12

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY,

2669

INCLUDING

13

ZOOLOGY, BOTANY, AND GEOLOGY.

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

CONDUCTED BY

ALBERT C. L. G. GÜNTHER, M.A., M.D., Ph.D., F.R.S.,

WILLIAM CARRUTHERS, F.R.S., F.L.S., F.G.S.,

AND

WILLIAM FRANCIS, Ph.D., F.L.S.

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"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 exculta; malè doctis et barbaris semper nimica fuit."—LINNÆUS.

"Quelque 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."—BRUCKNER, *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.

ALERE FLAMMAM.

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THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SIXTH SERIES.]

"................. per litora spargite muscum,
Naiades, et circùm vitreos considite fontes:
Pollice virgineo teneros hìc 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. 79. JULY 1894.

I.—*On* Lepidosiren paradoxa, *Fitzinger, and* Lepidosiren articulata, *sp. n., from Paraguay.* By E. Ehlers*.

In November 1893 Dr. J. Bohls had already reported to me from Ascension the discovery of *Lepidosiren*, and it is to his kindness that I am indebted for the opportunity of being able to scrutinize a considerable number of this fish, which is rare in our collections, and to submit some specimens of it to examination. In the following pages I give a provisional account of the observations which I have made in so doing, reserving to myself the right of making a further communication on the completion of the investigations which have been commenced †.

* Translated from the 'Nachrichten der k. Gesellschaft der Wissenschaften zu Göttingen,' 1894, no. 2: from an advance copy. The paper was submitted at a meeting of the Society held March 10, 1894.

† A synopsis of the literature on the subject of *Lepidosiren paradoxa*, Fitz., has been given by G. Baur ("Ueber *Lepidosiren paradoxa*, Fitzinger," Zool. Jahrbücher, Bd. ii. 1887, p. 575). I may supplement this by pointing out that, in the list of papers furnished by this author, the titles given under the numbers 18 and 19 belong to one and the same memoir: they are the general and special titles of a paper by Castelnau which was not accessible to Baur.

Since Dr. Bohls obtained his specimens from the neighbourhood of the River Paraguay, while the few which were collected by Natterer and Castelnau came from the region which is watered by the tributaries of the Amazon, it was impossible to overlook the question whether the fish produced by Dr. Bohls are identical with those obtained in Brazil. In order to decide this point, on the one hand I had at my disposal thirty specimens of the fish from Paraguay, while on the other I could only fall back upon the papers of Natterer, Bischoff, Hyrtl, and Castelnau.

That the animals submitted to me belong to the genus *Lepidosiren* is at once rendered sufficiently clear by their general outward appearance; the picture of the entire creature supplied by the existing figures of Natterer, Bischoff, and Castelnau proved this beyond doubt. In length alone the specimens before me fell short of those described by Natterer, who records this dimension as 3 feet and 9 lines; the largest of the fish which I measured was 72 centim. long. I was, however, informed by Dr. Bohls that, owing to the difficulties which had to be faced in connexion with the preservation and transport of the specimens, he found it impossible to bring away the large fish. The largest individuals that he saw were somewhat over 1 metre in length, and were all females; the largest male was 92 centim. long. Dr. Bohls mentioned that the living fish are much darker than the preserved specimens; they are almost black, and in consequence of a thick coating of slime are as slippery as eels.

On going into details it is soon found that the animals before me present individual differences. The larger portion of them, twenty-seven specimens in all, exhibit peculiarities which are not mentioned by any one of the describers of *Lepidosiren paradoxa*, and which render it probable that the latter fish is not identical with those before me; I consider these to be representatives of a species hitherto undescribed, and which I designate *Lepidosiren articulata*. Five other specimens, on the other hand, exhibit a structure which entirely corresponds with the description of *Lepidosiren paradoxa* given by Natterer, Bischoff, and Castelnau, to which species I consequently refer them. In accordance with Günther's explanation, I regard the species *L. dissimilis*, created by Castelnau, as identical with *Lepidosiren paradoxa*.

I will next proceed to give the dimensions of two males of almost equal size belonging to the two species:—

	L. articulata. centim.	*L. paradoxa.* centim.
Total length	57	57·5
Distance of the anus from the tip of the snout	40·1	40
Distance of the anterior margin of the eye from the tip of the snout	2·1	1·5
Distance of the posterior angle of the mouth from the tip of the snout	2·5	1·5
Distance of the branchial aperture from the same	6·5	5·3
Internal distance between the eyes	2·4	2·05
Diameter of the eye	·3	·3
Height of the branchial aperture	1	·8
Length of the anterior extremity	2·6	3·1
Height of the base of the anterior extremity	·4	·2
Thickness of the base of the anterior extremity	·2	·1
Length of the posterior extremity	3·8	4·9
Height of the base of the posterior extremity	·8	·5
Thickness of the base of the posterior extremity	·9	·3
Length of the anal aperture	·6	·6
Circumference behind the anterior extremity	15·5	14
Circumference in front of the posterior extremity	16	14

In the above figures, which have a merely conditional value, differences are seen which are distinctly expressed in the general appearance of the animals. The fact that *L. articulata* appears somewhat thicker than *L. paradoxa* may be due to differences in the state of nourishment or preservation, and is to be disregarded for the present. The differences in the head and in the appendages, on the other hand, are independent of this. The portion of the head forming the snout is shorter in *Lepidosiren paradoxa*, and is more decidedly conical than in the case of *L. articulata*; the distance of the eye and of the posterior angle of the mouth from the tip of the snout is smaller in the former than in the latter; in *Lepidosiren paradoxa* the posterior circumference of the eye lies almost above the posterior angle of the mouth, while in *L. articulata* it lies somewhat in front of it. A line drawn from the anterior circumference of the eye horizontally towards the margin of the snout meets this in the case of *L. paradoxa* at the sloping lateral portion, and is equal in length to four times the diameter of the eye, while in *L. articulata* it impinges upon the broad anterior margin of the snout and is six times as long as the diameter of the eye. Owing to the greater distance of the branchial aperture from the tip of the snout, the entire cephalic portion of *L. articulata* appears longer than that of *L. paradoxa*. The occipital region in the latter is more strongly arched than in *L. articulata*; the profile of *L. paradoxa* consequently makes a more marked descent towards the tip of the snout than does that of *L. articulata*, whereby the head of *Lepidosiren paradoxa* acquires the sharper conical form which is seen in the figures of Natterer, Bischoff, and Castelnau. This is especially evident if the heads of the two fishes are compared together when looked at from above. *Lepidosiren paradoxa* then appears to have a pointed snout, since the portion of the head lying in front of a line connecting the eyes is sharply conical, while the less narrowed snout of *L. articulata* is bluntly rounded. These differences in the shape of the head, which are occasioned by the conditions of the skeletal parts, are accordingly to be regarded as constant.

The measurements quoted above show a difference between the two species in the size of the extremities, the posterior of which exhibits a sexual dimorphism in each case. But no great value is to be attributed to these differences, since the size of the extremities appears to vary, and is influenced by injuries which afterwards heal up. The extremities of *Lepidosiren paradoxa* are in general longer and more slender than those of *L. articulata*; in both species the posterior appendage is stronger than the anterior, and in it the difference between the two species is especially evident, since in *L. articulata* it is generally stouter than in *Lepidosiren paradoxa*, in which it is of a slender conical shape. The anterior extremities of *Lepidosiren articulata* were generally flattened and furnished with a slight marginal border. This was not so strongly marked in those of *Lepidosiren paradoxa*. The posterior extremities of the males of *L. articulata* are longer and thicker than in the females of the same species, and also are probably thicker than those of *L. paradoxa*. What is more striking than anything else, however, is that while in the females of *L. articulata* the posterior extremities are perfectly smooth, as they are also represented in the figures of the female of *Lepidosiren paradoxa*, in the case of the male animals these appendages bear upon the median and dorsal region a thick growth of close-packed pale-coloured papillæ, of a flattened leaf-shaped form, which are set in tufts upon a common base. These papillæ were most strongly developed in the largest specimens, where they formed a thick brush-like coat, which, with the exception of a short basal area, extended over the entire length of the appendage. In other specimens only a median portion of the extremity was covered by the papillæ, and in smaller examples I found that merely a low fringe of them was present. The male *Lepidosiren paradoxa* likewise exhibits these structures, which vary in the extent to which they are developed, just as in *Lepidosiren articulata*; the leaf-like form of the papillæ, however, is not so pronounced, and they are more filiform in shape. Since no mention is made of a similar equipment in the case of the posterior appendage of the female of *Lepidosiren paradoxa*, which was previously examined, we are probably justified in taking it for granted that in the case of this species also a sexual character is herein displayed.

The unpaired fin-membranes agree in the two species, and are disposed in the manner previously recorded for *Lepidosiren paradoxa.*

The distance of the anus from the tip of the snout is nearly the same in the examples measured; the position of the anus, on the contrary, is strikingly variable. Bischoff and Castelnau figure it as situated upon the left side of the body to the side of the median plane. In the animals before me the anus occupies this position in the case of eleven males of *Lepidosiren articulata*, while in twelve males and two females it lies upon the right half of the body. In their figures of *Lepidosiren paradoxa*, Natterer, Bischoff, and Castelnau show the anus upon the left side of the body in the female, while I met with it lying on the left in three males, and in two others, on the contrary, on the right. The position of the anal opening is consequently variable, and is not to be regarded as of any value for the purposes of specific diagnosis, nor probably even as a sexual character.

The epidermis of the two species shows a difference which appears to me to be characteristic. In *Lepidosiren paradoxa* the coat of scales is distinctly visible, and upon the head can be traced right towards the front; it is remarkable that in the cephalic region the edges of the scales are directed anteriorly, as has, moreover, been represented by Natterer; towards the ventral side the scales diminish in size. In *Lepidosiren articulata* the coat of scales is covered, and to an equal degree in the two sexes, by a very much stouter epidermis than in *Lepidosiren paradoxa*; the outlines of the individual scales are consequently very much less distinct; corresponding with the coat of scales the surface of the trunk is covered with more or less regularly intersecting furrows and wrinkles, while the head and also the tail, as well as the unpaired fin-membrane, are perfectly smooth. Specimens were nevertheless met with in which the surface of the body was smooth almost throughout. I should be inclined to regard this difference as not being specific, but as one rather to be ascribed to conditions of preservation, if all five specimens of *Lepidosiren paradoxa* had not therein presented a striking contrast to the remaining examples of *Lepidosiren articulata*.

The colour of *Lepidosiren articulata* is for the most part a uniform slate-grey; in the case of *Lepidosiren paradoxa*, especially in the anterior region, and particularly upon the ventral surface, a spotted appearance is noticeable, since the marginal portions of the scales are darker than their centres. I have also seen similar markings upon one specimen of *Lepidosiren articulata* which displayed dark spots arranged in rows upon the ventral surface. The specimen of *Lepidosiren paradoxa* dissected by Hyrtl was similarly marked.

In the examples of *Lepidosiren paradoxa* before me the system of the lateral lines is not distinctly recognizable; it is so much the better to be seen in a female *Lepidosiren articulata*. Upon the trunk two lateral lines are present, both of which run from the head to beyond the anus on to the tail, while the lower one is continued for more than half the length of the latter. The upper line lies approximately upon the lower margin of the upper fourth, the lower one upon the upper margin of the lower fourth of the total height of the fish; the upper line is situated in some specimens in a sunken groove. Each line is frequently interrupted and composed of sometimes longer, sometimes shorter, portions. From each line there arise at right angles and at equal distances one behind the other, which seem to me to correspond to the metamerism of the trunk, short lateral branches, which run towards the dorsal and ventral median lines, while part of them also exhibit short processes which pass across the main stem in the opposite direction; on the right side of the body I counted nine such lateral branches on the lower line, and on the upper one only eight; on the left side of the body they were much less distinctly visible. The system of lines upon the head corresponds in its general features to what is represented in the existing figures of *Lepidosiren paradoxa*; the description of the details of its arrangement must be reserved until a future occasion, when it will be accompanied by illustrations. I distinguish an opercular arch, with which the lower lateral line inosculates, and the curve of which extends backwards to the level of the branchial cleft; a mandibular arch, which runs close beneath the margin of the lower jaw, embracing the angle of the mouth; and an orbito-nasal arch, which is in connexion with the superior lateral line, surrounds the eye with a tortuous line above and below, and terminates in an anteriorly-directed curve upon the front end of the nasal sac. All of these lines are more or less interrupted. In the centre of the occipital region short transverse lines are seen running at nearly equal distances one behind the other. In each portion of the lateral lines there can be seen with the aid of a lens small white flecks equidistant one from another upon a dark ground; these are manifestly the nerve-end-structures. The scales which lie upon the lateral lines are not perforated; the line runs in the anterior portion of the integument, from which the free part of the scale penetrates inwards.

A difference between the two species, which is probably of importance, is presented by the anterior olfactory apertures. In the existing figures showing these in *Lepidosiren paradoxa* they are represented as transversely oval openings lying close together. This agrees with the condition which I find in the fish considered by me to belong to this species. In *Lepidosiren articulata*, on the contrary, the anterior nasal apertures are separated by a triangular process, which runs between them from the margin of the upper lip into the cavity of the mouth; the nasal aperture is circular, and at its anterior margin there is situated a conical papilla. However, I also find a flat papilla in the case of *Lepidosiren paradoxa.*

The skull of *Lepidosiren articulata* exhibits but trifling deviations from the figures given by Bischoff and Hyrtl. I shall give a representation of it later on. The five cartilaginous branchial arches lie freely on each side in the œsophageal wall, without being connected one with another by means of a copula or being joined to the skull; this confirms the statements of Hyrtl with regard to the branchial arches of *Lepidosiren paradoxa.*

The vertebral column of *Lepidosiren articulata* possesses fifty-five pairs of ribs, which agrees with the number given by Bischoff for *Lepidosiren paradoxa.* The end of the vertebral column runs out into a point, with uniform reduction of all parts to form the monocercal tail. The figure which Bischoff has given of the termination of the caudal vertebral column of *Lepidosiren paradoxa* was very probably derived from an animal which had lost and incompletely regenerated the tip of its tail; in this manner the abrupt termination of the posterior end of the notochord there represented is explained.

The results obtained from the study of the skeleton of the limbs are of special importance. The arches in both of the species before me correspond to the figures given of them in the case of *Lepidosiren paradoxa.* In the specimens which I assign to this species the skeleton of the appendages is likewise a simple unsegmented cartilaginous rod. In *Lepidosiren articulata*, on the other hand, this portion of the skeleton is distinctly segmented, and that, too, in the case of the anterior as well as the posterior limb; the segments are largest in the basal part, and diminish in size towards the tip. In the case of the male of this species the basal segment in the posterior limb is strikingly enlarged and slightly bent; the terminal joints which succeed it are small, and, taken together, convey the impression of a jointed ray situated upon a larger basal segment. This peculiar condition must, however, be tested by the examination of a larger series of specimens, since in the individual instance in question the structure may be due to an injury which has afterwards healed.

With regard to the internal organization, I am at present only able to state that the faveolate connective tissue figured by Hyrtl as existing in the anterior portion of the body occurs at a similar spot in *Lepidosiren articulata*, but is also found in the posterior region outside the peritoneum. I am inclined to suspect that the tissue in question constitutes lymphatic sacs.

The appearance of the organs lying in the body-cavity of the female of *Lepidosiren articulata* does not seem to me to agree with the figure given by Hyrtl. The ovaries, which are apparently metamerically constricted, are enveloped longitudinally in a fold of yellow fat, and thus remind the observer of the similarly situated testes of the male animal. The difference between what I have observed and Hyrtl's representation is, however, probably a physiological one. It is to be presumed that the specimen dissected by the distinguished Viennese anatomist was a female at the period of complete sexual maturity, in which the fatty masses had disappeared, while the animal which I opened possessed ovaries which were far from being mature, but had stored-up masses of fat instead.

For the present we arrive at the following diagnoses for the two species:—

Lepidosiren paradoxa, Fitz.

Coat of scales distinct; snout conical; nasal apertures transversely oval; limbs with unsegmented cartilaginous axis.

Lepidosiren articulata, sp. n.

Coat of scales more or less concealed by thick epidermis; head and snout longer than in *L. paradoxa*, bluntly rounded off in front; nasal apertures circular, with conical papilla; limbs with segmented cartilaginous axis.

II.—Scarabæidæ *in the British Museum.—A Sixth Contribution.* By CHARLES O. WATERHOUSE.

Onitis inuus, Fabr.

Fabricius described two species by the name *Scarabæus sphinx*, and to the earlier of these he afterwards gave the name *inuus*. Harold, in the Munich Catalogue, has retained the name *sphinx*, placing *inuus* as a synonym, and has been followed in this by M. Lansberge, in his "Monograph" (Ann. Soc. Ent. Belg. xviii. p. 89). The types (♂ ♀) of this earlier species are in the Banksian collection under the name *inuus*, and from the figures given by Olivier I feel sure that these specimens are those from which the drawings were made. The male is *not* the species described as *sphinx* by Lansberge, as there is no trace of the spine behind the anterior femora. It has the uniform bronzy-green colour of *O. shoënsis*, Reiche. The elytra are moderately strongly crenate-striate, with no crenulation within the marginal carina. The clypeal ridge is very short and is a trifle nearer to the frontal ridge than to the anterior margin; the clypeus itself is rather finely punctured, and is not granular as in many allied species. The thorax is strongly punctured, but has a smooth median line. The anterior femora have a small tooth (emarginate at its apex) below on the anterior margin beyond the middle. The anterior tibiæ are quadridentate, and have five tubercles below. The intermediate femora are unarmed. The posterior femora have a strong, triangular, acute-pointed tooth beyond the middle. The metasternum is nearly smooth and is not channelled.

The only specimen in the Museum collection which agrees well with the type is one from Lake Nyassa; this differs from the type only in having some slight crenulations within the lateral carina of the elytra near the apex; but this is much less on one side than on the other, and no doubt is a variable character.

The type female of *O. inuus* is quite a different species, and, as will be seen from Olivier's figure, is pubescent below. This I have determined from Lansberge's Monograph to be *O. confusus*, Bohem., ♀.

Onthophagus crassus, Sharp.

Dr. Sharp describes this species from Laos and Cambodia, and throws doubt on the habitat "Java" borne by the Dejeanian example. The British Museum Collection has two specimens of this species from Java.

Onthophagus quadripustulatus, Fabr.

The Fabrician type of this species is in the Banksian collection in the British Museum; it is 4 millim. long, very shining black, with four red spots on the elytra; the head has two slight oblique tubercles on the vertex and a fine transverse scarcely raised frontal line, the space between these very delicately and obscurely punctured; the thorax is very convex, very finely punctured, the punctures separated from each other by about three diameters of a puncture; the elytra are very distinctly punctured, the punctures in the striæ rather large and separated from each other by about a diameter and a half.

A specimen of this species has just been received from North-west Australia, collected by Mr. J. J. Walker. A female example, also from North-west Australia, differs from the male in having the thorax a trifle more distinctly punctured; the tubercles on the vertex of the head are less raised and are transverse; the frontal line is more raised, and there is a very slight tubercle behind this.

O. rubrimaculatus, M'L., is a much larger insect, "2½ lines long," from East Australia, and, if the Museum specimens are correctly named, has rather dull elytra.

Another species closely resembling the true *O. quadripustulatus* occurs at Port Bowen. It is not quite so short as that species, the thorax is not quite so broad and has the punctures more separated, the space between the ridges on the head is distinctly punctured, and the sides of the thorax are beset with short hairs. I propose to call this

Onthophagus Fabricii, sp. n.

Niger, nitidissimus; capite cupreo-æneo tincto, clypeo leviter emarginato crebre sat rugoso-punctato, carina antica recta, postica retrorsum angulata; thorace subtiliter minus crebre punctulato, marginibus parce setosis; elytris distincte striatis, striis evidenter punctatis, interstitiis leviter convexis lævibus, macula humerali, marginibus, maculaque apicali rufis, femoribus piceo-rufis.

Hab. East Australia, Port Bowen.

Onthophagus declivis, Harold.

Onthophagus declivis, Harold, Col. Hefte, v. p. 85.

This species was described by Harold in 1869. In 1871 Mr. M'Leay described *O. desectus* (Tr. Ent. Soc. N. S. W. ii. p. 182). In 1872 Harold (Col. Hefte, x. p. 210) refers *O. desectus* to *O. declivis*, but gives no reason for this determination; and I think this synonymy must be received with caution. Harold describes *declivis* as having *dull* elytra; M'Leay describes *desectus* as "nitid," the elytra as smooth, and I think it very possible that his species may be distinct from *O. declivis*; at any rate, there are in the Museum collection two closely allied species which differ in one having dull and the other shining elytra, as well as in the sculpture of the thorax, &c.

Onthophagus rupicapra, sp. n.

Ater, opacus, convexus: thorace granulis nitidis crebre sparsis; elytris striatis, striis bene impressis subtilissime discrete punctulatis, interstitiis convexis, subtiliter parce punctulatis, punctis setigeris; pygidio parce obsolete punctulato.

♂. Capite nitido, granuloso, clypeo medio triangulariter inciso, sub-bidentato, utrinque obtuse angulato; vertice cornibus duobus sat gracilibus (ad basin non conjunctis) acuminatis, vix divaricatis, ad apicem retrorsum curvatis; thorace antice declivi, flavo-testaceo-piloso, parte elevata medio longitudinaliter leviter sulcata, antice tuberculis duobus parvis obtusis instructa.

Long. 9 lin.

Hab. Swan River.

I place this species near *O. adelaidæ*, Hope. It is a somewhat singular species on account of the rather long slender horns, which are curved backwards over the thorax. The thorax has its basal part much raised, and the front declivous part is clothed with rather long soft pubescence. The minute shining granules are rather close together in the front part, but almost disappear on each side of the base.

Onthophagus Duboulayi, sp. n.

Obscure purpureo-cupreus, sat opacus; clypeo medio triangulariter inciso, sub-bidentato, utrinque obtuse angulato; thorace sat crebre sat fortiter punctato; elytris nitido-striatis, striis discrete subtiliter punctatis, interstitiis parum convexis parce subtiliter punctatis.

♂. Capite nitido, antice crebre subtiliter punctulato, postice sublævi, vertice cornibus duobus erectis (ad basin non conjunctis) linearibus, sat distantibus, paullo divaricatis, ad apicem paullo introrsum curvatis; thorace postice bene convexo, medio leviter obtuse sulcato, antice declivi subnitido, subtiliter punctulato, utrinque lævissime late impresso.

Long. $3\frac{1}{4}$ lin.

Hab. West Australia (*Du Boulay*).

Allied to *O. adelaidæ*. The horns on the head are of nearly equal thickness throughout and blunt at the apex;

they are widely separated at their base. The punctures in the striæ of the elytra are small and widely separated from each other.

Onthophagus nanus, sp. n.

Oblongo-ovatus, sat depressus, niger, opacus, subtus purpureo tinctus nitidus; capite crebre punctato, clypeo sat late triangulariter emarginato; thorace confertim sat fortiter punctato, æquali, subnitido; elytris evidenter striatis, striis nitidis parce subtiliter punctulatis, interstitiis suturalibus parum convexis obsolete subtilissime punctulatis, lateralibus nitidis punctatis; tarsis piceis.

♂. Capite nitido, cuprescenti, vertice carina bene elevata apice arcuatim emarginata, clypeo subtiliter punctulato.

♀. Capite minus nitido, vertice carina parum elevata retrorsum angulata, clypeo carina fere recta, clypeo creberrime sat fortiter punctato.

Long. $2\frac{1}{4}$–$2\frac{1}{2}$ lin.

Hab. East Australia, Sydney.

Somewhat the appearance of the European *O. ovatus*, but with the thorax much more closely and rather more strongly punctured; rather more convex, with scarcely any trace of longitudinal impression. The elytra are dull; the first and second interstices are nearly flat, with a few indistinct punctures; the third has a slightly raised central line, which is punctured, and each of the following interstices has this line more distinct, more shining, and more punctured, until the lateral interstice is entirely shining, convex, and closely and rather strongly punctured.

The male has the clypeus rather closely and delicately punctured, the forehead still more delicately punctured, the ocular canthus more strongly punctured.

The female has two raised transverse lines, the one on the vertex angulated; the punctuation is much stronger than in the male and more uniform.

A single specimen, which is probably an undeveloped male, has the punctuation of the head as in the female; the carina on the vertex is also like that of the female, but there is no anterior raised line.

III.—*Two new* Coccidæ *from the Arid Region of North America.* By T. D. A. Cockerell, Entomologist to the New Mexico (U. S. A.) Agricultural Experiment Station.

The arid region of Western North America has not been well explored for Coccidæ, but it is already known to support about a dozen species of these insects found nowhere else. Moreover, the only genus (*Cerococcus*, Comstock) considered peculiar to the Nearctic Region comes from the arid portion of it; while *Tachardia*, *Prosopophora*, and *Lecaniodiaspis* are restricted to the arid portion so far as America north of Mexico is concerned.

Last year I found in the State of Chihuahua, Mexico, a peculiar Coccid, which I made the type of a new subgenus (*Ceroplastodes*) of *Fairmairia*. It was then questionable whether *Ceroplastodes* should not be considered a valid genus, and I now propose so to regard it, having a new species referable to it to announce. *Fairmairia* must be regarded as monotypic and restricted to Europe.

Ceroplastodes daleæ, sp. n.

Adult ♀.—Scales numerous on the twigs, snow-white, 3 millim. long, 2⅓ wide, 2 (or slightly over) high. Glassy but opaque, with posterior orifice as in *C. niveus*. Rough, with strong prominences, irregularly placed, but running in an antero-posterior direction. The outline of the scale, as seen from either end, may present six prominences, but this is variable; the two dorsal ones are the largest. After boiling in caustic soda the female is pale brownish; the margin with a few short, rather thick spines.

Tibia very little longer than tarsus; a little shorter than tarsus + claw. Tibia with three bristles near its distal end—two on the inner side, one on the outer. Tarsal knobbed hairs rather stout, but with obscure knobs; extending as far as end of claw. Claw large, moderately curved; digitules small and ordinary.

Antennæ seven-jointed: joint 2 shortest, then 6 and 7; 4 almost or quite as long as 3, 5 nearly as long as 4. Formula 3 (41) 5672, but one might almost as correctly write (3415) 6 (72). Last joint rounded, with many short hairs.

Other specimens indicate some variation in the antennæ; joint 7 may be a little longer than 6, 4 may be even a little shorter than 5 and only about as long as broad.

Young elongate, not keeled, shiny, rugose, reddish brown, longitudinally flattened, but transversely decidedly convex, somewhat less than 1 millim. long.

These young individuals are observed on the leaves, mostly stationary, but sometimes crawling.

Larvæ taken from under the female scale are (in soda) crimson, elongate; with distinct caudal tubercles, each emitting two short bristles or hairs and the usual caudal seta, which is not quite so long as half the greatest diameter of the larva. There are also six short bristles proceeding from the region of the anus.

Antennæ six-jointed: joint 2 shortest, 3 longest; 4, 5, and 6 subequal, but of these 6 is a little the longer.

Hab. On *Dalea formosa*; this plant kindly identified for me by Prof. E. O. Wooton. The scales were discovered on the Little or Tortugas Mountain, in the Mesilla Valley, New Mexico, on the occasion of a meeting of the New Mexico Agricultural College Field Club, May 12th, 1894. Although the plant is very common all over the mountain, I found the scales only on two plants, but on these they abounded.

The species is entirely distinct from *Ceroplastodes niveus*, though clearly congeneric with it.

Lecanium phoradendri, sp. n.

Adult ♀.—Length $3\frac{1}{2}$ millim., breadth $3\frac{1}{4}$, height 1. Almost exactly circular in outline, flattened, only moderately convex, shiny, moderately wrinkled and pitted. So dark brown as to seem black, varying to lighter brown, with a broad dark brown ring and a dark brown elongated central patch. Immature specimens are greenish.

Lecanium phoradendri in situ, nat. size.

After boiling in soda the female appears brownish, with a conspicuous broad pale margin; derm granulose; margin with few very small spines; lateral incisions with one large blunt spine and a rudimentary one. Anal plates broad, together forming a square. Lower lip two-jointed.

