larger oval antennal club and the undivided eyes, and from the latter in the six-jointed antennal funiculus. The maxillary armature is that of a xylophagous rather than a phloeophagous species; and these genera, which show certain affinities with *Trypodendron*, are perhaps wrongly placed near the *Cryphali*.

Scolytomimus dilutus, sp. n.

Oblongo-ovalis, opacus, glaber, fusco-piceus, elytris stramineis, antennis pedibusque testaceis; prothorace semiorbiculato, basi bisinuato, apice tuberculo unico exstructo, supra convexe gibboso ante basin transverse impresso, granulato, anterius tuberculis magnis, discretis exstructo; elytris prothorace sesquilingioribus, lateraliter ad medium rectis, inde rotundatis, apice medio haud profunde emarginatis, supra subdepressis, punctato-striatis, punctis magnis, interstitiis fere planis, angustis, confuse subtiliter punctulatis, 9° ad apicem elevato et cum margine laterali ad angulum emarginationis externum conjuncto. Subtus piceus, abdominis segmentis 2°-5^m transverse impressis, porcatis.

Long. 2 mm.

Hab. Ceylon, Bogawantalawa. Two specimens.

This insect can hardly be confounded with any other species except *Xyloctonus scolytoides*, Eichh., from which it differs by the generic characters, the very large scutellum, and the absence of costæ on the elytra.

Dryocætes flavicornis, sp. n.

Oblongus, cylindricus, sat nitidus, parce breviter pilosus, pedibus nigro-piceis, antennis tarsisque flavo-testaceis, fronte convexa, nitida, fortiter punctata, linea media subcarinata; antennarum scapo longo, clava ovali, compressa, haud evidenter articulata, ad apicem præcipue inferne pubescente; prothorace oblongo, mox ante basin latissimo, lateribus parum apice fortius singulatim rotundatis, angulis posticis obtusis, dorso leviter convexo, haud gibboso, asperato, tuberculis posterius subtilioribus, præter

lineam mediam obsolete; elytris prothorace duplo fere latioribus, lateribus rectis posterius subampliatis, apice rotundato, supra striato-punctatis, stria suturali profundius punctata, interstitiis angustis, subconvexis, transverse rugulosis, subtiliter uniseriatim punctatis, in declivitate subobliqua subtiliter pilosis et uniseriatim squamis erectis testaceis ornatis; tibiis angustis, anticis extus subrectis.

Long. 2.5 mm.

Hab. Ceylon, Bogawantalawa. One specimen.

On account of the absence of distinct sutures on the antennal club, the comparatively long and slender scape, and the slender tibiæ, I am in doubt whether this species should be associated with *Dryocates*. There is, however, no other genus in which it can be placed, and it approximates to certain species—*D. dinoderoides*, Blandf., &c.—also of doubtful systematic position, from Japan.

Its generic characters require to be fully ascertained by dissection.

Xyleborus asperatus, sp. n.

♀. Oblongo-cylindrica, piceo-nigra, parce longius pilosa, antennis pedibusque testaceis; fronte fortiter rugose punctata, linea media subelevata lævi; prothorace orbiculato, transverso, lateribus postice mediocriter antice cum apice fortius rotundatis; dorso convexo, opaco, medio transverse obtuse elevato, per totum asperato, tuberculis ante medium densis, postice sparsis subtilibus, interstitiis alutaceis; elytris prothorace duplo vix longioribus, lateribus post medium rectis, inde gradatim fortiter rotundatis, apice medio subtransverso, supra sat fortiter lineato-punctatis, lineis parum impressis, interstitiis angustis, subrugulosis, punctis setigeris vix subtilioribus notatis; declivitate convexa, subtus tenuiter carinata, præter suturam impressa, subtiliter striata, punctis obsolete, interstitio 2° sat fortiter trituberculato, ceteris piligeris.

Long. 2.4 mm.

Hab. Ceylon, Dikoya. One example.

This species is distinguishable by the finely asperate hinder half of the subglobose prothorax, the uniseriate punctures of the elytral interstices, and the convex declivity, which is impressed along the suture and bituberculate on each side.

Xyleborus interjectus, Blandf.

Hab. Ceylon, Galle, Kitugalle, Horton Plains; Chusan Is.; Japan.

The examples from Ceylon differ from those from China and Japan, from which I described the species, in the more

evidently impressed elytral striæ; the anterior margin of the prothorax is also a little more rounded.

These differences are hardly specific.

Xyleborus seminitens, sp. n.

♀. Oblonga, cylindrica, picea, breviter pilosa, antennis pedibusque ferrugineo-testaceis; fronte convexa, subglabra, opaca, subtiliter sparsim punctulata, ore ciliato; oculis oblongis, profunde emarginatis; prothorace oblongo, lateribus subparallelis, apice fortiter rotundato, angulis posticis obtusis; dorso ante medium transverse subelevato, anteriori asperato, posteriori subopaco, dense alutaceo et hinc illinc subtiliter punctulato; elytris prothorace vix tertia parte longioribus, lateribus ad medium parallelis, inde rotundatis, margine apicali singulo obliqua, subrecta, apice ideo acuminato; supra ante medium nitidis, lineato-punctatis, lineis parum impressis, punctis minutis postice subdilatis, interstitiis planis confuse subtiliter punctatis; declivitate ante medium incipiente, convexa, infra carinata, pruinoso-opaca, interstitiis tuberculis parvis setiferis uniseriatim instructis; tibiis extus rotundatis, subtilissime serratis.

Long. 3 millim.

Hab. Ceylon, Dikoya. Two specimens.

This species differs from any known to me in which the prothorax is subcylindrical by the acuminate elytra, the declivity of which is dull, with the interstices very finely and equally tuberculate.

Xyleborus perforans, Woll.

Hab. Ceylon, Dikoya, Balangoda; India, Madeira, &c.

I have elsewhere identified the Ceylonese species, which has been described by Walker under the name *Bostrichus testaceus* and by Eichhoff as *X. Kroatzi*, with Wollaston's *Tomicus perforans*. Possibly *Anodius tuberculatus*, Motsch., is a synonym of the same species.

Xyleborus parvulus, Eichh.

Hab. Ceylon, Kitugalle; India, Belgaum (*Andrewes*); Mauritius (*Eichhoff*).

The single example taken by Mr. Lewis differs from Eichhoff's description in being a little larger (2·3 millim.), rather darker in colour, in having the apex of the thorax somewhat transverse, in possessing no tubercle at the sutural angle of the elytra, whereas it has additional very fine tubercles on the first interstice before its declivous portion and on the third and fourth interstices.

These tubercles are more conspicuous in a still larger specimen (2.5 millim.) taken at Belgaum by Mr. H. E. Andrewes.

As Eichhoff has described under the name *X. dilatatus* a form from Mauritius which differs from the present species by characters precisely similar, it would appear that the two are merely varieties depending on the size of the individual.

Xyleborus dentatus, sp. n.

♀. Linearis, cylindrica, nitida, ferruginea vel picea, prothoracis basi rufescente, antennis pedibusque ferrugineis, parvissime longius pilosa; fronte subconvexa, rarius sat fortiter punctata, spatio medio subelevata lævi; prothorace oblongo, lateribus subparallelis, apice fortiter rotundato, dorso medio subnodoso, posterior nitido frequenter subtiliter punctulato, punctis in linea media et versus marginem basalem obsolescentibus; elytris prothorace sesquolongioribus, lateribus subparallelis posterior subangustatis, apice medio haud profunde emarginato; supra lineato-punctatis, linea suturali subimprensa, interstitiis planis vix perspicue seriato-punctatis, 1^o tuberculis 2 aut 3 minutis notato, declivitate excavato-retusa, obcordata, fundo subconcavo, nitido, lævi, ambitu utrinque bituberculato, tuberculis acutis.

Long. 3-3.3 mm.

Hab. Ceylon, Dikoya, Bogawantalawa. Several examples.

The hairs on the elytra are limited to a very few at the apex; the terminal excavation is not very oblique nor concave, its margin is raised and thickened, and the lower acute tubercle is situated somewhat within it. Between the upper and lower tubercles are usually situated one or two smaller denticles. The apical emargination is narrow and shallow, and the angles which it forms with the posterior margin are thickened, but not tuberculate.

The species appears allied to *X. fallax*, Eichh., which differs in possessing three spines on each side of the apical excavation which gradually increase in size.

Eccoptyterus sex-spinosus, Motsch.

Hab. Ceylon, Kitugalle, Dikoya. Four examples.

This insect appears to be widely distributed. It has been found in Ceylon, Damma Island, Burma, Borneo, Celebes, Batchian and New Guinea. Some specimens from the two latter islands possess one or two smaller spines on the lateral border of the elytral declivity. This is well-marked in a specimen from Borneo, which has five spines on each elytron. But these subsidiary denticles are not constant, nor even

symmetrical; and though they do not occur in any Ceylonese or Burmese examples, do not appear to be indicative of a new species.

In a previous paper on the Scolytidæ of Japan (Trans. Ent. Soc. 1894, p. 127) I suggested that there were grave doubts as to the accuracy of the application of the sexual characters throughout Chapuis's 'Monographie des Platypides.' The hesitation I then felt as to the necessity of reversing the sexual distinctions throughout his work has since been dispelled. Hopkins, in a paper on the sexual characters of North-American Scolytids as ascertained by dissection (Canad. Ent., Oct. 1894), reverses the sexes of the species of *Platypus* therein dealt with. I propose in future to do the same throughout the subfamily, with the exception, perhaps, of one or two monotypic genera which are not available for dissection.

Crossotarsus venustus, Chap.

Crossotarsus venustus, Chap. Mon. Plat. p. 88, ♂ (*lege* ♀).

♂. Ferrugineo-piceus, capite et elytrorum apice infuscatis; fronte subconcaua, opaca, posterius profunde punctata, striga media longitudinali impressa; vertice subopaca, subtilius irregulariter punctata, linea media nitida obsoleta; prothorace latitudine sublongiore, subtiliter irregulariter punctato, sulco brevi haud profundo, disco ante sulcum subimpresso; elytris lineato-punctatis, lineis ad basin impressis, interstitiis planis tenuiter lineato-punctatis, apice decliui, convexo, striato, interstitiis elevatis, seriato-tuberculatis et pilosis, angulis externis productis, margine externo singulo a lateris apice crena acuta separato, inde intus curvato, serrato, emarginatione media profunda, angulis suturalibus productis acutis, impressione apicali lunata, nitida, subconcaua.

Long. 4 mm.

Hab. Ceylon, Dikoya. A pair.

The male, the characters of which must refer the species to the *Crossotarsi subdepressi*, appears to be nearly allied to *C. terminatus*, Chap., which it resembles in shape, having the apical processes of the elytra incurved and separated by a narrow deep emargination. It differs from the description and figure of that species (I have not seen the type) in the fact that the elytra are abruptly narrowed at the commencement of the declivous portion, the outer margins of which are separated from the sides by a sharp toothed angle.

Platypus solidus, Walker.

♂. *Platypus solidus*, Walk. Ann. Nat. Hist. (3) iii. p. 261; Chap. Mon. Plat. p. 267, ♀.

♀. *Platypus pilifrons*, Chap. Mon. Plat. p. 265, ♂.

Hab. Ceylon, Dikoya, Colombo; India, Belgaum, Kanara (*Andrewes*). Generally distributed through the Oriental region.

The numerous examples I have seen of *P. solidus* and *P. pilifrons* taken together in different localities in India, Ceylon, &c., satisfy me of the correctness of Chapuis's supposition that they are sexes of the same species.

Platypus furcatus, sp. n.

Piceus vel ferrugineo-piceus, prothorace suboblongo; elytris striato-punctatis, apice infuscato, breviter piloso.

♂. Fronte subconcava, opaca, rugosa; prothorace sparsim fortiter punctato, punctis ad apicem et in medio ante sulcum confertioribus, sulco brevi, anteriore latiore; elytris ad apicem attenuatis et in processu productis, interstitiis vix convexis, subimpunctatis, 2° præter limbum internum seriato-punctato, in apice obliquo opacis pilosis, striis obsoletis; processibus declivibus, divaricatis et angulo acuto separatis, desuper aspicienti triquetris, spinula media longiore.

Long. 4.5 millim.

♀. Fronte latiore, concava, subopaca, rugulosa; prothorace sparsim subtilius punctato, sulco congerie lata cordiformi punctis inæqualibus anterioribus majoribus composita circumdato; elytris elongatis, prothorace duplo amplius longioribus, interstitiis convexis, haud alternatis, ad basin modo punctulatis, 3°, 5° ibi elevatis, transverse granulatis; apice rudi, striis oblitteratis, impressione postica in singulo elytro æque longa quam lata, granulata, subtus impressa, margine apicali convexo.

Long. 4.6-4.8 mm.

Hab. Ceylon, Dikoya. Several examples.

This species is intermediate between *P. oxyurus*, Duf., and *P. solidus*, Walk., and requires careful discrimination from either. The male differs from *P. oxyurus* ♀ by its shorter prothorax, less convex elytral interstices, and by the apical processes appearing simple when viewed from the side, triquetrous from above; in *P. oxyurus* the reverse is the case. From *P. solidus* ♂ it is distinguished by greater length, coarser thoracic punctuation, indistinct punctuation of the elytral interstices, and the divergent apical processes. It is smaller than *P. Severini*, Blandf., has a narrower, more scantily and coarsely punctured prothorax; the elytra are more attenuate behind, the apical processes are longer, more

acute, and less divergent, for in the latter species they are separated by a broad arcuate emargination.

The female differs from *P. oxyurus* ♀ by the front being shorter, more concave, and less coarsely punctate, the eyes less prominent, the prothorax shorter, with the discoidal cribriform patch broader, and by the absence of an apical tooth to the elytra; from *P. solidus* ♀ by its darker colour, more elongate form, less concave front, the absence of granules at the base of the fourth interstice, the greater depth of the elytral striæ, and consequent convexity of the interstices.

Chapuis had much reluctance in associating the Pyrenean *P. oxyurus* and the Oriental *P. solidus* in the same group, on account of their geographical remoteness and the difference in the shape of the mentum in the female.

P. furcatus is not only intermediate in form, but the female agrees strictly with *P. oxyurus* in the form of the mentum; and his grouping is therefore entirely justified.

Platypus latifinis, Walk.

♂. *Platypus latifinis*, Walk. Ann. Nat. Hist. (3) iii. p. 261.

Platypus excavatus, Chap. Mon. Plat. p. 280, ♀.

♀. Elongata, testacea vel fusco-testacea, elytrorum postica parte obscuriore; fronte oblonga, subconcaeva, fortiter sparsim punctata, striga mediana brevi notata; prothorace oblongo, sat subtiliter irregulariter punctato, sulco brevi, tenui, plaga magna orbiculata punctis antierius paullo fortioribus composita circumdato; elytris subtiliter lineato-punctatis, interstitiis planis subimpunctatis, 3°, 4°, 5° ad basin elevatis granulatis, impressione postica verticali, impressa, granulata, margine inferiore arcuatim exciso, in singulo elytro quam margine suturali brevior.

Long. 4·7 mm.

Hab. Ceylon, Kitugalle; a pair. India, Belgaum, Kanara (*Andrewes*); Burma, Bhamo (*Fea*).

The length and darker colour will separate the female from that of any other described species in the *Platypini cupulati* except *P. cupulatus*, Chap. It is rather more slender than that insect, has a more concave and sharply defined frontal area; the prothoracic cribriform patch is shorter and wider, more closely and finely punctured, like the rest of the pronotum. The base of the third interstice is raised for a longer distance, and the interstitial punctures are so weak as to be practically non-existent. A typical example of *P. cupulatus* ♀ shows a well-marked fovea on the apical impression just within each sutural angle, which is absent in both females of

P. latifinis before me. Nevertheless, even with the assistance of types, the females of the two species must remain very difficult to distinguish.

Platypus uncinatus, sp. n.

Linearis, testaceus, capite et elytrorum apice fusco-piceis, his ante medium pallidis, tenuissime lineato-punctatis, prothorace latitudine sesquilingiore sat subtiliter irregulariter punctulato; femoribus anticis subtus fortiter angulatis et ad apicem lobatis.

♂. Fronte subopaca, fortiter sparse punctata, striga brevi mediana impressa; prothoracis sulco tenui, marginibus anterie punctatis; elytris præter suturam stria singula notatis, interstitiis planis, impunctatis, 3°, 5° ad basin elevatis conjunctis, punctatis; ante apicem valde constrictis, impressione postica lunata, nitida, utrinque impressa, ambitu superne transverso ad angulos suturales haud rotundato, extus ad angulos postremos acute productos subsinuato, emarginatione inferna sat profunda, lateribus et basi singulatim leviter curvatis, illis versus apicem subconvergentibus.

Long. 3·5 mm.

♀. Fronte minus opaca, striga media variabili; prothoracis sulco congerie punctorum angusta, oblonga, circumdato; elytris subpallidioribus, versus apicem subangustatis, stria suturali tenuiore, interstitio 3° ad basin granulato, depressione postica lunata, subnitida, sparse granulata, supra subcallosa, margine inferiore late arcuato, in singulo elytro quam suturali longiore.

Long. 3·7 mm.

Hab. Ceylon, Dikoya, Bogawantalawa; several examples. India, Belgaum (*Andrewes*).

A very distinct little species. The male is allied to *P. forficula*, Chap., but is less robust, shorter, and much darker at the apex of the elytra; the posterior impression is deeper, being about as long when measured along the suture as the length of the emargination below; this has the sides—that is, the inner margin of the apical processes—and the base (the lower apical border of the elytra) separately curved, the former being slightly convergent and unarmed. From *P. hamatus*, Blandf., and *P. calamus*, Blandf., it is at once separated by the fact that the upper margin of the posterior declivity is transverse and angulate, instead of being broadly and obliquely rounded off at the suture. The female is separable from those of the *Platypi cupulati* except *P. pallidus*, Chap., by the narrow, oblong, cribriform patch on the prothorax. From that species it differs in colour, in its greater length and tenuity, in the frontal striga, the extremely weak

lines of punctures on the elytra, and in the more strongly produced external apical angles (when seen from the side).

The specimens from Dikoya were taken on the Hadley Tea Estate at an elevation of 3800–4200 feet; those at Kitugalle and Balangoda at an elevation of 1700 feet; those at Bogawantalawa at 4900–5200 feet; those on the Horton Plains at 6000 feet approximately; and those at Colombo at sea-level.

XXXVII.—*Note on a West-African Apodal Batrachian hitherto confounded with Cæcilia seraphini of Aug. Duméril.*
By G. A. BOULENGER, F.R.S.

THE first-discovered West-African Cæilian was described in 1859 by Aug. Duméril. Several others have since been added. In the British Museum Catalogue, published in 1882, I mainly followed the arrangement proposed shortly before by Peters, whose classification was based on various morphological features unknown in the time of the Dumérils. Accordingly a specimen from Lagos was referred by me to *Hypogeophis seraphini*, as defined by Peters, whilst a West-African specimen of the genus *Uræotyphlus* was made the type of a new species, *Uræotyphlus africanus*.

Professor Vaillant having lately examined the Apodal Batrachians in the Paris Museum, informs me that A. Duméril's *Cæcilia seraphini* does not belong to the genus *Hypogeophis*, but to the genus *Uræotyphlus*, with which it agrees in the structure of the tentacle, the dentition, and the vacuity between the parietal and squamosal bones, at the same time sending me for the British Museum one of the type specimens of that species.

I now find that the *Hypogeophis seraphini* of Peters and myself is not only specifically different from *Uræotyphlus seraphini* of A. Duméril, but belongs to a distinct genus, defined below, and that *Uræotyphlus africanus* is the same as *U. seraphini*.

In a note published in 1880 (Sitzb. Ges. naturf. Fr. Berl. p. 55) Peters pointed out that his supposed *Hypogeophis seraphini* (from Cameroon) differs from *H. rostratus* in the large size of the mandibular teeth, of which there are as many as 14 or 15 in the second row, in this respect agreeing with the specimen from Lagos in the British Museum; and the new genus *Geotrypetes* was proposed. After examining the

skull of this *Geotrypetes*, I come to the conclusion that the genus is valid, for the squamosals are not in contact with the parietals, as in *Hypogeophis rostratus*. It may be thus defined :—

GEOTRYPETES.

(Peters, Sitz. Ges. naturf. Fr. Berl. 1880, p. 55.)

Squamosals separated from parietals. Teeth large, numerous in inner row of mandible. Eyes visible. Tentacle flap-shaped; tentacular groove horseshoe-shaped, situated below and behind the nostril. Cycloid scales imbedded in the skin.

A single species, from West Africa :—

Geotrypetes Petersii.

Hypogeophis seraphini, Peters, Mon. Berl. Ac. 1879, p. 937; Boulenger, Cat. Batr. Caud. Ap. p. 97 (1882).

XXXVIII.—Description of a new Snake from Borneo.

By G. A. BOULENGER, F.R.S.

Calamaria Brookii.

Rostral as deep as broad, the portion visible from above half as long as its distance from the frontal; frontal once and one fourth as long as broad, much shorter than the parietals, thrice as broad as the supraocular; a præocular and a postocular; diameter of eye equal to its distance from the mouth; five upper labials, third and fourth entering the eye; first pair of lower labials forming a suture behind the symphysial; two pairs of chin-shields, in contact with each other. Scales in 13 rows. Ventrals 147; anal entire; subcaudals 23. Tail obtusely pointed. Yellowish brown above, with five black stripes, the median the broadest and occupying one scale and two halves; head marbled with black; a black nuchal collar; two similar black bars on the tail, one at the base, the other near the end; outer row of scales, ventrals, and subcaudals yellowish white, the upper third of the outer scale black, otherwise unspotted.

Total length 220 millim.; tail 23.

A single male specimen, from Matang. Presented to the British Museum by H.H. Rajah Brooke.

XXXIX.—On the American Box-Tortoises.

By G. A. BOULENGER, F.R.S.

WHEN revising the Tortoises in 1889, I felt somewhat perplexed as to the taxonomic rank to assign to some of the forms of the genus *Cistudo* which had previously been described by Gray and Agassiz. With regard to Agassiz's *Cistudo ornata*, no doubt could be entertained that it fully deserves to be regarded as specifically distinct from *C. carolina*; the other forms, owing to the insufficient material at my disposal, I provisionally admitted as varieties, which, as I remarked, perhaps deserved to rank as species. Dr. G. Baur ('Science,' xvii. 1891, p. 190, and Amer. Natur. 1893, p. 677) has since shown that the latter alternative is the more correct, and pointed out various important additional characters by means of which the species may be easily distinguished. In the light of this latest information I have re-examined the specimens in the British Museum, and fully agree with Dr. Baur. Moreover, I may add that Mexico is inhabited by at least two species of the genus *Cistudo*, as evidenced by three specimens obtained in North Yucatan by Mr. Gaumer and presented to the Museum by Mr. Salvin. These specimens are not so perfect as might be desired; the skins have been dried, and all the bones, except the skulls, are wanting. Nevertheless they appear to show this difference from all the described species except *C. major*, that the digits are distinctly webbed, although a bony temporal arch is absent. The latter character was believed to be characteristic of the genus *Cistudo* until Dr. Baur pointed out the presence of a complete bony quadrato-jugal arch in *C. major*.

We may now distinguish six species of *Cistudo*, for the determination of which the following synopsis will be of service:—

I. Plastron completely closing the shell, without trace of a bridge; carapace with at least a trace of a vertebral keel; median fingers with three phalanges.

A. Digits shortly but very distinctly webbed; upper jaw notched in the middle, bicuspid.

A bony temporal arch	1. <i>C. major</i> , Ag.
No bony temporal arch; quadratojugal bone vestigial	2. <i>C. yucatanana</i> , Blgr.

B. Digits free or with a very indistinct web.

- Upper jaw notched in the middle, bicuspid ; hind limb with three clawed digits ; six vertebral shields 3. *C. mexicana*, Gray.
 Upper jaw notched in the middle, bicuspid ; hind limb with three clawed digits ; five vertebral shields 4. *C. cinosternoides*, Gray.
 Upper jaw without notch ; hind limb with four clawed digits 5. *C. carolina*, L.
- II. Plastron incompletely closing the shell, with a very short but distinct bridge ; no vertebral keel on the carapace ; fingers all with two phalanges 6. *C. ornata*, Ag.

In shape and size (length 145 millim.) the shell of *C. yucatanana* resembles more *C. carolina*, but it is, in one of the specimens, rather more elongate. The shields of the carapace are yellowish, bordered with dark brown and with small irregular brown spots, or nearly uniformly dark brown. The plastron is yellow with large dark brown blotches, or dark brown with the borders of the shields yellow.

The suture between the gular shields is longer than that between the pectorals, and that between the anal shields is nearly as long as the distance which separates them from the plastral hinge.

XL.—Description of a new Species of Helictis from Borneo.
 By OLDFIELD THOMAS.

THE genus *Helictis*, whose members range from Nepal and China to Java, has not hitherto been known to occur in Borneo, and Mr. Everett, to whom this fact was of course well known, was proportionally pleased when his collectors brought him from Mount Kina Balu four skins referable to this striking group of Carnivores. Two of these specimens have now been acquired for the British Museum, and prove to represent a new species, which I propose to call after its discoverer.

Helictis Everetti, sp. n.

Size small ; form, as judged by the skull, light and delicate. Coloration generally dark, the white markings of the head and neck less developed than in any other species known.

General colour above dark broccoli-brown (*Ridgway*), this colour running as usual on to the limbs, and extending on the belly, as in *H. orientalis*, nearly or quite to the middle line, the chin and throat, the axillæ, and the inguinal region, however, remaining orange or white. On the head the usual white interorbital patch is reduced to two small spots, each about one third of an inch square; the postorbital marking is a mere narrow line, sometimes almost obsolete; while the prominent nuchal line is reduced to a very narrow one, barely reaching to the withers and more or less interrupted altogether on the nape. Tail rather short, brown, its terminal half mixed with longer whitish hairs, but less profusely so than usual.

Skull light and delicate, with a slender conical muzzle; zygomata diverging backwards, less boldly expanded anteriorly than usual. Infraorbital foramina of medium size.

Teeth small, almost as small as in *H. moschata*, but of the rounded shape characteristic of *H. orientalis* and its allies (see measurements below).

Dimensions of the type (a well-made skin, apparently a male):—

Head and body 350 millim.; tail 130; hind foot 46; hairy part of sole 19.

Skull: extreme length from gnathion to occiput 72; greatest breadth 40·2; interorbital breadth 17·2; intertemporal breadth 15·7; breadth of brain-case 28·5; greatest mastoid breadth 32; palate length from gnathion 33; palate breadth between outer corners of $\underline{p.4}$ and $\underline{m.1}$ 18·4.

Teeth: $\underline{p.4}$, antero-posterior diameter 5·9, greatest oblique diameter 6·0, distance from antero-external corner to back of inner lobe 4·5; $\underline{m.1}$, greatest diameter 5·9; $\overline{m.1}$, length 6·0, breadth 2·8.

Hab. Mount Kina Balu, N. Borneo, about 4000 feet.

Type: B.M. 95.1.23.3.

This species seems on the whole, as is natural, to be most nearly allied to the Javan *H. orientalis*, Horsf., from which it may be readily distinguished by its smaller size, smaller teeth, and the reduction of the white head-markings.

XLI.—*Description of a new Species of Papilio from West Africa.* By HERBERT DRUCE, F.L.S.

Papilio phrynon, sp. n.

Allied to *P. ucalcyon*, Hewitson: primaries reddish brown, a cream-coloured bifid spot near the apex considerably larger

than in *P. ucalcyon*; a streak in the cell along the median nervure, below which, between the second and third median nervules, is a long angular-shaped cream-coloured spot, which extends almost to the outer margin; a cream-coloured spot about the middle of the inner margin, and a long broad spot joining it above the submedian nervure: secondaries golden brown, crossed above the middle by a wide cream-coloured band, which is much dentated on the outer edge; the inner margin of the wing thickly clothed with orange-yellow hairs. Underside: primaries very similar to the upperside, but paler in colour; secondaries paler than above, the veins all black, the basal portion of the wing deep reddish brown, not crossed by a light-coloured band, as in *P. ucalcyon*; a large black spot on the costal margin and a white dot at the base. Head, antennæ, and thorax black; abdomen brown, with a row of yellow spots on each side; legs black.

Expanse 4 inches.

Hab. Upper Congo (*Mus. Druce*).

This species is allied to *P. ucalcyon*, Hewitson, and *P. auriger*, Butler, but very distinct from either. *P. harpagon*, Grose Smith (*Ann. & Mag. Nat. Hist. ser. 6, vol. v. p. 224*), is the same as Mr. Butler's species, and therefore will not stand.

XLII.—*On the Development of the Shoulder-girdle of a Plesiosaur* (*Cryptoclidus oxoniensis*, *Phillips, sp.*) *from the Oxford Clay.* By C. W. ANDREWS, F.G.S., Assistant in the British Museum (Natural History).

THE structure of the pectoral girdle in the Plesiosauria has been the subject of much controversy, and various conflicting views as to the homologies of some of its parts are held. It is not, however, necessary here to recapitulate these different opinions, but for the present purpose it will be sufficient to mention that the chief points in dispute are:—(1) The nature of the anterior ventral bar of the scapula; (2) the homology of the anterior structure, which has been variously regarded as omosternalia or as the clavicular arch.

The abundant Plesiosaurian remains obtained by Mr. Leeds from the Oxford Clay near Peterborough render it possible to describe several stages in the growth of an Elasmosaurian type of pectoral arch, which seem to throw some light on the points at issue. The species, to which the remains here described belong, is the commonest of those found in the locality above

mentioned, and may be provisionally referred to the genus *Cryptoclidus**, a division established by Professor Seeley † for the reception of forms which are distinguished from *Murænosaurus* by possessing vertebræ with broader, shorter, and more concave centra, less cylindroid zygapophyses, and, in the cervical region, shorter neural spines; coracoids with large postero-lateral prolongations; clavicles which meet in the middle line, the interclavicle being absent; radius of great vertical depth and ulna transversely elongated. It is not clear whether Professor Seeley himself considers *Cryptoclidus* a distinct genus or merely a subgenus of *Murænosaurus*, since he speaks of it in both ways; but there can be no doubt that it is entitled to generic rank, since in the number and form of the cervical vertebræ the animals referred to it are totally different from the Murænosaurus; moreover, in the rest of the skeleton, *e. g.* the pectoral arch, constant differences can be detected.

The following diagnosis of the genus may be given, the characters being determined from the type of *C. platymerus* and other specimens in the Leeds collection:—Skull about one third of the length of the neck, with broad blunt snout. Mandible with very short symphysis. Cervical vertebræ 31–32 in number; centra short and with rather deeply concave oval articular surfaces, the width of which is considerably (as 7 to 5) greater than the length of the centrum; zygapophyses cylindroid, zygosphenal articulation well developed. There are 2 or 3 pectoral vertebræ and 21 or 22 dorsal, all with concave articular ends. There appear to be 3 or 4 sacral vertebræ, distinguished by bearing ribs, which are expanded at the outer ends and articulate partly on the centrum and partly on the neural arch. The abdominal ribs are very strongly developed and are arranged in about ten transverse rows, each consisting of a median piece and two lateral pairs. The chevrons, at least in the adult, impress the vertebræ both in front and behind them. In the adult the ventral rami of the scapulæ meet in median symphysis and extend back to meet the median anterior prolongation of the coracoids, closing the coraco-scapular foramina; anteriorly they extend beneath the clavicles. These latter are triangular membrane-bones which meet in median symphysis; there is no known interclavicle. The coracoids are very thick and massive in front,

* It is not improbable that this genus is identical with *Colymbosaurus*, established by Professor Seeley in 1874 on the evidence of a shoulder-girdle from Ely. If this should prove to be the case, the name *Colymbosaurus*, having the priority, must be adopted for these Plesiosaurs.

† Proc. Roy. Soc. vol. li. (1892) p. 145.

but thin posteriorly; their hinder outer angles are prolonged into short thick rod-like projections. The humerus when fully grown is immensely expanded at its distal end. The radius is very large and vertically elongate; the ulna very wide transversely. On the postaxial side of this latter there is usually a small ossification, which may fuse with it or with the ulnare, and in one specimen is in contact with the humerus; this bone may perhaps be regarded as a pisiform. In the pelvis the pubis and ischium met in the middle line in the adult, closing the obturator foramen. The ilium does not touch the pubis, a character, however, which seems to be universal among the Plesiosaurs. The femur is not nearly so much expanded distally as the humerus.

In a future paper I hope to give a complete account of some of the more important osteological characters of this genus.

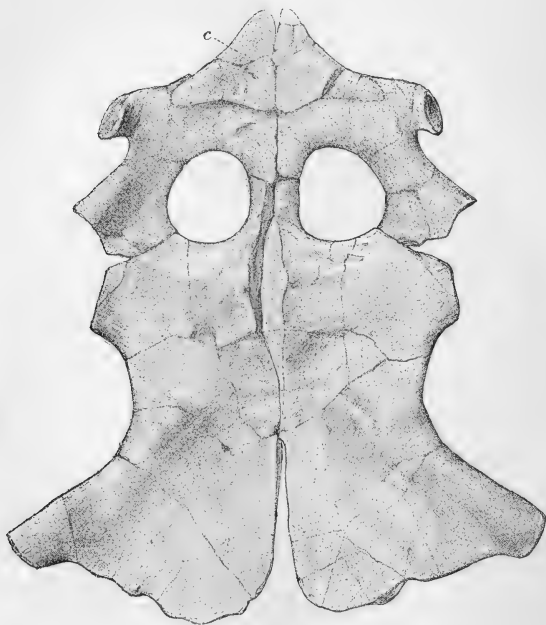
With regard to the specific name of this reptile there is some difficulty. Examination of a considerable number of more or less complete sets of associated bones shows that there are two forms possessing the generic characters given above and differing only in size when compared at corresponding ages as determined by the condition of the scapulæ, cervical ribs, &c. Mr. Leeds is of opinion that this may indicate the occurrence of sexual dimorphism in these Plesiosaurs, the larger bones, which are always proportionately more massive and possess more strongly marked surfaces for muscle-attachment, being those of males, while the smaller, more lightly built skeletons are those of females. Such sexual dimorphism does occur in reptiles; for example, it is well-marked in the case of *Sphenodon*, a circumstance of some interest, since that reptile shows some affinities with the Sauropterygia. At present, therefore, it seems best to refer all these remains to a single species, the name of which will be *Cryptoclidus oxoniensis*, this specific name having been applied by Phillips* to cervical vertebræ which differ only in size from those of *Cryptoclidus platymerus*, Seeley. Moreover, Phillips rightly referred to the same species scapulæ (described as ischia), dorsal vertebræ, and other bones which resemble those of the type specimen *C. platymerus*, but belonged to a younger individual.

Turning now to the description of the shoulder-girdle (fig. 1), and taking the adult condition first, we find that the scapula is of the usual triradiate form, consisting of a backwardly directed

* 'Geology of Oxford,' 1871, p. 307.

bar carrying the articular surfaces for the coracoid and humerus, an upwardly directed process, the blade, and a broad ventral ramus, which extends forward and inwards to the middle line, where it unites with its fellow of the opposite side.

Fig. 1.

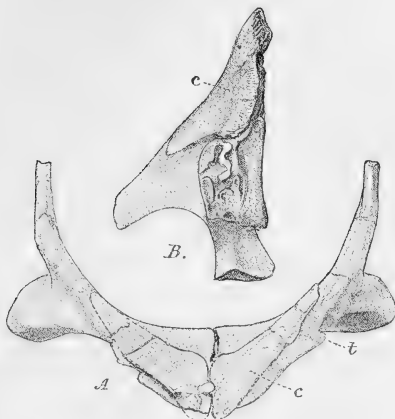


Shoulder-girdle of *Cryptoclidus oxoniensis* (adult), from above.
About $\frac{1}{2}$ nat. size. *c*, clavicle.

The posterior bar is triangular in section. Its inner edge forming the outer border of the coraco-scapular foramen is sharp, thickening slightly as it approaches the coracoidal surface; the upper outer border is rounded and passes into the posterior edge of the blade; the lower outer border rises into a rough ridge about 2 centim. from the glenoid surface, and then runs forwards and inwards, forming on the outer

surface of the scapula the boundary between the ventral and lateral regions of the bone; anteriorly it terminates at the edge in a strong outwardly directed tubercle (*t*, fig. 2 *A*) bearing a smooth facet at its summit.

Fig. 2.



A.—Scapulae and clavicle of *Cryptoclidus oxoniensis* (adult), from front. About $\frac{1}{3}$ nat. size. *c*, clavicle.

B.—Symphyseal surface of left scapula with clavicle (*c*) in position. About $\frac{1}{3}$ nat. size.

The surfaces for the humerus and coracoid meet at right angles in an irregular slightly concave line about 6.5 centim. long. The glenoid surface forms half a rather irregular oval measuring 6.5 centim. from the middle of the base to the vertex of the curve, while the coracoidal surface is an isosceles triangle, the sides of which are slightly convex and measure 8.2 centim. in length; the base is formed by the line of junction with the glenoid surface. This latter is fairly smooth, while the surface for the coracoid is extremely rugose.

The dorsal ramus of the scapula is compressed from within outwards and is from 4 to 5 centim. wide at the upper end, which is occupied by a rough depressed surface, to which a small suprascapular cartilage seems to have been attached. The anterior border, which is slightly convex, is rough, as if growth in that direction had not yet ceased.

The anterior ventral ramus is the largest and most important part of the scapula; its anterior border, a continuation of that of the dorsal ramus, is at first rounded and concave as far as the prominent tubercle above mentioned, then comparatively sharp and thin, running inwards and forwards till, by a sharp curve, it passes into the median border, with which it makes an angle of about 45° . The hinder border, forming the anterior as well as part of the inner edge of the coraco-scapular foramen, increases in thickness from without inwards and then backwards to the junction with the anterior prolongation with the coracoid, the surface for union with which is nearly semicircular and is at right angles to the scapular symphysis. This latter (fig. 2 *B*), which occupies the inner end of the thick posterior portion of the ventral ramus, forms a nearly rectangular surface, measuring 7 or 8 centim. long by 5 centim. deep; its anterior dorsal angle is rounded, while its anterior ventral angle is prolonged forward as the inner edge of the thin anterior portion of the ventral ramus. The symphyseal surface is deeply pitted and channelled by blood-vessels which passed into the thorax by a foramen between the two scapulæ at about the middle of the symphysis.

The outer surface of the ventral ramus of the scapula is nearly flat, but the visceral surface is divided into two areas—a high posterior portion, where the bone is very thick and convex antero-posteriorly, and a thin, depressed, slightly concave anterior area, which is triangular in form and is separated from the posterior portion by a step which runs directly outwards from the upper anterior angle of the symphysis. This anterior region of the scapula does not meet the corresponding portion of the opposite side in the oldest specimen I have been able to examine, but is separated from it by a narrow V-shaped interval. Probably the two sides were united by cartilage, and in very old individuals ossification may have extended inwards till they met in the middle line.

The above description is founded on a left scapula (R. 1966), which, with an associated complete clavicle, is preserved in the Leeds collection at the British Museum. Recently, on examining Mr. Leeds's private collection, I noticed a shoulder-girdle wanting the left scapula and clavicle, but found associated with numerous vertebræ and the greater part of the pelvis. Comparison of the two scapulæ shows that they are exactly similar both in size and in details of structure, even to the vascular impressions on the symphyseal surface, so that there can be no doubt that they belong to one and the same individual. The vertebræ and other bones present the

characters of the genus given above, and appear to have been portions of the skeleton of a large (? male) adult animal.

When the scapulæ are placed together in their natural position (fig. 2 *A*), a line drawn on their visceral surface from the tip of one dorsal ramus to the other forms an arc rather greater than a semicircle.

The left clavicle (the right is imperfect) is in the form of a scalene triangle (*c* in figs. 1 and 2). Its anterior and posterior borders are slightly concave and meet in the thickened and rounded outer angle. On the ventral surface of this latter are irregular rugosities, which fit into the depressions in a corresponding roughened area on the upper surface of the scapula near its outer margin, so that the two bones appear to have united at this point in an imperfect loosely connected suture: in some other specimens I have been able to examine this connexion seems to have been more perfect. This union of the clavicle with the scapula is a point of considerable interest, since in the Nothosauridæ and Lariosauridæ the outer end of the clavicle is usually suturally united with the ventral plate of the scapula. The inner border of the clavicle is somewhat thickened and has a bevelled edge by which the bone united with its fellow of the opposite side. This symphysial surface presents a ridged and fibrous appearance, quite unlike that found in the cartilage bones of these animals. In all the clavicles examined this inner border, at about one third of its length from the front angle, is divided into two portions by an oblique notch, which runs outward and backwards into the bone for some distance.

The clavicles of *C. platymerus* figured by Seeley are simply the parts of those bones which lie in front of this division, the remainder being lost. The significance of this notch is not clear; it may either have allowed the passage of a blood-vessel or may possibly mark the position of an interclavicle which has either escaped notice owing to its small size or never ossified. The greatest thickness of the clavicle is near the inner border, where it measures 1.5 centim. through; the whole surface is marked by lines of growth which radiate from the middle of the bone. Its dimensions are:—

	centim.
Length of anterior edge	17
" posterior "	14
" inner "	12

When the clavicle is in its natural position on the visceral surface of the scapula its hinder border rests against the front of the thick posterior portion of the ventral ramus of that bone, its anterior and inner portions extending rather

beyond the underlying thin portion of the scapula, so as to be visible on the ventral surface. Probably, however, in a later stage the scapula grew forward and inward, completely shutting in the clavicles and extending the symphysis of the scapulæ to their extreme anterior end. This appears to have taken place in the shoulder-girdle of *Colymbosaurus* figured by Seeley* and in that of *Elasmosaurus* figured by Cope †, in both of which genera, however, the clavicles are unknown.

The general form of the coracoids at this stage is shown in fig. 1. These bones are extremely thick and massive in the inter-glenoidal region, but further back become very thin except at the lateral borders, which are thick and rounded and are produced postero-laterally into short stout prolongations with truncated ends.

Successively younger stages may now be compared with the mature or nearly mature condition above described.

The first of these is represented by a left scapula, which, allowing for more imperfect ossification, closely resembles the last, and no doubt belonged to an individual of the same species. In this specimen the anterior ramus was already well developed and had grown back in the middle line for some distance towards the median prolongation of the coracoid, but had not yet quite reached it, as can be seen from the fact that it terminates posteriorly in a sharp edge. The symphyseal surface is marked with pits and vascular impressions, but probably was still separated from the scapula of the opposite side. The thin anterior portion of the scapula is much smaller than in the last stage, and does not extend so far forwards and inwards, so that the scapulæ were separated in front by a much more widely open V-shaped interval, and a much larger part of the clavicles would be visible from the ventral surface. The dorsal ramus is shorter and its anterior border was incompletely ossified. The clavicle is unfortunately wanting, but the impression of its posterior edge shows that it occupied exactly the same position in relation to the scapula as in the last specimen.

The next stage is represented by a shoulder-girdle (no. 05) in Mr. Leeds's collection (fig. 3 A) ‡; the left scapula only is wanting, but the bones are somewhat crushed. This crushing does not, however, affect the anterior ramus of the scapula,

* Quart. Journ. Geol. Soc. vol. xxx. (1874) p. 447.

† Trans. Amer. Phil. Soc. vol. xiv. (1870) p. 51, fig. 7.

‡ The clavicle should be placed a little further inwards than is shown in this figure.

the inner end of which must have been separated by a considerable interval from its fellow of the opposite side, and had not yet commenced to grow back towards the coracoids, so that the coraco-scapular foramina were widely open to one another in the middle line. Of the thin anterior portion

Fig. 3.



A.—Right half of an immature shoulder-girdle of *Cryptoclidus oxoniensis*, from above. About $\frac{1}{2}$ nat. size.

B.—Left half of a younger specimen of the same, from above. About $\frac{1}{2}$ nat. size. *c*, clavicle.

supporting the clavicles only a very small part near the outer border is yet developed, so that the whole of the clavicle except a small portion of the outer limb would be visible from below. As in the adult, the clavicles met in the middle line.

The coracoids, which must have been separated by a thick pad of cartilage, had commenced to grow forward in the middle line towards the scapulæ, and their anterior prolongation already extended considerably in advance of the surfaces for the scapulæ.

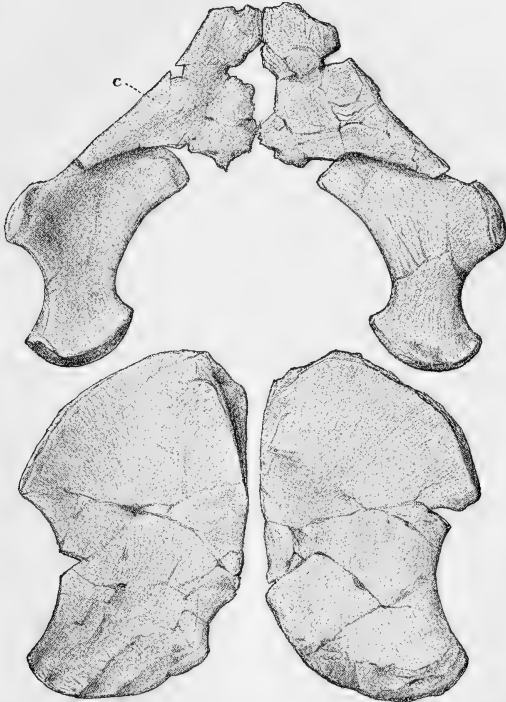
The next specimen (Leeds Coll. 37, R. 2416) is a shoulder-girdle wanting the clavicles and part of the right scapula, but found in association with the greater portion of the vertebral column, the paddles, and some of the pelvic bones, all of which, allowing for their immature condition, show the generic characters given above. At this age (fig. 3 *B*) the anterior ramus of the scapulæ is very incompletely developed, so that the two bones were widely separated in the middle line. On the upper surface of the thickened anterior edge is a slight depression, which comparison with older stages shows to be that occupied by the extreme outer angle of the clavicle, which in this stage therefore is entirely anterior to the scapula. The coracoids, which were of the form shown in fig. 3 *B*, had as yet not commenced to grow forward in the middle line, and their outer posterior angles were not prolonged into projecting processes.

The last pectoral girdle (Leeds Coll. 36, R. 2417) (fig. 4) is that of a young individual of the smaller (? female) type. The scapulæ show that it is in about the same stage of development as that last described, though considerably smaller. This specimen is here described and figured on account of its completeness and because it forms part of the nearly entire skeleton now mounted in the Gallery of Fossil Reptiles at the Natural History Museum*. The cervical vertebræ, abdominal ribs, &c. all agree essentially in structure with the type specimen of *Cryptoclidus platymerus*. The clavicles are of the same form as the adult specimen described above, but smaller and very much thinner. The structure of their inner border shows that they already met in median symphysis, at least in front. The extreme end of the external angle is broken away, but the ventral surface at the fracture shows the beginning of the rough surface of contact with the anterior border of the scapula. This latter is in much the same condition as in the stage last described, but is perhaps a little older. The coracoids also are very similar to those last described.

* The clavicles of this specimen have been figured by Professor Seeley under the name *Plesiosaurus durobrivensis* in the 'Proceedings of the Royal Society,' vol. li. (1892) p. 133, fig. 5, where also other parts of the skeleton are described and measurements given.

Although the elements of this pectoral arch are free from matrix, and in no way united with one another, there can be little doubt that the figure represents very nearly their relative position during life. In the first place, the fact that the clavicles met in the middle line is shown by the structure of

Fig. 4.



Complete shoulder-girdle of a young specimen of *Cryptoclidus oxoniensis* (Leeds Coll. 36). About $\frac{1}{3}$ nat. size.

their median border; in the next, the position of the outer ends of the clavicles with regard to the scapulæ is settled by the depression on the anterior border of those bones into which the outer part of the hinder edge of the clavicle fits,

and, as was mentioned above, a rough surface marks the exact position on the scapulæ of the outer angle of the clavicles. The relative position of the scapulæ to one another is thus fixed, and that of the coracoids is easily determined.

It may here be remarked that in comparing scapulæ of these animals at different ages, one circumstance is of great assistance, namely that the inner edge of the bone forming the outer border of the coraco-scapular foramen undergoes scarcely any growth during life except at the ends, this thin sharp edge in the adult scapula being the thin edge of the young stages almost unchanged. If, therefore, in comparing an older and a younger scapula the latter be superimposed upon the former, so that the corresponding portions of their inner borders are coincident, the area added to the older bone since it was in the condition of the younger one is clearly seen.

Turning now to the consideration of the conclusions that may be drawn from an examination of the series of shoulder-girdles above described, we find that in the condition shown in fig. 4 the pectoral arch, as far as its ossified portions are concerned, is similar in all essential respects to that found among the Nothosauridæ and Lariosauridæ, the scapulæ consisting of a hinder portion bearing the surfaces for articulation with the coracoids and humerus, a dorsally directed blade, and an anterior ventral portion, against the anterior edge of which the hinder end of the clavicle was fixed, the two bones apparently uniting in a rude suture, as has been already pointed out; in many members of the families above mentioned the sutural union of scapula and clavicle is very perfect. The clavicles, as in the Nothosauridæ and Lariosauridæ, met in median symphysis, but, owing to the antero-posterior expansion of their inner ends and the absence or reduction of the interclavicle, their symphysis is much longer. The close union of the clavicles with one another and with the interclavicle at their inner ends, and with the scapulæ at their outer ends, among the Nothosauridæ and Lariosauridæ seems to imply the mechanical necessity of great rigidity in the ventral portion of the pectoral arch of these swimming reptiles, and the changes undergone by the shoulder-girdle of *Cryptochidus*, in its passage from its immature condition to the adult state, all tend to render this rigidity more perfect. For instance, in the stage shown in fig. 3 A the ventral plate of the scapula is growing inward towards the middle line behind the posterior edge of the clavicle, and near the outer border it is sending a plate

forward beneath the same bone, both tending to increase the firmness of their union by adding to the surface in which they are in contact. The continued extension inwards of the ventral bars of the scapulæ finally brings about their union in the middle line, and at the same time their extension forwards beneath the clavicles gradually shuts these bones off from the ventral surface, so that we are met by the anomalous condition of the membrane-bones lying on the inner side of bones developed from cartilage. That this condition is a purely secondary one is clear from the foregoing description, so that the argument that the elements in question cannot be true clavicles on account of their deep-seated position falls to the ground.

It is evident that when the ventral rami of the scapulæ have once met in the middle line, they usurp the function of the clavicular arch as anterior ventral support of the pectoral girdle to a gradually increasing extent; this may account for the reduction and great variability of the clavicles in some forms (e. g. *Murænosaurus*, in which an interclavicle is present). For the same reason the eventual disappearance of the clavicular arch is very probable, and appears to have taken place in the Cretaceous genus *Elasmosaurus*.

The changes undergone by the coracoids during growth also tend to increase the rigidity of the girdle. Their median symphysis is gradually prolonged both backwards and forwards; in the latter direction it is carried far in advance of the glenoid cavity, and finally becomes continuous with the scapular symphysis, so that in the adult the scapulæ and coracoids form a continuous union in the mid-ventral line from one end of the pectoral girdle to the other.

How far the above explanation of the peculiarities of the Elasmosaurian pectoral girdle applies to other types of structure, such as those occurring in *Pliosaurus* and *Plesiosaurus*, cannot now be considered; but there appears to be no reason why they should not be regarded merely as less specialized conditions of the same kind of modification.

As to the homology of the ventral ramus of the scapula, there seems no reason whatever for considering it to represent a precoracoidal element fused to the scapula, all the facts leading to the conclusion that it is merely a secondary outgrowth from the latter. That this outgrowth is homologous with the ventral ray of the Chelonian scapula is highly probable; and if it be so regarded, it is interesting to note that while in the Plesiosaurs it lies ventral to the clavicular arch, in the Chelonia it is dorsal to it (*i. e.* to the entoplastron and

epiplastra). The name "proscapula," as suggested by Baur*, may be applied to this process both in the Chelonia and in the Sauropterygia; but since, as Professor Howes has pointed out to me, the use of the term as a substantive is open to the objection that it implies the existence of a distinct element, it will be better to speak of it as the "proscapular process."

XLIII.—*Report upon the Chilopoda and Diplopoda obtained by P. W. Bassett-Smith, Esq., Surgeon R.N., and J. J. Walker, Esq., R.N., during the Cruise in the Chinese Seas of H.M.S. 'Penguin,' Commander W. U. Moore commanding.*
By R. I. POCOCK, of the British Museum of Natural History.

[Plate XI.]

THE following report is based primarily upon the species of Chilopoda and Diplopoda obtained by Messrs. J. J. Walker and P. W. Bassett-Smith during the cruise of H.M.S. 'Penguin' in the Chinese Seas. But, to render the account of further interest and value, notices have been incorporated of all the Japanese and Chinese species of these two groups that are contained in the British Museum, including descriptions of a large number of new forms obtained by Mr. Holst principally in the islands of Loo-Choo and in Formosa. It is hoped that by this means the paper may prove to be an index of the affinities of the Chilopod and Diplopod fauna of the Chinese area.

So far as can at present be judged from the material at my disposal, this fauna is a most curious mixture, being identical in most of its features with that of the central and southern part of the United States of America, with an infusion from the Indo-Malayan area of the Oriental Region and from the southern and central portions of the Palæarctic.

Taking first the Chilopoda, it seems evident that such forms as *Scutigera clunifera*, *Scolopendra morsitans* and *subspinipes* (with its varieties), and the species of *Otostigmus* are migrants from the Oriental Region; the Lithobiidæ are both Palæarctic and North American, while *Otocryptops sexspinus* is essentially a North-American species. In the Diplopoda the species of *Polydesmus* and of *Iulus* show affinities with both

* Proc. Acad. Nat. Sci. Philadelphia, 1891, p. 421.

the Palæarctic and North-American areas; the species of *Orthomorpha* and *Strongylosoma* seem to indicate an Oriental infusion, while *Fontaria*, *Paraiulus*, and *Spirobolus* are decidedly North-American elements.

Thus, on the whole, the North-American character predominates in the Chinese fauna; but it is interesting to note that Dr. Wood long ago described from Hong Kong a species of the genus *Glomeris*, which belongs to a family that is wholly unknown in North America, but is abundant in the temperate parts of Europe. The genus *Glomeris* is also found in South Burma, Sumatra, and Borneo; and the fact of its having been turned up in Hong Kong seems to point to the conclusion that it has made its way southwards into the Indo-Malayan area by the Chinese route.

CHILOPODA. (CENTIPEDES.)

Family Scutigeriðæ.

Scutigera longicornis (Fabr.), subsp. *clunifera* (Wood).

For descriptions and the synonymy of *longicornis* and *clunifera* see Haase, 'Die Indisch-Australischen Myriopoden,' pt. i. pp. 17-19.

Loc. Hong Kong (in a drain-pipe); Hang Chau in Che Kiang (*J. J. Walker*); Fatshan, 20 miles up the Pearl River beyond Canton (*Bassett-Smith*).

The wide-ranging Oriental species *S. longicornis* is the largest of the genus, and it appears to attain to its greatest dimensions in China and Japan. The specimen obtained by Mr. Bassett-Smith at Fatshan is, I believe, the largest on record; it is 63 millim. (over $2\frac{1}{4}$ inches) in length.

The prevailing colour of the upper surface appears to be a deep green, often tinged with or passing into brown; the saddles are very conspicuous on account of their large size and their yellowish-red colour; the legs are either pale or deep green or brown, sometimes obscurely annulate, with ferruginous tarsi.

Dr. Haase regarded *clunifera* and *longicornis* as distinct species. I cannot, however, at present quite adopt this view; but, upon the possibility of the species being ultimately capable of division into local races, I provisionally retain Wood's name for the Chinese form of it.

In addition to the specimens obtained at the above localities, the British Museum has others from the following places in

the Chinese area:—Central Japan, Oö-Sima (Loo-Choo), Shanghai, Kinkiang, Kinkiang Mountain.

Scutigera tuberculata (Wood).

Cermatia tuberculata, Wood, J. Ac. Philad. (2) v. p. 12 (1863).

Scutigera cæruleo-fasciata, L. Koch, Verh. z.-b. Wien, 1868, p. 787.

Loc. Hang Chau, province of Che Kiang (under loose bark) (*J. J. Walker*).

This species may be readily recognized from the preceding by its much smaller size (20–25 millim.), its variegated green and whitish colouring, its low and inconspicuous saddles, short tracheal apertures, &c.

I have also seen specimens of this species from the following places:—Tsu-Shima (*P. A. Holst*); Corea (*J. Kalinowski*); S.E. Corea (*A. Carpenter*); Che Foo, N. China (*Miss Macomish*).

In the bottle containing the specimens collected by Commander Alfred Carpenter there is a label stating that when living this species is “mottled white and bluish grey.”

Family **Lithobiidæ**.

Lithobius asperatus, L. Koch.

Lithobius asperatus, L. Koch, Verh. z.-b. Wien, xxvii. p. 788 (1878).

Lithobius thetidis, Karsch, Zeitschr. f. Nat. Halle, liii. p. 848 (1880).

Loc. Da-zeh Valley, 60 miles inland of Sam-Moom Bay, Che Kiang (*P. W. Bassett-Smith*).

The British Museum also has specimens from S.E. Corea (*A. Carpenter*).

Lithobius, sp.

A single mutilated example of this genus, obtained by Mr. Bassett-Smith in Da-zeh Valley, cannot be satisfactorily determined. The antennæ and most of the legs are gone. Eyes of about 9 ocelli, in a subcircular cluster. The ninth, eleventh, and thirteenth tergites have their posterior angles produced, the angles of the rest are nearly squared and the posterior borders not or hardly emarginate. Coxal teeth of the maxillipedes are strongly produced and furnished with 2+2 large teeth and a smaller external tooth. Coxal pores rounded, uniserial, 3 or 4 in number.

Length 12 millim.

* [*Lithobius shimensis*, sp. n.]

Pale-coloured, of very small size.

Antennæ composed of 19 segments.

Eyes composed of a small number of ocelli (5 or 6) arranged in two rows.

Coxæ of maxillipedes anteriorly truncate, armed with 4+4 acute subequal teeth.

Terga rather strongly wrinkled, the eighth, tenth, twelfth, and fourteenth posteriorly emarginate, the ninth, eleventh, and thirteenth with their posterior angles dentate.

Coxal pores few in number, circular, and arranged in a single series.

Anal legs moderately robust; claw single; armed beneath 0 (coxa), 1, 3, 2, 0.

Generative forceps of the female armed with two pairs of spurs and with trilobate claw.

Length 7 millim.

Loc. Tsu-Shima (*Holst Coll.*.)]

[*Lithobius Holstii*, sp. n.]

Colour castaneous, pale yellow below.

Antennæ hirsute, composed of 19 to 21 segments.

Eyes composed of about 6 ocelli arranged in two rows.

Coxæ of maxillipedes produced and armed with 2+2 conspicuous teeth.

Tergites moderately smooth, all the angles squared or nearly so.

Coxal pores round, in a single series, 3, 4, 4, 4.

Anal legs armed beneath 0, 1, 3, 2, 0; claw with a basal spur.

Generative forceps of the female with two large diverging basal spines and the claw obsoletely trifid.

Loc. Ashinoju, Japan (*Holst Coll.*). Also a mutilated specimen of what is possibly the same species from Tsu-Shima.]

The three species here named may be recognized as follows:—

- a. Coxal pores very numerous and arranged in several series..... *asperatus*, L. Koch.
 b. Coxal pores few in number and arranged in a single series.
 a¹. Terga wrinkled, mostly emarginate, the ninth,

* Species not obtained during the cruise of the 'Penguin' are placed within brackets.

- eleventh, and thirteenth with their posterior angles acutely produced; coxal teeth 4+4 . . . *shimensis*, sp. n.
 ♂¹. Terga not or hardly wrinkled, their posterior angles squared and not produced; coxal teeth 2+2 *Holstii*, sp. n.

Family Scolopendridæ.

Scolopendra subspinipes, Leach, subsp. *De Haanii*, Brandt.

Loc. Hong Kong (*J. J. Walker*). A single example obtained under a stone near the summit of the island, 1700 feet alt.

Subsp. *mutilans*, L. Koch.

Loc. Tung Yung Island; Chusan and Hong Kong (*J. J. Walker*).

The *mutilans* form of *S. subspinipes*, characterized by the deep green colour of the body and the chestnut tint of the head and first segment, takes the place in China and Japan of the typically coloured southern form, *subspinipes*, s. s.

The British Museum has specimens from the following localities:—S.E. Corea; Japan, S. Japan, Nikko (Central Japan), Yokohama; Snowy Valley in Ningpo, King Kiang, Chung Yung, Kwan Gan-kway, in China; Great Loo-Choo, Tsur Island, and Formosa (*Holst Coll.*).

Of the form *japonica*, L. Koch, which differs from *mutilans* in having the head and first tergite entirely green like the rest of the body, the Museum has examples from Oö-Sima, Loo-Choo (*A. Carpenter*); Tokio, Japan, and Tsu-Shima (*Holst*).

[*Scolopendra morsitans*, Linn.

Loc. Great Loo-Choo (*Holst Coll.*.)]

Otostigmus orientalis, Porath.

Otostigmus orientalis, Porath, Bih. Sv. Vet.-Akad. Handl. iv. no. 7, p. 19.

Loc. Manilla (*J. J. Walker*).

[*Otostigmus scaber*, Porath.

Otostigmus scaber, Porath, Bih. Sv. Vet.-Akad. Handl. iv. no. 7, p. 20.
Otostigmus carinatus, id. *ibid.*, and of all authors.