Coxa with a long hair; trochanter with a long hair. Tarsal knobbed hairs ordinary, but unequal, one longer and stouter than the other.

Claw small; digitules ordinary, well-knobbed, extending beyond claw.

Antennæ seven-jointed: joint 3 longest; 4 and 2 about equal, or 4 perhaps a little the longer; 5, 6, and 7 subequal, but 7 shortest; a false joint in distal half of 3; 2 and 4 each emitting a long hair on inner side. Last joint with several hairs.

♂ *scale.*—Glassy, ordinary, 2 millim. long, 1 broad.

Hab. On *Phoradendron*, in Arizona; sent from Tucson, Arizona, by Prof. J. W. Toumey. The scales are abundant both on the leaves and stems in the specimen sent.

This makes the third Coccid believed to be found on ly on Loranthaceæ; the others are *Diaspis visci*, Schr., on *Viscum*, in Europe, and *Pulvinaria dendrophthoræ*, Ckll., on *Dendrophthora*, in Jamaica.

Las Cruces, New Mexico, U.S.A.,
May 1894.

IV.—*On a Small Collection of Odonata (Dragonflies) from Queensland, with Descriptions of Five new Species.* By W. F. Kirby, F.L.S., F.E.S., Assistant in Zoological Department, British Museum (Natural History), South Kensington.

The British Museum has lately received one or two collections of insects of various orders from Mr. Gilbert Turner, of Mackay, Queensland, among which were twenty species of dragonflies; and as five of these appear to be new and others interesting from the locality or otherwise, I thought it might be useful to publish a list of them.

Libellulidæ.

Libellulinæ.

Pantala flavescens.

Libellula flavescens, Fabr. Ent. Syst. Suppl. p. 285 (1798).

An almost cosmopolitan species, found in all parts of the world except Europe.

Tramea Rosenbergii.

Tramea Rosenbergii, Brauer, Verh. zool.-bot. Ges. Wien, xvi. p. 564 (1866).

The known localities are Ceram (*Brauer*), New Caledonia, and Moreton Bay (*Brit. Mus.*).

Rhyothemis graphiptera.

Libellula graphiptera, Ramb. Ins. Névr. p. 45 (1842).

A common Australian species.

Rhyothemis chloë, sp. n.

Long. corp. 30 millim.; exp. al. 68 millim.; long. pter. 2 millim.

Female.—Body pale greenish bronze; head above and behind, as well as the rhinarium, rather darker; the face otherwise testaceous; legs inclining to rufous brown or blackish.

Wings yellowish hyaline, pterostigma dark reddish brown; tips of all the wings beyond light brown, fore wings with twelve or thirteen antenodal and eleven or twelve postnodal cross-nervures; sectors of the arculus just connected at their base; triangle rather wide, with one or two cross-nervures, followed by four or five rows of cells, decreasing and then increasing; two supra-triangular nervures; subtriangular space consisting of five to seven cells; the base and more or less of the supra-triangular space and upper part of the triangle clouded with brown; a large smoky-brown patch on the costa, extending from just beyond the nodus over four cells on the inner side of the nodus, and down to at least the upper sector of the arculus. Hind wings with two large cupreous-brown blotches at the base, separated by a narrow yellowish hyaline band; the upper one extends much beyond the triangle, and on the costa is more or less continuous as far as the blotch on the nodus, which nearly corresponds to that of the fore wings; the lower blotch is narrowly or not at all bordered outside with hyaline, and extends nearly to the lower sector of the triangle or further. In one specimen there is a dark spot on the subnodal sector, halfway between the dark blotch on the nodus and the clouded tip of the wings.

Hab. Mackay, Queensland.

Described from two female specimens.

Allied to *R. amaryllis*, Selys, but easily distinguished by the large dark blotch on the nodus of both wings.

Rhyothemis princeps, sp. n.

Long. corp. 28–32 millim.; exp. al. 52–64 millim.; long. pter. $2\frac{1}{2}$ millim.

Head purplish above, face testaceous, rhinarium black, labrum yellow; thorax and abdomen black in the male, the former with a slight greenish-coppery reflexion on the sides; in the female reddish, the incisions and last three joints of the abdomen black; legs black.

Wings rather long and narrow, cupreous brown, iridescent, darkest in the male, with a large vitreous spot on the costa beyond the nodus in all the wings, a corresponding one on the opposite margin, and a third at the tip of the wings; the apical spot varies much in size and is wanting in the only male; in some of the specimens there are one or two more scattered vitreous dots.

Fore wings with ten to eleven antenodal cross-nervures, the last not continuous, generally with pale spaces between; eight to ten postnodal cross-nervures; pterostigma dark testaceous or black; triangle long, rather narrow, with three cross-nervures, and followed by five or six cells, increasing; two supra-triangular nervures; cells of the subtriangular space numerous.

Hab. Mackay, Queensland.

Described from one male and four female specimens.

Probably allied to *R. regiæ* and *chalcoptilon*, Brauer. Very like *R. cuprina*, Kirb., from Sierra Leone, in general appearance.

Rhyothemis Turneri, sp. n.

Rhyothemis resplendens, var., Selys, Mitth. Mus. Dresd. iii. p. 301 (1878).

Long. corp. 12–14 millim.; exp. al. 44–48 millim.; long. pter. $1\frac{1}{2}$ millim.

Four specimens (three males and a female), almost precisely alike, the opaque colouring in the fore wings extending only just beyond the nodus on the fore wings, instead of two cells beyond, but ceasing five to seven cells before the pterostigma on the hind wings, instead of only two or three, as in typical *resplendens*; the opaque part of the wing is shot with brilliant blue in the males, more or less bordered with black; in the female it is cupreous, with the larger oval vitreous patch in the hind wings covering rather more than three cells on each side of the upper sector of the arculus; the smaller patch only covering part of one on each side of the nodal sector.

Hab. Mackay, Queensland.

De Selys noticed this form as a variety from a single male in the collection of Mr. M'Lachlan. I have not thought it necessary to give a detailed description, but think that the constancy of the characters in the four specimens now received entitle it to be considered distinct from typical *resplendens*, which the British Museum possesses from New Guinea. There is also a female from Batchian in the Museum agreeing with *R. Turneri* in the opaque part of the wing ceasing just beyond the nodus; but the opaque part ceases on the hind wings four cells before the pterostigma, and the hyaline spots are much larger and more conspicuous. This form was also regarded by De Selys as a variety of *R. resplendens*, but may prove to be distinct when more specimens are obtained.

Neurothemis stigmatizans.

Libellula stigmatizans, Fabr. Syst. Ent. p. 421. n. 5 (1775).

A considerable number of specimens of both sexes; they exhibit no great amount of variation, and I am inclined to think that many neuropterists (myself included) have been too hasty in putting together insects which appear to be constant in their own localities, as mere forms of *N. stigmatizans* and *fluctuans*, Fabr.

Trithemis bipunctata.

Libellula (*Diplax*) *bipunctata*, Brauer, Reise d. Novara, Neur. p. 86 (1866).

Two specimens received from Mr. Turner. There is also a pruinose blue male, which probably belongs to this species, if it ever assumes that colour.

Trithemis rubra.

Trithemis rubra, Kirby, Trans. Zool. Soc. Lond. xii. p. 328 (1889).

Two specimens in Mr. Turner's collection.

Crocothemis servilia.

Libellula servilia, Drury, Ill. Ex. Ent. i. pl. xlvii. fig. 6 (1773).

A single specimen of this common East-Indian and Australian species.

Brachydiplax australis, sp. n.

Long. corp. 27 millim.; exp. al. 47 millim.; long. pter. 2 millim.

Male.—Head black behind, with two confluent yellow spots behind what Charpentier calls the "cuneus," the small space filling up the space between the eyes behind; upper part of the head metallic green, except at the sides; lower part yellow; mandibles (except at base), lower edge of the rhinarium (rising into a spot in the middle), and suture of the labium black. Thorax black and yellow, as is also the base of the abdomen, which is yellow beneath and blue above beyond the base of the third segment; thorax mostly blackish above, beneath the blue dusting (in young specimens it would probably be æneous); pleura yellow, with four black, separate, slightly æneous stripes; legs black; pectus mostly black and shining, slightly æneous, and intersected by yellowish sutures; anal appendages as long as the last two segments, slightly hairy, not dentated.

Wings clear hyaline, with black nervures; fore wings with six antenodal and five postnodal cross-nervures, the first two postnodals not continuous; pterostigma dull yellow, between black nervures, triangle not traversed, followed by two rows of cells, increasing; subtriangular space consisting of one cell; hind wings with the base of the triangle not quite coinciding with the arculus.

Described from a single male specimen. If this was completely mature the blue pulverulescence would probably obliterate all trace of yellow markings; but the female and newly-emerged male are both probably yellow and æneous black, without any trace of blue.

This is the first species of the genus described from Australia. It is probably allied to *B. denticauda*, Brauer, &c.

Zyxomma petiolatum.

Zyxomma petiolatum, Ramb. Ins. Névr. p. 30 (1842).

A single specimen, perhaps a little darker than Indian specimens, but otherwise hardly differing from them.

Orthetrum sabina.

Libellula sabina, Drury, Ill. Ex. Ent. i. pl. xlviii. fig. 4 (1773).

An abundant species from India to Australia.

Orthetrum nigrifrons, sp. n.

Long. corp. 46 millim.; exp. al. 70 millim.; long. pter. 5 millim.

Male.—Head black, sutures of the rhinarium and labrum yellowish, face smooth and shining, frontal tubercle bifid, thorax black or blue-black, abdomen blue, legs black. Wings clear hyaline, very narrowly stained with saffron at the base of the hind wings; pterostigma long, yellow, between black nervures, not remarkably thickened, nervures mostly blackish, except the costal nervure between the nodus and pterostigma, which is testaceous; it is also testaceous in front from the base to the nodus: fore wings with eleven antenodal cross-nervures, the last not continuous, and with nine or ten post-nodal nervures, the first two not continuous; triangle moderately long and broad, followed by three rows of cells increasing; subtriangular space consisting of three cells; no supra-triangular nervules, nodal and subnodal sectors not much waved; hind wings with the triangle not traversed. Anal appendages of moderate length; the lower one broad, truncated, nearly as long as the others.

Described from two male specimens. Much resembles *O. triangularis*, De Selys, but smaller, and the want of supra-triangular nervures on the fore wings and the untraversed triangle of the hind wings will at once distinguish it.

Orthetrum villosovittatum.

Libellula villosovittata, Brauer, Verh. zool.-bot. Ges. Wien, xviii. p. 167 (1868).

The collection contained four specimens of a species which I regard as *O. villosovittatum*, although it is less yellow at the base than Brauer's description appears to indicate. There is a supra-triangular nervure, and the triangles of all the wings are traversed, points on which the description says nothing.

Orthetrum bramineum.

Libellula braminea, Fabr. Ent. Syst. Suppl. p. 284 (1798).

This species is very common throughout Australia, and the description of Fabricius would apply very fairly to the female or immature male. I have therefore added a more full description of the adult male. If I have correctly identified Fabricius' insect, it is a true *Orthetrum*, and not a *Nesoxenia*.

Long. corp. 43 millim.; exp. al. 68 millim.; long. pter. 5 millim.

Male.—Head yellow, frontal tubercle concave; thorax lighter or darker olive, with five dark reddish or black stripes above, one on the central carina and two on each side, of which the lower one is often hidden by the pruinosity which covers the sides and under surface of the thorax in adult examples, and partly extends to the legs, which are black, striped below with testaceous; abdomen pruinose blue; anal appendages as long as the ninth segment, lower appendage two thirds as long as the upper ones. Wings with twelve to fifteen antenodal cross-nervures, the last continuous, and nine to ten postnodal cross-nervures; pterostigma moderately long and broad, yellow, between black nervures, the uppermost thick, the apical half of the wings clouded with smoky yellow; nodal and subnodal nervures considerably waved; triangle of moderate size, with one cross-nervure and a supra-triangular nervure, followed by three rows of cells, increasing; supra-triangular space consisting of three cells; triangle of hind wings not traversed.

The female and immature male are yellow, with five reddish-brown lines on the thorax, and the sutures of the abdomen black, with a broad brown band running along each side; the legs are also streaked with black, and the smoky yellow cloud on the outer half of the wings is either much reduced or, in a few cases, entirely obsolete.

Corduliinæ.

Hemicordulia australiæ.

Cordulia australiæ, Ramb. Ins. Névr. p. 146 (1842).

A single female specimen, much darker than those previously in the collection of the British Museum.

Æschnidæ.

Gomphinæ.

Gomphina.

Ictinus australis.

Ictinus australis, Selys, Bull. Acad. Belg. (2) xxxv. p. 769 (1873).

A single specimen.

Æschninæ.

Æschna brevistyla.

Æschna brevistyla, Ramb. Ins. Névr. p. 205 (1842).

A common species, and the only Australian representative of typical *Æschna*.

Agrionidæ.

Cœnagrioninæ.

Micronympha aurora.

Agrion (Ischnura) aurora, Brauer, Verh. zool.-bot. Ges. Wien, xv. p. 510 (1865).

A single discoloured specimen, apparently belonging to this species.

V.—*Descriptions of some new Species of* Agaristidæ. By Herbert Druce, F.L.S.

Agarista.

Agarista Goldiei, sp. n.

Male.—Primaries black, with a large elongated white band beyond the middle, which does not reach either margin; the fringe black: secondaries white, broadly bordered with black, the base black; the fringe white at the apex. Head, palpi, antennæ, thorax, and abdomen black, the abdomen banded with white close to the base; the collar and anus yellow; legs black and white.—*Female* almost identical with the male.

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

Hab. New Guinea, Port Moresby (*Goldie, Mus. Druce*).

Agarista rhœo, sp. n.

Male.—Primaries and secondaries deep black; primaries with two small spots in the cell, one at the end of the cell on the costal margin, and a large square-shaped one below nearest the anal angle, all creamy white; the apex and a small streak on the anal angle creamy white; the fringe black: secondaries with the fringe at the apex and a rather large spot near the anal angle creamy white. Underside very similar to the upperside. Head, palpi, antennæ, thorax, and abdomen black; the underside of the head and thorax orange; legs orange and black.

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

Hab. Madagascar (*Mus. Druce*).

Agarista darna, sp. n.

Male.—Primaries and secondaries brownish black; primaries crossed beyond the middle from the costal margin to the anal angle by a wide orange-yellow band, between which and the base a narrow yellow band partly crosses the wing; a faint metallic bluish streak at the end of the cell; the fringe of both wings blackish brown. Head, palpi, antennæ, thorax, and abdomen blackish brown; the collar and anus orange-yellow; legs dark brown.

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

Hab. Timor (*Mus. Druce*).

Agarista cynapes, sp. n.

Male.—Primaries black, crossed about the middle by a wide white band, which does not extend to either margin; a narrow bluish-grey line extends from the base along the costal margin to the end of the cell; the fringe black, white at the apex: secondaries white, the outer margin broadly bordered with blue-black, widest at the apex; the base of the wing blue-black. Head, antennæ, thorax, and abdomen bluish black; the anus dark orange-yellow.—*Female* very similar to the male.

Expanse, ♂ ♀, $2\frac{1}{2}$ inches.

Hab. New Guinea (*Mus. Druce*).

Agarista prochyta, sp. n.

Female.—Primaries very similar to those of *A. cynapes*: secondaries orange-yellow, broadly bordered with bluish black; the fringe white from the apex to the middle of the outer margin. Head, antennæ, thorax, and basal third of the abdomen bluish black; the anal portion of the abdomen orange; legs black.

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

Hab. New Guinea (*Mus. Druce*).

This species is closely allied to *A. cynapes*, but is much more glossy blue.

Massaga, Walk.

Massaga demena, sp. n.

Primaries black, the veins dark blue; a wide curved white band crosses the wing about the middle from the costal to the inner margin: secondaries blue-black, with a wide central white band extending from the costal to the inner margin; the fringe of the primaries greyish, of the secondaries white at the apex and partly round the outer margin, then black. Head, collar, front of thorax, and anus bright carmine; thorax, palpi, antennæ, abdomen, and legs blue-black.

Expanse 2 inches.

Hab. West Africa, Cameroons (*Fuller*); Old Calabar and Sierra Leone (*Mus. Druce*).

Eusemia.

Eusemia darocana, sp. n.

Male.—Primaries black, with four greyish-blue spots near the base and a yellow spot slightly beyond; two dark yellow bands cross the wing, but do not reach either margin—the first (about the middle) is widest on the inner margin, the second (beyond the cell) is narrow and extends almost to the anal angle; below the end of the band, close to the anal angle, is a small yellowish-white spot; a submarginal row of white dots extends from the costal margin near the apex to the anal angle; the fringe black: secondaries brick-red, slightly paler at the base and along the inner margin; the outer margin broadly bordered with black; a wide black band extends from the inner margin above the anal angle to the end of the cell; the veins between the black band and the outer margin black. Head, antennæ, collar, and thorax black; head and collar spotted with white; abdomen dark chrome-yellow, broadly banded with black; anus black.—*Female* very similar to the male, but the yellow bands on the primaries are slightly paler in colour.

Expanse, ♂ $3\frac{1}{4}$, ♀ $3\frac{1}{2}$ inches.

Hab. Philippine Islands, Mindanao (*Semper*, *Mus. Druce*).

A very distinct species, allied to *E. fasciatrix*, Westw.

Pompelon.

Pompelon cynosura, sp. n.

Allied to *P. ampliatum*, Butler, but much browner in colour; more blue, of a different shade of colour, on the costal margin and apex of primaries; the blue on the apex of the secondaries is more suffused than in *P. ampliatum*, Butler, but not nearly so much so as in *P. marginata*, Guér. Head, antennæ, thorax, and abdomen blue-black; the collar, underside of the abdomen, and anus bright carmine; the front of the thorax spotted with blue.

Expanse 3 inches.

Hab. Penang (*Biggs*); Province Wellesley, Mergui (*Doherty*); Borneo, Sandakan (*Pryer*); Kina Balu (*Everett*, *Mus. Druce*).

Hypsa.

Hypsa darsania, sp. n.

Primaries pale dove-colour, bright yellow at the base; two black spots close to the base and a row of four black spots extending from the costal to the inner margin just beyond: secondaries chrome-yellow; the fringe dove-colour at the apex and partly round the outer margin. Head, collar, tegulæ, thorax, and abdomen chrome-yellow; palpi, antennæ, and legs black; abdomen with a row of black spots from the base to the anus; the underside of the abdomen banded with black.

Expanse 3 inches.

Hab. North Celebes (*Curtis*, *Mus. Druce*).

VI.—*Descriptions of Two more new Species of Butterflies from New Britain, in the Collection of Mr. Grose Smith, captured by Captains Cayley Webster and Cotton.* By H. Grose Smith.

Thysonotis hanno.

Male.—*Upperside* similar to that of *T. hymetus*, Feld., but both wings more violet-blue, with the outer margins more narrowly black.

Underside with the costal and outer margins of the anterior wings and the outer margin of the posterior wings brighter black; on the anterior wings the black band along the costa, on its inner margin, has a short black spur at the end of the cell and a longitudinal excrescence a little before the apex, and the basal blue streak above the cell extends further along the wings; on the posterior wings the subbasal blue streak does not extend along the inner margin, the metallic blue rings round the submarginal row of black spots are less clearly defined, and the black area above them is less irregular on its inner edge.

Expanse of wings $1\frac{1}{8}$ inch.

Hab. New Britain.

One specimen only was in the collection; it is a tailless species.

Thysonotis hamilcar.

Female.—*Upperside* closely resembles that of the same sex of *T. cyanea*, Cramer, but on the anterior wings the white area is less sharply angulated at its apex, and the outer margin is rather more broadly greyish black; on the posterior wings along the costal margin is a broad greyish-black band, which extends from the base two thirds along the wings towards the apex; the blue band of lunules across the disk towards the outer margin is broader and brighter.

On the *underside* the double white lines, which intersect the greyish-black outer marginal band on the anterior wings, are less distinct, especially the outer line, and they do not extend so far towards the apex. On the posterior wings the dark band along the costa is, as on the upperside, broader and longer than in *T. cyanea*; the dark outer marginal band is broader, and the black spots in the row of blue ocelli before the margin are smaller.

Expanse of wings $1\frac{3}{8}$ inch.

Hab. New Britain.

One specimen only in the collection; it is tailed like *T. cyanea*.

VII.—*On Parthenogenesis in Spiders.* By N. Damin *.

For the preservation of the species the union of two separate sexes of the species is necessary. At the same time, however, multiplication without a union of the sexes, that is to say, an asexual reproduction, has been proved to take place in the vegetable and animal kingdoms.

To the latter class of phenomena belongs the *virgin* reproduction, or *parthenogenesis*, which occurs also among higher animals. In such cases the egg-cells are capable of developing into embryos without previous impregnation.

Parthenogenesis is met with especially in the great phylum Arthropoda. It has been observed in the case of bees, wasps, and gall-flies (Cynipidæ), in the silkworm-moth and in Psychidæ, in Tineidæ, midges, Aphidæ, and Coccidæ, as well as in the Phyllopoda and Ostracoda among the Crustacea. Considering the frequency of parthenogenesis among Arthropods, the question arises whether the phenomenon does not also occur among spiders, which belong to the same division of the animal kingdom. Hitherto, however, no case of parthenogenesis in these animals has become known †.

After having observed living spiders for many years, I am now in the happy position of being able to establish an instance of parthenogenesis among the Araneina also.

In the spring of 1891 I placed two living specimens of *Filistata testacea*, Latr.‡, in separate glass tubes, in order to observe them from day to day. One of these spiders, of which I shall speak, twice underwent ecdysis in the course of the summer of 1891, and in the spring of 1892 once again—a proof that when I shut it up it was still immature, *i. e.*, according to the previous state of our knowledge, incapable of reproduction. On the 8th of July, 1892, this female spun on the side of the tube an egg-sac shaped like a tobacco-pouch, similar to that of *Micrommata*. I was not surprised at this, since I had frequently noticed that spiders spin a cocoon and lay eggs without ever having had intercourse with a male. After a few days, however, the eggs in such envelopes were

* Translated from the 'Verhandlungen der k.-k. zoologisch-botanischen Gesellschaft in Wien,' Jahrg. 1893, xliii. Bd., II. Quartal (Wien, 1893), pp. 204-206.

† [An instance of probable parthenogenetic reproduction in the case of *Tegenaria Guyonii*, Guér., was recorded by Mr. F. M. Campbell (Journ. Linn. Soc. xvi. pp. 536–538) in 1882.—Transl.]

‡ *Filistata bicolor*, Luc. ('Exploration de l'Algérie'), and *Teratodes attalicus*, C. Koch ('Die Arachniden,' v.), are synonyms of this species.

always already shrivelled and dry, since they were unfertilized. Nineteen days afterwards (consequently on the 27th of July), during which time, in the case of fertilized ova, the young are wont to emerge, I opened the cocoon, and saw in this instance, contrary to all expectation, developed young ones. The egg-membranes had already burst. I counted sixty-seven young spiders.

Under the microscope the egg-membrane presented the appearance of a delicate glassy substance; it was smooth and destitute of a coating of hairs. The young had arrived at the stage at which a distinct movement of the little blunt legs is recognizable. The cephalothorax was glistening white, the legs were blackish, and the abdomen dark-coloured. To discover the reason of these shades of hue I placed first one of these young spiders entire, and afterwards various separated portions of the body, beneath the microscope, when I saw the coat of hair in process of origin beneath the integument; the little hairs stood almost parallel one to another, and closer together upon the legs than upon the abdomen; the former consequently appeared darker in colour than the latter. It is not until the young spider has undergone yet another ecdysis that it appears capable of leading an independent existence. I removed these young ones: the old female remained in good health and lively, and continued to feed and to spin.

Two days later, that is on the 29th of July, I opened the box in which I had placed them, and found that all the young ones had emerged. Beside them now lay the second skin, so that, as I have observed in the case of other spiders also, they had moulted after a couple of days; by this time they were also recognizable as specimens of *Filistata* both in form and colour. They ran about readily, and, after a few days, were already able to lie in wait for their prey *.

I likewise examined these skins under the microscope, and found that I was not deceived on the first occasion; these membranes had no hairs upon them, while the cuticle of the young spiders is thickly clothed with hair, which could now be seen standing up.

These young *Filistata* are still living, and have already successfully accomplished one ecdysis outside the cocoon.

Are we not entitled to regard this case as a proof that parthenogenesis occurs in *Filistata testacea* and, perhaps, in other spiders also? There can here be no question of any mistake. *Filistata* is very common in the Croatian littoral; it lives in holes in old walls, and is recognizable by the star-

* To lie in wait—because *Filistata* spins a peculiarly sticky web, to which everything adheres.

shaped web which it spins, after the manner of *Segestria* and *Amaurobius*, at the entrance to its abode. It is abundantly represented in my collection; but what has struck me very forcibly in this connexion is the fact that there is not a single male among my specimens, and that I have never yet met with a male, either alive or dead: I do not know the male at all. Does not this very absence of the male constitute an indirect testimony in favour of the parthenogenesis of *Filistata*?

It may here be remarked, further, that neither Thorell, in his two memoirs *, nor C. Koch † says anything about a male of *Filistata testacea*. In response to my inquiries I learn from the well-known arachnologists Dr. C. Chyzer, of Ujhely, and Prof. W. Kulcynski, of Cracow, that, with the exception of a single male received by the latter from Madeira, they, too, have not met with a male specimen of *Filistata*. It is, however, not my intention to imply that males of *Filistata* never occur; I would merely remind the reader of the males of *Psyche helix*, so long missing, and first discovered by C. Claus. It is, indeed, well known that among other creatures also, especially insects, where parthenogenesis is met with, the males, at least at one period, are rare or entirely wanting.

It is self-evident that further observation is still necessary in order to prove whether parthenogenesis in *Filistata* is accidental, as, for instance, in the case of *Bombyx mori* and certain butterflies, or actually a phenomenon of regular occurrence, as in *Psyche*, *Solenobia*, &c. Moreover, it is reserved for subsequent investigations to decide whether parthenogenesis does not occur in other spiders also.

Another noteworthy point may be alluded to. We are aware that it is not until they have undergone their last ecdysis that spiders are mature or capable of reproduction. After copulation or the first deposition of eggs, as the case may be, spiders change their skin no more.

It was quite contrary to my expectation therefore when the parthenogenetic female that I have been observing moulted on the 29th of September of last year, consequently two months after it had spun its virgin cocoon. This led me to the following reflection: either a kind of pædogenesis occurs in *Filistata*—that is, parthenogenesis is here relegated to a stage in life at which sexual reproduction does not otherwise take place, as we meet with it in the case of midges, and in this event it is possible that differences from the fully

* T. Thorell, 'On European Spiders;' 'Remarks on Synonyms.'

† C. L. Koch, 'Die Arachniden,' i.–xviii. (Nürnberg).

developed form may also be shown to exist,—or spiders, although it may be only a few species, have the power of changing their skins in the adult condition, which has not been observed hitherto.

I therefore examined one or two females from my collection which, according to external appearances, were mature. In none of them did I find an epigyne near the pulmonary opercula. On the 20th of October I again examined a *Filistata*, which apparently died during (the last?) ecdysis. This likewise had no epigyne at the usual place; but I discovered on the lower half of the ventral side of the abdomen, towards the spinnerets, a horizontal suture ("Fuge"), which was almost entirely covered by close-lying hairs. As I attempted to introduce a needle beneath the suture, which I had no difficulty in doing, the spider moved its legs (it was consequently not yet dead), and a drop of clear viscid fluid showed itself at the suture, receded again, and again issued forth when I exerted a little pressure. Can this have been a mass of germ-cells from the ovary? I have not examined the parthenogenetic female, since it is valuable to me for further observations, and I was afraid of injuring it; it is still alive at the present moment (February 1893).

VIII.—*On a Medusa observed by Dr. Tautain in the River Niger at Bamakou (French Soudan).* By M. Jules de Guerne *.

The Société Zoologique is indebted to M. Gaston Tissandier for the first intelligence of the interesting circumstance detailed below.

In consequence of an article, accompanied by three figures and giving a *résumé* of R. T. Günther's paper on the Medusa of Lake Tanganyika †, published by me in 'La Nature' ‡, the courteous editor of that journal received a letter from Nouka-Hiva (Marquesas Islands), which he hastened to communicate to me. The letter bears the signature of

* Translated from the 'Bulletin de la Société Zoologique de France,' t. xviii. (séance du 28 novembre, 1893) pp. 225–230: from a separate impression communicated by the Author.

† R. T. Günther, "Preliminary Account of the Freshwater Medusa of Lake Tanganyika," Ann. & Mag. Nat. Hist. ser. 6, vol. xi. pp. 269–275, pls. xiii. and xiv.

‡ J. de Guerne, "La Méduse du lac Tanganyika," La Nature, June 24, 1893.

Dr. Tautain, a distinguished anthropologist and an excellent observer, who is well-known on account of his travels in the French Soudan and in Bélédougou, and who was formerly medical officer to the Galliéni Expedition, and is now colonial administrator of one of the most distant archipelagos of the Pacific.

The following are the principal passages in Dr. Tautain's communication, written from Taiohae (Nouka-Hiva Island), 30th September, 1893:—

"In the issue of 'La Nature' for June 24, 1893, I observe, under the signature of M. Jules de Guerne, an article on the subject of freshwater Medusæ, with reference to the Medusa of Lake Tanganyika.

"It is stated by M. de Guerne that this species is the third freshwater Medusa that has been recorded. I believe that I am acquainted with another.

"In the month of January in the year 1888, at low water, I found in the Niger near Bamakou, in the still water at the edge of the river above the rocks of Sotuba, a Medusa which appears to me to be different from that of Lake Tanganyika. If my memory serves me, the diameter of this Medusa is from 20 to 25 millim.

"On the day when I noticed it I busied myself in collecting a certain number of individuals, and in a short time I had some fifty specimens of it in a bottle.

"On my return to Bamakou I endeavoured to preserve these Medusæ, in order to bring them back to France; but the various methods which I employed, the only ones that I had at my disposal, miscarried, and after the lapse of a certain time, varying according to the different methods, I had nothing left. It was my fixed intention to return to Sotuba to make a fresh collection and attempt other systems or combinations of systems of preservation, but I was unable to do so.

"The distance between the habitat of the Medusa of the Niger and the sea is considerable, and it must be remarked that the number of rapids (besides those of Sotuba) between Timbuctu and Boussa renders communication with the ocean very difficult for a creature of the nature of a Medusa."

It is a matter for regret that Dr. Tautain did not think of at once making a sketch of the animal in question. Its dimensions would certainly have enabled him to recognize with a simple lens, or even to see with the naked eye, certain details of structure, according to which it would have been possible to form a correct idea of the organism.

The animal is, in all probability, a Hydromedusa of a somewhat larger size than the three forms already recorded as existing in fresh water *. As a matter of fact the largest specimens of *Limnocnida tanganyikai* (*sic*), Böhm †, measure 22 millim., while the diameter of *Limnocodium Sowerbyi*, Allman and Ray Lankester, amounts to 8 millim., and that of *Halmomises lacustris*, von Kennel, only to 2·5 millim.

The fixed polypes of a creeping Hydrozoon of marine origin progressively adapted to fresh water may, in the course of centuries, ascend a river like the Niger, and even surmount its rapids. Without speaking of the changes which may have supervened in the configuration of the country, and of the accidental transport of débris of all kinds to which the animals with which we are dealing readily attach themselves, it is necessary to pay particular attention to the peculiar conditions affecting the river.

This is not the place to enter into lengthy considerations of geographical questions. I may be permitted, however, to quote a few passages from the great work by Elisée Reclus ‡, which will show, without requiring any comment, how a freshwater fauna is able to disseminate itself with great rapidity through a very extensive region, both up and down a river-system.

"United to each other to the south of Ségou Sikoro two large rivers flow parallel to the Niger; then, after breaking up into pools (*marigots*), which convert the Jénneh country into a labyrinth of islands, the common current rejoins the principal stream above Lake Debo. At this spot the waters, which are broad and very deep, are almost stagnant: a dam a few metres in height would transform the confluent into an inland sea; at the time of the falling of the waters the lacustrine reservoir spreads out on all sides, *even flowing up stream towards the upper river*.

"Below the region where the liquid volume of the two Nigers in some places unites into lakes, and in others ramifies in tortuous arms around low islands, the stream, retarded by

* I purposely omit to recall to mind here all the instances of Craspedote or Acraspedote Medusæ (*Crambessa*, *Callirhoë*, *Laodice*, &c.) which have been recorded as non-marine. I have spoken elsewhere of the majority of these (J. de Guerne, "Méduses d'eau douce et d'eau saumâtre, d'après quelques travaux récents," Bull. scient. du dép. du Nord, 1880). Neither are the Cœlenterates which live in what is almost fresh water in numerous localities of the Baltic and of the Gulf of Finland enumerated here.

† This is how, according to the rules of nomenclature, the name of the Medusa of Lake Tanganyika ought to be written.

‡ Elisée Reclus, 'Géographie universelle, XII. Afrique occidentale,' p. 52.

the obstacles of its banks, spreads out into a labyrinth of 'marigots,' which penetrates south of the major current to a distance of 150 kilometres into the interior. During seven months of the year this district of marigots, which extends to the south of the river, below the meridian of Timbuctu, is cut off from free communication with the Niger: there is nothing to be seen but scattered lakes, pools of stagnant water, obliterated channels, dead water, and damp hollows filled with reed-beds; but the river-floods, which overflow in a lateral direction along depressions in the ground, transform these into a network of flowing streams, and during four or five months large boats can be navigated freely in an immense maze of lakes and channels, in which the currents change without apparent rule, according to the force and the direction of the winds, the abundance of rain, or the heat of the sun. In this part of Central Africa nature assumes an aspect which resembles in certain respects that of Sweden, with its lakes of every variety of form, its creeks, its firths, and its rivers. . . . .

". . . . . In one channel the water is open and deep, unimpeded by vegetation; in another it is encumbered with weeds, through which it is difficult for boats to force a passage, and which occasionally become detached in the shape of floating islands, which eventually form barriers at the bends of the stream which are impassable for boats: every year traders are compelled to change their route through the tortuous intricacies of this vast labyrinth. . . . ."

But even if we exclude the possibility that the higher waters above the rapids may be reached at last in an indirect manner by means of the floods, the rapids themselves might still be directly surmounted by the Hydroids; for it has been found at Hamburg that the water-mains are invaded by colonies of *Cordylophora lacustris*, Allman, which develop there in all directions in spite of the intensity of the current *. Besides, if the actual rocks in the torrent do not furnish these animals with a base upon which to grow, they will attach themselves to dead or living shells †. This is the habit of

* Kraepelin, "Die Fauna der Hamburger Wasserleitung," Abhandl. a. d. Geb. der Naturwissensch., herausg. v. Nat. Verein Hamburg, ix. 1886, pp. 5, 6. Allman had previously recorded the presence of *Cordylophora* in the water-mains of London (Allman, 'A Monograph of the Gymnoblastic or Tubularian Hydroids,' Ray Society, London, 1871–72, p. 253).

† It has long been known that *Cordylophora lacustris* is frequently met with upon the shell of *Dreissena polymorpha*, Pallas. In this situation it was found in Paris itself, in the great reservoir of the Jardin des Plantes (E. Perrier, "Sur l'existence à Paris du *Cordylophora lacustris*, Allman," Arch. zool. expérim. ii. 1873, Notes et Revue, p. xvii).

Bryozoa, whose mode of dispersal is not without analogy to that of Hydroids. Their colonies or their statoblasts are frequently met with upon the shells of mollusks, not only upon stationary or slowly-moving bivalves, but upon Gastropods like *Paludina*, which are very well able to crawl against the stream *.

A few months ago, when Dr. Meissner was examining the specimens of *Ætheria* in the Berlin Museum, he recognized upon their shells statoblasts of *Plumatella* †, thus placing beyond doubt the existence of these Bryozoa in the great rivers of Africa (Nile, Senegal, and Niger), although they were for a long time not to be found upon the Dark Continent, and were so difficult to discover that a naturalist so able as Stuhlmann declares that he searched for them in vain for two years and a half ‡.

Ætheria, masses of which form in great rivers accumulations comparable to oyster-beds, and which, like the latter, resist the action of the water, furnishes an excellent basis for

* I append a few instances of freshwater Bryozoa attached to Mollusca:—Upon the shell of an undetermined species of *Unio* Leidy discovered at Philadelphia the curious *Urnatella gracilis*, while upon *Unio delphinus*, Lea, *Symphinota bialata*, Lea, and *Anodonta securiformis*, Say, Jullien found *Norodonia* from China and Cambodia. The same naturalist records the occurrence of statoblasts of *Plumatella* upon specimens of *Unio* collected by M. Chaper in the Madras Presidency. *Pectinatella Carteri*, Hyatt, and *Hislopia lacustris*, Carter, have been likewise met with in India upon *Paludina bengalensis*, Lamk. (J. Jullien, "Monographie des Bryozoaires d'eau douce," Bull. Soc. Zool. de France, x. 1885, *passim*). Kraepelin, moreover, has given some extremely interesting details as to the veritable *symbiosis* which appears to exist between *Plumatella princeps*, Kraep., var. *spongiosa*, Kraep., and *Paludina fasciata*, O. F. Müller. In the Bille and in the Elbe, in the neighbourhood of Hamburg, thousands upon thousands ("Tausende und Abertausende") of *Paludina* are found covered with *Plumatella*, and resembling in consequence so many potatoes rolled about by the water. It is a remarkable fact that in these localities scarcely a trace of the Bryozoon in question is seen upon submerged stones. Moreover the *Paludina*, in burying themselves in the mud to hibernate, ensure the preservation of the statoblasts with which they are covered, and which they also bring back to the surface on the return of spring, at the period of development (K. Kraepelin, "Die Deutschen Süsswasser-Bryozoen," Abhandl. a. d. Geb. der Naturwissensch., herausg. v. d. Nat. Verein Hamburg, x. 1887, p. 121 of the separate impression, pl. iv. figs. 113 and 114).

A number of exotic fluviatile mollusks, and especially the large and small species of *Ampullaria*, which are so widely distributed in hot countries, should be examined from the point of view here considered; I am not aware that this has ever been done.

† Meissner, "Beitrag zur Kenntniss der geographischen Verbreitung der Bryozoengattung *Plumatella* in Afrika," Zool. Anzeiger, xvi. p. 385.

‡ F. Stuhlmann, "Fauna von Ost Afrika," Sitzgsber. Gesellsch. naturforsch. Freunde zu Berlin, 1890, p. 184.

the development of colonies of Hydroids *. Can it be a matter for surprise that the latter, which are doubtless of very small size, have never been seen and may still long remain unnoticed, if we reflect that the statoblasts of which we have been speaking are quite a recent discovery, and, above all, that, in spite of continual watching, it has taken nearly *five years* to find in London itself, with all the resources of a perfectly equipped laboratory, a hydroid phase of *Limnocodium*? †

IX.—*On the Development of the Fins of Teleosts.* By Ross Granville Harrison ‡.

Excepting the Elasmobranch Fishes, we have no complete knowledge of the development of the extremities of any group of vertebrates. The skeleton alone has received due attention. The muscular system of the limbs of the higher vertebrates has been supposed by recent writers who have touched upon the subject to take its origin from masses of cells derived from the myotomes. These myotomic cells are in a general way to be regarded as homologous with the cells of the muscle-buds ("Muskelknospen"), out of which the

* The oyster-beds at certain points of the coast are justly regarded by zoologists as exceptionally rich localities. I have mentioned a very typical example of this lying off Dunkirk. Sponges, Hydroids, various Annelids, Bryozoa, and Cirrhipedes, to speak of fixed animals alone, multiply upon the dead or living shells with singular vigour, and this in spite of the violence of the gyratory currents, which in these parts may attain a speed of two metres a second (J. de Guerne, "La rade de Dunkerque," Revue Scientifique, March 11, 1885).

† A. G. Bourne, "On the Occurrence of a Hydroid Phase of *Limnocodium Sowerbyi*, Allman and Ray Lankester," Proc. Roy. Soc. Lond. xxxviii. p. 9. It will be remarked that the basin in Regent's Park in which the Medusæ have appeared at intervals, and where the hydroid phase of *Limnocodium* has at last been discovered, has been emptied and left dry for a somewhat long period on several occasions. This appears to indicate on the part of this freshwater type a singular power of resistance to the most abrupt changes in the condition of the medium. *Vide* the plate, p. 12 *loc. cit.*

While correcting the proofs of the present note I have received no. 1258 of 'Nature' (Dec. 7, 1893), containing an article by Prof. Ray Lankester entitled "Reappearance of the Freshwater Medusa (*Limnocodium Sowerbyi*)." This organism, which had not been observed again in London since July 1890, has unexpectedly come to light at Sheffield in a tank containing aquatic plants sent from Regent's Park.

‡ From the 'Johns Hopkins University Circulars,' No. 111, May 1894, pp. 59–61: being a preliminary communication.

definitive muscles of the elasmobranch fins are known to develop. The following observations made upon the salmon (*Salmo salar*) render a modification of this view necessary.

The Unpaired Fins.—The unpaired fins arise as proliferations of the mesenchyme cells, which, in the form of a loose meshwork, fill the median fin-folds. The caudal fin is the first to appear, and is followed by the dorsal, the anal, and the adipose, in the order named.

Shortly after the dorsal thickening has appeared muscle-buds appear at the anterior dorsal angles of the myotomes of that region, and grow rapidly into the fin-rudiment, as has been described by Dohrn ("Studien IX.," 'Mittheilungen aus der Zool. Stat. zu Neapel,' Bd. vi.). These processes converge considerably towards one another, so that, while the middle ones project at right angles to the long axis of the body of the fish, those at each end of the fin cut the axis at an angle of about forty-five degrees. Cross sections show that the buds are solid; a few cells are enclosed by an epithelium of similar cells. The nuclei closely resemble those of the mesenchyme, and the cell boundaries are indistinct. The buds are continuous with the cells of the lateral layer of the myotomes (cutis-plate). Similar buds grow out from the anterior ventral angle of the myotomes in the region of the anal fin. The tail-fin also receives outgrowths from several of the terminal myotomes; the adipose fin never contains muscle-buds or muscle-tissue of any kind. As the buds grow further into the fin-rudiment their outer ends become enlarged and somewhat flattened against the epidermis, in which a considerable bulging is caused. The stalk now disintegrates, and its component cells can no longer be distinguished from the mesenchyme. In the meantime the nuclei which lie in the median half of each bud accumulate considerable cytoplasm as a first step towards differentiation into muscle-cells. These masses of embryonic muscle-cells now grow centripetally; they ultimately become the erector muscles of the fin-rays. The lateral half of the bud now loses its identity as a cell-mass, having become undistinguishable from mesenchyme; but very soon the cells which lie opposite the peripheral end of each bud accumulate more cytoplasm, and these masses also grow towards the body, remaining close to the epidermis. They ultimately become the superficial muscles of the rays, which in the adult take origin from the skin. By this time the mesenchyme has developed to such an extent that the muscle-masses are not at all clearly defined, so that it is impossible to draw a sharp dividing line between nuclei which will ultimately belong to muscle and those of the connective tissue.

By this time cartilaginous rods, alternating with the muscle-pairs, have appeared in the middle plane of the fin. These become the interspinal bones which support the rays of the dorsal fin; in the anal fin they are the interhæmals. The chondrification takes place centripetally. I shall call them ray-supports.

Horizontal sections of this stage show clearly the serial arrangement of the various structures of the fin. Opposite the cartilaginous rods the ectoderm is constricted to a marked degree. At these constrictions mesenchyme cells have aggregated close to the ectoderm, forming loose strands of cells, one on each side of each ray-support. This is the beginning of the definitive depressor muscles of the fin-rays.

The dermal rays now begin to develop, in lines which are distally continuous with each erector muscle rudiment, the cells of which are not separated from those of the corresponding rays by any sharp dividing line. Considerably later a small nodule of cartilage is formed at the tip of each cartilaginous ray-support, which has in the meantime become considerably bent with its convexity forward. Each pair of dermal rays grasps with its basal end the corresponding cartilaginous ball, and a strong fibrous tissue binds them together. Muscles now become inserted into this mass, in such a manner that each ray receives one pair of each of the three muscles belonging to each segment of the fin. Anterior to the pivot on which the cartilaginous ball rests the erector is attached; posterior to the pivot the depressor and the muscle which takes origin from the skin. The depressor and the erector arise from the ray-supports. The fin has now practically reached its adult condition, except that the cartilaginous skeleton has not yet ossified.

The above account holds good only for those segments which do not lie at the ends of the fin. In the first two or three segments the course of development is considerably modified, although the same definitive arrangement is reached.

The number of myotomes which produce buds is variable, but, as a rule, ten or eleven reach the dorsal fin and eight the anal. Both anterior and posterior to these buds may be formed, but they do not reach more than rudimentary development. The number of these buds is very variable. When the cartilage has just begun to appear, and the muscle-masses are on their way to segregation from the surrounding mesenchyme, these rudimentary buds have disappeared, presumably having disintegrated into ordinary mesenchyme tissue. Both anterior and posterior to the regularly formed muscles are paired masses of closely packed mesenchyme cells, which form a distinct layer under the epidermis. These masses are undoubtedly derived both from the original mesenchyme of the fin and from the breaking down of the rudimentary buds. The posterior mass of each side differentiates into two muscles, one corresponding to the erectors, the other to the skin-muscles. These become attached to the posterior ray of the fin. A depressor muscle is wanting in the case of this ray.

Anterior to the first of the regularly formed muscles is a cartilaginous ray-support, and anterior to this are the masses or laminæ of undifferentiated cells described above. In the middle plane, anterior to the first cartilage, at the regular distance existing between the other ray-supports, cells aggregate, and, later, chondrify, forming another ray-support. That portion of the undifferentiated cell-mass lying between this new cartilage and the one next succeeding it segregates from the rest, and from it muscles corresponding to those of the region of the muscle-buds are developed. This process continues until the usual number of rays and muscles found in the adult fin is reached. In *Salmo salar* this is fourteen in the dorsal and ten in the anal. The anterior ray-support and its muscles are not so fully developed as the others.

Each fin is innervated by a series of spinal nerves. The nerves of each fin are connected by a longitudinal commissure, which is a branch of the ramus lateralis vagi. I am unable at present to trace the development of this interesting plexus.

In late embryonic and in the adult stages the metamerism of the fin corresponds to that of the body of the fish. In earlier stages the fin is more concentrated, as exhibited by the strong convergence of the muscle-buds which enter into it. This varies, however, greatly in different species, and is a matter to which but little importance is to be attached.

The Ventral Fin.—The ventral fin appears considerably later than the median fins. The first traces of it to be seen are slight aggregations of cells in the body-wall just below the ventral edge of the myotomes which lie in the region of the dorsal fin. About the same time the epidermis covering these parts becomes considerably thickened through multiplication of its cells. Before the aggregations of mesenchyme cells become very conspicuous muscle-buds grow out from the anterior ventral angle of each myotome in this region: about six enter the fin-rudiment; those at each end of it projecting very obliquely to the axis of the body, converge towards the middle of the fin.

Dohrn ("Studien IX.," p. 401) draws a sharp distinction between the mode of origin of the musculature of the anal fin and that of the ventral. In this he is followed by Kaestner (Arch. f. Anat. u. Physiol., Anat. Abt. 1892, p. 200). Dohrn remarks that while the anal fin derives its muscles from muscle-buds the musculature of the ventral originates "ohne Vermittelung von Muskelknospen, direct durch Einwachsen der Musculatur vom Urwirbel aus, wie sich leicht an Lachs- und Forellenembryonen nachweisen lässt." I am unable to confirm this statement, as my preparations, both surface views and sections, show distinctly that the muscle-buds which grow into the ventral fins are similar to those which enter the anal, except that the latter are considerably larger.

At this stage nerve-fibres from the spinal nerves of corresponding segments which give off muscle-buds may be detected in the fin. This is a very much earlier stage than the earliest at which nerves could be seen in the median fins.

The mesenchyme proliferates rapidly, while the ectoderm is raised into a fold which projects from the ventro-lateral surface of the body, parallel to its long axis. The mesenchyme forms a compact mass lying under the epidermis; the region next to the somatopleure is filled with less densely packed tissue. The muscle-buds project far into the fin, but, unlike those in the paired fins, are separated from the epidermis by a layer of mesenchyme. Very soon the buds disintegrate.

The region in which the first steps towards differentiation of muscle first appear is the space previously occupied by the muscle-buds. From the very first there are no traces of metamerism in this muscle, although it is safe to assume that the cells from the buds take part in its formation. About the same time at a corresponding position on the opposite or inner side of the fin a similar differentiation takes place. It is not so likely that cells from the muscle-buds take part in this. Between these two muscle-layers the cartilaginous skeleton has by this time appeared. The development of the skeleton has received such thorough treatment at the hands of Wiedersheim and others as to render further mention of it here unnecessary.

The fin rotates so that its line of attachment to the body makes an angle of about forty-five degrees with the long axis of the body. The inner muscle, of which the beginning was described above, becomes the protractor or abductor profundus, and the outer the retractor or adductor profundus. The superficial muscles develop before the twisting of the fin takes place. They are formed through differentiation of the mesenchyme cells which lie between the deeper muscles and the epidermis. It is extremely improbable that cells from the muscle-buds take any part in their make up. The muscles and skeleton grow forward in the body-wall between the ventral ends of the myotomes, so that eventually only a very small portion of each of the muscles lies in the free extremity. In embryonic stages these muscle-masses are continued distally, without sharp dividing line, into the mother-cells of the dermal rays.

The Pectoral Fin.—The pectoral fin diverges from the primitive type more than the other fins, both in its definitive structure and in its course of development. It develops considerably earlier than the others, and lack of histological differentiation of the tissues at that time renders its study more difficult.

The first trace of this fin is to be seen in a thickening of the somatopleure; the thickening of the ectoderm and its fold arise later. This is in accordance with Boyer's observations on *Fundulus* (Bull. Mus. Comp. Zoöl. vol. xxiii. no. 2). The thickened portion of the somatopleure is not confined to the "pectoral plate," but extends to the portions of the splanchnopleure, on the same level, and through the nephrostome to the Wolffian duct. This thickened portion of the peritoneum is due to the cuboidal or columnar character of the epithelium composing it. Anteriorly, laterally, and posteriorly to it the cells flatten out. There is, just anterior to it, a portion of the body-wall in which are numerous mesenchyme cells derived from the head mesoderm. Ziegler (Arch. f. mikr. Anat. Bd. xxx.) has regarded this as the rudiment of the fin. Study of the later stages shows, however, that this region lies completely anterior to that in which the fin develops.

At a somewhat later stage the cells belonging to the pectoral plate become much more distinctly columnar than the others, and, multiplying rapidly, soon become several layers thick, and are much more densely packed than those lying anterior to them. A thickening of the epidermis now takes place, which, unlike that of the ventral fin, consists in an increase in size of the individual cells, and not in a multiplication of the same. At the crest of the prominence which the proliferation of the mesoderm has caused, the ectoderm is thrown into a fold parallel to the axis of the body and extending through three somites. In cross section the structure is triangular; the somatopleure, which extends out over the yolk-sac, is its base, and is nearly horizontal. In profile the crest is semicircular. Through rapid proliferation of the mesoderm-cells the prominence becomes much more pronounced, and soon the height greatly exceeds the breadth. The cells which lie near the base are not so densely packed as those lining the ectodermal walls.

In the meantime the myotomes have sent out processes from their ventral growing edges; but instead of entering into the fin-rudiment, as given by Kaestner (Arch. f. Anat. u. Phys., Anat. Abth. Jahrg. 1892, p. 200) for *Salmo* and Boyer for *Fundulus*, they become greatly elongated and, growing forward, give rise to the coraco-hyoid muscle, as has been described by van Wijhe (Verh. d. Konink. Akad. van Wetenschappen, Amsterdam, Deel 22) for *Pristiurus* and by van Bemmelen (Anat. Anzeiger, Bd. iv.) for *Lacerta*. The first myotome is at this stage quite rudimentary; the second and third lie entirely anterior to the fin, which is on a level with the fourth, fifth, and sixth. The anterior end of the Wolffian duct is opposite the middle or posterior portion of the fifth segment. The first myotome has no ventral process; the second, third, and fourth send out long strands consisting entirely of cells from the cutis plate. These grow ventrally in the somatopleuric wall of the pericardial cavity. After a certain time the first one atrophies, the second and third bend forwards and are followed by the fourth (from the fifth myotome), which grows straight forwards and slightly ventrally. The foremost one becomes attached to the base of the hyoid arch by means of a tendon, the stalks connecting the buds with the myotomes atrophy, and the three buds unite to form a muscle which takes origin from the membranous shoulder-girdle, and is attached to the urohyal. This muscle is still divided into three segments, at least in young fish, in which the yolk-sac is entirely absorbed. The last of these buds extends for one whole segment under the pectoral fin, with the cells of which it is in close contact. Sections through this, a little anterior to the point of origin of the outgrowth, give such a figure as has been drawn by Kaestner (fig. 32). This outgrowth is less well-defined than the others, and in cross section it can often scarcely be distinguished from the mesoderm of the fin. It is not at all unlikely that individual cells may detach themselves from it and remain in the fin; but it is certain that *as a mass it takes no part in the formation of the fin-muscles.*

The sixth myotome has a ventral process, which, however, does not grow forward as the others do. It ultimately pinches itself off from the whole length of the myotome, and becomes an independent longitudinal strand of muscle-fibres which runs dorsal to the attachment to the fin, but which is afterwards probably incorporated into the lateral muscle-masses. The seventh and succeeding myotomes grow ventrally and are concerned in forming the ventral muscles of the fish.

The changes that the fin has undergone are now considerable. The attachment has constricted considerably, at least in comparison with the free portion, which has become a fan-like expansion. With the absorption of the yolk the fin is brought to the ventro-lateral surface of the body, and, rotating on its axis, so that the line of attachment instead of being parallel to the axis of the body now makes an angle of about forty-five degrees with it, the anterior extremity is thus brought into a corresponding position with that described in the posterior. The internal changes that have taken place during this time are the differentiation of the central core of cells into cartilage, and of the proximal portions of the superficial mesenchyme layer into muscle. *It may be regarded as certain that the cells which give rise to these muscles originate from the somatopleuric thickening, and, as is the case with most of the muscles of the ventral fin, are in no way connected with the myotomes.* At first there are but two muscle-masses, a primitive abductor or protractor lying on the outer side of the cartilaginous skeleton and an adductor or retractor on the inner side. A superficial muscle is developed later from a mass of cells lying just within the fin between the deeper abductor and the inner epidermic wall. The superficial protractor or abductor does not appear till much later, and probably arises through delamination from the primitive muscle, though I am not perfectly convinced of this.

The nerves of this fin are distinguished very early in its development, just as in the ventral, *i. e.* before any differentiation of the tissue has taken place. They arise from the first four spinal roots. The first root corresponds to the second myotome, and its ramus ventralis unites soon with the second nerve to form the hypoglossal. This gives off a branch to the fin-plexus and one to the coraco-hyoid muscle. The arrangement is completed very early in the life-history of the individual, and seems to be quite typical for the Teleosts.

Recapitulation.

The mesodermic structures of the median fins are derived from mesenchyme cells derived from the sklerotome and from muscle-buds, which are outgrowths of either the dorsal or the ventral edge of the myotomes. To a certain extent these fins retain their primitive metamerism, in that each muscle-bud may be traced directly into a certain muscle of each segment of the fin. Other muscles are derived from cells which are indistinguishable from mesenchyme cells, and which are in all probability to some extent derived from the same. The segmentation of the extreme anterior portion of the fins is secondary, although in the adult no difference can be seen between the two portions.

The ventral fins show in the early stages of development traces of a similar metamerism. The buds in this case soon disintegrate, and in the space occupied by them a single muscle-mass develops—the adductor or retractor profundus. The other three muscles of this fin are developed from cells which have arisen from the somatopleure, and perhaps also from the sklerotome. This condition in the Teleosts seems to be a step between the Elasmobranchs and the Amphibia. In *Triton* a few isolated cells break off from the ventral edge of several myotomes and mingle with the cells of the posterior extremity, which are, however, mostly derived from the somatopleure.