Loc. Oö-Sima (*A. Carpenter*); Hong Kong (*J. C. Bowring*).

This species has generally been known under the name

carinatus; but there seems to me to be no satisfactory reasons for regarding *scaber*, which was described first, as a distinct form.]

[*Otostigmus aculeatus*, Haase.

Otostigmus aculeatus, Haase, Die Ind.-Austral. Chilopoden, p. 71, pl. iv. fig. 69.

Loc. Hong Kong (*J. C. Bowring*).]

[*Otostigmus politus*, Karsch.

Otostigmus politus, Karsch, Berlin. ent. Zeitschr. xxv. p. 219 (1881).

Loc. Peking.]

[*Otocryptops sexspinosus* (Say).

Scolopocryptops sexspinosus (Say), Newport, Wood, Bollman, Meinert, &c.

Otocryptops punctatus, Pocock, Ann. & Mag. Nat. Hist. (6) viii. p. 159 (1891).

Loc. S.E. Corea (*A. Carpenter*); Tsu-Shima (*Holst*).

This species furnishes a remarkable instance of resemblance between the fauna of China and Japan and that of the United States of America.]

[*Otocryptops rubiginosus* (L. Koch).

Scolopocryptops rubiginosa, L. Koch, Verh. z.-b. Wien, 1878, p. 792.

Scolopocryptops Confucii, Karsch, Abh. nat. Ver. Bremen, ix. p. 65.

Otocryptops rubiginosus, Haase, Die Indisch-Austral. Myriopoden, p. 97.

Loc. Japan; Ashinoju, Japan (*Holst*); Great Loo-Choo (*Holst*); Corea (*Kalinouski*).]

Family Geophilidæ.

Mecistocephalus Smithii, sp. n.

Colour yellow, head and maxillary somite castaneous.

Head not twice as long as wide, gradually narrowed posteriorly, coarsely punctured, biimpressed behind; maxillipedes thickly punctured; coxæ bidentate anteriorly, the femur armed with two strong teeth and the two following segments with a small one each; claw unarmed.

Tergites smooth, polished, the first and second not sulcate.

Sternites at the anterior half of the body, with a median, anteriorly abbreviated, deep longitudinal groove.

Anal somite of normal form; the pre-tergal sclerite very

short and wide, more than twice as wide as long; the *pleuræ* only moderately inflated, thickly covered, except close to the tergite, with larger and smaller pores; *sternite* small; *legs* long and slender, clothed with fine hair.

Number of pairs of legs 59.

Length up to 80 millim.

Loc. Da-laen-Saen, 30 miles S.W. of Ningpo, 500–2500 feet alt. (*J. J. Walker*); Wo Lee Lake, 25 miles S. of Ningpo (*Bassett-Smith*).

[*Mecistocephalus mirandus*, sp. n.]

Nearly allied to *M. Smithii*, but differing apparently in having the maxillipedes and head almost smooth; the head narrower, being more than twice as long as wide; the pretergal plate of the anal somite narrower, *i. e.* about twice as wide as long; the anal *pleuræ* more inflated and more densely porous; and, lastly, as many as 65 pairs of legs.

Length up to 99 millim.

Loc. Great Loo-Choo (*Holst Coll.*).

Two examples (♂, ♀).]

[*Geophilus* (?) *Holstii*, sp. n. (Pl. XI. figs. 1, 1 a.)

Colour pale yellow, head pale castaneous.

Head coarsely punctured, studded with short setæ, narrow, much longer than wide, wider in front than behind, with widely rounded anterior angles, with two posterior longitudinal impressions; frontal plate distinct; *basal plate* narrow, wider than long, about as wide as the head, but much narrower than the first tergite, its sides converging.

Antennæ moderately long, hirsute, rather robust. *Coxæ* of *maxillipedes* not covered below by the *pleuræ*, punctured, hairy, the anterior border mesially notched, bidentate, the femora largely overlapping the head at the sides, but the joint of the claw falling short of the anterior angle of the head, armed internally with a strong tooth; claw basally armed with a small tooth. The *pleuræ* of the maxillipedes leaving the external angle of the coxa uncovered above, but with their inner edge not raised and thickened where it touches the basal plate and the head.

Terga bisulcate, punctured, hairy.

Sterna with a median impression at the anterior end of the body.

Anal segment small; the *tergite* much longer than wide, not covering the *pleuræ*, and nearly parallel-sided; *pleuræ*

not strongly inflated, studded below and laterally with more than a dozen large scattered pores, the upper surface not porous; *sternite* narrow, longer than wide, narrowed posteriorly; *legs* long, slender, without claw.

Generative appendages present.

Legs hairy, the first pair the smallest; 41 pairs.

Length about 20 millim.

Loc. A single (? ♂) example from Ashinoju, Japan (*Holst Coll.*).

I am rather divided in opinion as to whether this species should be referred to *Mecistocephalus* or *Geophilus*; and since there is only one specimen, I refrain from putting it to the necessary anatomical examination of the mouth-parts to settle the point. But since I can detect no definite external characters which absolutely sever it from *Geophilus*, and since there is no trace of the thickening of the inner edge of the pleura of the maxillipedes, such as is seen in the other species of *Mecistocephalus*, and the basal plate is wider than in that genus, I decide to refer it provisionally to *Geophilus*.

Possibly it is a young example of *Mecistocephalus*.]

Orphnæus brevilabiatus (Newp.).

Loc. Hong Kong (*J. J. Walker*).

DIPLOPODA. (MILLIPEDES.)

Suborder POLYDESMOIDEA.

Family Polydesmidae.

Orthomorpha roseipes, sp. n. (Pl. XI. figs. 2-2 c.)

♂.—*Colour.* Head and upper surface of body pitch-black, fading to ferruginous on the under surface; keels and caudal process light yellow; antennæ ferruginous, with black apical segment; legs reddish yellow, with nearly white tarsi.

Antennæ longish, slender; segments 3, 4, 5 long and subequal, 2 and 6 shorter but about equal.

Segments coriaceous above, not polished; the transverse sulcus faint but long, beginning on the fourth and just visible on the eighteenth; the constriction not beaded; the keels rising above the middle of the side, small, with rounded anterior angles, and the posterior scarcely produced even at the hinder end of the body; the keel of the second segment large, below the level of that of the first and third, rounded in front and behind. *Caudal process* rather wide, truncate,

with an acute anterior spine on each side and four tubercles round the distal extremity. *Anal sternite* triangular, with two very large tubercles on each side. Lateral surface of segments very finely granular, much more coarsely so in front, the tracheal tuberosities prominent; the inferior keel strong on the anterior segments, but gradually dying out towards the hinder end of the body, just visible on the seventeenth; even on the fourth segment it is represented by a flattened excrescence, projecting behind the posterior stigma.

Sterna normal, not spined, that of the eighth with a long linguiform process directed downwards and a little forwards.

Legs longish, hairy; femur longer than the tarsus, about twice as long as trochanter, but not twice as long as the tibia, which is only a little shorter than the tarsus; a tuft of white hairs on the apex of the lower surface of the trochanter, and the last two segments thickly clothed beneath with white hairs; claw conspicuous.

Copulatory feet long, slender, the terminal portion bent strongly downwards, terminating in an external short, truncate, spatulate piece, with the flagellum and its sheath rising on the inner side of this, both being strongly curved and directed inwards, downwards, and outwards; the flagellum simple, the sheath apically bifid, with two short processes near its base.

Length 44 millim.; width across keels 5, width between the keels 3.5.

Loc. A single male example from Chusan Island (*J. J. Walker*).

[*Orthomorpha gracilis*, C. Koch.]

Loc. Great Loo-Choo (*Holst Coll.*.)

[*Strongylosoma Swinhoei*, sp. n.]

♀.—*Colour* black or very deep brown, the posterior half of each tergite with a yellow transverse band, which (except on the first four segments) spreads on to the posterior half of the keel; antennæ black; legs black distally.

Body nearly smooth, polished, finely striolate above, the first tergite subgranular; *keels* very small, situated above the middle of the sides, defined above by a sulcus, without distinct anterior and posterior angles; that of the second segment below the level of those of the first and third, with its anterior angle strongly produced; almost absent on the nineteenth; the transverse sulcus beginning on the fifth and extending to the

eighteenth segment, not beaded. The sulcus marking the constriction not sculptured.

Caudal process truncate, triangular, not conspicuously tubercular.

Anal sternite oval, the two tubercles not projecting beyond the edge.

The *lateral surface* lightly wrinkled, the inferior keel distinct to the hinder end of the body, crescentic.

The *sterna*, except at the anterior end of the body, with two pairs of backwardly directed blunt spines, one at the base of each leg.

Legs with distinct claws, normally hairy; femora about as long as the tarsi, twice as long as the trochanters, but not twice as long as the tibiæ.

Length 35 millim.; width across keels 3.8, width between keels 3.

Loc. A single female example from Chee Foo (*Swinhoe Coll.*).

This species is perhaps allied to the Japanese *Oxyurus flavo-limbatus* of L. Koch (Verh. z.-b. Wien, xxvii. p. 795, 1878), but the latter seems to have better developed keels and to be differently coloured; for the keels, including those of the first segment, are said to be yellow, whereas in this new form the first tergite is not yellow laterally and only the posterior portion of the keels of the rest of the segments is this colour.

In colouring *S. Swinhoei* presents a strong likeness to two other species, namely *S. transverse-teniatum* of L. Koch, from Australia, and *S. Phipsoni*, Pocock, from India. But in neither of these two species are the sterna spined; moreover, in *Phipsoni* the first tergite is entirely bordered with yellow, and in *transverse-teniatum* the yellow band on the tergites does not extend on to the keels.]

[*Strongylosoma Holstii*, sp. n. (Pl. XI. fig. 3.)

♀.—*Colour.* Head and antennæ black, the segments with yellow just above and on the keels, and a large yellow spot on the middle of each; this yellow spot extends on to the anterior part of the segments, and thus the series of them forms a continuous median dorsal stripe; the lateral surface black above, yellow below; legs and sterna yellow.

Antennæ incrassate, with segments increasing in length from 2 to 6, the sixth being noticeably longer than the second.

Body smooth above; the *keels* small, just above the middle

of the side, without any anterior angle, and the posterior angle scarcely spiniform even quite at the hinder end of the body, and not projecting beyond the posterior border of the somites, rather deeply excavated for the pore; those of the second segment below the level of those of the first and third, larger, with squared angles. The transverse sulcus extending from the fifth to the eighteenth segment, not beaded, but the furrow separating the anterior and posterior halves of the segments finely beaded; *caudal process*, *anal sternite*, and *sterna* of the other segments normally formed. The lateral surface of the segments smooth, the inferior keel practically absent on the segments succeeding the fourth.

Legs distinctly clawed; femur nowhere twice as long as the trochanter or tibia, sometimes only a little longer, and barely twice the length of the patella.

♂.—Smaller and thinner than the female, with the keels a little larger and a prominent process on the sternum of the fifth segment.

Tarsi of anterior legs more thickly hairy below.

Copulatory feet rather short; the flagellum and its sheath distinct almost from the base; the sheath twisted on itself like a corkscrew, and giving the appearance of being itself divided into two branches and terminating in a divided apex.

Length of female 20 millim., width across keels 2; of male 15.5, width 1.5.

Loc. Great Loo-Choo (*Holst Coll.*.)]

Polydesmus Moorei, sp. n. (Pl. XI. fig. 4.)

Colour fuscous on the middle of the dorsum, paler on the keels, fuscous beneath the keels; sternal surface flavous; legs flavous, with the distal segment fuscous; antennæ fusco-flavous, the three distal segments fuscous.

Antennæ incrassate; segments 1 and 2 about equal, third more than twice the second and about twice the fourth; fourth to sixth gradually increasing in length and thickness, the latter shorter than the third.

Body nearly flat, smooth, polished, wide, not manifestly narrowed in front or behind; the first tergite distinctly sculptured, wide, much wider than the head, with a distinct keel, of which the anterior angle is rounded and the posterior nearly squared. The rest of the segments with strong sculpturing; the keels very wide, those in the middle of the body wider than long, nearly oblong anteriorly, the posterior border of the fifth in approximately the same straight line as the posterior border of the tergite; the border

becomes gradually and slightly more and more emarginate towards the hinder end of the body, but is never strongly so, for it is only in about the last four keel-bearing segments that the posterior angle of the keel is produced into a point which surpasses the posterior border of the tergite; the lateral border of the keels very lightly convex and very finely denticulate, the anterior angle rectangularly or posteriorly obtusely rounded; the anterior border very lightly sinuate, being lightly convex in its basal half and nearly straight in its distal half, the upper surface of the keel sculptured. The *caudal process* with a spiniform tubercle in the middle of its length, the tip truncate. *Anal sternite* not distinctly tubercular.

Legs stoutish; femur a little longer than the trochanter, but distinctly shorter than the tarsus; tibia much shorter than trochanter, almost twice as long as patella, but barely (except on the last somite) half the length of the tarsus.

Total length 17 millim.; width across keels 3·3, between them 1·8.

Loc. Da-zeh Valley, 60 miles inland of Sam-Moom Bay, Che Kiang, China (*Bassett-Smith*).

Polydesmus paludicola, sp. n. (Pl. XI. fig. 5.)

Very nearly allied to the preceding species in all its characters, but with the sculpturing stronger and the keels much narrower, being in fact in the middle of the body scarcely wider than long, with the anterior border not sinuate but straight. The colour, too, is more of a uniform slate-grey, there being less red about the keels and less fuscous on the legs and back.

Length 15 millim.; width across keels 2·6, between keels 1·6.

Loc. Wo Lee Lake, 25 miles S. of Ningpo (*Bassett-Smith*).

[*Polydesmus compactus*, sp. n. (Pl. XI. fig. 6.)

Colour a slate-grey, slightly tinged with red; margin of the keels reddish; legs reddish yellow.

(*Antennæ* fractured.)

The keel-bearing parts of the segments in contact, the keels overlapping each other. The dorsal surface polished; the first tergite large, not sculptured, its anterior border evenly convex, its posterior border very lightly emarginate mesially, and at the sides directed obliquely forwards, its angle acute. The rest of the segments nearly flat above, lightly convex; the sculpturing into polygonal areas is weak and does not

extend on to the keels; keels with widely rounded, strongly convex anterior angles, very finely denticulate lateral edges, and concave posterior edge; the posterior angle acutely produced, even as far forwards as the fifth projecting beyond the posterior edge of the tergite. *Caudal process* narrow, triangular, truncate, with two spiniform tubercles on each side near the base. *Anal sternite* trifid, the two tubercles projecting on each side beyond the posterior edge.

The *sternal areas* rather high, conspicuously sulcate transversely; the distance between the posterior coxæ equal to the length of one of them.

Legs as in *P. dentiger*.

Length 29 millim.; width across keels 5, width between keels 2·7.

Loc. Tsu-Shima (*Holst Coll.*.)]

[*Polydesmus dentiger*, sp. n. (Pl. XI. figs. 7-7 b.)

Colour as in *P. compactus*, but without the reddish tinge.

Antennæ long and slender; first segment half the second, second nearly half the third and about equal to the fourth, which is a little shorter than the fifth, but about equal in length to the sixth, but thinner.

Body much thinner than in *compactus*, with the sculpturing more strongly defined, being visible on the first tergite, and on the nineteenth passing into ridges which project as spiniform processes beyond the edge of the plate. The *keels* smaller, with the anterior angle in all but the anterior segments not projecting forwards, but widely and obtusely rounded; the lateral margin finely denticulate; the posterior angle acute, spiniform, and from the fifth segment projecting beyond the edge of the tergite; the posterior margin bearing a strong triangular tooth, which is separated by a deep notch from the angle of the keel.

Anal tergite not so distinctly denticulate as in *compactus*, but the *sternite* distinctly bifid owing to the large size of the lateral tubercles.

Sternal areas almost as in *compactus*, but those at the hinder end of the body are less compressed, so that the space between the basal segments of the legs of the last pair is considerably greater than the length of one of the said segments.

Legs covered with fine white hairs; tarsus much the longest segment, longer than the femur by about one third of its length; femur correspondingly longer than trochanter, which is quite three times the length of the coxa and almost as long as the patella and tibia taken together, the latter not very unequal.

Length 27 millim.; width across keels 3·8, width between keels 2·6.

Loc. Ashinoju, Japan (*Holst Coll.*.)]

These four species may be recognized as follows:—

- a. Of large size, with long legs and antennæ; the anal sternite furnished with two very large tubercles; the anterior angles of the keels rounded and convex.
- a¹. The anterior border of the keels convex and produced forwards beneath the keel of the preceding segment, the posterior border evenly arched; very wide *compactus*, sp. n.
- b¹. The anterior border of the keels not produced forwards, but running backward from their point of origin; the posterior border armed with a triangular tooth; much narrower *dentiger*, sp. n.
- b. Not so large, legs and antennæ shorter; anal sternite oval or convex, not bifid; anterior angles of the keels squared.
- a². Keels very wide, with the anterior border convex in its basal half. *Moorei*, sp. n.
- b². Keels much narrower, the anterior border straight or nearly so from the base to the angle. *paludicola*, sp. n.

Polydesmus cruentatus, L. Koch (Verh. z.-b. Wien, 1878, p. 795), from Japan, appears to belong to the same category as *P. compactus* and *dentiger*, inasmuch as its author mentions the enlarged tubercles on the anal sternite. In measurements it agrees closely with *dentiger*; but no tooth is described as occupying the posterior border of the keels, while from *compactus* it seems to be separable by its more slender build and by the sculpturing of the first dorsal plate.

Fontaria lacustris, sp. n. (Pl. XI. figs. 8–8 b.)

Colour (? faded) pale yellowish white throughout.

Terga smooth, laterally above the keels lightly wrinkled or coriaceous; keels rather large, the anterior angle rounded, the posterior rectangular or acute, but not dentiform; the anterior edge of the keel with a small basal shoulder, the posterior edge emarginate, with a larger basal shoulder.

Sterna and *coxæ* of the legs studded with long hairs. *Anal sternite* furnished with a median backwardly projecting spiniform process.

Copulatory feet diverging externally from the base, each terminating in two processes—the inferior simple, pointed, curved like an S, the superior inwardly directed, bifid.

Length 20 millim.; width across keels 3·5, width across cylindrical part of segment 2·5.

Loc. Wo Lee Lake, 25 miles S. of Ningpo (*Bassett-Smith*).

[*Fontaria Holstii*, sp. n. (Pl. XI. figs. 9, 9 a.)

♀.—*Colour* olive-green, the middle of the dorsum slightly paler, the borders of the keels and of the labrum, the distal ends of the antennal segments, and the tarsi flavous.

Body smooth and polished, very slightly wrinkled just above the keels; dorsum evenly arched from its summit to the edge of the keel; keels small, rising above the middle of the side, directed slightly upwards and backwards, the posterior angle spiniform; the posterior border of the keels directed slightly forwards in segments 1 to 6, and slightly backwards in segments 14 to 19, the margin moderately thickened. *Caudal process* triangular, apically truncate, and laterally bituberculate.

Anal sternite semicircular, bituberculate.

Legs with the spine slender, elongate, and acute.

♂.—Less robust, but with larger keels.

Copulatory feet rather small, each dividing distally into an anterior or upper and posterior or lower ramus; the latter pointed, strongly curved internally and furnished along its inner edge with a series of long thickly-set hairs, the former flattened antero-posteriorly and strongly curved when viewed from the side, shorter than the other.

Length of female 47 millim.; width across keels 9·5, across cylindrical part of segment 7.

Length of male 47 millim.; width across keels 9, across cylindrical part of segment 6.

Loc. Great Loo-Choo (*Holst Coll.*.)]

[*Fontaria neptunus*, sp. n. (Pl. XI. fig. 10.)

♂.—*Colour* pale yellow; lower surface, antennæ, and legs a uniform pale colour; an olivaceous spot on the front of the head and two connected by a transverse band on each segment, the cylindrical part of each segment clouded above with yellow, a central spot being darker.

Copulatory feet resembling in construction those of the preceding species; the two rami, however, closer together, and each of them is tridentate at the apex.

Length 40 millim.; width across keels 7·5, between keels 5·5.

Loc. Great Loo-Choo (*Holst Coll.*). Several male specimens.

This species differs from the preceding in being slightly smaller, differently coloured, and in having the copulatory foot differently formed.]

[*Fontaria variata*, sp. n. (Pl. XI. figs. 15, 15 a.)

♂.—*Colour*. Upper surface rather thickly clouded with fuscous, with a clearer spot on each side above the keels; the keels and the posterior border of the tergites, the legs, antennæ, and lower surface flavous; a fuscous patch on the face.

Allied to the two preceding species, but with the keels a little larger and rather more produced posteriorly.

Copulatory feet terminating in two nearly contiguous, undivided, pointed, strongly curved processes.

Length 29 millim.; width across keels 6, across cylindrical part of segment 4.

Loc. Great Loo-Choo (*Holst Coll.*). A single specimen.

Differs from the two preceding in colouring, size, shape of keels, and structure of copulatory feet.]

[*Fontaria coarctata*, sp. n. (Pl. XI. fig. 11.)

Colour (dry example) almost entirely pale testaceous, the segments at the hinder end of the body tinted with yellowish red.

The segments of the body not pressed together with contiguous keels; the keels above the middle of the sides moderately large, with the anterior and most of the posterior angles rounded; the posterior angles nowhere acute and only projecting backwards beyond the border of the tergite in about the seven posterior keel-bearing segments; the keel-bearing area lightly impressed transversely on its upper surface; the *caudal process* not laterally spiniform, but apically distinctly bifid; the *anal sternite* posteriorly spiniform, as in *F. lacustris*.

Legs with long spines; the distance between the posterior coxæ greater than the length of one of them.

The *copulatory foot* enormously long and slender, completely curled backwards upon itself, with a distinct spine on its inner surface just before the bend; on its outer side near the end it bears an elongate inwardly directed lamina, which ends distally in three processes, two short and contiguous and one longer and curved; the end of the organ is divided into three processes, the internal being styloform, the median stout, more or less spatulate and bifid, and the external thin, compressed, pointed at the apex, and furnished with an acute process in front of the apex.

Length about 40 millim.; width across keels 6, width between keels 4.

Loc. Japan (*J. H. Leech*). A single male example.

This species is very nearly related to *F. Dœnitzi* of Karsch (Zeitschr. Naturwissen. (3) v. p. 848, 1880), which is also a Japanese form. The two agree apparently in length, in proximity of the keels, colours, and in a general way in the form of the copulatory apparatus; but in Karsch's description of this latter structure no mention is made of a spine halfway along the length of the organ, and the apex is said to be acute, without any word to imply that it presents the complicated trifurcate extremity presented in this new form.

Fontaria Martensii, Peters (Mon. Ak. Wiss. Berlin, 1864, p. 536), from Yokohama, is, like *Dœnitzi*, unknown to me; but judging from its description and from what Karsch (*loc. cit.*) has said about it, there seems to be no reason for supposing it to be identical with any of the species described below.]

[*Fontaria*, sp.]

Loc. S.E. Corea (*Alfred Carpenter*).]

[*Fontaria*, sp.]

Loc. Tsu-Shima (*Holst Coll.*).]

These two species are represented in the collection by solitary female examples. I consequently refrain from describing them.

I have entirely failed to identify the following species of Polydesmidae:—

1. *Strongylosoma carinulatum*, Motschulsky, Bull. Nat. Mosc. xxxix. (1866) p. 200. From Japan.
2. *Strongylosoma japonicum*, Peters, Mon. Ak. Wiss. Berlin, 1864, p. 536. From Yokohama.
3. *Paradesmus pekinensis*, Karsch, Arch. Nat. 1881, p. 39. From Pekin. Certainly differs from any that I have described in the granulation of its first tergite.
4. *Oxyurus flavo-limbatus*, L. Koch, Verh. z.-b. Wien, xxvii. p. 795. From Japan.
5. *Oxyurus rosulans*, Tömösvary, Term. füzetek, ix. p. 69. From Japan.

I have not seen a single example of the genus *Oxyurus* from the Chinese region. Perhaps the species named *rosulans* is a *Fontaria*.

Suborder IULOIDEA.

Family Cambalidæ.

In vol. xxxiii. of the Ann. Mus. Genova, pp. 388-389, I proposed to unite the genera *Cambala*, *Glyphiulus*, and *Trachyiulus*. But provisionally, at all events, perhaps they may be recognized until more intermediate forms come to light. Moreover, I have thought it admissible to add two more genera to the series. The five that are now known may be recognized by the following key:—

- a. The segments of the body furnished with as many as 20 longitudinal crests, the crests on each side extending to the base of the legs; first tergite at most only carinate behind; with 4 or 5 crests on the dorsum of the segments.
 - a¹. With 4 dorsal crests, the median one obsolete; all the crests undivided, the areas between them smooth and polished *Cambala*, Gray.
Type *annulata* (Say).
 - b¹. With 5 dorsal crests lying between the pore-bearing crests.
 - a². First tergite as in *Cambala*, not carinate above *Cambalopsis*, nov.
Type *calvus* (Poc.).
 - b². First tergite carinate above in its posterior half *Trachyiulus*, Pet.
Type *ceylonicus* (Pet.).
- b. Segments furnished with from 9 to 12 keels, the area above the base of the legs not keeled; first tergite completely covered with carinæ; with 3 (4) crests on the dorsum of the segments.
 - a³. Segments with 11 (12) bituberculiform crests—three on each side below the poriferous crest, and on the dorsal area three tubercles behind and four in front. *Glyphiulus*, Gerv.
Type *granulatus*, Gerv.
 - b³. Segments with only 9 crests, three between the poriferous crests and two on each side below them *Cambalomorpha*, nov.
Type *formosa*, sp. n.

The genera *Cambala* and *Trachyiulus* contain, I believe, but one species each. In addition to *calvus*, I refer to *Cambalopsis* the Sumatra species *cavernicola* and *dentata* recently referred by me to the genus *Cambala*. *Cambalomorpha* contains the three enumerated below.

Cambalomorpha formosa, sp. n.

Colour mostly orange-yellow, with a wide black band on each side extending from the second segment to the end of the body; the upper half of the head and of the second, third, and fourth segments fuscous, but the first tergite or collum entirely yellow; antennæ and the distal half of the legs palely fuscous.

Head smooth; eyes composed of about nine ocelli arranged in two rows.

Collum furnished with nine complete high keels, extending from the anterior to the posterior margin. On the rest of the segments the so-called keels are represented by two transverse rows of tubercles, of which the tracheal tubercle is the largest and rounded at the summit, while the rest are lower and more spiniform; there are nine rows of these tubercles or carinæ, three rows lying between the tracheal carina and two on each side beneath it; the areas between the keels are densely sculptured with impressions which form anastomosing ridges arranged in a reticulated pattern; the cylindrical part of the segments are densely punctured in front, but behind they have the appearance of being gouged out into longitudinal furrows.

Anal tergite with a single median dentiform tubercle, sculptured with a widely rounded posterior border, which distinctly overhangs the valves; *valves* sculptured, hairy, impressed on each side of the borders.

Legs hairy.

Number of segments 72.

Length about 50 millim.

Loc. Hong Kong (*J. J. Walker*).

C. formosa is most nearly allied to *C. Doriæ*, Pocock (*Ann. Mus. Genov.* (2) xiii. p. 389), from Pegu. It resembles that species in having more than one series of ocelli, the collum carinate above, and only nine rows of tergal keels, each keel being completely divided into an anterior and a posterior tubercle. It may be at once recognized from *Doriæ* by the fact that in the latter species the keels of the collum are divided into an anterior and a posterior series.

The species of this genus known to me may be recognized as follows:—

- a. Keels on the collum entire, as in *Glyphiulus granulatus*. . . *formosa*, sp. n.
 b. Keels on the collum divided into an anterior and a posterior row.
 a¹. Eyes nearly obsolete, only about two ocelli on each side of the head *Fœæ*, Poc.
 b¹. Eyes well developed, 7 or 8 ocelli on each side of the head *Doriæ*, Poc.

Family Iulidæ.

Paraiulus coreanus, sp. n. (Pl. XI. figs. 12, 12 a.)

♀.—*Colour* black (when dry banded with pale green), the lower half of the face ochraceous; antennæ and legs testaceous.

Face smooth, with a strong transverse groove between the eyes.

Collum with its inferior portion strongly narrowed and reaching behind the gnathochilarium almost to the base of the first pair of legs, the anterior border of this lateral portion strongly emarginate, deeply sulcate, like the rest of the segments. The rest of the segments with a very deep and complete transverse sulcus, the area behind which is dorsally elevated and for the most part smooth, but laterally it is strongly striate or ridged nearly up to the pore in the front of the body, but not so high behind, while the area behind it is transversely ridged from summit to base and is furnished with a fine median dorsal carinule. *Pores* conspicuous, situated above the middle of the body and nearly halfway between the sulcus and the posterior border.

Anal tergite scarcely at all produced behind, its posterior border being widely rounded; *valves* convex, with edges not compressed; *sternal plate* widely convex.

♂.—Thinner than the female, the collum laterally stouter, the second segment of the mandible squared and notched, and a small tooth-like outgrowth on the promentum of the gnathochilarum; the legs of the first pair long, thick when seen from behind, but rather slender in profile. The protruded portions of the copulatory apparatus consisting of two pairs of processes—an anterior, each half of which is thickly clothed internally and for half its length externally with long setæ, and a posterior pair, which consists of two simple, shorter, tongue-like pieces.

Number of segments in female 58, in male 55.

Length of female 46 millim., width 3.

Length of male 39 millim., width 2.

Loc. S.E. Corea (*Alfred Carpenter*).

ANAULACIULUS, gen. nov.

Ocelli conspicuous; forehead with punctures. *Pores* behind the sulcus, and receding further and further from it towards the hinder end of the body, not touching it even on the sixth segment. *The division between the halves of the segments very faint on the summit of the dorsum on segments 2 to 5, on the rest of the segments only extending as a faint crenulate ridge laterally a little higher than the pore. The posterior half densely and closely striate; the whole of the dorsal area of the segments sulcate, except just the anterior covered portion; the lateral portion of the anterior half also finely striolate longitudinally. Caudal process short, just surpassing the valves.*

♂. With the first legs hook-like and without processes on the coxæ of the second.

Anaulaciulus paludicola, sp. n.

Colour brunneo-flavous, with three distinct longitudinal black bands, one running along the middle line of the back, the others on a line with the pores on each side; head clear yellow below, infusate above, with a darker band between the eyes; first segment with a darker anterior border; legs flavous; segments of antennæ distally infusate; anal tergite fuscous, valves paler.

Eyes composed of about 7 rows of ocelli. *First tergite* finely striolate along its posterior border, above the lateral angle the striæ extend from anterior to posterior border; segments 2 to 6 distinctly striate above. The pores at the hinder end of the body separated from the divisional line between the segments by a space which is equal to at least twice their diameter.

Anal valves not margined, hairy, scarcely surpassed by the caudal process, which is rectangular.

Number of segments 64.

Length 30 millim., width 2; of immature male with last five segments apodous, length 20 millim., width 1.5.

Loc. Wo-Lee Lake, 25 miles S. of Ningpo (*Bassett-Smith Coll.*).

Iulus (? s.) *vallicola*, sp. n. (Pl. XI. fig. 13.)

Colour. Body longitudinally banded as in *sabulosus*, Linn., but the flavous stripes wider and occupying the whole of the dorsal area, except for the narrow median series of black spots; the lower half of the lateral surface of the segments flavous, although more or less clouded with fuscous; the

black stripe separating this lower flavous area from the dorsal flavous stripe narrow, consequently the body might with some accuracy be described as flavous, with three black bands; these three black bands fusing together anteriorly, so that the front of the body, *i. e.* about the first three segments, and the upper half of the head are fuscous; a darker band between the eyes; lower half of head and legs fulvous; anal segment fuscous; antennæ infusate, pale at the base.

Eyes well developed, composed of six transverse rows of ocelli.

Head smooth, without frontal setæ.

Antennæ practically as in *I. sabulosus*.

First segment larger than in *sabulosus*, its lateral angle much less narrowed, with its thickened antero-lateral border not emarginate; the lateral portion also striate right across, with fine striæ extending along the posterior border up to the summit; second segment also larger than in *sabulosus*, its inferior portion much larger and produced forwards towards the mandible. The rest of the segments closely and densely striate from base to summit; most of the striæ complete, *i. e.* extending from the sulcus to the hinder border, some of them falling short; on segments 2 to 6 the two striæ on the summit sensibly diverging from before backwards, and leaving a triangular space, which on the posterior segments becomes filled in with striæ. *Pores* at anterior end of the body close behind the sulcus, though barely touching it, posteriorly gradually receding, until at the hinder end the space between the two is greater than the diameter of the pore; the sulcus scarcely sinuate opposite the pore. The anterior half of the segments only finely striolate.

Anal valves and sternite as in *I. sabulosus*.

Caudal process acutely angular, but only surpassing the valves a little, not upturned apically.

Legs as in *I. sabulosus*.

Number of segments 59.

Length 31 millim., width 2·3.

Loc. Da-zeh Valley, Che Kiang (*Bassett-Smith*).

Family Spiroboldiæ.

Spiroboldus Walkeri, sp. n. (Pl. XI. figs. 14, 14 a.)

♀.—*Colour* deep olivaceous, with the posterior border of the segments yellowish red; the anterior border of the collum and the posterior half of the caudal process yellowish red; antennæ and legs fuscous, in young examples yellowish; the anterior two pairs of legs always yellow.

Head striolate-punctate and mesially sulcate below, finely striolate above, with from 3 to 6 labral pores on each side; *eyes* large, separated by a space which is rather less than twice a diameter, composed of six transverse rows of ocelli.

Antennæ short, when extended laterally not reaching the posterior border of the collum.

Collum punctulate and striolate above, laterally narrowed to an angle of about 45° , the apex rounded, the anterior margin obliquely cut away from a point nearly on a level with the eye, sulcate, the second segment projecting below the level of the first; the rest of the segments longitudinally striate halfway up to the pore on the anterior segments, and not so high posteriorly; the upper surface very closely and finely transversely striolate in front and densely punctulate and lightly longitudinally striolate behind; scobina absent; the transverse sulcus is very weak laterally and absent on the dorsal surface, it scarcely ascends, in fact, above the pore. The *pore* rather small, just behind or almost upon the transverse sulcus, above the middle of the side. *Sterna* striate.

Anal tergite produced into an acute or rectangularly angled process, which just covers, without overlapping, the summit of the valves; *valves* with rather strongly compressed borders, lightly punctulate; *sternal plate* obtusely angled.

Legs longish, with a single seta on the distal end of the lower surface of each segment.

♂.—Thinner than the female, with the sixth and seventh segments swollen and the legs longer; the distal segments of the legs of the third to the seventh pairs inferiorly produced. *Copulatory apparatus* on the same type as that of *S. americana-borealis*; the unpaired median lamina with very slender arms, the inferior angle produced into a truncate subcylindrical process projecting between the two halves of the anterior lateral laminae; the latter short, with straight inner border, and widely but unevenly convex latero-inferior border; the posterior lateral lamina strongly convex externally, lightly concave internally, with its apex narrowed and bent into a strong hook; protrusible portion very stout and long, consisting of four distinct externally convex and internally hollowed segments, from the second of which there projects inwards a sclerite which ends below in an inwardly directed pointed process, while the distal is pointed, fringed in front with a series of short hairs, and is furnished apically with a short tongue-like process.

Number of segments in female 50 to 51 and 56; in male 49 to 53.

♀. Length 82 millim., width 8.

♂. Length 85 millim., width 6.3.

Loc. Chusan Island (*J. J. Walker*, 2 ♂, 2 ♀); Da-laen-Saen, 30 miles S.W. of Ningpo, 500–2500 feet alt. (*J. J. Walker*, 1 ♀).

The example from the latter locality has fifty-six pairs of legs, but otherwise does not appear to differ from those that were taken at Chusan Island.

This species is evidently nearly allied to *S. exquisitus* of Karsch (*Zeitschr. Naturwissen.* (3) vi. p. 57) from Peking; but Karsch says of the latter: "*annulis profunde segmentatis*," and asserts that the pores are situated "*ante sulcum sat profundum longitudinalem partis posticæ*."

In *S. Walkeri*, however, there is only sometimes a trace of this latter sulcus, and the transverse sulcus, which Karsch describes as profound, is entirely obsolete dorsally and very weak at the sides.

Spirobolus Bungii of Brandt, also from Peking, may be identical either with *exquisitus* or *Walkeri*. In fact, were it not for the difference of locality, I should scarcely have felt justified in describing *Walkeri* as distinct from *Bungii*.

*Supplementary Note upon Herr Verhoeff's Subdivisions
of the so-called Genus Iulus.*

I feel that I cannot altogether pass over the genus *Iulus* without commenting upon a revision of the group that Herr Verhoeff has recently proposed (*Zool. Anz.* xvi. p. 479 &c., 1893; and *Verh. z.-b. Ges. Wien*, 1894, pt. ii. p. 137, &c., 1894). The anatomical part of this work is, it seems to me, worthy of all praise; and I cannot but congratulate the author upon the industry and perseverance he has shown in elucidating many points of morphological importance. But his supreme disregard for, or entire ignorance of, the fundamental principles of zoological nomenclature is certainly astonishing. It has resulted, moreover, in the creation of an immense amount of wholly unnecessary confusion, the unravelling of which will prove to be a task of no small difficulty. I have here taken upon myself to attempt to correct some of the more glaring errors, in order that they may penetrate no further into literature. Firstly, however, to avoid ambiguity, I venture to lay down the following propositions, which, I take it, will be generally admitted by most thoughtful systematic workers:—

A genus must contain one of the species originally referred

to it by its founder. For purposes of nomenclature generic and subgeneric terms are equivalent. If a genus be split into two or more subgenera, the subgenus which contains the type species of the genus must receive the generic name. A generic or subgeneric name must not be consigned to oblivion on the grounds that the species referred to it prove to be capable of finer division; nor yet upon the grounds that the character upon which it was based proves in itself to be not of generic, or subgeneric, or even specific value. It can only be finally sunk as a synonym when it has been shown that its type species possesses no other character of generic or subgeneric importance. And, lastly, when a generic name has once been published by an author, neither he nor anyone else has the power to replace it by another, unless preoccupied, nor yet to transfer it from one set of species to another.

Herr Verhoeff seems to me to have disregarded all these rules; nor has he been careful to avoid the use of names already in vogue. An instance or two will illustrate my meaning:—The type of *Iulus*, Linn., must be either *sabulosus* or *terrestris*; but neither of these species is referred to *Iulus* by Verhoeff. The species named *Iulus fœtidus* by Koch received the subgeneric name *Unciger* from Brandt; but, for no valid reasons, Verhoeff proposes *Oncoiulus* for the same species. The genus *Pachyiulus* of Berlese is adopted, but it is divided into two subgenera—*Megaiulus* and *Acanthoiulus*; but *Megaiulus* is equivalent to *Pachyiulus*, and *Acanthoiulus* was used over fifty years ago for perhaps the best-marked genus in this same group of Diplopoda. *Leptoiulus* includes *fallax* of Meinert, which is the type of *Ophiulus* of Berlese; and since it appears to be admitted that *trilineatus*, Koch, the type of *Leptoiulus*, is congeneric with *fallax*, it is clear that *Leptoiulus* is a synonym of *Ophiulus*. *Brachyiulus* of Berlese and *Anoploiulus*, Verhoeff, are synonyms, because they have the same type species, *pusillus*, Leach; and *Leucoiulus* is similarly synonymous with *Allaiulus*, &c., &c. To pursue further the inquiry as to the stability of the other genera and subgenera proposed would be beyond my present purpose; but the following table will, I think, show, at all events approximately, the genera and subgenera of European Iulidæ.

I may add that, since Herr Verhoeff has not seen the necessity to state which species out of a number is the type of a genus or subgenus, I have here ventured to save him this trouble by selecting the first.

1. IULUS, Linn. (= *Ommatoiulus*, Latz.; *Archiulus*, Berl.; *Mesoiulus*, Verh. 1893, not 1894; *Bothroiulus*, Verh. 1894).
Type *sabulosus*, L.

2. UNCTIGER, Brandt, 1841 (= *Oncoiulus*, Verh.).
Type *fætidus*, Koch.
3. ALLAIULUS, Koch, 1847 (= *Leucoiulus*, Verh.).
Type *molybdinus*, Koch.
4. PACHYIULUS, Berl. (= *Megaiulus*, Verh.).
Type *varius* (Fabr.).
5. (New name wanted) (= *Acanthoiulus*, Verh., preoccupied).
Type *fuscipes*, Koch.
6. OPHIULUS, Berl. (= *Leptoiulus*, Verh.).
Type *fallax*, Mein.
7. BRACHIULUS, Berl. (= *Anoploiulus*, Verh.).
Type *pusillus*, Leach.
8. DIPLOIULUS, Berl.
Type *rufifrons*, Koch.
9. MESOIULUS, Berl. (not *Mesoiulus*, Verh.).
Type *paradoxus*, Berl.
10. TYPHLOIULUS, Latz.
Type *pilonotus*, Latz.
11. MICROPODIULUS, Verh. (= *Ophiulus*, Berl., in part).
Type *ligulifer*, Latz.
12. XESTOIULUS, Verh.
Type *blaniuloides*, Verh.
13. CRYPTOIULUS, Verh.
Type *italicus*, Latz.
14. CYLINDROIULUS, Verh. (= *Diploiulus*, Berl., in part).
Type *silvarum*, Mein. (= *punctatus*, Leach).
15. CHROMATOIULUS, Verh.
Type *podabrus*, Latz.
16. PALÆOIULUS, Verh. (= *Eleutheroiulus*, Verh.).
Type *Oliveiræ*, Verh.
17. HEMIPODIULUS, Verh. (= *Mesoiulus*, Verh. 1894, not 1893; not
Mesoiulus, Berl. 1885).
Type *Karschi*, Verh.
18. TACHYPODIULUS, Verh.
Type *albipes*, Koch.

EXPLANATION OF PLATE XI.

- Fig. 1. *Geophilus* (?) *Holstii*. Head and maxillipedes from above.
 Fig. 1 a. Ditto. Anal somite from below.
 Fig. 2. *Orthomorpha roseipes*. External aspect of copulatory foot.
 Fig. 2 a. Ditto. Apex of the same.
 Fig. 2 b. Ditto. Caudal process (tubercles exaggerated).
 Fig. 2 c. Ditto. Anal sternite.
 Fig. 3. *Strongylosoma Holstii*. Left copulatory foot from below.
 Fig. 4. *Polydesmus Moorei*. Keel of twelfth segment.
 Fig. 5. *Polydesmus paludicola*. Keel of twelfth segment.
 Fig. 6. *Polydesmus compactus*. Keel of tenth segment.
 Fig. 7. *Polydesmus dentiger*. Keel of eleventh segment.
 Fig. 7 a. Ditto. Antenna.
 Fig. 7 b. Ditto. Anal sternite.

- Fig. 8. *Fontaria lacustris*. Left copulatory foot from below.
 Fig. 8 a. Ditto. Keel of thirteenth segment.
 Fig. 8 b. Ditto. Anal sternite.
 Fig. 9. *Fontaria Holstii*. Left copulatory foot from below.
 Fig. 9 a. Ditto. Ditto, external view.
 Fig. 10. *Fontaria neptunus*. Left copulatory foot from below.
 Fig. 11. *Fontaria coarctata*. External aspect of copulatory foot.
 Fig. 12. *Paraiulus coreanus*. Lateral view of head and first segment.
 Fig. 12 a. Ditto. Protruded portion of copulatory apparatus.
 Fig. 13. *Iulus vallicola*. Lateral view of tergites 1 and 2.
 Fig. 14. *Spirobolus Walkeri*. Anterior view of half the copulatory apparatus.
 Fig. 14 a. Ditto. Inner protrusible portion of copulatory apparatus.
 Fig. 15. *Fontaria variata*. Left copulatory foot from below.
 Fig. 15 a. Ditto. Ditto, outer view.

XLIV.—On a new Species of Hesperiidæ of the Genus *Amenis*,
 Watson. By F. D. GODMAN and O. SALVIN.

MR. O. T. BARON, who is now travelling in Northern Peru, recently sent us a series of a remarkable species of Hesperiidæ which he captured near Cajamarca at an altitude of 10,000 feet above the sea. The species belongs to Mr. Watson's genus *Amenis* (P. Z. S. 1893, p. 12), the wing-structure being very similar to that of *A. pionia*, the type of the genus. The cell of the primaries is long and narrow, and the discocellulars very oblique, as in that species; the third median segment is relatively still shorter than in *A. pionia*. The wings are shorter, the secondaries not so produced at the anal angle, the outer margin being rounded; the radial of the secondaries is obsolete; and the hind tibiæ, being thickly scaled, do not clearly show the proximal pair of spurs.

Amenis Baroni, sp. n.

Costa of primaries slightly curved, outer margin convex; anal angle of secondaries very slightly produced. Primaries golden olive, the outer and inner margins broadly black; veins black; a transverse series of three black-bordered red spots, the largest in the cell, the others below in the direction of the inner margin; a cluster of four orange-red spots beyond the cell in a black border, another of two spots in the disk: secondaries black, with two irregular bands of golden olive, one submarginal, the other through the cell, the two meeting near the anal angle; fringes of both wings buff. Underside: primaries as above, the lowest spot of the transverse band orange-buff; a large patch of black on the inside of this band: secondaries greenish buff, the outer and inner margins, two narrow irregular lines across the disk, a single

wider one through the cell, and another nearer the base, black. Head above black, spotted with buff; thorax black, with two longitudinal light bands on either side; abdomen above black, banded with olive, the extremity buff; palpi beneath, thorax, abdominal bands, hind surface of the coxæ, and dorsal fringe of the hind tibiæ orange-buff, the rest of the legs and antennæ black.

The tegumen of the male secondary organs is split into two flattened lobes, beneath which is a cylindrical rod, which may be part of the scaphium; the harpes are upturned and end in a rounded lobe with a serrate edge; on the inner surface of the dorsal edge is a small lobe directed backwards, and on the inner surface of each harpe nearer the base is an elongated lobe with a strongly serrated dorsal edge. These organs, though differing in several details of structure, are similar in the main features to those of *Amenis pionia*.

Exp. 2·2 inches.

Female similar to the male, but rather larger and with more rounded wings.

Hab. Cajamarca, Peru, alt. 10,000 feet (*O. T. Baron*).

BIBLIOGRAPHICAL NOTICE.

The Fauna of British India, including Ceylon and Burma. Published under the authority of the Secretary of State for India in Council. Edited by W. T. BLANFORD. *Moths.*—Vol. III. By G. F. HAMPSON.

NOTWITHSTANDING the almost phenomenal speed with which one volume of the 'Moths of India' has followed another, this third instalment is in no respect inferior to the previous ones. The keys to the subfamilies and genera evidence the author's unflagging industry; and the illustrations, prepared under his supervision, demonstrate his perfect knowledge of the anatomical differences upon which these divisions are based.

The present volume deals with the two remaining groups of Noctuidæ—the Focillinæ and Detoidinæ,—also the three small families, Epicopiidæ, Uraniidæ, and Epiplemidæ, of which the author remarks that they might perhaps be regarded as subdivisions of one comprehensive family, the Uraniidæ; but by far the greater part of the volume is occupied with the extensive family Geometridæ. In his subdivision of this immense group of moths Mr. Hampson has largely followed the classification proposed by Mr. Meyrick for the European genera of the family.

Unmoved alike by the open disapproval of one class of lepidopterists and the praise of another, Mr. Hampson, with true scientific stoicism, has continued to treat both genera and species precisely in the same way in this as in the previous volumes: all genera

based upon secondary sexual characters are regarded as sections; all local races or supposed varietal forms are reduced to a dead level as synonyms. Although it is certain that in this matter of synonymy the author of the 'Moths of India' will have many opponents, and in the case of some species probably no followers, his action must yet be respected as an evidence of that indomitable self-reliance, without which the completion of so arduous a task as a comprehensive revision of the Indian Moths would have been quite impossible. Mr. Hampson has expressed his own honest convictions, and those who do not agree with the minor detail of synonymy are not bound to follow his lead; but in any case all true lepidopterists must most earnestly desire that the ability which the author has shown in bringing order out of chaotic confusion may be recognized by the sanction of a fourth volume, to include the *Pyrilidæ*.

A. G. BUTLER.

MISCELLANEOUS.

The Irish Stoat distinct from the British.

By OLDFIELD THOMAS and G. E. H. BARRETT HAMILTON.

[Preliminary note.]

THERE has always been a great deal of confusion as to the identity of the single Irish member of the genus *Putorius*; but the fact that it has a long black-tipped tail has always been hitherto taken as sufficient proof that it is a stoat (*P. ermineus*), and not, as the natives call it, a weasel. The third alternative—that it is neither—seems never to have presented itself to anyone's mind; but on a careful comparison of specimens we have now come to the conclusion that this animal is an insular intermediate form, with some of the characters of each of our two British species, and is not referable to either of them.

It may be called

Putorius hibernicus, sp. n.

Intermediate in size between the two allied species. Light colour of underside white, not yellowish; not extending on to the upper lip, much narrowed on chest and belly, and not extending on limbs beyond the middle of the forearms and lower legs, the whole of the hands and feet being brown with the exception of a few hairs on the ends of the toes. Tail as in the stoat, but rather shorter.

Dimensions of the type (an adult male), measured in the flesh:—

Head and body 228 millim.; tail 88; hind foot 40; ear 21. Basal length of skull 41.2.

Type from Enniskillen, killed Jan. 7, 1895; presented to the British Museum by J. E. Harting, Esq.

A fuller account of this interesting animal, and our reasons for distinguishing it, will appear in the 'Zoo'logist' for April.

Description of a new Suctorial Millipede sent from Trinidad by Mr. J. H. Hart, of the Royal Botanical Gardens, Trinidad. By R. I. Pocock.

In my report upon the Diplopoda of the West Indies, published in Journ. Linn. Soc., Zool. xxiv., I enumerated on pp. 478-479 four species of suctorial Millipedes as being known from the West-Indian area. Three of these, belonging to the genus *Siphonophora*, were from Cuba and St. Vincent, and the fourth, a *Siphonotus*, was from the latter island. No species had at the time been obtained in Trinidad; consequently Mr. Hart's recently received consignment of a dozen specimens of a new species of this group was of considerable interest, the more so since they prove to belong to a genus, *Siphonorhinus*, which is new to the Neotropical fauna.

This species may be called, in honour of its discoverer,

Siphonorhinus Hartii, sp. n.

Colour (in alcohol) a reddish yellow, deeper at the anterior end; a distinct black band extending along the middle line of the back throughout the length of the body; the keels of the segments a little darker than the pale area on each side of the dark median band; the head reddish brown; antennæ, rostrum, and legs pale yellow.

Head not pyriform, four-sided, being very abruptly narrowed at the base of the rostrum.

Rostrum slender, elongate, only a little thicker at the base than halfway up, a little more than half the length of the head.

Antennæ thick, rather short, incrassate, the second segment a little longer than the third, fourth, or fifth, and a little longer than wide, the sixth barely thicker than the fifth and not quite twice its length.

Body wide, the pleuræ projecting beyond the tips of the feet, the area of the tergal piece that lies below the keel or poriferous excrescence nearly vertical. The elevated portion of the segments clothed thickly with silky pubescence; the anterior lower part coriaceous in front, granular behind.

Number of segments variable; in the type 59, in others 50, &c.

Length of type 18.5 millim., width 2.

This species may be at once recognized from the Oriental members of the genus by its variegated colouring and longer and thinner rostrum.

On the Dates of Shaw and Nodder's 'Naturalist's Miscellany.'

This book is usually found bound in twenty-four volumes, with dedicatory titlepages; but considerable uncertainty has been felt with regard to the actual dates of the species therein described for the first time.

The 'Naturalist's Miscellany' came out in parts, 287 of which

were issued; there were 1068 plates, of which 1064 were actually published, the last four having been prepared, but the text never written, owing to the illness and death of Dr. Shaw. Now 287 parts make up 23 years 11 months if issued monthly; and as Dr. Shaw died on July 22, 1813, leaving the descriptions of the last set of plates (1065-1068) unpublished, we may suppose this to have been the number for July 1813, the concluding number of the twenty-fourth vol. Pursuing this argument further, we find that the first number should have appeared as an August number in 1789, and we find it reviewed in the 'Gentleman's Magazine' for October of that year. Referring to a copy of the 'Nat. Misc.' in the British Museum (Nat. Hist.), the required evidence is found in one of the original circulars about the work, which states that it will be "Published in monthly numbers. Price one shilling and sixpence. To begin the First of August." It is said also that "three, and sometimes more" plates will be published in each number.

Taking these facts into consideration, as well as the dated plates, I believe the following to be the actual dates of publication of Shaw and Nodder's 'Naturalist's Miscellany':—

Vol.	Plates.		Vol.	Plates.	
I.	1-15	1789.	XIII.	493-508	1801.
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It will be comparatively easy to fix with a fair amount of certainty the actual month any of the above plates was issued.

C. DAVIES SHERBORN
(Index gen. et spec. anim.).

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[SIXTH SERIES.]

No. 89. MAY 1895.

XLV.—*On the Specimens of the Genus Cutiterebra and its Allies (Family Œstridæ) in the Collection of the British Museum, with Descriptions of a new Genus and Three new Species.* By E. E. AUSTEN, Zoological Department, British Museum.

[Plate XIII.]

THE genus *Cutiterebra** was founded by Bracy Clark in the year 1815 (Clark, 'An Essay on the Bots of Horses and other Animals,' London, 1815, p. 70) for a group of Œstridæ which is confined to the Nearctic and Neotropical Regions, where the larvæ are parasitic in the subcutaneous tissues of Rodents and Marsupials. The flies themselves, which are characterized by a large stout body, feathered arista, brown wings, and broad flat tarsi, include some of the largest of all Diptera, but are by no means frequently found in collections, although the larvæ of certain species must be exceedingly common in the districts in which they occur. Since the publication of Prof. Brauer's epoch-making work on the Œstridæ ('Monographie der Oestriden,' Wien, 1863), more than thirty years ago, which includes seventeen species of *Cutiterebra*, two of which are apparently synonyms, only one additional species of the genus (*C. approximata*, Walk.) has been described. The present revision proves that the British Museum possesses specimens of nine species of *Cutiterebra*, two of which are new. In 1887 the "division" (Abtheilung) CUTEREBRIDÆ (Brauer,

* Clark wrote *Cuterebra*: the obviously correct form given by Scudder ('Supplemental List of Genera,' p. 93), on the suggestion of Verrall, is here adopted.

Wien. ent. Z., vi. Jahrg., 1887, pp. 5, 11, and 13) (which it would surely be better to call the subfamily CUTITEREBRINÆ) was instituted by Prof. Brauer for *Cutiterebra* and the allied genera *Rogenhofera* and *Dermatobia*. I now find it necessary to introduce a fourth genus, allied to *Rogenhofera*, for an interesting new species from the Mexican shore of the Gulf of California.

I am aware that, as a result of the recent labours of Brauer and von Bergenstamm, the family CESTRIDÆ is abolished, and its constituent genera form a "section" of the MUSCIDÆ ("Muscaria Schizometopa," Brauer and v. Berg.). For the sake of convenience, however, I have decided to retain the old terminology in the title of the present contribution.

Cutiterebra funebris, sp. n. (Pl. XIII. figs. 1-1 b.)

Cuterebra atrox, Clark (?), 'Essay: Addenda' (1848); description translated by Brauer, 'Monographie der Oestriden,' pp. 241-242 (1863).

The type of this species is a male specimen from Trinidad, forwarded for identification by Mr. J. H. Hart, of the Trinidad Botanical Department. The larva is known in the island as the "Mosquito Worm," and the present specimen, which is accompanied by its pupa-case, was bred from a spiny rat (*Loncheres guianæ*, Thos.). Mr. Hart's statement on the subject will be found below. This species is apparently closely allied to *C. atrox*, Clk., with which after all it may prove to be identical. Unfortunately, owing to the fact that the typical specimen was sent home in a mixture of spirit and glycerine, many of the characters, such as pollinose markings, have been destroyed, while, on the other hand, in spite of many attempts, I have not succeeded in obtaining access to Clark's original description of *C. atrox*, which is accompanied by a figure: I have therefore been forced to content myself with Brauer's translation. On the whole, however, it seemed better to describe the present specimen as new, especially as the type of Clark's species was obtained from Mexico. Since writing the appended description I have discovered that the type of *C. atrox* is in the Oxford Museum, and by the kindness of Prof. Poulton I hope before long to have an opportunity of comparing it.

♂. Dimensions agreeing very well with those given by Brauer for *C. atrox*, taken from Clark's figure: length 24 millim. (25 millim., Brauer); length of wing 20 millim. (as in Brauer); width of vertex 4 millim.; width of head $9\frac{1}{2}$ millim.; width of thorax at base of wings $9\frac{2}{3}$ millim.; width of abdomen at base of third segment $11\frac{2}{3}$ millim.

Black; reddish brown on pectus, pleuræ, sides and posterior angles of dorsum of thorax, base of scutellum, and sides of

abdomen below; abdomen metallic greenish black, shining, dull reddish brown on sides of segments below; wings dark brown, lighter at the base in front; alulae blackish brown.

Front dull, with a deep depression in the median line, possibly due to immaturity; ocellar triangle large, shining black; the depressed area of front reddish brown, doubtless originally pollinose; an impressed pollinose mark running from the eye on each side to the fissura frontalis opposite the base of the antennæ; below this, and separated from it by a subquadrate shining black spot, a large dull reddish-brown area, extending from the eye to the fissura frontalis and also running upwards so as to join the extremity of the former mark; this area would doubtless likewise be pollinose in a well-preserved specimen; a round subconical shining black tubercle on each cheek below the eye; entire head thinly clothed with short black pile. *Antennæ*: first two joints black, with black pile; third joint short, about as long as the first two joints taken together, reddish brown, apparently pollinose; arista black, thick at the base. Antennary pit broad, septum not developed. *Thorax* and scutellum dull dark brown above; the beginnings of two narrow shimmering silvery stripes in front of the dorsum, not reaching to the suture, which is very deep; a dull dark brown broader stripe outside these and reaching to the suture, and a similar median one scarcely reaching the suture, faintly indicated; thorax and scutellum entirely clothed with short black pile, which is sparse above, but thicker and longer on the pleuræ and along a line bordering the dorsum. *Abdomen* also thinly clothed with short black pile and punctuate; fifth segment more thickly clothed with hair and showing no blue above; apparently it was originally more or less covered with greyish pollen; the reddish area on the sides of the segments below was doubtless also covered with pollen; there are indications that the margins of the second, third, and fourth segments were narrowly white. *Legs* black and clothed with black pile; tibiæ with a very prominent fringe of bristly hairs on the outside, making them look very broad; there is a faint indication that they were originally pollinose at the base; all the tarsi extremely broad, the second joint of the second pair measuring $1\frac{1}{2}$ millim. in breadth, the posterior pair even broader.

Trinidad (*Hart*); one specimen.

Pupa-case: length 30 millim.; breadth across the ridge on the sixth segment $17\frac{1}{2}$ millim.; the transverse ridges very strongly developed; entirely clothed with imbricated scales, of which those on the anterior portion of the segments, on the dorsal surface at any rate, are denticulate.

Mr. Hart writes as follows:—

“Royal Botanic Gardens,
Trinidad,
Dec. 11, 1894.

“I take the liberty to forward you a circular issued by my office on the so-called ‘Mosquito Worm.’ This insect has been commonly attributed to *Tipula* as its originator in Trinidad, which of course, without experiment or argument, could be shown to be erroneous. Still the actual rearing of the imago was needed to show on the spot that it was so. This has now been done, as described by circular.” . . .

The following is the circular referred to:—

“Botanical Department, Trinidad.
Circular-note No. 14.

“On Saturday, the 13th of October, I had brought to me a specimen of the Spiny Rat (*Loncheres guianæ*), which had been found feeding on a fruit-tree in the Royal Botanic Gardens.

“On examination the animal was found to be affected with the parasite known in Trinidad as the ‘Mosquito Worm,’ whose life-history up to the present has been but imperfectly known.

“The Rat was placed in a finely netted cage, and on Oct. 22nd, or nine days after it was captured, the animal rid itself of the parasite, and the latter assumed the chrysalis stage in one of the cage corners.

“The chrysalis was a hard body, almost black, with nine [eleven] segments, and in form slightly tapered to opposite ends. It was over one inch and a quarter in length, and measured five eighths of an inch in diameter at its broadest part.

“The chrysalis was kept in damp earth, and on Dec. 3rd (42 days) the perfect insect emerged. . . .

“The puncture in the skin of the Rat on which the fly was developed healed in two or three days.

“The term ‘Mosquito Worm’ is therefore proved to be erroneously applied.

(Signed) “J. H. HART, F.L.S.”

“Dec. 3rd, 1894.”

Cutiterebra approximata, Walk.

Cuterebra approximata, Walker, ‘The Naturalist in Vancouver Island and British Columbia,’ by J. K. Lord, vol. ii. pp. 338-339 (1866).

This, with *C. terrisona*, Walk., *C. funebris*, Austen, and

C. atrox, Clark, belongs to a group of black or blue-black species, which are clothed with black hair, either entirely or with the exception of a tuft of yellow pile on the pleuræ. Much more material is necessary before the limits of these species can be determined satisfactorily.