According to Paterson (Quart. Journ. Micr. Sci. vol. xxviii.) the myotomes in the chick take no part in the formation of the muscles of the limbs. Kaestner has cast doubt upon this statement, but it is doubtful whether his grounds for so doing are sufficient.

The pectoral fin is derived entirely from somatopleuric cells. The muscle-buds of this region are greatly modified and take part in the formation of the coraco-hyoid muscle.

I wish to postpone the full discussion of the meaning of this diversity in the origin of the muscles until some observations on other forms are completed. It is in all probability to be referred to delay in the differentiation of the component parts of the fin until they take up their position within it. In other words, instead of so much connective and skeletal tissue and so much muscle being contributed to the fin, it receives cells which still retain the potentiality to become any of these, and their position with regard to surrounding cells rather than their origin determines their ultimate fate.

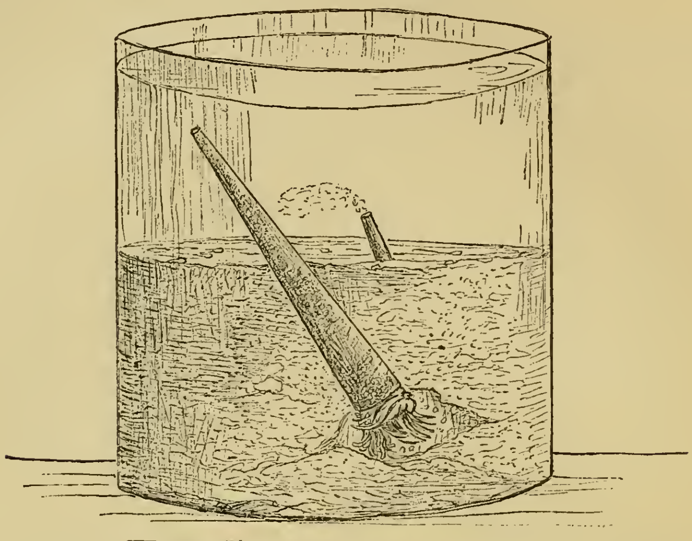
This work, undertaken at the suggestion of Prof. M. Nussbaum, was carried on partly in the Anatomical Institute in Bonn and partly in the Biological Laboratory of the Johns Hopkins University.

X.—*On the Habits of the* Amphictenidæ. By Arnold T. Watson.

Although the marine Annelids of this group are well known as the skilful architects of tapering cylindrical tubes of fine sand, there appears to be a difference of opinion amongst naturalists as to their mode of life; and it may therefore be of interest to record my own observations. Some authorities, for instance, speak of the smaller end of the tube as found uppermost, projecting from the sand, which is doubtless, as we shall see, its normal position. Others, however (Pallas amongst them), describe this position as reversed, the small end buried and the wider one, which is occupied by the animal's head, exposed, or, at all events, close to the surface. This at first sight does not seem unnatural; but when we understand the object of the comb-like head-bristles, whose function, so far as I am aware, has not previously been explained, the vertical position, with the wide end exposed, is seen to be a most disadvantageous one, and, excepting under accidental or occasional circumstances, must be contrary to the habit of the worm.

I have at different times had several specimens of *Pectinaria* or *Lagis* under observation, and in all cases, when left undisturbed, the worms buried themselves more or less completely in the sand, entering it by digging with their combs (as with a fork), and making a passage through which the wide portion of the tube first passed, followed by the narrower part, the extremity of which was frequently left projecting from the sand—the refuse from the animal being expelled through the small end of the tube, which is usually inclined to the surface of the sand, the small end uppermost. As these worms are great travellers, the position varies somewhat, and the tube may occasionally assume the horizontal or even the vertical position; but in all cases the large end is the advancing one. The head-bristles or "golden combs" are used not only for the purpose of digging, but also probably for sifting the sand, thus enabling the animal to select food and suitable material for building. This is evident from the eager way in which the tentacles explore the fresh ground laid open in the cavity formed by each "toss" of the animal's head. The digging is continuous throughout the day, and it is therefore probable that the worm does not, as at present supposed, confine its building operations to the night-time.

The accompanying sketch shows the creature, natural size, partially submerged in the sand and working close against the side of a glass vessel; further off another is ejecting waste material from the narrow end of its tube.



Whether each tube is the lifework of its tenant, or the tubes are shed from time to time, as has been suggested, is an open question; but I am strongly inclined to the former view, for the following reasons:—

(1) Their construction is, as one would naturally expect of such beautiful workmanship, very slow, so far as I have been able to judge.

(2) In many tubes the small end is so minute that it was evidently formed when the animal was *very much* younger.

(3) The tube gradually increases in diameter towards the mouth or growing edge (as in the tubes of other annelids and shells of some mollusks), so that there would appear to be no necessity and but little advantage in shedding the tube; while, on the other hand, there would be, unless we assume a complicated method of change, the great disadvantage of a lengthened exposure of the delicate helpless body of the worm. The fact mentioned by Prof. M'Intosh in a paper recently contributed to the 'Annals and Magazine of Natural History'*, viz. that "the smaller end of the tube has grains considerably finer than the wider upper end," would also appear to support my view.

Sheffield,
June 8, 1894.

* *Vide* ser. 6, vol. xiii. p. 14.

XI.—*Descriptions of One new Genus and Six new Species of Hymenoptera Terebrantia from Queensland.* By W. F. Kirby, F.L.S., F.E.S., Assistant in Zoological Department, British Museum (Natural History), South Kensington.

The following species were received, among others, from Mr. Gilbert Turner, of Mackay, Queensland, for identification; and as they are of considerable interest I hasten to describe them.

Tenthredinidæ.

Hylotominæ.

Hylotoma apicale, sp. n.

Exp. al. 10 millim.; long. corp. 5 millim.

Male.—Head and thorax black, face below the antennæ testaceous; antennæ ciliated; front tibiæ and tarsi whitish; abdomen luteous, the terminal segment and the hinder half above, except on the sides in front, black. Wings brownish hyaline, iridescent.

Female differs as follows:—head rufo-testaceous; abdomen luteous, with only the apex black; antennæ pubescent, not ciliated.

Described from three specimens.

This is the first species of the genus described from Australia. It is a small species, not closely allied to any other.

Pterygophorinæ.

Pterygophorus insignis, sp. n.

Exp. al. 32 millim.; long. corp. 14 millim.

Female.—Head and thorax blue-black; nearly the basal third of the antennæ, a transverse stripe below the antennæ, the prothorax, a large spot on the pleura, the scutellum and postscutellum, and the tibiæ and tarsi testaceous. Abdomen black; segments 2 and 3 testaceous, and 4 sometimes partly so at the base, in the middle and on the sides above, and a long equilateral triangle below, testaceous; segment 7 testaceous, except a triangle at the extremity pointing forward, and a short line on each side of its base; 8 testaceous on the sides, and the curved arch above the saw testaceous.

Wings yellowish hyaline; costa dull orange, a smoky bar extending below its outer two thirds to the tip.

Described from two specimens.

Allied to *P. interruptus*, Klug.

Pterygophorus uniformis, sp. n.

Exp. al. 17–20 millim.; long. corp. 8–10 millim.

Both sexes with the head and thorax chalybeous green, shining; abdomen with the middle segments (generally four, sometimes fewer in male) luteous, edged before and behind with violet-blue, the rest of the abdomen blue-black; antennæ black, with very long pectinations in the male, and strongly dentated in the female; legs testaceous; coxæ, trochanters, femora nearly to the tip, and often the tips of the tibiæ and the greater part of the tarsi, except the basal joint, blue-black.

Wings purplish hyaline; a black dot near the base of the second submarginal cell.

Described from seven specimens.

A small species, varying little, and with sexes alike. It is allied to *P. analis*, Costa, and to a species from Victoria wanting the black dot, and with a lighter yellow band on the abdomen, which is too much damaged to be worth describing.

Lophyridinæ.

Clarissa, gen. nov.

Female.—Antennæ twelve-jointed, thick, subclavate, first and second joints globose; third more slender, nearly twice as long as the first and second together; fourth rather longer than these, and thickened to its extremity; fifth rather shorter than the fourth, thickened at its extremity; the sixth shorter and less thickened; the remainder of nearly uniform thickness, a little longer than wide; the last two joints hardly separated.

Neuration as in *Eurys*, Newman.

Clarissa divergens, sp. n.

Exp. al. 14 millim.; long. corp. 7 millim.

Female.—Rufo-testaceous; head, antennæ, hinder part of pectus, extremity of abdomen, four hind femora, tips of tibiæ, middle tarsi above, and hind tarsi wholly black. Wings iridescent hyaline, with blackish nervures.

Described from a single specimen.

The antennæ differ so much from those of *Eurys*, which has nine-jointed antennæ, slender, well-separated, and not remarkably thickened, that I have decided, with some hesitation, to treat it as a new genus.

Eurys inconspicua, sp. n.

Exp. al. 8 millim.; long. corp. 4 millim.

Female.—Head and thorax æneous black; antennæ short, not much thickened, third joint longest, the rest of nearly equal length as well as thickness; prothorax and legs luteous; meso- and metapectus black, with a slight æneous lustre; tips of hind tibiæ and more or less of four hind tarsi black; tip of antennæ greenish black, most broadly beneath. Wings yellowish hyaline, with broad nervures.

A single specimen.

Chalcididæ.

Eucharinæ.

Rhipipallus (?) *Turneri*, sp. n.

Long. corp. 6 millim.

Male.—Antennæ pubescent, twelve-jointed, scape rather long; the fourth and following joints throwing off a double series of long, stout, pubescent rami, the outer row one-third longer than the inner.

Antennæ black, head and thorax deep violet-purple; vertex narrow, metallic green; ocelli testaceous, in a straight line; thorax rugose-punctate, with a green shade in front, on the sides, and at the edges; petiole blue-green; scape of antennæ beneath, jaws, abdomen, and legs rufous or rufo-testaceous; femora more or less blackish in the middle, hind femora somewhat thickened.

In this species and in *R. Cameroni*, Kirb., the abdomen is shorter and more elevated than in *R. volusus*, Walk., the type of *Rhipipallus*; but the rami of the antennæ in *R. Cameroni* are longer and more slender, and the hind femora are not distinctly thickened. But I do not wish to multiply genera until the Australian Chalcididæ are better known, and therefore include the three species provisionally in one genus.

Described from a single specimen.

XII.—*On the Nutritive and Excretory Processes of Porifera.*

By Arthur T. Masterman, B.A., Assistant-Professor of Natural History, University of St. Andrews.

Since the publication in the June number of this Magazine of my short paper upon the above I have, through the courtesy of Mr. G. Bidder, of the Naples Zoological Station, been put in possession of a paper of his upon the same subject (Proc. Roy. Soc. vol. li.). Before arriving at my own results I had inadvertently overlooked this important work; and my conclusions in several points bear out those stated by him.

Firstly, he finds that "In *Heterocœla* the collars of the collar-cells are at first mere fringes, which help to retain the food and filter the water as it passes from the base of the cell to the moving tip of the flagellum. When the cell is satiated the flagellum ceases to move and degenerates; the collar unites with the neighbouring collars to prevent the water that is already filtered and already foul from returning past the inactive area to pollute the afferent water-supply. When the food has been digested the cells elongate and become closely pressed together; the separation of their basal parts takes place in the manner already described ('In *Leucandra aspera* and *Sycon raphanus* the collar-cell, after it has accumulated a certain quantity of spherules in its base, splits off this base by a transverse fission as a non-nucleated mass of protoplasm, which we may term a "plinth"'—p. 477), and the distal parts start on a new cycle with hungry protoplasm, active flagella, and separated collars."

This conclusion only differs from that at which I arrived in the fact that I have reason to believe that in the case I examined the *whole* collar-cell degenerates to the amœboid condition. The process here described by Bidder is obviously a stage in the differentiation of the endoderm cells into locomotory permanently collared cells, and permanently amœboid (so-called "mesodermic") digestive cells which I suggested as being probable in the higher sponges (p. 495), just as the separation of any organ performing any two main functions into two distinct organs, each performing one of these functions, will be preceded by steps in which the primary organ will be divided into two parts more or less distinct, each performing mainly one function, the separation of the two functions taking place by degrees in time and space (*cf.* urogenital organs and differentiation of sexes).

The above author also describes and figures "Metschnikoff cells," which result from the amœboid degeneration of the collared cells. These he traces to the ectoderm, and he suggests that they are excretory in function.

Secondly, he finds that the ectodermal gland-cells (for which he claims a general occurrence in sponges) are excretory in function, and conduct a process of intracellular excretion. I can find, however, no evidence in his paper of the occurrence of diapedic nephrocytes, which are so clear a feature in the form I studied, unless, indeed, his Metschnikoff cells be shown later to leave the colony through the ectoderm.

The course of the metabolic circuit through the tissues, including the identification of the endodermal choanocytes and the so-called "mesoderm," both morphologically and physiologically, and the part played by each in ingestion and digestion, are all points in which Mr. Bidder's conclusions, arrived at independently and prior to my own, agree with the latter, and confirm the doubts which I expressed with regard to Lendenfeld's deductions.

The importance of the collar-cell metamorphosis from a phylogenetic point of view may be expressed in the statement that further proof than at present exists must be forthcoming before the presence of a true mesoderm or middle germinal layer in the sponges can be accepted as an established fact.

XIII.—*A Visit to Damma Island, East Indian Archipelago.* By James Walker.—*With Notes on the Fauna*, by R. B. Sharpe, G. A. Boulenger, E. A. Smith, R. I. Pocock, C. O. Waterhouse, C. G. Gahan, W. F. Kirby, and F. A. Heron.

The volcanic island of Damma, one of the northernmost outliers of the Serwatty Group, is situated almost exactly halfway between the large islands of Timor and Timor-Laut, and about 350 miles from the nearest point of the coast of Australia. It is less than ten miles in length by about five miles wide, and thus ranks among the smaller members of the great Eastern Archipelago, while it is certainly one of the most remote and least known of them all. Though the island has been for some time in the possession of the Dutch, nothing was known of its natural history previous to the visit of H.M. surveying-ship 'Penguin,' so far as I can ascertain, except that a Dutch collector had landed there for a short time and had procured a few birds. It was the cause of no little satisfaction, both to myself and to my energetic fellow-worker, Dr. P. W. Bassett-Smith, that orders were received on board the 'Penguin' to call at Damma on the voyage from Port Darwin to Hong Kong, and to survey the principal anchorage, Koelewatte Bay—a service which would occupy several days in its execution, and afforded us a prospect of work on a spot hitherto almost untouched by a naturalist.

The 'Penguin' sailed from Port Darwin on October 28th, 1891, and a few days were occupied in the survey of the "Flinders Bank" and other shoals on the edge of the region of comparatively shallow soundings which extends for a long distance from this part of the north coast of Australia. This work being completed on November 4th, we shaped our course for Damma, which was sighted at sunset on the following day. This island rises abruptly from profoundly deep water, a depth of several hundred fathoms being found in the entrance of Koelewatte Bay itself; and at a distance of about forty miles to the southward we reached bottom at 2637 fathoms. Although at first sight Koelewatte Bay has the appearance of a commodious harbour, the available space for anchorage is very limited, the upper part being greatly encumbered with sand-banks and coral-reefs, while it is fully open to the easterly monsoon, which sends in a heavy sea. At the time of our visit the weather was very fine and calm, and we lay snugly enough in twenty fathoms water close to the shore, opposite the crumbling remains of what had once been a very strongly built stone watch-tower, of unknown origin and antiquity.

Soon after we anchored, at 6.30 A.M. on November 6th, the "Posthonder," or representative of the Netherlands Government, came off to the ship in a dug-out canoe to pay his official visit. He was a tall, grey-bearded old man, a Macassar half-caste, and was dressed in the orthodox but most uncomfortable black cloth coat which is *de rigueur* on all occasions of ceremony throughout the Dutch possessions in this part of the world. His staff of office was a gold-headed cane surmounted by the Royal arms of Holland. No European lives here permanently, but the Resident of Amboyna, under whose rule Damma is placed, visits the island annually in a man-of-war, and the mail steamer which makes the round of the Aru, Kei, and other remote islands of the Far East, calls here once in three months for a few hours. This is the sole communication of Damma with the outside world.

We remained at anchor in Koelewatte Bay until the evening of November 11th, and during our stay the harbour was surveyed, a full series of observations to determine the magnetic elements was made, and the Doctor and I were able to ramble about on shore to our heart's content. After the monotony of the wretchedly sterile and featureless coasts of North-west Australia, where we had spent the previous six months, the aspect of this little island was most picturesque and pleasing. The Bay is enclosed on either hand by hills of remarkable steepness and bold serrated outline, rising abruptly from the water's edge to a height of from 600 to 2000 feet; while from high-water mark (and even from below this, if the dense growth of mangrove which fringes the shore in many parts is taken into account) these hills are clothed with a dense unbroken forest of the most vivid green, but apparently not consisting of very large trees. On the northern side of the Bay the fine volcanic peak rises to a height of more than 4000 feet, emitting a constant stream of white smoke from a large depression near its somewhat truncated summit. The upper half of the mountain is bare of forest growth, and is seamed with huge rents and landslips, while bright yellow patches of sulphur can be readily made out near the top. Small quantities of this substance, in a finely crystallized state, are occasionally brought down for export by the natives. Even they do not appear to ascend the mountain very often, and during the stay of the 'Penguin' none of our people mustered up sufficient energy to attempt to reach the summit. The ascent is represented by the inhabitants as being very laborious, and not to be accomplished in a single day. From the steepness and rugged nature of the slopes of the mountain, and the dense and tangled nature of the almost trackless forest which clothed its lower half, I can readily imagine that this is the case. The volcano appears to have remained in its present quiescent state for many years past.

We found it a matter of no small difficulty to penetrate for any distance into the forest, as there were scarcely any paths except in the immediate neighbourhood of the villages, and prickly rattans and thorny bushes rendered the dense undergrowth almost impassable. The shores of the Bay afford somewhat easier walking, and on its north side, at the junction of the sandy beach with the rocks just above high-water mark, are innumerable little springs and trickles of perfectly fresh and pure, but almost boiling water. Some of the larger springs are even utilized by the natives to cook their food, and in none of them can the hand be held even for an instant. In several places, indeed, the volume of hot water flowing over the sand is so great that it is by no means pleasant to walk over, even in thick boots. A beautiful clear stream falls into the head of the Bay, and flows down a

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picturesque gorge, shaded with fine trees, giving access for nearly a mile into the interior of the island, beyond which its rugged and rocky bed, encumbered with huge blocks of trachyte, becomes quite impassable on foot.

Damma is rather scantily inhabited by two races of Papuan and Malay type, who live in separate villages scattered round the shore of the island, and appear scarcely, if at all, to intermix with each other. As Dr. Bassett-Smith has given elsewhere a detailed account of the inhabitants of Damma (Trans. Anthropological Institute, Nov. 1893, p. 135 *et seq.*), it is not necessary for me to say much about them here. Solla, one of the principal Malay villages, is situated near the head of Koelewatte Bay and consists of about thirty very neat palm-leaf huts, surrounded by a well-made "dry-stone" wall some eight feet in height, access being obtained to the interior by means of wooden ladders. The land close to this village, and about the mouth of the stream, is fairly level, and is partly cleared, and roughly planted with tobacco, bananas, a poor kind of bread-fruit tree, the jack-fruit (*Artocarpus integrifolia*), the rose-apple (*Eugenia Jambos*), and the mango. The last-mentioned tree attains to a great size, and produces abundance of delicious fruit, which was just beginning to ripen at the time of our visit. The coco-nut palm flourishes everywhere near the sea, and is tapped for "sagueir" or palm-wine, which is a slightly effervescent milky-looking fluid, somewhat like rather "hard" cider, with a slight but pleasant flavour of the coco-nut, and is very refreshing to drink in the heat of the day. The sago-palm also grows profusely in swampy places, and furnishes the principal sustenance of the natives; the process of preparing the sago from the pith of the palm, in the curious washing-troughs made from the tree itself (so admirably described by Dr. Wallace in the 'Malay Archipelago'), was to be seen in full swing on the bank of the stream. Some fine and curious beetles were obtained by turning over the heaps of half-fermented fibrous refuse resulting from this operation.

The natives have a few pigs and fowls, and are expert fishermen, using a cast-net in the shallows for small fish, and shooting larger ones in the water with a peculiar arrow having three barbed prongs of hard wood. Their canoes are of exceedingly elegant shape and very creditable workmanship, and are hewn out, thwarts and all, from solid logs of a large leguminous tree, which furnishes a soft white timber very like the wood of the lime-tree. The tools used in the work are small adzes, axes, and chisels, the finishing touches being given by a "parang," or chopping-knife. Stability is imparted to these long narrow boats by means of outriggers about ten feet distant from either side, and they are practically unsinkable.

We found these people, without exception, very friendly and well-disposed; the women and young girls were somewhat shy at first, but the small boys were inquisitive, as they are in most other places. In my rambles I was usually accompanied by three or four little urchins, with clothing reduced to a minimum, and they proved very useful in hunting up insects, land-shells, &c. for me. One beetle, a large bronze-coloured Buprestid (*Belionota Walkeri*, Waterhouse), was very abundant on felled timber, but was so exceedingly shy and active on the wing as to defy my efforts for a long time to secure one with a big net. The boys caught them with their hands without the least trouble, exactly as a schoolboy at home catches a "bluebottle," and in a very little while they brought me as many specimens as I wanted. On another occasion I was much amused at the manner in which a little Papuan boy secured the large freshwater prawns (*Palæmon*, sp.) which abounded in the deeper pools in the bed of the stream. He took two long fibres from the pinnule of a rattan-palm, one of which he formed into a running noose, while a morsel of bait was attached to the end of the other. On presenting this bait to a prawn, the creature at once laid hold of it with its long chelæ with an action ludicrously like that of a monkey, and, while thus busily engaged, the noose was gently slipped over its tail and the Crustacean flicked on to *terra firma* with a smart jerk. The boy caught prawn after prawn in much less time than it takes me to describe the operation; but neither my companions nor I could secure a single specimen in this way, though we spent more than half an hour in trying to do so.

A brisk trade was carried on with the natives for weapons, such as heavy palm-wood bows, bamboo-arrows, and spears with large lancet-shaped heads of soft iron &c., besides such personal ornaments as long bamboo combs and neatly carved bone and tortoiseshell earrings and armlets. Old clothes and silver coins were readily taken in exchange for these, the latter being much appreciated for working up into ornaments; but the number rather than the value of the coins appeared to be taken into account when bartering, as a good deal more could be obtained for four threepenny pieces than for a shilling. Tobacco was also eagerly accepted.

In the forest the most abundant birds were two very handsome large fruit-pigeons (*Carpophaga concinna*, Wall., and *C. rosacea*, Temm.). The deep booming notes of these birds could be heard everywhere, especially in the early morning and towards sunset, though in the thick jungle they were by no means easy to see. The crop of nearly every specimen shot was found to contain one or more entire nutmegs, evidently from wild trees, as the nutmeg is not cultivated on Damma. These imparted a peculiarly delicate flavour to the flesh of the pigeons, which were consequently the objects of eager pursuit by our sportsmen. A very beautiful little green fruit-dove (*Ptilopus xanthogaster*) was not rarely seen, and flocks of small and very noisy green parrots frequented the tops of the tall mango-trees, quite out of gunshot. I did not meet with any white cockatoos, which are said to be found on the island.

Butterflies were tolerably numerous, especially along the course of the stream; but I was unfortunately not able to secure examples of the three finest species seen. These were a large light-coloured *Charaxes* and two handsome *Papilios*—one a large black-and-white species evidently allied to the Australian *P. erechtheus*, the other being, I feel almost sure, the *P. aberrans*, Butl., recorded from Timor-Laut. Some twenty-five species in all were observed, the most noteworthy being two or three forms of *Euplœa*, a red *Danais* (*Salatura laratensis*, Butl.), a very pretty *Neptis*, a *Precis* (probably *P. timorensis*, Wall.), two or three species of *Terias*, and several Lycænidæ. Nearly all these appear to be closely allied to or identical with the species collected by Mr. H. O. Forbes in Timor-Laut, and described by Mr. Butler (P. Z. S. 1883, pp. 366, 367). Not the least interesting capture was a large light-coloured female specimen of that wandering butterfly *Anosia plexippus*, L., which I shortly afterwards met with abundantly in the islands of Amboyna and Ternate, many thousands of miles away from its original American home.

The Coleoptera were also well represented both in species and individuals, and I found two recently made clearings in which the stumps and such felled trees as had been allowed to remain yielded a good harvest of small but very interesting beetles under the loose bark and among decaying leaves and fungi. Two grand Buprestidæ, *Cyphogastra abdominalis* and *Pseudochrysodema Walkeri*, recently described by Mr. C. O. Waterhouse (Ann. & Mag. Nat. Hist. ser. 6, vol. x. pp. 410–412), were not rare here, flying in the bright morning sunshine and settling on logs and stumps. These beetles appeared to take a great fancy to one particular stump of a large *Ficus* tree near the top of a steep bank, and not easily reached; but, unlike another large Buprestid already alluded to, they were sluggish and heavy in flight, and were not very difficult to catch. The bright yellow dorsum of the *Cyphogastra* is very conspicuous when the insect is on the wing. One of the most interesting beetles met with was a singular form of the Heteromerous genus *Platydema* (*asymmetricum*, Champion, Ent. Month. Mag. ser. 2, vol. iv. p. 274), the male of which is furnished with a single long erect horn on the left side of the head. The Longicornes proved, to my disappointment, to be very poorly represented here, as only two or three species of this important group of beetles were captured.

Other insects were fairly abundant, and I must not forget to mention the mosquitoes, which were sufficiently numerous and troublesome in the vicinity of water; nor the ants, which swarmed everywhere, and on one occasion got into my pith helmet (used as a collecting-box) in myriads while I was resting and dozing under a tree, and ate up my entire day's catch of butterflies. Fortunately the solitary specimen of *Anosia plexippus*, which I valued more than any other, was evidently not to their taste, as it escaped their devouring jaws without the slightest damage. On the prickly leaves of the *Pandanus*, or screw-pine, growing on the beach, a large green "stick-insect" was frequently met with in pairs, and was remarkable for emitting when handled a milky-looking fluid, having a strong odour of peppermint, from the thoracic spiracles.

I could only hear of one mammal indigenous to Damma, this being a species of *Cuscus*, or eastern opposum (*C. maculatus*). One of the men procured a young specimen from the natives, which, on its decease two or three days afterwards, was handed over to me and duly put into spirit.

The result of our five days' collecting was approximately as follows:—

- 1 species of Mammalia.
- 9 species of Birds (skinned and preserved by Dr. Bassett-Smith).
- 5 species of Reptiles.
- 7 species of Land and 3 species of Freshwater Mollusca.
- 100 species of Coleoptera.
- 30 species of Lepidoptera.
- 30 species of other orders of Insects.
- 1 Freshwater Crustacean.

As well as a large number of specimens of marine zoology, collected by the doctor on the reefs and by dredging in the harbour.

We finally quitted Damma on the afternoon of November 11th, enjoying a splendid view of the volcano as we steamed slowly out of Koelewatte Bay; and I think that all on board regretted that our stay at this interesting little island was necessarily so brief, even though our next halting-place was to be one of the most beautiful and famous localities in the Eastern tropics—the island of Amboyna.

Zoological collections of great scientific interest were made during the surveying-voyages of H.M.S. 'Penguin,' under the command of Captain W. U. Moore, by Messrs. J. J. Walker, Chief-Engineer, and P. W. Bassett-Smith, Surgeon of the ship. All these collections were presented by the Lords of the Admiralty to the Trustees of the British Museum, and are in progress of being worked out by the staff of the Zoological Department. The following notes refer to the terrestrial fauna only of the island.—A. G.

BIRDS. By R. B. Sharpe.

The small collection of birds obtained on Damma Island apparently contains two species new to science. One of these, *Rhipidura Büttikoferi*, I have already described; and in the present paper I add another species to the overwhelming genus *Zosterops*.

So far as can be judged from this small amount of material, the birds of Damma Island are almost identical with those of Timor-Laut on the one hand and Timor on the other, though some species, such as *Rhipidura elegantula*, may be found peculiar to the Damma, Lettie, and Wetter group of islands.

1. *Rhipidura elegantula.*

Rhipidura elegantula, Sharpe, Notes Leyden Mus. i. p. 23 (1879).

An adult specimen in rather poor condition. I think, however, that there can be no doubt about the identity of the bird with *R. elegantula*, which I described from a Lettie specimen in the Leyden Museum.

2. *Rhipidura Büttikoferi.*

Rhipidura Büttikoferi, Sharpe, Bull. Brit. Orn. Club, no. iv. p. xviii (1892).

An adult bird. This species is closely allied to *Rhipidura setosa*, but is much darker brown above, being blackish brown, not grey, and having much more white on the two outer tail-feathers. Total length 6·8 inches, wing 3·4.

3. *Graucalus melanops.*

Graucalus melanops (Lath.), Sharpe, Cat. B. iv. p. 30 (1879); Salvad. Orn. Papuasia, ii. p. 130 (1881).

One adult and two immature birds. This species has somewhat a wide range in the Moluccas, being found not only in Australia, but in New Guinea, the Aru and Kei Islands, Amboina, and Timor.

4. *Zosterops Bassetti*, sp. n.

Similis *Z. albiventri*, sed paullo major, loris et gutture aurantiacis nec sulphureis, et corporis lateribus cinerascenti-brunneis nec isabellinis distinguenda.

Long. tot. 5·0 poll., culm. 0·6, alæ 2·45, caudæ 1·75, tarsi 0·75.

This species belongs to the section of the genus *Zosterops* which contains *Z. albiventer* and *Z. crissalis*. It is very like both these species, but is slightly larger than either of them. The loral spot and the throat are of a deeper and more orange-yellow, and the sides of the body are ashy brown, darker than the same parts in *Z. albiventer*, but not so dark as in *Z. crissalis*.

5. *Stigmatops kebirensis.*

Stigmatops kebirensis (A. B. Meyer), Salvad. Agg. Orn. Papuasia, ii. p. 123 (1890).

A single specimen, which seems to be immature. The scaling on the throat appears not to extend down the breast as in *S. squamata*, but to be more confined to the throat, this being one of the characters of *S. kebirensis*.

On looking over the series of these birds in the Museum, I must say that I fail to see the characters for separating *S. Salvadorii* of Timor-Laut from the true *S. squamata* from Khoor, of which two specimens are in the Museum. It also seems to me very doubtful if the distinctness of *S. kebirensis* will ultimately be maintainable, for it appears quite probable that the characters of this species are those of immaturity.

It should be noticed that, according to Count Salvadori, *Stigmatops chloris* is found on Damma; but the specimen now sent is certainly not of that species.

6. *Hirundo gutturalis.*

Hirundo gutturalis (Scop.), Salvad. Orn. Papuasia, ii. p. 1 (1881) Sharpe, Cat. B. x. p. 134 (1885).

A young bird just commencing its moult.

7. *Psitteuteles euteles.*

Psitteuteles euteles (Temm.), Salvad. Cat. B. xx. p. 64 (1891).

An adult male. Apparently a species confined to the Timor group of islands, and already known from Timor, Flores, Wetter, Lettie, Babbar, and Timor-Laut.

8. *Ptilopus xanthogaster.*

Ptilopus xanthogaster (Wagl.), Salvad. Orn. Papuasia, iii. pp. 4, 554 (1882); id. Cat. B. xxi. p. 91 (1893).

An adult bird. This species has already been recorded from Lettie, and it is also found in Banda, Timor-Laut, and the Kei Islands.

9. *Carpophaga rosacea.*

Carpophaga rosacea (Temm.), Salvad. Orn. Papuasia, iii. p. 89 (1882) id. Cat. B. xxi. p. 198 (1893).

An adult male. Found in all the Timor group of islands, and already recorded from Lettie, Kisser, and Wetter; also occurs in the Kei Islands, Halmahéra, and Celebes.

10. *Carpophaga concinna.*

Carpophaga concinna, Wall., Salvad. Orn. Papuasia, iii. p. 81 (1882); id. Cat. B. xxi. p. 186 (1893).

An adult male. This specimen has been recorded by Count Salvadori in the 'Catalogue.' The species is found in Timor-Laut and Banda, as well as in Matabello, the Kei, Aru, and Sanghir groups.

REPTILES. By G. A. Boulenger.

Of the five forms obtained, three are well known and widely distributed, whilst two (*Lygosoma striolatum* and *Ablepharus Boutonii*, var. *furcata*) are recent additions to science, and were previously unrepresented in the British Museum. They have been described by Prof. Max Weber in his 'Zoologische Ergebnisse einer Reise in Niederl. Ost-Indien,' 1890, from specimens obtained on the Island of Flores.

Gecko verticillatus, Laur.

Widely distributed species, ranging from Bengal, Burma, and Southern China to the Moluccas and Tenimber Islands.

Calotes cristatellus, Kuhl.

The range of this lizard extends from the Malay Peninsula to the Moluccas and Tenimber Islands.

Lygosoma striolatum, M. Weber.

Two specimens were obtained by Mr. Walker: one has 40 scales round the body, like the type from Flores, the other 42. In the specimen with 40 series of scales the præfrontals are fused, the median suture having entirely disappeared. In both the first supraocular is considerably longer than the second.

Lygosoma fuscum, D. & B.

So far as we know at present, Damma Island is on the western limit of the distribution of this lizard, which inhabits the Moluccas, New Guinea, and Northern Queensland.

Ablepharus Boutonii, var. *furcata*, M. Weber.

Three specimens of this well-marked variety: two with 24 scales round the body, the third with 26; all three with four upper labials anterior to the subocular and the characteristic coloration so well described by Prof. Weber; the stripes, however, instead of being white, are golden. Total length 77 millim.

LAND AND FRESHWATER SHELLS.

By Edgar A. Smith.

The collection of land and freshwater shells, although small, has a special interest, being the first which has been received from Damma Island. It consists of seven species of land-shells (one operculate and six non-operculate), a *Neritina*, a *Septaria*, and a *Cassidula*. Four of the non-operculate terrestrial species are certainly new, and belong to the genera *Macrochlamys*, *Xesta*, *Chloritis*, and *Eulota*. The species belonging to these groups are, generally speaking, restricted in their distribution, although the genera themselves may have a fairly wider range. On the contrary, the sixth non-operculate species belongs to the genus *Opeas*, the species of which, in some cases at least, are almost cosmopolitan. The operculate form, *Leptopoma vitreum*, is also very widely distributed.

The species of *Neritina*, *Septaria*, and *Cassidula* also belong to forms which have a great range, as might be expected, for the species of these genera, in many instances, are notorious for their wide distribution.

In comparing the terrestrial fauna of Damma Island, we naturally seek a comparison with that of the most adjacent localities. The islands of Timor and Timor-Laut are the largest tracts of land in the vicinity, and Damma lies about midway between them, but a little more northward. The terrestrial mollusca of both Timor and Timor-Laut are more or less perfectly known, and there certainly is a close resemblance between the shells of those islands, especially Timor-Laut, and those occurring at Damma. All the genera found by Mr. Walker at the latter locality are represented on Timor-Laut with one exception—the *Macrochlamys*, and the *Lamprocystis* mentioned by Dr. O. von Möllendorff* may be considered its equivalent. In one instance the species are extremely closely related, namely, *Eulota subcornea* with *E. hemisphærica*, and in the case of *Corasia* and *Leptopoma* the same species occur in both localities.

1. *Macrochlamys pseudosuccinea.*

Testa minute perforata, conoideo-depressa, nitida, semipellucida, flavo-cornea, lineis incrementi tenuissimis striata; spira brevis, conoidalis, ad apicem obtusiuscula; anfractus 5, convexiusculi, infra suturam concave marginati, ultimus in medio acute rotundatus, sed haud angulatus, vix descendens; apertura oblique lunata; peristoma tenue, margine columellari leviter incrassato, superne dilatato et reflexo, umbilicum semiobtegente.

Diam. maj. 12 millim., min. $10\frac{1}{3}$, alt. 8; apertura 6 lata, 5 alta.

Four specimens of this species were collected by Mr. Walker. The largest, the measurements of which are given above, has half a whorl more than the rest and is probably adult.

In the younger shells the columella is more upright than in the more mature shell, and forms a more or less distinct angle with the basal margin of the aperture.

M. succinea, Pfr., from the Philippines, recalls the general appearance of this species. It is, however, smaller, and yet has more numerous whorls.

2. *Nanina* (*Xesta*) *dammaensis.*

Testa minute perforata, depresse conoidea, in medio carinata, fusco-cornea, interdum linea rufa angusta supra carinam pallidam et

* Nachrichtsblatt deutsch. malak. Gesell. 1892, pp. 81–102.

suturam cincta, maculis irregularibus opacis luteis plus minus picta, nitida, lineis incrementi tenuibus, aliis obliquis et spiralibus decussatis sculpta; anfractus 5, convexiusculi, subceleriter accrescentes, supra suturam anguste marginati, ultimus ad peripheriam subacute angulatus, haud descendens, infra paulo convexior quam supra; spira breviter conica, vix convexiuscula, ad apicem subobtusa; apertura obliqua, fusco-cornea, in medio linea rufa et carina albida translucentibus; peristoma tenue, margine superiore obliquo, parum arcuato, ventrali late curvato, columellari paulo incrassato, superne breviter reflexo, rimam semiobtegente.

Diam. maj. 25 millim., min. 22, alt. 15; apertura 13 lata, $11\frac{1}{2}$ longa.

Six specimens of this species were collected by Mr. Walker, three being adult and three about half-grown. In the young state none of that opaque yellowish or creamy mottling which sometimes occurs in the adult is visible. It is present in two out of the three adult examples, the third being of a rich brown colour above, somewhat paler beneath, and whitish at the peripherial keel. The oblique sculpture, which is rather irregular and scratchy, is exactly in the opposite direction to the lines of growth.

I do not know any species very closely allied to the present form. It is somewhat like *X. glutinosa*, Metcalfe, from Borneo as regards general form and the carinate periphery. *N. Peaseana*, Pfr., said to come from Timor, is a larger species, less acutely keeled, more opaque, and more strongly obliquely striated. It was considered a form of *N. rareguttata* by Tryon, who never saw a specimen of it; but in my opinion it is sufficiently distinct.

3. *Eulota subcornea.*

Testa anguste umbilicata, parva, depresse globosa, semipellucida, cornea, oblique tenuiter et arcuatim striata, lineis spiralibus microscopicis confertis sculpta; spira mediocriter elata, leviter convexa, ad apicem subobtusa; anfractus $4\frac{1}{2}$, convexiusculi, regulariter crescentes, ultimus haud descendens, ad peripheriam postice subacute carinatus, carina labrum versus fere evanida; apertura obliqua, lunata; peristoma pallidum, leviter incrassatum, superne vix expansum, inferne reflexum, margine columellari leviter dilatato.

Diam. maj. 10 millim., min. $8\frac{1}{2}$, alt. 7; apertura 4 longa et lata.

This species must be very similar in many respects to *E. hemisphærica* from Timor-Laut, judging from Möllendorff's * description. It is, however, smaller and the peristome is not rose-tinted. It appears to be similarly minutely striated, has

* Nachrichtsblatt deutsch. mal. Gesell. 1892, p. 90.

the same kind of spire, a sharpish keel at the periphery, and a smooth nucleus.

4. *Chloritis dammaensis.*

Testa depressa, suborbicularis, umbilicata, mediocriter tenuis, fuscescens, haud nitida, lineis incrementi tenuibus striata, undique minute punctata; anfractus 4, convexi, sutura profunde sejuncti, ultimus ad peripheriam acute rotundatus, antice breviter descendens; spira depressa, ad apicem obtusa; apertura late lunata, obliqua; peristoma tenue, cæruleo-albidum, breviter expansum et reflexum, margine columellari superne dilatato, reflexo.

Diam. maj. 16 millim., min. 14, alt. 10; apertura 7 alta, 5 lata.

Chloritis Micholitzi, Möllendorff*, from Timor-Laut, is a similarly depressed species, but otherwise different in form. Its aperture is much more elongate and the body-whorl descends more obliquely and is more regularly rounded and not so shouldered as in the present form. The upperside of *C. ursina*, Pfeiffer, from the Admiralty Islands is peculiarly like that of *C. dammaensis*, but the form of the aperture and the sculpture are different.

5. *Cochlostyla* (*Corasia*) *tenimberica*, Möllendorff.

Cochlostyla (*Corasia*) *tenimberica*, Mölldff. Nachrichtsbl. deutsch. mal. Gesell. 1892, p. 97, pl. i. fig. 2.

A single specimen from Damma is a little larger than the type, having a major diameter of 26½ millim. On comparison with an example from Timor-Laut, the columella appears a little different, being less thickened, and the reflexed white callus in the umbilical region is wanting. In other respects the shells are so alike, that I have no doubt of their being conspecific.

6. *Opeas Tuckeri*, Pfr.?

Hab. Sir Charles Hardy's Island, North Australia, &c.

Dr. Möllendorff quotes *O. gracile*, Hutton, from Timor-Laut, but that species is more acuminate or tapering than the specimens from Damma. These are hardly so slender as the type from Hardy's Island, but are very similar to other examples of this species from Mabuiag, N. Australia.

7. *Leptopoma vitreum*, Lesson, var.

The three specimens from Damma appear to agree with var. *intermedia*, Martens (Reise Ost-Asien, Zool. vol. ii. p. 144).

* Nachrichtsbl. deutsch. mal. Gesell. 1892, p. 95, pl. i. fig. 5.

Two of them are immature, very thin, and of a semitransparent white colour. The remaining specimen is full-grown, with oblique olive-brown stripes above and a broad zone of the same tint around the umbilicus. Beside the peripherial keel, there are three others, somewhat finer, which encircle the upper part, and the entire surface is finely spirally striated. In general form they resemble Marten's figure 5, var. *latilabris*, rather more than the figure of var. *intermedia* (fig. 4).

8. *Cassidula sulculosa*, Mousson, var.

The form of this species occurring at Damma differs from the type from Java and other localities both in colour and the notch in the upper part of the labrum. These specimens are of a very dark black-brown colour, with a single yellowish line at the shoulder of the body-whorl, which is also of a flesh tint at the base below the keel. The lip is also of a pale reddish or flesh tint, but the notch at the upper part is very slight, a mere sinuation and not a decided sharp incision as in the typical form. This variety also occurs at the Louisiade Archipelago.

9. *Neritina corona*, Linn., var.

The specimens from Damma Island agree with the variety figured by Reeve under the name of *N. subgranosa*, Récluz (Conch. Icon. fig. 24). This form also occurs at the Louisiade Archipelago and the Philippine Islands.

10. *Septaria borbonica*, Bory St. Vincent.

The specimens collected by Mr. Walker appear inseparable from this species, which is common to Mauritius, Madagascar, and the neighbouring islands. The occurrence of specimens at Damma agreeing precisely with examples from Mauritius seems very remarkable, but I have already recorded an equally interesting case of wide distribution in a species of the allied genus *Neritina*, namely *N. crepidularia*. This species, which is common in the delta of the Ganges, at Ceylon, the Eastern Archipelago, &c., also occurs on the Gold Coast, West Africa.

ARACHNIDA. By R. I. Pocock.

Scorpions.

Archisometrus mucronatus (Fabr.).

This species ranges from Burmah, through Sumatra and Java, to Celebes and Flores.

Hormurus australasiæ (Fabr.).

This species is also widely distributed over the Indo-Malayan and Austro-Malayan areas.

Spiders.

Nephila, sp.

An immature female example, apparently about half-grown.

Pistius spectabilis (Dol.).

Pistius spectabilis (Dol.), Verh. Nat. Vereen. Nederlandsch Indië, v p. 56, pl. vi. fig. 7 (1858–1859).

This species was originally described from Amboyna, and Dr. Thorell (Ann. Mus. Civ. Genov. xvii. p. 332, 1881) has subsequently recorded it as *P. pustulosus*, L. Koch, from New Guinea, Kei Island, and Aru Island. It also occurs in the north-eastern parts of Australia.

COLEOPTERA (partim). By C. O. Waterhouse.

Carabidæ.

Tachita nana, Gyll. Europe, Siberia, N. America.

Aleocharidæ.

Homalota, sp.

Staphylinidæ.

Philonthus, sp.
Leptacinus flavipennis, Kz. Ceylon.

Pæderidæ.

Lithocharis curtus, Kz. Ceylon &c.

Piastidæ.

Lispinus, sp. Under bark of *Ficus*.
——, sp. Under bark of *Ficus*.
Leptochirus Beccari, Fauv. Common in heaps of sago-refuse.

Scydmænidæ.

Eumicrus, sp. Under bark.

Histeridæ.

Platysoma cribropyum, Mars. Philippines &c.
Epierus, sp.
Paromalus, sp.
All these Histeridæ were found under bark.

NITIDULIDÆ.

Carpophilus flavipes, Er. Singapore &c. Under bark of *Ficus*.
Genus —— ? Near *Carpophilus*.

COLYDIIDÆ.

Ditoma, sp.
Colobicus, sp.
——, sp.
Synchita rugulosa, Guér. ? West Indies. Under bark.
Colydium ??, sp.
——, sp.

CUCUJIDÆ.

Hectarthrum brevifossum, Newm. Java, Borneo.
Inopeplus trepida, Pascoe. Dorey.
Læmophlœus plicatus, Watl. Europe.
——, six other species.
Platycotylus inusitatus, Olliff. Andamans, Australia.
Silvanus unidentatus, F. ? Europe.

CRYPTOPHAGIDÆ.

Genus —— ?

LATHRIDIIDÆ.

Holoparamœcus singularis, Beck. Cosmopolitan. Under bark.

HYDROPHILIDÆ.

Cyclonotum dytiscoides, Fabr. Malacca, Java, Celebes, &c. In decayed stems of banana.
—— *hydrophiloides*, McLeay. China, Java, &c. In wet sago-refuse.
——, sp.

FIGULIDÆ.

Figulus, sp. (near *manillarum*, Hope). Under bark.

CETONIIDÆ.

Cetonia (near *intricata*, Saund.). Not in good condition.

BUPRESTIDÆ.

Pseudochrysodema? *Walkeri*, Waterh. Sometimes flying, at other times in company with the following on stumps of *Ficus*.
Cyphogastra abdominalis, Waterh.
Belionota Walkeri, sp. n. Everywhere on fallen timber; very active.

EUCNEMIDÆ.

Soleniscus?, sp. Under bark of felled *Ficus* in a clearing.

DASCILLIDÆ.

Ptilodactylus?

CLERIDÆ.

Tenerus Moorei, sp. n. Under bark of newly felled *Ficus*.

Cioidæ.

Minthea rugicollis, Walker. Ceylon, China, Saylee.
Cherostus (gen. nov.) *Walkeri*, sp. n. This and the foregoing were found in numbers in dry fungus on stumps.

Tenebrionidæ.

Opatrum dispersum, Champion.
—— *moluccanum*, Blanch. Amboyna &c. Under logs.
Bradymerus clathratus, Schaufuss. Sunda Island.
Hoplocephala?
Platydema asymmetricum, Champion.
—— *sodale*, sp. n.
—— *scriptipenne*, Chevr. "Madagascar"*, India, Siam, Java, Macassar.
—— *plagiatum*, sp. n.
All these species were under loose bark.
Pachycerus, sp., very near *domesticus*, Montr.
Palorus depressus, Fabr.? Under bark.
—— *minor*, sp. n. Under bark.
Toxicum ruficolle, Pascoe. Under bark.
Amarygmus, sp. Under bark.

Anthribidæ.

Plintheria?
Encorynus, sp.
Aræocerus, sp.

Brenthidæ.

Orychodes, sp.
Cyphagogus, sp.
Genus ——?

Curculionidæ.

Celeuthetes cinerascens, Blanch. Australia, Morty, Aru, &c. Sweeping herbage.
Camptorhinus, sp.
Acalles, sp.
Myctides, sp.
Phænomerus exilis, Pascoe. Australia.
Oxydema, sp.
Stenotrupis?
Sphenophorus tincturatus, Pascoe. Celebes, Batchian, Mysol. In decayed banana-stems.
——, sp.

Scolytidæ.

Hylesinus?
Cryphalus?
Eccoptopterus sexspinosus, Mots.

* Has not this locality been originally misread? a specimen in Mr. Pascoe's collection is from Macassar. I think *P. bifasciatum*, Chevr. (Dorey), may be a variety.

Tomicus?
Crossotarsus, sp.
Platypus solidus, Walker. Ceylon, Celebes.

COCCINELLIDÆ.

Epilachna, sp.

CORYLOPHIDÆ.

Aphanocephalus, sp.

EROTYLIDÆ.

Episcapha australis, Lac. Australia, Batchian, &c. In fungus, common.
Aulacochilus cyaneipennis, sp. n.
Euxestus Parki, Woll. Madeira, Island of Rodriguez, &c.

New Species and Notes.

Buprestidæ.

Pseudochrysodema (?) *Walkeri*, Waterh.

Aureo-viride, nitidum; thorace subtiliter punctulato, linea mediana vix elevata lævi, lateribus leviter impressis crebrius punctatis, basi utrinque fovea parva insculpta; elytris nigro-cyaneis, convexis, punctatis, haud costatis, ad apicem bene acuminatis acute serratis; tarsis flavis, unguibus æneis; antennis articulis 3^{o}–11^{m} nigris.
Long. 15 lin.

In the Ann. & Mag. Nat. Hist. x. 1892, p. 411, I described this and the following species from Mr. Walker's specimens. *P. Walkeri* is somewhat intermediate between *Pseudochrysodema* and *Paracupta*; but I have not thought it desirable to propose a new genus for its reception.

Cyphogastra abdominalis, Waterh.

Viridis, nitida; thoracis disco utrinque cyaneo suffuso; elytris sat fortiter punctatis, ad apicem lævioribus, fere nigris, ad latera postice aureo-viridi suffusis, margine ipso cupreo tincto; corpore subtus aureo-viridi, lateribus abdomineque læte cupreis, hoc vittis quatuor sordide albis ornato.
Long. 13–16 lin.

Very like *C. nigripennis*, Th., but rather broader and more strongly punctured, with the apex of the elytra formed as in *C. calepyga*, Th.

Belionota Walkeri, sp. n.

It is always with great reluctance that I give a name to what many would consider a variety, but this is one of the cases in which I feel obliged to do so. The examples brought by Mr. Walker are constant in coloration and are very different from any specimens of *B. fallaciosa*, with which in every other respect they agree. The general colour is brassy brown, a colour common in *Sphenoptera* (e. g. *S. rauca*) but not in *Belionota*. The hind angles of the pronotum are obscure violet. The abdomen is obscure steel-blue, with the sides and a spot in the middle of each segment coppery, the sides in some examples being reddish coppery.

Cleridæ.

Tenerus Moorei, sp. n.

Aurantiacus, nitidus; thorace maculis duabus, elytris fasciis duabus latis, antennis, tibiis tarsisque nigris.
Long. 5 lin.
Var. Elytris nigris.
Long. 3 lin.

This species very much resembles the African *T. variabilis*, but it is more strongly punctured. Thorax very slightly transversely impressed before the middle, with an elongate smooth tubercle at the base, on each side of which is a distinct impression; in front there are two rather large black spots. Elytra with a rather broad blue-black fascia at the base, and a rather broader one just before the apex, both interrupted by the suture, and not quite reaching the margin. The knees, tibiæ, and tarsi are black.

A small specimen, which appears to me to be only a variety of this species, has the two black spots on the thorax united into one large spot, but there are traces of a red line in its middle. The elytra are black, but a little red may be traced at the extreme apex and in the middle of the lateral margin.

Cioidæ.

Minthea rugicollis, Walker.

I have just compared the types of *Ditoma rugicollis*, Walker (1858), and *Minthea similata*, Pascoe (1863), and they appear to me to be the same species. Both these authors place this insect in the Colydiidæ. It is, I think, undoubtedly allied to *Lyctus*—in fact, scarcely separable from that genus.

CHEROSTUS, gen. nov.

Head when at rest concealed from above by the prothorax. Eyes slightly reniform, coarsely granular. Antennæ eleven-jointed, the basal joint moderately large, the second irregularly globose, the third narrower; the following joints gradually becoming wider, the ninth and tenth very transverse, the eleventh broader than long, rounded at the apex. Mentum subquadrate; ligula broad, narrowed at the base, with its anterior angles rather prominent; labial palpi acuminate at the apex. Maxillæ small, rather short and broad; the inner lobe small, fringed with soft hairs; the terminal part of the outer lobe short and broad, fringed on its inner and apical margins with long, dense, rather stiff hairs. Mandibles triangular, very acute at the apex, with a small tooth beyond the middle. Prosternum very short; the intercoxal process narrow, arched; coxal cavity closed behind. The anterior coxæ somewhat transverse, moderately prominent; tibiæ elongate, a little wider at the apex; outer margin serrate, with a slightly curved hook at the apex at the insertion of the tarsus. Intermediate coxæ very slightly separated, transversely ovate. Metasternum rather short, its episternum very narrow. Posterior coxæ transverse. Posterior tibiæ elongate, a little widened at the apex, denticulate at the truncate apex, without spurs. Tarsi four-jointed *, the claw-joint a little longer than the three basal joints united. Pronotum separated from the prothoracic episterna by an acute margin. Scutellum distinct. Elytra costate.

This genus is very closely allied to *Eutomus*, but the structure of the antennæ is quite different; the anterior coxæ are a trifle more prominent; the metasternum shorter. In form it is even more like *Eledona* than *Eutomus* is.

The pubescence on the head of *Ch. Walkeri* is very suggestive of Xylophagous affinities, but the position of the genus is, I think, certainly with the *Cioidæ*.

Cherostus Walkeri, sp. n.

Oblongus, bene convexus, fusco- vel rufo-piceus, opacus; antennis pedibuspue rufo-piceis; capite confertim punctato, antice leviter concavo, aureo-pubescenti, antice cristato; thorace transverso, convexo, antice parum angustato, confertim fortiter punctato, rugoso; elytris parallelis, costatis, costis acutis, angustis, nitidis, interstitiis rugosis.

Long. $1\frac{1}{2}$–$1\frac{3}{4}$ lin. †

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* If there be a fifth it is entirely within the tibial cavity.

† An allied species from Port Bowen, E. Australia, has been for some years in the British Museum. I propose to call it

Cherostus Simpsoni.

C. Walkeri valde affinis, ferrugineus, opacus; capite convexo, confertim punctato, antice nitido, calvo; thorace confertim fortiter punctato; elytris costatis, interstitiis rugosis.

Long. $1\frac{1}{2}$ lin.

A trifle smaller than *C. Walkeri*, without pubescence on the head, and with the costæ of the elytra so narrow that they do not appear shining.

Tenebrionidæ.

Diaperinæ.

Platydema sodale, sp. n.

Ovale, convexum, nitidum, flavum; elytris *x*-nigra ornatis.
Long. $1\frac{1}{2}$ lin.

Head moderately closely and rather strongly punctured. Eyes separated above by a space equal to rather more than the width of the eye. Thorax rather closely and moderately strongly punctured, but the punctures are of unequal size; a fine smooth median line extends from the base to near the front margin; there is a slight impression on each side of the base. Elytra with lightly impressed striæ; the striæ closely and very distinctly punctured; the interstices gently convex, closely and extremely finely punctured; yellow, with a narrow blackish-brown basal band (not extending beyond the humeral callus), and a broader band across the middle, not quite reaching the margin, slightly emarginate behind in the third interstice; both bands united by black at the suture. Antennæ with the fourth joint scarcely enlarged, the fifth distinctly broader, the following joints transverse.

Platydema plagiatum, sp. n.

Ovale, convexum, nitidum, piceo-nigrum; ore, antennis pedibusque rufo-piceis; thorace rufo, subtiliter crebre punctulato, basi apiceque infuscato; elytris evidenter striato-punctatis, fascia sat lata ante medium (in sutura interrupta) apiceque flavo-rufis.
Long. $2\frac{1}{4}$ lin.