Judging from the descriptions (Brauer's translation in the case of that of *C. atrox*, Clk.), *C. approximata*, Walk., and *C. atrox*, Clk., are very closely allied. If the dimensions of the latter as given by Brauer ('Monographie,' &c. p. 242) on the basis of Clark's figure are to be depended upon, however, *C. approximata* is a smaller and much more slender species. The following are the dimensions of Walker's type (a female):—Length 21 millim. (correctly given by Walker as "10 lines"); width of vertex 3 millim.; width of head 8 millim.; width of abdomen at base of third segment 9 millim.; length of wing 16 millim.

The head shows only a single flattened, deeply punctured, but ill-defined tubercle on each side, its base resting on the eye opposite the antennæ; there is no tubercle on the cheeks beneath the eyes, as in the specimen from Trinidad, which I have described as *C. funebris*; the dorsum of the thorax and scutellum seems originally to have been shining black; the "dark cinereous tomentum" mentioned by Walker is due to the dirty state of the typical specimen; pleuræ clothed with tufts of black pile, without a trace of yellow; dorsum and scutellum thinly clothed with shorter black pile: abdomen metallic dark violet, shining, the fourth and fifth segments more purple than the rest, the central portion of the third segment somewhat greenish blue; the sides of the segments below sprinkled with the usual irregular markings of greyish pollen, leaving rounded and irregular patches of the shining ground-colour; no trace of white margins to the segments above. Legs: femora reddish at the tips; tibiæ pollinose at the base; tarsi apparently not very broad; front tarsi, at any rate, scarcely more than half as broad as the corresponding pair in the typical specimen of *C. funebris*, the first joint longer, the remainder more compact and squarer. Wings somewhat narrow, uniformly brown, not paler at the base in front.

C. approximata, Walk., is distinguished from *C. funebris*, Austen, by its smaller size, more slender form, deeper violet colour of the abdomen, narrower tarsi, and the absence of a tubercle upon the cheeks.

The typical specimen, which is the only one in the collection, is from British Columbia (*J. K. Lord*); it is labelled in Walker's handwriting, and the description is attributed to

Walker in the list on p. 337 of vol. ii. of Lord's work; van der Wulp is therefore in error in crediting the species to Smith (Biol. Centr.-Amer., Diptera, vol. ii. p. 2).

Through the kindness of Mr. O. Salvin I have had the privilege of examining the 'Biologia' specimens of *Cutiterebra*, and after a careful study of the two specimens which van der Wulp (*loc. cit.*) somewhat doubtfully assigns to *C. approximata*, Walk., I am able to say that neither of them belongs to this species. The specimen from Pinos Altos, Mexico, should apparently be referred to *C. terrisona*, Walk., while that from San Geronimo, Guatemala, seems to me to be a male of *C. americana*, F.

Prof. Brauer ('Monographie,' &c. p. 222) states that the eggs of *Cutiterebra* are unknown, and he is inclined to think, on account of the structure of the abdomen of the female, that the flies may be viviparous. However, I found an egg protruding from the ovipositor of the type of *C. approximata*, and also discovered an egg adhering to the type of *C. terrisona*, Walk. The egg of *C. approximata* is about $1\frac{1}{3}$ millim. in length, and is yellowish white in colour; but with the exception of a longitudinal groove, doubtless due to drying, it appears to present no peculiarities.

Cutiterebra terrisona, Walk.

(Pl. XIII. figs. 2, 2 a.)

Cuterebra terrisona, Walker, List Dipt. Ins. in Coll. British Museum, iii. p. 683 (1849).

The typical specimen (the only one in the collection) is a female from Guatemala (*Sallé*). Dimensions:—Length $23\frac{1}{3}$ millim. (correctly stated by Walker as 11 lines); width of vertex $3\frac{2}{3}$ millim.; width of head 9 millim.; width of abdomen at base of third segment $10\frac{2}{3}$ millim.; length of wing $18\frac{1}{2}$ millim.

There are five triangular spots of yellow pollen resting on the inner margin of each eye; the three uppermost spots are small, the other two much larger; the lowest, which rests on the inferior angle of the eye, is somewhat more quadrangular than the rest, while the spot above this is much the longest and extends to a point midway between the eye and the tip of the oral cleft; the extremity of the vertical fissura frontalis on each side is also surrounded with an oval spot of yellow pollen; the antennary pit is greyish and the occiput yellowish pollinose; the head is entirely clothed with black hair, and there is no jagged band of yellow pollen on the posterior border of the cheeks below; *thorax, except a narrow oblique*

tuft of yellow pile on the pleuræ in front of the base of the wings, entirely clothed with black hair: abdomen shining plum-purple*, the anterior margins of the third and fourth segments narrowly yellowish pollinose; in the case of the third segment there is an expansion of this narrow band on each side, so as to include the posterior margin of the preceding segment, and there are indications that the band at the base of the fourth segment is similarly expanded at the sides; the sides of the first four segments below and the whole upper surface of the fifth sprinkled with the usual irregular markings of yellowish pollen, leaving connected or isolated dots of the shining ground-colour. *Legs*: tarsi large and broad; last two pairs of femora with a patch of yellowish pollen at the base in front. *Wings* broader than in *C. americana*, F., $7\frac{1}{3}$ millim. in width at their broadest part, somewhat paler towards the base on the inner side.

Prof. Brauer ('Monographie,' &c. p. 245) states that he regards *C. terrisona* as a synonym of *C. americana*, F., and that he cannot understand how Walker could separate it; on this account Walker's species is definitely referred to *C. americana* by van der Wulp (Biol. Centr.-Amer., Diptera, vol. ii. p. 1). *C. terrisona* is, however, a perfectly good species, which can at once be distinguished from *C. americana* by the pleuræ being entirely clothed with black pile, except the small fleck of yellow hair, and by the absence of the jagged yellow pollinose border to the cheeks in the female.

Cutiterebra americana, F.

Cutiterebra americana, Fabricius, Syst. Ent. 774, 6 (nec Walker, List Dipt. &c. iii. p. 683).

Two specimens, both females—one labelled "Georgia," the other without a locality. In his description Fabricius writes, "thoracis lateribus canis:" in these specimens the pleuræ are clothed with cadmium-yellow pile, but herein they agree with Prof. Brauer's description of the species ('Monographie,' &c. pp. 243-244) and also perfectly with Bracy Clark's coloured figure of his species *C. cauterium* ('An Essay on the Bots of Horses and other Animals,' London, 1815, p. 70, pl. ii. fig. 28), which is regarded by Brauer as a synonym of *C. americana*, F. The colour of the pile clothing the pleuræ is probably variable. In these specimens the contrast between the yellow pleuræ and black dorsum is very sharp, and with the polished deep purple abdomen and uniformly deep brown wings renders the species a strikingly

* Ridgway, 'Nomenclature of Colours,' pl. viii.

handsome one. The dimensions of the specimen from Georgia are as follows:—Length 23 millim.; width of vertex $3\frac{2}{3}$ millim.; width of head $9\frac{1}{3}$ millim.; width of abdomen at base of third segment $10\frac{2}{3}$ millim.; length of wing 18 millim.; greatest width of wing 6 millim.

Cutiterebra buccata, F.

Cuterebra buccata, Fabricius, Genera Insectorum, p. 305, 1776 (1777 ?), = *C. horripilum*, Walker (nec Clark), List Dipt. &c. iii. p. 683.

Two specimens, both males—one from Nova Scotia (*Redman*), the other with no locality. Prof. Brauer ('*Monographie*,' &c. pp. 249–250) does not mention that the outside of the anterior femora is thickly clothed with whitish hair.

Cutiterebra fontinella, Clark.

Cuterebra fontinella, Clark, Trans. Linn. Soc. xv. pp. 410–411 (1827), = *C. americana*, Walker (nec Fabricius), List Dipt. &c. iii. p. 683.

Three female specimens—two from Nova Scotia (*Redman*), the third presented by the Entomological Club, without a locality. These specimens have certainly nothing whatever to do with *C. americana*, F., but I refer them somewhat doubtfully to *C. fontinella*, Clk., since this species is stated by the author to have the last *two* segments of the abdomen white, whereas in the present specimens only the fifth segment is of that colour. In size, however, and other respects they agree very well with Clark's description, and *fontinella* is the only species given by Prof. Brauer in his table ('*Monographie*,' &c. pp. 229–230) to which it is possible to assign them. In '*Insect Life*,' vol. v. p. 319 (1893), Townsend describes two female specimens which he assigns to *C. fontinella* and which were bred from larvæ obtained near Doña Ana, New Mexico, "taken from *Lepus artemisia* (?), the common cottontail of the lower Rio Grande region in New Mexico." Townsend states that his specimens are "without doubt *Cuterebra fontinella*, Clark;" but the correctness of the identification seems to me to be very questionable. Clark mentions that *C. fontinella* is half the size of *C. cuniculi*, Clk., which he states to be as large as *Bombus terrestris*; but Townsend gives the length of his specimens as "20·5 millim. to 21 millim.," while he adds that a third specimen received from Colorado, which he also regards as belonging to this species, is "22 millim. in length." Townsend's specimens therefore must be nearly as large as *C. cuniculi* itself. Clark calls *C. fontinella* the "White-tailed *Cuterebra*,

or Blue Rabbit Fly," and the former of these names would seem to imply that the white tip to the abdomen is a conspicuous feature; but in the case of the two specimens bred by Townsend it was not until the colour of the abdomen was restored with chloroform that a "greyish bloom," clothing the inferior lateral edges of the segments, was observed "to extend in both specimens upon sides of abdomen and dorsum of last two segments, or even in places on dorsum of second segment." With reference to the specimen from Colorado, Townsend writes:—"The dorsum only of segments 1 to 3 of abdomen is narrowly purplish black, the side of the abdomen and all of last segment being covered with the whitish bloom and circular purplish-black spots." Clark's description of the abdomen, however, runs as follows:—"Abdomen breve, atrum, lucidum, supernè violaceo resplendens: segmentis duobus postremis hirtis, albidis, punctisque variis atris elevatis, glabris." I take this to mean that the white segments are more hairy than the rest, and clothed with pale pile; Townsend, however, says nothing about this, though, on the other hand, he states that the yellowish-white hairs clothing the pleuræ are "continued completely around edge of scutellum," which is not mentioned by Clark. Our specimens have the scutellum entirely clothed with black hairs, the first four segments of the abdomen shining violet-purple, clothed with short black pile, the fifth entirely covered with whitish-yellow pollen, sprinkled, especially at the sides, with small round shining dots of the ground-colour, and fairly thickly clothed with short pale golden-yellowish pile. It is therefore evident that, whether I am correct in assigning these specimens to *C. fontinella*, Clk., or not, they certainly cannot belong to the same species as Townsend's specimens. Except that only the last segment of the abdomen is whitish yellow, our specimens agree very well with Clark's description so far as it goes. The front shows two small triangular flecks of silvery-white pollen, resting on the eye on each side, which are not mentioned by Clark, and there is a similar fleck on the occipital margin on each side of the ocellar tubercle. The whole of the face and cheeks is covered with yellowish-white pollen and clothed with pile of a similar colour. In addition to the round shining spot on each cheek mentioned by Clark there is a similar but smaller one resting on the lower margin of the eye. The antennary pit is greyish, the lower margin on each side shining black, and the vertical fissura frontalis terminates on each side below in the usual dull black triangular mark. The antennæ are dark brown or

reddish brown, the third joint stout, rather longer than the first two joints taken together. The dorsum of the thorax greyish black, shining, clothed with short black pile; the pleuræ clothed with longer yellowish-white pile, which terminates above the base of the wing in front of the posterior tubercle. Of the three black spots on the pleuræ, arranged in a triangle, the upper one, which consists in a tuft of black pile, is in one specimen almost obsolete. Legs shining dark reddish brown, entirely clothed with black pile. Dimensions: length 16 millim.; width of vertex 3 millim.; width of head 7 millim.; width of abdomen at base of third segment $7\frac{1}{2}$ –8 millim.; length of wing 13 millim.

These specimens are much smaller than any other species of *Cutiterebra* in the collection, and their size and the white tip to the abdomen give them a very distinctive appearance. One specimen has three yellowish eggs adhering to the right hind tarsus.

Cutiterebra analis, Mcq. (= *C. apicalis*, Guér.).

Cuterebra analis, Macquart, Diptères Exotiques, ii. 3, pp. 22–23, tab. ii. fig. 5 (1843).

Cuterebra apicalis, Guérin-Ménéville, Iconographie du Règne Animal, Insectes, pp. 547–548 (1844), and pl. ci. fig. 1 &c. (1835).

Two specimens, male and female—the former from Orizaba, Mexico (*Sallé*), the latter from Tunantins, R. Amazons, Brazil (*Bates*). The male has a fleck of black pile on the humeral tubercles in addition to those on the pleuræ.

Guérin-Ménéville's excellent coloured figure leaves no doubt of the synonymy above given. Macquart's figure, on the other hand, is execrable; but his description is much more detailed than that of Guérin-Ménéville. It is clear from internal evidence (the date 1844 is quoted on p. 531 and "mars 1844" on p. 553) that the *description* of *C. apicalis* was not published until 1844, although the date on the title-page of the portion of the 'Iconographie' which contains the Insects would lead the reader to suppose that it appeared in 1838. The particular plate on which the figure of *C. apicalis* is given is, like certain other of Guérin-Ménéville's plates, not dated; but since the plates immediately preceding and following it bear the date "8^{bre} 1835," we may safely conclude that pl. ci. was published at the same time. On the whole, however, it seems better to adhere to the principle that a figure of a species unaccompanied by a description does not constitute publication.

Cutiterebra rufiventris, Macq.
(Pl. XIII. figs. 3, 3 a.)

Cutiterebra rufiventris, Macquart, Diptères Exotiques, ii. 3, pp. 21-22 (1843); Brauer, Monographie der Oestriden, pp. 245-246 (1863).

A female specimen from Ecuador, collected by Mr. Clarence Buckley, undoubtedly belongs to this species, which was described from a single male from the neighbourhood of Pará (Brazil): Brauer merely translates Macquart's description without having seen a specimen. I therefore append a description of this female.

♀. Length $23\frac{1}{2}$ millim. (rather more than that of Macquart's type, which he states as 9 l. (French), = 20 millim.); width of vertex $3\frac{2}{3}$ millim.; width of head $9\frac{1}{3}$ millim.; width of thorax at base of wings 9 millim.; length of thorax including scutellum $11\frac{1}{2}$ millim.; width of abdomen (second segment) $11\frac{1}{2}$ millim.

Margins of the *front* next the eyes below bordered with yellowish pollen, which on each side runs out inwards in two triangular projections, enclosing the uppermost "espace arrondi luisant" of Macquart; the lower of these triangular projections extends to the *fissura frontalis*; the bare spots on the *face* large and very conspicuous when the head is viewed from in front. *Thorax* greyish black; *scutellum* reddish brown, darker at the sides, semitranslucent by transmitted light, flattened, and somewhat acuminate, yellowish pollinose below; a strongly marked brownish-black median stripe extending from the anterior margin of the thorax to the middle of the scutellum, about 2 millim. broad in front, and tapering somewhat posteriorly; on each side of this a light grey stripe of about half its width, and, contrary to the statement of Macquart, extending to a distance of 2 millim. beyond the suture; outside the grey stripe a black one on each side running to the scutellum, somewhat broader than the grey stripe in front, but extremely attenuated behind the suture; the greyish area outside the last-mentioned stripe on each side somewhat indistinctly divided by a broader black stripe, which joins the inner margins of the tubercles on the anterior and posterior angles: *pectus* and *pleuræ* greyish pollinose, two small dark brown shining spots, of which the posterior is the more elongated and duller, on the *pleuræ* below the spots of black pile noticed by Macquart; the yellow pile clothing the *pleuræ* and *pectus* forming a narrow fringe, which limits the *dorsum* and extends to the posterior tubercle above the base of the wing; *dorsum* and upper surface of *scutellum* clothed with short black pile, becoming more conspicuous

where it meets the yellow fringe; a few short yellowish hairs projecting from the under surface of the scutellum posteriorly. *Abdomen* reddish chestnut, the sides of the last three segments below, as well as more or less of the anterior portion of the third, greyish pollinose; the first four segments thickly clothed with short, appressed, silky hairs of a ferruginous hue; the fifth segment thickly clothed with longer golden hairs; the second segment with an oblong patch of black hairs on each side, occupying only the anterior two-thirds of the segment, and not descending far down the sides; it is probably to these patches that Macquart is referring when he states, "premier segment noir, à bord postérieur fauve;" a triangular area in the centre of the second segment also clothed with short black pile, reaching to the posterior margin in the median line, and surrounded on each side by a tuft of longer yellowish-orange pile starting from the posterior margin of the first segment; central portion of third segment near the posterior margin with an ill-defined black band, due to short black hairs mingling with the ferruginous ones; posterior margin of second and third segments narrowly whitish. *Legs*: first two pairs of *coxæ* black, greyish pollinose, the anterior pair clothed externally with pale yellow hairs and in front with black hairs, the middle pair clothed externally with yellow hairs, mingled with which are a few black ones; posterior *coxæ* black, reddish brown behind, clothed externally with a tuft of yellow pile and at the extreme base with black hairs; *femora*, *tibiæ*, and *tarsi* brownish black, clothed with black hairs; the anterior femora and the posterior side of the others at the base reddish brown; the bases of the femora, posteriorly in the case of the first two pairs and anteriorly in that of the the last pair, yellowish pollinose and clothed with yellow pile; bases of the middle femora also with traces of yellow pollen above and anteriorly, those of the last pair posteriorly slightly yellowish pollinose and with a few yellow hairs. *Wings*, *alulæ*, and *squamæ* very dark brown, the latter with a fine border of extremely short yellowish pile; *wings* not very large for the size of the insect, covered with conspicuous transverse wrinkles; *alulæ* large, subquadrate in shape, strongly wrinkled, and very conspicuous when the insect is viewed from the side with the wings at rest.

Ecuador (*Clarence Buckley*); one specimen.

Cutiterebra nigricincta, sp. n.

(Pl. XIII. figs. 4, 4 a.)

♂. Length 19½ millim.; width of vertex 3 millim.; width

of head 8 millim.; width of thorax at base of wings $8\frac{3}{4}$ millim.; width of abdomen (second segment) 10 millim.; length of wing $16\frac{1}{2}$ millim.

Black; dorsum of the thorax, except a small area on the anterior margin, clothed with black pile; central portion of the pleuræ also clothed with black pile; abdomen metallic brassy green, shining, thickly clothed with silky golden-yellow pile, with a conspicuous band of black pile on the posterior margin of the third segment, the base also clothed with black pile.

Head entirely clothed with shimmering pale golden pollen, thinly covered with short pile of the same colour, which is longer and thicker on the cheeks below and nearly conceals the oral cleft; occipital margin of the vertex brownish, with a blackish-brown triangular mark enclosing the upper angle of each eye, and bearing a few short black hairs; ocellar tubercle also with a few black hairs; *antennary pit* greyish pollinose; *antennæ* dark brown, first and second joints clothed with pale golden pile above, third joint ovate, about half as long again as the two former taken together; *arista* dark brown at the base, reddish brown towards the tip, cilia pale yellowish; *lunula frontalis* brownish black, shining; on each side of the face and touching the margin of the eye opposite the third joint of the antenna a large shining black spot, with the upper margin straight and bluntly conical below, sparsely punctuate and bearing a few pale golden hairs; the upper margins of these spots are on a level with the base of the third joint of the antenna; they are separated from the fissura frontalis by barely half their width; a similar spot, rather larger in size and subquadrate in shape, on the cheeks near the lower margin of each eye, and directly below the upper spot; a small bare triangular fleck between the lower spot and the eye, touching the lower margin of the latter. *Thorax*: anterior surface clothed with golden pile, which extends to a distance of 2 millim. as a semilunar patch on the anterior margin of the dorsum; this patch is scarcely visible when looked at from above, but conspicuous when the insect is viewed from in front; *scutellum* black and clothed with short black pile above, yellowish pollinose below, and with a few short yellowish hairs projecting from below the posterior margin; *pectus* clothed with deep yellow pile, which runs up on to the pleuræ in two stripes; the anterior of these, which is the broader, forms an arch over the prothoracic stigma and is in connexion with the yellow pile on the anterior surface, while the posterior stripe terminates in a tuft in front of the squamæ. *Abdomen*: first and second segments clothed with short black pile, sides

of the second segment below greyish pollinose and with a few short yellow hairs, a little yellow pile on the anterior angles of the first segment also; central portion of the third segment somewhat bluish, the band of black pile on the posterior margin very conspicuous and sharply defined when the insect is viewed obliquely from the front; this band does not reach the posterior angles of the segment below, while the ends are divided by a tapering band of greyish pollen, on which the pile is somewhat sparser, while in front of it there is a line of hair projecting at a different angle from the rest, so that on looking at the ventral surface we appear to see the margin of an additional segment; ground-colour of the fifth segment, when viewed from behind, tawny, with a dull greyish pollinose transverse band, divided in the median line and occupying rather more than the anterior half of the segment; this is most conspicuous when the specimen is held so that the eye looks directly at the edge of the hind margin of the fourth segment; in certain positions a narrower greyish pollinose band is also visible on the sides of the third and fourth segments, lying nearer to the anterior than to the posterior margin, but not in contact with either, and dying away on the dorsal surface before reaching the median line; a narrow dull median longitudinal stripe is faintly indicated when the abdomen is viewed obliquely from behind; the pile clothing the fifth segment thicker and longer than elsewhere. *Legs* clothed with black pile, the posterior surface of the last pair of femora thinly clothed nearly to the tip with short silky yellowish pile; all the coxæ, the bases of the anterior femora above, and those of the middle pair posteriorly also with some yellow pile; *femora* and *tibiæ* reddish brown, the latter darker than the former; *tarsi* black, short and broad; *claws* black. *Wings* brown, somewhat lighter towards the posterior margin, narrow and tapering to the tips, somewhat lancet-shaped; *alulæ* dark brown, of moderate size, subquadrate; *squamæ* dark brown, fringed with short brown pile, and showing no light margin.

Pará, Brazil (*Bates*); one specimen.

This species presents no resemblance to any of those previously described: it is at once distinguished from *Cutiterebra analis*, Macq. (*apicalis*, Guér.), by the thorax and scutellum (with the exception of the anterior margin of the former) being entirely clothed with black pile instead of with golden yellow; while the unstriped thorax and the shining metallic abdomen, with its black transverse band, render it impossible to confuse *C. nigricincta* with *C. rufiventris*, Macq.

BOGERIA, gen. nov.

Large, compact, and thick-set flies, resembling *Cutiterebra* in general appearance, but with the arista bare and the tarsi, or at least the front and middle pairs, not expanded.

Allied to *Rogenhoferia*, Brauer (Verh. k. k. z.-b. Ges. Wien, 1863, and 'Monographie der Oestridenten,' 1863, pp. 215-216), but differing as follows:—*Profile of the head* much more nearly semicircular than that of *Rogenhoferia* as shown in Brauer's figure ('Monographie,' &c. tab. iv. fig. 8 a); viewed from in front the outline of the head much more nearly circular than that of *Rogenhoferia* as figured by Brauer ('Monographie,' &c. tab. vi. fig. 14); *eyes* occupying rather more than the upper half of the head in profile, but not projecting above the vertex—rather on a slightly lower level when viewed from in front; with the head in its natural position, no space visible between it and the thorax, when the insect is viewed from the side; *antennary pit* small, in length equal to about one fourth of the greatest length of the eyes, and, when the head is viewed from in front, extending from a point opposite the centre of the inner margin of the eye to another slightly lower than the middle of the lower half of the latter; *antennæ* small, first two joints very short, *third joint* rounded at the tip, *rather longer than the first two joints taken together*; *arista* short, stout, tapering only at the tip, first segment somewhat elongated and arising from the third joint of the antennæ at a point about one third of its length from the base; *proboscis* short, concealed in the oral cleft, at least in the typical species; *occipital orbits* very conspicuous; *first pair of legs* slender, the tarsi not expanded; middle and posterior legs, though stouter, with tarsi but slightly dilated, scarcely broader than the tibiæ, their middle joints ovate, not semilunar; *wings* shorter than in *Rogenhoferia*, tapering to their tips, with no appendix to the angle of the fourth vein; *alulae* large, quadrate, with the anterior angles rounded, very prominent when the wings are at rest; *abdomen* bluntly conical, the basal angles rounded off abruptly.

Pupa-case viewed from above subpyriform, much more regular in outline than that of *Cutiterebra*, since the segments bear no ridges as in the genus alluded to; viewed from the side, the under surface slightly concave, the upper strongly convex; upper surface of the first four segments forming a cap ("Deckel"), as in *Cutiterebra*, to facilitate the escape of the imago; terminal segment concealed in a narrow transverse slit, bearing a notch on the lower instead of the upper margin, as in *Cutiterebra*; the eighth segment the longest;

rather less than the anterior half of all the visible segments (the "cap" is wanting in the two specimens from which this description is taken) surrounded by a zone of small, sharp, backwardly directed *spines*, the largest of which are about 1 millim. in length; a narrow and less conspicuous ring of smaller spines surrounds the posterior margins of the segments; the rest of the surface covered with small, distinct, bluntly conical *tubercles*, *not scales*; the three lateral rows of protuberances exhibited by the pupa-case of *Cutiterebra* but very faintly indicated, and that only upon segments anterior to the seventh; posterior stigmata reniform.

The absence of transverse ridges upon the posterior region of the segments and the fact that the surface is covered with tubercles and spines* instead of with imbricated scales at once distinguish the pupa-case of *Bogeria* from that of *Cutiterebra*. The previous stages of *Rogenhoferia trigonophora*, Brauer ('Monographie,' &c. pp. 217-218), the type of its genus, are unknown; but, according to Berg's description (Stett. ent. Z., Jahrg. xxxvii. 1876, pp. 271-272) of the larva of *Rogenhoferia* (*Cephenomyia*) *grandis*, Guér., the only other species that has as yet been assigned to *Rogenhoferia*, the pupa-case in that genus also is covered with scales.

Bogeria can be inserted in Prof. Brauer's tables (*vide* 'Monographie der Oestriden,' p. 45, and Wien. ent. Z., Jahrg. vi. 1887, p. 15) as follows:—

Œstridæ.

CUTITEREBRINÆ.

I. Arista feathered above.

a. Tarsi broad, flattened *Cutiterebra*, Clk.

b. Tarsi slender *Dermatobia*, Brauer.

II. Arista bare.

a. Antennary pit large; third joint of the antennæ short, round, not longer than the second; arista

* The spiny larva described by Coquerel and Sallé (Ann. Soc. Ent. Fr. iv. sér. t. 2, 4^{ième} trim., 1863, p. 785, pl. xix. fig. 2) from *Lepus palustris*, Bachm., from Mexico, and assigned by the authors to an undetermined species of *Cutiterebra*, may possibly belong to this genus. In this case, however, the spines are apparently not arranged in definite zones, and, judging from the enlarged figure (pl. xix. fig. 2 b), they are shorter and broader than in *Bogeria*. The fact that some of them are bifid at the tip may be due to their being broken. Townsend ('Psyche,' vol. vi. 1892, pp. 299-300) describes a spiny larva, assigned by him to *Dermatobia*, sp., from *Lepus callotis*, Wagler, from New Mexico; but neither in this case are the spines arranged in zones. Townsend writes:—"Segments after the first sparsely covered with short, black, curved spines. . . ."

long, slender; alulæ of moderate size; wings with a short appendix to the angle of the fourth vein

Rogenhoferia, Brauer.

b. Antennary pit small; third joint of the antennæ slightly longer than the first two joints taken together; arista short, stout; alulæ large; wings with no appendix to the angle of the fourth vein

Bogeria, nov.

I dedicate this genus to Lieut. H. O. Boger, R.N., to whom the British Museum is indebted for the specimens of the typical species described below.

Bogeria princeps, sp. n.
(Pl. XIII. figs. 5-5 b.)

♂. Length $20\frac{1}{2}$ - $21\frac{1}{2}$ millim.; width of front at vertex $2\frac{1}{2}$ -3 millim.; width of head $8\frac{1}{2}$ millim.; length of wing 16 millim.

General colour of thorax brownish grey, abdomen silvery grey; ground-colour reddish brown, concealed by greyish dust; thorax and abdomen nearly bare above; pleuræ clothed with thick white pile, which extends in a stripe above the base of the wing to the base of the scutellum.

Head almost precisely the same width as the thorax, the latter appearing slightly broader at the base of the wings, owing to the pilosity of the pleuræ; front thinly clothed below with short appressed yellowish-white hairs, and above and on the vertex with short erect blackish hairs, and forming a rounded projection in front of the eyes when the insect is viewed from above; a narrow median shining black triangle extending forwards from the anterior ocellus to a distance of $1\frac{1}{2}$ millim.; a strongly marked ridge surrounding the antennary pit, except below, and bounded by the vertical semi-circular fissura frontalis; antennary pit contracted below into a narrow flattened median ridge extending to the oral cleft; septum separating the antennæ well marked: *antennæ* blackish brown, second joint reddish brown; arista bright reddish brown; first joint and extreme base of the second black; a shining dark brown semilunar spot above the base of each antenna, while, on a slightly lower level, a transversely elongated shining spot of a similar colour extends upwards and inwards from the margin of each eye; above each of the latter spots a small silvery-white triangle, resting on the margin of the eye: *face and cheeks silvery white*; face covered

with somewhat coarse closely-set punctures, which become smaller below and are absent on the cheeks below the eyes; face and cheeks clothed with silvery-white pile, which is very sparse on the former, but thicker on the latter, and partially conceals the oral cleft; a curved shining black mark on each side of the antennary pit below, continued backwards as a narrow incised line on each side of the contracted portion, and ending in a small triangular shining spot on each side of the commencement of the wider portion of the oral cleft; between each of these spots and the eye, and nearer the latter, a conspicuous, sharply defined, and somewhat rounder shining spot, while in the same straight line and close to the orbit lies a much smaller and less distinct fleck, above which and halfway between it and the transverse shining spot already mentioned is a similar mark; the extremity of the vertical arc of the *fissura frontalis* on each side dull black; occiput clothed with silvery-white pile; occipital orbits silvery white.

Thorax and scutellum thinly clothed above with short black pile, which becomes more conspicuous and forms a distinct longitudinal stripe above the thick white pile of the pleuræ; pectus also clothed with thick white pile; posterior border of the *scutellum* thinly clothed beneath with whitish pile, which projects beyond the margin, and so gives the scutellum a whitish rim.

Abdomen coarsely granular above; posterior border of third, fourth, and fifth segments and that of the second on the sides narrowly shining black; upper surface thinly clothed with short black hairs; basal angles in the typical specimen clothed with longer silvery-white pile, in front of which is a little black pile, while the basal angles are connected by a semilunar band of silvery-white pile, which conceals the hind margin of the second segment, and in the median line projects on to the third segment, which is clothed in the centre behind this projection with brownish pile; in the other specimen the longer pile on the second segment is for the most part brownish, a little paler and thinner in the middle of the hind margin, while there is more black pile on the sides of the segment in front; ventral groove thickly clothed with whitish pile, except in the median line; sides of the segments below thinly clothed with short silvery pile; genital ring a broad quadrangular plate.

Legs: *coxæ* shining black, pollinose, clothed with whitish pile, the posterior pair also with black hairs; *femora* reddish brown, pollinose, apices black, extreme tips shining, clothed above and below with whitish pile, while the second and third also bear a certain number of black hairs on the inner side at

the base and above; tibiæ and tarsi black, greyish pollinose, the former thinly clothed, the latter fringed at the sides with black hairs; claws black, sometimes reddish brown in the middle.

Wings uniformly light brown; *alulæ* and *squamæ* also brown, the margin of the latter paler and fringed with very short silvery pile; *alulæ* very conspicuous when the wings are at rest, directed upwards, and embracing the scutellum on each side.

Pupa-case black: length 25–26 millim.; width of seventh segment (the broadest) 15 millim.; posterior stigmata orange-yellow.

Médano Blanco, Sta. Barbara Bay (Gulf of California), Mexico (*Lieut. H. O. Boger, R.N.*); two specimens, both males, with their pupa-cases. The pupæ, from which the specimens subsequently emerged, were found in January 1893, when *Lieut. Boger* was serving on the Pacific station in H.M.S. 'Melpomene.' The flies appeared in the following March.

To the anal extremity of each of the pupa-cases are still adhering a number of hairs, evidently those of the host; they are pale yellowish brown, somewhat curling, and one of them has a distinct black tip. They probably belong to some Rodent, but I fear are not sufficient to enable one to hazard even a guess at the host's identity. *Lieut. Boger*, however, informs me that jack-rabbits (*Lepus callotis*, *Wagler*) were abundant in the locality where the larvæ were found.

DERMATOBIA, Brauer.

Dermatobia, Brauer, Verh. z.-b. Ges. Wien, 1860; 'Monographie,' &c. 1863, pp. 251–253. ♀

Dermatobia cyaniventris, Macq. (= *D. noxialis*, Goudot).

Cuterebra cyaniventris, Macquart, Diptères Exotiques, ii. 3, p. 23 (1843).

Cuterebra noxialis, Goudot, Ann. des Sc. Nat. 3^e sér. t. iii. pp. 229, 230 (1845).

One female, from Ega, R. Amazons, Brazil (*Bates*).

In spite of the fact that, as pointed out by Goudot (*loc. cit.* p. 230), Macquart does not mention that the abdomen of *C. cyaniventris* is clothed with short black pile, with whitish (yellowish) pile at the base, there can be no doubt that the descriptions of the two authors refer to the same species. The species is redescribed by Brauer ('Monographie,' &c. pp. 267–268) from a specimen in the Imperial Natural History Museum at Vienna.

In addition to the specimen mentioned above, the Museum also possesses two larvæ of *Dermatobia*, both of which are probably in the second stage, and belong to the form known in Cayenne as the "Ver macaque," although one is considerably smaller and more attenuated than the other. *D. cyaniventris* is the only species at present described; but whether either or both of these larvæ belong to this species or to some other it is, of course, impossible to say. The smaller larva, which was removed from the arm of Mr. E. Bartlett in Chamicuros, E. Peru, in 1867, is 15 millim. in length, of which the more swollen portion, consisting of the first seven segments bearing the usual bands of spines, occupies less than one third. The width of this larva at the sixth segment (the widest part of the swollen portion) is $2\frac{1}{2}$ millim., while the width in the centre of the attenuated portion is only 1 millim. The second larva is from Trinidad, and was forwarded by Mr. J. H. Hart at the same time as the typical specimen of *Cutiterebra funebris*, Austen. This larva was removed from a human knee at the commencement of December 1894. In his letter accompanying it Mr. Hart writes:—"From frequent cases I think it highly probable that we have several species of this kind of insect in the colony." This, however, remains to be seen; there may be several species of *Dermatobia* in Trinidad, but it is quite possible that Mr. Hart is referring to different stages of the larva of the same insect. The dimensions of this larva are as follows:—Length $9\frac{1}{2}$ millim.; length of swollen portion 7 millim.; greatest width about 4 millim.; width of attenuated portion $1\frac{1}{3}$ millim. Although about twice the length, in the ratio of the attenuated to the swollen portion of the body, this larva closely resembles that described and figured by Dr. Matas ('Insect Life,' i. pp. 76–80, fig. 10), which, with two others, was removed by the author referred to, in the Charity Hospital, New Orleans, from the body of an Englishman who had recently come from Spanish Honduras.

EXPLANATION OF PLATE XIII.

- Fig. 1. *Cutiterebra funebris*.
 Fig. 1 a. Ditto. Head from in front.
 Fig. 1 b. Ditto. Pupa-case.
 Fig. 2. *Cutiterebra terrisona*, Walk.
 Fig. 2 a. Ditto. Head from in front.
 Fig. 3. *Cutiterebra rufiventris*, Macq., ♀.
 Fig. 3 a. Ditto. Head from in front.
 Fig. 4. *Cutiterebra nigricincta*.
 Fig. 4 a. Ditto. Head from in front.
 Fig. 5. *Bogeria princeps*.
 Fig. 5 a. Ditto. Head from in front.
 Fig. 5 b. Ditto. Pupa-case.

XLVI.—Two new Amphipods from the West Indies.

By the Rev. THOMAS R. R. STEBBING, M.A.

[Plates XIV. & XV.]

Amphithoë megaloprotopus, sp. n.
(Pls. XIV. and XV. B.)

From *Amphithoë*, Leach, the genus *Grubia*, Czerniavski, is separated only by its possession of a one-jointed accessory flagellum on the upper antennæ. From *Microdeutopus*, Costa, Professor Della Valle distinguishes *Stimpsonella* by the single character that "the prehensile angle of the second gnathopods in the male is prolonged into a more or less notable process." Upon these precedents it is to be expected that the species now to be described will not long escape from transfer to a new generic name. It is, to be sure, a characteristic *Amphithoë*, except in one respect; but, contrary to the existing definition of that genus, it has the first gnathopods larger instead of smaller than the second. Thus it is easily distinguishable from all its hitherto known congeners, and at the same time it shows an approximation between Boeck's subfamilies of the *Microdeutopinæ* and *Amphithoinæ*, which Della Valle groups together with others in an extensive family called *Corophidæ*.

The new species has the body flecked all over with stellate markings, as is commonly the case in this genus.

Eyes placed on the front lobes of the head, rounded, of moderate size, black in the specimen preserved in spirit.

Upper Antennæ.—First joint long and stout, fringed with very long setæ; second joint much thinner, but not much shorter than the first, with numerous tufts of setæ; third joint short, slightly curved; flagellum imperfect, the remnant as long as the peduncle, containing twenty-three small joints.

Lower Antennæ.—Imperfect; the second and third joints short and stout; the fourth joint robust, nearly once and a half the length of the first joint of the upper antennæ.

Mouth-organs.—As will be seen from the figures these are of the usual type. This remark applies also to the second maxillæ, which were examined, but were accidentally lost before they had been drawn. The left mandible has six serrate spines in the spine-row, the right has only five; the secondary plate is strongly denticulate on the left, but very feebly on the right. The molar tubercle is partially fringed with spine-like teeth and carries a long seta. The third

joint of the palp is nearly equal in length to the first and second combined. The first maxillæ have three small setæ on the inner margin of the small inner plate*, the outer plate carries the usual ten spines. The maxillipeds are chiefly remarkable for the stout and prominent development of the chin-like base. As the figure shows, one of the palps has suffered an injury. It is noticeable that the cicatrice is in the middle of the third joint, not, as might have been expected, and as is the case with the likewise damaged lower antennæ, at an articulation.

First Gnathopods.—The side-plates are very large, much longer than deep, produced forwards so as completely to cover the mouth-organs. The second joint of the limb, attached near the hind margin of the side-plate, is directed backwards; in length it about equals the hand, but is much narrower. The front margin is channelled and distally lobed. The fourth joint has three tufts of setæ on the hind margin and a small pointed apex. The wrist is triangular, cup-shaped, scarcely longer than broad. The length of the massive hand is equal to more than twice the breadth; its margins are nearly parallel, but the front is regularly though slightly convex, while the hinder is somewhat sinuous. The palm is a little oblique, though at the end forming a right angle with the hind margin. The curved finger is stout at the hinge, and its apex very decidedly overlaps the palm.

Second Gnathopods.—The side-plates scarcely half the length of the preceding pair; the limb very similar in structure to that of the first gnathopods, except that the hand is rather shorter and rather narrower, with a much more sinuous palm, within the point of which the apex of the short much-curved finger closes down. The setæ on the rounded apical part of the hand's front margin are very long. Both pairs of gnathopods are bulky, and as the base of the maxillipeds is also thick, it seems as if there were no room for the animal to draw up its "hands" into concealment between the side-plates, as Amphipods in general are so inconveniently fond of doing. The lateral view of the specimen shows the actual undisturbed position in which the gnathopods were observed.

First and Second Peræopods.—The side-plates are similar to those of the second gnathopods, and so also are the broadly flask-shaped branchial vesicles. Neither in these nor in the following peræopods were any distinguishing features discerned, and the general character will be sufficiently seen by the figures.

* According to Della Valle the first maxillæ in *Amphithoë* are devoid of an inner plate; but this is contrary to my experience.

Pleopods.—Coupling-spines two; cleft spines six; joints of rami from seventeen to nineteen in number; the outer ramus slightly shorter than the inner and a little curved.

Uropods.—The proportions and armature are sufficiently shown in the figures.

Telson.—The breadth at the base is slightly longer than the length. There is a small apically rounded triangular piece produced beyond the two lateral apices, which appear to be constituted each by a small upturned hook. Within these points are backward-projecting setæ, and considerably above them are planted other setæ which diverge laterally.

The length of the specimen from the front of the head to the end of the peræon was three tenths of an inch, and the length of the pleon two tenths. Allowing for the overlapping of the segments, the animal when distended would probably have measured considerably less than five tenths of an inch from the head to the telson.

The specific name, meaning "with a large first foot," refers to the superiority in size of the first over the second gnathopods.

The specimen was obtained from seaweed on rocks at Antigua, and forwarded to me by the kindness of my friend Mr. W. R. Forrest.

DEUTELLA, Mayer, 1890.

In the Supplement to his 'Monograph on the Caprellidæ' Dr. Mayer defines this genus as follows:—

"Mandibular-palp three-jointed. Flagellum of the antennæ two-jointed. Rudiments of legs on the third and fourth segments, in the female those on the fourth segment being at a considerable distance from the branchiæ. On the abdomen of the male one pair of one-jointed leg-stumps."

In the following paragraph he mentions that the rudimentary legs are two-jointed and provided with numerous setæ. Assigned to the genus are the species *Deutella californica*, *Deutella venenosa*, and a third as yet unnamed. In the tabular view of the twenty-three genera of Caprellidæ which Dr. Mayer gives on page 8 of his exceedingly valuable Supplement a difficulty arises in regard to *Deutella*. For there the abdomen of the male is stated to have two pairs of leg-stumps, instead of only one pair as in the subsequent diagnosis. Moreover, the characters ascribed in the table to *Pseudoprotella* are practically the same as those given to *Deutella*, the only differences being that in *Pseudoprotella* the number of setæ on the terminal joint of the mandibular palp

is reckoned as $1 + 20 + 2$, while in *Deutella* it is $1 + x + 1$, and the position of the penes in the former genus is median, in the latter almost median. A key to facilitate the discrimination of the numerous genera is given in three different forms; but it so happens that in each of these *Deutella* and *Pseudoprotella* are grouped together, instead of being distinguished. As regards the abdomen in the two genera, the illustrations on plate v. seem to show that there is in fact no tenable distinction in this respect between them. It is otherwise with the palp of the mandibles, for its third joint in *Deutella* is armed with very few setæ, while in *Pseudoprotella* they are numerous. Yet this seems a rather precarious character on which to separate two genera. The species about to be described agrees with *Deutella* in the simple armature of the mandibular palp, but differs from it and apparently from all other Caprellidæ in the shortness of the third joint of the palp, herein making an approach to the genus *Parvipalpus*, Mayer, in which the third joint is altogether wanting.

Between *Pseudoprotella* and *Deutella* there is one feature of distinction, which Dr. Mayer mentions, though he lays very little stress upon it, but which, in the absence of more striking differences, acquires some importance. This concerns the relation between the fourth, fifth, and sixth joints of the first gnathopods. In *Pseudoprotella* the fifth joint or wrist is elongate, so that the fourth joint is kept at a considerable distance from the hand, whereas in *Deutella* the wrist is so short that the fourth joint almost touches the base of the hand.

Deutella Mayeri, sp. n. (Pl. XV. A.)

The head is rounded and smooth, with the skull-like appearance familiar in *Caprella acanthifera*. The peræon is smooth, its third and fourth segments being the longest and equal to one another in length; the second segment deep in the front part, at which in both sexes the gnathopods are attached.

The eyes are round and black in the specimens preserved in spirit.

Upper Antennæ.—The second joint much longer than either the first or third, the first stouter but very little longer than the third; the flagellum having in the male six joints, of which the first is much the longest and carries four hyaline filaments, each of the others having but one. In the female the flagellum has five joints.

Lower Antennæ.—Much more slender than the upper, the peduncles of which they do not quite equal in length. The

fourth and fifth joints are equal to one another, and each is longer than the small two-jointed flagellum.

Mandibles.—The cutting-edge and secondary plate denticulate, the spine-row containing apparently not more than three spines, the molar tubercle prominent. The palp slight in structure, with the first joint not much shorter than the second and longer than the third, the third carrying only two or three short apical setæ.

Lower Lip.—The inner lobes comparatively large, the outer widely separated, the mandibular processes small.

First Maxillæ.—No distinct inner plate, the outer plate armed with five spines; the palp two-jointed, the large second joint carrying four setæ on its distal margin.

Second Maxillæ.—The inner and outer plates each distally armed with three spines, the inner having an additional one on its inner margin.

Maxillipeds.—The inner plates rather small, tipped with a few setæ, the outer plates reaching halfway along the second joint of the palp, and armed with two spines on the apex and two on the inner margin. The second joint of the palp the longest, the third ending in the pointed process which Mayer mentions as being found in several genera. The figure which Mayer gives of the maxilliped of his *Deutella venenosa* would serve for that of the present species.

First Gnathopods.—These are attached so far forward that the base of the maxillipeds appears behind them. The short wrist lies beside the fourth joint, which, as usual, to use Spence Bate's expression, overrides it. The hand is somewhat triangular, broadest at the base. The finger curves over the whole elongate palm and is pectinate within. In the larger specimens the finger, at least in the oblique view, appears to be to a trifling degree sinuous.

Second Gnathopods.—The second joint is equal in length to the hand; the third is rather longer than the fourth; the fifth is of insignificant size and coalescent with the large hand, which has at the base a backward directed process surmounted by a spine and one or two setules. The long front margin is very convex. In the female the hind margin is also convex, the long finger curving over it as far as the hollow formed between it and the above-mentioned process. In the male the hind margin is slightly concave, distally forming a small sharp tooth and ending squarely between this tooth and the hinge of the finger.

First and Second Peræopods.—The minute rudimentary limbs lie close to the bases of the branchial vesicles. The second joint of the limb is scarcely a third of the length of

the first joint, and is almost devoid of setules. The marsupial laminae in the female are large, with short filaments, chiefly, though not exclusively, on the first pair. The specimen figured had four large eggs in the slightly dehiscent marsupium.

Third, Fourth, and Fifth Peræopods.—These limbs are similar in structure, but the fourth are of larger size than the third and the fifth than the fourth. The hand is powerful, with a projection at the base, against which the long curved finger impinges. The basal process is followed by four or five of like character, but successively decreasing in size, along the inner margin. This form of hand is noticed by Mayer as occurring not only in *Deutella venenosa*, but also in the genera *Paracaprella* and *Hemiægina*.

The length of the male specimen is three-twentieths of an inch, the antennæ and limbs not being included. The females with eggs are rather shorter. A specimen from which the mouth-organs separately figured were dissected was smaller than the females; it had the appearance of being a young male.

The specific name is given out of respect to Dr. Paul Mayer, whose works on this branch of Crustacea can scarcely be too highly appreciated.

The specimens were taken from sand in shallow water at Antigua by Mr. W. R. Forrest. Since Mayer's *Deutella venenosa* was taken at Coquimbo, on the west coast of South America, along with *Caprella scaura*, Templeton, it may be worth mentioning as a coincidence that along with the present species Mr. Forrest sent also a specimen of *Caprella scaura*. Moreover, he sent a specimen which appears to belong without doubt to the species named *Æginella tristanensis* in the Report on the 'Challenger' Amphipoda. This species has since been referred by Dr. Mayer to a new genus, *Pseud-æginnella*. The 'Challenger' specimen was destitute of all the last three pairs of peræopods: the specimen from Antigua has them all. In general appearance they are not very unlike those of *Deutella Mayeri*, though the inner margin of the head is simpler; but they have one character which is very unusual, namely, that the penultimate pair is notably larger than the ultimate. Additional specimens may hereafter show that this is only a casual variation.

EXPLANATION OF THE PLATES.

PLATES XIV. & XV. B.

Amphithoë megaloprotopus.

Lateral view of the animal; the natural size indicated by the line above. *a.s.*, upper antennæ; *a.i.*, portion of lower antennæ; *l.s.*, upper lip; *m, m*,

mandibles; *li.*, lower lip; *mx.* 1, one of the first maxillæ, and spines of the outer plate of the other more highly magnified; *mxp.*, maxillipeds; *gn.* 1, first gnathopod; *gn.* 2, second gnathopod; *prp.* 1, 3, 4, 5, first, third, fourth, and fifth peræopods; *ur.* 1, 2, 3, first, second, and third uropods; T, telson.

The mouth-organs and parts of the pleon are much more highly magnified than the antennæ and limbs.

PLATE XV. A.

Deutella Mayeri.

Lateral view of the female above, and of the male below, the natural size of the male being indicated by a line on the right.

os., the mouth-organs of the male specimen viewed laterally *in situ*. The palp of the mandible is seen overtopping the upper lip; the lower lip can be perceived almost edgewise below the molar tubercle of the mandible and above the palp of the first maxilla; between the latter and the prominent palp of the maxilliped are discerned the two plates of the second maxilla.

li., lower lip; *mx.* 1, first maxilla; *mx.* 2, second maxilla; *mxp.*, maxillipeds; *gn.* 1, first gnathopod. This group is taken from a specimen smaller than either the male or female specimen figured on the plate.

a.s., upper antenna; *a.i.*, lower antenna; *gn.* 1, first gnathopod; *gn.* 2, second gnathopod; *prp.* 1, 2, 3, 5, first, second, third, and fifth peræopods.

The parts of the female are distinguished by the sign ♀, of the male by the sign ♂.

XLVII.—*On a Group of the Aplysiidæ, with Description of a new Species.* By J. GILCHRIST, Ph.D., &c.

[Plate XVIII.]

THE following description of a small group of Aplysias is a contribution to an account of the collection of Tectibranchs in the British Museum (Natural History). This collection contains a great number and variety of forms from the Pacific, Atlantic, and Indian Oceans, and illustrates very forcibly what could be done if a systematic search for these animals were made in almost any unexplored region. Owing to careful preservation and a liberal supply of spirit some of the specimens are in a good state of preservation and sufficient for purposes of identification.

The small group to be considered here is represented by half a dozen specimens, more especially by *Aplysia piperata* (Smith), from Thursday Island, Torres Straits ('Alert')

collection), and by a specimen in a good state of preservation from Siam (M. Mouhot's collection).

This latter (Pl. XVIII. figs. 1 and 3) appears to be a new species, which I am enabled to describe by permission of Dr. Günther, Keeper of the Zoological Department, and which may be designated *Aplysia Mouhoti*. It closely resembles *A. piperata* (figs. 2 and 4) in the general structure of the body and in colouring. It is, however, well differentiated from it: (1) by the absence of the prolongation of the mantle into a long excretory siphon posteriorly (figs. 3 and 4, *siph.*). (2) The pleuropodia also are somewhat less developed, lie closer to the body, and evidently do not function as swimming-organs—compare the plicated edge of the pleuropodia of fig. 2, *pl.*, with that of fig. 1, *pl.* Figs. 3 and 4, *pl'*, indicate the line of attachment of the pleuropodia to the body. The difference between the pleuropodia in the two species is most marked at their anterior end. (3) The colouring differs somewhat: in *A. piperata* there is a uniform sprinkling of black dots all over the animal except on the sole of the foot and under the mantle, showing an inclination, especially on the head and mantle, to run into small radiating lines. (The lighter posterior end and dark encircling band described by Mr. Smith are perhaps due to accidental causes, as another and better preserved specimen in the collection shows no traces of these.) In *A. Mouhoti* this speckling of dark spots is absent, and there is a tendency rather to reticulate marking on pleuropodia and linear marking on head and mantle.

The two animals, on the other hand, possess several striking features in common. This is most marked in the general external topography of the body, a point which I have elsewhere tried to show is of special significance in the classification of the Tectibranchs:—(1) The pleuropodia in both cases start from about the posterior end of the first third of the body and run backwards to within a few millimetres of the end of the foot, being quite separate throughout their entire length. (2) In both the mantle, shell, and visceral mass are much more posterior than in, e. g., *A. limacina*; and, in coordination with this, the genital opening is peculiar in being located somewhat anteriorly to the mantle-cavity (figs. 3 and 4, *g.o.*). In the Tectibranchs it is, as a rule, within the pallial cavity. (3) The most striking point of agreement, however, is found in the position of the rhinophora. These are situated close together, just between the anterior ends of the pleuropodia. This is such a marked feature, and is so different from what is found in other Aplysiidæ, that it would seem to justify the establishment of a separate genus.

Other specimens in the collection present the same features. A second species in M. Mouhot's collection, also from Siam, seems identical with *A. Mouhoti*, but is not sufficiently well preserved. The same is to be said of a specimen from Australia, collected by J. B. Jukes, Esq. A larger specimen (foot 10×5 centim.) presents the same specific features, but is devoid of colour (bleached?).

The question of the systematic position of this group is of interest, as it seems to form a connecting-link between the Cephalaspidea and Anaspidea in the following particulars:— (1) Rhinophora (cf. *Acera*) in close proximity to anterior end of pleuropodia, in contrast to the position in, e. g., *A. limacina*. (2) Visceral mass posterior (with shell and mantle) and not yet entirely fused with foot (*vide* fig. 5). These characteristics mark it off sharply from the genus *Syphonota*, which Adams has proposed (on very insufficient grounds). If this genus is to be retained, these points must be taken into consideration.

Besides these forms there are in the collection other unexamined and probably new forms of the Aplysiidæ. There are, moreover, many representatives of the genera *Dolabrifera*, &c., forming good material for further work, though unfortunately with "spirit"-specimens.

EXPLANATION OF PLATE XVIII.

Fig. 1. *Aplysia Mouhoti*. Nat. size.

Fig. 2. *A. piperata*. Nat. size.

Figs. 3, 4. *Aplysia Mouhoti* and *A. piperata*. *gf.*, genital furrow; *rhin.*, rhinophora; *pl.*; free edge of pleuropodia; *pl'*, point of attachment of pleuropodia; *g.o.*, genital opening; *ct.*, point of attachment of gill; *an.*, anus; *siph.*, siphon.

Fig. 5. Longitudinal section of *Aplysia Mouhoti*. *sh.*, shell; *siph.*, siphon; *v.m.*, visceral mass.

XLVIII.—Descriptions of new Coleoptera from New Zealand. By Captain THOS. BROWN.

[Concluded from p. 245.]

Group Otiorhynchidæ.

Catoptes spermophilus, sp. n.

Robust, broad, moderately convex; piceous; tarsi flavo-castaneous, antennæ obscure rufous; densely covered with small, round, flat, fusco-testaceous scales; the setæ are erect

and mostly fuscous, the few that are greyish are not conspicuous; on top of the posterior declivity there is a transverse, much interrupted, pitchy space; below this the colour is only slightly paler than that on the dorsum. In one example the squamæ on the surface are somewhat rufescent.

Rostrum quite one third shorter than the thorax, but little expanded apically, with a central carina; vertex convex. *Scape* elongate, attaining the front of the thorax. *Funiculus* with the basal two joints equally elongate; third slightly longer than the fourth; seventh rather longer than broad; club elongate, acuminate. *Thorax* about one fourth broader than it is long, slightly wider before the middle than it is elsewhere; feebly obliquely impressed towards the sides in front, obsolete channelled along the middle, without asperities. *Scutellum* minute. *Elytra* evidently broader than the thorax; the shoulders, however, do not exceed the base of the thorax in width; disk slightly convex, with regular series of moderate punctures; interstices broad, the third and fifth but little, and rather irregularly raised, and ending in nodiform elevations behind, those on the third are distinct, the others are often indistinct; the sutural region is moderately convex behind. *Legs* fusco-rufous, with scales and greyish setæ; tibiæ slightly flexuous; third joint not very broad.

Underside with yellowish-grey decumbent setæ; the metasternum and basal segments with fine sponge-like grey clothing; the suture between the first and second segments strongly sinuate, fifth longitudinally impressed. *Prosternum* deeply emarginate in front. *Head* black, opaque, densely transversely strigose.

The *posterior corbels* are not at all cavernous. The *ocular lobes* are broad but well developed. The *eyes* are oblique and rather flat. The swelling alongside the scutellum is quite indistinct.

The minute scutellum at once distinguishes this from Nos. 2591 and 2592. The longer antennæ, broader form, and the vestiture of the lower surface differentiate it from *C. obliquisignatus*. The lines of pallid setæ so conspicuous in No. 2110 are here absent.

♀. Length (rostr. incl.) $3\frac{1}{2}$ –4, breadth $1\frac{3}{8}$ – $1\frac{5}{8}$ line.

Ashburton. Five examples were found by Mr. W. W. Smith in the seed-pods of *Phormium tenax*.

Var.—*Squamosity* much darker, quite fuscous near the sides and on the summit of the hind slope, with a few grey specks here and there. *Thorax* nearly as long as it is broad. *Scutellum* more distinct, longer than broad. *Elytra* narrower

and more parallel-sided; the nodosities on the fifth interstices are indistinct. This, most likely, is the male, but only one has been obtained.

Length (rostr. incl.) 3, breadth $\frac{7}{8}$ line.

Catoptes æqualis, sp. n.

Subovate, rather elongate; piceous, antennæ ferruginous; densely clothed with small, round, depressed, grey and yellowish-grey scales, and numerous nearly erect greyish setæ; the posterior declivity is not very pallid, and there are no fasciæ.

Rostrum shorter than thorax, with a moderate central carina; just before the eyes there is a slight transverse impression. *Thorax* nearly one third broader than long, widest before the middle, narrowed behind, with a slight frontal constriction; its surface is punctate, but not at all rugose. *Scutellum* minute. *Elytra* elongate, not broad, the base slightly incurved and but little wider than the thorax; they are not abruptly narrowed posteriorly; striate-punctate, interstices simple. *Tarsi* rather short, the small second joint not much more than half the breadth of the penultimate.

Underside squamose. *Prosternum* deeply emarginate. *Metasternum* and first abdominal segment broadly impressed; fifth segment with a slight longitudinal groove.

Scape rather densely setose, attaining front of thorax. *Funiculus* with the second joint quite the length of the first, 3 to 7 rather small, third and fourth but little longer than broad. *Club* oblong-oval, acuminate. *Eyes* obliquely oval. *Ocular lobes* moderately developed. *Scrobes* subapical, directed towards the lower part of the eyes; there is no groove between the eye and the scrobe itself. *Posterior corbels* not distinctly truncate.

This species looks like No. 1520; in it, however, the corbels are slightly cavernous, the eyes are much larger and nearly rotundate, the scrobes are directed more towards the lower surface, the suture near the scutellum is slightly raised; the third and fifth interstices, though slightly elevated, are not nodose.

Length (rostr. incl.) $2\frac{1}{4}$, breadth $\frac{7}{8}$ line.

Ashburton. One example from Mr. W. W. Smith.

Group *Eirrhinidæ*.

Pactola humeralis, sp. n.

Convex, subovate, fuscous; legs fusco-testaceous, scape rufo-testaceous, funiculus piceous; clothing dense, variegate,

consisting of dark brown, fusco-testaceous, and grey depressed scales; there are also many erect setæ, the finer ones are fuscous, the coarser are nearly white and chiefly distributed on the hind part of the body.

Rostrum rather short and broad. *Eyes* longitudinally oval, lateral. *Antennæ* finely pubescent; *scape* flexuous, subclavate for nearly half its length; basal joint of the *funiculus* nearly as long as the next four taken together, slender at the base, second about the length of the following two, 3 to 7 small, moniliform; *club* oblong-oval, triarticulate. *Thorax* cylindric, longer than broad, slightly constricted in front of the middle. *Elytra* ovate, shoulders rounded and narrowed and scarcely exceeding the thorax in width; posterior declivity rather abrupt; they are punctate-striate; there are no nodosities; the squamæ have a tendency to form spots. *Legs* squamose, stout.

Underside with grey hair-like scales; metasternum moderately convex; abdomen elongate, rather flat, fifth segment broadly grooved longitudinally.

This may be mistaken for *P. demissa*, Pascoe; the narrow shoulders and the shorter elytra, which are more abruptly deflexed behind, are constant and reliable characters; the posterior femora are usually less angulate and dentiform below.

Length (rostr. incl.) 1, breadth $\frac{3}{8}$ line.

West Plains, Invercargill. Found by Mr. A. Philpott.

About ten years ago Mr. S. W. Fulton sent me a specimen which he took off a *Veronica buxifolia*, but it was so mutilated that I did not think it advisable to describe it. It is subject to variation; the funiculus is not always piceous.

Group Cryptorhynchidæ.

Psepholax crassicornis, sp. n.

Convex, rather broad, opaque; antennæ and tarsi piceorufous, the body darker; squamosity dense, pale ochry, greyish, and fuscous, causing a slightly speckled appearance.

Rostrum shorter than the thorax, its anterior portion nearly double the breadth of the basal; finely and closely asperate behind, punctate in front, with a few yellow hairs there. *Antennæ* short and thick, bearing slender flavous setæ; the *scape* barely touches the eye, it is very thick; *funiculus* about a third longer than the scape; second joint about as long as the first, contracted at the base, joints 3 to 7 strongly transverse, the seventh broader than the preceding

ones; club ovate, rather short and broad, densely pubescent, indistinctly articulated. *Thorax* depressed and abruptly contracted in front for nearly half the whole length, base strongly bisinuate, sublobate in the middle; there is a narrow smooth space near the middle; the rest of the surface is closely punctured, the squamæ are flat and obscure tawny behind; in front there are many coarse variegate setæ. *Scutellum* depressed, indistinct. *Elytra* oblong, slightly wider than the thorax at the base, a little wider behind the middle, broadly rounded behind; punctate-striate, the third and fifth interstices are slightly raised backwards; these latter are rather more elevated, but do not extend more than halfway down the posterior declivity; the dark scales are most numerous near the base and sides; there are many coarse, erect, greyish setæ. *Legs* with griseous scales and setæ; *hind femora* laterally compressed, glabrous along the inner or hind face; *intermediate tibiæ* with median and apical prominences on the outside, the posterior similarly but much less evidently armed; penultimate joint of the *front tarsi* broadly expanded.