Antennæ dilated from the fourth joint. Head finely but distinctly punctured. Eyes large, separated above by a very narrow space. Thorax red, blackish brown at the base and behind the head, very finely and rather closely punctured, the punctuation more distinct at the sides than on the disk, the extreme lateral margin blackish. Elytra black, with distinct lines of punctures, the punctures close together, the dorsal lines fine and not impressed, the lateral ones stronger and impressed; interstices closely and extremely finely punctured, the lateral ones very slightly convex. Each elytron has near the base a transverse rectilinear yellow spot extending from the margin to near the suture; this spot is only a trifle wider than the black at the base; the apical spot occupies the greater part of the apex, extending on the margin itself to the first spot and to the sutural stria at the apex, leaving the suture black, the black widening out above.

Ulominæ.

Palorus minor, sp. n.

Statura *P. depressi*, angustior, nitidus; elytris tenuiter striato-punctatis.

Long. $1\frac{1}{4}$ lin.

Resembles *P. depressus* in general form, but is much smaller, much narrower, paler in colour, and more shining. The thorax is narrower, narrowed at the base in the same way, very much more finely punctured. Elytra more parallel, with lines of very fine but distinct punctures, the punctures appearing slightly irregular in size; the interstices rather narrow, nearly flat, each with a line of extremely fine and delicate punctures. The fifth stria is more impressed for a short distance at the base, and the interstice beyond it is rather more convex, giving the appearance in certain lights of a short costa.

Toxicum ruficolle, Pascoe.

This species was described from Matabello by Mr. Pascoe under the name *Anthracias ruficollis* (A. M. N. H. 1883, xi. p. 439), and he placed with it a specimen from Saylee which he considered a variety of it, having a black line down the middle of the thorax.

The specimen from Saylee is *Toxicum Chevrolati*, Montr. (1855), described from Woodlark Island; specimens are in the Museum collection from New Guinea, and were described by Mr. F. Bates as *Toxicum picticolle* (1873).

T. ruficolle differs from *T. Chevrolati* in having the thorax entirely red, in being a trifle larger, and in having the prosternal process less strongly punctured and less strongly grooved at the sides.

Erotylidæ.

Aulacochilus cyaneipennis, sp. n.

Ovalis, convexus, niger, nitidissimus; elytris læte cyaneis, striato-punctatis; ore, antennis, pedibus abdomineque piceis; antennarum clava, femoribus tibiisque plus minusve infuscatis.

Long. $1\frac{1}{2}$ lin.

Head moderately finely and moderately closely punctured. Thorax more finely and moderately closely punctured; at the extreme base and at the margins the punctuation almost vanishes and the surface is slightly dull. Elytra blue, striate punctate, the dorsal lines fine and scarcely impressed, the lateral ones rather more strongly punctured and moderately deeply impressed, the lateral interstices distinctly convex.

[To be continued.]

MISCELLANEOUS.

Descriptions of a new Genus and two new Species of African Freshwater Crabs. By Mary J. Rathbun.

The crabs described below were found in mud under boards and timbers by Mr. J. H. Camp at Stanley Pool, Congo, West Central Africa.

Family Thelphusidæ.

Parathelphusa Campi, sp. n.

Carapace subquadrilateral, conspicuously punctate. Depression between the gastric and cardiac regions deep. Protogastric lobes prominent, separated by a median groove which extends backward from the frontal margin. The postfrontal crest begins behind the base of the eyestalk and is continued to the lateral margin; it is finely denticulate and is almost straight, sloping backward and outward. Front a little more than one third the width of the carapace, deflexed, divided by a very shallow sinus into two lobes, with a raised margin, which is continued to the postfrontal crest. Superior orbital margin sinuous, advanced in its middle portion. Postorbital tooth acute, prominent. Lateral branchial spines three. In one of the two specimens there is a spinule between the first and second spines and a short fourth spine on the left side. Between the first spine and the postfrontal crest there are two or three spinules, forming a short ridge in the same line with the postfrontal crest. From the last spine a raised line extends backward upon the carapace, and is followed by several broken parallel lines. The inferior margin of the orbit is rather deeply rounded below the outer angle; from that point the margin is directed inward and forward; the inner angle is obtuse; the margin is set with a row of bead-like granules. The terminal segment of the abdomen of the female is subtriangular and the length is nearly half the width. The merus of the maxillipeds is very transverse, the antero-external angle rounded, the antero-internal angle not deeply cut.

Chelipeds of female unequal; merus rugose above, inner margin tuberculous, with a sharp spine just below the margin; carpus with two spines on the inner margin. Hand slightly inflated; upper margin straight, lower slightly convex. Fingers irregularly toothed and almost touching. Ambulatory legs rather slender, flattened; propodal joints indistinctly spinulous on the margins.

Measurements (No. 18065, two females).—Length of larger specimen 21·5 millim., width 29·5; length of smaller specimen 19, width 27.

This species in its three lateral teeth resembles *P. pœcilei*, A. Milne-Edwards, but differs from that species in its narrower and more quadrate carapace and interrupted postfrontal crest.

Erimetopus, gen. nov.

Carapace arcuate anteriorly, quadrate posteriorly, moderately convex. Front advanced beyond the antennular cavities, composed of two distinct rounded lobes. Orbits narrow; eyestalks tapering to the extremity. Postfrontal crest short and inconspicuous or wanting. Lateral margins spinous. The merus of the maxillipeds is transverse, the antero-external angle rounded, the palpus articulating at the internal angle, which is very slightly notched. Chelipeds with a row of spines on the anterior margin of the carpus. Ambulatory legs with margins spinous.

Erimetopus spinosus, sp. n.

Carapace about four fifths as long as broad, convex longitudinally, postero-lateral margins long, sloping slightly inward and backward, antero-lateral margins arcuate. The cardiac region and the posterior portion of the gastric region are outlined by shallow depressions. Front about one third the width of the carapace, advanced, two-lobed, lobes separated by a broad V-shaped sinus. Margin of front and orbits granulous. Orbits well-defined, the outer angle a sharp incurved spine. There are two protogastric lobes, little elevated and often not discernible, except by two transverse lines of a lighter colour. A very shallow median groove extends backward from the frontal margin and forks directly behind the protogastric lobes. The postfrontal crest, when present, is short, arcuate, tuberculous, and indistinct; it begins back of the cornea, and for a short distance is nearly straight, directed outward and slightly forward, then curves almost parallel to the antero-lateral margin. In most specimens, however, the crest is obsolete, indicated only by the smoothly rounded elevation behind the orbit. Antero-lateral margin with a row of from five to eight spines next the orbit, of which the orbital spine is the largest. The spines are irregular in size and position. On the anterior branchial region are five or more marginal spines separated by a space from the hepatic spines; the anterior is by far the larger and is sometimes bifid. The others decrease in length posteriorly. The suborbital margin is granulous except at the notch beneath the postorbital spine. The abdomen of the female covers the sternum.

Chelipeds in the female unequal. The margins of the merus are spinulous, the upper margin with a sharp spine near the carpus, the inner surface tuberculous at its base, the lower surface with a transverse tuberculous ridge at its distal end. The carpus has two strong spines on its inner margin and a row of about seven smaller spines on the anterior margin, two of which are close to the condyle of the manus and are separated by a wide interval from the remaining spines. Sometimes one of the spines is bifid, and occasionally additional spinules occur on the upper surface behind the marginal spines. The manus is slightly swollen, with a convex lower margin and almost straight upper margin, which sometimes in the smaller cheliped has a small sharp spine at the distal end; in a few specimens there are one or two spines at the proximal end. Fingers irregularly dentate on their prehensile edges and slightly gaping. The ambulatory legs are rather broad, flattened; meral joints with two spines at the distal end: carpal and propodal joints strongly spined above; carpal joints with distal spines in the first pair and often in the second and third pairs; propodal joints with a few spines below; dactyli with four rows of spines.

Measurements (No. 18066, female). — Length 30·5 millim.; reatest width 38; width between postorbital spines 19.

The male is unknown.

This species can be distinguished from other Thelphusidæ by its produced round-lobed front, narrow orbits, and numerous spines.—*Proc. Nat. Mus.* vol. xvii. no. 980, pp. 25–27. (Communicated by the Author.)

The Dipterous Parasites (Sarcophagidæ) *of Locusts.—Apteny and Parasitic Sterilization.* By M. J. Künckel d'Herculais.

Among Diptera the countless species comprised in the family Muscidæ furnish their contingent of enemies of the Locust, some of which attack their victims in the perfect stage, while others prey upon the eggs which are deposited in the ground; not content with playing a beneficent *rôle* in contributing to a large degree to arrest the multiplication of the Acridians, they present biological peculiarities and possess physiological attributes which are worthy of being recorded.

We shall devote our attention in the first instance to the Muscidæ which prey upon Acridians.

At the time of the great invasion of Northern Africa by migratory locusts in 1866 it was found at different points in Algeria (military subdivisions Aumale and Médéah) that Muscid larvæ were present in a certain number of these insects *. In 1889 the considerable invasion of *Stauronotus maroccanus* gave an opportunity of making fresh observations in the Department of Constantine, in civil as well as in military territory; I myself found around Constantine, which was besieged by the Acridians, that a quantity of *Stauronotus*, as well as of other species, were affected; but it was not until the year 1890, at Teniet-el-Haad (Department of Algiers), that I was able to carry out methodical investigations. Just as in the previous year, I observed everywhere where the bands of locusts, escaping from destruction, had acquired their wings, that numbers of individuals crawled along among the herbage without having been able to follow their companions, the flights of which traversed the air. I had some sacks full of them collected: a few days afterwards some hundreds of larvæ were crawling at the bottom of these sacks. If the return of 1889 † showed that 65 per cent. of the locusts lagging behind were infected with parasites, that which I made in 1890 gives the number thus affected as 75 per cent., and a post-mortem examination revealed the fact that each *Stauronotus* contained one, two, or three Muscid larvæ.

These larvæ hid themselves immediately in earth which was supplied to them in order to undergo the transformation into the

* Letter of the General of Division commanding the province of Algiers (General de Wimpffen) to the Marshal the Governor of Algeria (Marshal MacMahon), 25th July and 5th August, 1866: registered nos. 2541 and 2776.

† Return drawn up at my initiative by the exertions of M. L. Tardieu, administrator of the mixed commune of R'hiras (Department of Constantine). Observations of M. Chartrousse, deputy-administrator.

pupal stage; after the lapse of from eight to ten days the pupæ produced specimens of *Sarcophaga clathrata*, Meigen *.

This Muscid is widely distributed in Algeria: I have bred it from larvæ derived from *Stauronotus maroccanus* as well as from *Acridium ægyptium* and other indigenous species; but it is not the only Sarcophagid which in that country may be parasitic upon Acridians; from specimens of *Stauronotus* I have observed larvæ emerge which have developed into *Sarcophaga atropos*, Meigen, *S. cruentata*, Meigen, and *S. nurus*, Rondani; and from migratory locusts larvæ which have produced *S. (Agria) affinis*, Fallén, and likewise *S. nurus*, Rondani †; this latter is, moreover, a common species.

The larvæ of the parasitic species of *Sarcophaga* are admirably adapted for passing their existence in the body-cavities of their hosts, and differ in a remarkable manner from those which live in the open air in dead bodies—from those of *S. carnaria*, L., for example; they have neither the form nor the external aspect of common maggots ‡: the posterior stigmata, which are situated upon the last ring of the abdomen, are placed at the bottom of a cavity, which can be closed more or less completely by means of an upper and two lower lips; they are composed, in larvæ which have attained their full size, of three pairs of oblique clefts. The arrangement of the external organs of respiration is in itself alone sufficiently characteristic to justify the separation of the parasitic Sarcophagids from their congeners.

The habits of the adult insects are no less specialized. The viviparous flies follow the bands of locusts, which they harass unceasingly. If we possess the requisite patience we may sometimes surprise a female in the act of inserting her curved oviduct between the anal plates of the victim, which she has selected in order to deposit thereon a tiny larva, girdled with several rows of spinules, which will be able to open a passage for itself in order to penetrate the body of the insect which is destined to harbour it.

This parasitism, owing to its physiological consequences, is of the first importance, for in the case of the locusts it destroys the power of aerial locomotion and suppresses the reproductive faculty. By absorbing for their own respiration the oxygen dissolved in the sanguineous plasma of their host, and by devouring the adipose tissue from which the latter has to derive the constructive principles of the organic elements of new formation, the larvæ of the *Sarcophaga* are the cause of a general insufficiency of nutriment for the tissues; they smite with impotence the elevator and depressor

* Bull. de la Soc. d'Agr. d'Alger, 34[e] année: Bull. no. 103, 1891, p. 47 (séance du 15 mai, 1891). *Dépêche algérienne*, no. 2111, 19 mai, 1891.

† A preliminary determination of the species was made according to the types of Meigen and Macquart, preserved in the collections of the Museum; a second and independent determination, which served to control the former, was solicited from Dr. R. H. Meade, of Bradford, who is so widely known for his knowledge of the Muscidæ, and to whom I here convey my best thanks. *Cf.* J. Künckel d'Herculais, 'Les invasions des Acridiens, vulgo Sauterelles, en Algérie,' pl. i. *S. clathrata*, larva and adult, figs. 20–22; *S. nurus*, fig. 23; *S. affinis*, fig. 24.

‡ *Loc. cit.* pl. i. fig. 20, *a*, *b*, and *c*.

muscles of the elytra and wings, which remain in a feeble condition and incapable of continuous action, and they induce atrophy of the internal organs of generation. The intensity of the arrested development and atrophy is, we may conceive, proportional to the number of larvæ that are contained in the body-cavity of the victim; but, at any rate, the infected Acridians perish immediately the Muscid larvæ have left them; the exit of the larvæ, which is effected at the junction of the head with the thorax, or of the thorax with the abdomen, from the tympanic cavities or the intervals of the abdominal rings, is always accompanied by mortal lesions.

The presence of Sarcophagid larvæ consequently occasions in Acridians, by a kind of rachitis, *apteny* (ἀπτήν, flightless), to use a neologism which it seems to me useful to create, and *parasitic sterilization* ("*castration parasitaire*"), to employ the happy expression of Prof. Giard *.

To the already long list of *gonotomous* parasites, furnished by this naturalist, we shall have to add the larvæ of entomobious Diptera.—*Comptes Rendus,* t. cxviii. no. 20 (May 15, 1894), pp. 1106–1108.

The Distribution of Coccidæ. By T. D. A. Cockerell, Las Cruces, New Mexico †.

It would be difficult to point to any group of insect pests the ravages of which have been more seriously increased by human interference than the Coccidæ. As a general rule when one finds Coccids under strictly natural circumstances they are local in their distribution, and their attacks are confined to one or two species of plants. But now that we continually carry plants from one country to another, we take with them Coccidæ of many kinds; and already some scale-insects are so cosmopolitan by human introduction, that it is very difficult to guess where they originally came from.

It is a matter of common knowledge amongst economic entomologists that the evils thus arising are on the increase; and I would submit that the outlook is a very serious one ‡. Even in the temperate zone we have become familiar with the injuries done by Coccidæ in countries where they are not indigenous; but in the tropics the state of affairs is beyond anything one could easily imagine without having seen it. Coming to New Mexico from Jamaica I experienced a kind of surprise at not seeing the leaves of the roadside trees spotted with Diaspinæ and Lecaniinæ, although I knew quite well that such appearances were not to be looked for

* A. Giard, "La Castration parasitaire et son influence sur les caractères extérieurs chez les Crustacés décapodes" (Bull. sc. du Départ. du Nord, 2e série, 10e année, 1887, nos. 1 and 2, p. 1); "La Castration parasitaire: nouvelles recherches" (Bull. sc. de la France et de la Belgique, 3e série, t. xix. vol. i. 1888, pp. 12 *et seq.*). See also the subsequent memoirs upon the same subject.

† Read by the secretary, in the absence of the author, at the Fifth Annual Meeting of the Association of Economic Entomologists, held at the University of Wisconsin, Aug. 14, 1893.

‡ I here assume that anything which decreases the food-supply of the human race is disadvantageous. This is not the place to discuss those artificial conditions whereby abundance is made a cause of scarcity, and the wealth of some depends upon the want of others.

so far north. In Jamaica, if instructing an inexperienced person to collect Coccidæ, it would almost be sufficient to say "gather leaves of various trees that grow about the town."

The luxuriance of tropical vegetation is such that the harm done by Coccidæ is not so great as one might expect from their abundance; but still their presence is often the occasion of annoyance and injury to growers of field and garden crops. On the whole I see no reason to doubt that Coccidæ do more injury in the tropics than elsewhere, although their ravages have not very frequently been recorded; and probably there is no tropical country whose Coccid fauna is not at the present time being increased by introductions.

Having said so much, I wish to call your attention to a few facts which have come under my own observation, hoping to illustrate thereby the more important phases of the subject.

The number and variety of neotropical Coccidæ have not been sufficiently realized in the past, owing to the fragmentary nature of our information concerning them. At the present time those of the West Indies are better known than the species inhabiting the mainland; but even here the records are exceedingly imperfect. Jamaica has 61 recorded species, but Cuba has less than half a dozen; and I cannot discover a single record from Haiti. The Coccidæ of the Bahamas are almost entirely unknown, although the Caicos and Turks islands have each produced an interesting endemic form. In the Lesser Antilles, thanks to Mr. C. A. Barber, Antigua has 16 records; but of the other islands only one has as many as half a dozen, the figures being Barbados 7 (only 5 actually published), Montserrat 4, Grenada 3 (records not yet published), and Nevis, St. Kitts, and Dominica 1 each. Trinidad has 14 species (some not fully identified), but owing to the exertions of Mr. F. W. Urich I shall shortly be able to add considerably to this figure. The Mexican list stands at the absurdly low figure of 26, which includes 12 found by the present writer recently while travelling through that country. It will be understood how insufficient are the published records when I mention that not one of the species I found was previously known from Mexico, so far as I have been able to ascertain. The list from British Guiana exceeds 20, but very few species are known from other parts of South America. For Brazil I find mentioned about half a dozen, for Chile 4, for Ecuador 1, and so forth.

Yet these beginnings of knowledge already indicate some interesting facts in geographical distribution.

Aspidiotus articulatus, Morg., is known from Demerara, Trinidad (St. Ann's, on *Pandanus*, coll. by F. W. Urich), Barbados, Nevis, Jamaica, and Mexico (Vera Cruz). It has not been detected in Antigua, where it must be absent or rare, else Mr. Barber would surely have found it.

Aspidiotus personatus, Comst., is known from Demerara, Barbados, Cuba, and Jamaica. I did not find it at Vera Cruz; and, what is more interesting, Mr. Urich after some search has been unable to detect it in Trinidad.

These two species, where they occur, infest many kinds of cultivated trees and shrubs, and are quite noticeable. Up to the present time neither has been detected in the United States, although if introduced they might probably manage to exist in the extreme south. Both probably are spreading through human means. *A. articulatus* probably originated in South America; but *A. personatus* is more likely a native of the Greater Antilles, its absence in Trinidad favouring this supposition.

Aspidiotus ficus, Riley MS., Ashm., abounds in Jamaica, and is also known from Cuba and Florida. It is likewise common at Vera Cruz, Mexico. Probably it is a native of the Greater Antilles, but possibly of Mexico; it has apparently been taken to Japan, whence it was brought to California, according to Mr. Craw. It does not appear to occur yet in the Lesser Antilles, Trinidad, or Demerara. It is against its being of Mexican origin that I could not find it on oranges sold in that country, except at Vera Cruz, which is a most likely place for any scale to be imported. Mr. H. Tryon reports it from Australia.

This, like the two before mentioned, feeds on many plants. It seems probable that unless means are taken to prevent their introduction into various countries on plants all three are destined to become universal in the tropics. Any one who has seen them in Kingston, Jamaica, where they all abound in the same locality, will appreciate the undesirability of this from an agricultural and horticultural point of view.

Aspidiotus aurantii, Mask., has a very curious distribution: Australia, Tahiti, California, New Zealand, South Europe, and the West Indies. Who shall say where it originally came from? But the curious thing about it is that in Jamaica it is not found on citrus-trees, but principally on lignum-vitæ (*Guaiacum*), occasionally also on cycas * (at King's House) and areca. Its place on the citrus-trees in Jamaica is occupied by *A. articulatus*.

Aspidiotus punicæ, Ckll., presents another instance of difference of food-plant according to locality. In Jamaica it is found principally on pomegranate, never, so far as I know, on coconut; but in Dominica Mr. Barber found it infesting the coconut-palm, just in the way that *Aulacaspis Boisduvalii* infests it in Jamaica.

A fact that should not be lost sight of is that tropical Coccidæ may be taken from one side of the world to the other, *viâ* hothouses in temperate climates. It is wonderful what a lot of interesting forms have turned up in hothouses in Europe. Signoret mentions no less than forty-eight found in such situations, and Douglas and Newstead have recorded several from greenhouses in England, the most recent addition being *Pseudinglisia rodrigueziæ*, Newst., which appears to be referable to my genus *Conchaspis*. Some time ago I wrote to Kew, urging that an entomologist should be appointed to inspect the plants distributed by that institution to all parts of the world. Mr. D. Morris kindly replied in great detail, stating that at Kew they took all possible care, and that probably private importers

* [Mr. Cockerell subsequently wrote us that this is not *A. aurantii*, but probably *A. dictyospermi*, Morg.—Eds. of '*Insect Life*.']

and exporters were in most cases responsible for the wide distribution of certain Coccidæ. Be this as it may, it is clear that the scale-insects manage to travel, and it is difficult to see how Kew or any large dealer in exotic plants can avoid transmitting pests unless the plants are under the strict supervision of an entomologist. This leads one to think of quarantine regulations, which have not yet been dreamed of in England; and, so far as present methods go, no doubt Kew is altogether superior to the average of private firms, as Mr. Morris states. The consequence of this state of affairs is that one never knows what will turn up in a given locality. *Chionaspis minor*, Mask., described from New Zealand, now proves to be common in the West Indies. *Dactylopius calceolariæ*, Mask., from New Zealand and Fiji, is discovered in Jamaica. *Lecanium mangiferæ*, Green, from Ceylon, is detected in Jamaica and Demerara. A *Ceroplastes* from Antigua, which I believe to be the same species as *C. Cassiæ*, Chav., of Brazil, does not appear to differ from *C. Dugesii*, Licht. MS., Twns. (of which I have specimens), from Mexico, and these again seem identical with the Indian *C. ceriferus*, Anders. Mr. Maskell pointed out this latter fact to me, and he has been so good as to forward Indian specimens of *C. ceriferus*, which seem to bear out his opinion as to the identity. I have all three now before me, but Mr. Maskell had only compared the Antigua form with *C. ceriferus*.

Such instances become more numerous as fresh information comes to hand. Thus *Asterolecanium* (vel *Planchonia*) *pustulans*, Ckll., known from Demerara, the West Indies, and Florida, was lately detected by myself at Vera Cruz, Mexico; and Mr. Maskell writes me that he knows it from Brazil and the Sandwich Islands. When I promised this paper I thought of preparing something more elaborate than these few notes; but the distractions attendant on a change of residence, and the temporary detention of my books in Mexico City through the blundering of a transfer company, have made it impossible to adequately gather together the statistics. Nor have I tried to discuss the distribution of Coccidæ within the United States, as I have nothing fresh of importance to contribute, and among those present are some doubtless much more competent to speak on this subject than myself. Yet the principles are the same throughout, and the evident indications are that we should endeavour to increase the knowledge of Coccid distribution by all possible means, and so far as possible to prevent their importation into fresh countries. If my view is correct, now is the time to insist on the necessary precautions, as in fifty or a hundred years it will be altogether too late.

In conclusion I will give a list of the Coccids I found this year in the Marine Gardens, Kingston, Jamaica. This locality is in the midst of the town, and it will afford an illustration of the Coccid fauna of the island as now found on cultivated plants. It may be seen at a glance that nearly all the species have been found in distant localities, and it may well be doubted if the scale-insects as a whole belong any more to the original fauna of Jamaica than the plants on which they are found do to the flora.

Coccidæ *of the Marine Gardens, Kingston, Jamaica, April* 1893.

Species.	Plants infested.	Distribution elsewhere.
1. Dactylopius longifilis, *Comst.*	On a palm; and 1 juv. on upperside of leaf of star-apple.	District of Columbia (under glass).
2. —— virgatus, *Ckll.*..	Several juv. on leaf of coconut.	(Endemic so far as known.)
3. Asterolecanium pustulans, *Ckll.*	On pink oleander; very abundant and injurious.	Montserrat, Demerara, Florida, Mexico, Brazil, Sandwich Islands.
4. Lecanium oleæ, *Bern.*	On *Terminalia*; on pink oleander, and many on twigs of star-apple, attended by ants.	Antigua, Mexico, California, Florida, South Carolina, France, Australia, New Zealand.
5. —— terminaliæ, *Ckll.*	On *Terminalia*.	Mexico.
6. —— hesperidum, *L.*	One on a palm; found by my wife.	Mexico, Sandwich Islands, South Africa, Europe, Georgia, Utah, California, Florida, New York, District of Columbia, Ohio.
7. ——hemisphæricum, *Targ.*	On an orchid; on a palm.	Trinidad, Antigua, Montserrat, New Zealand, Pennsylvania, California, Australia, Europe (under glass).
8. Ceroplastes floridensis, *Comst.*	On oleander; on upperside of leaves of star-apple.	Florida, Louisiana, Barbados (on leaf, apparently *Chrysophyllum*).
9. Aspidiotus articulatus, *Morg.*	On oleander, with newly-hatched larvæ, which are orange; on *Citrus*; on upperside of leaves of star-apple.	Nevis, Barbados, Trinidad, Demerara, Mexico.
10. —— ficus, *Riley MS.*, *Ashm.*	On upperside of leaves of pink oleander; on underside of leaves of rose; on *Citrus*; many on upperside of leaves of an orchid.	Cuba, Florida, Mexico, Japan, Kew (under glass), Australia.
11. —— sacchari, *Ckll.*..	On sugar-cane.	(Endemic so far as known.)
12. —— personatus, *Comst.*	On a palm.	Barbados, Cuba, Demerara.
13. Diaspis lanatus, *Ckll.*	On oleander.	Antigua.
14. Aulacaspis Boisduvalii, *Sign.*	On coconut; ♀ pale lemon-yellow.	Barbados, Trinidad (Urich), Europe (under glass),
15. Pseudoparlatoria ostreata, *Ckll.*	On *Acalypha*.	(Endemic so far as known.)
16. Chionaspis minor, *Mask.*	On a palm.	Trinidad, Antigua, New Zealand.
17. Ischnaspis filiformis, *Dougl.*	On a palm.	Trinidad, Antigua, Grenada, Demerara, District of Columbia (under glass), London (under glass).
18. Pinnaspis pandani, *Comst.*	On coconut.	Trinidad, Massachusetts (under glass).

Thus, of eighteen species all but three are known outside of Jamaica (and it is very doubtful if these are confined to the island, although not yet found elsewhere), while eleven have been detected outside of the neotropical region.—*Insect Life*, vol. vi. no. 2, pp. 99–103.

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WILLIAM CARRUTHERS, F.R.S., F.L.S., F.G.S.,
AND
WILLIAM FRANCIS, PH.D., F.L.S.

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

WITH TWO PLATES.

Illustrative of Messrs. J. C. Melvill and J. H. Ponsonby's Paper on new Mollusca from South Africa, and Mr. R. I. Pocock's on the *Thelyphonidæ* in the British Museum.

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THE ANNALS

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[SIXTH SERIES.]

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XIV.—*On the Herpetological Fauna of Palawan and Balabac.* By G. A. Boulenger, F.R.S.