The rather broad form, unusually thick antennæ, short club, and dense clothing are good distinguishing characters. The scrobes, owing to the anterior dilatation of the rostrum, are quite open above in front, though quite lateral behind. The eyes are oblique. The head is globose underneath. The rostrum is rather longer and narrower behind than in the typical species. In some respects *P. femoratus* is the nearest ally, but it is oviform and much narrower; the apices of the elytra are obtusely produced individually, thus causing a sutural gap, the third interstices are more prominent at the summit of the declivity, and the hind tibiæ are simple.

Length (rostr. excl.) $2\frac{3}{8}$, breadth $1\frac{3}{8}$ line.

Wellington. Mr. G. V. Hudson kindly sent me a specimen marked No. 113.

DENDROSTYGNUS, gen. nov.

Rostrum rather thick, not longer than the thorax, sub-parallel. *Scrobes* deep, beginning near the apex and reaching the eyes. *Antennæ* inserted near the apex. *Scape* rather slender, flexuous, only moderately thickened towards the extremity; it attains the eye. *Funiculus* 7-articulate, the basal two joints about equally elongate; joints 3 to 6 decrease, seventh rather larger than the preceding one; none are transverse. *Club* oblong-oval, four-jointed. *Eyes* just uncovered, narrowed towards the front. *Femora* strongly

angulate or dentate underneath. *Tibiæ* flexuous, with long spurs. *Tarsi* narrow and elongate, the penultimate joint lobate, but only moderately expanded. *Thorax* feebly bisinuate at the base, abruptly contracted in front. *Scutellum* absent. *Elytra* slightly wider than the thorax, the shoulders a little porrect, the middle of the base obtusely rounded.

Tychanus and *Sympedius* possess a scutellum, and the antennæ arise from or near the middle. In *Crisius* the rostrum is elongate, the second joint of the funiculus is longer than the first (sometimes twice as long), the antennal insertion is antemedian, and the scutellum is present, &c. *Tychanopais* bears most resemblance to the present genus, but it differs in having the eyes longitudinally oval and rather short from above downwards; it has short tarsi, with their third joint less evidently lobate, the claws are small and slender; the antennæ are shorter, joints 4 to 7 of the funiculus being transverse, and the base of the elytra is different.

Dendrostygnus calcaratus, sp. n.

Variégate, rostrum and thorax nigro-piceous, the apical portion of the latter reddish; elytra along the middle and behind rich pitchy brown, their sides rufescent; tarsi and antennæ reddish; the legs more infusate.

Rostrum not longer than the thorax, slightly dilated at the apex, broad; the anterior portion reddish, closely and finely punctured; behind more coarsely sculptured, with short, erect, coarse dark setæ; near the eyes there are some tawny scales. *Thorax* one fourth broader than long, abruptly narrowed and a little prominent in front at the middle; the sides behind slightly narrowed; its surface closely and irregularly punctured, the squamosity dark and indefinite on the disk, but near the sides it becomes pallid; there are some coarse erect setæ; the contracted portion is nearly nude. *Elytra* broadly rounded medially at the base, a little sinuate near the sides; shoulders slightly prominent; sides nearly straight, the posterior declivity nearly vertical and narrow; their surface is a little uneven; along each side of the suture there are two series of oblong rather distant punctures; the lateral sculpture is irregular; the dark sutural portion is nearly nude and shining; the scales near the sides are mostly yellowish; there are two or three slight prominences on each elytron near the summit of the hind declivity. *Legs* thickly covered with yellowish squamæ.

Underside with greyish pubescence.

Anterior tibiæ bent and dilated inwardly.

Length (rostr. excl.) $2\frac{1}{8}$, breadth $1\frac{1}{8}$ line.

Mount Pirongia.

This is another of the rare ground-weevils of New Zealand.

SCHYLUS, gen. nov.

Body convex, suboviform, narrowed towards both extremities, without superficial inequalities, clothed with hair-like scales and erect setæ. *Rostrum* as long as the thorax, stout, hardly at all arched, subparallel. *Scrobes* deep, lateral, extending from near the apex to the eyes. *Antennæ* inserted near the apex. *Scape* slender, gradually clavate apically; it attains the front of the eye. *Funiculus* rather longer than the scape; the basal two joints elongate and about equal; joints 3 to 7 decrease. *Club* ovate, 4-articulate. *Eyes* just uncovered, flat, coarsely faceted, longer than broad, yet nearly rotundate. *Thorax* truncate at base, gradually narrowed anteriorly, its apical portion projecting over the head. *Scutellum* absent. *Elytra* closely applied to the thorax, hardly any wider at the base than that is, narrowed and nearly vertical behind. *Legs* long and thick. *Femora* elongate, not clavate, grooved below, the anterior toothed or angulate near the middle. *Tibiæ* rather short, the front pair distinctly, the others indistinctly, mucronate. *Tarsi* finely pilose, rather narrow, their penultimate joint broadly lobate.

Pectoral canal deep, extending to the front of the middle coxæ, limited by the raised borders of the mesosternum; these borders touch the front coxæ. *Metasternum* very short. *Coxæ* widely separated. *Abdomen* with the frontal suture broadly rounded and very indistinct; the basal segment nearly as long as the following three; second short, but little longer than the third, its basal suture indistinct; third and fourth short, with deep sutures. *Epipleuræ* extremely narrow.

The apex of the *rostrum* is almost truncate above and below, and the almost concealed mandibles close the aperture. The *mentum* seems elongate. The *palpi* are invisible. The *ocular lobes* are represented by the rounded angles between the rostral canal and the sides of the thorax.

In *Cyclacalles*, the type of which is No. 883, all the femora are angulate and dentate, the antennæ are inserted before the middle of the rostrum instead of near its apex, the metasternum, though short, is rather longer, and there is a well-marked suture between it and the first ventral segment; the abdomen is shorter, the basal segment notably so, the tibiæ have more distinct spurs, and the body is shorter and more rotundate.

Schylus nigricollis, sp. n.

Subopaque, rostrum and thorax pitchy black, elytra and legs rufescent, the antennæ and tarsi yellowish red.

Rostrum more or less obviously tricarinate, with some scale-like yellowish setæ behind. *Antennæ* slender, sparsely pubescent; second joint quite as long as the first, joints 3 to 7 decrease in length. *Thorax* about as long as broad, gradually narrowed anteriorly, not constricted there; closely and coarsely punctate, nearly nude, there being only a small patch of depressed round tawny scales near each hind angle. *Elytra* a little wider behind the shoulders than at the base, cordiform, apparently striate-punctate, densely covered with variegated yellow hair-like scales and erect setæ. *Legs* long and stout, with clothing similar to that on the elytra.

Underside piceous, sparingly clothed with fine yellowish setæ.

There can be no difficulty in identifying this insect. The nearly bare black thorax forms a marked contrast to the conspicuously and brightly pubescent hind body.

Length (rostr. excl.) 1, breadth nearly $\frac{3}{8}$ line.

Mount Pirongia, Te Aroha, and Papakure. One found at each place within the last two years, on the ground.

Scelodolichus politus, sp. n.

Glossy, black; rostrum piceo-rufous, antennæ and tarsi ferruginous, tibiæ infusate; squamosity depressed and elongate, tawny and grey, unequally distributed, the setæ erect, slender, fuscous.

Rostrum hardly as long as the thorax, indistinctly punctured in front, squamose behind. *Scape* short, gradually incrassate. *Funiculus* double the length of the scape; second joint more slender than the first, but quite as long; 3 to 7 decrease in length. *Club* oblong-oval, nearly as long as the scape. *Thorax* convex, longer than broad, its sides a little rounded behind the middle; the frontal portion almost abruptly depressed, with a few punctures, the rest of the surface smooth and polished. *Elytra* elongate-ovate, very convex, on a higher plane than the thorax, their shoulders so rounded as not to exceed the thorax in width; their basal portion is covered with slender tawny scales partially bordered behind with grey; the middle is bare, the posterior declivity is very sparingly clothed, principally with greyish scales or setæ; they are striate-punctate; the sculpture is nowhere deep and becomes obsolete behind. *Legs* elongate,

clothed for the most part with slender grey scales and outstanding setæ; the *posterior tibiæ* somewhat inwardly bent, all distinctly uncinatæ; *tarsi* narrow, their penultimate joint but little expanded.

The polished impunctate basal portion of the thorax will enable anyone to recognize this species.

Length (rostr. excl.) $1\frac{1}{8}$, breadth quite $\frac{1}{2}$ line.

Mount Pirongia. A single specimen found on the ground.

Scelodolichus squamosus, sp. n.

Elongate, convex, subopaque, nigro-fuscous; rostrum shining piceous; antennæ and tarsi reddish; legs fusco-rufous; densely covered with narrow, slender, depressed testaceous squamæ and moderately elongate fuscous setæ; there are two grey spots near the middle of the thorax, and its apex is of the same colour.

Rostrum elongate, finely sculptured, with a very indistinct ridge along the middle, its base squamose; it is very gradually contracted towards the middle. *Antennæ* inserted behind the centre; funiculus elongate; club ovate. *Thorax* as broad as it is long, broadly constricted and slightly depressed near the front, most elevated along the middle, but not distinctly keeled there; its punctuation rather fine and much concealed. *Elytra* elongate-ovate, higher than the thorax; shallow indistinctly punctate striæ are visible on a denuded spot in the disk. *Legs* long, clothed like the body, but with more grey scales; *tibiæ* nearly straight.

Basal ventral *segment* very long and flat, second short and deflexed behind, third and fourth much abbreviated, fifth large and flat, the supplementary segment depressed behind.

This may be placed near *S. hilaris*; it is, however, much more convex and narrower, with longer and more slender legs and antennæ, and the clothing and sculpture are materially different.

Length (rostr. excl.) $1\frac{1}{2}$, breadth $\frac{3}{4}$ line.

Mount Te Aroha. One, March 1894, on the ground.

Obs.—*S. lineithorax* (No. 882). A variety occurs on the Hunua Range which should be recorded here. *Body* rather shorter; *tarsi* not so slender and elongate; the erect *setæ* not so coarse; the basal ventral *segment* longitudinally impressed. If I were to treat this as a distinct species there would be great difficulty in distinguishing the two.

Group *Cossonidæ*.*Pentarthrum Philpotti*, sp. n.

Nitid, nigro-piceous; elytra and tibiæ rufo-piceous; the tarsi and antennæ red; sparingly clothed with short, slender, erect greyish hairs.

Rostrum slightly contracted behind the middle, distinctly punctured, more finely in front. *Antennæ* medially inserted, stout and elongate; second joint of the funiculus hardly at all longer than the third; club distinct, ovate, its apical joints small. *Thorax* longer than broad, narrowed and constricted in front, its sides well rounded; the disk is only slightly convex, and its punctuation, especially along the middle, though distinct, is not close, it is closer near the sides, and in front of the constriction becomes quite fine. *Scutellum* small. *Elytra* wider than the base of the thorax, gradually narrowed posteriorly; sutural region slightly depressed; their striæ are not very deep, but they are closely punctured; interstices with fine serial punctures and slight rugosities; the apical margins are not explanate, the third interstice is bent behind and at that part there is an evident thickening of the external interstice; the second does not touch the basal margin. *Tarsi* narrow, third joint not lobate.

Underside moderately coarsely punctured, with fine grey setæ. *Metasternum* canaliculate. First segment of *abdomen* broadly impressed, its posterior margin nearly straight, the front broadly rounded; fifth distinctly pubescent.

When compared with *P. zealandicum*, this species is seen to be shorter and flatter. The *rostrum* is rather shorter, less parallel, and more arched above. The *eyes* are rather smaller and less prominent, and they are more distant from the thorax. The back part of the *head* is longer and broader, being, in fact, quite swollen; and although it is minutely sculptured, it appears smooth and glossy. The *thorax* is shorter and broader, its sides are more strongly rounded, and its punctuation is rather coarser. The *scape* is a little longer. The *legs* are not quite as long, and the tibial hooks are less developed.

Although it is not closely allied to *P. zealandicum*, I decided to compare it with that well-known species; this will enable anyone to identify it more certainly than if I had chosen some rare insect he may never possess. It is not at all similar to the *P. rufum* group. Sharp's *P. cephalotes* is a very different insect.

♂. Length $1\frac{3}{8}$, breadth $\frac{3}{8}$ line.

Invercargill.

The species bears the name of its discoverer, Mr. Alfred Philpott.

Pentarthrum antennale, sp. n.

Fusiform-cylindric, moderately shining, piceo-rufous, sparsely clothed with yellowish, but not at all conspicuous, hairs; the legs and antennæ red.

Rostrum distinctly punctured, more coarsely near the eyes; in front of the antennal insertion (just behind the middle) it is parallel and broader than the hinder portion. The back part of the *head* is smooth and shining; it is narrowed or constricted immediately behind the eyes; these therefore are more prominent behind than they are in front. *Funiculus* longer than the scape, second joint only slightly longer than the third. *Club* rather narrow, its three small terminal joints marked off by fine pubescence. *Thorax* one third longer than broad, gradually narrowed anteriorly, deeply constricted there, its posterior angles rounded; it is coarsely punctured, not so closely on the disk as it is at the sides, much more finely in front of the constriction; apical margin smooth. *Scutellum* small, smooth. *Elytra* as broad at the base as the widest part of the thorax, gradually and slightly narrowed posteriorly, the margins moderately explanate behind, the apical sutural notch distinct; they are evidently punctate-striate; the punctures are coarse and close; interstices with fine distant serial punctures. *Tarsi* narrow, their third joint not expanded.

Underside coarsely and closely punctured, with fine but distinct yellow hairs. *Mesosternum* with very few punctures. *Metasternum* a little depressed behind, and with a fine central line. Basal segment of *abdomen* broadly depressed. *Rostrum* with two obvious longitudinal grooves, separated throughout by a carina, as is the case in No. 908.

♀. *Rostrum* cylindrical, not broad, finely but distinctly punctured. *Thorax* rather longer, more closely punctured on the middle. First segment of *abdomen* not impressed. *Antennæ* inserted some distance behind the middle.

This is distinguished from Sharp's *P. porcatum* by the presence of pubescence and interstitial punctures. From Nos. 908, 1299, and 2194 it may be separated by its longer scape; this, though as long as that of No. 1301, is shorter than that of *P. zealandicum*.

♂. Length $1\frac{3}{4}$, breadth $\frac{3}{8}$ line.

West Plains, Invercargill.

Another of Mr. Philpott's captures.

Obs. As this is one of a group of species or varieties that are very troublesome to identify, I have drawn up brief diagnoses to lessen the difficulty. The species bear the numbers 908, 1297, 1299, 1301, 2194, and 2198.

From *P. zealandicum* they are differentiated by the margins of the *elytra* being thickened or explanate near the extremity; by the longer, basally contracted *rostrum* of the males; by the back part of the *eyes* being more prominent than the front; and by the rather longer and narrower *thorax*. They are all coarsely sculptured, and, except No. 1301, dark red.

No. 908.—♂. *Scape* short, quite one third shorter than that of No. 903. *Rostrum* one third longer, closely and rugosely punctured, coarsely near the eyes. *Antennal insertion* a little behind the middle. *Thorax* coarsely, closely, and confluent or rugosely punctured. Interstices of *elytra* with fine serial punctures. *Pubescence* fine and scanty.

No. 1297.—♂. *Rostrum* nearly twice as long as that of No. 903, broad, flat above, densely and rugosely punctured, only a little contracted behind; between the antennal insertion and the apex there is a very distinct transverse depression. *Club* rather short and broad. *Thorax* coarsely, closely, and rugosely punctured. *Scape* short.

No. 1299.—♂. *Rostrum* more slender than that of No. 908, more finely sculptured; rather shorter and distinctly broader than in the female of No. 908, and with the *antennal insertion* nearer the middle. *Thorax* not closely punctured along the middle. The smooth *occiput* is not so well limited from the sculptured portion. *Scape* short.

No. 1301.—♀. *Rostrum* rather longer than in this sex of No. 908, more finely sculptured. *Thorax* less narrowed and constricted in front, the constriction obsolete above (*i. e.* not causing a well-marked depression there). *Elytra* more deeply striate, the punctures closer, interstices more rugose, the margins less explanate behind. *Scape* somewhat longer. *Colour* darker, nearly black.

No. 2194.—♂. Smaller than No. 908. *Elytra* paler, their punctures more separated, interstices less convex. *Rostrum* rather shorter. *Scape* short.

No. 2198.—This is distinguished from all the species of this group or series by the absence of *pubescence* and interstitial punctures.

No. 1300.—Does not belong to the *P. rufum* series, as the *rostrum* is not narrowed behind the middle (it is like that of No. 903) and the *elytral margins* are not dilated near the extremity.

Group **Scolytidæ**.*Acrantus opacus*, sp. n.

Cylindric, subopaque, fuscous; head nigrescent; the legs, coxæ, and antennæ pale ferruginous, club dark; densely clothed, the thorax with small, round, depressed brown and brassy scales and short erect slender setæ; on the elytra the squamosity is similarly variegated but less decumbent and the erect setæ are rather paler and more conspicuous.

Head minutely sculptured, with some yellow hairs in front. *Thorax* hardly longer than broad, narrowed and slightly constricted in front, with some yellow pubescence at the middle of the base; it is closely punctate. *Elytra* individually rounded and minutely crenulate at the base; striate, interstices plane; the external striæ are distinctly punctured. *Legs* finely pubescent; *tibiæ* expanded towards the extremity, with three or four denticles along each of them. *Tarsi* slender, the terminal joint as long as the basal three; claws well developed.

Antennæ moderately elongate; scape elongate, very gradually incrassate; funiculus short, much more slender than the scape, its first joint stout, longer than broad, the following five transverse and provided with very long outstanding slender hairs; club elongate, opaque, indistinctly four-jointed; it is rather narrow, and equals the funiculus in length.

Underside with fine pale pubescence; the mesosternum with minute squamæ. *Metasternum* longitudinally grooved along the middle. First ventral *segment* large, 2 to 4 short, fifth with a broad basal suture.

A considerable amount of individual variation occurs. In one the legs are fuscous, in others the clothing of the thorax is of a dark uniform colour and consists of hairs, and the antennæ are quite short, with an ovate club; in these examples (probably females) the remarkable villosity of the antennæ seems wanting.

Length $1\frac{1}{8}$, breadth quite $\frac{3}{8}$ line.

Mount Te Aroha. Discovered by Mr. J. H. Lewis.

Group **Anthribidæ**.*Anthribus flavipilus*, sp. n.

Subcylindric; the dark ground-colour concealed by the clothing; this is hair-like, depressed, and greyish yellow on the thorax, but brighter on the elytra; these latter are variegated with grey patches, as in *A. vates*.

Rostrum as long as broad, closely and rather coarsely punctured; black, with scanty pubescence. *Thorax* about as long as broad, much narrowed towards the front, its carina a little curved and extending about halfway along each side; the surface closely but not coarsely punctured. *Scutellum* oviform, small, raised, with yellow tomentum. *Elytra* not distinctly depressed before the middle and without distinct elevations, the apices broadly rounded towards the suture; they bear series of fine punctures; the sutural series form striæ and converge posteriorly, so that near the extremity they almost touch the suture.

Antennæ nearly glabrous; their second joint is larger than the exposed portion of the first, and is nodiform at the apex; the third is about one half longer than the second, but hardly any larger than the fourth; the ninth is rather longer than broad and subtriangular; tenth transverse; eleventh conical.

The *eyes* barely touch the thorax, and are similar to those of *A. vates*; the thoracic *carina* and angles are similar; the *scutellum* is narrower and more elevated; the maculation of the *elytra* differs but little, though the colour does.

Length (rostr. incl.) $2\frac{1}{2}$, breadth $\frac{7}{8}$ line.

Ohaupo, near Mr. Kusab's mill. One, January 1893.

Group Lamiidæ.

Somatidia picticorne, sp. n.

Variagate; *thorax* pale yellowish-chestnut, covered with depressed yellowish hairs, these are more scanty in front, its sides pitchy brown; *elytra* of a similar pale colour, but across the middle a broad ill-defined space bears greyish hairs; behind this pale space there is a dark irregular band, which is prolonged near each side towards the shoulder, but becomes of a lighter brown there; the hind slope is more or less spotted; on the disk, just before the middle, there are two small blackish spots; front *femora* fuscous, testaceous at the base, the other pairs almost wholly testaceous; *tibiæ* testaceous, with a black spot below the knee and another lower down; *antennæ* variegated, two basal joints reddish, third fuscous, paler at base; 4 to 10 testaceous, tipped with black.

Thorax hardly broader than long, its sides only moderately rounded, moderately closely and coarsely punctured in front; behind the middle the dots are rather less numerous and are partially concealed by the pubescence; there is a slight swelling near the scutellum, but there are no tubercles. *Elytra* oviform, much wider near the middle than elsewhere, of the same width as the thorax at the base; the punctures near the base are rather irregular, the large punctures on the

hind slope are serial. *Legs* stout, rather finely pilose. *Antennæ* hardly as long as the body, fringed with short hairs underneath; second joint short, not longer than broad; third reaches beyond the base of the thorax, about a third longer than the fourth; fifth longer than the sixth, about a third shorter than the fourth. *Scutellum* large, triangular.

Smaller and flatter than *S. convexa*, the thorax not at all rotundate. It is not similar to any other species.

Length 2, breadth $\frac{7}{8}$ line.

Invercargill. I am indebted to Mr. A. Philpott for the only specimen I have seen.

Group Eumolpidæ.

Atrichatus æneicollis, sp. n.

Convex, oblong-oval, glabrous, shining; fusco-testaceous, head and thorax æneous.

Head moderately coarsely and irregularly punctured. *Eyes* prominent. *Antennæ* inserted near the front and inner margins of the eyes; they reach backwards beyond the middle thighs; first joint clavate, second about half the length of the third. *Thorax* transverse, finely marginated, anterior angles rectangular and depressed, the posterior laterally prominent; its sides curvate and more narrowed in front than behind, widest behind the middle; its surface moderately coarsely and irregularly punctured, and with minute punctures between some of the larger ones. *Scutellum* large. *Elytra* suboblong, curvedly narrowed behind the middle, the shoulders slightly wider than the base of the thorax; their sculpture consists of series of moderate punctures, these become duplicate towards the base, the external ones are rather larger and more irregular; on the hind slope there are two sutural striæ; most of the punctures are pitchy brown, and other dark marks occur, some of them quite linear. *Legs* robust; *tibiæ* more or less grooved along the outer face, the posterior dilated towards the extremity and deeply excavate behind; *tarsi* with the third joint bilobed and nearly as long as the second.

Underside with yellowish-grey pubescence; abdomen fuscous; metasternum rufo-castaneous.

The thorax is rather larger than in *A. ochraceus* (No. 1099); it is iridescent, and the four or five abbreviated apical striæ on the elytra of that insect are reduced in number.

Length $2\frac{1}{2}$ - $2\frac{3}{4}$, breadth $1\frac{1}{4}$ - $1\frac{3}{8}$ line.

Ashburton. Three examples were found by Mr. W. W. Smith.

XLIX.—*On the Significance of the Proliferated Epithelium in the Fœtal Mammalian Jaw.* By R. BROOM, M.B., B.Sc.

IF a transverse section be made through the anterior part of the lower jaw of a seven-month human fœtus, it will be noticed that from the outer alveolar margin and about half of the adjacent tooth-space arises a well-developed and projecting gum, which is covered, especially on the inner side, by a layer of epithelium many times thicker than that covering the adjoining mucous membrane. On the inner side of this epithelial covered ridge is the neck of the dental germ.

On serial section it will be found that, though this ridge of gum extends all round the alveolar margin, the thick coating of epithelium is only met with in the region of the incisors and canines, and that on reaching the first milk-molar the epithelial armature of the gum differs little from that of the general mucous membrane of the mouth.

That this epithelial protection is directly connected with the requirements of the young mammal in grasping and retaining the nipple will readily suggest itself; but when one finds that, within certain limits, the younger the fœtus examined the more is the epithelial ridge developed proportionally, one is led to think that the proliferated epithelium has a deeper significance than merely the strengthening of the gum during the short period of sucking.

Even in the human fœtus of ten weeks there is a ridge of thick epithelium covering the incisor part of the jaws, but, as in older specimens, entirely confined to that part. A similar condition seems to exist in all the higher mammals, though in some the proliferated area extends to the premolar region. In Marsupials the thick layer of epithelium, besides covering the incisor part of the jaws, passes back to the molar region, and differs from the typical mammalian condition in extending to and covering the inner part of the lips.

That the thickened epithelium on the sides of the mouth in the marsupial is not specially developed to protect the jaws while grasping the nipple may be inferred from the fact that the tongue and the palate, which have almost the entire share in holding the nipple, are coated with a uniform comparatively thin layer of squamous epithelium. Even in placental mammals the epithelial armature of the jaw is developed at such an early date as to suggest its being the remains of an ancestral horny beak.

Geological strata have not yet yielded any evidence of the

immediate ancestors of the mammals; but there is reason to believe that anomodonts and mammals are diverging branches from a common origin, and which primitive group was derived from the higher amphibians. The larva of the frog and of most other amphibians is provided, as is well known, with a horny beak on the front of each jaw, which fulfils all the requirements of teeth. In the siren the horny sheath is retained throughout life. It is impossible to say with what armature the jaws of the young anomodonts were provided; but it is highly probable that they possessed beaks, as in most of the groups of the order we find teeth playing a secondary part. In *Oudenodon* teeth were entirely absent, and the jaws have evidently been provided with a strong horny casing. A similar condition existed in *Dicynodon*, with the addition of a pair of large maxillary teeth. In *Endothiodon* we find the unique arrangement of a horny beak on the premaxilla and maxilla, with a row of small teeth in addition on the maxilla internal to the horny edge. The theriodonts had a row of teeth along the alveolar margin of the premaxilla and maxilla, though it is probable that, as Owen believed (Todd's *Cyclop. Anat. and Phys.*, art. Teeth), these animals were monophyodont, and in this differed entirely from the ordinary reptilian type. In the remaining group of anomodonts, of which *Pariasaurus* is the type, we find a single feebly developed set of teeth.

As we find evidences of a horny beak in many of the anomodonts, or a feeble development of teeth, rendering probable the existence of a horny armature in the young of this group, which is most nearly allied to the mammals of which we have remains, there is every reason to suppose that the proliferated epithelium which arms the front of the fœtal mammalian jaw is the exact homologue of the horny beak of the anomodont and the remains of a functional beak possessed by the young of the mammalian ancestor. These young were probably furnished with a well-developed horny beak on escaping from the egg, and, being probably aquatic in habit, derived nourishment from sucking plants and decomposing animal matter.

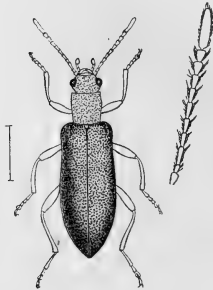
The marsupials are probably derived from a subdivision of this premammalian group, in which the horny beak of the young was developed to a greater extent and retained to a later period in life, aborting the secondary tooth-germs, and resulting in the descendants being practically monophyodont.

Taralga, New South Wales,
Jan. 20, 1895.

L.—On the Cistelidæ and other Heteromerous Species of Japan.
By G. LEWIS, F.L.S.

[Continued from p. 278.]

Fig. 3.



Arthromacra decora (p. 278).

MACROLAGRIA, gen. nov.

This genus agrees with *Arthromacra* in most of its characters. The thorax is marginate anteriorly, with the anterior angles somewhat projecting; the antennæ are long and slender, second joint alone short, shorter than that in *A. ænea*, Say; 3 to 5 coequal and agreeing with Say's species, 6 to 9 slightly longer and coequal, 10 scarcely so long and usually not half the length of the eleventh; the head slightly constricted behind the eyes (but not sufficiently to compare the constriction to that in *Statira*); the facets of the eyes are rather coarse, the thorax not longer than wide and the elytra deeply striate, with the interstices more or less convex.

Type *Statira rufobrunnea*, Mars.

Macrolagria fujisana, sp. n.

Elongata, brunnea vel nigro-picea, nitida, haud pubescens; capite thoraceque grosse et sparse punctatis; elytris punctato-striatis, interstitiis convexis, lævibus; antennis pedibusque brunneis vel obscure brunneis.

L. 9-10 mill.

This species is much smaller than *M. rufobrunnea*, Mars., but otherwise it closely resembles it. The head is narrower and the eyes less prominent (especially noticeable in the males), and the joints of the antennæ are less constricted at their bases. The colours of all my specimens are much darker than those of Marseul's species.

Hab. Chiuzenji, Miyanoshita, and in other places in the plain of Fujisan. Beaten from flowering shrubs in June.

Macrolagria hirsuta, sp. n.

Elongata, nigra, nitida, hirsuta; elytris æneo-nigris, punctato-striatis, interstitiis transversim rugosis; antennis piceis; femoribus nigris, tibiis tarsisque dilutioribus.

L. $9\frac{3}{4}$ -10 mill.

Elongate, pitchy black or black, shining, clothed with long scattered greyish hairs; the head, surface uneven, irregularly and coarsely punctate; the thorax less coarsely and less closely punctured than the head; the elytra with a brassy greenish or bluish tint, punctate-striate, interstices irregularly and transversely rugose, apices obtusely acuminate; the antennæ piceous, with basal joint usually darker; the legs, thighs blackish, tibiæ and tarsi less dark, usually obscurely brown and blackish.

I do not think this hairy species can be generically separated from the last.

Hab. Chiuzenji and Niohosan, in June.

Monomma glyphysternum, Mars.

This species, Marseul says, occurs in China and Formosa, as well as in Japan. The type example came from Satzuma, and is unique in my collection. *Monomma? japonicum*, Motsch., appears to me to be *Cyrtotriplax Maacki*, Sols.; the species is founded apparently on a specimen without legs or antennæ, and may be considered a nondescript.

Eurygenius niponicus, sp. n. (Pl. VIII. fig. 9.)

Elongatus, infuscatus, griseo-brunneo-pubescent, griseo-hirtus; elytris haud striatis, dense punctatis; antennis pedibusque nigris. L. 12 mill.

Elongate, dusky, clothed with greyish-brown pubescence, short and thickly set, and with long grey erect hairs; the head rather densely and roughly punctured, sculpture not

easily seen by reason of the pubescence; the thorax clothed and sculptured like the head, median channel wide and well defined; the elytra long and parallel, densely clothed, with the surface closely and evenly set with somewhat large punctures; the antennæ, palpi, and legs black; the tibiæ are very conspicuously clothed with long greyish hairs; claws reddish.

In one specimen the elytra are entirely brown.

Hab. Chiuzenji. Several examples.

Stereopalpus gigas, Mars.

Macratria gigas, Mars., belongs to the genus *Stereopalpus*, Champ. Biol. Centr.-Am., Col. iv. (2) p. 195 (1890); Ent. M. M. (2) i. p. 189 (1890).

Hab. Oyama in Sagami, in May; also in Kawachi.

Stereopalpus femoralis, sp. n.

Elongatus, infuscatus, pubescens; capite valde punctato, punctis subocellatis; femoribus perspicue rufis.

L. 7-8 mill.

Elongate, parallel at the sides, shining, and clothed with tawny pubescence; the head very densely sculptured with rather rough subocellate punctures; the thorax, sculpture somewhat similar to that of the head, but without the ocellate points; the elytra, sculpture again agrees somewhat with that of the thorax, but it is also more or less transversely rugose; the antennæ, palpi, and tarsi infuscate; thighs clear reddish brown; tibiæ infuscate at base, reddish on the tarsal half.

Hab. Konosé. A small series in April and May.

Macratria cingulifera, Mars.

Marseul inadvertently did not return me a specimen of this insect after describing it in 1876, and I did not afterwards meet with it. The type, therefore, is probably now in the Museum of Paris and is possibly unique.

Hab. Hiogo.

Macratria apicalis, sp. n.

Elongata, subtus obscure brunnea, supra nigra, cinereo-pubescens; capite basi thoraceque apice vage rufis; elytris apicalibus distincte rufis; antennis pedibusque pallide rufo-brunneis.

L. 5½-6 mill.

Elongate, black above, obscurely brown beneath, with ashen pubescence; the head rather sparsely punctured, somewhat reddish behind the eyes; the thorax closely and rather roughly punctured, faintly red anteriorly; the elytra similarly sculptured to the thorax, except that the punctures in parts are vaguely arranged longitudinally; apex narrowly red; the antennæ, palpi, mouth-organs, and legs pale reddish brown.

Hab. Numata. Two examples in June.

Macratría fluviatilis, sp. n.

Elongata, nigra, cinereo-pubescentis; antennis basi, palpis pedibusque brunneo-rufis.

L. $5\frac{1}{2}$ – $5\frac{3}{4}$ mill.

This species is extremely similar to *M. apicalis*, but it is smaller, wholly black above, with the joints 8 to 11 of the antennæ distinctly black.

Hab. Natakugawa. Two examples, July 23rd, 1881.

Macratría antennalis, sp. n.

Elongata, parum nigra, cinereo-pubescentis; elytris basi obscure brunneis; antennis articulis 9^o–11^m perlongis infuscatis, basi, palpis pedibusque brunneo-rufis.

L. $4\frac{1}{4}$ mill.

This species is extremely like *M. fluviatilis*, but it is smaller and narrower, with the head more shortened behind the eyes; bases of the elytra vaguely brownish, and the joints of the antennæ 9 to 11 are markedly lax, and each joint is nearly as long again as the corresponding one in *M. fluviatilis*, and they are dusky brown, not black; joints 4 to 8 are relatively shorter and almost moniliform.

Hab. Numata.

Macratría japonica, Harold.

Macratría japonica, Har. Deutsche ent. Zeitschr. p. 359 (1877).

This species is about half the size of *M. fluviatilis*; the femora at their bases are usually infuscate.

Hab. Yamaguchi (*Hiller*); Yokohama, very common in winter under loosened bark of *Zelkova Keaki*, Sieb. Also at Ichiuchi, Numata, and Niigata.

Xylophilus distortus, Champion.*Xylophilus distortus*, Champ. Ent. M. M. ser. 2, i, p. 267 (1890).

Fig. 4.



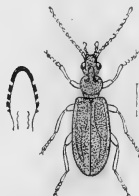
This species is figured here to show the curious form of the intermediate tibiæ of the male (fig. 4).

Hab. Kobé, Sakai, and Nikko.

Notoxus Haagi, Marseul.*Notoxus Haagi*, Mars. Ab. xvii. p. 28 (1879).

This peculiar species is without the dark elytral markings usual in the genus. The pattern of the coloration is shown in fig. 5, also the form of the thoracic process.

Fig. 5.



Hab. Yokohama. I found a few specimens by beating willows growing in the bed of a river midway between Yokohama and Oyama, in May. Also two examples at Nikko.

Notoxus daimio, sp. n.

Oblongus, rufo-testaceus, griseo pubescens; elytris 4-nigro-macu-

latis et in regione scutellari suturalique infuscatis; antennis pedibusque concoloribus.

L. $4\frac{1}{2}$ -5 mill.

Oblong, reddish testaceous, with grey pubescence; the head, rostrum somewhat produced and truncate anteriorly; the thorax, anterior process wider in the female than in the male, edges crenulate; the elytra paler in colour than the thorax, with somewhat variable dark markings. The sutural marking terminates before the apex at about two thirds of the elytral length, and in the region of the scutellum it widens out to half the width of the wing-case, on each side below the humeral angle is a marginal detached infuscate spot, and before the apex is a second and larger spot, which is usually rather circular in outline, but sometimes it is confluent with the sutural marking. There is a variety in which all the dark markings extend and join. In the female the apices of the elytra are rounded off; in the male they are truncate near the suture and feebly acuminate near the middle. The antennæ and legs are wholly reddish testaceous.

The general colour of this species resembles that in *N. elongatus*, Lef., *binotatus*, Gebl., and *trinotatus*, Pic.; the elytra are less elongate and less parallel than those of *trinotatus*, the species to which it is, on the whole, most similar.

Hab. Hakodate. Not rare on the sandhills in August.

Mecynotarsus niponicus, sp. n.

Obscure brunneus; antennis pedibusque dilutioribus, gracilibus et longissimis; elytris immaculatis.

L. $2\frac{1}{4}$ mill.

Dusky brown; antennæ, palpi, legs, and thoracic protuberance somewhat lighter in colour, thickly clothed with a minute silken whitish pubescence. This species is somewhat smaller than *M. tenuipes*, Champ., with the thoracic protuberance less widened at the base, and the antennæ are slightly shorter taking them joint by joint; the legs, and especially the tarsi, are markedly shorter, but, except in colour, in other respects they are closely similar. Both these species resemble superficially *Hypaspistes armatus*, Waterh. (figured in this Magazine in 1886, vol. xvii. p. 39), in the length of the antennæ and tarsi, and I possess a third species from Ceylon which also agrees with it. In *M. minimus*, Mars., the legs and tarsi are much shorter and the antennæ also have the last five joints shorter and relatively thicker.

Hab. Odawara. On the sandhills; one specimen.

Mecynotarsus minimus, Mars.

This species is sometimes very common in arable fields in early spring. I once saw it in profusion at Bukenji, near Yokohama, in company with a small species of *Blechnus*; both species were running together, and were exceedingly active in the sunshine.

Easily recognized from the other two species of this series by the shortness of the antennæ and legs.

Hab. Nagasaki, Enoshima, Kioto, Otsu, and Yokohama.

Tomoderus clavipes, Champion. (Pl. VIII. fig. 10.)

Tomoderus clavipes, Champ. Ent. M. M. ser. 2, i. p. 325 (1890).

Hab. Kobé. I took five examples under moist decaying leaves near the temple on Maiyasan, 8th June, 1881, in company with *Apatetica princeps*, Sh.

ANTHICOMORPHUS, gen. nov.

The general characters agree with those of the genus *Anthicus*; the important differences are:—Eyes very large, with very coarse facets; antennæ stout, with an enlarged basal joint and a long and apically constricted terminal one; in the males joints 3 to 8 are longer than those of the female and somewhat obconical; in the female these joints (especially in *A. cruculis*) are more moniliform. The legs are long and robust.

Type *A. suturalis*.

Anthicomorphus suturalis, sp. n. (Fig. 6.)

Rufo-testaceus, capite, thorace supra elytrisque sutura (apice excepta) late infuscatis; antennis pedibusque rufo-testaceis. L. 5 mill.

Elongate, reddish testaceous, shining, pubescent; the head and thorax infuscate above, densely punctured, head sometimes infuscate beneath; the elytra with a broad sutural infuscate area, broadest in the region of the scutellum, parallel in the middle, and terminating well before the apex; the abdominal segments, legs, antennæ, mouth-organs, and the sides of the elytra clear reddish brown. The elytra are punctured like the thorax.

Hab. Oyayama, Miyanoshita, Tsukubayama, and Kashiwagi.

Fig. 6.



Anthicomorphus niponicus, sp. n.

F. suturalis simillimus at minor; elytris griseo-pubescentibus, obscure brunneis vel infuscatis; antennis pedibusque rufo-brunneis.

L. $4-4\frac{1}{4}$ mill.

This species is much smaller than the last, but the punctuation throughout is very similar; the head, thorax, elytra, and under surface are infuscate, or, rarely, the elytra are brownish; the legs and antennæ wholly reddish brown.

Hab. Hitoyoshi, Ichiuchi, Fukushima, Kashiwagi, Nikko, and Junsai. Apparently more widely distributed than the other three species.

Anthicomorphus cruralis, sp. n.

Rufo-testaceus; capite, thorace tibiisque infuscatis.

L. $3\frac{1}{2}-3\frac{3}{4}$ mill.

This species again is smaller than the last, but very similar in sculpture; the head and thorax are dusky above, usually obscure reddish brown beneath; tibiæ and tarsi infuscate. In two male examples the antennæ are dusky; in two females they are reddish brown, and in the last markedly moniliform.

Hab. Nara, Hitoyoshi, and Oyayama. Four examples only, two of each sex.

Anthicomorphus puberulus.

Anthicus puberulus, Mars. Ann. Soc. Ent. Fr. 1876, p. 467.

This species will also come into the genus *Anthicomorphus*.

Hab. Kobé (264). A few examples taken on Maiyasan in 1871.

Anthicus litorosus, sp. n.

Piceo-niger, nitidus, hirsutus; capite thoraceque nigris; elytris flavo-rufis, 4-maculatis, maculis piceo-nigris; antennis elongatis.
L. 4 mill.

Pitchy black, shining, clothed with long tawny-coloured hair; the head black, nearly smooth, with a few punctures; the thorax distinctly rather closely and coarsely punctate; the elytra bright orange-red, with the base and region of the scutellum blackish, with a blackish band over the first segment of the abdomen which touches the outer edge but not the suture, apex also of the same dark colour, with the anterior edge of the markings sinuous; the antennæ long and slender, would reach to the anterior edge of the dorsal band,

pitchy brown, apical joint reddish ; the legs similar in colour, tarsi palish ; the meso- and metasterna and abdominal segments obscurely brown.

Hab. Hakodate. I took a single example on the sandhills near Nanai.

Anthicus cohæres, sp. n.

Elongatus, parum convexis, nitidus ; capite thoraceque nigris ; elytris 4-maculatis ; antennis articulis ultimis tribus testaceis.
L. 4 mill.

Elongate, rather convex, shining ; the head black, transverse, clearly, not closely punctured ; the thorax also black, relatively narrow, less wide than that of *A. scoticus*, much more densely punctured than the head ; the elytra black, with four lobe-shaped reddish testaceous spots, the first well behind the humeral angle, evanescent on the outer edge, leaving on the sutural side a fairly wide margin ; the second spot, midway between the posterior coxæ and the apex, leaves a distinct margin on the outer edge and a narrower one at the suture ; the under surface obscurely brown ; the antennæ, joints 9 to 11 palish, male with joints 7 to 9 nearly as long as the tenth and eleventh together ; the legs dull brown or sometimes infuscate, male posterior tibiæ distinctly swollen on the upper edge of the apical half.

Somewhat similar to *A. Marseuli*, Pic., but the head and thorax are black ; the elytra more parallel, with the red markings wider.

Hab. Yokohama, Kobé on Maiyasan and on the Usui-togé. Five examples only.

Anthicus extus, sp. n.

Elongatus, parum convexus ; antennis, capite thoraceque nigris ; elytris 4-maculatis, maculis rufis ; pedibus brunneis, partim infuscatis.
L. 4½ mill.

This species is not very dissimilar to *A. cohæres*, but it is much more robust in body, the head, thorax, and elytra being wider, and the thorax and wing-cases shorter ; the elytra also are similar in colour, but the red marking below the humeral angle reaches the outer edge and widens out along it, the punctuation also is coarser ; the antennæ wholly black ; body beneath reddish brown ; the legs, anterior pair dusky, intermediate and posterior thighs palish at the base, all the tarsi reddish brown.

Hab. Sapporo. One example only.

Anthicus fugiens, Mars. (Pl. VIII. fig. 11, ♂.)

The male of this species has the elytra very curiously excavated on each side in the widest part; the excavation is somewhat oblong, and in the middle attached to the outer side there is a bunch of stiffish tawny hair, which extends out over the middle of the hollow part, and seems to serve to prevent any foreign substance, such as pollen, from entering the deepest part. The species is essentially one that frequents flowers. Marseul only knew the female.

Hab. Kiga, Miyanoshita, Nikko, Nagasaki, and other places. Usually beaten from the flowers of *Deutzia gracilis* and an arboreous *Spiræa*.

Anthicus lepidulus, Mars., a very pale species, and *A. nigro-cyanellus*, Mars., a pretty blue species, also frequent the flowers mentioned above; the second species occurs also on the mainland of Asia.

Anthicus baicalicus, Muls.

The specimens I submitted to Marseul in 1874, and which are mentioned by him in the paper of 1876, were maculate, a form of the species found in the Kobé and Yokohama districts; but a long series I obtained afterwards on the sandy beaches of Hakodate and Niigata are uniformly olive-green (var. *niponicus*) and are entirely free of the vague reddish spots usually found in this species.

Hab. Kobé, Odawara, Yokohama, Kawasaki, Niigata, and Hakodate.

Anthicus perileptoides, sp. n.

Elongatus, depressus, pallide flavo-testaceus; elytris basi vage nigro-maculatis, dense punctulatis; antennis pedibusque concoloribus.

L. 2 mill.

Elongate, depressed, pale yellowish testaceous; the head clearly, not densely punctured, rounded off behind, feebly widest behind the eyes; the thorax not quite so wide as the head, rounded off laterally before the constriction, punctured like the head; the elytra behind the scutellum have two oblique ill-defined black marks, surface closely punctulate, sutural edges towards the apex slightly raised; the antennæ and legs testaceous yellow, articulations 7 to 10 of the former moniliform.

This is the only species in the present series with flattened

elytra, a form suitable to and often seen in species which live under stones.

Hab. Kobé. I took an example from under a stone on the beach; *Perileptus japonicus*, Bates, was running plentifully with it.

Pyrochroa higonica, sp. n.

I propose this name for a species which appears to be found only in the south of Japan. It is closely similar to *Pyrochroa japonica*, Heyd., but the vertical protuberance on the head is at the apex very distinctly divided into two lobe-shaped bosses. I referred to this form in the *Ann. & Mag. Nat. Hist.* (5) xx. 1887, p. 171, but thought at that time the differences I noticed were merely individual. I see now that the tarsi of the specimens are stouter and shorter, especially noticeable in the basal joints of the intermediate and hind tarsi, and there can be no doubt the differences are specific. All my specimens come from the southern island of Kiushiu.

L. 11 mill.

Hab. Oyayama and Yuyama. Three or four specimens.

Pyrochroa japonica, Heyden.

A figure is given of the profile of the head of this species, to give an idea of the curious cephalic protuberance in the

Fig. 7.



male (fig. 7). The colour of the thorax varies in both the above species; sometimes the lateral margins are infuscate, sometimes the central area also, and in other specimens the thorax is wholly red.

Pyrochroa episcopalis, sp. n.

Atra, subopaca, pubescens; capite antice rufo-testaceo, palpis piceis; thorace nigro; elytris obscure rufo-coccineis.

L. 12 mill.

The head black between the antennæ; face and mouth-organs reddish testaceous; palpi pitchy brown. In the male

there is a broad flattish protuberance on the head similar to that in *P. atripennis*, Lew.; the thorax black; the elytra obscurely reddish scarlet; the antennæ and legs black, with posterior tibiæ gradually but slightly enlarged from the base to the apex, and at the tarsal end they are as thick again as those of *P. atripennis*, and in *P. episcopalis* the basal joint of the antenna is bulbiform.

This species scarcely differs from *P. atripennis*, except in the colour of the thorax and elytra and in the form of the legs and basal antennal joint.

Hab. Yuyama. One male example.

STOLIUS, gen. nov.

This genus is founded to receive a species not very dissimilar to *Microtonus elongatus*, Champ. It differs in having a wider and more transverse head, with the eyes occupying the anterior angles; the antenna has a 3-jointed club; the thorax is nearly as wide anteriorly as at the base; the tibiæ have very minute spines on the tarsal ends of the anterior and intermediate pair (only visible under a high power), but they are wanting on the posterior pair.

Stolius vagepictus, sp. n. (Fig. 8.)

Elongatus, parallelus, obscure pallido-brunneus; capite nigro; elytris sutura maculisque duabus vage infuscatis.
L. $4\frac{1}{4}$ mill.

Elongate, parallel at the sides, rather dull pale brown, with grey pubescence; the head nearly black, transverse, finely but thickly punctured, eyes a little prominent; the thorax not so wide as the head anteriorly, but rather wider at the base, anterior and posterior margins brownish; surface blackish, but not so dark as the head, punctured like the head; the elytra rather pale brown, with the sutural margin narrowly, and two rather vague spots on the elytra not far from their bases, and two others well before the apices, infuscate; the palpi pale brown; the antennæ obscurely brown at the base, club and five preceding joints darker; the legs, thighs reddish brown at their bases, narrowly reddish at their apices, infuscate in the middle, tibiæ and tarsi dull brown.

Hab. In Higo on Oyayama and at Ichiuchi. Four specimens.

Fig. 8.



Ditylus ruficollis, sp. n.

Obscure brunneus; capite dense punctulato; thorace rufo, minute et sparse punctulato; elytris fusco-brunneis, opacis; antennis pedibusque concoloribus.

L. $7\frac{1}{2}$ –8 mill.

Obscurely brown, with very short pubescence; the head black or infuscate, rather densely punctulate, eyes not very prominent; the thorax red, a little constricted before the posterior angles, widest behind the posterior angles, punctuation minute and scattered; the elytra dingy brown, opaque, feebly costate, parallel on the sides, densely and minutely sculptured; the antennæ dusky brown; the legs are more or less of the same colour; the ventral segments obscure reddish brown.

Hab. Chiuzenji. Two examples, male and female.

PATIALA, gen. nov.

The species for which this genus is founded have all the characters of *Xanthochroa*, except that the anterior tibiæ are bispurred, the second spur being strong and robust; the basal joints of the antennæ are very elongate and the maxillary palpi also longer. The last six joints of the antennæ, joints 7 to 12, are in male very short, but in female there are only eleven joints, and these are formed like those in *Xanthochroa*.

Type *P. antennata*.

Patiala antennata, sp. n. (Pl. VIII. fig. 12.)

Elongata, parallela, fusco-brunnea, luteo-pubescentis, subnitida; oculis prominulis; antennis basi, femoribus partim tibiisque fuscis.

L. 13 mill.

Elongate, parallel at the sides, dull brown, scarcely shining; the head prolonged anteriorly as in *Xanthochroa Waterhousei*, Har.; eyes rather prominent and posteriorly nearly circular in outline, space between them wider than in the next species and of nearly the same width throughout; the thorax a little longer than wide, without dusky markings, uneven, but without any well-defined impressions; the elytra sculptured like those of *X. Waterhousei*, but with the two dorsal costæ better defined and less evanescent apically, where they apparently join; the antennæ, basal joint very long, longer than the first and second together in *X. Waterhousei*, second less than half as long as the first, third as long as the first and

second together, fourth scarcely shorter than the third, fifth somewhat shorter than the fourth, sixth shorter and stouter than the second, seventh to the eleventh shorter than the sixth and coequal, apical shorter than the eleventh; the seven apical joints are reddish brown, the others fuscous.

Hab. Nara. One male specimen, taken in the deep shade of the forest, 29th June, 1881.

Patiala ocularis, sp. n.

P. antennatæ forma simillima at oculis obliquis; thorace partim infuscato.

L. 13 mill.

This species is extremely similar to the last, but the eyes are much less convex, and therefore not so prominent, and are obliquely set, so that the space between them is less than in *P. antennata* anteriorly, but posteriorly it widens out in a marked degree along the rim of the eye; the thorax is considerably longer than broad, infuscate at the sides and in the median area; the sculpture of the elytral interstices is also coarser, and the small seven terminal joints of the antennæ are less slender. The antennæ and legs are rather darker in colour, but I can see no other differences.

Hab. Oyayama in Higo. One male example.

Patiala deformis, sp. n.

Elongata, parallela, fusco-lutea; oculis vix prominulis; antennis articulis (septem) ultimis modice brevibus.

L. 12-13 mill.

This species, as regards the eyes, is intermediate between the last two; the eyes are nearly as convex as those of *P. antennata*, but in being somewhat oblique posteriorly they more resemble those of *P. ocularis*. The thorax is rather longer than broad, reddish yellow, uneven and finely punctulate; the scutellum and bases of the elytra narrowly correspond in colour to the thorax; the general colour of the elytra is darker, costæ well-defined, with the interstices more finely sculptured than those of *P. antennata*. The antennæ are very dissimilar; two basal joints agree with those of *P. antennata*, but the third is not longer than the first; fourth and fifth are shorter than the third, and thicker; sixth three-quarters the length of the fifth, and swollen on the anterior half; seventh to twelfth nearly half as long again as the corresponding joints in *P. antennata*. I have a species some-

what similar to *P. deformis* from the Andaman Islands; the sixth joint of the antenna is triangular.

Hab. Chiuzenji. Eight male examples. There is one female in the British Museum, taken by Mr. Maries.

Xanthochroa Waterhousei, Harold.

Xanthochroa Waterhousei, Har. Col. Hefte, xiv. p. 93 (1875); id. Abh. Brem. p. 133 (1876); Deutsche ent. Zeitschr. p. 360 (1877); Heyden, l. c. p. 355 (1879).

Xanthochroa cyanipennis, Mars. Ann. Soc. Ent. Fr. p. 483 (1876).

Hab. Yokohama, Osaka, Tokio, Miyanoshta, Junsai, Sapporo, and other places.

There is a small race of this species which measures only 8-9 millim.—var. *bicostata*—in which the antennæ and legs are always a clear yellow. It occurs in the neighbourhood of Chiuzenji, where I took eight examples.

The species of this genus have an antenna of twelve joints in the male, eleven in the female, and one spur on the anterior tibia.

Xanthochroa atriceps, sp. n.

Elongata, parallela, griseo-pubescent; capite nigro; thorace rufiflavo; elytris subcyanis; antennis pedibusque infuscatis. L. 10-11 mill.

Elongate, parallel, clothed with grey pubescence; the head black, uneven, and sparsely punctured between the eyes, punctures thicker set nearer the neck; the thorax reddish yellow, vaguely punctured, slightly constricted before the base; the scutellum obscurely brown; the elytra somewhat obscurely blue, densely clothed with grey pubescence, rather more coarsely sculptured than those of *X. Waterhousei*, Har., and the apex more acute than in that species; the antennæ dusky, with the palpi and basal joints paler; the legs infuscate, joints palish; the sterna and abdominal segments dusky.

Hab. Chiuzenji. Two examples taken in August.

Xanthochroa ainu, sp. n.

Elongata, parallela, obscure fusca, griseo-pubescent; antennis pedibusque partim dilutioribus. L. 13½ mill.

Elongate, parallel, obscurely dark brown; the head somewhat small, shining, faintly and sparsely punctured, with a

short inconspicuous carina before the middle of the neck, constricted behind the eyes, mouth-organs reddish testaceous; the thorax longer than wide, widest a little behind the neck, scarcely narrowed behind, sculptured like the head, with three shallow ill-defined impressions—one before the scutellum, one on each side of the widest part; the elytra densely sculptured and somewhat opaque, lateral costa complete and well-raised, the next less elevated, and the third again is less conspicuous; the antennæ dull reddish brown, two basal joints darker; the legs same colour, femora darker, tibiæ bispurred.

I think I am right in assigning this curious species to *Xanthochroa*; it has the facies somewhat of the female of *Oncomera venosa*.

Hab. Sapporo. One female example.

Xanthochroa Hilleri, Harold.

“Rufo-testacea vel lurido-testacea; antennis basi, femoribus antice apice, posticis cum tibiis omnino fere fuscis; ♂ femoribus anticis crassioribus.”

L. 11–13½ mill.

Five basal joints of the antennæ usually infusate, the others reddish brown.

Hab. Osaka, Shiukano, Junsai, and Sapporo. Occurs in July and August.

Xanthochroa luteipennis, Mars.

This species may be recognized from the others of this series by its having yellowish-brown elytra, but being otherwise entirely black.

Hab. Osaka, Nikko, Fukui, Nishimura, and Sapporo.

EOBIA, Semenow.

Eobia, Semenow, Hor. Soc. Ent. Ross. xxviii. p. 455, nota (1894).

This genus is founded to receive:—

Asclera cinereipennis, Motsch. Bull. Mosc. p. 173 (1866).

Ananca japonica, Har. Abh. Brem. p. 133 (1876).

Sessinia japonica, Har. Deutsch. ent. Zeitschr. p. 82 (1878).

Sessinia remained uncharacterized until 1894; the type is now *livida*, F. *Ananca* is a name proposed by Fairmaire in 1863, but not yet characterized. The genus *Nacerdochroa*, Reitt. Wien. ent. Zeit. xii. p. 113, 1893, is very close indeed to *Eobia*; it has the same constriction in, or false joint

to, the apical articulation of the antennæ, but the antennæ are stouter and less elongate. It agrees also with *Eobia* in the tibial spurs, but the eyes are more transverse.

Hab. South and Central Japan, and on Oshima, one of the Ruikiu group. Found in August in the flowers of *Clerodendron*, the "Kusai noki" of the Japanese.

Eobia florilega, sp. n.

Elongata, flavo-testacea, subopaca; capite thoraceque rugosopunctatis; abdomine partim infuscato; antennis pedibusque (tarsis exceptis) flavis.

L. $11\frac{1}{2}$ mill.

Elongate, clear yellow testaceous; four basal segments of the abdomen, palpi, and tarsi dusky brown; the head closely and rather roughly punctured, eyes somewhat wide apart (as compared to those of *Xanthochroa Waterhousei*, Har.); the thorax rather long and relatively wide (as long as that of *X. Waterhousei*, and wider than that of *X. Hilleri*), widest before the middle, sculptured like the head, the sculpture being close gives an appearance of opacity; the elytra, as compared with those of the species noted above, are shorter and broader, two dorsal costæ faint and evanescent towards the apex, sculpture similar to but finer than that of the thorax; the antennæ and legs are concolorous with the upper surface, the terminal joint is constricted in the upper half, and has the appearance (but falsely) of being divided into two parts.

Marseul considered this species to be *Nacerdes nigriventris*, Motsch., and as such erroneously introduced Motschulsky's species into the Japanese fauna.

Hab. Kobé; three examples. I have also found it in Foochow, China.

Eobia ambusta, sp. n.

Elongata, flavo-testacea, subnitida, flavo-pubescentis; capite elytrisque apice nigris.

In general sculpture and facies this species is extremely similar to *E. cinereipennis*, Motsch., but the head is clearly, rather coarsely, but not densely punctate, and the antennæ are somewhat less slender.

Hab. Nagasaki, in flowers of *Clerodendron*. I have two allied species from China—one from Amoy, the other from Foochow.

Oxaxis carinicollis, sp. n.

Elongata, parallela, subnitida; capite thoraceque æneo-nigris, parum dense punctulatis; elytris obscure brunneis; pedibus ferrugineis; thorace in medio carinato.

L. 7 mill.

The head blackish, rather closely punctulate, with a fovea between the eyes, eyes small and rather prominent; the thorax broadest behind the anterior angles, narrowest at the base, with a rather large shallow fovea on either side before the middle, with a median carina before the scutellum, well marked at the base, evanescent on the disk; the elytra brownish, with a very faint metallic tinge, densely clothed with short prostrate pubescence, parallel at the sides, rounded off apically, costæ obsolete; the antennæ, first three joints reddish brown, the rest dusky; the palpi and legs also reddish brown, claws and the terminal tarsal joints darker.

The second example, from Sapporo, has the legs and elytra black, with an æneous tinge.

Hab. Hakodate and Sapporo. Two male examples.

Nacerdes melanura, Linn.

This species is commonly found in Japan, chiefly on the coast; some of my specimens have dark-coloured legs.

Hab. Nagasaki, Kobé, Yokohama, and Hakodate.

Anoncodes sambucea, sp. n.

Nigro-cyanea, subnitida, griseo-pubescentis; ♀ thorace abdomineque rufo-flavis.

L. 10–12½ mill.

Dark blue, shining, with grey pubescence; the head irregularly punctured, eyes prominent; the thorax rounded off at the sides behind the neck, with median impressions not well defined in outline; the elytra 4-costate, inner costa forming a sutural margin; the antennæ black, 12-jointed in male, 11-jointed in female; palpi sometimes pitchy red, obscurely brown or black; male, intermediate thighs largely swollen and emarginate on the lower edge at the tibial end, intermediate tibiæ bent at the base, anterior and hind femora strongly and acutely toothed; female, thorax and abdominal segments bright orange-red, thighs simple.

The species is notable for being of a deep blue colour, and it is much larger and much more robust than *A. coarctata*, Germ., *A. croceiventris*, Motsch., or *A. nigriventris*, Motsch. *A. nigriventris* is described as being "nigro-viridis," and

A. croceiventris as being "viridi-subæneus," and these species measure only 3 to $3\frac{1}{2}$ lines. I have used the generic name of *Anoncodes* instead of *Nacerdes*, because I do not consider any of the above-mentioned species are congeneric with *Nacerdes melanura*, Linn.

Hab. Junsai, in profusion in elder-flowers in August; also taken on Ontake and other places of high elevation in Central Japan.

Asclera brunneipennis, sp. n.

Elongata, parallela, nigra, subnitida; capite thoraceque nigris; elytris rufo-brunneis; antennis pedibusque nigris.

L. 6-8 mill.

Elongate, parallel, black, somewhat shining; the head black, closely punctulate, with two shallow impressions on the face; the thorax also black, punctured like the head, widest behind the anterior angles, then somewhat abruptly narrowed to the base, with a rather large shallow fovea on each side at the widest part; the scutellum black; the elytra reddish brown, with two costæ parallel to the suture, but abbreviated before the apex, others obsolete; the antennæ, palpi, and legs dull black.

Hab. Hakodate. Two examples only.

Asclera nigrocyanea, sp. n.

Elongata, parallela, nigro-cyanea, opaca; capite thoraceque densissime punctulatis; elytris 5-costatis; antennis (basi excepta) nigris.

L. $7-7\frac{1}{2}$ mill.

Elongate, parallel, opaque, with greyish pubescence, chiefly noticeable on the sutural costæ; the head very densely and rather minutely punctured in the male, rather less densely in the female; the thorax punctured like the head, emarginate behind the anterior angle, surface uneven; the elytra 5-costate, interstices closely sculptured, sculpture rather coarser than that of the thorax; the antennæ black, with the three basal joints flavous on the underside; the legs with a bluish tint, claws pale.

Marseul in 1876 considered this species to be *Asclera cinereipennis*, Motsch., and specimens in his collection in Paris are still possibly so labelled.

Hab. Oyama in Sagami, Nikko, and at Nagasaki on Mitzudake.

Oncomera venosa, sp. n.

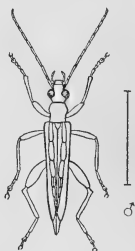
Elongata, pallide brunnea; capite inter oculos, thorace partim elytrisque costis infuscatis.

L. 14 mill.

Elongate, dull pale brown; the head, eyes prominent, forehead and area between the eyes dusky, neck sometimes flavous; the thorax darkish brown, with a median longitudinal space, which widens out before and behind, pale; the elytra have a close leather-like sculpture, with dusky-coloured costæ, outer costa complete and joined to the second over the metasternum by a diffused coloration on a somewhat raised patch in the interstice, behind this patch the inner costa is usually interrupted and bent towards the suture, it reappears over the hind coxæ and again before the apex; outside the long outer costa is a dark line, which towards the apex breaks up into dusky points (but this is a variable character), the lateral rim of the elytra is also dusky; the antennæ dusky brown, with the two basal joints paler; the legs pale, with the apices of the femora dusky; male, posterior thighs largely swollen, and the hind tibiæ much shorter and thicker than those of female. The colour and form of the elytral costæ are somewhat variable; sometimes the costæ join three times, as in fig. 9.

Hab. Kiga, Hakone, and Miyanoshita. Repeatedly beaten from pear- and cherry-blossoms in May.

Fig. 9.

*Edemera sexualis*, Marseul.

This species differs from all in this series in the enlarged femora of the male being yellow, and in the female the abdominal segments are of the same colour.

Hab. Nagasaki. In the flowers of *Deutzia* and *Spiræa* in spring.

Edemera montana, Marseul.

Edemera lucidicollis, Motsch. Bull. Mosc. i. p. 174 (1866).

Oncomera vitticollis, id. *ibid.*

Motschulsky's descriptive lines seem to refer to one species, but from their peculiar construction appear to have been written at different times. *Oncomera vitticollis* is compared to *Onc. flavipes*, evidently meaning *Edemera flavipes*, Fabr.

Ann. & Mag. N. Hist. Ser. 6. Vol. xv.

In one description there is no mention of the antennæ or the legs, in the other nothing is said of the elytra. The words "thorace nigro-æneo, antice subtestaceo," and "thorace medio vitta testacea," apply to *Æ. montana*, Mars., a species which varies to this extent in the colour of the thorax. The colour of the antennæ, "nigris, basi infuscatis," also applies to it. Motschulsky's descriptions read as follow :—

"*Ædemera lucidicollis*, Motsch., statura *Æd. luridæ* sed thorace lucido. Elongata, parallela, subconvexa, viridi-cyanea; thorace subcordato, nitido, glabro, nigro-æneo, antice subtestaceo; elytris punctulatis, opacis utrinque binervis, nervo interiori abbreviato. "Long. $2\frac{1}{2}$ lin."

"*Oncomera vitticollis*, Motsch., statura et color *Onc. flavipedi* sed pedibus anticis obscuris. Elongata, postice attenuata, depressa, vix nitida, viridi-cyanea; thorace medio vitta testacea; antennis nigris, basi infuscatis. "Long. 3 lin."

I consider Marseul's name is entitled to rank first, as his description leaves no doubt as to the species he had before him, and it is not quite clear whether Motschulsky had one or more.

Hab. Nagasaki, Yokohama, and Miyanoshita. Abundant in May in the flowers of *Deutzia gracilis*.

Ædemera manicata, sp. n.

Elongata, obscure æneo-viridis; pedibus anticis flavis.
L. $7\frac{1}{2}$ – $9\frac{1}{2}$ mill.

Elongate, obscurely green or brassy green; the head, eyes prominent in the male, shining and very feebly punctulate; the thorax with two large foveæ, one on either side near the middle, and a transverse impression before the scutellum, female roughly sculptured, male smoother; the elytra 4-costate, gradually but markedly narrowed from the base to the apex, interstices densely sculptured; the antennæ, three basal joints pale on the underside; the legs, anterior pair flavous, with bases of the femora black, all the coxæ yellow, intermediate and hind legs bluish black.

Hab. Plain of Fujisan, Nikko, Miyanoshita, Kashiwagi, and Oyama.

Ædemera concolor, sp. n.

Elongata, obscure viridis, griseo-pubescentis; capite thoraceque vix robustis; antennis pedibusque concoloribus.
L. 9 mill.

Elongate, rather obscurely green or bluish green, with greyish pubescence; the head densely and roughly sculptured, somewhat opaque; the thorax widest behind the anterior margin, constricted behind; the elytra rather long, 4-costate, very slightly narrowing to the apex; the antennæ and legs wholly brassy green or bluish green; the claws palish.

I only know the female of this species; it differs from *C. manicata* in the wider head and thorax, shorter antennæ, and the elytra are scarcely narrowed behind.

Hab. Junsai and Sapporo. Two examples.

Edemera robusta, sp. n.

Elongata, cyanea; capite thoraceque rugoso-punctatis; antennis pedibusque concoloribus.

L. $6\frac{1}{2}$ mill.

Somewhat deep blue; the head rather wide, roughly, densely and rather coarsely sculptured; the thorax also rather wide and sculptured like the head, with two transverse impressions before the middle, very little constricted before the base; the elytra 4-costate, costa next the suture short, scarcely reaching one third of the elytral length, thickly but not quite so coarsely sculptured as the thorax, narrowed very slightly and only before the apex; the antennæ relatively short, with the terminal joint pointed at the tip, and, like the legs, wholly cyaneous.

Hab. Miyanoshita and Nikko. Three examples.

Chrysanthia viatica, sp. n.

Elongata, parallela, pubescens; capite thoraceque viridi-cyaneis, subnitidis; elytris aureo-cupreis vel viridi-cupreis; antennis pedibusque nigris vel infuscatis.

L. 6- $6\frac{1}{2}$ mill.

Elongate, rather narrow, parallel at the sides, clothed with short pubescence; the head greenish or bluish green, little shining, densely but not very minutely punctured; the thorax of similar colour and sculpture, longer than broad, sinuous before the posterior angles; the elytra 5-costate, golden copper in colour, turning to greenish copper in a side light; the antennæ and legs black or dusky brown.

Hab. Wada-togé, on the 1st August, 1881, in profusion; Tsumago, Torii-togé, Suwaratake, and Sapporo.

CEPHALON, Newman.

In this genus the species have the head gradually narrowed

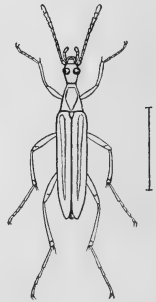
behind the eyes, the abdomen has six free ventral segments, and all the claws are pectinate, each claw being furnished interiorly with a long appendage. In 1883 Leconte and Horn (Class. Col. N. Am. p. 405) proposed the family name of Cephaloidæ, in which at present there is only one genus. Newman placed the genus originally in the CEdemeridæ.

Cephaloon sakuræ, sp. n.

Elongatum, angustatum, pallide testaceum, sericeo-pubescent; capite, thorace supra elytrisq̄ue marginibus infuscatis.
L. 9-14 mill.

Elongate, narrow, parallel at the sides, very densely and minutely sculptured, clothed with silken pubescence; the head testaceous, with upper surface infuscate; the thorax testaceous beneath, disk and region behind the neck dusky; the scutellum somewhat dark; the elytra pale testaceous, with a lateral and sutural infuscate border; these bands usually join apically, but only very rarely anteriorly as in fig. 10; the antennæ are usually testaceous, joints 9 to 10 alone being sometimes dusky; the legs, anterior pair testaceous, intermediate and posterior pairs (with the femora near the tibiæ) sometimes marked with a dusky coloration; the abdomen, the bases of each segment are narrowly infuscate along the edges. Some examples are entirely testaceous.

Fig. 10.



In all probability *C. variabile* and *pallens*, Motsch., are colour-varieties of one species. In sixteen examples of *C. sakuræ* I have before me no two are similar in colour, and I doubt if two could be found to match in a much larger series.

Hab. Miyanoshita, Subashiri, and Suyama. Beaten from pear- and cherry-blossoms when the trees were in full flower.

List of 180 Species, with Synonymy.

CISTELIDÆ.	<i>Allecula melanaria</i> , Mükl.
<i>Allecula cryptomeriæ</i> .	<i>rufipes</i> , Mars.
— <i>fuliginosa</i> , Mükl.	— <i>noctivaga</i> .
<i>velutina</i> , Mars.	— <i>simiola</i> .
<i>obscura</i> , Har.	— <i>bilamellata</i> , Mars.

Allecula cruralis, *Mars.*
 — *acicularis*, *Mars.*
 — *tenuis*, *Mars.*
 — *æneipennis*, *Har.*
Hymenorus veterator.
Cistela oculata, *Mars.*
 — *Haagi*, *Har.*
Hymenalia rufipennis, *Mars.*
Mycetochares collina.
 — *mimica*.
 — *scutellaris*.
Cteniopus hypocrita, *Mars.*

OTHNIIDÆ*.

Othnius Kraatzi, *Reitt.*
 — *ocularis*, *Lew.*

PYTHIDÆ.

Pytho nivalis, *Lew.*
Istrisia rufobrunnea.
Salpingus niponicus.
Lissodema ainunum.
 — *plagiatum*.
 — *pictipenne*.
 — *lævipenne*, *Mars.*
 — *myrmido*, *Mars.*
 — *japonum*, *Reitt.*
 — *beatulum*.
 — *dentatum*.
 — *validicorne*.
 — *tomaroides*.
 — *minutum*.

MELANDRYIDÆ.

Eustrophus macrophthalmus, *Reitt.*
 1877.
 — *niponicus*.
Holostrophus orientalis.
 — *dux*.
 — *4-maculatus*.
 — *unicolor*.
Orchesia elegantula.
 — *imitans*.
 — *ocularis*.
 — *Marseuli*.
Microscapha japonica (*Lederia*),
Reitt.
 — *fœnilis*.
 — *lata*.
Synchroa crepuscula.
 — *melanotoides*.

Serropalpus filiformis, *Mars.*
 — *niponicus*.
Mikadonius gracilis.
Euryzilora lividipennis.
Phlœotrya bellicosa.
 — *rugicollis*, *Mars.*
Dircæa flavitarsis.
 — *validicornis*.
 — *erotyloides*.
 — *dentato-maculata*.
 — *obscura*.
 — *parvula*.
 — *femoralis*.
Abdera scriptipennis.
Hypulus cingulatus.
 — *higonius*.
 — *acutangulus*.
Bonzicus hypocrita.
Ivania coccinea.
Melandrya gloriosa.
 — *mongolica*, *Sols.*
 — *modesta*.
 — *niponica*.
 — *atricolor*.
 — *ordinaria*.
 — *ruficollis*.
 — *pictipennis*.
Penthe japana, *Mars.*
Scotodes niponicus.
Osphya (*Nothus*) *orientalis*.

LAGRIIDÆ.

Lagria rufipennis, *Mars.*
 — *vervex*, *Mars.*
Eutrapela robusticeps.
Arthromacra viridissima.
 — *sumptuosa*.
 — *higonix*.
 — *decora* (*Lagria*), *Mars.*
Macrolagria rufobrunnea (*Statira*),
Mars.
 — *fujisana*.
 — *hirsuta*.

MONOMMIDÆ.

Monomima glyphysternum, *Mars.*

PEDILIDÆ.

Eurygenius niponicus.
Stereopalpus gigas (*Macratrìa*),
Mars.
 — *femoralis*.

* It seems better to place this family near the Cistelidæ rather than in the position assigned to it by Leconte.

- Macratria serialis*, *Mars.*
 — *cingulifera*, *Mars.*
 — *apicalis*.
 — *fluviatilis*.
 — *antennalis*.
 — *japonica*, *Har.*
Xylophilus distortus, *Champ.*
 — *japonicus*, *Champ.* 1890.
 — *rubrivestis*, *Mars.*
 — *brunneidorsis*, *Mars.*
 — *rufulus*, *Mars.*
 — *cinctus*, *Mars.*
 — *4-maculatus*, *Mars.*
 — *amabilis*, *Sahlb.* (*Phyto-*
bænus).
 bisbimaculatus, *Hampe.*
 scapularis, *Mars.*
 — *gibbulus*, *Mars.* (*Aderus*).
Scraptia liveus, *Mars.*

ANTHICIDÆ.

- Notoxus Haagi*, *Mars.*
 — *daimio*.
Mecynotarsus tenuipes, *Champ.*
 1891.
 — *niponicus*.
 — *minimus*, *Mars.*
Tomoderus clavipes, *Champ.*
Anthicomorphus suturalis.
 — *niponicus*.
 — *cruralis*.
 — *puberulus* (*Anthicus*), *Mars.*
Anthicus litorosus.
 — *Marseuli*, *Pic.* 1895.
 scoticus, *Mars.*
 — *cohæres*.
 — *extus*.
 — *fugiens*, *Mars.*
 — *monstrosicornis*, *Mars.*
 — *Confucii*, *Mars.* (*Laf. ined.*).
 — *baicalicus*, *Muls.*
 — *lepidulus*, *Mars.*
 — *pilosus*, *Mars.*
 — *valgipes*, *Mars.*
 — *prostensus*, *Mars.*
 — *nigro-cyanellus*, *Mars.*
 — *lævipennis*, *Mars.*
 — *perileptoides*.
Formicomus cribriceps, *Mars.*
 — *bengalensis*, *Wiedem.*
 — *Lewisi*, *Mars.*
 — *braminus*, *Laf.*
 — *trigibber*, *Mars.*

PYROCHROIDÆ.

- Ischalia patagiata*, *Lew.* 1879.

- Pyrochroa japonica*, *Heyden*, 1879.
 ? *rufula*, *Motsch.* 1866.
 — *higonis*.
 — *vestiflua*, *Lew.*
 — *brevitarsis*, *Lew.*
 — *peculiaris*, *Lew.*
 — *atripennis*, *Lew.*
 — *episcopalis*.
Schizotus rubricollis, *Lew.*
 — *auritus*, *Lew.*
 — *gibbifrons*, *Lew.*
Dendroides niponensis, *Lew.*
 — *ocularis*, *Lew.*

CEDEMERIDÆ.

- Microtonus brunneus* (*Scraptia*),
Mars.
 — *dimidiatus* (*Scraptia*), *Mars.*
Stolius vagepictus.
Ditylus ruficollis.
Patiala antennata.
 — *ocularis*.
 — *deformis*.
Xanthochroa Waterhousei, *Har.*
 1875.
 cyanipennis, *Mars.* 1876.
 — *atriceps*.
 — *ainu*.
 — *Hilleri*, *Har.* 1878.
 — *luteipennis*, *Mars.*
Eobia cineripennis (*Asclera*),
Motsch.
 japonica, *Har.* (*Ananca*).
 cinereipennis, *Har.* (*Ses-*
 sinia)
 — *florilega*.
 — *ambusta*.
Oxacis carinicollis.
Nacerdes melanura, *L.*
Anoncodes sambucea.
Asclera brunneipennis.
 — *nigrocyanæa*.
Oncomera venosa.
Cedemera sexualis, *Mars.*
 — *montana*, *Mars.*
 lucidicollis, *Motsch.*
 vitticollis, *Motsch.*
 — *manicata*.
 — *concolor*.
 — *robusta*.
Chrysanthia viatica.

CEPHALOIDÆ.

- Cephaloon sakuræ*.

The following notes refer to the paper on the Tenebrionidæ published last year.

1. *Phellopsis suberea*, Lew., and *Pseudonosoderma amurense*, Heyd., are distinct species. *P. amurense* is less elongate than *P. suberea*, as the figures of the two species which have been given show, and there are several other differences, notably the absence of cephalic nodules in Heyden's species. This note is made necessary, (1) by my stating that *P. suberea* was represented in the Pascoe collection by a specimen from E. Siberia (the example belongs to *P. amurense*), and (2) by Champion concluding the two species were identical and stating that the names were synonymous (Ent. M. M. xxx. p. 114, 1894). It was unfortunate that Heyden made a new genus for *amurense*, and also that his name was overlooked at the time, as the notice of it in the Zool. Record of 1885 occurs amongst the Byrrhidæ. I have lately been able to set the matter right through the kindness of Major L. von Heyden, who has sent me over one of his two examples for comparison.

2. *Platyscelis strigicollis*, sp. n.

Ovata, convexa, nigra, subnitida; capite grosse et rugose punctato; thorace undique punctato, utrinque strigoso; elytris totis punctatis, costis vagis et evanescentibus.

L. 13 mill.

Oval, convex, black, somewhat shining; the head roughly and coarsely punctate, punctures sometimes confluent and a little strigose before the neck; the thorax more clearly punctate on the disk than on the head, with a few confluent punctures, strongly strigose longitudinally on each side from behind the eyes to the base, anterior angles obtuse, posterior angles nearly rectangular, faintly turning outwards; the scutellum very narrow and transverse and usually covered by the thorax; the elytra much less clearly punctate than the thorax, punctures smaller and more irregular, least dense on the disk, and sometimes vaguely arranged in rows; costæ vague and evanescent, lateral rim evenly and narrowly raised; the antennæ, terminal joint reddish apically, otherwise like the legs, black.

In size this species is intermediate between *P. hypolithos*, Pall., and *P. rugifrons*, Fisch., and it differs from *P. punctatissima*, Fairm., in the punctuation; the last species I know by description only.

Hab. "Japan" (Heyne).

I am much indebted to Major L. von Heyden for an example (♀) of this species, which introduces a new genus to the Japanese fauna. There are eight examples in the Bates collection, labelled "Manchuria," which I believe belong to this species.

3. *Lichenum seriehispidum*, Mars.

Mr. J. J. Walker has taken this species on the coast of China; and Mr. Champion notes that the head is carinate, not canaliculate, as misprinted in the French 'Annals.'

4. *Epiphaleria*.—P. 382, line 28, for mesosternum read metasternum.

5. *Leiochrinus*, Westwood, 1883.

Fairmaire states (Ann. Soc. Ent. Fr. p. 26, 1893) that *Ades*, Guer.,

Hades, Thoms. 1860, and *Pimplema*, Pasc., are names of genera synonymous with "*Liochrinus*." This is not correct as regards *Hades* and *Pimplema*; the species of these genera belong to the Leiochrininae, but they are not congeneric. Thomson's name of *Hades* was occupied by Westwood in 1851, but otherwise the genus is founded on valid characters. *Ades*, Guérin, I do not know.

6. *Platydemia subfascium*, Walker.

Alphitophagus subfascius, Walk. Ann. & Mag. Nat. Hist. ser. 3, ii. p. 284 (1858).

Alphitophagus japanus, Mars. Ann. Soc. Ent. Fr. (5) vi. p. 109 (1876).

Haplocephala celeba, Chevrol. Pet. Nouv. ii. p. 177 (1877).

Haplocephala diversidens, Fairm. Ann. Soc. Ent. Fr. lxii. p. 20 (1893).

Champion (Ent. M. M. ser. 2, vol. vi. p. 47, 1895) has revived Walker's name after examining the type at South Kensington, and places the species in *Platydemia*. *A. pallidicollis*, Lew., may also be included in *Platydemia*.

7. *Eutochia lateralis*, Boheman.

Alphitobius lateralis, Boh. Res. Eugen. p. 94, 1858 (nec *lateralis*, Motsch. 1859).

Holanaria picescens, Fairm. 1885.

Holanaria dorsalis, Mats.

Fairmaire has recorded this species as occurring in Japan (Ann. Soc. Ent. Fr. xii. p. 20, 1893), but without giving his authority or any special locality. It was originally found in Hong Kong, and it is a species likely to be distributed by commerce. The synonymy given is partly Fairmaire's. F. Bates has published a note on the genus *Eutochia* (Ent. M. M. ix. p. 93). *Aniara*, Leconte, 1859, was preoccupied, and *Holanaria* is not required.

8. *Misolampidius morio*, Kolbe, 1886, = *Helops clavicus*, Mars., 1876, = *Misolampidius clavicus*, Mars., Lew. Ann. & Mag. Nat. Hist. xiii. p. 476 (1894).

Additions to the List of Tenebrionidæ.

Platyscelis strigicollis.

Eutochia lateralis, Boh.

EXPLANATION OF PLATE VIII.

Fig. 1. *Synchroa crepuscula*.

Fig. 2. *Mikadonius gracilis*.

Fig. 3. *Dircæa flavitarsis*.

Fig. 4. *Bonzicus hypocrita*.

Fig. 5. *Ivania coccinea*.

Fig. 6. *Melandrya atricolor*.

Fig. 7. *Melandrya ruficollis*.

Fig. 8. — *pictipennis*.

Fig. 9. *Eurygenius niponicus*.

Fig. 10. *Tomoderus clavipes*.

Fig. 11. *Anthicus fugiens*, ♂.

Fig. 12. *Patiala antennata*.

LI.—*Descriptions of Two new South-American Characinoid Fishes.* By G. A. BOULENGER, F.R.S.

Leporinus semivittatus.

Depth of body $3\frac{2}{3}$ times in total length, length of head 4 times. Upper profile of head straight; jaws equal; incisors pointed, brown-edged; snout $1\frac{1}{2}$ diameter of eye, which is 4 times in length of head; interorbital width $2\frac{1}{2}$ times in length of head; eye equally distant from the end of the snout and the gill-opening. Dorsal 13, equally distant from the end of the snout and the base of the caudal, the sixth ray opposite to the first ventral. Anal 10. Pectoral $\frac{2}{3}$ length of head, widely separated from the ventral. Scales $38\frac{5\frac{1}{2}}{6\frac{1}{2}}$. Olive above, silvery beneath; an interrupted black stripe on each side, on the lateral line, originating above the base of the ventral; fins whitish.

Total length 115 millim.

A single specimen from Manaos, Rio Negro, collected by Mr. J. C. Antony.

Xiphostoma lateristriga.

Depth of body $8\frac{1}{2}$ times in total length, length of head $3\frac{1}{4}$ times. Snout a little more than half length of head, terminating in a cartilaginous appendage; cleft of mouth half length of head; diameter of eye 4 times in length of snout (without appendage), 3 times in postorbital part of head, $\frac{2}{3}$ interorbital width. Dorsal 10, a little nearer base of caudal than base of ventrals. Anal 10, originating opposite to fourth dorsal ray. Pectoral $\frac{1}{3}$ length of head. Ventrals equally distant from centre of eye and base of caudal. Scales 82 (16 in a transverse series); lateral line reduced to a few scales. Pale brown above, darker on the middle of the back; a dark grey lateral band, narrower on the head and passing through the eye, edged with black above on the body and both above and below on the head; white beneath; fins white, with two black spots on the pectorals and one on the ventrals, dorsal, and anal; caudal with a black median streak and two oblique ones on each lobe, converging behind.

Total length 210 millim.

A single specimen from Manaos, collected by Mr. Antony.

LII.—*On a Genus of Frogs peculiar to Madagascar.*

By G. A. BOULENGER, F.R.S.

I HAVE hitherto associated with *Rana* a number of species previously referred to *Limnodytes* or *Hylorana*, a group of frogs which they closely resemble externally, but from which they differ in a character first pointed out by Peters in other Batrachians of the same family, viz. the presence of an additional ossification between the distal and proximal phalanges—the existence of which I was not aware of at the time I published my 'Catalogue' in 1882. As these frogs cannot be referred to the genus *Rhacophorus*, on account of their T-shaped distal phalanges, I propose to establish for them a new genus, to be named *Mantidactylus*. Many of the species possess, at least in the male sex, the curious femoral glands to which I have previously called attention.

This genus contains numerous species, of which a list is appended.

MANTIDACTYLUS.

Pupil horizontal. Tongue free and deeply notched behind. Vomerine teeth. Tympanum distinct or hidden. Fingers free; toes webbed; tips of fingers and toes dilated into small disks. Outer metatarsals separated by web. Omosternum and sternum with a bony style. A small ossification between the proximal phalanx and the distal, which is T-shaped.

Madagascar.

1. *M. guttulatus*, Blgr. 1881.
2. *M. ulcerosus*, Bttgr. 1880.
3. *M. curtus*, Blgr. 1882.
4. *M. betsileanus*, Blgr. 1882.
5. *M. biporus*, Blgr. 1889.
6. *M. redimitus*, Blgr. 1889.
7. *M. flavicrus*, Blgr. 1889.
8. *M. lugubris*, A. Dum. 1853 (*femoralis*, Blgr. 1882).
9. *M. albofrenatus*, F. Müll. 1892.
10. *M. Cowanii*, Blgr. 1882.
11. *M. inaudax*, Peracca, 1893.
12. *M. opiparis*, Peracca, 1893.
13. *M. ærumnalis*, Peracca, 1893.
14. *M. pliciferus*, Blgr. 1882.
15. *M. asper*, Blgr. 1882.

The genus *Rana* is represented in Madagascar by *R. labrosa*, Cope, *R. mascareniensis*, D. & B., and *R. madagascariensis*, A. Dum.

LIII.—*On the Representatives of Putorius ermineus in Algeria and Ferghana.* By OLDFIELD THOMAS.

WHILE investigating the constancy of the markings and other characters of *Putorius ermineus* for comparison with the newly discovered *P. hibernicus**, the differences presented by certain representatives of the species found on the southern and eastern outskirts of its Old-World range have appeared to me worthy of notice.

One of the forms to be considered is from Algeria and the other from Ferghana, Central Asia; and both show a marked reduction in size as compared with typical individuals of the species from Northern Europe, a fact instructive in its bearing on the question as to what is the real centre of distribution of this widely spread animal. But curiously enough, contrary to the usual rule, the southern (Algerian) form is characterized by a particularly short tail, while elsewhere, even in the Arctic Regions, the tail is always long. That from Ferghana, on the other hand, has the normal proportions of the species, although combined with reduction in size and a coloration apparently due to desert influences.

As tending to oppose the generally received ideas on the relative value of size and proportions as against that of colour-markings, special attention may be drawn to the constancy of the distribution of the markings of *P. ermineus* amid all the variations found in size, proportions, and actual shades of colour.

Putorius ermineus algiricus, subsp. n.

Decidedly smaller than in *typicus*, with a shorter tail. Colour of back with a much stronger fulvous suffusion, and of belly more markedly sulphur-yellow. Distribution of colours quite as in *typicus*. Upper lip and chin and edge of ears white. Yellow colour of belly running down inner sides of hind limbs on to the digits, leaving the outer halves of the metatarsals brown.

Skull small and slender, with a particularly low and narrow brain-case.

Dimensions of type (an adult female skin):—

Head and body 205 millim.; tail, without hairs 52, with hairs 76; hind foot 31·5.

Skull: length from gnathion to upper edge of foramen magnum 39; zygomatic breadth 19·8; interorbital breadth 9; breadth of brain-case 18; height of brain-case above level of

* Ann. & Mag. Nat. Hist., Apr. 1895, p. 374.

bullæ 13·3 ; palate length from gnathion 15·2 ; palate breadth between outer corners of $\frac{p-4}{m-1}$ 12 ; horizontal length of $\frac{p-4}{m-1}$ 4·2, of $\frac{p-1}{m-1}$ 4·5.

Hab. Algeria. *Type* from "Environs d'Alger" (*Parzudaki*).

Type: B.M. 56.3.12.13.

The specimens now described are those called by Dr. Gray* "*Mustela erminea*, var. 1. *africana*," a term assigned without much inquiry to the Algerian representative of the Weasel group † by Lataste, who was evidently not aware that any member of the *ermineus* group occurred in that country. In this he was the more to be excused, as the only description given by Gray was, "Tail very short, black-tipped, one sixth the length of body,"—a description quite true of some members of the Weasel group. Gray, however, was here perfectly correct, as the specimens really prove to represent a tenable variety of *ermineus*, and, had he not used a name already preoccupied, his designation would have had to be adopted.

When laid beside a series of ordinary European *P. ermineus*, the Algerian skins are very readily distinguishable from all by their shorter tails and more fulvous colour. Curiously enough, in the last-named character these southern Stoats are most nearly matched at the furthest northern point of the range of *P. ermineus*, the only skins in the Museum series at all like them being some from the Polar Region (Greenland, 82° N.) and extreme north of North America (Fort Simpson, Mackenzie River). But the northern specimens have the long tails of *P. e. typicus*.

Putorius ermineus ferghanæ, subsp. n.

Similar to *P. e. typicus* in proportions and essential respects, but very much smaller, the male considerably smaller than the female of that form. General colour pale, almost matching Ridgway's "isabella colour," with a distinct suffusion of yellowish throughout above and below, except just on the chin and throat, which are pure white. Head especially

* P. Z. S. 1865, p. 111; Cat. Carn. B. M. 1869. Nec *M. africana*, Desm. 1818.

† *P. numidicus*, Puch. Rev. Mag. Zool. .vii. p. 393 (1855). The type specimen of this form has been most kindly re-examined on my behalf by Dr. Trouessart, and he informs me that it unquestionably belongs to the Weasel group, and is, in his opinion, a mere variety of *P. nivalis*. I am also indebted to him for a complete list of all the specimens of the present group in the Paris Museum, with their measurements, which have naturally proved of the greatest value to me.

paler than in *typicus*, about matching the dorsal colour of an English weasel (*P. nivalis*), and less conspicuously darker than the back. Distribution of colours as in *typicus*; the small white spot behind the eye and the white ear-rim well marked, and the underside of the proximal half of tail pale sulphur-yellow, like the belly.

Skull scarcely equalling in size that of a large male weasel.

Dimensions of the type (a well-made skin, ♂):—

Head and body 200 millim.; tail without end-hairs 63, with end-hairs 88; hind foot 31.

Skull: length from gnathion to upper rim of *foramen magnum* 35; zygomatic breadth 18.2; interorbital breadth 8.6; intertemporal breadth 8.4; breadth of brain-case 17.8; palate length from gnathion 14.2; palate breadth between outer corners of $\frac{p}{4}$ and $\frac{m}{1}$ 11.3; horizontal length of $\frac{p}{4}$ 4.1, of $\frac{m}{1}$ 4.3. Upper canine, cingulum to point behind, 3.1.

Hab. Ferghana. Coll. Th. Barey, June 10, 1893.

Type: B.M. 94.9.2.2. Received from the Branicki Museum, Warsaw.

This peculiar little animal, owing to the identity of the distribution of its colours with that found in *P. ermineus*, I retain within the same species, but consider that its diminutive size and markedly paler colour necessitate its separation as a subspecies. So great is the difference in size that, as already noticed, its skull is even smaller than that of a large male weasel.

It will be of much interest to find out what is the exact range of this little stoat, and whether it is confined to the near neighbourhood of its type locality or is the representative of the ordinary stoat throughout the highlands of Central Asia. It may be noticed that a specimen from Narimskaja, on the Ob (Dr. Otto Finsch), although rather smaller than average Norwegian examples, is nothing like so small as the Ferghana one, while its colour is absolutely normal.

With the Pygmy Stoat Mr. Barey obtained a weasel which I refer to the form called by Blanford *P. Stoliczkanus*, but which will probably prove to have very much the same degree of distinction, whether specific or subspecific, from *P. nivalis* that *P. e. ferghanæ* has from *P. e. typicus*.

As both of the subspecies above described are small representatives of a single species, the question naturally arises whether they have any direct relationship to each other; but for the elucidation of this point specimens from intermediate localities must be obtained and compared with each of them. There appears to be a certain faunistic community between

Algeria and Central Asia so far as mammals are concerned *, and it is probable that we have in this southern fringe to the "Palæarctic" Region a zone corresponding with the Sonoran Region of N. America, similarly interposed between the Boreal Region and the tropical ones south of it, and perhaps once similarly distinct from those to the north and south, however it is now obscured by the migrations and other modifications induced in the west by the sinking of the Mediterranean and in the east by the rise of the Thibetan plateau. Such speculations must, however, be reserved until our knowledge of the exact distribution of the mammals of the Old World is enormously advanced and in some slight degree comparable to that which in America has enabled Dr. Merriam to make his valuable and far-reaching observations on the faunistic regions of that hemisphere.

LIV.—*Note on the Genus Goniopleura, Westwood, with the Description of a new Species.* By C. J. GAHAN, M.A.

THE genus *Goniopleura* contains some of the most striking and remarkable species among the whole of the Phytophagous Coleoptera; but, strangely enough, none of the authors who have been more especially engaged in the study of this group of beetles succeeded in discovering the true affinities of the genus. Westwood, its founder, contented himself by stating that it came near *Chrysomela*. Clark, who described the second species, referred the genus without further comment to the subfamily Galerucinae. Subsequent writers, with the single exception of Chapuis, do not seem to have questioned this position. But even Chapuis, though he recognized in the genus certain Eumolpidous characteristics, did not venture to remove it from the Galerucinae, but formed for it a special group—the *Goniopleurites*—which he placed at the end of this subfamily.

Having been recently engaged in studying the genus, I find its characters such that I have no hesitation in assigning it to the subfamily Eumolpinae, where it has a very close ally in the genus *Aulexis* of Baly. The antennae of *Goniopleura* are as widely separated at their points of insertion as in many genera of Eumolpinae, and more widely than in any genus of Galerucinae; so that I fail to appreciate Chapuis's objection to placing it in the Eumolpinae on account of the approxima-

* Witness the distribution of the genera *Meriones*, *Otonycteris*, &c.

tion of the antennæ. But, in addition to this, the shape of the legs, the structure of the pronotum, and the form of the pro- and mesosterna, together with other minor characters, all point to the Eumolpinæ as the proper position for the genus. The peculiar form of the intercoxal processes of the pro- and mesosterna, which it possesses in common with *Aulexis*, *Metaxyonycha*, and other Eumolpinæ, has never been adequately described, though it could scarcely have escaped observation. The prosternal process is rather strongly arched, and at about the middle of its length is angularly dilated on each side, with the angle fitting into a corresponding niche in the coxa; behind this point it is slightly narrowed, and then gradually widens out behind. The mesosternal process is somewhat similarly dilated between the middle of its length and the hind border. This form of the sternal processes is all the more important, inasmuch as, so far as I am aware, it nowhere occurs in the Galerucinæ.

One of the chief characters of *Aulexis* is that the epistome is emarginate in the middle of its anterior border and is furnished with a tooth on each side which overlaps the labrum. This character is even more pronounced in *Goniopleura*. In other points of structure these two genera exhibit the greatest resemblance, notwithstanding that the species of *Goniopleura* average more than twice the size of those of *Aulexis*.

Up to the present only four species of *Goniopleura* have been described; and the last of these was probably founded on female examples of the first. I have now to add to the number the following new species:—

Goniopleura bicoloripes, sp. n.

Rufo-testacea, dense punctata, griseo sat sparsim pubescens; elytris (parte quinta basali excepta) cyaneo- aut viridi-metallicis, tarsis, tibiis, genibus et antennarum articulis octo distalibus, nigris.

Elytris maris setis griseo-fulvis, longissimis, erectis, sparsim hirsutis.

Long. 14–15 mm.

Hab. Java.

This species resembles *G. auricoma*, Westw., but may be easily distinguished by the narrower reddish area at the base of the elytra, and by the colour of the legs and antennæ, which in *auricoma* are entirely testaceous. In both species the males only have the elytra furnished with very long and erect pale tawny hairs; in the females the elytra have a shorter greyish pubescence. This sexual difference does not

seem to be present in *G. viridipennis*, where in both sexes the pubescence is rather short.

The following brief synopsis may help to distinguish the species of the genus:—

1. *G. auricoma*, Westw., Griffith's Cuv. An. Kingd. xv. p. 149, pl. lxxvii. fig. 3 (1832).
Reddish testaceous; with hinder two thirds of elytra metallic blue or green. Hab. Penang.
2. *G. bicoloripes*, sp. n.
Reddish testaceous; with hinder four fifths of elytra metallic blue or green; with tibiæ, tarsi, apices of femora, and distal eight joints of antennæ black. Hab. Java.
3. *G. viridipennis*, Clark, Ann. & Mag. Nat. Hist. (3) xv. p. 146 (1865).
Reddish testaceous; with elytra entirely metallic blue or green. Hab. Penang.
4. *G. Chapuisi*, Thoms., Rev. et Mag. de Zool. 1875, p. 163.
Black; with elytra metallic blue, regularly and strongly punctured. Hab. Borneo.
5. *G. basalis*, Jac., Proc. Zool. Soc. 1882, p. 58.
With characters of *auricoma*, Westw. (♀). Hab. Sumatra.

MISCELLANEOUS.

Description of a new Species of Butterfly from Taganac Island, N.E. Borneo. By H. GROSE SMITH, B.A., F.E.S., F.Z.S., &c.

Nectaria nigriana.

Male.—*Upperside* resembles *N. leuconœ*, Erichs., but the outer third of both wings is much darker, the marginal and submarginal rows of pale greyish-white spots and irregular markings being almost obsolete, and the veins on the posterior wings, where they cross the pale area of the inner two thirds of the wings, being more widely greyish brown; both wings are less elongate and comparatively broader than in *N. leuconœ*. The *underside* is also darker, but the pale spots and markings are more developed than on the *upperside*.

The female differs from the male only in being larger and blacker.

Expanse of wings, ♂ $3\frac{7}{8}$, ♀ $4\frac{1}{8}$ inches.

Hab. Taganac, a small island near the north-east coast of Borneo (*Cator*).

A pair only were sent. It is an insular form of *N. leuconœ*, but the shape of the wings and its much darker general appearance render it, I think, worthy of description.

THE ANNALS

AND

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[SIXTH SERIES.]

No. 90. JUNE 1895.

LV.—*On some new and rare Crustacea from Scotland.* By THOMAS SCOTT, F.L.S., Naturalist to the Fishery Board for Scotland, and ANDREW SCOTT, Fisheries Assistant, University College, Liverpool.

[Plates XVI. & XVII.]

Attheyella MacAndrewæ, sp. n.
(Pl. XVI. figs. 1–6.)

Description of the Species.—*Female.* Length $\cdot 58$ millim. ($\frac{1}{43}$ of an inch). In general appearance this species somewhat resembles *Attheyella pygmæa*, but is rather smaller and less hirsute. Antennules moderately stout and eight-jointed, the end-joint being distinctly more elongate than any of the others; the first four joints are also stouter than the last four (fig. 2). The proportional lengths of the various joints are nearly as follows:—

Proportional lengths of the joints..	9	9	9	6	6	7	6	11
Number of the joints	1	2	3	4	5	6	7	8

The secondary branches of the antennæ are two-jointed and the end-joint is only about half the length of the other. The second joint of the posterior foot-jaws has the inner margin fringed with short stout setæ arranged in a pectinate manner; there is also a short stout seta on the inner distal angle of the first joint, which is plumose on one side (fig. 3). In the first pair of swimming-feet the end-joint of the two-jointed inner

branches is considerably shorter than the first joint, being only about two thirds the length of it; the end-joint is also narrower than the other; both the branches of the first pair are short and are of nearly equal length (fig. 4). The inner branches of the next three pairs of swimming-feet, which are also two-jointed, are very short, being not much longer than the first joint of the outer branches; the outer branches, on the other hand, are elongate and robust, and consist of three nearly equal joints, as shown by the drawing (fig. 4). In the fifth pair the inner produced portion of the basal joint is subcylindrical, rather longer than broad, and furnished with four stout coarsely plumose setæ and two smaller hairs, arranged thus—the two small hairs are on the outer margin, two of the larger plumose setæ spring from the apex, and the other two are subterminal, one on each side of the apical setæ: the secondary joint is in form somewhat like that of the produced part of the basal joint, but rather broader; it is furnished with a stout, elongate, and coarsely plumose apical seta, in addition to which there is interiorly a smaller subterminal seta, also plumose, and three small plain setæ exteriorly—that is, on the distal half of the outer margin, as shown in the drawing (fig. 6). Caudal stylets short, narrow, and having a wide space between them; each stylet is provided with a stout, very long, and coarsely plumose apical seta articulated near the base; there is also a smaller apical seta, the basal part of which forms a stout conical enlargement.

Habitat. Lochan a Chaite, on the south-east shoulder of Ben Lawers, Perthshire, altitude 2400 feet above the sea-level; specimens not very common.

Remarks. The characters by which the species is distinguished are the structure of the antennules, the armature of the posterior foot-jaws, and, especially, the structure of the first and fifth pairs of thoracic feet. The short end-joints of the inner branches of the first pair form so marked a character, that by them alone we had no difficulty in distinguishing specimens of this species from among others of the same genus by the use of an ordinary hand-lens.

The name we give to this species is the maiden surname of her who, as wife and mother, has, by a lifelong self-denial and ever-ready sympathy, enabled us to overcome difficulties in the course of our natural history studies that would otherwise have been well nigh insurmountable, and whose native home in the beautiful valley of Strathtay is but a few miles from the famous mountain on whose giant shoulder rests the little loch in which the species was found.

Canthocamptus palustris, var. *elongatus*, var. n.
(Pl. XVI. figs. 7-17.)

Description of the Variety.—Female. Length .7 millim. ($\frac{1}{36}$ of an inch). Body elongate and slender. Antennules eight-jointed; the second, fourth, and last joints are subequal and longer than the other joints, but the seventh joint is considerably shorter than any of the others; the formula shows the proportional lengths of the joints very nearly—

Proportional lengths of the joints..	9	12	7	11	7	8	5	10
Number of the joints	1	2	3	4	5	6	7	8

Antennæ moderately stout, three-jointed; the first joint is short, the second and third are longer and nearly equal in length; secondary branch small, one-jointed (fig. 9). Mandibles slender and provided with a small two-jointed palp (fig. 10). Posterior foot-jaws moderately stout; a small seta springs from the inner distal angle of the first joint, and another from the margin of the second joint near the distal end; terminal claw about equal in length to the second joint (fig. 11). Both branches of the first pair of swimming-feet are short and of nearly equal length, and are both three-jointed; the inner, which is slightly the longer branch, has the second and third joints short and subequal, their combined length being only a little more than two thirds of the length of the first joint, which is also considerably stouter; the joints of the outer branch are moderately stout and gradually increase in length from the basal joint (fig. 12). The second, third, and fourth pairs are more elongate than the first, and the inner branches are all three-jointed and considerably shorter than the outer branches; the first joint of the inner branches is also much shorter than the second and third joints (fig. 13). Fifth pair broadly foliaceous; the produced inner portion of the basal joint is shorter than the secondary joint and broadly rounded at the end, where it carries five slender setæ, having a somewhat pectinate arrangement; the two outermost setæ are much longer than the others and plumose; the secondary joint is subrotundate, but somewhat longer than broad, and furnished with five long slender hairs (fig. 14). Caudal stylets very short (fig. 17). The abdomen is only sparingly hirsute, and the ovisac is large.

Male. The male resembles the female very closely except in the antennules and fifth pair of feet; the antennules are elongate, nine-jointed, and strongly hinged. In the fifth pair of thoracic feet the inner portion of the basal joint is scarcely produced and broadly rounded, and bears three terminal and

slender subequal spines (fig. 15); the secondary branch is somewhat subcylindrical, the breadth is about two thirds of the length, and it is furnished with two setæ on the inner margin and four on the truncate apex (fig. 15). Spermatophore large.

Habitat. Pools above high-water mark near the head of West Loch Tarbert, Argyleshire; not very common.

Remarks. There seems to be little doubt that this is a variety of *Canthocamptus palustris*, Brady; it agrees with that species in several of its more important characters, such as the general structure of the antennules and of the first and fifth thoracic feet of the female; the second, third, and fourth pairs of thoracic feet are also similar to those of that species. The chief differences, on the other hand, are these:—(1) the secondary branches of the antennæ of this variety are only one-, instead of two-jointed; (2) the proportionally shorter second and third joints of the inner branches of the first thoracic feet; and (3) the structure of the fifth pair in the male. In the male fifth pair the secondary joint is comparatively large, being elongate and subcylindrical.

Laophonte propinqua, sp. n. (Pl. XVII. figs. 1–9.)

Description of the Species.—*Female.* Length .72 millim. (about $\frac{1}{35}$ of an inch). Body elongate, depressed; rostrum broad and with a minute seta on each side of the bifid apex (fig. 2). Antennules seven-jointed; the second and third joints are considerably longer than the others, and the second joint is also dilated and armed with a strong conical tooth on the external aspect (fig. 3). The proportional lengths of all the joints are nearly as follows:—

Proportional lengths of the joints..	17	22	23	6	5	7	11
Number of the joints	1	2	3	4	5	6	7

Antennæ strong; both the first and second joints are fringed with small setæ on the inner edge; secondary branch small, one-jointed (fig. 4). The second joint of the posterior foot-jaws is somewhat dilated and bears a powerful terminal claw. The inner branches of the first pair of swimming-feet are very strong; the first joint is of considerable length, being five times longer than broad; but the second is very short and is armed with a strong claw; the outer branches are slender, three-jointed, and about half the length of the first joint of the inner branches; the second basal joint is also densely hirsute, as shown by the drawing (fig. 6). The second pair

are slender; the outer branches are elongate and strongly spiniferous; the second joint is rather shorter than the first and only two thirds the length of the last joint; the two-jointed inner branch does not reach to the end of the second joint of the outer branch; the first joint is rather stouter than, but little more than half the length of, the second joint; the second joint bears four setæ—the two apical and one of the marginal are very long, but the other is short (fig. 7). The third and fourth pairs are also slender and with short inner branches; in the fourth pair the first joint of the inner branches, which only reach to about the middle of the second joint of the outer branches, is so short as to be almost rudimentary (fig. 8). In the fifth pair the inner produced portion of the basal joint is somewhat cone-shaped and bears three moderately long and stout plumose setæ on the inner margin and two smaller setæ at the apex; the apex of the basal joint only reaches to about half the length of the secondary joint; the secondary branch is elongate-ovate in form, being nearly three times longer than broad; the apex is lengthened into a narrow process, from the end of which springs a moderately long seta; on each side of this there is a subapical seta, also of moderate length, while three other setæ spring from the distal half of the outer margin (fig. 9). Caudal stylets narrow and about equal in length to the last abdominal segment.

Habitat. Port Erin, Isle of Man; and near the mouth of the River Alness, Cromarty Firth; rather rare.

Remarks. This *Laophonte* has a superficial resemblance to *L. denticornis*, T. Scott, but on closer examination it was found to differ very markedly, not only from that species, but from any other *Laophonte* known to us.

Idya longicornis, sp. n. (Pl. XVII. figs. 10-17.)

Description of the Species.—*Female.* Length 1·7 millim. ($\frac{1}{5}$ of an inch). This form resembles *Idya furcata*, Philippi, in general appearance, but is larger. The antennules, which are eight-jointed, are very long and slender; the first four joints are elongate, especially the third and fourth, which are nearly of equally length, the fourth being slightly longer than the other; it is also longer than all the last four taken together. The formula shows the proportional lengths of all the joints—

Proportional lengths of the joints..	30	· 40	· 45	· 47	· 7	· 10	· 8	· 18
Number of the joints	1	2	3	4	5	6	7	8

The antennules are sparingly setiferous, and the long somewhat slender filament springs from the end of the fourth joint (fig. 11). The antennæ are slender, and the first and second joints are each provided with one seta, while the last bears a few setæ at the apex (fig. 12). The mouth-organs are somewhat similar to those of *Idya furcata*, but the posterior foot-jaws have the terminal claws void of supplementary setæ (fig. 13). The swimming-feet are also somewhat similar to those of *Idya furcata*, but the second joint of the outer branches of the first pair is about twice the length of the first joint, and the spine which springs from the outer distal angle of the first joint is comparatively slender (fig. 14). The fifth pair are also more elongate than those of *Idya furcata*, being fully four times longer than broad (fig. 17).

Habitat. East Loch Tarbert, Loch Fyne. Several specimens of this species were taken with the dredge in 5 to 6 fathoms water in February 1886, but have not been previously recorded.

Remarks. *Idya longicornis* is easily recognized, not only by its larger size, but also and especially by the length and structure of the antennules. The proportional lengths of the joints of the outer branches of the first pair of swimming-feet and the elongate fifth pair also serve to distinguish this from any other British form of *Idya*. Though this *Idya* is the largest form of the genus with which we are familiar, the armature of the first pair of swimming-feet is not so powerful as that of the first pair in *Idya furcata*, a much smaller species. We are not altogether unfamiliar with the liability of *Ioya furcata* to variation, and also with the observations of several eminent naturalists on this liability to variation in *Idya furcata*; but we have seen no explanation that could account for the great differences between *Idya furcata* and the species we have now described on the principal of local variation, for both forms were taken together by the dredge on the same ground and at the same time. Had the two forms been taken in different localities hundreds of miles apart, there might have been some reasonableness in considering them merely as varieties of the one species; but, taken as they were, under similar conditions of time and place, we can only judge of the differences between them as we judge of the differences between forms belonging to other genera.

ADDITIONAL NOTES.

An interesting addition to the freshwater Crustacea of Scotland has only lately been obtained, viz. *Ophiocamptus*

(*Canthocamptus brevipes*, G. O. Sars. It was discovered in some hand-net gatherings from Loch Lubnaig, Perthshire, collected in September last. A description, with drawings, of it will be published in the 'Thirteenth Annual Report of the Fishery Board for Scotland.'

PSEUDOTHALESTRIS, G. S. Brady.

Pseudothalestris, G. S. Brady, Report on the 'Challenger' Copepoda, p. 100, pl. xlii. figs. 1-8 (1883).

In the Report on the 'Challenger' Copepoda Dr. Brady has described a new genus of the Harpacticidæ under the above name. He had only a single specimen (a male), which he describes as being like *Thalestris*; its characters were so marked, as to be of generic rank. This Copepod was obtained by Dr. Brady in a gathering from Betsy Cove, Kerguelen Island (lat. 49° 16' S., long. 70° 12' E.).

Last year one of the authors of this paper instituted a new genus—*Pseudowestwoodia*—for the reception of a Copepod that closely resembled *Westwoodia nobilis* (Baird) in general appearance, but differed in some important structural details. The genus *Pseudowestwoodia* was described, with illustrative drawings, in the 'Twelfth Annual Report of the Fishery Board for Scotland,' published last year. Descriptions of other two species of the same genus were published by us in the 'Annals and Magazine of Natural History' for January last.

A short time ago, when looking over the Report on the 'Challenger' Copepoda, we happened to observe a certain resemblance between Dr. Brady's *Pseudothalestris* and our *Pseudowestwoodia*; a careful study of the two was then made, with the result that we believe them to be identical. It is unfortunate that Dr. Brady had only a single specimen (and a male) to describe from; had it been a female, the identity of the two genera would no doubt have been more clearly established. Though our name—*Pseudowestwoodia*—is more in accord with the general form of the British species of the genus, there can be no question as to the priority of *Pseudothalestris*.

It is surely of much interest to find in this little group of Copepoda another instance of the remarkably close similarity between organisms living on opposite sides of the globe.

EXPLANATION OF THE PLATES.

PLATE XVI.

Attheyella MacAndrewæ, sp. n.

Fig. 1. Female, seen from the side, $\times 80$. 2. Antennule, $\times 380$. 3. Posterior foot-jaw, $\times 506$. 4. Foot of first pair of swimming-feet, $\times 380$. 5. Foot of fourth pair, $\times 380$. 6. Foot of fifth pair, $\times 380$.

Canthocamptus palustris, var. *elongatus*, var. n.

Fig. 7. Female, seen from the side, $\times 80$. 8. Antennule, $\times 169$. 9. Antenna, $\times 266$. 10. Mandible, $\times 380$. 11. Posterior foot-jaw, $\times 400$. 12. Foot of first pair, $\times 200$. 13. Foot of fourth pair, $\times 133$. 14. Foot of fifth pair, female, $\times 266$. 15. Foot of fifth pair, male, $\times 253$. 16. Spermatophore, $\times 380$. 17. Last two abdominal segments and caudal stylets, $\times 190$.

PLATE XVII.

Laophonte propinqua, sp. n.

Fig. 1. Female, dorsal view, $\times 64$. 2. Rostrum, $\times 380$. 3. Antennule, $\times 300$. 4. Antenna, $\times 253$. 5. Posterior foot-jaw, $\times 253$. 6. Foot of first pair of swimming-feet, $\times 253$. 7. Foot of second pair, $\times 253$. 8. Foot of fourth pair, $\times 169$. 9. Foot of fifth pair, $\times 253$.

Idya longicornis, sp. n.

Fig. 10. Female, dorsal view, $\times 24$. 11. Antennule, $\times 66$. 12. Antenna, $\times 100$. 13. Posterior foot-jaw, $\times 130$. 14. Foot of first pair of swimming-feet, $\times 66$. 15. Foot of third pair, $\times 66$. 16. Foot of fourth pair, $\times 66$. 17. Foot of fifth pair, $\times 130$.

LVI.—*The Amphipoda of Bate and Westwood's 'British Sessile-eyed Crustacea.'* By ALFRED O. WALKER.

IN February 1892 I published in this Magazine a paper on the Lysianassides of Bate and Westwood's 'British Sessile-eyed Crustacea,' in which I endeavoured to bring them into line with Prof. G. O. Sars's Amphipoda of Norway by an examination of the collection of Bate's types in the British Museum. Since then Sars's work has been completed so far as the Amphipoda are concerned, and as, from the extreme care and accuracy with which the species (a very large proportion of which have been found on our own coasts) are described and figured, it is likely to become the standard work on this order of Crustacea, I have throughout adopted its nomenclature. I am aware that another work—important in size,

cost, and pretensions, but, so far as the systematic portion is concerned, worse than worthless, because misleading—has appeared during the same period, viz. Della Valle's *Gammarrini* of the 'Fauna des Golfes v. Neapel.' I have not thought it necessary to include those species in which there has been no alteration of name and no correction required; and I would only add that I have found Mr. Stebbing's 'Challenger' Amphipoda invaluable in ascertaining the correct nomenclature.

Allorchestes Nilssonii (Rathke).

Now *Hyale Nilssonii*.

Allorchestes imbricatus (Bate).

This is *Hyale Lubbockiana* (Bate), male.

Nicea Lubbockiana (Bate).

= *Hyale Lubbockiana*, female.

Montagua monoculoides (Montagu) and *M. marina* (Bate).
Several specimens. = *Stenothoë monoculoides* and *S. marina*.

Montagua Alderi (Bate). One female.

= *Metopa Alderi*.

Montagua pollexiana (Bate). Two specimens.

= *Metopa pollexiana*.

Danaia dubia (Bate).

= *Cressa dubia*.

[For *Lysianassides* see Ann. & Mag. Nat. Hist. ser. 6, vol. ix. p. 134.]

Lysianassa Audouiniana (Bate). One specimen.

In my former paper I stated that the single specimen was in such bad condition that it could not be determined. With Mr. R. I. Pocock's assistance I subsequently succeeded in cleaning it with liquor potassæ, and satisfied myself of its identity with *Perrierella crassipes* (Chevreux and Bouvier), since described and figured by Bonnier*, who gives a full list of synonyms, as *Perrierella Audouiniana* (Bate).

* "Les Amphipodes du Boulonnais, Travaux de la Station Zool. de Wimereux-Ambleteuse," Bull. Scientifique, vol. xxiv. p. 175, pl. v.

Ampelisca Gaimardii (Kröyer). One large and four or five smaller specimens.

Both the figure in the 'Sessile-eyed Crustacea' and the specimen in the tube appear to me to agree much more closely with *A. spinipes* (Boeck)—much the commonest species in Liverpool Bay—than with *A. typica* (Bate), to which G. O. Sars refers it, as described and figured by the latter.

Ampelisca Belliana (Bate), = *A. lævigata* (Lilljeborg).
Three specimens.

Phoxus simplex (Bate). One specimen.

The single specimen is in bad condition, but the rostrum is straight, and not curved downwards, as supposed by Boeck. It appears to be an immature male of *Phoxocephalus Holbölli* (Kröyer). The upper antenna is badly figured; the flagellum is wanting, but the accessory appendage remains, having four longish joints.

Phoxus Holbölli (Kröyer). Two females.
= *Phoxocephalus Holbölli*.

Phoxus plumosus (Kr.). Two females in good condition.
= *Harpinia neglecta* (Sars).

Grayia imbricata (Bate). One specimen in very bad condition; probably, as suggested by Mr. Stebbing, a young *Amathilla homari* (Fabr.).

Westwoodilla cæcula (Bate) and *W. hyalina* (Bate) are not in the collection, but are probably, as has been suggested by Canon A. M. Norman, the young of the next species.

Ædiceros parvimanus (Bate). Two specimens.

This is rightly identified by Sars with *Halimедon Mülleri* (Boeck), which name he retains. As, however, Bate's name is the older, it should be *Halimедon parvimanus* (Bate).

Monoculodes Stimpsoni (Bate). One specimen.

Is *Synchelidium* (Kröyer) *brevicarpum* (Bate).

Kröyera altamarina (Bate) is not in the collection.

Darwinia compressa (Bate). Five or six specimens.

Is *Laphistius sturionis* (Kröyer).

Sulcator arenarius (Bate), = *Haustorius arenarius* (Slabber).

Urothoë Bairdii (Bate). Six specimens.

The species of this genus were compared with the "Monograph" of the Rev. T. R. R. Stebbing in Trans. Zool. Soc. vol. xiii. part 1 (1891). Judging from the form of the pleon-segments and the second uropods, the specimens named as above appear to be *U. marinus* (Bate), as suggested by Mr. Stebbing. Length about 6 millim.

Urothoë brevicornis (Bate). Six specimens.

All the larger specimens are females of *U. marinus*; the smallest may be *U. brevicorne* (Stebbing) from the shortness of the peduncle of the second uropods, which has two spines on it. All the specimens are similarly marked with dark red spots, which suggests the probability that the small specimen may be the young of *U. marinus*. Its length is $3\frac{1}{2}$ millim.

Urothoë marinus (Bate). One imperfect specimen.

The rami of the first and second uropods very decidedly curved, the peduncle of the second almost as long as that of the first.

Urothoë elegans (Bate).

Tube marked in Bate's writing "Unique," and, in a note on the jar, "Damaged or destroyed by the spirit." Only small fragments remain, including the tail.

Sars only describes one species of this genus, viz. *Urothoë norvegica* (Boeck), which appears hardly distinguishable from *U. elegans* (Bate), as described by Stebbing; the latter is the older name.

Lilljeborgia shetlandica (Bate & Westw.) is not in the collection, but is no doubt, as suggested by Norman, *Cheirocratus Sundevalli* (Rathke).

Phædra antiqua (Bate). Not in the collection.

Phædra Kinahani (Bate). Not in the collection.

Now *Lilljeborgia Kinahani* (Bate).

Iphimedia obesa (Rathke). Two specimens.

This, as figured, looks more like *I. minuta* (Sars) in the form of the third pleon-segment. The specimens in the tube, however, are both *I. obesa*.

Iphimedia eblancæ (Bate). Not in the collection.

Pereionotus testudo (Mont.). Not in the collection.

Acanthonotus Owenii (Bate). Six specimens.

Now *Epimeria cornigera* (Fabricius).

Dexamine tenuicornis (Rathke). Not in the collection.

G. O. Sars rightly conjectures that the species described by B. & W. under this name is not *Amphithoë tenuicornis* (Rathke), which he identifies with *D. spinosa* (Mont.), but *D. thea* (Boeck).

Dexamine vedlomensis (Bate & Westw.). Not in the collection.

Now *Paratylus vedlomensis*.

Atylus gibbosus (Bate).

Now *Tritæta gibbosa*. *T. dolichonyx* (Nebeski) is the adult male of this species.

Atylus bispinosus (Bate).

Now *Apherusa bispinosa*.

Pherusa bicuspis (Kröyer). Four or five specimens.

This, as I have shown elsewhere, is not *Amphithoë bicuspis* (Kröyer). It is probably *Apherusa (Halirages) borealis* (Boeck).

Pherusa fucicola (Leach). Not in the collection.

This, as shown in Ann. & Mag. Nat. Hist. ser. 6, vol. vii. p. 418, is *Gammarella brevicaudata* (M.-Edw.), female.

Calliope Ossiani (Bate) and *C. Fingalli* (Bate & Westw.).

Not in the collection. As pointed out by Boeck, these are respectively the young and old forms of *Amphithoë* (now *Parapleustes*) *latipes* (M. Sars, 1858).

Calliope grandoculis (Bate). One large and two small specimens.

These appear to be immature specimens of *C. leviusculus* (Kröyer).

Eusirus helvetiæ (Bate). Not in the collection.

According to Boeck this is *E. longipes* (Boeck, 1860).

Leucothoë furina (Savigny).

The tube thus labelled contains only two specimens of a male *Bathyporeia* of the form called by G. O. Sars *B. Robertsonii* (Bate), so far as can be judged in the absence of the colouring-matter of the eyes.

Gossea microdeutopa (Bate). Fragments of two specimens.

Appears to be *Apherusa Jurinii* (M.-Edw.).

Microdeutopus gryllotalpa (Costa).

The young male of *M. anomalus* (Rathke), as suggested by Norman *, and not Costa's species. G. O. Sars makes it (somewhat doubtfully) a distinct species under Bate's earlier name of *M. damnoniensis*.

Microdeutopus Websterii (Bate).

Now *Autonoë Websteri*.

Microdeutopus anomalus (Rathke). Not in the collection.