In his valuable paper, "On the Zoo-geographical Relationships of the Island of Palawan and some adjacent Islands" *, Mr. A. Everett has shown that Palawan, together with other islands west of Mindoro Straits, should be regarded as forming part of that district of the Indo-Malayan subregion to which Borneo belongs, as its fauna has much more in common with that of the latter island than with the Philippines proper. His conclusions were derived from a study of the mammals and birds. Of the reptiles and batrachians very little was known at that time. A new snake from Palawan (*Callophis bilineatus*) had been described by Peters in 1881, a new toad by myself in 1887 (*Bufo philippinensis*), and a widely distributed Agamoid lizard (*Calotes cristatellus*) had been recorded in the British Museum 'Catalogue of Lizards.' A list of eight species has since been contributed by Dr. Mocquard (Nouv. Arch. du Muséum [3] ii: 1890). Thanks to an important collection made for the British Museum by Mr. Everett himself on Palawan and Balabac, we are now able to draw up the following list of the species of reptiles and batrachians represented on these islands. Mr. Everett's conclusions are entirely confirmed so far as these classes of animals are concerned.

* Proc. Zool. Soc. 1889, p. 220, with map.

REPTILIA.

Chelonia.

1. *Cyclemys dhor*, Gray.

Palawan, Balabac.

Known from the Malay Peninsula, Sumatra, Borneo, and Java.

Lacertilia.

2. *Hemidactylus platyurus*, Schneid.

Balabac.

From Southern China and the Himalayas to Java, Celebes, and the Philippines.

3. *Gecko verticillatus*, Laur.

Palawan, Balabac.

From Southern China and Bengal to the Philippines, the Moluccas, and Timor-Laut.

4. *Gecko monarchus*, D. & B.

Recorded from Palawan by Mocquard.

Malay Peninsula, Sumatra, Borneo, Philippines, Java, Celebes, Moluccas.

5. *Draco volans*, L.

Palawan.

Malay Peninsula, Sumatra, Borneo, Java.

6. *Calotes cristatellus*, Kuhl.

Palawan, Balabac.

Malay Peninsula, Sumatra, Borneo, Philippines, Java, Celebes, Moluccas, Timor, Timor-Laut.

7. *Varanus salvator*, Laur.

Palawan.

From China and Nepal to Cape York.

8. *Mabuia multifasciata*, Kuhl.

Balabac.

From Sikkim and Burma to the Philippines, the Moluccas, and Timor-Laut.

Ophidia.

9. *Polyodontophis bivittatus*, sp. n.

Palawan. Two male specimens.

Rostral twice as broad as deep, just visible from above; internasals shorter than the præfrontals; frontal once and two thirds as long as broad, longer than its distance from the end of the snout, shorter than the parietals; loreal as deep as long; one præocular; two postoculars, both in contact with the parietal; temporals 2 + 2, the lower anterior wedged in between the sixth and seventh labials; eight upper labials, third, fourth, and fifth entering the eye; four lower labials in contact with the anterior chin-shields, which are as long as the posterior. Scales in 17 rows. Ventrals 153–155; anal divided; subcaudals — ? (tail mutilated). Black above, with two white streaks commencing on the parietal shields and running along the sixth series of scales and the adjoining halves; a white cross bar on the forehead, occupying the anterior two thirds of the frontal and supraocular shields; a series of white spots along the upper lip; lower parts white, with a black dot or spot at the outer end of each shield.

Total length 490 millim.

In the coloration of its upper parts this snake shows a remarkable similarity to *Adeniophis bilineatus*, which inhabits the same island.

10. *Tropidonotus spilogaster*, Boie.

Palawan.

Only known from the Philippines.

11. *Tropidonotus chrysargus*, Schleg.

Palawan, Balabac.

From the Eastern Himalayas and Southern China to Sumatra, Borneo, and Java.

12. *Coluber erythrurus*, D. & B.

Palawan.

Philippines, Sooloo Islands, Celebes.

13. *Coluber oxycephalus*, Boie.

Balabac.

Eastern Himalayas, Malay Peninsula, Sumatra, Borneo, Philippines, Java, Celebes.

14. *Dendrophis pictus*, Gm.

Balabac.

From the Eastern Himalayas and Bengal to the Philippines and Moluccas.

15. *Dendrelaphis caudolineatus*, Gray.

Palawan, Balabac.
Southern India, Malay Peninsula, Sumatra, Borneo.

16. *Calamaria Everetti*, Blgr.

Palawan.

Two specimens are referred to this species, recently described (Proc. Zool. Soc. 1893, p. 525) from Sarawak. They differ, however, from the type in the coloration. The dark nuchal blotch and yellow collar are absent, and in one of the specimens a series of black dots runs along the middle of the belly. Ventrals 184 and 175; subcaudals 16 and 18.

17. *Dipsas dendrophila*, Schleg.

Palawan.

Malay Peninsula, Sumatra, Borneo, Philippines, Java, Celebes.

18. *Psammodynastes pulverulentus*, Boie.

Palawan, Balabac.

From the Eastern Himalayas to the Philippines and Timor.

19. *Cerberus rhynchops*, Schneid.

Palawan.

From India and Ceylon to New Guinea and the north coast of Australia. Enters salt water.

20. *Naia tripudians*, Merr.

Palawan.

From Transcaspia and Southern China to Sumatra, Borneo, the Philippines, and Java.

The young specimen obtained on Palawan by Mr. Everett is black, with 11 whitish annuli, the first interrupted on the nape and confluent with the white of the throat and upper lip. 23 scales across the neck, 19 across the middle of the body. Ventrals 185; subcaudals 47, second and third entire.

This form is intermediate between the true *N. tripudians* and *N. sputatrix*.

21. *Adeniophis bilineatus*.

Callophis bilineatus, Peters, Sitz. Ges. naturf. Fr. Berlin, 1881, p. 109.

Palawan, Balabac.

The following diagnosis is taken from two specimens obtained by Mr. Everett, a female from Puerto Princesa and a male from Balabac :—

Frontal as long as its distance from the rostral, considerably shorter than the parietals; one præ- and two postoculars; temporals 1+2; six upper labials, third and fourth entering the eye; chin-shields two pairs, subequal, the anterior in contact with four labials. Scales in 13 rows. Ventrals 245 (♂) and 268 (♀); anal entire; subcaudals 29 (♂) and 25 (♀). Black above, with two white streaks along the body, commencing on the parietal shields, and running along the fourth and fifth series of scales; outer row of scales white, with a black longitudinal streak or a series of black dots; upper lip and a blotch across the præfrontal shields white; belly with black cross bars, each involving two or three ventral shields and separated from each other by two to four white shields; tail orange or pink, with two or three black blotches or rings.

Total length 710 millim., tail 45.

22. *Amblycephalus boa*, Boie.

Palawan, Balabac.

Malay Peninsula, Borneo, Philippines, Java, Moluccas.

23. *Trimeresurus formosus*, Schleg.

Palawan.

Sumatra, Borneo.

24. *Trimeresurus subannulatus*, Gray.

Palawan.

Sumatra, Borneo, Philippines, Celebes.

BATRACHIA.

Ecaudata.

1. *Oxyglossus lævis*, Gthr.

Balabac.

Burma, Malay Peninsula, Sumatra, Philippines.

2. *Rana macrodon*, D. & B.

Palawan, Balabac.

Burma, Malay Peninsula, Sumatra, Borneo, Philippines, Java.

3. *Rana palavanensis*, sp. n.

Palawan. Three female specimens.

Allied to *R. modesta*, Blgr., *Doriæ*, Blgr., *Limborgii*, W. Sclater, and *Hascheana*, Stol. Vomerine teeth in two oblique oval groups, commencing on a line with the hinder edge of the choanæ. Head moderate, as long as broad; snout short, rounded, as long as the diameter of the orbit; canthus rostralis angular; loreal region slightly concave; nostril equidistant from the orbit and the end of the snout; interorbital space as broad as the upper eyelid; tympanum distinct, three fifths the diameter of the eye. Fingers moderate, the tips dilated into small disks; first finger extending slightly beyond second; toes moderate, two-thirds webbed, the tips dilated into small but very distinct disks; subarticular tubercles moderate; inner metatarsal tubercle elliptic, blunt, two fifths the length of the inner toe; no outer metatarsal tubercle; no tarsal fold. Tibio-tarsal articulation reaching beyond the tip of the snout; tibia as long as the fore limb. Skin nearly smooth; posterior half of upper eyelids warty; a narrow glandular dorso-lateral fold; a fold from the eye to the shoulder. Brown above; sides of snout below the canthi blackish; temporal region light; a dark cross bar between the eyes; a ∧-shaped blackish interscapular marking; dorso-lateral folds edged with blackish on the outer side; limbs with regular dark cross bands; lower parts whitish.

From snout to vent 43 millim.

4. *Rana varians*, sp. n.

Palawan. Several specimens.

Closely allied to *R. temporalis*, Gthr. Vomerine teeth in two oblique series extending beyond the level of the hinder edge of the choanæ. Head depressed, longer than broad; snout obtusely or acutely pointed, prominent, longer than the diameter of the orbit; canthus rostralis angular; loreal region nearly vertical, strongly concave; nostril nearer the tip of the snout than the eye; interorbital space as broad as the upper eyelid or a little narrower; tympanum very distinct, as large as the eye or a little smaller. Fingers moderate, first extending beyond second; toes nearly entirely webbed; tips of fingers and toes dilated into well-developed disks; subarticular tubercles well developed; inner metatarsal tubercle oval, blunt; a small round outer metatarsal tubercle; no tarsal fold. Tibio-tarsal articulation reaching beyond the tip of the snout; tibia as long as the fore limb. Skin finely granulate, with or without scattered small warts; a narrow glandular dorso-lateral fold. Brown, pink, or dark grey above; a black streak below the canthus rostralis and a black temporal blotch; limbs with dark cross bands; hinder side of thighs marbled with brown; some specimens with a pale line along the vertebral line and another along the upper surface of the tibia. Male with internal vocal sacs and without humeral gland.

From snout to vent, ♂ 43 millim., ♀ 70.

5. *Rana glandulosa*, Blgr.

Palawan.

Malay Peninsula, Borneo.

6. *Staurois natator*, Gthr.

Palawan.

Numerous specimens of this species first described from the Philippines, and since recorded from Palawan under the name of *Ixalus nubilus* by Mocquard. All lack the vomerine teeth. All Bornean specimens of *Rana guttata*, Gthr., have more or less distinct vomerine teeth. I have recently examined a number of specimens from Kina Baloo, and it is therefore probable that the curious larvæ described by Mocquard should be referred to that species, and not to *Ixalus nubilus* = *Staurois natator*.

7. *Rhacophorus leucomystax*, Gravh.

Recorded from Palawan by Mocquard.

From the Himalayas and Southern China to the Philippines, Borneo, Sumatra, Java, and Celebes.

8. *Rhacophorus macrotis*, Blgr.

Palawan, Balabac.

Recently described (Ann. & Mag. Nat. Hist. [6] vii. 1890, p. 282) from Baram, Borneo.

9. *Rhacophorus Everetti*, sp. n.

Palawan. Two specimens.

Vomerine teeth in two oblique groups between the moderately large choanæ. Head slightly broader than long, without dermal ossification. Snout rounded, shorter than the diameter of the orbit; canthus rostralis obtuse, curved; loreal region concave, very oblique; nostrils near the end of the snout; interorbital space as broad as the upper eyelid; tympanum distinct, two fifths the diameter of the eye. Fingers with a slight rudiment of web; disks moderate, nearly as large as the tympanum; toes three-fourths webbed; inner metatarsal tubercle very small; no tarsal fold. Tibio-tarsal articulation reaching a little beyond the tip of the snout. Skin finely granulate above, coarsely beneath; small conical tubercles below the vent, at the heel, and along the outer edge of the forearm and tarsus. Pale yellowish or reddish brown above, with dark brown markings; the most conspicuous of these are a cross band between the eyes and a symmetrical marking on the præsacral part of the back, roughly representing a frog with the four limbs stretched out; limbs with dark cross bands; lower parts uniform white.

From snout to vent 32 millim.

10. *Ixalus longicrus*, sp. n.

Palawan. Three specimens.

Closely allied to *I. Schmackeri*, Bttgr., from Mindoro. Snout pointed, as long as the diameter of the orbit; canthus rostralis angular; loreal region concave; nostril nearer the end of the snout than the eye; interorbital space broader than the upper eyelid; tympanum distinct, about two fifths the diameter of the eye. Fingers free, disks a little smaller than the tympanum; toes half-webbed. Tibio-tarsal articulation reaching far beyond the tip of the snout; femoro-tibial articulation reaching the shoulder. Above rough with small warts; two oblique glandular ridges, converging behind, between the shoulder; throat smooth; belly and lower surface of thighs granulate. Grey above, with a large X-shaped dark marking or a pair of)(-shaped bands on the back, a dark cross band or triangular blotch between the eyes, and regular cross bands on the limbs; a black light-edged spot on the knee; a streak below the canthus rostralis, a bar below the eye, and the whole temporal region blackish; dirty white beneath, throat finely speckled with brown; a series of small round white spots on the lower lip. Male with internal vocal sacs.

From snout to vent 21 millim.

11. *Bufo philippinicus*, Blgr.

Palawan, Balabac.

This species was described in 1887 (Ann. & Mag. Nat. Hist. [5] xix. p. 348, pl. x. fig. 5) from a single female specimen obtained by Mr. Everett at Puerto Princesa. Numerous specimens have now been collected. I suspect that the Palawan toad recorded by Mocquard under the name of *Bufo divergens*, Peters, belongs to this species, which is in some respects intermediate between the latter and *B. biporcatus*, but differs from both in its thicker cranial ridges and larger parotoids. In some specimens the frontal and parietal ridges form nearly a straight line, as in *B. biporcatus*, whilst in others the parietal ridges form an angle with the frontals and converge posteriorly as in *B. divergens*. The parotoid glands are oval or elliptical, and measure two thirds to three fourths the length of the head. The male possesses an internal vocal sac.

12. *Leptobrachium Hasseltii*, Tsch.

Palawan.
Burma, Malay Peninsula, Sumatra, Borneo, Java.

13. *Megalophrys montana*, Kuhl.

Palawan, Balabac.
Sumatra, Borneo, Philippines, Java.

The geographical distribution of the species enumerated above may be thus tabulated:—

1. South-eastern Continental Asia.
2. Malay Peninsula.
3. Sumatra.
4. Borneo.
5. Palawan (and Balabac).
6. Philippines east of Mindoro Straits.
7. Java.
8. Celebes.
9. Islands east of Java and Celebes.

	1.	2.	3.	4.	5.	6.	7.	8.	9.
Cyclemys dhor	..	*	*	*	*	..	*		
Hemidactylus platyurus ..	*	*	*	*	*	*	*	*	
Gecko verticillatus	*	*	*	*	*	*	*	*	*
—— monarchus	..	*	*	*	*	*	*	*	*
Draco volans	..	*	*	*	*	..	*		
Calotes cristatellus	..	*	*	*	*	*	*	*	*
Varanus salvator	*	*	*	*	*	*	*	*	*
Mabuia multifasciata	*	*	*	*	*	*	*	*	*
Polyodontophis bivittatus..	..	..	..	..	*				
Tropidonotus spilogaster ..	..	..	..	..	*	*			
—— chrysargus	*	*	*	*	*	..	*		
Coluber erythrurus	..	..	..	..	*	*	..	*	
—— oxycephalus	*	*	*	*	*	*	*	*	
Dendrophis pictus........	*	*	*	*	*	*	*	*	*
Dendrelaphis caudolineatus	*	*	*	*	*				
Calamaria Everetti	..	..	..	*	*				
Dipsas dendrophila	..	*	*	*	*	*	*	*	
Psammodynastes pulverulentus	*	*	*	*	*	*	*	*	*

	1.	2.	3.	4.	5.	6.	7.	8.	9.
Cerberus rhynchops	*	*	*	*	*	*	*	*	*
Naia tripudians	*	*	*	*	*	*	..	*	
Adeniophis bilineatus	..	..	..	..	*				
Amblycephalus boa	..	*	..	*	*	*	*	..	*
Trimeresurus formosus....	..	..	*	*	*				
—— subannulatus	..	..	*	*	*	*	..	*	
Oxyglossus lævis	*	*	*	..	*	*			
Rana macrodon..........	*	*	*	*	*	*	*		
—— palavanensis........	..	..	..	..	*				
—— varians	..	..	..	..	*				
—— glandulosa	..	*	..	*	*				
Staurois natator	..	..	..	..	*	*			
Rhacophorus leucomystax	*	*	*	*	*	*	*	*	
—— macrotis	..	..	..	*	*				
—— Everetti	..	..	..	..	*				
Ixalus longicrus..........	..	..	..	..	*				
Bufo philippinicus	..	..	..	..	*				
Leptobrachium Hasseltii ..	*	*	*	*	*	..	*		
Megalophrys montana	..	..	*	*	*	*	*		

XV.—*Descriptions of Fifteen new Species of South-African Terrestrial Mollusca.* By James Cosmo Melvill, M.A., F.L.S., and John Henry Ponsonby, F.Z.S.

[Plate I.]

Since our last communication * a fair amount of additional material has been kindly forwarded by various correspondents, and one or two more species from the rich stores of Mr. E. L. Layard.

1. *Nanina morrumbalensis*, sp. n. (Pl. I. fig. 1.)

N. testa olivaceo-cornea, pertenui, planulata, obtecte et angustissime umbilicata, parum nitente; anfractibus quinque, undique irregulariter longitudinaliter rugoso-striatis, ultimo rapide accrescente, spira conico-depressa; apertura ampla, ovato-lunari; peristomate pertenui, simplici, apud umbilicum paullum reflexo.
Long. ·75, lat. 1·30 unc.

Hab. Mount Morrumbala, Central East Africa (*E. L. Layard*).

A large, somewhat transparent, horny shell, but little shining, throughout longitudinally striately wrinkled, the

* Ann. & Mag. Nat. Hist. ser. 6, vol. xii. pp. 103 *et sqq.*

spire being conically depressed, mouth large, lip very thin and fragile.

Three specimens in Mr. Layard's collection.

2. *Natalina coerneyensis*, sp. n. (Pl. I. fig. 2.)

N. testa anguste umbilicata, conica, cornea, nitente; anfractibus quatuor (ultimo rapide accrescente), supra fortiter tenuistriatis, infra nitidis; apertura rotunda; peristomate tenui, simplici, apud umbilicum paullum reflexo.

Long. ·75, lat. 1 unc.

Hab. Coerney, near Port Elizabeth (*J. Crawford*).

A comparatively large and handsome species, near *N. knysnaensis* (Pfr.), but the upper whorls are strongly striate, while the umbilicus in the latter species is much more narrowed by the triangularly reflexed growth of the columella.

We have also seen a good series of this shell in Mr. Layard's collection, labelled "Natal."

3. *Natalina Chaplini*, sp. n. (Pl. I. fig. 3.)

N. testa depressiuscula, late et profunde umbilicata, ad apicem planata; anfractibus quatuor, supra oblique longitudinaliter dense striatis, ultimo infra nitido; apertura ovato-lunari; peristomate tenui, simplici.

Long. 6, lat. 10·50 mill.

Hab. Karnachs, near Port Elizabeth (*J. Crawford*).

A very pretty species, of the same section as *vernicosa* &c., and of a beautiful golden horny colour, striated above, shining beneath, widely umbilicated, and much depressed.

Three specimens, which, although perhaps not quite full-grown, seem to present distinct specific characteristics.

4. *Helix* (*Dorcasia*) *inhluzana*, sp. n. (Pl. I. fig. 4.)

H. testa profunde sed anguste umbilicata, oblique depressa, cornea, nitida; anfractibus quatuor, longitudinaliter striatulis, apud suturas compressis, ultimo subdepresso, antice deflexo; apertura oblique ovata; peristomate simplici, ad umbilicum paullum reflexo.

Long. 15, lat. 23 mill.

Hab. Inhluzan Mountain, Drakensberg Range (*Mrs. C. Shaw, per J. F. Quekett*).

Two specimens of a conspicuous shining horny shell, allied to *H. Kraussii* (Pfr.), from which species it differs in being more compressed laterally and not so much at the base round the umbilicus, and also in being smooth, more shining, and of a warmer chestnut-olive.

5. *Buliminus nuptialis*, sp. n. (Pl. I. fig. 5.)

B. testa angustissime umbilicata, delicatula, tenui, succineo-brunnea; anfractibus quatuor, tribus supra parvis, ultimo perlato, rapide accrescente, effuso, undique longitudinaliter oblique rude liratis; apertura oblonga; peristomate simplici, tenui, apud umbilicum fere clausum, reflexo.
Long. 15, lat. 8·50 mill.

Hab. Craigie Burn, Somerset East (*Mrs. Mary Layard Barber*). In coll. E. L. Layard.

A small delicate shell, of succinoid character and nearly allied to *B. Bowkeri*, Sow., but differing in its fewer whorls, broader last whorl, coarser longitudinal liration, and in the absence of any granular sculpture.

6. *Achatina cinnamomea*, sp. n. (Pl. I. fig. 6.)

A. testa obesa, tumida, semipellucida, tenui, cinnamomeo-ochracea; anfractibus sex, ultimo rapide accrescente, tumidis, longitudinaliter irregulariter rugosis, flammis brunneis hic illic decoratis; apertura ovato-oblonga; peristomate tenui, labro intus lactescente.
Long. (sp. maj.) 2·25, lat. 1·70 unc.

Hab. Standerton (*Burnup*).

A handsome species, obese, of a cinnamon horn-colour, with darker brown longitudinal flames irregularly disposed.

Two fresh specimens and two dead; the latter are smaller, but undoubtedly the same species.

7. *Achatina œdigyra*, sp. n. (Pl. I. fig. 7.)

A. testa oblonga, compacta, nitida; anfractibus septem, tumidis, ventricosis, undique lævibus, planatis, specimine altero olivacea, fere unicolore, altero longitudinaliter flammis zebrinis decorato; apertura oblonga; peristomate pertenui, simplici.
Long. (sp. majoris unicoloris) 2·25, lat. 1·30 unc.

Hab. Craigie Burn, Somerset East (*Mrs. Mary Layard Barber, née Bowker*). In coll. E. L. Layard.

As Mr. Layard observes, this form would appear to be one of the links in the chain of *Achatinæ* which inhabit the tropical and subtropical African regions. The present species is meanwhile well characterized by the remarkably ventricose growth of the whorls.

8. *Pupa psichion*, sp. n. (Pl. I. fig. 8.)

P. testa umbilicata, obesula, minuta, pallide brunnea, apice obtuso; anfractibus sex, tumidis, planulatis; apertura rotunda; peristomate incrassato, simplici.
Long. 2·50, lat. 1·50 mill.

Hab. Pretoria.

A minute species, like *haploa* (M. & P.), but the whorls are more tumid and only six in number. Mouth round, peristome simple, toothless, and without plaits.

9. *Pupa custodita*, sp. n. (Pl. I. fig. 9.)

P. testa umbilicata, obesa, dolioliformi, minuta, tenui, brunnea; anfractibus sex, ventricosis, arctissime longitudinaliter tenuistriatis; apertura ovata; peristomate albo, reflexo, dentibus quinque internis munito, altero parietali, altero columellari, tribus labialibus.
Long. 3, lat. 1·50 mill.

Hab. Pretoria.

Much the same in ventricose tumidity of whorl and superficial appearance to the *P. psichion* just described, but entirely differing in the internal armature of the mouth, which, apparently simple externally, is really guarded within by no less than five teeth, three of these being labial, one sutural, and one columellar. It is a highly interesting species, and seems, though of the *fontana* group, to bear no very direct resemblance to hitherto described species.

10. *Pupa iota*, sp. n. (Pl. I. fig. 10.)

P. testa minutissima, superficialiter umbilicata, cylindrica, recta, tenui, apice obtuso; anfractibus septem, ventricosulis, tenuissime longitudinaliter striatis, striis obliquis; apertura ovata; peristomate pallido, reflexo, uniplicato, plica interna transversa fere aperturam ipsam attingente.
Long. (sp. maj.) 1·25, lat. ·50 mill.

Hab. Pretoria.

Two specimens, one being more curt than that taken as the type, but the mouth-process, consisting of one median raised transverse internal plait not quite reaching the peristome, is the same in each.

11. *Pupa omicronaria*, sp. n. (Pl. I. fig. 11.)

P. testa minuta, cylindrica, recta, brunnea; anfractibus septem (in uno specimine octo), ventricosis, tenuissime longitudinaliter

striatis, striis obliquis; apertura ovato-rotunda; peristomate pallido, simplici.
Long. (sp. maj.) 3, lat. 1·50 mill.

Hab. Pretoria.

This shell comes next to our *P. quantula*, and may perhaps eventually turn out to be a variety of that species. The mouth, however, is rounder and the form a little less cylindrical.

12. *Pupa keræa*, sp. n. (Pl. I. fig. 12.)

P. testa minutissima, brunnescente, cylindrica; anfractibus sex, rectis, longitudinaliter tenuistriatis; apertura ovata; peristomate pallido, reflexo, intus uno dente suturali instructo.
Long. 2·15, lat. 1 mill.

Hab. Pretoria.

A small insignificant shell, with one internal sutural or parietal tooth.

Two specimens.

13. *Pupa charybdica*, sp. n. (Pl. I. fig. 13.)

P. testa compacta, crassiuscula, cylindriformi, brunnea, apice obtuso; anfractibus septem, rectis, longitudinaliter obscure et oblique tenuistriatis; apertura rotunda; peristomate incrassato, pallido, reflexo, intus tribus dentibus mamillaribus munito, altero parietali, altero columellari, tertio basali.
Long. 3, lat. 1·15 mill.

Hab. Coerney, near Port Elizabeth.

A cylindrical dark brown shell, not shining, stouter in substance than most of its congeners; whorls seven, straight, longitudinally, obscurely and obliquely finely striate; aperture round; peristome incrassate, reflexed, furnished with three internal teeth—basal, columellar, and sutural.

Three specimens.

14. *Pupa frustillum*, sp. n. (Pl. I. fig. 14.)

P. testa nitida, cylindrica, late brunnea; anfractibus septem, rectis, oblique tenuissime striatis; apertura ovata; peristomate pallide brunneo, intus tribus dentibus munito, dente altero parietali, altero basali, tertio columellari.
Long. 3·50, lat. 1·25 mill.

Hab. Port Elizabeth.

Near *P. fontana*, Krauss, but more cylindrical than that species, and differing, besides, in the tooth-processes.

15. *Ennea nonotiensis*, sp. n. (Pl. I. fig. 15.)

E. testa rimata, dolioliformi, straminea, delicatula, apice obtusissimo; anfractibus quinque, undique tenuissime longitudinaliter striatis: apertura rotunda; peristomate paullum extus crenulato, albo, plicis vel dentibus quinque instructo, plica parietali magna intrante, dentibus duobus labialibus, uno basali, plica columellari valde intrante, magna.

Long. 5, lat. 2 mill.

Hab. Nonoti, coast of Natal (*Burnup*).

A delicate straw-coloured species, apparently distinct from any of its allies in the small group characterized by the presence of a double tooth on the outer lip.

EXPLANATION OF PLATE I.

Fig. 1. *Nanina morrumbalensis.*
Fig. 2. *Natalina coerneyensis.*
Fig. 3. —— *Chaplini.*
Fig. 4. *Dorcasia inhluzana.*
Fig. 5. *Buliminus nuptialis.*
Fig. 6. *Achatina cinnamomea.*
Fig. 7. —— *œdigyra.*
Fig. 8. *Pupa psichion.*
Fig. 9. *Pupa custodita.*
Fig. 10. —— *iota.*
Fig. 11. —— *omicronaria.*
Fig. 12. —— *keræa.*
Fig. 13. —— *charybdica.*
Fig. 14. —— *frustillum.*
Fig. 15. *Ennea nonotiensis.*

XVI.—*Descriptions of new Species of Rhopalocera from Mexico and Central America.* By F. D. Godman and O. Salvin.

Specimens of the following species of Rhopalocera have been recently received by us from various correspondents. As it will be some time before we can refer to them in our 'Biologia Centrali-Americana,' we describe them as follows:—

1. *Opsiphanes Staudingeri*, sp. n.