Norman has suggested * that this is the female of *Aora gracilis* (Bate). From the description of the size, colour, and marking this is probably correct, though the females of these two species are almost indistinguishable.

Microdeutopus versiculatus (Bate).

The female is here described. The male was described by Norman * and again by Stebbing (Ann. & Mag. Nat. Hist. ser. 4, vol. xiv. p. 12, pl. i. figs. 2-2f).

Protomedeia hirsutimana (Bate).

An unrecognizable fragment only remains. Only the anterior half of the animal was seen by Bate; but Norman * supplied the description of the remainder in the above-mentioned Report. Sars describes and figures this species under the name of *Leptocheirus pilosus* (Zaddach); but as that species is described as having the first gnathopods with a somewhat swollen hand ("manus modice tumidus ad apicem versus latior factus"), which agrees rather with the form described and figured by Grube † than with Sars's description, the identification is open to doubt. In Zaddach's species also the secondary appendage of the upper antennæ

* Last Report of Shetland Dredgings, Brit. Assoc. 1868.

† "Beitr. zur Kenntniss der istrischen Amphipodenfauna," Arch. für Naturgesch. 1866, pl. x.

was overlooked entirely by the author, and subsequently was said by Fr. Müller (Arch. für Naturgeschichte, 1848) to be rudimentary and one-jointed, while in Sars's and Bate's species it is long and six-jointed. The form figured by Della Valle as *L. pilosus* (Zadd.) certainly agrees better than Sars's with the original description, as also with *L. pectinatus* (Norman).

Protomedeia Whitei (Bate). One specimen.

Evidently *Cheirocratus Sundevalli*, female, as suggested by Norman.

Bathyporeia pilosa (Lindström).

Two tubes so labelled. Of these no. 50 contains two females of *B. norvegica* (Sars); the other (no. 85) contains eleven specimens, all of which have dark eyes; some have dorsal spines on the fourth pleon-segment, others have not; one (a large female) had a rudimentary tooth slightly in front of the rounded hind margin of the third pleon-segment.

Bathyporeia pelagica (Bate). One adult male, 5 millim. long.

This agrees with the form described by Sars under the above name. The eye is large and dark, but it is impossible to say what colour it was when fresh, as red eyes sometimes fade entirely in spirit and sometimes turn dark. It must be confessed that, of the five species of *Bathyporeia* given by Sars, only *B. norvegica* (Sars) seems to be distinct, owing to its having the hinder angle of the third pleon-segment produced to a point, instead of being rounded, as in the other species.

Gammarella Normanni (B. & W.). Not in the collection.

Is *G. brevicaudata* (Milne-Edwards), female.

Melita proxima (Bate).

Of this Norman says it "is the common form of the male, and *Megamæra Alderi* is the female of *Melita obtusata* (Mont.). The variety of the male with a central dorsal tooth on the second and third segments of pleon is far less common." See also for this and *M. gladiosa* (Bate) the same author in Ann. & Mag. Nat. Hist., August 1889, p. 133.

Eurystheus erythrophthalmus (Lilljeborg).

Now *Gammaropsis erythrophthalmus*.

Eurystheus bispinimanus (Bate).

The female of the last species.

Amathilla Sabini (Leach).

Now *A. homari* (Fabr.). I take this opportunity of expressing my doubt as to the distinctness of *A. angulosa* (Rathke) from this species, notwithstanding the high authority of G. O. Sars and Boeck. The dorsal projections in the young of *A. homari*, which swarm on the coast of Wales in summer, are only gradually developed, and the same may be said of the other characters on which these authors rely. The large mature animals only seem to resort to the shore in winter and spring to deposit their young.

Gammarus campylops (Leach). Not in the collection.

Gammarus tenuimanus (Bate).

One specimen without telson and third uropods. This is clearly *Mæra Batei* (Norman) female, the male being *M. multidentata* of the Supplement to Bate and Westwood's work (vol. ii. p. 515). Norman's name is slightly the older. The figure of the second gnathopod appears to belong to a different species; that of the entire animal is more correct, as also are the description and figures in the Brit. Mus. Cat. of Amph. Crust. p. 214, pl. xxxviii. fig. 2.

Gammarus Edwardsii (M.-Edw.). Not in the collection.

Considered by Nebeski to be a variety of *G. locusta* (Linn.).

Megamæra semiserrata (Bate). Not in the collection.

Now *Mæra semiserrata*.

Megamæra longimana (Leach) and *M. othonis* (M.-Edw.).

Male and female of *Mæra othonis*.

Megamæra? *Alderi* (Bate).

See under *Melita proxima*, ante.

Megamæra brevicaudata (Bate).

Is *Elasmopus rapax* (Costa) female, as stated by Barrois ('Cat. des Crust. marins recueillis aux Açores').

Eiscladus longicaudatus (B. & W.). Not in the collection.

Now *Photis longicaudatus*. The length of this species is given as $\frac{1}{2}$ inch, while Sars says it scarcely exceeds 4 millim., which is the size of apparently adult specimens from the

Welsh coast. I have, however, a specimen, dredged by myself off Guernsey, which is nearly as large as the type.

Amphithoë rubricata (Mont.) and *A. littorina* (Bate).

Now united under the former name.

Amphithoë albomaculata (Kröyer). Not in the collection.

This species has also been united with *A. rubricata*.

Amphithoë gammaroides (Bate). Not in the collection.

Sars has restored Bate's original genus *Pleonexes* for this species, uniting with it the following.

Sunamphithoë hamulus (Bate), = *Pleonexes gammaroides*, ♀.

Podocerus pulchellus (Leach). Not in the collection.

Generally allowed to be the adult male of *P. falcatus* (Mont.).

Podocerus variegatus (Leach). Several specimens.

Among these is more than one form; some are typical *P. falcatus*, but there are two or three of a form which I incline to think distinct, and which may be considered as being this species. The most obvious distinction is the massive character of the antennæ, of which the upper (in adults) have a four-jointed flagellum, the first joint being nearly twice as long as the remaining three together, while in adult *P. falcatus* the flagellum is seven-jointed, the first joint rather shorter than the following three together. In the thickness of the antennæ and in the form of the second gnathopods this species (*P. variegatus*) approaches *Janassa capillata* (Rathke), with which Boeck confused it. It may, however, be at once distinguished from that species by its well-developed secondary appendage to the upper antennæ and by the outer curved ramus of the third uropods having two secondary teeth, as in *P. falcatus*, whereas *J. capillata* has practically no secondary appendage and no teeth on the outer ramus.

Podocerus capillatus (Rathke). One female with ova.

Now *Janassa capillata*. The figure of the entire animal is very bad; that of the lower antenna is good.

Podocerus falcatus (Mont.). Three specimens.

This is the form considered (no doubt rightly) by Sars as

the immature male. It certainly comes very near *P. Herdmani* (Walker) [= *P. odontonyx* (Sars)], and I have a specimen which cannot be distinguished from a young male *P. falcatus*, but which has the last two joints of the upper antennæ clothed with the dense plumose setæ which are held to be characteristic of sexual maturity in the male. As regards the tooth on the finger of the second gnathopods of *P. Herdmani*, two of the above three specimens have it, while the third, like them in other respects, has not; so that it seems to be a variable character. I am disposed to consider *P. Herdmani* and *P. pusillus* (Sars) as examples of arrested development and mere varieties of *P. falcatus*.

Podocerus pelagicus (Leach). Not in the collection.

No doubt, as suggested by Norman, the female of *P. falcatus*.

Podocerus ocius (Bate). Not in the collection.

The specimen described is probably a female. This species has lately been described by Della Valle. I have specimens from Port Erin, Isle of Man. The male has the tooth at the base of the palm longer than the central tooth.

Cerapus abditus (Templeton) and *C. difformis* (M.-Edw.).

Now *Erichthonius abditus* and *E. difformis*.

Dercotohö punctatus (M.-Edw.). Not in the collection.

Is *Erichthonius difformis* female, according to Norman.

Siphonæcetes typicus (Kröyer). One specimen.

Apparently *S. Colletti* (Boeck). *S. typicus* (Kr.) is an Arctic species, not even found on the Norwegian coasts. The species, however, seem to be barely distinct.

Siphonæcetes Whitei (Gosse). Not in the collection.

Siphonæcetes crassicornis ♀ (Bate).

Now *Cerapus crassicornis*.

Nænia tuberculosa (Bate).

Now *Podoceroopsis sophiæ* (Boeck).

Nænia rimapalmata (Bate) and *N. excavata* (Bate).

Respectively male and female of the same species, and
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identical with *Xenoclea Batei* (Boeck). Bate's name being the oldest, Sars calls this species after the female, viz. *Podoceroopsis excavata*.

Nænia undata (Bate). Not in the collection.

Probably *Podoceroopsis Sophiæ*, female.

Cyrtophium Darwinii (Bate).

Now *Lætmatophilus tuberculatus* (Bruzelius).

Cratippus tenuipes (Bate). Not in the collection.

Now *Colomastix pusilla* (Grube).

Dryope irrorata (Bate). Not in the collection.

Dryope crenatipalma (Bate). Not in the collection.

Male and female of the same species, now *Unciola crenatipalma* (Bate). *U. irrorata* (Say) is a distinct species.

Corophium longicorne (Latreille).

Now *C. grossipes* (Linné).

Corophium Bonellii (M.-Edwards).

The tube (no. 114) is labelled *C. spinicorne*, Bate's earlier name. The specimen is undoubtedly *C. crassicorne* (Bruz.) female.

Corophium crassicorne (Bruzelius).

The tube which is labelled *Cor. Bonellii* and *Cor. crassicorne* contains only one specimen, which is the male of *C. crassicorne*.

Lestrignonus exulans (Kröyer).

Hyperia galba (Mont.), male.

Lestrignonus Kinahani (Bate). Not in the collection.

Bovallius doubtfully refers this to *Hyperia Latreillei* (M.-Edw.), male.

Hyperia oblivia (Kröyer). Not in the collection.

Norman has pointed out that this is not Kröyer's species, and named it *H. gracilipes*, now *Parathemisto gracilipes* (Norman).

Proto pedata (Abildgaard).

Now *Phtisica marina* (Slabber).

Proto Goodsirii (Bate). One specimen.

Is the adult male of the latter species, as suggested by Stebbing.

Caprella lobata (Müller).

The adult male of *C. linearis* (Linné).

Caprella hystrix (Kröyer). Tube marked *C. acuminifera*.

This appears to be a young *C. linearis*.

Caprella tuberculata (Guérin). Not in the collection.

P. Mayer retains this species, though with some hesitation, as *C. tuberculata* (Bate & Westw.).

Podalirius typicus (Kröyer).

Now *Pariambus typicus*.

None of the species given in the Supplement are in the British Museum collection; some are at the Laboratory of the Marine Biological Association, Plymouth, but I have not seen them. The following notes may, however, be useful.

Orchestia brevidigitata (Bate & Westw.).

Considered by Barrois as probably only a young, though somewhat abnormal, form of *O. littorea*.

Montagua clypeata (Bate).

Probably the female of *Metopa pollexiana* (Bate).

Montagua norvegica (Lilljeborg).

Sars considers this the adult male of *Metopa Alderi* (Bate).

Opis leptochela (B. & W.), = *Euonyx chelatus* (Norman).

Opis quadrimana (B. & W.), = *Normania quadrimana*.

Kröyera brevicarpa (B. & W.), = *Synchelidium brevicarpum*.

Cheirocratus mantis (Norman), = *Cheirocratus assimilis* (Lilljeborg), male.

Megamæra multidentata (Norman, MSS.),
= *Mæra Batei* (Norman), male.

Unciola leucopes (Kröyer).

Is not Kröyer's species, but *U. planipes* (Norman).

Hyperia tenuiformis (B. & W.) and *H. prehensilis* (B. & W.).

Bovallius retains both these species provisionally in his genus *Hyperoche*, Bate and Westwood's descriptions being very imperfect*.

Themisto crassicornis (Kröyer), = *Euthemisto libellula*
(Mandt).

I have to thank the authorities of the British Museum, and more especially Prof. F. Jeffrey Bell and Mr. R. I. Pocock, for the valuable aid they have given me in going through the type collection there.

LVII.—*A Month on the Trondhjem Fiord.*

By the Rev. Canon NORMAN, M.A., D.C.L., F.R.S., &c.

[Continued from vol. xiii. p. 283.]

ISOPODA (continued).

61. *Jæra albifrons*, Montagu.

Tide-marks, Trondhjem.

* By the kindness of Mr. E. T. Allen, Director of the Marine Biological Laboratory, Plymouth, I have been allowed to see what remains of Spence Bate's type spirit-specimens of this species. Unfortunately these have been at some period allowed to dry up, and are in such bad condition that it is not easy to identify them. The first and second peræopods and one gnathopod are, however, in fair condition, and these agree with *Hyperoche Lütkeni* (Bovallius, 1887). In another tube of Spence Bate's collection marked "*Lestrigonus*, sp.," there are, besides five or six specimens of *Hyperia galba* (Mont.) male, three male specimens of *H. Lütkeni* in excellent condition, which shows at least that Bate had taken this species. It may therefore fairly be assumed that *Hyperia tauriformis* (Bate) is identical with *Hyperoche Lütkeni* (Bov.). But Sars holds that this species is identical with *H. Kröyeri* (Bov., 1885), a name which replaces *Metæcus medusarum* (Fabricius), erroneously given by Kröyer. As Bate's name is older than either of Bovallius's, this species should be called *Hyperoche tauriformis* (Bate & Westw., 1868). There appears to be no trace of a type specimen of *Hyperia prehensilis* (B. & W.), a very doubtful species.

62. *Cyproniscus cypridinæ*, G. O. Sars.

1882. *Cryptothiria cypridinæ*, G. O. Sars, Oversigt af Norges Crustaceer, i. p. 73, pl. ii. figs. 17-21.

1884. *Cyproniscus cypridinæ*, Kossman, "Neueres über Cryptonisciden," Sitz. der k. preuss. Akad. d. Wissensch. p. 460 (translated Ann. & Mag. Nat. Hist. ser. 5, vol. xiv. p. 4).

Two or three specimens in *Cypridina norvegica* from off Rödberg; also taken by me in the Hardanger Fiord. Sars's type specimens were from the Lofoten Islands.

Kossman has instituted the genus *Cyproniscus* to receive this species.

A M P H I P O D A.

The beautiful new work on the Amphipoda of Norway by Prof. G. O. Sars*, which is now almost completed, throws a flood of light upon this interesting group, and will henceforth make the study of the northern species comparatively easy. The descriptions and the figures in this monograph leave nothing to be desired. The great work of Della Valle lately published ('Fauna und Flora des Golfes von Neapel, Gammarini del Golfe di Napoli,' 1893) also adds much to our knowledge of the South European species; to this work I shall have occasion to, in some cases, refer †. I have followed Sars's arrangement.

In the opening sentences of these notes I mentioned that a chief reason of my going to the Trondhjem Fiord was a hope that by doing so I might meet with some of the new and rare Amphipoda which G. O. Sars had found there. I was not disappointed. The following list of 119 species is a good record for a month's work. Some of these species are not recorded from the Fiord by Sars; but he has given that locality for 70 species which were not obtained by me, and to these numbers must doubtless be added many of the commoner forms of West Norway, for which Sars in his work does not record special habitats. It will be evident how rich the Amphipodal fauna of this Fiord must be, when I mention that in Stebbing's great work on the 'Challenger' Amphipoda the number of described species is 294; but of these no less

* 'An Account of the Crustacea of Norway,' vol. i. Amphipoda, pts. 1-30, pls. i.-ccxl. (1890-94).

† It is much to be regretted that Signor Della Valle has added to his work synonymy of Arctic species, with which he was not familiar. With respect to these much confusion has been introduced by the lumping together of widely distinct species under a single name. No naturalist who was practically acquainted with the species, or, at any rate, had studied them in life, could have thus treated them.

than 93 are oceanic species of the tribe Hyperidea; that the total number procured by the 'Vöringen' Expedition during three summers' work was 149*; that the Amphipods of the 'Willem Barents' Expedition, 1878-84, were 73 †; those of the 'Dijmphna' Expedition 41 ‡. Moreover, the total known Amphipods of Greenland are 151 §; of Denmark 122 ¶; of the British Isles about 236; of the Mediterranean 143 ¶¶.

Sars's admirable and complete work proves how extremely rich the Norwegian seas are in Amphipoda; and the fact that I only found one undescribed species testifies to the thoroughness of his examination of the fauna.

63. *Hyale Nilssoni*, Rathke.

Rödberg, 3-5 fathoms.

Surely this is *H. pontica* of Rathke. That author's figure in 'Beitrag zur Fauna der Krym' closely agrees with *H. Nilssoni* of the same author's 'Beiträge zur Fauna Norwegens,' with one important exception. The last uropods of *H. pontica* are figured and described as two-branched; but there would seem to have been some mistake here, since no allied form has such uropods. Della Valle unites the two species; but then his figure (pl. xvi. fig. 5) of the second gnathopod of male, which gives a pyriform hand, with very oblique palm, does not agree with that organ in *H. pontica* as figured by Rathke, which is indistinguishable from the same organ in *H. Nilssoni*, Rathke. Heller** gave ten Adriatic species of this genus, the whole of which Della Valle includes under *H. Prevostii*, M.-Edwards (nec Rathke).

* 'Norwegian North-Atlantic Expedition, 1876-78:' Zoology, Crustacea, G. O. Sars.

† "Die zoologischen Ergebnisse in 1878 und 1879 des 'Willem Barents'" (Niederl. Archiv für Zool. Supp. Band, 1881-2); 'Die Crustaceen,' Dr. P. P. C. Hoek; and the Amphipoda, "Voyages 'Willem Barents,' 1880-84," by Rev. T. R. R. Stebbing (Bijdr. Dierk. 1894).

‡ H. J. Hansen, 'Dijmphna-Togtets zoologisk-botaniske Udbytte, 1887: Krebsdyr.'

§ H. J. Hansen, "Oversigt over det vestlige Grönlands Fauna af malakostrake Havkrebssdyr" (Vidensk. Middel. fra den naturh. Foren. i Kjöbh. 1887).

¶ Fr. Meinert, "Crust. Isop., Amphip., et Decap. Daniæ" (Naturhist. Tidssk. 3 R. xi. B., 1877, and xii. B., 1880); Fr. Meinert, Det Vidensk. Udbytte af 'Hauchs' Togter, Crustacea Malacostraca, 1890. I have previously in these notes (vol. xiii. p. 268) given the number of Danish Amphipods as 113, which is the number in the last of the three memoirs here quoted; I have here added some additional species mentioned in the two former.

¶¶ Della Valle and Mayer.

** C. Heller, 'Beit. zur näheren Kenntniss der Amphipoden des Adriatischen Meeres,' 1866.

Under the last-mentioned name Della Valle also includes *H. Lubbockiana*, G. O. Sars, while *H. Lubbockiana* of British authors he retains as a distinct species; but *H. Lubbockiana*, G. O. Sars, is undoubtedly the same as that of British authors, while the species described as *H. Lubbockiana* by the Italian author would seem to be something different, inasmuch as he could not in the large figure he gives have omitted to draw the remarkable serrated spines of the propodus of the peræopods. These spines have been figured by Bate, Stebbing, and Sars.

64. *Acidostoma obesum*, Bate.

Rödberg, 20–40 fathoms.

65. *Ichnopus spinicornis*, Boeck.

Rödberg, 150 fathoms.

Della Valle makes this, as well as *I. affinis* and *I. calceolus* of Heller, synonyms of *I. taurus*, A. Costa. With regard to *I. calceolus* he is probably right, but specimens of Heller's *I. affinis*, kindly given me by that author, agree with *I. taurus*, and these forms are markedly distinct from *I. spinicornis* in the much more slender antennules and antennæ and in the absence in these of calceola in the female, as well as the character of the nail of the second gnathopod (see Heller, fig. 22, and Della Valle, fig. 12). Sars makes *I. calceolus* of Heller the male of *I. spinicornis*; and Heller's figure of the first gnathopod of *I. calceolus* does not agree with that limb in *I. taurus*, moreover the differences illustrated in Della Valle's figs. 12 and 13 look something more than varietal.

Sars has not noticed the peculiar modification of the second uropod in the male of *I. spinicornis*, which corresponds to that figured by Della Valle (pl. xxvii. fig. 2) as found in *I. taurus*, and which occurs also in some other species, for example in the male of the genus *Triphosites* (see Sars, pl. xxix. fig. 1, *up.*²).

66. *Ambasia Danielsseni*, Boeck.

Rödberg, 100–300 fathoms.

67. *Aristias neglectus*, Hansen.

1872. *Aristias tumidus*, Boeck (nec Krøyer), Skand. og Arkt. Amphip. p. 148, pl. iii. fig. 4.

1887. *Aristias neglectus*, Hansen, Oversigt Grönlands Amphip. Malakos. Hafskrebsdyr, p. 86, pl. ii. figs. 3–3b.

1890. *Aristias Audouinianus*, G. O. Sars, Crust. Norway, Amphipoda, p. 48, pl. xvii. fig. 2 (nec *Lysianassa Audouiniana*, Bate).

1893. *Aristias neglectus*, Della Valle, l. c. p. 844, pl. vi. fig. 9, pl. xxvi. figs. 16–31.

Rödberg, one specimen in 40 and a second in 250–300 fathoms; also at Trondhjem.

I have specimens of this species from Shetland and Sleat Sound, Skye, and procured it at Naples in 1887.

Aristias tumidus, Kröyer, seems to be confined to the Arctic regions; the specimens in my collection are from Greenland (*Hansen*) and Spitsbergen (*Lovén*).

68. *Perrierella Audouiniana*, Bate.

1855. *Lysianassa Audouiniana*, Bate, Brit. Assoc. Rep. p. 58; Bate and Westwood, Brit. Sessile-eyed Crust. vol. i. p. 79 (nec auct. plur.).

1890. *Aristias Audouinianus*, Meinert, Vidensk. Udbytte 'Hauchs' Togter, Crust. Malac. p. 152, pl. i. figs. 1–6.

1892. *Perrierella crassipes*, Chevreux and Bouvier, Bull. Soc. Zool. France, vol. xvii. p. 50.

1892. *Pararistias Audouinianus*, Robertson, "Amphip. and Isop. Firth of Clyde," Trans. Nat. Hist. Soc. Glasgow, vol. iii. p. 201.

1893. *Perrierella Audouiniana*, J. Bonnier, Amphip. der Boulonnais, Art. iii., Bull. sci. de France et Belgique, vol. xxiv. p. 175, pl. v. figs. 1–10.

A single specimen, agreeing on dissection in all points with Bonnier's excellent figures, Laminarian zone, Rödberg.

It will be seen that much has been written lately on the disputed *Lysianassa Audouiniana*, Bate; and it has now been satisfactorily shown that *Perrierella* is that species, a conclusion confirmed by the examination of the type specimen in the British Museum by Mr. A. O. Walker. But Bate, like others after him, confused his own species with allies. I have a specimen of this species from Polperro, Cornwall, in my collection which was determined by Bate as his *Lysianassa Audouiniana*. I have also taken *Perrierella* at Oban in Ascidiaria, a habitat which is well known as a favourite one of *Aristias neglectus*. I am also indebted to the Copenhagen Museum for a Danish example determined by Herr Meinert.

69. *Callisoma Hopei*, A. Costa.

1851. *Callisoma Hopei*, A. Costa, in Hope, Cat. Crust. Ital. p. 44, and plate, fig. 2; id. Fauna del Reg. di Nap. Crust. p. 5, pl. viii. bis, fig. 1.

1857. *Scolepecheirus crenatus*, Bate, Ann. & Mag. Nat. Hist. ser. 2, vol. xix. p. 138.

1890. *Callisoma crenata*, G. O. Sars, Crust. Norway Amphip. pl. xix. fig. 1.

1893. *Callisoma Hopei*, Della Valle, *l. c.* p. 839, pl. vi. fig. 11, pl. xvi. figs. 1–15.

Rödberg, 40–100 fathoms.

The North-European form is identical with the Mediterranean species described by A. Costa. I have examined

specimens from Naples: the carpus of first gnathopods is longer in proportion to the hand and the telson to the last uropods than figured by Della Valle, at least in the specimens which I have examined.

70. *Hippomedon denticulatus*, Bate.

Trondhjem, 20-40 fathoms.

71. *Orchomene serratus*, Boeck.

Rödberg, 40-300 fathoms.

72. *Orchomene crispatus*, Goës.

Rödberg, 150-300 fathoms.

73. *Orchomenella pinguis*, Boeck.

One specimen, Trondhjem, 20-40 fathoms.

74. *Triphosa Höringii*, Boeck.

Two specimens, off Trondhjem, 150 fathoms.

75. *Triphosa angulata*, G. O. Sars.

One, Rödberg, in about 150 fathoms.

76. *Triphosites longipes*, Bate.

= *Anonyx longipes*, Bate, ♀, = *Anonyx ampulla*, Bate, ♂.

Trondhjem and Rödberg, 20-150 fathoms.

77. *Anonyx nugax*, Phipps.

Common in the Laminarian zone, but the specimens all small.

78. *Haplonyx similis*, G. O. Sars.

Rödberg, in 150 fathoms.

79. *Haplonyx albidus*, G. O. Sars.

Rödberg, 250-300 fathoms.

80. *Haplonyx cæculus*, G. O. Sars.

This species is, as yet, only known from the Trondhjem Fiord; the two type specimens from which the species was described by Sars were taken in about 150 fathoms at Lexvigen (as Sars spells it, or Lensviken, as it is spelt in the

chart); and I dredged also two specimens off Rödberg, in 250-300 fathoms, the latter spot being only a few miles from Sars's locality. *H. caeculus* is distinguished by its want of eyes, the acutely produced lateral angles of the head, the produced lower hind margin of the third segment of the pleon, and the slender second gnathopods; but the peculiarity which at once attracted my notice as belonging to a species new to me consisted in the very slender nails of the peræopods, which recalled those of *Triphosites longipes*.

81. *Urothoë norvegica*, Boeck.

In various dredgings down to 150 fathoms. I employ this name as certainly correct when applied to this form without expressing any opinion as to the British species, with which it must be synonymized, because I have not again carefully examined the latter since the publication of Stebbing's memoir on the genus. Della Valle has united the whole of the northern forms, including *U. abbreviata*, G. O. Sars, together with *Egidia pulchella*, A. Costa, and *U. Poucheti*, Chevreux, under the name *Urothoë irrostrata*, Dana; and he maintains that marked differences occur in the third peræopod of the two sexes (*cf.* his pl. xxxvi. figs. 14, 15). Now specific characters have been drawn partially from the different structure of this limb. The point therefore is of consequence, for Sars shows that the form of this limb is not affected by sex in the case of *U. norvegica*. Stebbing's elaborate memoir on this genus in *Trans. Zool. Soc.* vol. xiii. p. 1, should be consulted.

82. *Argissa hamatipes*, Norman.

1869. *Syrrhoë hamatipes*, Norman, "Last Report Shetland Dredging," *Brit. Assoc. Report*, 1868, p. 279.

1870. *Argissa typica*, A. Boeck, *Crust. Amphip. bor. et arct.*, *Vidensk. Selsk. Forhand.* p. 45.

A glance at the very peculiar little hook-formed last joints of the peræopods at once suffices to distinguish this species from all others known to me. A single specimen, Trondhjem, between Monkholmen and the shore.

83. *Leptophoxus falcatus*, G. O. Sars.

Rödberg, among the mud at the bottom of the Fiord in 250-300 fathoms.

84. *Harpinia neglecta*, G. O. Sars.

= *Phoxus plumosus*, Bate (nec Kröyer), = *H. antennaria*, Meinert, ♂.

Trondhjem and Rödberg, 20-40 fathoms. This is our

common British species, and it reaches the Mediterranean, whence I have received specimens from Della Valle, who records it under this name.

85. *Harpinia pectinata*, G. O. Sars.

Rödberg, 250-300 fathoms.

86. *Harpinia truncata*, G. O. Sars.

Five specimens, Rödberg, 250-300 fathoms. Sars's description was drawn up from two specimens also taken in the Trondhjem Fiord, which is as yet the only recorded habitat.

87. *Harpinia crenulata*, Boeck.

Trondhjem and Rödberg, 20-300 fathoms.

88. *Harpinia lævis*, G. O. Sars.

Two examples, Trondhjem, in 20-40 fathoms.

89. *Ampelisca typica*, Bate.

= *A. Gaimardi*, B. & W. (nec Kröyer).

Trondhjem, between Monkholmen and the land. Della Valle's description and figures clearly show that the *Araneops brevicornis*, A. Costa, 1853, and *Ampelisca lævigata*, Lilljeborg, 1855, are the same species; and this I have confirmed by comparison of specimens, and the latter specific name must therefore give way to the former, of which another synonym is *A. Belliana*, Bate. But when Della Valle proceeds further to make *Tetromatus typicus*, Bate, and *A. gibba*, G. O. Sars, also synonyms of *A. brevicornis*, I am at a loss to understand on what grounds he has arrived at such a conclusion.

90. *Ampelisca assimilis*, Boeck.

Trondhjem, two or three specimens in shallow water.

91. *Ampelisca gibba*, G. O. Sars.

Rödberg, 150-300 fathoms, frequent.

92. *Ampelisca macrocephala*, Lilljeborg.

Trondhjem, 20-40 fathoms; also at Rödberg.

93. *Ampelisca odontoplax*, G. O. Sars.

Numerous specimens, Rödberg, 100-300 fathoms.

Della Valle unites this with *A. Eschrichti*, but I find not the slightest difficulty in distinguishing them. The pronounced character of the tooth of the anterior epimera is one well-marked distinction; and under the microscope it is seen that the propodos of the penultimate peræopod has not the lobe projecting beyond the base of the nail, which is so distinctive a mark in *A. Eschrichti* (see Sars, *l. c.* pl. lxi. fig. 1, p.⁶); and the carpus of the last peræopod is quite different in form and spination. In *A. Eschrichti* the front side of this carpus is furnished with a little lobe bearing two spines, while in *A. odontoplax*, though there are two spines, there is no lobe. This may seem a trifle, but when familiar with species it is generally by some microscopic "trifle" on a part easily seen that I am in the habit of identifying them; and the structure of the carpus of the last peræopods in this species at once separates it from all known allies.

94. *Ampelisca æquicornis*, Bruzelius.

Rödberg, 10–150 fathoms.

95. *Ampelisca pusilla*, G. O. Sars.

Two specimens, Rödberg, one in 150, the other in 250–300 fathoms.

96. *Byblis Gaimardi*, Krøyer (nec *A. Gaimardi*, B. & W.).

Rödberg, 250–300 fathoms.

97. *Haploops setosa*, Boeck.

Rödberg, 100–300 fathoms.

98. *Stegocephalus inflatus*, Krøyer.

= *Stegocephalus inflatus*, Boeck &c. (nec Phipps).

Rödberg, among Corals and Alcyonarians on the precipices, in about 150 fathoms.

99. *Stegocephalus similis*, G. O. Sars.

Rare, with the last.

100. *Andania abyssi*, G. O. Sars.

Rödberg and Trondhjem, in 150–300 fathoms.

101. *Stegocephaloides christianiensis*, Boeck.

Trondhjem, 20–40 fathoms; Rödberg, 250–300 fathoms.

102. *Andaniella pectinata*, G. O. Sars.

One specimen only of this little species, taken at Rödberg in 3–10 fathoms. It is easily distinguished by the pectinated fingers of the gnathopods.

103. *Astyra abyssi*, Boeck.

Three specimens, Rödberg, 250–300 fathoms.

104. *Amphilochus manudens*, Bate.

In 40 to about 200 fathoms, Rödberg.

105. *Gitana Sarsii*, Boeck.

A single specimen, taken in the tow-net at Trondhjem.

106. *Gitana rostrata*, Boeck.

Rödberg, 250–300 fathoms.

107. *Stenothoë megacheir*, G. O. Sars.

In 40–300 fathoms, Rödberg; chiefly, as G. O. Sars observed in the same locality, among the coral *Lophohelia prolifera*.

108. *Probolium calcaratum*, G. O. Sars.

One male, Rödberg, in 250–300 fathoms.

109. *Probolium gregarium*, G. O. Sars.

Two only, Rödberg.

110. *Leucothoë spinicarpa*, Abildgaard.

= *Leucothoë articulosa*, B. & W.

Common.

111. *Monoculodes borealis*, Boeck.

Only two specimens, in 40–100 fathoms. In Finmark I have taken it abundantly at Vadsö and in the Sydvaranger Fiords. Della Valle has united under the name *Ædiceros nubilatus*, Packard, no less than seven of the species described in Sars's work, and also *M. simplex*, Hansen. This genus seems to attain its maximum development in the Norwegian and Finmarckian fiords, the muddy still bottom and great range of depth being suitable for their delicate structure. I am not personally acquainted with *M. simplex*, Hansen; but of the distinctness of the several species in Sars's work I am fully satisfied.

112. *Monoculodes norvegicus*, Boeck.

Trondhjem and Rödberg, in 20–40 fathoms.

113. *Monoculodes subnudus*, Norman.

1889. *Monoculodes subnudus*, Norman, Ann. & Mag. Nat. Hist. ser. 6, vol. iii. p. 450, pl. xviii. fig. 11, and pl. xix. figs. 6–10.

1892. *Monoculodes falcatus*, G. O. Sars, l. c. p. 302, pl. cvii. fig. 2.

Three specimens, Rödberg, 150 fathoms.

114. *Perioculodes longimanus*, Bate and Westwood.

= *Monoculodes longimanus*, B. & W., = *M. Grubei*, Boeck, = *M. æquimanus* (Norman, MS.), Robertson, = *M. longimanus*, Norman, Ann. & Mag. Nat. Hist. ser. 6, vol. iii. p. 451, pl. xx. figs. 6–9.

Rödberg, Laminarian zone.

115. *Synchelidium haplocheles*, Grube.

= *Krøyeria haplocheles*, Grube, = *Krøyeria brevicarpa*, B. & W., = *Krøyeria haplocheles*, Della Valle, = *Synchelidium brevicarpum*, G. O. Sars (nec *Pontocrates haplocheles*, Boeck, nec *Synchelidium haplocheles*, G. O. Sars).

Several specimens, taken at Rödberg in 20–40 fathoms. This is the species which has been known in Britain as *Krøyeria brevicarpa*, B. & W. In 1887 I procured a *Synchelidium* in some numbers while at Naples which corresponds in all respects of colour and structure with Bate and Westwood's species, and which would appear to be the true *Krøyeria haplocheles* of Grube.

116. *Synchelidium tenuimanum*, nov. nom.

= *Pontocrates haplocheles*, Boeck, = *Synchelidium haplocheles*, G. O. Sars (nec *Krøyeria haplocheles* of Grube and Della Valle).

Three or four specimens at Rödberg, in 250 fathoms.

117. *Synchelidium intermedium*, G. O. Sars.

In 150 fathoms, Rödberg, three examples.

118. *Ædiceropsis brevicornis*, Lilljeborg.

Trondhjem, 150 fathoms.

119. *Halimeton Mülleri*, Boeck.

= *Westwoodilla cæcula*, Bate, = *Westwoodilla hyalina*, Bate, = *Ædiceros parvimanus*, Bate.

Trondhjem and Rödberg, 20–70 fathoms.

120. *Halimedon acutifrons*, G. O. Sars.

Trondhjem and Rödberg, 40–150 fathoms.

121. *Bathymedon longimanus*, Boeck.

Trondhjem and Rödberg, 150–300 fathoms.

122. *Aceros phyllonyx*, M. Sars.

Trondhjem and Rödberg, 150–300 fathoms. About fifty specimens, all young. Sars writes:—"More generally only young specimens are met with during the summer months. Mr. Schneider, who has recently published a most interesting paper on the biological relations of the Amphipoda, therefore opines that this form has only an annual existence, and that its breeding is restricted to the early spring, an opinion that is quite confirmed by my own observations."

123. *Paramphithoë pulchella*, Kröyer.

= *Paramphithoë euacantha*, G. O. Sars (variety).

Among deep-sea corals and Alcyonarians, precipices at Rödberg. Hansen and Sars have pointed out that, though Boeck's description of *Pleustes pulchellus* is referable to this species, his figures represent an allied species named by the former author *P. Boeckii*.

124. *Paramphithoë assimilis*, G. O. Sars.

Off Trondhjem, in 150 fathoms; two specimens only.

125. *Stenopleustes Malmgreni*, Boeck.

A single specimen, Rödberg, 150 fathoms.

126. *Stenopleustes nodifer*, G. O. Sars.

Rödberg, 40–150 fathoms.

127. *Parapleustes latipes*, M. Sars.

= *Calliope Ossiani* and *C. Fingalli*, Bate.

A single adult specimen, Rödberg.

128. *Epimeria cornigera*, Fabricius.

= *Epimeria tricristata*, A. Costa, = *Acanthonotus Oweni*, Bate.

On the precipices at Rödberg, among deep-sea corals.

129. *Epimeria tuberculata*, G. O. Sars.

With the last, and, when alive, distinguishable at a glance

by its different colouring without examination of its specific characters with a lens.

130. *Epimeria parasitica*, M. Sars.

A single specimen at Trondhjem, in deep water.

131. *Iphimedia obesa*, Rathke.

Abundant both at Trondhjem and Rödberg in shallow water.

132. *Laphystiopsis planifrons*, G. O. Sars.

I was not a little pleased to meet with three specimens, of which two were young, of this remarkable Amphipod, with its *Platypus*-like, broad, vertically depressed, and flattened rostrum, in 150 fathoms at Rödberg.

133. *Syrrhoë crenulata*, Goës.

Only one young specimen, taken at the bottom of the fiord, Rödberg.

134. *Bruzelia typica*, Boeck.

Rödberg, 125 fathoms; two examples.

135. *Pardalisca tenuipes*, G. O. Sars.

Two specimens, Rödberg, in 150–300 fathoms.

136. *Pardalisca abyssi*, Boeck.

Rödberg, 150–300 fathoms; a few specimens.

137. *Nicippe tumida*, Bruzelius.

Trondhjem, in 150 fathoms.

138. *Halice abyssi*, Boeck.

= *Halice grandicornis*, Boeck, ♂.

A single specimen, 250–300 fathoms, Rödberg.

139. *Eusirus propinquus*, G. O. Sars.

Rödberg, in greatest depths; two specimens.

140. *Eusirus leptocarpus*, G. O. Sars.

In the same locality as the last, though in a different dredging; one only.

141. *Rhachotropis macropus*, G. O. Sars.

Rödberg, in 250–300 fathoms.

142. *Rhachotropis tumida*, G. O. Sars.

Rödberg, four specimens.

143. *Rhachotropis leucophthalma*, G. O. Sars.

Rödberg, 250–300 fathoms; more numerous than the two preceding.

144. *Halivages fulvocinctus*, M. Sars.

= *Pherusa tricuspis*, Stimpson.

Trondhjem and Rödberg, shallow water.

145. *Apherusa bispinosa*, Bate.

= *Atylus bispinosus*, Bate.

Trondhjem, 5–10 fathoms.

146. *Calliopius Rathkei*, Zaddach.

= *Calliope grandoculis*, Bate, ♂.

Trondhjem, 3 fathoms.

147. *Laothoë Meinerti*, Boeck.

Two specimens, Trondhjem, 150 fathoms. This species is remarkable on account of the immense size of the projecting buccal mass and the conspicuous character of the serrated edge of the great masticatory lobes of the maxillipeds.

148. *Amphithöpsis longicaudata*, Boeck.

Rare, Rödberg, 150 fathoms.

149. *Leptamphopus longimanus*, Boeck.

A single specimen, Rödberg, 250–300 fathoms.

150. *Paratylus vedlomensis*, Bate.

= *Dexamine vedlomensis*, Bate.

Rödberg, 5 fathoms.

151. *Dexamine thea*, Boeck.

= *Dexamine tenuicornis*, Bate.

Rödberg, 5–10 fathoms.

152. *Melphidippa spinosa*, Goës.

Two quite young specimens, Röddberg, 40–100 fathoms.

153. *Amathilla homari*, Fabricius.

= *Amathilla Sabini*, B. & W.

Röddberg, 3 fathoms.

154. *Gammarus locusta*, Linné.

Laminarian zone.

155. *Melita dentata*, Kröyer.

= *Gammarus purpuratus*, Stimpson.

Röddberg, 5–10 fathoms.

156. *Eriopisa elongata*, Bruzelius.

Not rare in the greatest depths.

157. *Cheirocratus Sundevalli*, Rathke.

Trondhjem and Röddberg, 20–70 fathoms.

158. *Lilljeborgia pallida*, Bate.

Trondhjem and Röddberg, 10–150 fathoms.

159. *Lilljeborgia fissicornis*, M. Sars.

Röddberg, 100–150 fathoms.

160. *Autonoë megacheir*, G. O. Sars.

1885. *Autonoë megacheir*, G. O. Sars, Den Norske Nordhavs-Exped. 1876–1878, Crustacea, p. 203, pl. xvi. fig. 7.

Röddberg, 250–300 fathoms.

161. *Autonoë longipes*, Lilljeborg.

Trondhjem, in 150 fathoms.

162. *Protomedeia fasciata*, Kröyer.

20–40 fathoms.

163. *Megamphopus cornutus*, Norman.

1869. *Megamphopus cornutus*, Norman, "Last Report Dredging Shetland," Brit. Assoc. Rep. for 1868, p. 282.

1870. *Protomedeia longimana*, Boeck, Crust. Amphip. bor. et arct. p. 160; Skand. og Arkt. Amphip. 1872, p. 278, pl. xxv. fig. 4, pl. xxix. fig. 5.

1878. *Podoceropsis intermedia*, Stebbing, Ann. & Mag. Nat. Hist. ser. 5, vol. ii. p. 367, pl. xv. figs. 3 a-f.

Trondhjem, 5 fathoms.

I have specimens of this species from Shetland (the type, a full-grown male); off Cumbrae, 20-25 fathoms, taken in company with Mr. D. Robertson, who has recorded this species under two of the foregoing names; and from Lofoten Islands (*G. O. Sars*).

164. *Podoceropsis Sophiæ*, Boeck.

= *Nenia tuberculosa*, Bate.

Trondhjem, 20-40 fathoms.

165. *Amphithoë rubricata*, Mont.

= *Amphithoë littorina*, Bate, = *A. podoceroides*, Rathke.

Tide-marks to 10 fathoms.

166. *Ischyrocerus anguipes*, Kröyer.

Specimens of this species occurred, including adult males, with the characteristic arched elongated hand of the second gnathopods.

167. *Ischyrocerus minutus* (Lilljeborg).

= *Podocerus isopus*, Walker.

This so-called species was more abundant than the last; but I am not satisfied of its distinctness. *I. anguipes* attains a much greater size in Spitsbergen than it does in Norway. In rock-pools and shallow water in Norway, I, like Sars, have found *I. minutus* to be abundant, and, though small, the individuals are sexually mature; but that is no proof that they have attained their full growth. In the British Isles, whence I have it from Shetland, Oban, Aberdeen coast, and Cullercoats, Northumberland, in which places I have myself found it, and also from Colwyn Bay, North Wales, received as *Podocerus isopus* from Mr. A. O. Walker, the examples are still smaller. The form of the second gnathopod of the fully mature male is not materially different in the two so-called species, the arched form being peculiar to that age, and the number of teeth-processes on the upperside of the last uropods I find in different specimens to range from two to five; and all the characteristics of the larger form appear to me to be reconcilable with considerations of growth and size. I should be satisfied of their distinctness had I been able to find the arched gnathopod of male in very young

specimens; but the whole series appear to point to a process of gradual development of that organ with increasing size.

168. *Ischyrocerus megacheir*, G. O. Sars.

Rödberg, 40–150 fathoms; several specimens.

May at once be recognized by examination of some very small and microscopic peculiarities: 1st by the uncinatè ramus of the last uropod having four (three to five, four more commonly) tooth-like serrations on the margin; 2nd, by the dactyli of the hinder peræopods being very minutely serrulated on the anterior two thirds of their length.

169. *Corophium grossipes*, Linné.

= *Oniscus volulator*, O. F. Müll., = *Gammarus longicornis*, Fabr.

Between tide-marks at Trondhjem, near the mouth of the Nidd.

170. *Corophium affine*, Bruzelius.

1869. *Corophium tenuicorne*, Norman, "Last Report Shetland Dredging," Brit. Assoc. Rep. for 1868, p. 286.

30–40 fathoms.

In Britain I have found this species in St. Magnus Bay, Shetland, in Loch Fyue, and at Cumbrae in the Firth of Clyde.

171. *Corophium crassicorne*, Bruzelius.

= *Corophium spinicorne*, Bate, ♀.

Trondhjem, in 5–10 fathoms.

172. *Neohela monstrosa*, Boeck.

An imperfect specimen of this rare and remarkable Amphipod taken in 150 fathoms at Rödberg.

The species was described from an imperfect specimen taken in the Christiania Fiord; a perfect specimen was taken by the Norwegian North-Atlantic Expedition in the Porsanger Fiord, Finmark, in 127 fathoms; these are the only recorded occurrences of the species on the Norwegian coast. By the expedition just mentioned mutilated examples were dredged to the north of Finmark, to the north of Faroe, and to the west of Spitsbergen, down to a depth of 1215 fathoms; a male and female have been recorded by Hansen from Greenland; and it is probable that the *Neohela phasma*, S. I. Smith, of which the type was taken off the N.E. American coast in 372 fathoms, is the same species, since Smith's

observations on the gnathopods exactly apply to my own specimen. Although numerically so scarce, and from its very slender body and limbs so difficult to procure in a perfect condition, *Neohela monstrosa* is thus seen to have a wide geographical range.

The name given by Boeck to the genus *Hela* being pre-occupied, S. I. Smith changed it to *Neohela*; but Sars, by a *lapsus pennæ*, gave it in his 'Oversigt af Norges Crustaceer' as "*Helella*, Smith."

173. *Dulichia porrecta*, Bate.

Rödberg, in shallow water; females only.

174. *Dulichia fulcata*, Bate.

Rödberg, Laminarian zone.

175. *Dulichia nordlandica*, Boeck.

Rödberg, females only.

176. *Dulichia Normani*, G. O. Sars, MS.

Rödberg, females only.

Finding difficulty in naming some of the females of *Dulichia*, I sent them to Professor G. O. Sars, who kindly determined them for me. One species was new to him, and will be described in the Supplement to his work, now being published, under the above name, which he has given me for use in this report.

177. *Lætmatophilus armatus*, Norman.

1869. *Cyrtophilum armatum*, Norman, "Last Report Dredging Shetland," Brit. Assoc. Rep. for 1868, p. 285.

1870. *Lætmatophilus spinosissimus*, A. Boeck, Crust. Amphip. bor. et arct. p. 186.

1872. *Lætmatophilus spinosissimus*, De Skand. og Arkt. Amphipoder, p. 665.

Rödberg, 250-300 fathoms. The type and only British specimen yet known was a female, and was dredged off the Shetland Isles.

178. *Zenodice Frauenfeldti*, Boeck.

A male (quite perfect) and a female (perfect except antennæ), Rödberg. The entrance of the Trondhjem Fiord is the only habitat in which Sars has taken this rare and remarkable species.

179. *Phthisica marina*, Slabber.

= *Proto pedata*, Leach, ♀, = *Proto Goodseri*, Bate, ♂.

Trondhjem and Rödberg, 10–40 fathoms.

180. *Æginella spinosa*, Boeck.

Rödberg, 40–70 fathoms.

181. *Caprella linearis*, Linné.

Trondhjem, 20–40 fathoms.

[To be continued.]

LVIII.—*Insects collected by Messrs. J. J. Quelch and F. McConnell on the Summit of Mount Roraima.* By CHARLES O. WATERHOUSE.

So far as I am aware, no Insects have been recorded from Mount Roraima; any species, therefore, from this locality would be of interest. But, as it turns out, the few obtained with considerable difficulty by Messrs. J. J. Quelch and F. McConnell during their visit to the summit of this mountain in November of last year are of double interest, as all the species are new to science.

COLEOPTERA.

HYDRADEPHAGA.

Rhantus elegans, sp. n.

Oblongo-ovalis, sat angustus, leviter convexus, nitidus, niger; capite linea transversa, altera mediana longitudinali, epistomo, ore, antennarumque basi flavis; thorace lateribus flavis, linea mediana impressa; elytris flavis, confertim nigro-vermiculatis et guttatis, disco fere toto nigro, sutura marginibusque anguste flavis; prosterni processu margineque anteriori flavis; trochanteribus rufis flavis.

Long. $4\frac{1}{2}$, lat. $2\frac{1}{3}$ lin.

Hab. Venezuela, Mount Roraima, 8500 feet.

At first glance this species is not unlike *Agabus arcticus* in general form and appearance, but is a little larger and a little less narrowed anteriorly.

The antennæ are black, with the two basal joints and the following ones on their underside reddish yellow. The thorax

is not much narrowed anteriorly (as compared with *R. exoletus*, &c.), with a distinct impressed medial line; with a few punctures near the side and along the front margin; obscure yellow, with a broad black stripe in the middle, widened in front and at the base, crossed in the middle by a broad transverse band. The elytra are yellow, irrorated with black somewhat as in *R. exoletus*, but the black prevails to a much greater extent, so that the discoidal area is almost entirely black, leaving a narrow yellow sutural line, and the yellow marginal stripe very narrow and somewhat interrupted, whilst the margin itself is more broadly black; the under margins are yellow. The coxæ are marked with reddish yellow, and the trochanters are almost entirely of this colour. The anterior tarsi are very little incrassate, with narrow pads; the claws moderately long and slender, all but equal.

The only species in the Museum collection which closely resembles this is one from Tahiti, and which I believe to be *R. debilis*, Sharp; but that differs from the present species in being less convex, lighter in colour, with more yellow legs and antennæ, whilst the prosternal process is black. Both these species appear to be allied to *R. pacificus*.

PECTINICORNIA.

CHARAGMOPHORUS, gen. nov.

Insect parallel, convex. Mentum transverse, obliquely narrowed in front, with the angles arcuately rounded, the front gently emarginate. Antennæ as in *Scortizus*. Eyes less than one-half divided by the canthus, which in the male is flattened and projecting laterally. Prosternal process projecting backwards, gently arched. Mesosternum sloping and slightly concave. Anterior tibiæ denticulate. Intermediate tibiæ with one small spine. Posterior tibiæ without spines. Tarsi rather long, the first four joints with a fringe of long hairs arising from the apical margin of each joint.

I think the affinities of this genus are evidently with *Scortizus*.

Charagmophorus lineatus, sp. n.

♂. Parallelus, sat convexus, nitidus, niger; capite parum nitido, longitudine fere triplo latiori, antice arcuatim emarginato, impunctato, oculorum cantho deplanato, angulatim producto; mandibulis capite duplo longioribus, crassis, depressis, ad apicem acuminatis incurvatis et leviter reflexis, intus medio dente sat valido armatis, dente ipso trituberculato; thorace parum nitido,

dorso linea nitida vix impressa notato, marginibus et basi sat crebre punctulatis; elytris sat parallelis, singulis lineis quatuor latis et marginibus crebre punctatis, interstitiis fere lævibus, nitidissimis.

Long. (mand. exclusis) 9, lat. $3\frac{3}{4}$ lin.

Hab. Mount Roraima, 8500 feet.

The mandibles have the usual obtuse tooth at the base. The flattened expansion on the inner side is about the middle, and is furnished with three or four tubercles or teeth on its margin; but the two mandibles are not quite similar. Between this expansion and the apex there is a small tubercle and near the apex an indication of another. The thorax is slightly compressed at the sides, which are very gently sinuate before the subbasal angle, where the thorax is broadest. The punctured stripes on the elytra are the same width as the shining intervals, the sutural one is lightly impressed; each puncture is furnished with a minute whitish scale, but these scales are only visible in certain lights.

SERRICORNIA.

Elateridæ.

Heterocrepidius Macconnelli, sp. n.

Elongatus, angustus, niger, nitidus; capite crebre punctato, fronte leviter biimpressa; thorace sat elongato, antice bene angustato, crebre subtiliter punctato, lateribus fere rectis (lævissime bisinuatis), angulis posticis carinatis; elytris basi thorace vix latioribus, postice gradatim angustatis, sat fortiter puncto-striatis, interstitiis sat crebre subtiliter punctulatis, apice leviter impresso; tarsis apice piceo-rufis.

Long. 4, lat. $1\frac{1}{4}$ lin.

Hab. Mount Roraima, 8500 feet.

This insect has very much the appearance of a very small black *Melanotus rufipes*. It is clothed with nearly black pubescence, which is very conspicuous at the margins. The antennæ are slender, the third joint only a trifle longer than the globose second, the terminal joints almost linear. The epistome and front part of the head densely and finely punctured; the forehead has the punctures rather larger, very distinct, and slightly separated from each other. The eyes project only very slightly. The thorax is considerably narrowed from the base to the front, with the sides almost straight; the punctuation is fine, finer than on the forehead, and less sharply defined, the punctures slightly separated

from each other, becoming rather indistinct towards the hind angles. The elytra are very gradually narrowed posteriorly, rather acute at the apex; the punctures forming the lines are moderately strong, rather close together, but not equidistant; the interstices are very gently convex, very finely punctured, the punctures irregular and slightly separated.

PHYTOPHAGA.

Cryptocephalus Quelchi, sp. n.

Oblongus, convexus, flavo-rufus, nitidus; capite evidententer sat crebre punctato, inter antennis fovea transversa impressa; antennis fere nigris, articulo basali rufo tincto; thorace rufo crebre punctato; elytris flavescentibus, æneo-viridi tinctis, sat fortiter striato-punctatis; abdomine segmento ultimo fovea magna instructo pygidioque rufescenti, pube pallida vestitis; pectore nigrescenti; pedibus rufis; tarsis æneo-nigris, basi rufis.

Long. $1\frac{3}{4}$ lin.

Hab. Mount Roraima, 8500 feet.

This species closely resembles *C. viridipennis*, Suffr., from Cuba. It is, however, rather smaller than any specimens of that species before me; there is a well-marked fovea between the antennæ; the thorax is moderately closely and distinctly punctured, although the punctures are not sharply defined. The scutellum is long and narrow, shining, brassy black. The elytra are of a brassy green tint, with the posterior margins and apex dirty yellowish. There are lines of strong punctures, but the punctures are somewhat unequal in size, larger at the base than on the disk, scarcely half the size they are in *C. viridipennis*, and the lines are scarcely at all impressed except at the sides and apex, and consequently the interstices are scarcely convex.

NEUROPTERA.

ODONATA.

The specimens of this order were so injured by transit as to be unrecognizable. The fragments, however, are evidently those of one of the Libellulidæ. There are also larvæ of one of the *Æschnidæ*.

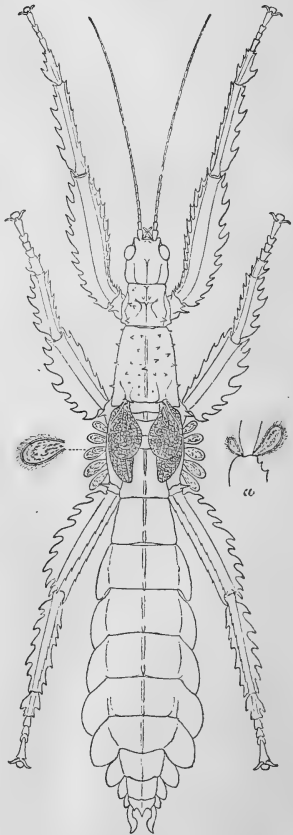
LIX.—*Observations on the supposed Semiaquatic Phasmid, Cotylosoma dipneusticum, W.-M.* By CHARLES O. WATERHOUSE.

IN the 'Annals' for 1878 (i. p. 101) the late Mr. Wood-Mason called attention to a species of Phasmidæ in the British Museum, to which he gave the name *Cotylosoma dipneusticum*, and which he suggests may be "modified for an aquatic life; for it breathes not only in the ordinary fashion amongst insects by means of tracheæ opening by stigmata on the exterior of the body, but also by the structures known as tracheal gills," &c.

Dr. David Sharp having recently asked me questions about this insect, I think it well to figure it and to call attention to the following facts:—

1. So far as I am aware, nothing is known of the habits of this species. It may or may not be aquatic.

2. The specimen is a dried one, and I think Wood-Mason in the sentence above quoted assumes too much. There is nothing in the form of the lateral plates of the metathorax to show definitely that they are "tracheal gills," although I would not, on the other hand, say that they are not. I notice, however, that an allied Brazilian insect—*Prisopus phacellus*—has very similar plates, one on each side of the insertion of the anterior tibia. For the



Cotylosoma dipneusticum.
a. Knee-joint of *Prisopus phacellus*.

supposed aquatic habits of *Prisopus* see Ann. & Mag. Nat. Hist. 1866, xviii. p. 265.

3. In the 'Zoologist' for 1860, p. 7141, MacGillivray described an insect from Aneiteum, New Hebrides, under the name of *Prisopus Carlottæ*. There is an insect in the Museum bearing this name from Aneiteum, which appears to be correctly named, but it has five lamelliform plates at the sides of the metathorax, as in *Cotylosoma*; the posterior one, however, is not visible from above, so that MacGillivray may have overlooked this when he gave the number as four. *Cotylosoma* is evidently very closely allied to MacGillivray's insect, which ought not to be placed in the American genus *Prisopus*.

4. *Cotylosoma* is from Taviuni, Fiji Islands; not Borneo, as stated in Wood-Mason's remarks.

It is not my purpose to characterize *Cotylosoma dipneusticum*; in fact it scarcely needs more than the figure.

LX.—Notes, Morphological and Systematic, on the Madreporarian Genus Turbinaria. By H. M. BERNARD, M.A. Cantab., F.L.S., F.Z.S.

[Plates XIX. & XX.]

HAVING been engaged for the last eight months in studying and arranging the Turbinarians in the Natural History Museum, I propose to give a short abstract of some of the more interesting results obtained.

The task has been one of very great difficulty, and I am deeply indebted to the constant consideration and sympathetic advice accorded to me during my work by Dr. Günther, F.R.S., to whose kindness I owe my access to the specimens in the collection; without such encouragement I should hardly have had the fortitude to proceed, in face of the apparent impossibility of ever being able to arrive at a satisfactory system of classification. The nature of some of these difficulties I propose now to describe. I take this opportunity also of thanking Prof. Jeffrey Bell, who has the more immediate charge of the corals in the National Collection, for much assistance, advice, and friendly criticism, which has often been of great value to me.

Without going into the history of the genus, I may briefly say that the Turbinarians, according to the classification of Milne-Edwards in 'Les Coralliaires' (which classification

has not been revised in this respect), are the principal genus of the Madreporarian subfamily Turbinariinæ. This subfamily is distinguished by the following characters:—Growth always by gemmation; cœnenchyma abundant, always distinct from the mural tissue, spongy and reticulated; at least six principal septa, equally developed. Of the five genera of the Turbinariinæ three are fossil, leaving two—*Turbinaria* and *Astræopora*—the chief distinction between which is the absence of a columella in the latter.

As compared with the subfamily Madreporinæ, containing the single genus *Madrepora*, the fundamental distinctions given are: in *Madrepora* the cœnenchyma is only slightly, or not at all, distinct from the mural tissue, which is very porous, and the chambers are divided by the directive septa.

My work on the Turbinarians has convinced me that this arrangement is entirely artificial and that it does not accord with the facts. One of these assumed distinctions does not exist, while the most fundamental difference, viz. the methods of budding, is entirely ignored.

It is true that in the introduction to the 'Coralliaires' (p. 35) the method of budding of Turbinarians is referred to; but it is nowhere used in the purely systematic part as a character even of the slightest value.

This abandonment of what appears to me to be the most fundamental taxonomic character of the genus was a retrograde step much to be deplored. The value of the different methods of budding in the classification of the corals had been distinctly laid down by Ehrenberg in 1834*, while Dana, in 1848, endeavoured to carry it out in detail in his magnificent attempt to classify the zoophytes of the United States Exploring Expedition. The practical rejection of this character by Milne-Edwards in favour of other and more artificial distinctions, whatever other consequences it may have had, has certainly delayed the establishment of a natural system of classification of the corals. It stands to reason that the different methods of budding, with their far-reaching consequences in bringing about the ultimate forms of the coralla, cannot be ignored. Its value is, as I shall show, abundantly exemplified in the case of the genus *Turbinaria*, and it must take its place side by side with other characters if the corals are to be arranged according to the demands of the modern theory of descent †.

* 'Korallenthiere des rothen Meeres,' Berlin.

† That there is a very general revival of the recognition of the value of the method of budding for the classification of the corals may be gathered from the following papers:—S. O. Ridley, "On the Classifi-

Earliest Cup-Stage of Turbinaria.—The corallum of the genus *Turbinaria* is somewhat peculiar in the fact that it typically appears in its earliest stage as a small cup. This cup-stage is, however, generally transitory. As the edge of the cup grows, its shape gradually changes in various ways presently to be described. This important fact has, I believe, never been thoroughly, if at all, recognized. The cup-shape of the corallum was thought to be a specific* distinction, and not what it really is, viz. merely a phase in the ordinary development of the specimens of this genus. The confusion this has caused in the arrangement of the Turbinarians may be more easily imagined than described.

Before, however, discussing the systematic arrangement of the genus, which must for the future be based upon this fact—that every corallum begins typically as a cup—it will be well to describe the method of budding to which this peculiar method of growth is to be attributed.

The earliest development of *Turbinaria* I have not had any opportunity of working out, and all my conclusions have been drawn from an examination of the specimens in the National Collection. Among these are a great number of very minute cups, ranging from 1 inch across, and standing on stalks from 1 inch high. The stalk is always slightly expanded where it adheres to the substratum.

The Stalk and the Axial Polyp.—A cross section through a stalk of a minute cup reveals a single rather large polyp-cavity, surrounded by a thick spongy wall which shows an irregular series of radiating plates (costæ) bound together by irregular concentric synapticulæ; near the surface the radiating plates project as the ridges which run longitudinally down the surface of the stalk (Pl. XIX. fig. 1).

This central polyp-cavity in the stalk is the parent polyp of the young corallum, and the spongy cœnenchyma is a simple thickening of its walls by the outward radial growth of costæ, which at more or less regular intervals are bound together by concentrically arranged synapticular plates. Surrounding the central cavity, then, there is a series of longitudinal canals running parallel with the polyp-cavity. All these are

catory Value of Growth and Budding in the Madreporidæ, and on a new Genus illustrating this Point," *Ann. & Mag. Nat. Hist.* vol. xiii. (1884); and A. Ortmann, "Die Morphologie des Skelettes der Steinkorallen in Beziehung zur Koloniebildung," *Z. wiss. Z.* Bd. 1. (1890).

* Ehrenberg appears to have made it a generic distinction. He revived Oken's genus *Turbinaria* for the stalked forms, and retained Lamarck's genus *Explanaria* for explanate specimens in which, if Turbinarians, the stalk had been obscured.

in open communication with one another and with the polyp-cavity through pores.

This description disposes of Milne-Edwards's distinction between the genera *Turbinaria* and *Madrepora*, that in the former the coenenchyma is distinct from the mural tissue of the polyp. The description above given would, if we allow for the different density of the structures, apply equally well to a section through an axial polyp of a typical *Madrepora*. "Concentric circles of thin calcareous structure are seen separated by radiating linear pillars, the circles having been in turn outside walls and the radii either spinules or costæ" *.

An interesting question arises as to whether these radiating plates are true morphological costæ, *i. e.* outward prolongations of the septa. Mr. Brook † found no connexion between the so-called costæ in *Madrepora* and the septa; and the same is true of the few sections of stalks which I have been able to examine in *Turbinaria*. In spite of this fact, however, I am persuaded that primitively such a connexion existed, and that it has been secondarily obliterated. My chief reason for believing that it was the primitive arrangement is to be found in the fact that in many *Turbinarians* the septa are directly continued into the ridges of the coenenchyma, and that the direct connexion between the septa and these costæ can very often be traced in the young calicles forming along the margin of a corallum (Pl. XIX. fig. 2). On the other hand, secondary obliteration of the connexion when it ceased to have any special use might easily take place. The process can, indeed, perhaps be traced as follows:—Between each pair of septa the rudiments of new cycles of septa are in many cases visible. In those cases in which the septa are continuous with the ridges of the coenenchyma other ridges frequently run up to the edge of the polyp-cavity, terminating between the two septa, and are unmistakably suggestive of a fresh cycle of septa. We thus have a great many more radiating costæ than septa abutting on the immediate wall of the cavity, the crowded costæ representing not only the actually developed septa, but rudimentary cycles of septa. If, together with this crowding of costæ round the polyp, we take into consideration the more or less accidental variations in their thickness in the gradual process of strengthening the corallum, there is no difficulty in understanding how the primitive connexion between the costæ and the septa

* Martin Duncan, "On the Hard Structure of some Species of *Madrepora*," *Ann. & Mag. Nat. Hist.* 1884, vol. xiv. p. 191.

† "The Genus *Madrepora*," vol. i. of the British Museum Catalogue of the *Madreporaria*, 1893, *Introd.* p. 9.

might be obliterated. It seems to me easier to believe that the costæ have secondarily lost their connexions with the septa than that in those Turbinarians in which they are regularly continuous the arrangement has been secondarily acquired. It is difficult to believe that it is not the primitive arrangement.

The Budding of the Axial Polyp.—The axial polyp in the stalk of a minute Turbinarian colony buds *laterally*, the buds forming a simple ring round the axial polyp. The new polyps radiate upwards and outwards around the axial polyp, which either does not grow any more or else grows very slowly. It is obvious that this single ring of daughter-polyps, cemented together by cœnenchyma, which appears to stream down round the axial polyp, forms, together with the axial polyp, a stalked cup. This cup, according to the angle the ring of buds makes with the axial polyp, and also with the regularity of the ring, may vary considerably in shape.

It is to be noted that the budding from the axial polyp is *lateral*, as in *Madrepora*, and not basal, as Dana, following Ehrenberg's "Stolonformation," described. The error of these distinguished naturalists in this respect was most natural, and arose from the fact that they examined only sections of fronds, not of young cups. A section of a frond alone certainly seems to show at first sight that the budding is basal. This mistake led Dana to place the genus *Turbinaria* (*Gemmipora*) in a different tribe from that of the genus *Madrepora*. In the former the budding was thought to be basal, while in the latter it was lateral, whereas in both cases the budding is lateral.

Comparison between Turbinaria and Madrepora.—This central parent polyp of the Turbinarians appears to me, then, in every way comparable with an axial polyp of a typical *Madrepora*, and *the fundamental difference between the Turbinarians and the Madreporæ is due to their different methods of budding* (cf. Pl. XIX. figs. 3, 3 a).

In the *Madreporæ* the buds appear laterally on the wall of the axial polyp, and the higher this grows the more buds are produced, till each axial polyp is thickly crowded with daughter-polyps, radiating out from it in all directions. Nutrient fluids stream down the channels between the costæ, forming new layers of cœnenchyma round the lower portions of the stock, which may increase in thickness so greatly as to submerge the lower and first-formed buds. If the stem branches, one of the buds becomes in its turn an axial polyp and gives off buds; otherwise the buds do not, as a rule, themselves again bud. In the Turbinarians, on the other

hand, only one ring of lateral buds is typically produced by the axial polyp, which then appears to cease to grow any further, the work of building up the corallum being carried on by the ring of buds.

If the facts justify this comparison, and I have little doubt but that they do, it follows that the cœnenchyma which streams down round the axial polyp, thickening its walls and submerging its lowest and oldest buds, is strictly homologous with the cœnenchyma which in the *Turbinaria* streams down to thicken the wall of the axial polyp to form the stalk of the cup and to widen its base of attachment. The structural similarity of the two has been already noted. In *Turbinaria* the cœnenchyma connects further the ring of buds, forming with them the wall of the cup, and ultimately the fronds (Pl. XIX. fig. 3). Mr. Brook*, led astray by the common belief that the budding in *Turbinaria* is quite distinct from that in *Madrepora*, drew a distinction between the cœnenchyma in the two genera, which no longer holds good when the respective methods of budding are correctly understood and compared.

Initial Variations in the Form of the Young Cup.—If the ring of buds rising round the axial polyp is perfectly horizontal, the youngest cup is symmetrical; but if the ring is not horizontal, but forms a wavy line round the axial polyp, then the cup is not symmetrical, but has a wavy edge. Again, if the polyps grow upwards at a sharp angle, the cup is conical or vasiform; if they grow out at a wide angle the cup flattens and may be quite disk-shaped or peltate; and, finally, if in growing outwards they bend downwards, the everted cup may easily form a hemispherical mass, the edges of which creep along the substratum. All these methods of growth take place.

Second and following Generations of Buds.—We may now temporarily dismiss the axial polyp, whose further fate we shall return to presently; the question which concerns us is how and when do the radiating daughter-polyps bud, in order to extend the edge of the cup.

For clearness of description we may assume that, whereas the axial polyp forms a complete ring of buds, each radial polyp produces only a portion of a ring, and that on the side turned away from the axial polyp.

The process appears, judging from a comparison of many specimens, to be as follows:—As soon as the polyps at any time forming the actual edge of the cup have, by outward

* "Affinities of the Genus *Madrepora*," Journ. Linn. Soc., Zool. vol. xxiv. p. 353.

radial growth, diverged sufficiently from their next neighbours to admit of buds appearing between them, these appear, while the parent polyps bend sharply upward towards the axis of the cup. As soon as this bending is effected, a fresh bud or fresh buds grow out close to the bend (*cf.* Pl. XIX. figs. 3, 3 *b*). This new generation (or incomplete ring) of buds may remain for a time hidden in a ridge of the cœnenchyma, which then forms the edge of the cup.

Without the bending up of the polyps as each series ceases to form the growing edge, it is clear that the cup-shape could not be maintained, the corallum would droop and curl under on all sides. It was this more or less sudden bending up of each polyp-cavity, with the bud starting from the bend, which led Ehrenberg to describe it as stolonformation, and not gemmation, and Dana to assert that the gemmation was basal. The more or less sudden bendings upward of the polyps were very naturally mistaken for the bases of the corallites. This, however, is obviously not the case, if the process be followed up from its starting point, viz. the budding of the axial polyp of the stalk of the young cup.

In this way, then, by the continual addition of a fresh series of polyps outside the one last formed, the edge of the corallum grows outwards into an ever-expanding cup or disk.

The Flowing of the Cœnenchyma and the Thickening of the Stalk.—It is obvious that increase of size of the cup or disk requires a stouter stalk and walls—that is, the basal region of the cup has to be thickened. In *Madrepora*, as already described, the basal thickening of each upright branch (consisting of an axial polyp surrounded by irregular tiers of daughter-polyps) can often be seen to submerge the lower earlier-formed buds (fig. 3 *a*). The downward streaming of the fluids can be gathered from the longitudinal channels between the costæ and from the gradually increasing density of the cœnenchyma. The same is the case with *Turbinaria*; while the cœnenchyma of the growing edge of the corallum is spongy both inside and outside of the cup, a short distance from the edge it is furrowed by a system of channels running downwards. The channels are separated by ridges which are, as we have seen, the most distal edges of the costæ. In nearly all cases the gradual thickening of these costæ can be followed from thin echinulate ridges, not thicker than septa near the growing margin, into dense masses in the stalk. This downward flow of matter, however it is to be explained physiologically, is a very striking feature in the Turbinarians. Within the cup it frequently fills up the bottom, often completely submerging all the polyps which formed the cup at

its younger stages. Outside it streams down over the stalk, not only thickening it, but expanding its base of attachment. If the slope of the outer surface of the cup does not permit it to run down the stalk, it may either merely thicken the corallum under the layer of intercommunication of the polyp-cavities, or it may even hang down like aerial rootlets seeking to attach themselves to the substratum independently of the original stalk.

Besides giving the corallum the necessary strength to stand erect, this flow of matter is protective. It threatens every parasite which endeavours to gain a foothold. The *Balanids* have found it necessary to develop elaborate fringes of bayonets to keep off the advancing tide. These are often successful on the upper surfaces, where the flow of the cœnenchyma is not so strong; but such defences are usually of no avail on an under surface. A *Balanus* attached to the under surface is soon engulfed by the coral-substance. In some cases, *e.g.* on perpendicular surfaces where the flow is also great, the *Balanus* manages somehow to keep itself from being submerged; but the efforts of the coral to get rid of the plague are evidenced by the length of the finger-like processes, in the ends of which the *Balani* rest secure. They appear to have risen on the cœnenchyma as it strove to surmount the edges of their bayoneted plates*.

Factors in the Growth of the Corallum.—We have, then, a stalked corallum, with edges *standing up* to form a cup, or *standing out* to form a disk, or *hanging down* to form a hemispherical mass, and we have two factors to account for the further growth of the corallum:—(1) The typical method of budding; (2) the flow of the material building up the cœnenchyma, this flowing being especially marked in *Turbinaria* owing to the great abundance of this tissue. Before showing how these primitive forms of the coralla become variously modified by these two typical elements of increase, it is necessary to describe a third, somewhat irregular, factor, *viz.* an adventitious bud-formation.

Adventitious Budding.—In nearly all Turbinarian coralla with uneven surfaces the cœnenchyma seems to accumulate in the valleys as it does in the bottom of the early cups, sub-

* A very beautiful correlation exists between the size of the teeth on the plates of the *Balanus* and the echinulations of the cœnenchyma. The fine echinulations in the Turbinarians are met by fine teeth on the *Balanus*; the long echinulations of the *Astræopora* are encountered by correspondingly long bayonets on the plates of the *Balanus*.

While on the subject of parasitic or attached organisms, I may mention that many infesting sponges "imitate" exactly the colour of the corallum, and sometimes also the polyp-cavities in the size of their oscula.

merging the polyps. In these cases it is not infrequent to find such places very thickly studded with minute polyps. So numerous are they that active budding can alone account for them. Without having much actual information to give as to the real origin of these adventitious buds, there seems to be little doubt that while normally the polyps of the Turbinarian colony merely produce their single ring (axial polyp) or portions of a ring (radial polyps), when submerged by cœnenchyma they may continue to put out buds. It is true that there is evidence to show that submerged polyps, if not too deeply covered, may break through again. But when, for instance, the axial and earliest-formed radial polyps are completely submerged in the bottom of the cup by an enormous thickness of cœnenchyma, which is nevertheless thickly studded with minute buds, we can hardly escape from the conclusion that these are due to secondary buddings of the submerged polyps. Further, some glomerate forms, which are characterized by an enormous thickness of the cœnenchyma, show a tendency to secondary budding of the polyps, which can be easily seen. In this connexion it is worth remarking that the limitation of the buds to one ring or to a portion of a ring is probably a derived condition, while the power of producing an indefinite number of buds one above the other, shown in *Madrepora*, is the more primitive. That this limitation actually exists there is abundant evidence, as may be gathered, for instance, from the very uniformity of the earliest cup- or disk-shape of the corallum, and again from sections of glomerate Turbinarians (fig. 7), which show enormous thickening of the cœnenchyma, with corresponding lengthening of the polyp-cavities, often without any traces of secondary budding. But that this adventitious budding undoubtedly exists and plays a part in the ultimate forms of the coralla, perhaps as a return to more primitive conditions, there can be no doubt. It seems, however, to play but a subordinate part, and in discussing the morphological basis of the classification of the genus it may be temporarily ignored. The two prime factors above mentioned are sufficient.

Variations in the Form of the Cup due to subsequent Growth.

—Of the three initial forms, dependent in the first place on the angle at which the first buds leave the parent polyp (or, perhaps, on the curving of the daughter-polyp outwards), the cup-shape, the disk-shape, and the hemispherical, the first is that most liable to great modification during the subsequent growth, while the last is naturally that in which form-changes are least to be expected.

The second or disk-shape, inasmuch as it hovers on the

borderland between convex and concave, may, according as it is the one or the other, develop either hemispherical masses or the typical cup modifications. In the former case the disk expands on all sides till it covers an enormous area, the centre constantly thickening till it approaches the true glomerate forms, without, however, being really the same; while in the latter its form-changes may follow, somewhat stiffly, the more numerous and luxuriant growths of the true cups.

The instability of the cup-shape is hardly to be wondered at. Even though the first ring of buds is horizontal and uniform, it must obviously become increasingly improbable, as the edge of the cup expands, that the radial polyyps round the edge should bud regularly enough and uniformly enough to keep the cup symmetrical. Large regular cups a foot in diameter must thus excite our admiration. There is only one really large cup in the National Collection; it is 16 inches across.

A point which remains to be established by further research is whether this persistence of the cup-shape is accidental or a normal specific character. It is at present impossible finally to decide this question. For the practical purposes of classification we are, however, provisionally compelled to assume that it is a reliable character.

In view, then, of the great improbability that the budding round the edge should be so regular as to keep the cup symmetrical, it is not to be wondered at that in the vast majority of cases the young cup is sooner or later completely obscured by the subsequent growth. The edge begins to fold or frill in various ways; the folding or frilling becomes more and more complicated as it continues; the coral-substance continually streams downwards until the early cup is buried up in the ever-thickening base of the enlarging corallum.

Apparent Periodicity in the Growth.—Before describing the subsequent forms assumed by the cup which it is so far possible to distinguish, an apparent periodicity in the growth requires to be mentioned. In many corals, as is well known, the living colony, secreting the coral-substance, is progressively withdrawn from the older parts of the corallum. The process seems to be uniform and continues as long as the stock lives. The Turbinarians *appear* to differ from this. An old Turbinarian stock is found to consist of many apparently distinct growths. The whole corallum appears to die down periodically, starting into life again along its edges, where growth had temporarily ceased. These new points of growth are not fresh Turbinarians; they form no stalked cups, but they continue the growth of the old and dead stock. This

apparent periodical growth is specially marked in erect fronds, because at the boundary line between the new and the old a projecting ridge, studded along its edge with young calicles, often forms a sharp contrast between the two.

This appearance, however, is, in this case at least, entirely delusive, and is due to the occasional streaming back of coral-substance from the living on to the dead portion of the corallum. Fig. 4 (Pl. XIX.) shows a portion of an erect frond which has fortunately fractured through one of these apparent border lines between new and old corallum. The growth is seen to be perfectly continuous, the lower part progressively dying, on the left face (height *c*) faster than on the right (*d*). Two floods of coral-substance have streamed down (to *a* and *b*), but in neither case do they overflow the *dead* corallum, but they submerge the living. Fig. 5 shows a calicle being overwhelmed by finely reticulated cœnenchyma. A study of a fracture passing through the edge of such an advancing flood of cœnenchyma shows that the calicles thus overrun are able to work their way again to the surface. The earlier flood marked *b* was so abundant that it formed the shelf shown in the figure, along the edge of which a number of minute calicles appear. The origin of these calicles I have not made out. I suspect they are due to the secondary budding of the submerged calicles which failed to break through the layer of cœnenchyma which overwhelmed them.

The Turbinarians, then, are no exception to the rule of progressive dying down. The gradual character of this is, however, obscured by occasional downflowings of cœnenchyma forming projecting ridges, which *appear* to indicate distinct periods of growth.

The continued downstreamings of the cœnenchyma, destructive as they are to the lower polyps, clearly add to the thickness of the basal portions of the corallum as the growing edges of the fronds rise higher and higher.

On the other hand, there are cases which can, I think, only be explained on some theory of periodicity of growth. There are specimens in the National Collection in which small points of fresh growth are to be found on the edges of otherwise dead coralla. Certain growth-forms, presently to be described, seem to require such regular periods; but in these cases the new growth, without passing exactly through the early cup-stage, repeats more or less independently the growth of the old stock.

There is one very remarkable specimen in the National Collection in which a new cup develops from the margin of an old one. The old cup has, however, been turned com-

pletely over, with the result that its margin has curved upwards all round, and at one point shot up to form a new cup. In this case there was evidently no periodical dying down of the first cup; its normal course was interrupted by an accident.

I have distinguished eight principal growth-forms among the Turbinarians in the National Collection. In addition to these eight there are a few specimens whose method of growth comes under no heading; and, whether they be normal or accidental, we are not in a position to decide until the collection of the Turbinarians is more complete. Each of these eight forms requires description.

First Type of Growth: Crateriform.—This, as the name implies, is a simple persistence of the early cup-form, not at all or but slightly modified. As above stated, the existence of large cups, in face of the great improbability of the budding being sufficiently regular, compels us to attribute a classificatory value to this method of growth. We cannot assume that it is the result of mere favourable chance until by experiment we have proved it. It seems further only natural that of all the various normal growths of the Turbinarians some species should depart less from the initial form of the corallum than others. Be this as it may, until our knowledge of the genus is much more extensive we have no other course open to us than to assume the persistence of the cup-shape throughout life to be a normal character distinguishing certain species from the remaining members of the genus.

The group is also practically of great use, inasmuch as all cup-shaped coralla whose subsequent method of growth is unknown may be provisionally placed in it.

On the outside of the large cup (referred to on p. 508) at various heights there occur several attempts to form small cups, which are generally much distorted owing to the angles at which they project from the parent-stock. These are, I think, to be associated with the streaming of the coral-substance. They appear, at least in many cases, to arise where the downward flow has been hindered by some obstacle.

Second Type of Growth: Peltate.—As above stated, the peltate growth may continue along two distinct lines of development, according as the early disk has the edges tending to fold upwards or downwards. We have here then, from the nature of the case, possibilities for great variation in growth in one and the same species, the peltate young form standing on the border-line between the cup and the glomerate or rather the flat encrusting type of growth. It is significant that

it is exactly in this case that the specific value of methods of growth appears to break down, for we find specimens which all appear to belong to one species, viz. *Turbinaria peltata*, forming on the one hand enormous hemispherical masses * and on the other hand systems of erect fronds.

Whether this particular "species" ought to be further broken up according to the different methods of growth it presents I find it very difficult to decide. There are thirty specimens apparently belonging to it in the National Collection, showing every stage of growth between the two extremes mentioned. Taking the coralla alone into account, it does not seem practicable to divide them. Perhaps when the living corals are studied, important differences which would justify their separation may be found.

The large specimens show that as the old stocks die down they are overrun by fresh layers of living coral. The dying down spreads gradually over the surface, and then the dead surface is grown over again by a fresh layer starting from some still living portion. In this way great hemispherical masses are produced by layer overgrowing layer. The layers themselves, however, are not thickened. This fact distinguishes these often glomerate masses from the true glomerate type of growth, in which each layer is itself enormously thickened in the centre and forms a hemispherical mass (Pl. XIX. fig. 7).

Third Type of Growth: Frondens.—This method of growth seems to originate from a deep bowl-shaped cup, the margin of which grows vertically. The constant lengthening of the circumference by the formation of new buds, while the form of the cup does not admit of any great enlargement of the circumference, leads to the breaking-up of the margin into lobes which roll inwards and curl round. Complicated masses of erect fronds, some spirally coiled, may thus arise. I understand this to be what Dana meant by "cucullately" folded. This group is established to take Dana's species *T. frondens* and a few specimens in the National Collection which approach this method of growth.

In these forms accessory lobes seem often to spring out from the faces of the fronds. These were either once marginal, the edge having again united, or are true accessory outgrowths, which are perhaps to be associated with the hindering of the downward flow of the coral-substance. In

* Two magnificent specimens illustrating this method of growth, sent by Mr. Saville Kent from the Great Barrier Reef, are mounted in the public galleries of the Natural History Museum.

the single specimen of a new species, which I propose to call *T. auricularis*, some of the accessory lobes certainly spring from the border-line between the living and the dead coral. Even in some other cases, where the hindrance cannot be so easily concluded, it is probable that it occurs.

Fourth Type of Growth: Foliate.—I propose to group under this heading all those cases in which the edge of the cup grows up into wavy fronds more or less erect, which may fuse irregularly together in every imaginable way. The fronds may be very deep and wide apart, or else very narrow, in which case they are generally very closely packed. Some very remarkable variations in their method of growth are found. In some the under surfaces of the fronds (*i. e.* the surfaces without polyps) are close together, while the spaces between the polyp-bearing faces of the fronds are wide apart; this is the arrangement one would naturally expect to be most suitable for the life of the polyps. There occur forms, however, in which the polyp-bearing surfaces almost touch, and even fuse, while the spaces between the under surfaces where there are no polyps are wide apart. In all cases the early cup is soon completely overgrown and obliterated.

Fifth Type of Growth: Mesenteriform.—This name is borrowed from Lamarck's species, *T. mesenterina*. The growing margin creeps outwards more or less horizontally, or even downwards. It is divided into lobes, which are separated by folds bent vertically upwards (*cf.* diagrammatic drawing, Pl. XIX. fig. 6). These folds are grown round, and then form open cylinders or closed knobs or finger-shaped processes. As the corallum expands the stalk is completely obscured, and its origin from an early cup could never have been guessed. The method of growth is, however, fairly uniform, and is pronounced enough to be recognized without difficulty. There is, further, fortunately a specimen in the National Collection at about the stage figured in the diagram (fig. 6). It forms a connecting-link between the early cup and the flat, nodulated, encrusting masses which show the "mesenteriform" method of growth only along their expanding margins.

Sixth Type of Growth: Tabulate.—I have adopted this name to designate a curious method of growth by no means infrequent. The cup evidently grows out rather flat, with slightly curled-up edges. As it dies down a fresh layer, appearing to start from the edge of the old, not only expands further, but spreads back over the old, and not always in contact with it, but arching over. An old stock thus shows several tiers of more or less horizontal coralla, which may be

separated by chambers or fissures. These flat coralla, seldom nodulated, are often of great thickness and strength, as indeed their form requires. They appear very often to be semi-circular, as if their shape were adapted to horizontal growth from a more or less vertical substratum. Such a horizontal growth requires far greater strength than does an erect frond. Consequently a section through such a tabulate form shows great thickness of the cœnenchyma both above and below the line of intercommunication between the polyp-cavities. The texture of the cœnenchyma is also very massive and dense.

In this case and in the next it seems to me as if we have periodical growths, or, at any rate, such a modification of the usual progressive dying down that it practically amounts to periodicity.

Seventh Type of Growth: Glomerate.—I was for a long time inclined to consider all glomerate forms as mere varieties of other species, varieties which had become glomerate owing to some accidental influence, perhaps of the form of the substratum; and it is undeniable that the likeness between certain glomerate forms and other Turbinarians found growing near them is very great. But this resemblance admits of another explanation, and will be referred to again. On the other hand, if any classificatory value is to be placed upon methods of growth, and I do not see how this can be disputed, we are bound to look upon the glomerate type of growth as one of the most marked and peculiar.

The corallum expands very little superficially. The cœnenchyma is built up, as it were, *in situ*. It is therefore always irregularly reticulate—that is, it shows none of the regular channels which indicate streamings. The consequence is that the corallites have to lengthen enormously to keep their apertures at the surface of the ever-thickening cœnenchyma. The budding of the polyps is, however, of the usual Turbinarian type, as is well shown in a section revealed by a broken specimen in the National Collection (Pl. XIX. fig. 7).

Here again it appears as if we have periodical growth. A fine specimen in the collection (fig. 8) shows three successive growths in vertical series. It appears as if each new growth must have started from the highest point of the old (perhaps from adventitious budding in the thickest part) and crept slowly out in all directions, covering it up.

We here have an excellent illustration of the great importance of recognizing clearly the essential morphology of the Turbinarians as shown in their method of budding. The method of budding and of growth of these glomerate Turbinarians is quite definite and distinct, and, in spite of the occa-

sional adventitious budding, conforms to the type. And yet these forms have been thought to represent a transition between *Turbinaria* and *Astræopora*, with their very different method of budding and of growth.

Relation of Turbinaria to Astræopora.—If there is any connexion between *Turbinaria* and *Astræopora*, it is not by way of their glomerate forms, for both genera have thin creeping as well as solid hemispherical methods of growth. Their affinity cannot be based upon the mere superficial resemblance of certain specialized growths. As far as I am at present in a position to compare them, it appears to me that they have no immediate connexion. The budding of the Turbinarians is probably one of the most specialized to be found amongst Corals, and that of *Astræopora* shows no resemblance to it. The polyp-cavities and the cœnenchyma are far simpler and more primitive in *Astræopora* than they are in *Turbinaria*. The costæ, of which it is built up as one of its chief elements, are in many cases simple echinulations, and still show the primitive connexions with the septa, a connexion which has apparently been secondarily lost in both *Madrepora* and *Turbinaria*. Further, the pronounced columella of *Turbinaria* is not developed in *Astræopora*, although the elements out of which it might be formed are clearly traceable.

In view, then, of these much simpler conditions found in *Astræopora* than occur in either *Madrepora* or *Turbinaria*, it seems to me to run counter to the most elementary canons of morphology to deduce the *Astræopora* from a specialized form of the specialized Turbinarians. Only the most rigid demonstration of ontogenetic simplification in the case of the former could justify such an order of descent. Failing such a demonstration we have to place *Astræopora* as the most primitive of the Madreporidæ, from which, first *Madrepora*, and then *Turbinaria*, as I think, through *Madrepora*, may have been deduced. In *Madrepora* the first stage is an encrusting one, as, with some modifications, it always remains in *Astræopora*. The typical method of growth by means of special axial polyps appears later. From such a specialized method of growth the still more specialized type of the Turbinarians can be deduced in the manner above described.

However intelligible and satisfactory such an order of descent may at first sight appear, it can only be accepted provisionally, inasmuch as it is based upon the skeletal structures alone. It can hardly be considered to be established until the soft parts have been studied especially from this point of view. Fowler has shown that differences

occur between the polyps of *Madrepora* and of *Turbinaria*; but the morphological value of these differences has to be estimated by extended comparative studies. We have yet to find out how far the living polyps are affected by the different conditions of life, due to the different forms of their coralla.

Eighth Type of Growth: Bifrontal.—Typically the Turbinarians carry polyps on only one side of the corallum. Forms occur, however, with polyps on both faces, this being brought about by the fusion of two fronds back to back. Such fronds, as might be expected, are always more or less erect. Among the specimens contained in Mr. Saville Kent's collection there exist complete series, showing the early cup-form and its subsequent folding. The folds do not form open cylinders, as in the mesenteriform method of growth, but thin vertical plates by the opposing under surfaces fusing together.

Similar fusions occur in all Turbinarians which form upright fronds, but irregularly, whereas in the type of growth under discussion they are the rule, and no free single fronds occur except here and there as horizontal expansions round the base of the corallum. These are to be considered as the continuations of the original edge of the cup, *i. e.* of those portions of the edge between the vertical folds.

These bifrontal growths show the phenomena which I at first took to be indications of regular periods of growth, but which, as above stated, I now think are due to occasional downward streamings of the cœnenchyma.

These definite types cannot be supposed to exhaust the possible transformations of the early cup. When our collections are more complete other normal methods of growth will no doubt have to be added.

Among the methods of growth shown by the specimens in the National Collection which do not as yet admit of being ranked as types there is one which I should like to describe here, as it appears to be too definite to be accidental. Inasmuch, however, as beyond being slightly indicated in one specimen, it actually occurs in only one other, it is not safe to claim it as a type.

One side of a conical cup is pulled down, as shown in Pl. XX. fig. 1, which represents a specimen in the National Collection. Two flaps, starting apparently in this way, grow round the cup closely fused with its outside. On meeting behind the cup they bend round again, and then again, the foldings on each side being almost symmetrical. Fig. 2*a* is a diagram of the singular method of folding. Fig. 2 gives a sketch of the specimen which has been

built up in this way. The original cup is naturally obscured by the continual upward growth of the edges and by the development of tall conical folds (*c*) and of wings (*d*) on the faces and sides of the original flaps, which have grown upwards with the growth of the cup, and also by the downward streaming of the coenenchyma from within the cup carrying down the lower edge of the flap, so that the stalk is completely obliterated. The lower portion of the stock, especially certain masses of dead corallum, are not easy to understand; it is possible that the cup shown in the diagram and figure as the foundation of the corallum was not the original cup, but a secondary cup-like growth of parts of an old stock. The question is, Is this strangely symmetrical method of modifying a cup typical or accidental? I would like to invite the attention of those who have access to any collections of *Turbinaria* to this point.

Grouping according to Growth probably a natural one.—Accepting these eight types of growth as of practical value in classification, we find that they enable us to divide the specimens into more or less well-defined groups. It must, however, remain undecided whether these are natural groups, although this would certainly appear to be the case, in spite of certain somewhat serious objections. I would instance as the greatest difficulty the fact that certain forms of coralla seem to belong to definite localities. There are specimens from the Torres Straits, belonging to at least two species, which show the same form of corallum. This seems to imply that, at least in these cases, the form is due to the environment. But while this fact cautions us against attributing too high a taxonomic value to the forms of the coralla, it would be rash to deny them all value. In view of the definiteness of some of these types of growth, more than one coming from the same locality, in view also of the possibility at any time of the living colonies being powerfully modified by exceptional conditions of the environment, we are, it seems to me, justified in assuming that these growth-forms are typical developments.

The Taxonomic Characters supplied by the Calicles.—These are far more difficult to define than are the methods of growth. The calicles vary in size, shape, depth, and degree of protuberance according to the part of the corallum they occupy*; even the number of the septa and the size of the columella vary greatly on one and the same specimen. The only practical course is to select those corallites which appear to be typical, *i.e.* which appear to be growing normally on the normal fronds or lobes of the special type of growth of the specimens

* Cf. Bell, "Variations in *Turbinaria*," J. R. M. S. 1895, p. 148.

under comparison. The average sizes of the calicles may be taken and the average number of septa. But certain other characters appear to me to be of even greater importance.

1. *Characters of the Protuberant Calicles.*—I do not here refer to the fact that the calicles may or may not protrude, but, *when* they do protrude, to the way in which this takes place. Pl. XX. fig. 3 shows three different ways in which the calicles may raise up the cœnenchyma—the conical, globose, and cylindrical protuberances. Great as is the variation in the *degree* of protuberance found in one and the same specimen, the *character* of the protuberance, when it does occur, is apparently constant. Of course these three types are subject to an enormous number of variations; but every form approaches one or other of these three.

2. *The Character of the Septa.*—I have not found dentition or granulation of the septa of much value, although perhaps they should be taken into account (see below on the cœnenchyma). Of greater value is the relation between the cycles of septa and the polyp-cavity. I have found it useful to draw an imaginary half-radius circle within the aperture of the calicle (Pl. XX. fig. 4, *b*). The septa may (*a*) fall short of this, leaving a large central fossa (fig. 4, *1*); (*b*) they may reach it, leaving a medium-sized central fossa (fig. 4, *2*); (*c*) they may cross it, in which case the central fossa is very minute (fig. 4, *3*); or (*d*) they may be quite irregular, some crossing, others not even reaching it.

Again, the septa in thus projecting into the cavity may run in on a level with the margin and then dip suddenly down towards the columella, or they may curve regularly round, or they may slope down gradually so that the central fossa is funnel-shaped.

We have accordingly many different sizes and forms of fossæ.

3. *The Interseptal Loculi.*—These are also of importance (Pl. XX. fig. 4); they may be large and open or narrow and slit-like. They may be almost square or petaloid, *i. e.* with neatly rounded peripheral margins; they may, indeed, have no distinct peripheral margins, *i. e.* the interseptal space runs on continuously with the surface-furrows of the cœnenchyma. When this is frequent it is an index of the large size of the pores connecting the polyp-cavities between the septa with the canal-system of the cœnenchyma.

4. The columella offers characters of value.

Important as these characters undoubtedly are, it has again to be pointed out that they are only strictly applicable to

calicles which appear to be the typical normal calicles of the specimen. Great variations may occur even in these points, according to the position of the calicle and according to its degree of protuberance; but, if due caution is used, a number of good taxonomic characters are thus at hand for use.

On the Influence of Position on the Character of the Calicles.
—A great field of investigation is here opened up. I am not referring primarily to the effects of variations in the direction and in the force of the currents and in the quantity of nutrition received, all of which, no doubt, play an important part, but to modifications of form due to internal causes, notably to the streaming of the nutrient fluids in the canal-system. I have already pointed out that the streaming of the cœnenchyma is a factor of prime importance in the building-up of the corallum. This streaming is sufficient in many cases actually to submerge living calicles, which, in some cases, may again break through or else apparently put out a number of secondary buds. In other cases the polyps have continually and progressively to lengthen, in order to keep at the surface of the cœnenchyma; and while calicles situated on rounded knobs are often abnormally large and protuberant, those on erect fronds project but slightly. These facts, taken together with the fact that the canals of the cœnenchyma are in open communication with the polyp-cavities, appear to me to make it highly probable that, just as this flow builds up the cœnenchyma and gives it its appearance of streaming, so it must also affect the skeleton of the calicle itself, through which it doubtless runs. Indeed, in some cases it appears as if the calicles have to be protected against this. In coralla where the downward streaming is very marked by the deep regularly parallel furrows, these, in descending, are turned to right and left whenever they reach a calicle, converging again below it.

This is no fanciful question, but one which may prove of profound significance; for if, in any single coral, the downward flowings of the cœnenchyma can in any way affect the morphology of the polyp, this would have to be taken into account in any attempt to classify the corals according to the type of the polyp. The differences found in the soft parts of the polyp may be secondary and adaptive to the physiological conditions resulting from the forms of the coralla and to the streamings of the contents of the canal-system.

The Cœnenchyma.—This intercalicular tissue is very prominent in *Turbinaria*. It is, as we have seen, comparable in every essential with the cœnenchyma of *Madrepora* and

of *Astræopora*; it differs chiefly in its greater abundance and in its distribution, both of these depending upon the method of budding.

Rapidly growing cœnenchyma is always finely reticulate or spongy; where streaming takes place it is often furrowed in the direction of the streaming. The relative breadths of the furrows and of the separating ridges are indicative of the density of the cœnenchyma. When the furrows are narrow and the ridges thick and solid the cœnenchyma is very dense. The lower portions of a corallum are, as a rule, the densest, and this can be traced by the ever-increasing thickness of the ridges and corresponding diminution in width of the furrows.

It is apparent, then, that before any systematic characters can be based upon the cœnenchyma its physiology requires to be understood; for instance, the spongy texture of that of the margin of the cup is often given as a character, whereas it is an invariable rule that in all such rapidly growing portions the cœnenchyma is spongy.

There are, however, peculiarities which are to be noted, viz. the characters of the trabeculæ building up the cœnenchyma. They may be filamentous or lamellate, giving in the former case a spongy, in the latter a flaky appearance to the cœnenchyma, or they may be close and granulated, making the surface look like sandpaper. In others, again, the ridges are continuous, *i. e.* only broken by pores between the neighbouring canals at long intervals; in others the ridges are highly echinulate, even broken up into rows of points representing so many open communications between the furrows, which, when covered over, will become canals.

Further, a certain value may be put upon the fineness or coarseness of the texture. In some it requires a glass to see it at all, in others it is visible to the naked eye.

In connexion with this subject of the general aspect of the cœnenchyma, it is worth noting that this seems to vary with geographical position. There are groups of specimens from various parts of the world evidently in each case collected at the same time and from nearly the same spot. In each case all the specimens of these groups look at first sight strangely alike. This is notably the case with a group from Formosa, with another from Tongatabu collected by J. J. Lister, and with another from Shark's Bay collected by Saville Kent. So strong is the likeness between the specimens in each case, that without some definite principles of classification one could hardly avoid lumping them all together, as, indeed, I found had been done with the Formosa specimens. It was only when, little by little, the different methods of growth and

certain characters of the calicles were recognized as of more value than mere superficial resemblance, that I found myself compelled to separate the groups into different species. The remarkable resemblances are due entirely to similarity in the general aspect of the cœnenchyma. The Tongatabu specimens, for instance, have a velvety appearance. The Formosan specimens have a rough look, like a gritty sponge. The Shark's Bay specimens have a solid stony look, the gyrating furrows being separated by broad granulated ridges. Other examples of the same phenomenon might be mentioned. Its cause is no doubt to be sought in the varying physical conditions of their several environments. All corals must in some way be influenced by the varying climatic and other conditions under which they develop. The effects of these are perhaps specially visible in *Turbinaria*, owing to the great abundance of the cœnenchyma in this genus.

EXPLANATION OF THE PLATES.

PLATE XIX.

- Fig. 1.* Section through the stalk of a very young cup-shaped corallum, showing the cavity of the parent polyp, the walls greatly thickened by cœnenchyma.
- Fig. 2.* A young calicle at the edge of a corallum, growing in the direction of the arrow. The cœnenchyma is built up by true costæ connected by concentric trabeculæ; distally the primitive costæ are distinct, proximally they are already secondarily obscured.
- Fig. 3.* Diagram to explain the method of budding peculiar to the genus *Turbinaria*. It is seen to be lateral throughout. The downward "flow" of the cœnenchyma has both thickened the stalk and submerged the axial polyp.
- Fig. 3 a.* Diagram to illustrate the relation of the buds and cœnenchyma to the axial polyp in *Madrepora*.
- Fig. 3 b.* Diagram to show the budding of a radial polyp from below. 1, the axial parent polyp; 2, a radial polyp; 3, three polyps budding from 2, one on each side and the middle one from below, after 2 has bent upwards as shown in fig. 3.
- Fig. 4.* Fragment of an erect frond (of the *bifrons* type), showing the appearance of periodicity in growth, due to the downward streamings of the cœnenchyma. *a*, the most recent downward flow, submerging the polyps below it (see fig. 5); *b*, a previous very abundant flow, which threw out a ridge along which young calicles appear; *c*, the line of progressive decay, which is advancing more rapidly on the left than on the right, where it stands at *d*.
- Fig. 5.* A calicle on the line *a* in the preceding figure, being submerged by the downward flow of the cœnenchyma.
- Fig. 6.* The initial modification of the young cup which gives rise to the mesenteriform type of growth (diagrammatic).
- Fig. 7.* A portion of a section through a glomerate *Turbinarian*, showing that the method of budding peculiar to the genus need not be affected by the enormous thickness of the cœnenchyma.

Fig. 8. A specimen of a glomerate Turbinarian, showing three periods of growth.

PLATE XX.

- Fig. 1. A peculiar modification of a young cup exhibited by a specimen in the National Collection, which appears to be the first stage in the method of growth shown in the next figure.
- Fig. 2. A specimen remarkable for the regularity and symmetry of its method of folding. For the letters see next figure.
- Fig. 2 a. Diagrammatic horizontal section, to explain the method of folding. The letters mark the edges seen in the actual specimen. *c* and *d* are secondary outgrowths somewhat obscuring the original folding.
- Fig. 3. Three types of protuberant calicles, showing the principal methods in which the cœnenchyma is raised by them.
- Fig. 4. Diagram to illustrate the principles of classification proposed as regards the form of the calicle. *a*, the margin of the calicle; *b*, an imaginary half-radius circle; *1*, four septa which do not reach the half-radius circle; *2*, a single septum reaching the half-radius circle; *3*, septa crossing the half-radius circle. Between the septa at *1* the interseptal loculi run over into the furrows of the cœnenchyma; at *2* and *3* they are sharply bounded peripherally, and show different shapes of interseptal loculi.

LXI.—Description of a new *Batrachian* (*Oreophryne Quelchii*) discovered by Messrs. J. J. Quelch and F. McConnell on the Summit of Mount Roraima. By G. A. BOULENGER, F.R.S.

OREOPHRYNE, gen. nov. (*Engystomatid.*)

Pupil horizontal. Tongue elliptical, entire, and free behind. Palate smooth. No tympanum; eustachian tubes extremely minute. Fingers and toes short, blunt, without distinct web; foot for grasping, the inner toe opposable and longer than the second. Coracoids and præcoracoids very strong, the former forming an extensive suture with the latter in the middle and enclosing on each side a rather small circular foramen; no omosternum; sternum cartilaginous. Diapophyses of sacral vertebra strongly dilated.

The genus *Oreophryne* is nearest allied to *Atelopus*, D. & B., from which it is, however, well distinguished by the stronger præcoracoids and the curious conformation of the foot, which recalls that of the Hyloid genus *Phyllomedusa*.

Oreophryne Quelchii.

Physiognomy of *Bufo* (*Phryniscus*) *nigricans*, Wgm., or *Atelopus Stelzneri*, Wey. Snout short, rounded, not prominent. *Ann. & Mag. N. Hist.* Ser. 6. Vol. xv. 36

nent, with distinct canthus rostralis; interorbital space as broad as the upper eyelids. Fingers very short, connected by thick skin at the base, somewhat swollen at the end, first, second, and fourth equal, third longest; toes likewise very short and connected at the base, first and fifth equal, fourth a little longer, second and third shortest; palms and soles warty, carpal and tarsal tubercles quite flat. The tarso-metatarsal articulation reaches the eye. Upper parts covered with prominent warts of unequal sizes; lower parts with smaller flat warts. Black; throat and belly spotted or marbled with bright yellow. Male without vocal sacs.

From snout to vent 22 millim.

Several specimens were found by Messrs. Quelch and McConnell on the summit of Mount Roraima, between British Guiana and Venezuela, at an altitude of 8500 feet.

LXII.—*Description of a new Anolis from Brazil.*

By G. A. BOULENGER, F.R.S.

Anolis holotropis.

Head once and two thirds as long as broad, a little longer than the tibia; forehead scarcely concave; frontal ridges absent; upper head-scales keeled, mostly tricarinate on the snout; scales of the supraorbital semicircles strongly enlarged, in contact in the middle; several enlarged supraocular scales, separated from the supraorbitals by one series of granules; occipital larger than the ear-opening, separated from the supraorbitals by two series of scales; canthus rostralis angular, canthal scales three; loreal rows four or five; seven upper labials to below the centre of the eye; ear-opening small, oval. Gular appendage small (♀). Gular scales keeled. Body cylindrical. Dorsal scales rather small, hexagonal, strongly keeled, passing gradually into the minute keeled granules of the sides; ventrals large, rhomboidal, imbricate, strongly keeled. The adpressed hind limb reaches the posterior border of the orbit; digits very feebly dilated; 17 lamellæ under phalanges II and III of the fourth toe. Tail cylindrical, covered with equal keeled scales, once and three fourths as long as head and body. Pale grey-brown above, with a yellow vertebral stripe edged with reddish brown; femur and tibia with a yellowish cross bar; pale golden beneath.

	millim.
Total length.....	149
Head.....	13
Width of head.....	8
Body.....	41
Fore limb.....	21
Hind limb.....	38
Tibia.....	12
Tail.....	95

A single female specimen from the Province Matto Grosso, Brazil, collected by Dr. C. Ternetz.

LXIII.—*Notice of Reptiles and Batrachians collected in the Eastern Half of Tropical Africa.* By Dr. A. GÜNTHER, Keeper of the Zoological Department, British Museum.

[Plate XXI.]

THE principal object of this paper is to give an account of a small collection of Reptiles made by Mr. G. F. Scott Elliot in the Victoria region at an elevation of less than 6000 feet, and during his journey to and sojourn in Uganda. However, it was found convenient to include in it also the examination of several other small East-African collections received about the same time from other sources. The differences that were at one time supposed to exist between the East and West, the South and North of the Reptilian Fauna of Tropical Africa gradually disappear as we become better acquainted with the local faunæ.

I.—REPTILES AND BATRACHIANS COLLECTED BY
MR. G. F. SCOTT ELLIOT.

Agama Gregorii, Günth.

Agama Gregorii, Günth. Proc. Zool. Soc. 1894, p. 86.

Specimens of an *Agama* collected in Buddu and other parts of Uganda, at elevations of from 3800 to 4500 feet, come nearer to this species than to either *A. atricollis* or *A. cyanogaster*, to which this species is generally closely allied. The ventral scales are larger than in either of those two species, and keeled and acute on the hind margin, with the exception of those in the middle of the abdomen, which are smooth. *None of these species have the scutes of the tail verticillated.*

Mabouia striata, Ptrs.

Two specimens from Uganda (alt. 3800–4500 feet). In both the suborbital scute is entirely excluded from the labial margin; also the hind leg is conspicuously shorter than in typical specimens, not reaching the axilla; so that I entertain some doubts as to the propriety of identifying these specimens with Peters's species.

Chamaesaura tenuior, sp. n. (Pl. XXI. fig. B.)

This species is conspicuously more slender than its congeners, especially the head and snout are narrower and longer. Both the vertical as well as the single posterior frontal are elongate, nearly twice as long as broad; otherwise there is great similarity between this and the other species. The fore limbs are about as long as the orbit and without claw; the hind limbs are not quite twice as long as the fore limbs and provided with a single claw. Thirty-six scales between the ear and vent; twenty-four round the body. Back of the trunk with a pair of narrow parallel brown lines.

One specimen from Kampala, Uganda, $22\frac{1}{2}$ inches long, of which the tail takes 18.

Chamaeleon senegalensis, var. *laevigata*, Gray.

Two specimens, one from Kavirondo (alt. 3900–4000 feet), the other from the foot of Mount Ruwenzori (5000–6000 feet), obtained together with the following species.

Chamaeleon Elliotti, sp. n. (Pl. XXI. fig. A.)

This species is represented by several specimens from the same localities as the preceding, and is apparently more common. The upper surface of the head distinctly concave, the superciliary edges and the canthus rostralis being raised, and coarsely granular. Three rows of enlarged granules commence about the middle of the interorbital space, and converge to form a distinctly elevated occipital crest, covered with tubercles. A longitudinal row of small tubercles traverses the temporal region. No rostral appendages; no occipital lobes. Body finely granular, with small tubercles irregularly scattered. A continuous row of tubercles along the middle of the back and anterior portion of the tail, forming a low crest. A gular-ventral crest formed by pointed tubercles. No tarsal process. Scales on the side and upper surface of the head and of the temples small, flat. Tail as long as, or rather shorter than, the body and head. Frequently a whitish line

from the temporal crest to the root of the tail. Sometimes one or two whitish bands across the lower part of the temple.

In the females the crests on the head are lower.

A male measures 152 millim., the tail taking 75 millim.; a mature female with fully developed ova is 102 millim., the tail taking 47 millim.

The female of *C. bitæniatus* is very similar to that of the present species, but distinguished by much larger tubercles; but the male of *C. bitæniatus* differs greatly in having a very high occipital crest, covered with large scutes, and the extremity of the snout raised into a knob.

Grayia Smythii, Leach (?).

Only the head and tail of a specimen from Uganda have been preserved; they show no structural difference from West-African specimens, but the coloration is peculiar; the parts are black, the head-shields and scales of the neck being finely mottled with salmon-colour.

Leptodira rufescens, Gm.*

From the foot of Ruwenzori.

Boodon lineatus, var. *bipræocularis*, Gthr.

Uganda, alt. 3900–4500 feet.

Elapsoidea Guentheri, Bocage. (Pl. XXI. fig. C.)

Two specimens were obtained. One on the lower slope of Ruwenzori; it is half-grown and agrees perfectly with an adult specimen from Stanley Pool belonging to the variety figured by Bocage and described by him as var. C. Being of immature age, it has the abdomen of a darker colour.

The second specimen (see figure) is quite young and was obtained in the Shiré Highlands. It is deep black above and below, with ten narrow white rings on the trunk, not reaching across the abdomen, and two on the tail. Evidently these rings disappear with age, leaving their traces merely as the paired faint whitish lines observed in adult specimens of

* *Coronella cana*, L.

This common South-African snake extends as far northwards as Zomba; but the single specimen (adult) (which was collected by Mr. Alex. Whyte) presents a singular coloration. Each scale is black, the greater portion of it being occupied by a yellow spot; these spots vary in their extent and position, producing thereby the appearance of an irregular network of black lines. Scales in 27 series.

var. C of Bocage. The head is dull whitish, with a tapering prolongation of the black ground-colour running along the occipital suture to the vertical—similarly to what Böttger describes of his *E. Hessei*, which I consider to be the young of a variety of the same species.

Rana mascareniensis, Dum. Bibr.

Shiré Highlands and Uganda, alt. 3900–4500 feet.

Pyxicephalus adpersus, var.

A half-grown specimen from the Shiré Highlands agrees with an adult obtained by Mr. Baxter in Ugogo in having the back covered with prominent rounded or oblong tubercles. These specimens therefore differ from typical specimens of *P. adpersus*, as well as of *P. edulis* (Ptrs.), which are distinguished by characteristic longitudinal folds of the skin. On the other hand, *P. Maltzani* (Blgr.) is said to have a remarkably smooth skin.

Bufo regularis, Reuss.

Shiré Highlands and Buddu.

Rappia viridiflava, Dum. Bibr.

Buddu and other parts of Uganda (alt. 3900–4500 feet).

Rappia marmorata, Rapp.

Mandala, Shiré Highlands, 3500 feet.

II.—REPTILES AND BATRACHIANS COLLECTED BY
MR. E. J. BAXTER.

Sepacontias modestus, Gthr.

Ugogo.

Rhinocalamus dimidiatus, Gthr.*

Ugogo.

Scaphiophis albopunctatus, Ptrs.

Ugogo.

* I may here mention that the allied genus *Xenocalamus*, Gthr., is likewise an opisthoglyphous snake; I have overlooked the hindmost grooved tooth, which is hidden in the mucous membrane at some distance behind the preceding teeth.

Bucephalus capensis, Smith.

Ugogo.

Leptodira semiannulata, Gthr.

Ugogo.

Lycophidium Horstockii, Schleg., var. *Jacksonii*, Blgr.

Ugogo.

Naja haje, L.

Uganda. Black variety.

Atractaspis irregularis, Ruhrdt.

Uganda. Two eggs with nearly fully developed embryos were obtained; the species is therefore oviparous. The eggs are elongate, subcylindrical, of large size, nearly 2 inches long, enclosing an embryo 9 inches long. Scales in 23 series.

Pyxicephalus adspersus, var.

Ugogo. Skin of a very large example: see above, p. 526.

Rappia viridiflava, Dum. Bibr.

Uganda.

Rappia marmorata, Rapp.

Uganda.

III.—REPTILES COLLECTED BY MR. F. J. JACKSON.

Mabouia varia, Ptrs.

Two specimens from Mount Elgon, alt. 6000–7000 feet.

Chamæleon biteniatus.

Several specimens from Mount Elgon, 6000–7000 feet.

Chlorophis neglectus, Ptrs.

One specimen from Witu.

CHLOROPHIS and PHILOTHAMNUS (*Ahaetulla*).

Adopting the limits and names of these two genera as proposed by Mr. Boulenger in Cat. Snakes, vol. i., I

modify the synopsis of the species, given by me in *Ann. & Mag. Nat. Hist.* 1863, xi. p. 283, thus:—

I. The subcaudal scutes without lateral keels: *CHLOROPHIS*.

A. Ventral scutes not keeled.

1. Three labial shields (the fourth, fifth, and sixth) enter the orbit.
 - a. Ventral scutes 151-158.
 - a. Uniform green; each scale with a white basal spot *C. Emini*, Gthr.
 - β. Back with black cross bands; scales without white spots *C. Güntheri*, Pfeff.
 - b. Ventral scutes 180 *C. gracillimus*, Gthr.
2. Three labial shields (the third, fourth, and fifth) enter the orbit *C. ornatus*, Boc.
3. Two labial shields enter the orbit *C. hoplogaster*, Gthr.

B. Ventral scutes keeled.

1. Anal single *C. heterodermus*, Hallow.
2. Anal double.
 - a. Upper labials nine, three entering the orbit.
 - a. Fore part of the body uniform green. *C. irregularis*, Leach.
 - β. Fore part of the body barred with black *C. shirana*, Gthr.
 - b. Upper labials eight, two entering the orbit.
 - a. The fourth and fifth enter the orbit.
 - aa. One anterior temporal *C. neglectus*, Ptrs.
 - bb. Two anterior temporals *C. natalensis*, Smith.
 - β. The fifth and sixth enter the orbit. *C. angolensis*, Bocage.
 - c. Upper labials eight (seven), three entering the orbit *C. heterolepidotus*, Gthr.

II. The subcaudal scutes with lateral keels: *PHILOTHAMNUS*. (Upper labials nine in all species known.)

A. Scales in fifteen rows.

1. Three labials entering the orbit.
 - a. Two anterior temporals *P. semivariatus*, Smith.
 - b. One anterior temporal.
 - a. Uniform green.
 - aa. Ventrals 164 *P. nitidus*, Gthr.
 - bb. Ventrals 207-219 *P. thomensis*, Boc.
 - β. A brown vertebral stripe *P. dorsalis*, Bocage.
2. Two labials entering the orbit.
 - a. Ventrals 169-173 *P. Kirkii*, Gthr.
 - β. Ventrals 196 *P. Bocagui*, Gthr.

B. Scales in thirteen rows. *P. Girardi*, Boc.

Thrasops Jacksonii, sp. n.

One specimen from Kavirondo.

Scales in nineteen rows, keeled, in transverse, scarcely oblique series, those of the median row being somewhat larger.

Upper labials eight, the fourth and fifth entering the orbit. Loreal nearly as high as long. The single anteocular just reaches the vertical, which is nearly as large as an occipital, very broad in front and narrow behind. Three postoculars. Temporals 1 + 1, the posterior twice as large as the anterior. Ventrals 195. Anal divided. Subcaudals 146. Entirely black.

Entire length 65 inches, of which the tail takes 20.

Dendraspis Welwitschii, Gthr.*

One specimen from Kavirondo; it differs somewhat in coloration from the type; the skin between the scales is black, but the scales themselves have no black tips; tail and hindmost part of the trunk black.

Causus rhombeatus, Wagl.

Common at Kavirondo.

EXPLANATION OF PLATE XXI.

Fig. A. Chamaleon Elliotti.

Fig. B. Chamæsaura tenuior (head).

Fig. C. Elapsoidea Guentheri.

LXIV.—*On a special Mountain Race of the Plantain Squirrel from Mount Dulit, E. Sarawak.* By OLDFIELD THOMAS.

DURING the past four or five years Mr. Charles Hose has repeatedly drawn my attention to the difference in size and general appearance presented by the specimens of *Sciurus notatus* obtained on Mount Dulit above 3000 feet from those got on the lowlands; but I have hitherto not ventured to describe them, on account of the known variability of the members of this group. However, the entire identity with each other of the five specimens taken at 3000 to 4000 feet, and their great difference from all the lowland ones, induces me now to describe the form, although the presence of one specimen somewhat intermediate in character from an inter-

* Of *Dendraspis intermedia*, Gthr., the British Museum has received specimens from Kilifi (*G. D. Trevor Rope, Esq.*) and from Tavita (*Keith Anstruther, Esq.*).

vening altitude (2000 feet) prevents my distinguishing the animal as more than a subspecies.

Its original discoverer was probably Mr. John Whitehead, who obtained what is perhaps the same form on Mount Kina Balu; but unfortunately his only adult specimen has an imperfect skull, so that I am unable to be quite certain as to its identity with that from Dulit. In any case it seems better to be on the safe side by describing the form of which good material is available, leaving the identity of its Kina Balu representative to be settled later.

Sciurus notatus orestes, subsp. n.

Size very much less than in the typical form. Markings similar to those of ordinary blue-bellied specimens of *S. notatus*, without any trace of rufous or orange on the belly. Sides with the usual lines of black and white. Back with a peculiar buffy or dull fulvous shade, due to the light rings on the hairs, ordinarily pale yellow, being deep buff. Cheeks and sides of muzzle less fulvous than the back, instead of more so. A small patch behind each ear white. Tail with shorter hairs, and these more broadly ringed than usual, so that there is an indistinct barring of the tail, instead of its being merely grizzled.

Skull conspicuously smaller than in lowland specimens, so much so that it seems difficult to assign both to the same species. In proportion also it is broader and more rounded, the muzzle shorter, and the bullæ and postorbital processes are less developed.

Dimensions of the type (a well-made skin, ♀):—

Head and body 195 millim.; tail 144; hind foot 33·3.

Skull (of another specimen): greatest length 39·7; greatest breadth 25; nasals, length 11, greatest breadth 5·9; interorbital breadth 14·7; diastema 9; length of upper molar series exclusive of p^3 6·1.

Hab. Mount Dulit, 4000 feet.

Type: B.M. 94.6.2.24. Collected January 1892, and presented to the Museum by Messrs. Charles and Ernest Hose.

The intermediate specimen above referred to, from 2000 feet, has a wash of rufous on the belly and a skull-length of 44 millim., while the normal lowland form, which in Borneo seems always to have an orange or rufous belly, has a skull-length of about 50 millim. It is noteworthy that the belly-

colour in *S. notatus* in the Malay Peninsula is conspicuously variable, or, rather, dimorphic, rufous and blue*, whereas in Borneo the two colours seem to be respectively restricted to the lowlands and mountains. On one of the first specimens sent, shot in November 1891, Mr. Hose has noted that he had obtained thirteen specimens exactly like it during the month; and since then a considerable number of *S. n. orestes* have passed through my hands, so that its constancy on the mountain is evidently beyond question.

LXV.—On a new Banded Mongoose from Somaliland.

By OLDFIELD THOMAS.

MR. F. GILLETT has submitted to my examination the skins of a few mammals which were shot by him when accompanying, in a sporting capacity, Dr. E. Donaldson Smith's adventurous collecting expedition into Central Somaliland. Among these there are two examples of a *Crossarchus* belonging to the group of banded species, but evidently quite distinct from anything hitherto described.

It may be called

Crossarchus somalicus, sp. n.

Size of *C. fasciatus* and *gothnehi*. General colour very pale. Dorsal bands almost obsolete. No black tip to tail.

Colour grizzled ashy grey on head and fore quarters. Long hairs of back, where in *C. fasciatus* they are sharply ringed with deep black and bright orange-rufous, indistinctly blackish and dull yellowish white, so that the transverse dorsal bands are almost imperceptible, although they are distinctly present, and not, as in *C. gambianus*, lost in the general grizzling. Under surface very sparsely haired, practically naked in the inguinal region, grizzled grey without any mixture of rufous, except just on the chin. Limbs coloured like body, scarcely darkening terminally, even on the ends of the fingers and toes. Tail as in *C. fasciatus*, except that the end is grizzled like the rest instead of being black-tipped.

Skull in general form very similar to that of *C. fasciatus*. Four median upper incisors very narrow, not touching one another; but how far this is due to wear I am not at present

* Cf. P. Z. S. 1886, p. 77.

able to ascertain. Proportions of molars as shown by the measurements given below.

Dimensions of the type (a well-made skin, ♀):—

Head and body 400 millim.; tail 250; hind foot (c.) 75.

Skull: basal length 64; greatest breadth 39; interorbital breadth 14·3; intertemporal breadth 13·5; palate length from gnathion 35; breadth between postero-external corners of P_4 23; greatest diameter of P_4 7, m_1 6·6, m_2 4·4.

Hab. Sunerdorler, Webi Shebeli, Somaliland, alt. 1500 feet.

Native name "Shūk-shūk."

Type killed Dec. 28, 1894.

This striking animal is apparently a desert representative of the Banded Mungoses, being distinguished from all those known by its pallid ground-colour, concolorous tail, and almost obsolete stripes. Compared with other species it may, in addition, be distinguished from *C. zebra* by its larger size and the absence of rufous in the coloration of the under surface. This latter character also separates it from *C. gothneh*, Fitz., to which I refer specimens in the Museum from Lado and Monbuttu, and which is probably its nearest ally. *C. fasciatus*, its southern representative, is much darker throughout, with a particularly strongly marked black tail-tip.

Mr. Gillett informs me that, on the day above mentioned, he met about fifteen individuals of this species hunting together in a pack, and that when they saw him several of them sat up on their hind legs and looked at him without fear. The ground they were found on was sandy and stony, and covered with thin scrub. Mr. Lort Phillips has also recently seen a large pack of what he believes to be the same species near Berbera.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

February 20, 1895.—Dr. Henry Woodward, F.R.S.,
President, in the Chair.

The following communication was read:—

‘Notes on the Genus *Murchisonia* and its Allies, with a Revision of the British Carboniferous Species, and Descriptions of some new Forms.’ By Miss J. Donald.

The generic characters of *Murchisonia* as now defined are given in the paper, and the various divisions of the genus are examined,

including four which appear to be intermediate between *Murchisonia* and *Pleurotomaria*.

The Carboniferous species of the genus are revised and eleven new forms described, raising the total number of known Carboniferous forms to about forty.

MISCELLANEOUS.

On a New Method of Studying Cell-motion.

By CHARLES LESTER LEONARD, M.D.

SINCE the enunciation by Virchow, in 1858, of his theory of cellular pathology the attention of the scientific world has been centred about the study of this unit. Nearly all the unsolved problems of medical science involve, in one way or another, the consideration of some one of the functions of the cell.

It is my purpose in this paper to call attention to a new method of studying one of these functions. I have chosen as illustrations some of the well-known facts of physiology already seen and described by competent observers, and have confined the greater part of my study to cell-motion as exemplified in the movements of the red and white blood-corpuscles.

The possibility of these studies was suggested by the successful result of an experiment in instantaneous photomicrography.

The method to be illustrated consists in the making of a consecutive series of instantaneous photomicrographs of the same microscopic field taken at definite intervals, and the comparative study of the series. The results obtained by this method are the elimination to a greater extent of the personal equation of the observer, the procuring of incontestable proof of phenomena observed, the extension of the observations over any length of time, and the possibility of studying the changes occurring over the entire field at any one moment. The method also enables the student to study the condition of a fresh, living, unstained specimen for any length of time in fields taken at definite intervals.

The original magnifications were one and two thousand diameters measured by the projection of a stage-micrometer upon the screen; the lantern multiplies these diameters by forty, giving on the screen 40,000 and 80,000 diameters. The time of exposure was instantaneous, at least relatively with regard to the motion of the bodies, varying in different pictures from two to one fourth of a second.

The results obtained as regards the photomicrography of unstained specimens is illustrated by six photomicrographs of human blood in the different forms which it assumes upon the warm stages.

The method of study is illustrated by the following series:—

Series A.—The amœboid motion of the white blood-corpuscle. The change of shape and motion with relation to the surrounding stationary and identical fields is well marked.

Series B.—This series shows the power of the white blood-corpuscle in forcing its way through a mass of red crenated and adherent blood-corpuscles.

Series C.—Is of marked interest; a white corpuscle has seized upon a red corpuscle, and a series of photomicrographs shows that it has dragged it through a considerable distance in a field which is proved to be stationary and identical in all the photomicrographs.

Series D.—This series shows motion in a red blood-corpuscle, situated in a field in which the series proves no other motion took place during one half-hour. This motion must therefore have been produced by some inherent power in the red blood-corpuscle, and as the photomicrographs show that no twist has occurred, the motion cannot be due to a previous torsion, and may therefore be considered a truly amœboid motion of the red blood-corpuscle.

Series E and F.—Show the diapedesis of the red blood-corpuscle from a capillary in which the blood is in motion and from one in which there is stasis of the blood. This phenomenon therefore occurs under two opposite or nearly opposite conditions as regards intravascular blood pressure, indicating perhaps that diapedesis is not a filtration due to pressure, but is due to the amœboid motion and power of the red blood-corpuscles.

Series G.—This series shows an empty capillary. Along the inner surface of its wall may be seen white corpuscles, in which the series indicates movement. The diapedesis of two red blood-corpuscles from this empty capillary tends to strengthen the belief in the amœboid motion of the red blood-corpuscle.

Further photomicrographs illustrate the position of the corpuscles within the capillaries, and show the presence of nuclei in the red corpuscles of the frog while in the living tissues. Different forms of the malarial plasmodia and the application of the method to pathological studies are illustrated by other photomicrographs.

The pictures are not shown as the perfect results of this method or as the outcome of research by it. They are simply to illustrate the author's method of studying cell-motion. Inferences based on the pictures are foreign to the purpose of the communication, which is intended merely to demonstrate a method of study worthy of scientific consideration. Its usefulness in producing accurate illustrations, both for publication and for lantern-slides, cannot be overestimated, as it supplies pictures whose counterpart can be found under the microscope.—*Proc. Acad. Nat. Sci. Philad.* Feb. 5, 1895, pp. 38, 39.

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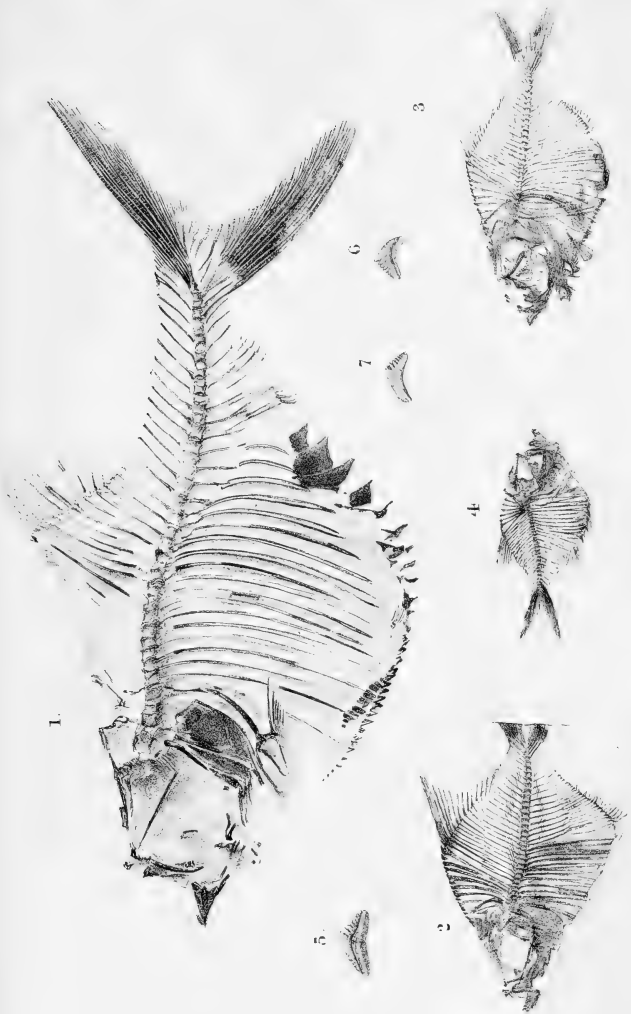
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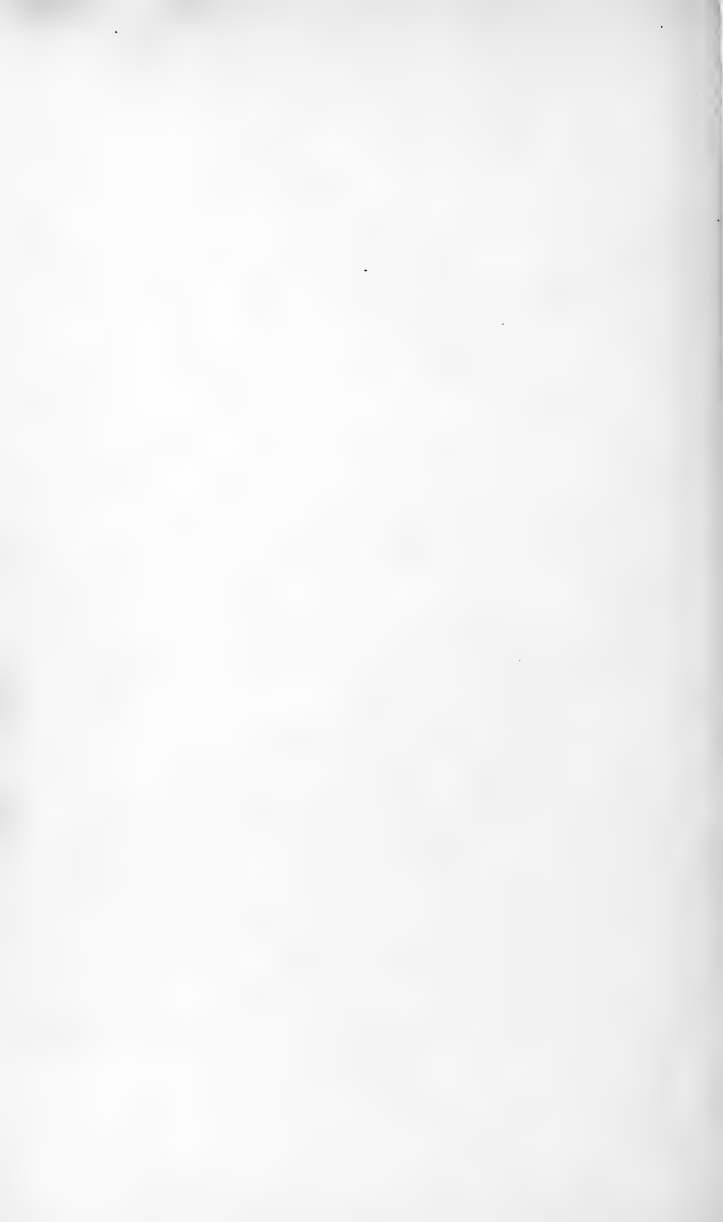
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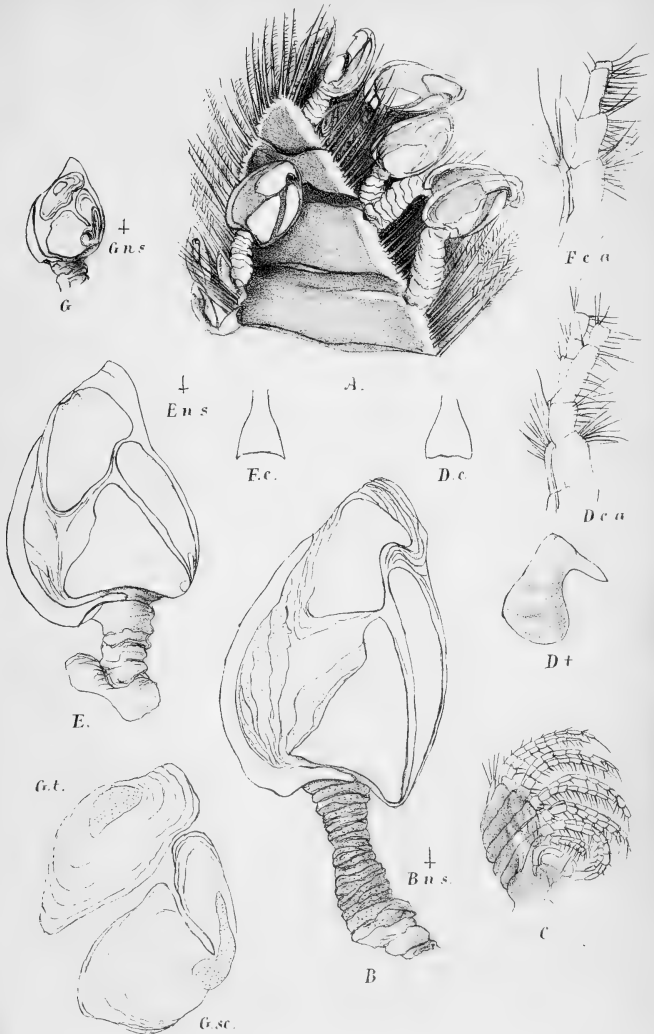
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END OF THE FIFTEENTH VOLUME.



CRETACEOUS FISHES.



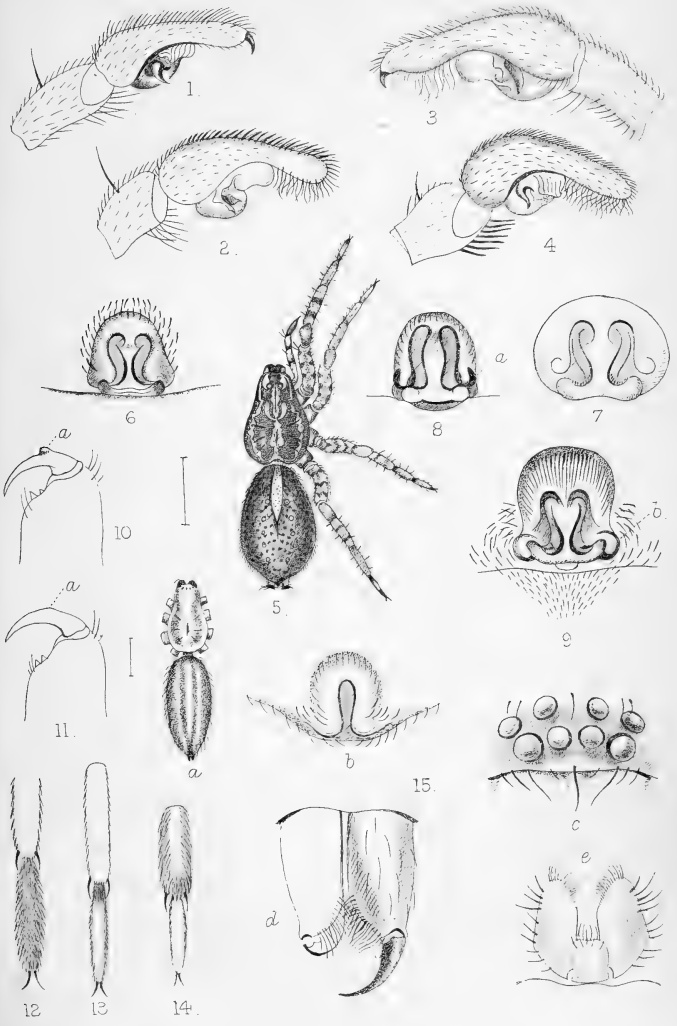


TRR. Stebbing del.

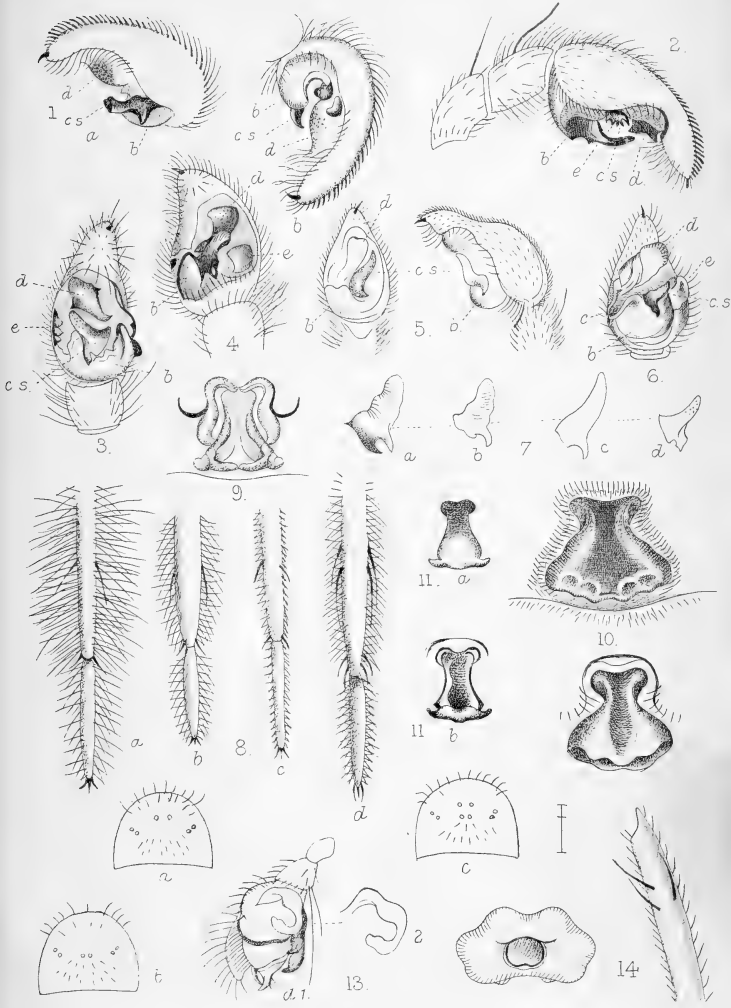
Mintern Bros. lith.

A-D. *DICHELASPIS HOEKI*, *n. sp.*

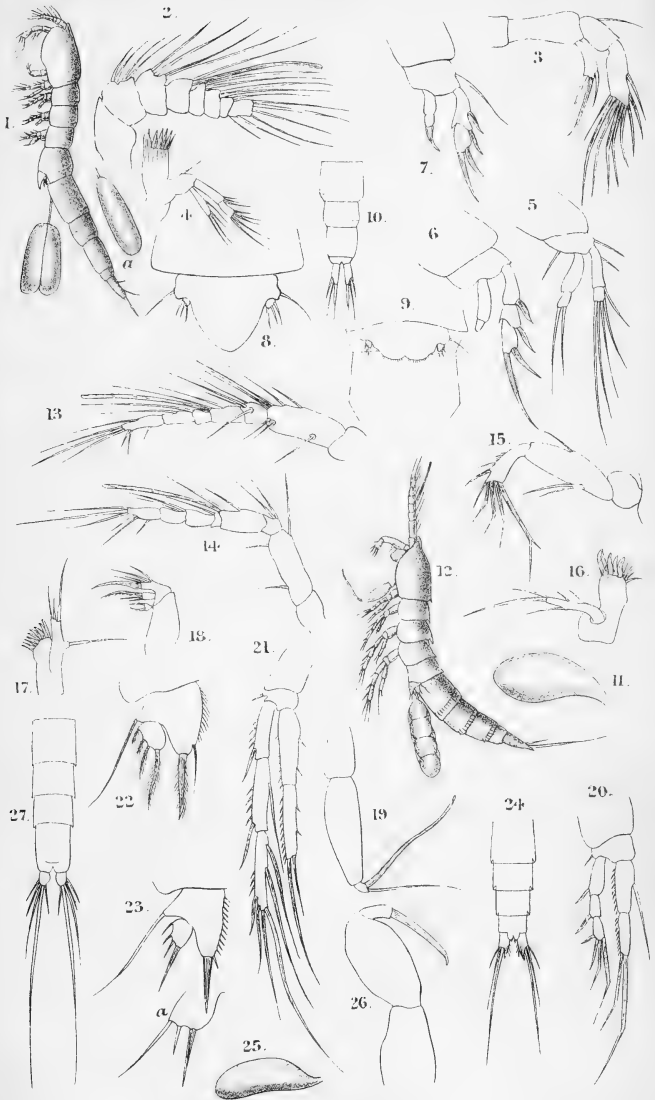
E-G. *DICHELASPIS ANTIGUÆ*, *n. sp.*

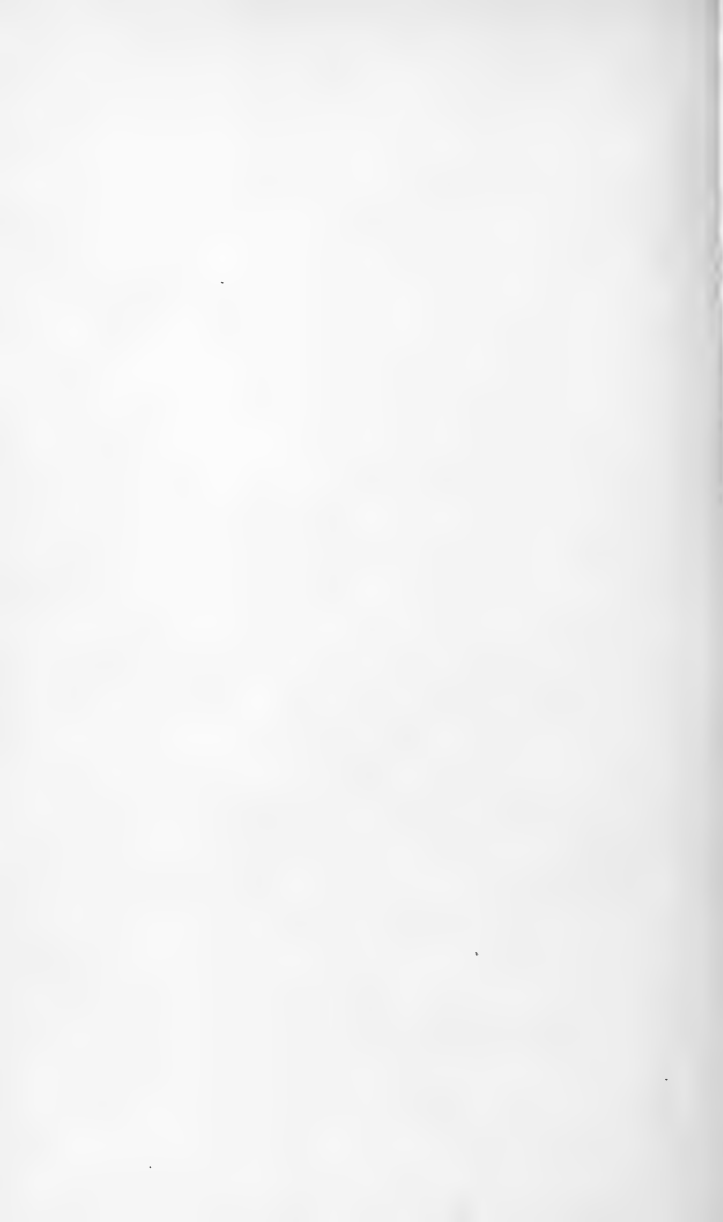


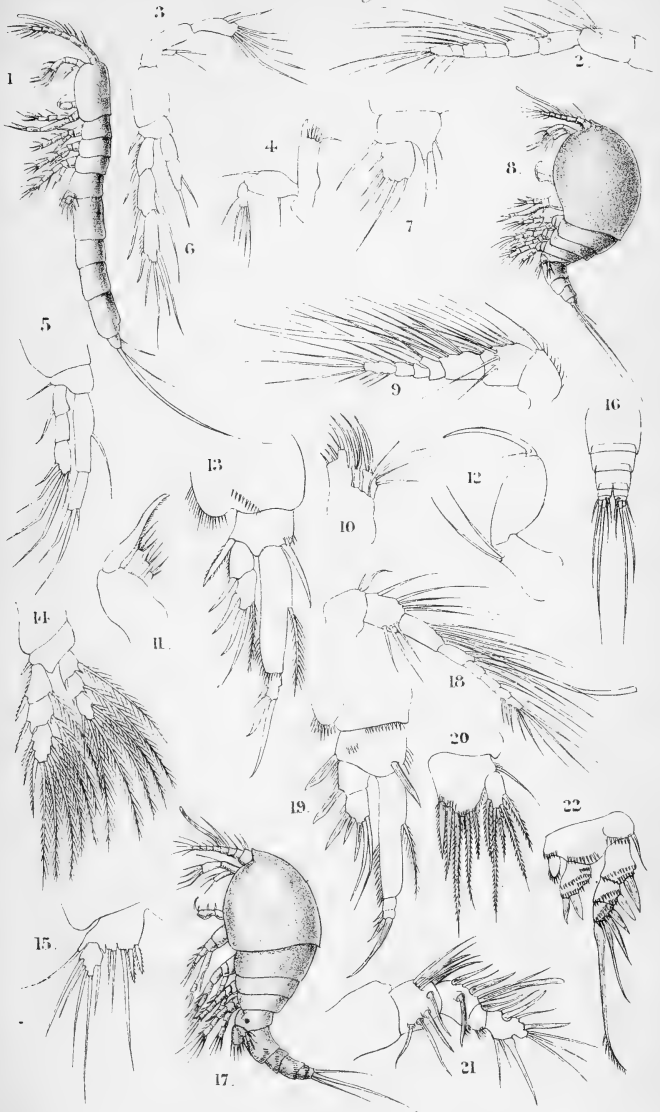


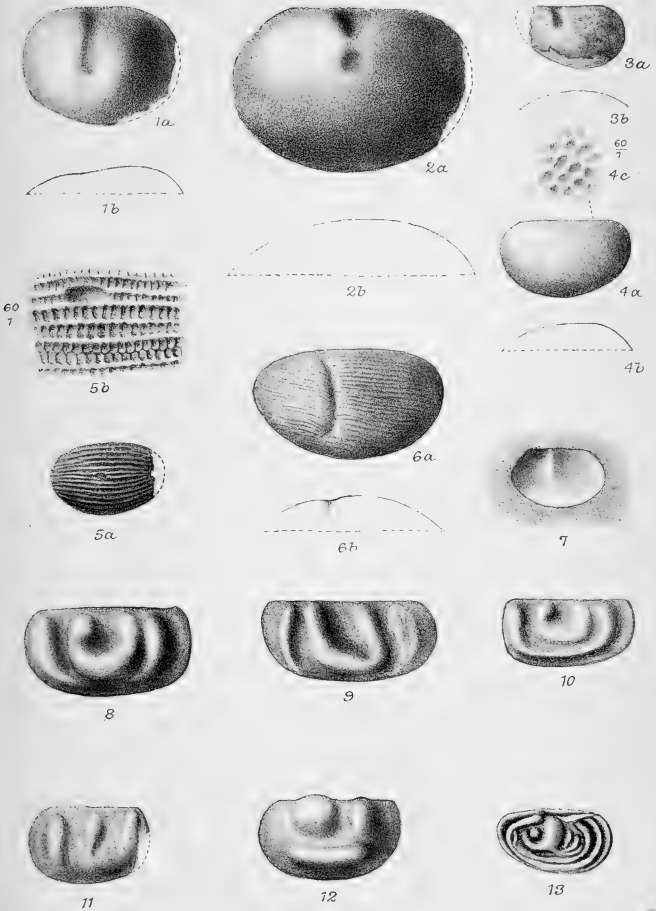








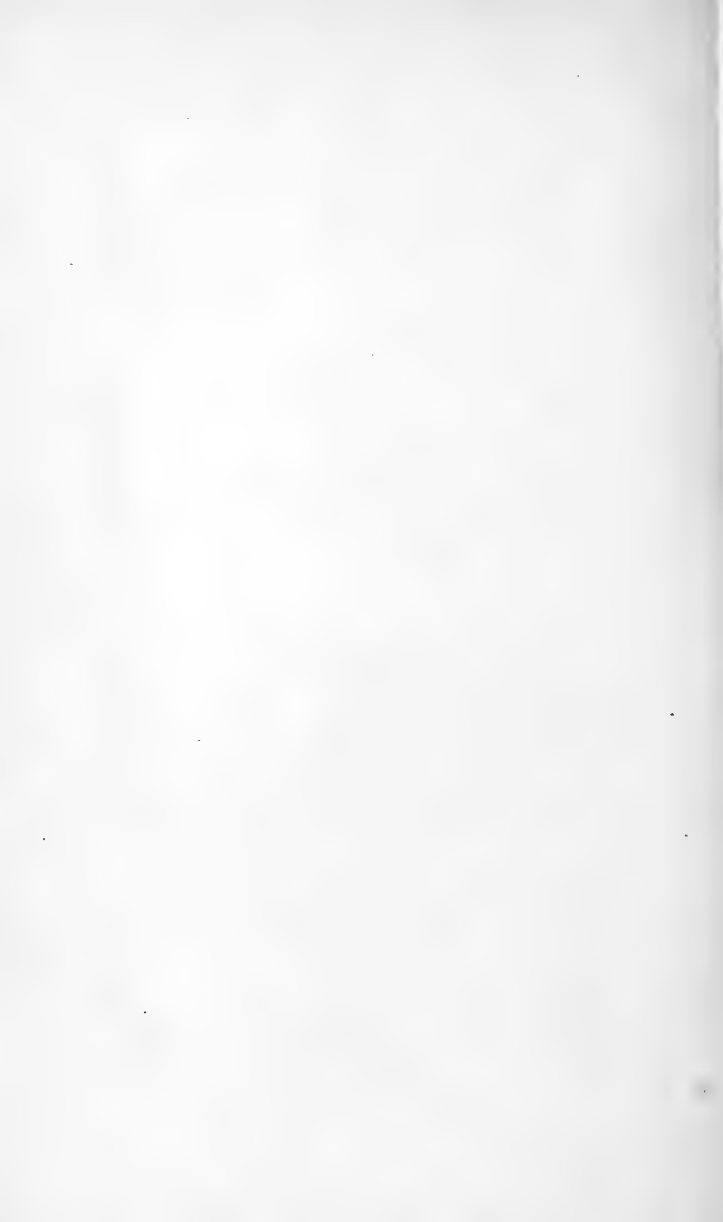




E.C. Knight del. et lith.

West, Newman imp.

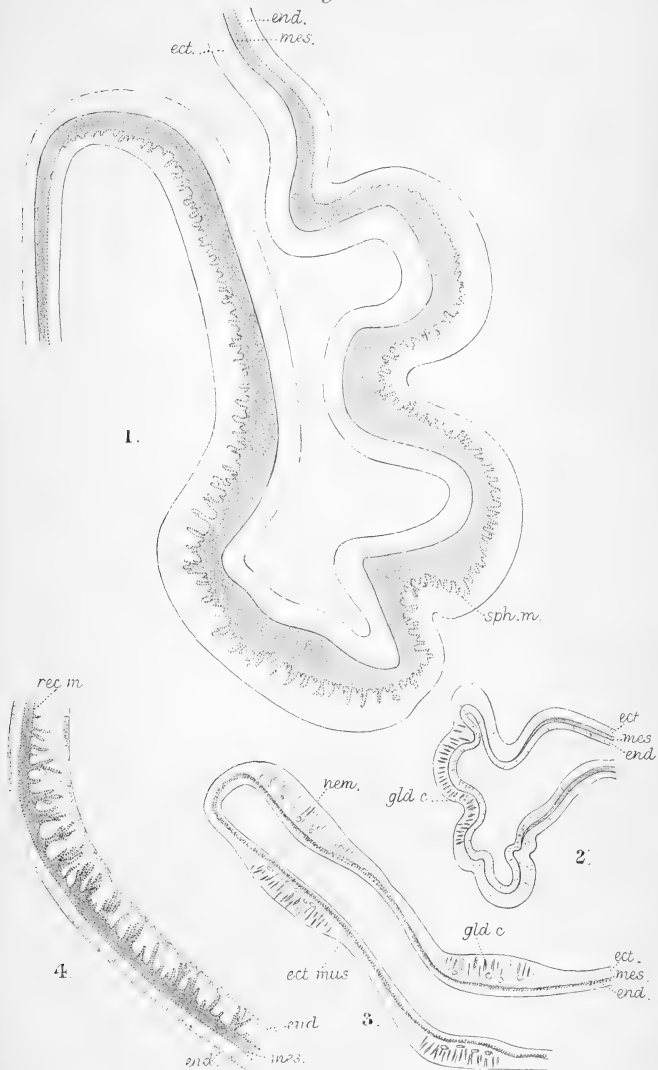
Devonian Ostracoda.





M. H. Fisher del. et lith.

Murtern Bros. imp.





1b.



1a.



1.



2b.



2a.



2.



3a.



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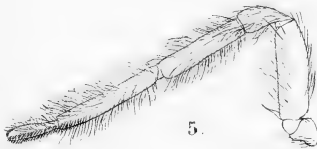


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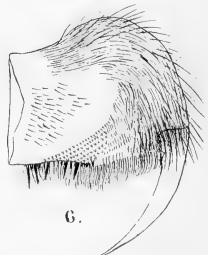
4.



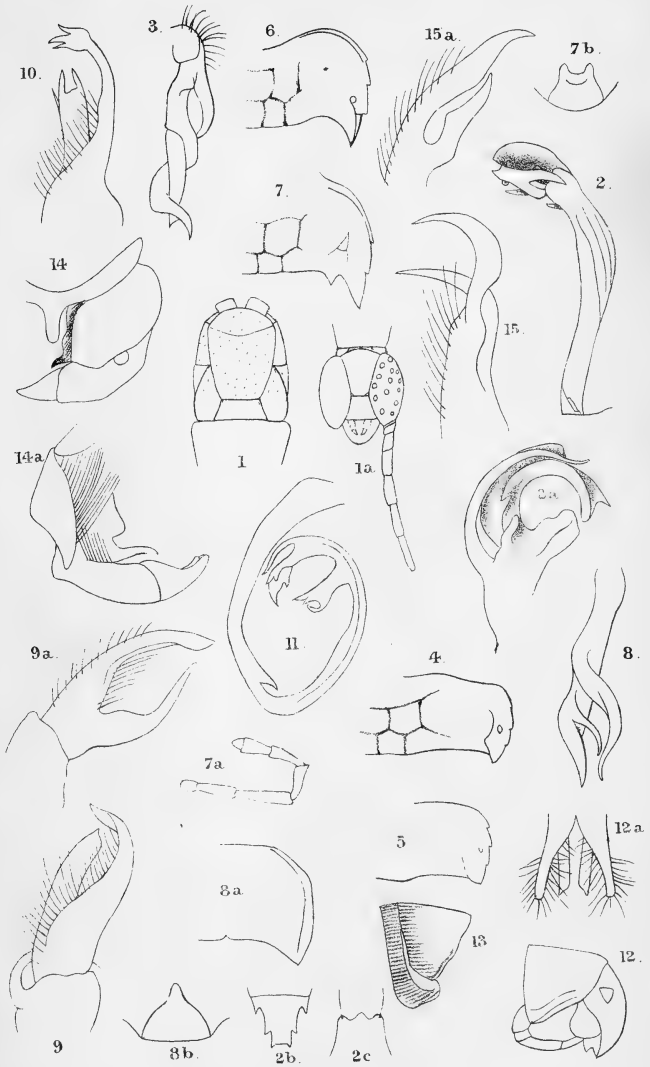
4b.

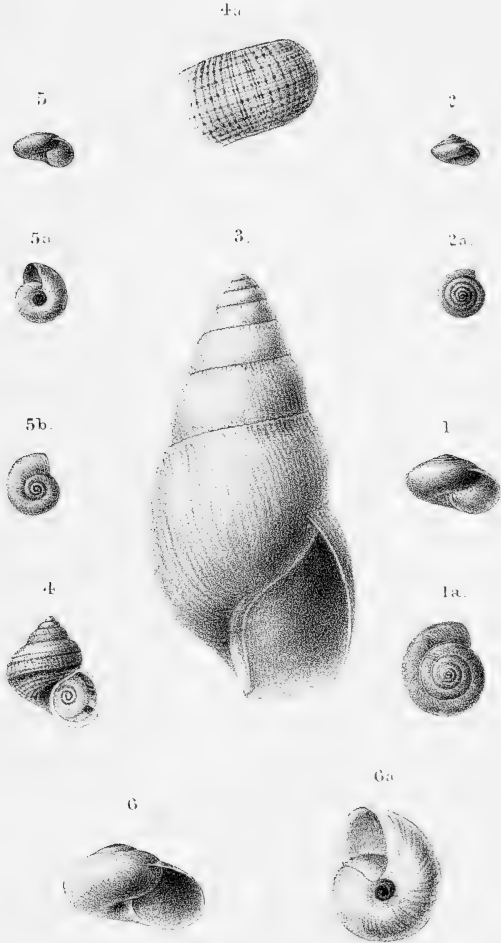


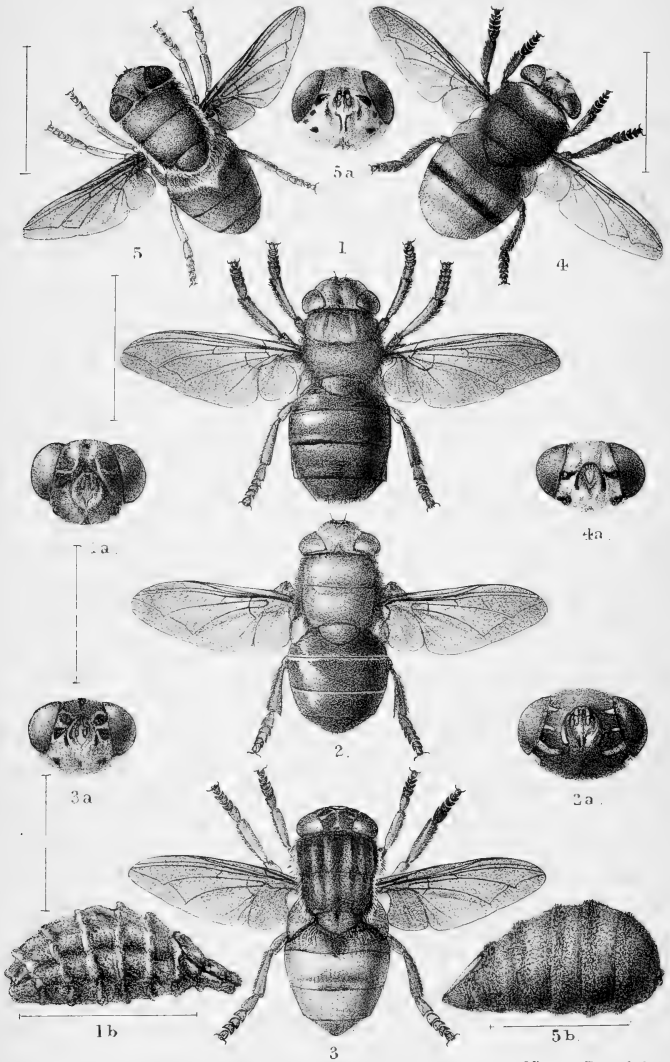
7.



6.

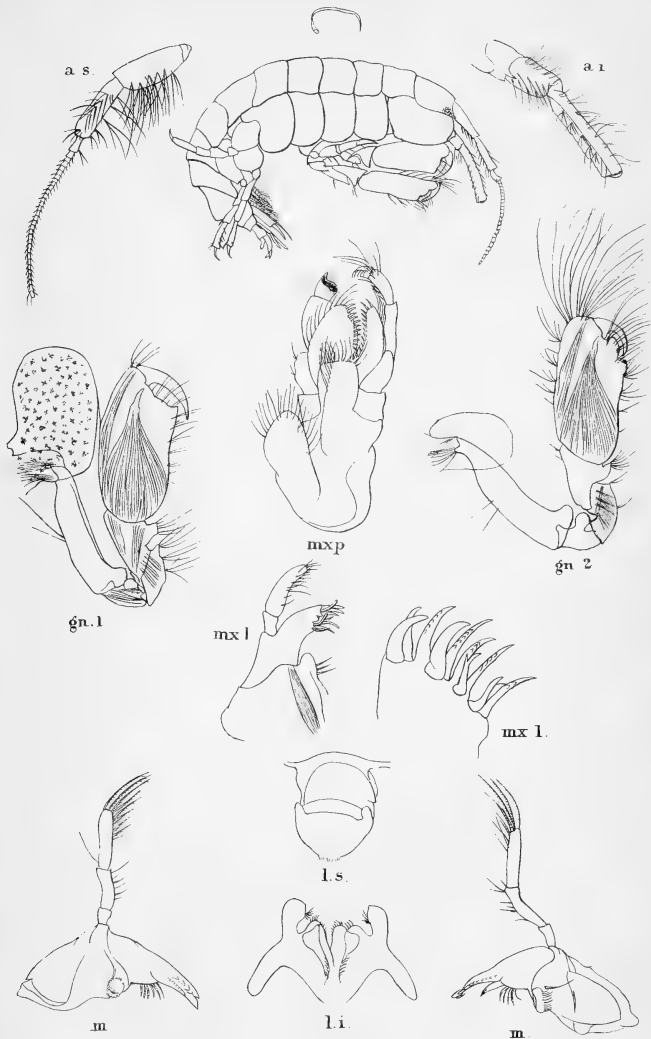






NEW SPECIES OF CUTITEREBRINAE

Mintern Bros. lith.



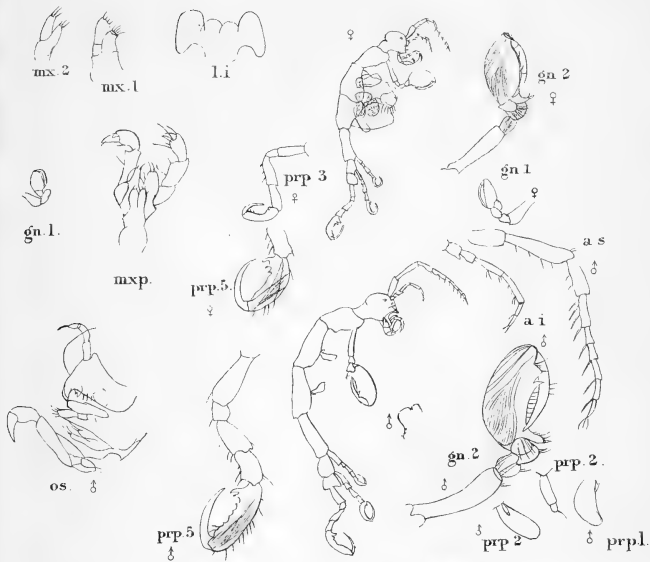
T.R.R. Stebbing del.

Mintern Bros. lith.

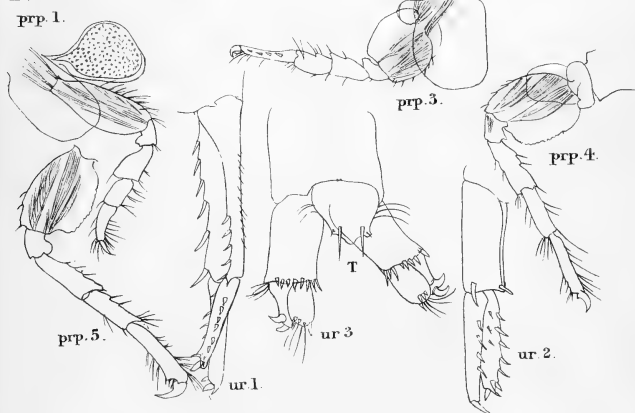
AMPHITHOE MEGALOPROTOPUS, n. sp.



A.



B.

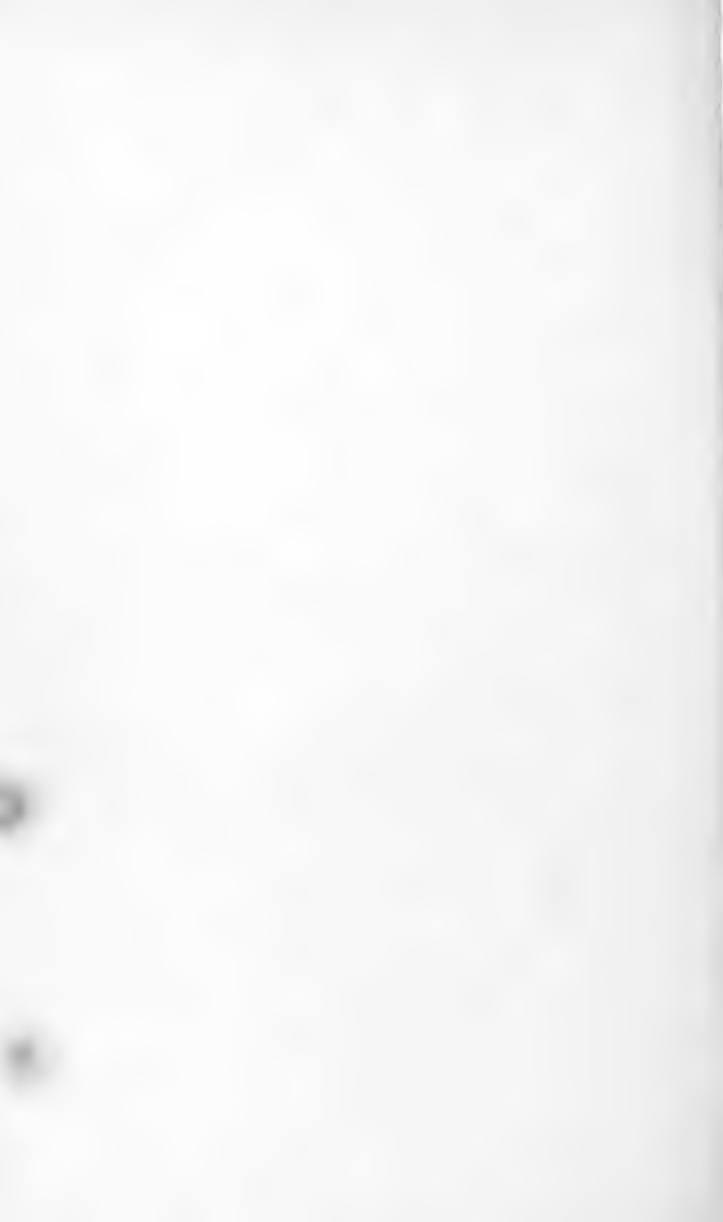


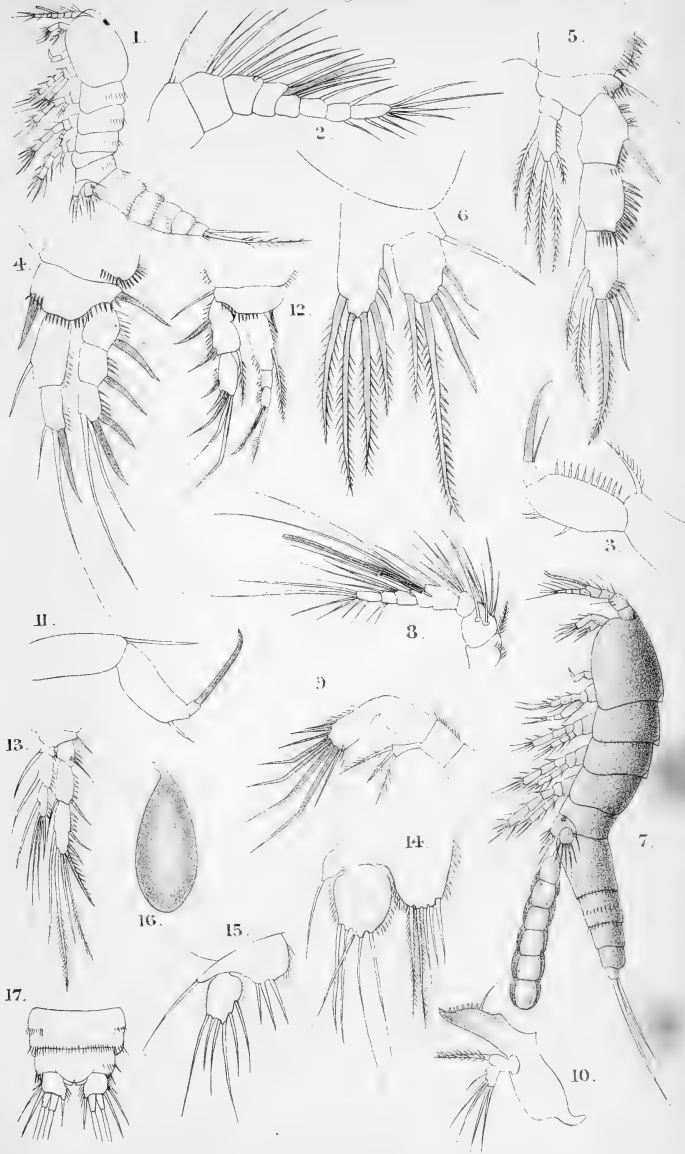
T.R.R. Stebbing del.

Mintern Bros. lith.

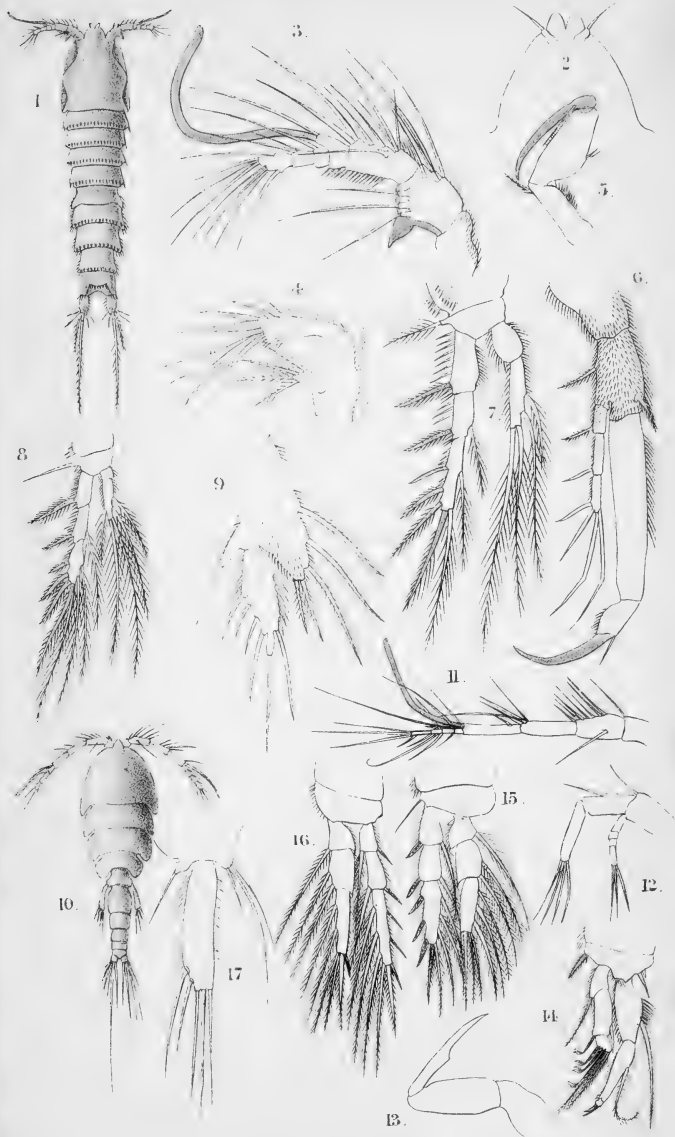
A. DEUTELLA MAYERI, n. sp.

B. AMPHITHOE MEGALOPROTOPUS, n. sp.

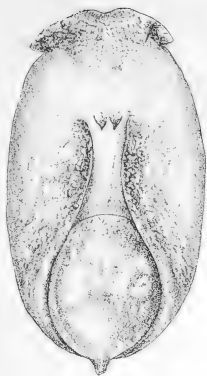




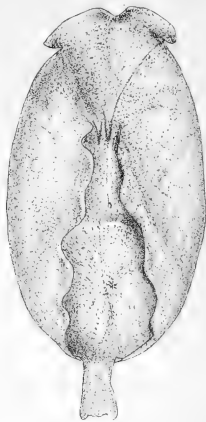
Figs 11 to 14, C. Scott del.
the others A. Scott del.



Figs 11-17. C. Scott del
the others A. Scott des.



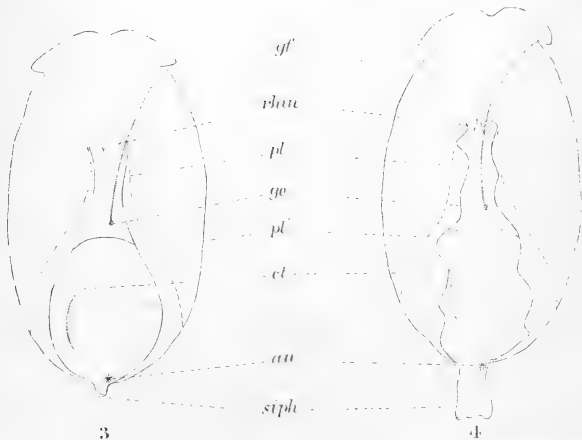
1.



2.



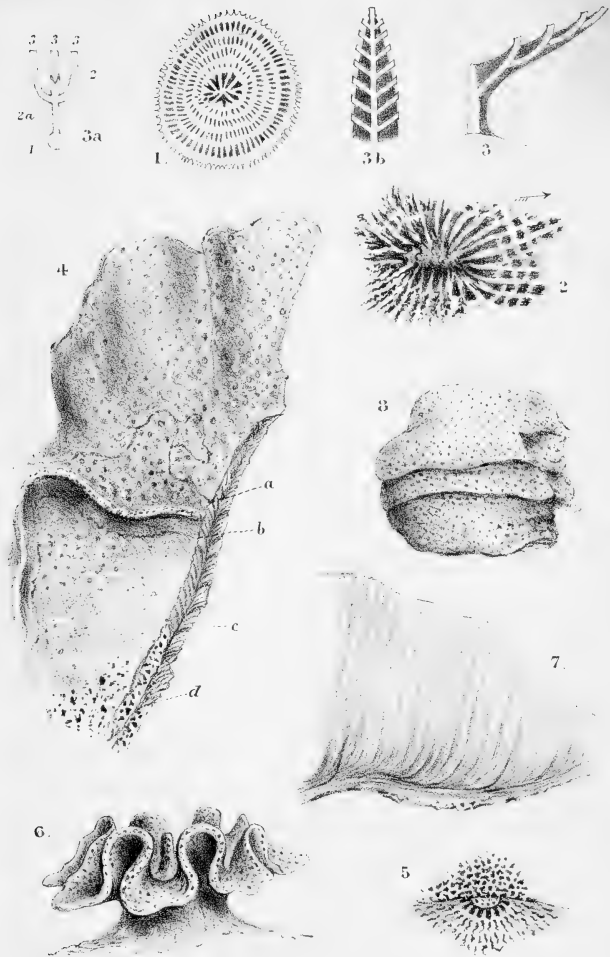
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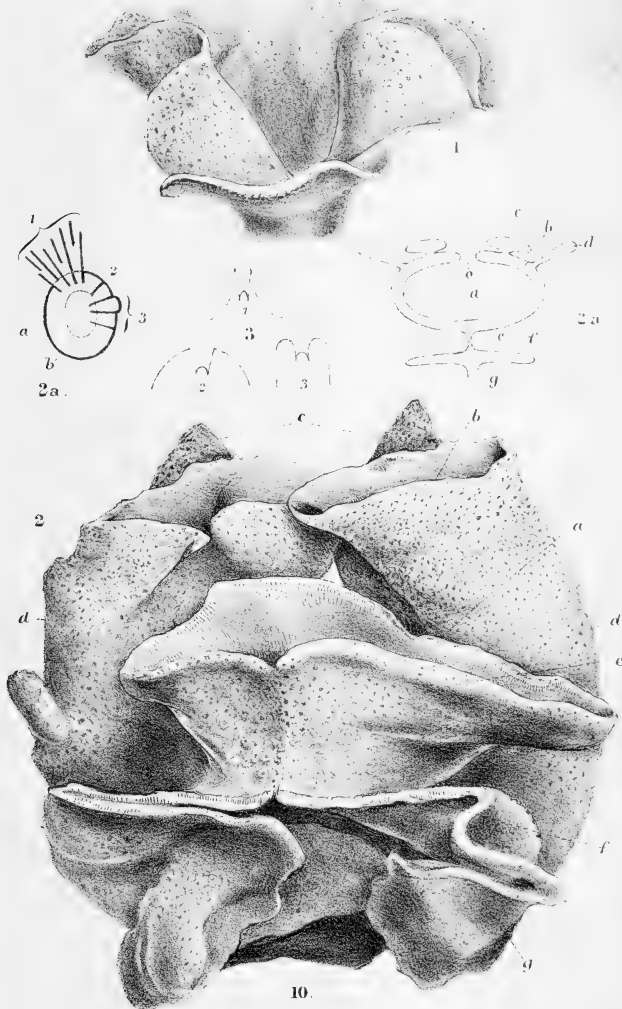
3

4

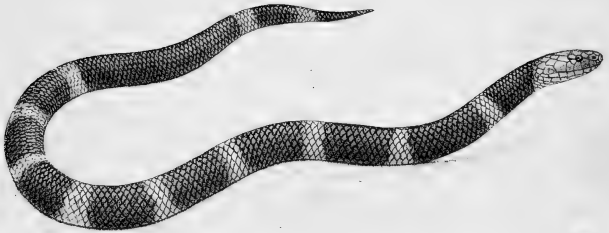












B



A

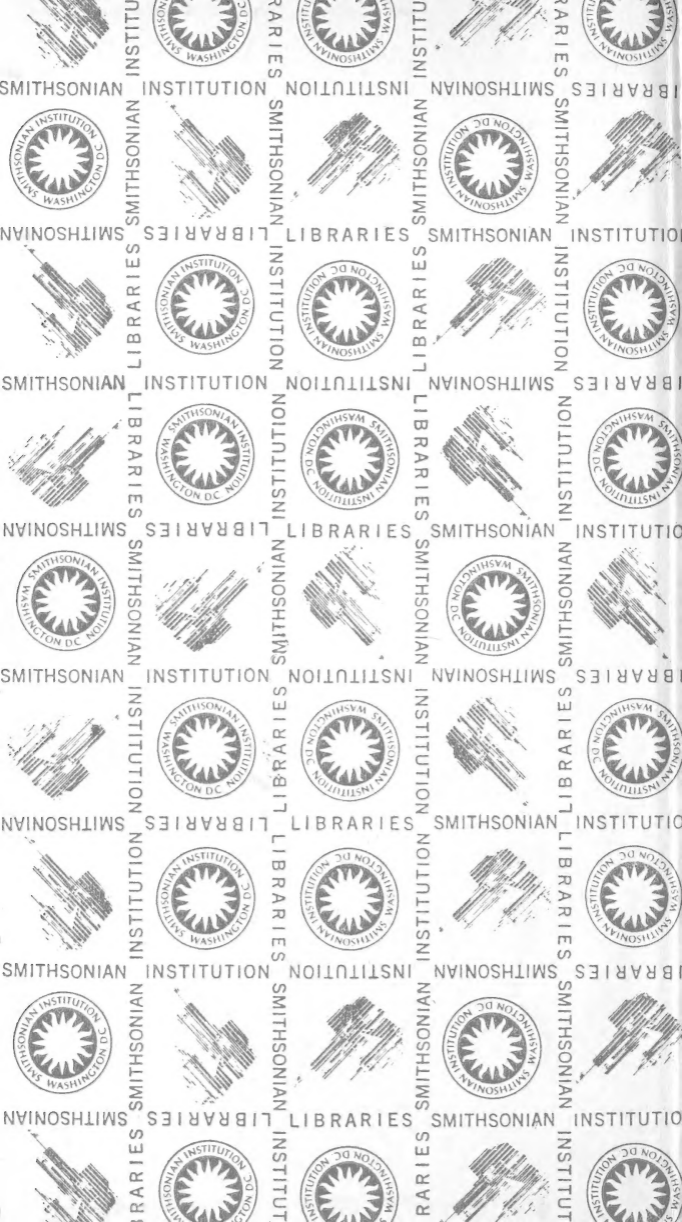


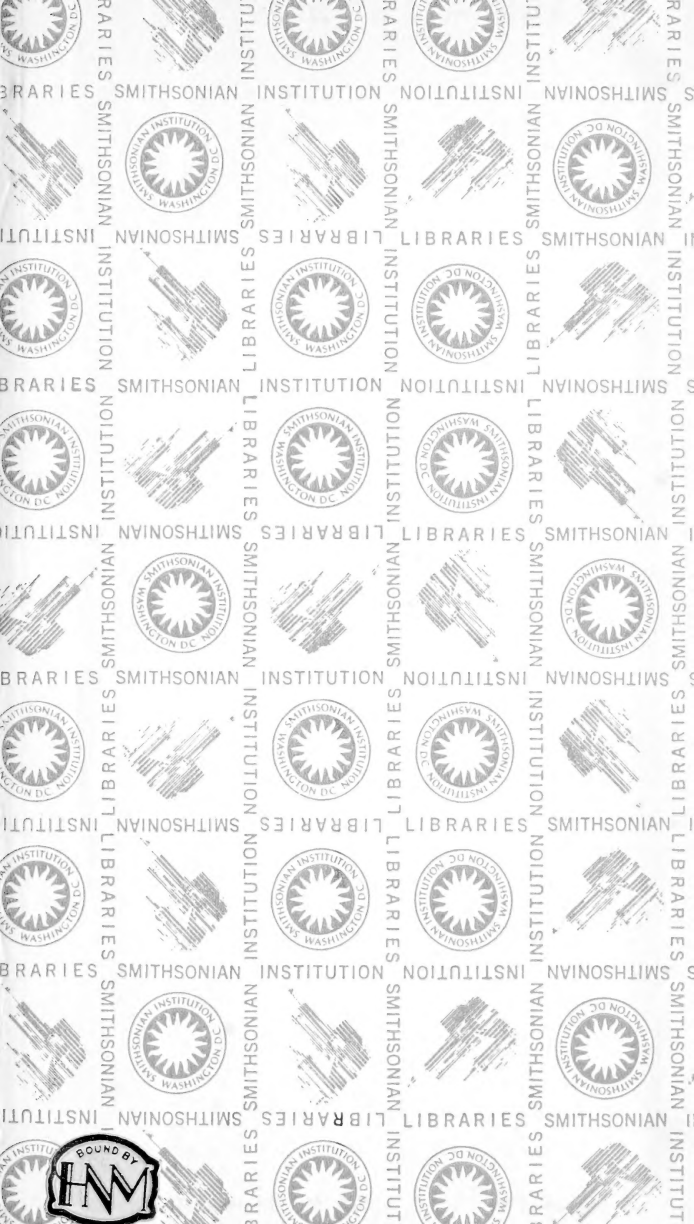
R. Mintern del et lith.

Mintern Bros. imp.

A. CHAMELEON ELLIOTI. B. CHAMÆSAURA TENUIOR
C. ELAPSOIDEA GUENTHERI, JUV.







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