Rich reddish brown, apex of the primaries darker; a curved tawny band proceeds from the costa across the apex and thence to the anal angle; the edges of this band are irregular, and it is bordered by dark brown on both sides; two rather widely divided white spots in the apex: secondaries with a tawny margin, the inner edge of which is irregular and is bordered with dark brown. Beneath nearly the whole surface is dark brown, mottled with tawny; dark bands enclosing a yellowish space cross the cell of the primaries, and other dark irregular lines occur at the end of the cell; there are two submarginal lines which recede from the margin itself, a subapical ocellus, and two white spots in the apex: secondaries with two ocelli—a large one on the middle of the costa and a smaller one over the first median branch; a distinct plain tawny border. The cell of the secondaries above is covered with long hairs, which, however, are not collected into a distinct tuft, and the region of the submedian nervure is very hairy over the basal half; there is a glabrous patch at the base of the first median branch.

Hab. Chiriqui.

Dr. Staudinger has submitted to us specimens of this distinct species, which has no near allies that we know of. As will be seen by comparison with what we have written on the arrangement of the tufts of hair on the secondaries of the males in this genus (*cf.* Biol. Centr.-Am., Rhop. i. pp. 125 *et seq.*), *O. Staudingeri* does not fall into any of our sections, but must stand by itself.

2. *Synchloë eumeda*, sp. n.

Allied to *S. pœcile*, Feld. (*cf.* Biol. Centr.-Am., Rhop. i. p. 180, t. xx. figs. 1, 2), but with the yellow spots in the cell of the primaries and the spot below the first segment of the median nervure evanescent; on the other hand, the six spots extending in a band across the wing beyond the cell to the middle of the inner margin are larger and more elongated; the base of the secondaries is almost wholly black, and the middle red submarginal spot is nearly of the same size as those towards the apical angle, instead of being much the smallest of the series. Beneath, the submarginal spots of the primaries are all yellow; the black spots at the base of the secondaries are smaller, and there is a distinct band of black spots across the wing, which in *S. pœcile* coalesces with the black margin. The palpi are white laterally, with black upper and lower edges.

Hab. Mochitlan in the State of Guerrero, Western Mexico (*O. T. Baron*).

Mr. Baron collected many specimens of this species during his residence in Western Mexico.

The sexes are alike in coloration.

3. *Synchloë dryope*, sp. n.

Closely allied to *S. eumeda*, and differing from *S. pœcile* in the same characters; but from the former it may be distinguished by the yellower colour of the transverse band common to both wings; the dark border to the secondaries is distinctly narrower. Beneath, the submarginal band of spots on the primaries is nearer the outer border, the dark border of the secondaries is narrower, and the black spots at the base of those wings are larger and sometimes confluent.

Hab. State of Jalisco, Western Mexico (*W. B. Richardson*).

The range of this species lies further north than that of *S. eumeda*, so far as we know at present.

4. *Synchloë hylæus*, sp. n.

Allied to *S. marina* (Geyer) (*cf.* Biol. Centr.-Am., Rhop. i. p. 181), but with all the spots on the primaries pale yellow instead of white; the central band of spots is much more definite, and forms with the band of the secondaries a common fascia. Beneath the two species are much alike, but the rufous colour of the primaries is confined to a single spot at the base of the costa.

Hab. Durango city, Mexico (*Becker*).

Several specimens obtained by Herr Becker near the city of Durango are alike in their differences from *S. marina*, a species of South-western Mexico.

5. *Synchloë endeis*, sp. n.

Also allied to *S. marina*, but with all the spots of the upper surface dingy white both on the primaries and secondaries; the central series of spots forms a band common to both wings. Beneath, the whitish black marginal spots at the base of both wings are surrounded by rusty red, which occupies the basal half of the wings; there is a rusty subapical spot on the primaries, and two nearly confluent ones near the anal angle. The palpi are narrowly white laterally, and are edged above and below with rusty red instead of black.

Hab. Sierra Madre de Tepic, Western Mexico (*W. B. Richardson*).

Mr. Richardson collected a good series of this distinct species, which, though allied to *S. marina* and *S. hylæus*, described above, can be very readily recognized.

6. *Callicore asteria*, sp. n.

Allied to *C. astala* (Guér.) (*cf.* Biol. Centr.-Am., Rhop. i. p. 254), but differs conspicuously by the total absence of the glittering blue oval spot in the middle of the deep blue of the upper surface of the primaries. The same wings beneath have hardly any trace of red in the cell, but an indistinct irregular whitish band crosses the wing beyond the cell. On the hind wings beneath the upper of the two figures of eight touches the inner of the two encircling bands.

Hab. San Blas, Western Mexico (*W. B. Richardson*).

A single male specimen captured in March was sent us by Mr. Richardson.

7. *Anæa Schausiana*, sp. n.

Deep purple-black, the bases of the wings and a subapical spot on the primaries bluish purple. Beneath rich brown, irrorated with silvery grey and black; an indistinct dark band runs from the inner margin towards the apex, a row of small white spots from the apex parallel to the outer margin; the secondaries have indistinct bands more or less parallel to the outer margin, and a small black spot at the base of the short tail, and another between it and the anal angle.

♀. The bases of the wings and two spots in the apex are paler and bluer than in the male, and the outer portion of the secondaries is not so dark a purple-black. Beneath much paler than the male and irrorated with ochraceous brown; the dark lines are more clear, and the tail to the secondaries larger and slightly spatuled at the end.

Hab. Coatepec, Mexico (*W. Schaus*).

This fine species belongs to the group of *Anæa* in which the inner margin of the primaries is falcate at the anal angle and the secondaries have a tail in both sexes (*cf.* Biol. Centr.-Am., Rhop. i. p. 340). It has no near allies in the Mexican fauna.

We are indebted to Mr. Schaus for a pair of this species. They were taken by himself at Coatepec, near Jalapa, in the Mexican State of Vera Cruz.

XVII.—*A Visit to Damma Island, East Indian Archipelago.* By James Walker.—*With Notes on the Fauna*, by R. B. Sharpe, G. A. Boulenger, E. A. Smith, R. I. Pocock, C. O. Waterhouse, C. J. Gahan, W. F. Kirby, and F. A. Heron.

[Continued from p. 71.]

COLEOPTERA LONGICORNIA and PHYTOPHAGA.

By C. J. Gahan.

LONGICORNIA.

Neomicrus, gen. nov.

Male.—Eyes completely divided. Antennæ longer than the body, sparsely ciliate; first joint gradually thickened into a club in its distal half; fourth joint about equal in length to the first and perceptibly longer than the third;

the fifth and following joints subequal to one another and each scarcely longer than the fourth. Prothorax elongated, unarmed, slightly narrowed from the beginning of the posterior third to the base. Elytra about half as long again as the prothorax, and not wider across the base than the greatest width of the prothorax; apices rounded. Pygidium exposed. Femora clubbed in their distal portion, pedunculate at the base. The anterior coxæ are closely approximated; the prosternal process is in the form of a very short triangle, whose backwardly directed apex does not reach as far as the middle point between the coxæ; the cavities of the latter are distinctly open behind. The mesosternal process is narrow and triangular in form.

This genus seems best placed in the group of the Graciliides.

Neomicrus Walkeri, sp. n.

Piceo-brunneus, capite prothoraceque griseo breviter pubescentibus; elytris dense punctatis et griseo-setosis, utrisque plaga vel macula inter basin mediumque paullo pallidiore; antennis testaceis, articulorum apicibus leviter infuscatis; femorum tibiarumque basibus testaceis.

Long. 4, lat. 1 mm.

Hab. Damma Island (*J. J. Walker*). Under bark.

Almost entirely of a dark reddish-brown colour, with the antennæ, the coxæ, the bases of the femora and tibiæ, and an obscure patch between the middle and base of the elytra testaceous. The head and prothorax have a covering of very short greyish pubescence. The prothorax appears to be very closely and finely punctured. The elytra are somewhat densely and more strongly punctured, each of the punctures bearing a greyish seta. The shoulders of the elytra are very slightly prominent.

Though slightly suggestive of *Gracilia pygmæa*, Fabr., the present species is markedly distinct. The elytra are proportionally much shorter and also narrower, the middle and posterior femora are more abruptly clavate, and the joints of the antennæ bear different proportions.

Purpuricenus quadrinotatus, White.

Damma Island (*J. J. Walker*); Australia and New Guinea.

Coptops auguralis, Pasc.

Damma Island (*J. J. Walker*); Timor (*Wallace*).

Olenecamptus bilobus, Fabr.

Damma Island (*J. J. Walker*).
This is a widely distributed species.

Prosoplus Banksi, Fabr.

Damma Island (*J. J. Walker*).
For the synonymy and distribution of this species see Trans. Ent. Soc. 1893, p. 192.

Oopsis Moorei, sp. n.

Subangusta, pube fulvo-grisea sat dense vestita; prothorace fortiter sat dense punctato; elytris seriatim punctatis, utrisque lineola basali minima et punctis duobus pone medium albescentibus; apicibus paullo divergentibus acutis.
Long. 7, lat. 3 mm.

Hab. Damma Island, Malay Archipelago.

Head almost impunctate, covered with a greyish or fulvous pubescence. Antennæ (♂) a little longer than the body; third and fourth joints slightly curved, the fourth barely longer than the third. Prothorax distinctly and rather thickly punctured. Elytra almost quite regularly punctured in rows; each elytron bears a very minute whitish line or point at the base, and two almost equally minute white spots, placed somewhat transversely, a little beyond the middle. The portion of the elytra which lies behind these spots is covered with a pubescence of a somewhat paler fulvous tint than that which covers the part in front.

This species is a little stouter and more convex in form than most of those which Pascoe included in his genus *Sybra*; but it is distinctly narrow as compared with *Oopsis nutator*, Fabr. It seems to be nearly enough allied to *Oopsis porcellus*, Pasc. (*Sybra*).

PHYTOPHAGA.

Aulacophora tetraspilota, Baly.

Occurs also in Celebes, Gilolo, Batchian, Amboyna, and Timor.

Aulacophora flavomarginata, Duviv.

Occurs also in Sumatra, Java, Borneo, Celebes, Amboyna, Timor, Flores, and Kei Islands.

Aulacophora, sp.

This species, represented by one female example only, appears to be new. It resembles *A. excisa*, Baly, in colour and in most of its other characters, but the emargination of the last ventral segment is different in form.

Galerucella ficus, Montrouz.

Galerucella thoracica, Baly.

This species occurs, widely distributed, in the Australian region. In the British Museum there are examples from the Salomon Islands—Alu (*Woodford*), Woodlark Island, New South Wales, Lizard Island, North and North-west Australia, the islands in Torres Straits, New Guinea, and other islands of the Malay Archipelago as far as Celebes.

Coptocycla, sp.

One example only.

LEPIDOPTERA. By F. A. Heron.

LEPIDOPTERA RHOPALOCERA.

The forty-three butterflies collected upon Damma Island belong to twenty species, five of which were new to the British Museum collection. The larger number are Euplœinæ or Lycænidæ, and it is noteworthy that the collection includes no Satyrinæ or Elymniinæ.

They are distributed as follows:—

Nymphalidæ.

Anonia plexippus, Linn.

A single female of this wide-ranging species was obtained.

Salatura laratensis, Butler.

Three males and one female.

Chanapa sacerdos, Butler.

Six males and two females were taken, which are interesting as showing the gradual disappearance of the spot between the first and second branches of the median vein of the fore wings.

Calliplœa darchia, McLeay, var. *priapus*, Butler.

Two males and one female.

Calliplœa visenda, Butler.

One male. This is closely allied to the foregoing species.

Hypolimnas alimena, Linn.

One damaged male of this common Oceanian form was taken, which had the transverse band on the fore wings whiter than in any other male seen previously by me.

Neptis pampanga, Felder?

A pair.

Lycænidæ.

Nacaduba aluta, Druce.

Two males and one female.

Lampides œlianus, Fabr.

A pair.

Castalius, sp.

One specimen belonging to a species allied to *C. roxus*, Godart.

Cyaniris, sp.

A male belonging to a species nearest to *C. puspa*, Horsfield.

Zizera pygmœa, Snellen.

One male.

Zizera phœbe, Murray.

Two males.

Catochrysops, sp.

A single female belonging to a species not in the B. M. Coll.

Spalgis epius.

A specimen of a curious variety of *S. epius*, Westwood, ♀; the colour of the upperside very much greener grey than usual; the strigæ upon the underside show through on the hind wings more strongly than in the common brownish form.

The single male *Castalius*, which on the upperside somewhat resembles *C. hamatus*, Moore, obtained on Damma Island, is noteworthy for its peculiar markings on the underside, and forms the type of a new species, characterized as follows, and called after my friend J. M. C. Austin :—

Castalius Austini, sp. n.

Antennæ. Shaft black-brown above, semi-ringed with white below; club below is of much redder brown.

Head. Forehead cream-white scaled. *Eyes* rich deep brown and hairy.

Palpi dark brown-black; the second joint creamy scaled below.

Colour.—*Thorax* and *abdomen* dark brown-black below, with occasionally lighter pubescence of greenish iridescence; below cream-white, the last joints of the abdomen marked off by three creamy scalings at the sides as well.

Legs dark brown, with cream-white scalings above; but only the fore legs were retained in this specimen.

Expanse of wings 28 millim., greatest breadth of fore wing 7 millim.; length of hind wing 9, breadth $6\frac{1}{2}$ millim.; length of thorax $2\frac{1}{2}$, abdomen $5\frac{1}{2}$ millim.

Wings. Above: brown-black, crossed from the centre of the disk of the fore wing to the inner margin of the hind wings, about one third from the base, by a cream-white band running in the direction of a line from apex of fore wing to centre of its inner margin; on the fore wing its breadth is about one fifth of the length of inner margin, but expands at the end of the discoidal cell to nearly twice that width, touching vein 6 above, and is slightly cut into by a dark mark which bounds the discoidal cell; on the hind wings the inner margin of the band is in a straight line with that of the fore wings, but the band as a whole is slightly broader, its width by the discoidal cell being almost half as much as its breadth elsewhere.

The cilia are of the same colour as the wings.

Below: the same band is apparent; the costa is dusted with brown, and at its base a patch of almost lemon-coloured scales extends for 5 millim. in length and $1\frac{1}{2}$ millim. in breadth. There is a submarginal band of creamy white which follows on its inner side the contours of the discal band, and on its outside is parallel to the wing-border; this band reaches from costa of fore wing to inner margin of hind wing; the resulting band of dark between the discal and submarginal band averages a little wider than the discal band.

At the outer margin of the hind wing the dark border tends to split into lunulate spots and to allow a narrow cream-white line to separate it into two portions, the outer forming a mere thread of dark.

Cyaniris dammæ, sp. n.

Expanse 30 millim.

Above somewhat resembling *puspa*, Horsfield (from Java), but the black-brown borders are much reduced in breadth, especially towards the internal angle of the wings; on the hind-wing-costa, however, the brown-black is more abundant than in *puspa*. Where the iridescence on the wings does not show, the ground-colours show more slaty and with less grey-white scalings than in *puspa*; the iridescence, too, is of a more brilliant cærulean-blue in *dammæ*. Abdomen, thorax, head, and antennæ much as in *puspa*. Below the general appearance is somewhat like *C. ladonides*, de l'Orza, from Japan, the ground-colour being a very bluish white, with silvery-blue scales at the base; the marginal row of dots is very slightly marked, and the submarginal lunular line is rather fainter on the fore wing. The discal row of spots on the fore wing forms a curve reaching the costa one third from apex and the inner margin about one fourth from the angle; from this angle the first, third, fourth, and fifth spots follow the direction of the curve, but the second inclines towards the base of the wing; the sixth spot is thrown a little inwards from the others.

On the hind wings are dark spots at the origin of vein 8 and two others between veins 8 and 7 dividing the costa roughly into three parts; below the second spot is another in the cell, and in a line with these a spot on the inner angle from a row of four small spots curves towards the outer spot on the costa; there is a dark spot one fourth along the inner margin from the base of the wing, and a small spot rather outside the curve between veins 2 and 1 *b*.

Papilionidæ.

Terias pumilaris, Butler.

One male.

Terias hebridina, Butler.

Two males.

Terias maroënsis, Butler.

Three females.

Huphina rachel, Boisd.

Two dwarfed males.

Hesperiidæ.

OCYBADISTES, gen. nov.

The three small Pamphilinæ belong to an undescribed genus nearest to *Padraona*, from which it differs in possessing much broader wings and in having vein 3 of the fore wing further from the end of the cell. The sexual mark on the fore wings, where present, is a black slightly lunulated streak crossing the disk from vein 1 to vein 4, instead of the small streak over the centre of vein 1 of the fore wing which some species of *Padraona* possess.

The genus will include *marnas*, Felder, and *Walkeri*, sp. n., the latter of which will be the type.

Lascivia, Rosenstock, has a small streak similar to that of *Padraona*, though the shape of its wings and its neuration would otherwise ally it to *marnas*, as stated by Watson (P. Z. S. 1893, p. 102).

The genus may be thus characterized:—

Antennæ about three fifths the length of the costa of the fore wings; club of moderate size, elongate, with a slight terminal crook rather longer than the thickness of the club.

Palpi. Second joint thickly scaled, forming with the third joint a quarter circle; third joint about half the length of the second joint, very slender, obtusely conical, and suberect.

Fore wings. Breadth rather more than half the length of the costa; inner margin rather longer than outer margin; cell less than two thirds length of costa; vein 8 reaching costa at apex of wings; lower discocellulars two thirds length of middle; vein 5 considerably nearer to vein 4 than to 6; vein 3 distant from 4 about the length of the middle discocellular, and vein 2 a similar distance from vein 3 and very slightly nearer end of cell than base of wing.

Hind wings. Outer margin even, slightly excised between veins 2 and 1 *b*; vein 7 well before end of the cell (except in *marnas*, ♂, where it is emitted just before the end); discocellulars very inconspicuous; vein 5 wanting; vein 3 close to end of cell, twice as far from 2 as from 4; vein 2 much nearer the end of cell than base of wings.

On the upperside of the costa of the hind wings of both sexes are stout backwardly-directed hairs arranged in a short row, and in addition fine long hairs projecting outwards and forwards, which, inconspicuous in the females, are largely developed in the males.

The males are usually provided with a discal sexual streak on the upperside of the fore wing, consisting of the more or less lunular silky marks between vein 1 and vein 4, which show when magnified a large proportion of fine long scales among the broader ones.

Two pairs of spines are present on the hind tibiæ.

The species I dedicate to the enthusiastic collector to whose efforts the National Collection is indebted for many entomological treasures.

Ocybadistes Walkeri, sp. n.

Expanse of wings 22 millim.

The general scheme of marking and coloration is much as in *marnas*, Felder, but the orange markings of *Walkeri* are not so red as in Felder's species, especially on the underside, where the brownish markings of *marnas* are represented by an ashy green shaded to a black-brown on the inner margin of the fore wings, and the orange markings are of a pale sienna colour on the fore wing, and on the hind wing inner margin ochreous, shaded to the orange of the upperside markings.

Antennæ dark black-brown, shaft semi-ringed with ochreous, club dark black-brown above, ochreous below, crook dark; palpi golden yellow towards the top, almost lemon-coloured below; this pale hue extends below the thorax and the abdomen; forehead with golden-orange scales; collar, patagia with scalings of similar colour, especially large on the latter.

Thorax thickly covered with yellow hairs of greenish iridescence. *Abdomen* golden orange.

Fore wings golden orange; costa black-brown, outer margin with a black-brown border from apex to inner angle, averages nearly one third the breadth of the inner margin, but reduced by intrusion of the orange ground between veins 6 and 4 to about half that width, below and to the side of the discoidal cell the dark colour stretches to an almost similar width, at the side and below vein 6 sends out a spur which sometimes reaches the dark border; dark scalings occur below vein 1, and from the costa opposite the end of the cell extends a small spur of dark, which may sometimes anastomose with the dark bounding the cell, thus leaving a small spot of the orange ground isolated.

Hind wings of similar coloration, but the orange is slightly deeper in tone and its borders much more irregular than in *marnas*, running out along the veins, especially opposite the end of the cell, and sending a spur towards the costa along vein 7; the orange fleck in the cell is more conspicuous than in *marnas*.

Below the markings show more faintly; the black-brown represented by an ashy green, except towards the base and inner margin of the fore wings, and the golden tint paler.

Cilia of the hind wings concolorous with the golden hue, but much browner on the fore wings except at the anal angle.

The species is represented in the British Museum by specimens from Port Darwin as well as Damma Island, and has a close ally of rather greater expanse and darker underside colouring ranging from Moreton Bay to Sydney.

LEPIDOPTERA HETEROCERA.

Syntomidæ.

Hydrusa, sp.

Liparidæ.

Chionophasma paradoxa, Butler.

Pyralidæ.

Sylepta plagiatalis, Walk.

Noctuidæ.

Selepa, sp.

HYMENOPTERA. By W. F. Kirby.

Nine species were obtained, of which two are here described as new.

Formicidæ.

Odontomachus hæmatodes.

Formica hæmatoda, Linn. Syst. Nat. i. p. 582. n. 16 (1758).

A species found in all the warmer parts of the world.

Pheidologeton, sp.

Two large workers of a species allied to *P. megacephala*, Smith, but with the head bright chestnut-red and the middle of the vertex very smooth and shining.

Rhagigaster, sp.

Four female specimens apparently belonging to this genus. They are from 5 to 7 lines long, rufo-testaceous, with the abdomen black, more or less distinctly banded with rufo-testaceous. It appears undesirable to describe the species as new from female specimens only.

Scoliidæ.

Dielis cultrata, sp. n.

Long. corp. 14 millim.

Female.—Deep black, very shining, the hair mostly black, except on the lower part of the face, where it inclines to cinereous, and some of the hairs on the body and legs are tipped with cinereous. Face and thorax densely punctured, but the vertex, the centre of the mesothorax, the sides of the scutellum and postscutellum, and the hinder part of the metathorax, which is tuberculate in the middle, almost smooth. Abdomen slightly iridescent, the segments punctured in front and the first also behind; the following segments mostly only with a row of bristle-bearing punctures before the extremity. Legs very bristly, strongly punctured on the upper surface; hind femora with a smooth ferruginous knife-like plate at the extremity beneath (as in other allied species). Wings subhyaline, with a strong violet reflection; inner recurrent nervure of front wings bent at nearly a right angle.

Agrees nearly with the description of *D. micans*, Guér., from Bouru, but smaller and with the costa not ferruginous.

Eumenidæ.

Eumenes arcuata, var.

Vespa arcuata, Fabr. Syst. Ent. p. 371. n. 40 (1775).

The thorax in the specimen from Damma Island is black, with detached yellow spots, and the yellow colouring on the petiole and abdomen is rather more extended than usnal.

Common in the Indian and Indo-Malayan regions.

Eumenes Walkeri, sp. n.

Long. corp. 25 millim.

Female.—Black, varied with yellow. Head black; clypeus rather long and narrow, yellow, emarginate below, the extremities rather pointed; a yellow stripe below the antennæ, extending to the orbits, and produced upwards between the antennæ into a somewhat pear-shaped spot above them; the orbits beyond the antennæ and the emargination of the eyes filled up with yellow, the black space below the ocelli connected with the black vertex, but descending in a horseshoe form to the black antennal tubercles, strongly punctured; hinder orbits with a narrow yellow line. Antennæ black; flagellum rather paler and sericeous. Thorax black; prothorax yellow in front and on the upper part of the sides, but with the part adjoining the head black, very smooth and shining; mesothorax with two large yellow curved spots on the sides before the middle, and two short subparallel yellow lines just behind the middle; pleura with a yellow stripe extending from just before the wings nearly to the middle coxæ; scutellum more strongly punctured than the thorax, yellow in front, black behind; postscutellum yellow, slightly edged with black in front; metathorax yellow above and round the rather obtuse angles of the sides below, deeply grooved in the middle, the groove black, the black gradually widening below and more broadly above, below which point a broad slightly oblique bar is thrown out on each side; sides of metathorax black, sericeous; petiole shaped as in *E. flavopicta*, Blanch., and allies, basal third black, with a long oval yellow spot on each side, the remainder yellow on the sides, black below, with a yellow spot at the extremity, and connected in the middle with a black lateral spot; the median line above is mostly black, terminating in a large spot before the extremity, which is also marked with a black spot, trifid in front. Abdomen with the first segment yellow, with black more or less trifid markings at the base and extremity, and with a broad black band, ceasing on the sides, across the middle, with the edges irregularly denticulated; the remaining segments with the median line black; the second segment black at the base and yellow at the extremity; the third, fourth, and fifth yellow, black at the extremity, and the sixth entirely black. Front legs ferruginous, spotted with yellow, and lined with black; four hind legs ferruginous, femora mostly blackish, and tibiæ and tarsi lined with black and slightly with yellowish; last joint of tarsi wholly reddish, except the claws. Wings smoky hyaline.

Closely allied to *E. flavopicta*, Blanch., but differs in the much longer and narrower clypeus.

Rhynchium brunneum.

Vespa brunnea, Fabr. Ent. Syst. ii. p. 264. n. 41 (1793).

A common East-Indian species.

Vespidæ.

Polistes extraneus, var.

Polistes extraneus, Kirb. P. Z. S. 1883, p. 344.

Two females, differing from the typical specimen from

Maroe (Timor-Laut Islands) in the rather darker colouring, especially towards the apex of the abdomen, and in the narrower yellow edging to the first segment of the abdomen. Without a better series from both localities it would be premature to treat the Damma Island insect as distinct.

Apidæ.

Megachile ornata.

Megachile ornata, Smith, Cat. Hym. Ins. B. M. i. p. 183. n. 114 (1853).

A single specimen in poor condition, apparently belonging to this species, which is known from India, Borneo, and Sumatra.

HEMIPTERA HETEROPTERA. By W. F. Kirby.

Only eight or nine species were obtained on Damma Island, belonging to the genera *Dysdercus*, Am. & Serv., *Melamphaus*, Stål, *Physopelta*, Am. & Serv. (?), *Capsus*, Fabr., *Brachyrhynchus*, Lap., *Mezira*, Am. & Serv., and *Euagoras*, Burm. The species cannot be determined with accuracy at present, but among them is the widely dispersed *Brachyrhynchus orientalis*, Lap.

ORTHOPTERA. By W. F. Kirby.

Græffea coccophaga (?).

Alopus cocophages, Newp. Phil. Trans. 1844, p. 288, pl. xiv. fig. 4.
Lopaphus coccophagus, Westw. Cat. Phasm. p. 99 (1859).

Mr. Walker met with several pairs of a species of Phasmidæ, which he describes as of a delicate green, about 4 inches long, and emitting a milky fluid smelling strongly of peppermint. The male was more slender than the female. It is not unlikely that it was the present species, which is very common and destructive to cocoanuts throughout the South Sea Islands, and which might perhaps also feed on *Pandanus*; but the specimens forwarded by Mr. Walker do not appear to have reached the Museum.

XVIII.—*Notes on a Small Collection of Odonata &c. from Upper Burma, with the Description of a new Species.* By W. F. Kirby, F.L.S., F.E.S., Assistant in Zoological Department, British Museum.

Mr. de Nicéville has just forwarded a box of Odonata from the Katha District of Upper Burma to the British Museum; as it proves to contain several species of considerable interest, I have given a list of the whole. The dragonflies sent all belong to the subfamilies Libellulinæ and Agrioninæ, and the box also contained three specimens of one of the Sialidæ —*Chauliodus maculipennis*, Gray—in better condition than those previously in the Museum collection.

Libellulidæ.

Libellulinæ.

Camacinia gigantea, Brauer.

Neurothemis gigantea, Brauer, Verh. zool.-bot. Ges. Wien, xvii. p. 8 (1867).
Camacinia gigantea, Kirb. Trans. Zool. Soc. Lond. xii. p. 267 (1889).

Brauer's original specimens were from Amboina, and he described both sexes. The specimen from Mysol in the British Museum, which I noticed in 1889, is a male, measuring 100 millim. across the wings. There are two specimens, male and female, in the Burmese collection, which appear to belong to the same species. The male measures 111 millim. across the wings, and is very slightly larger than the female. They exhibit no important differences either between themselves or from Brauer's description of the sexes, except that the number of cross-nervures in the basal cell of the fore wings and the number of cells in the triangle vary a little. In the male the hind wings have a greenish cupreous lustre, not mentioned by Brauer, over the deep reddish brown of the basal two-thirds. In the female the orange-brown staining of the fore wings extends to the lower basal cell and the lower sector of the arculus; but a little beyond the nodus it ceases, except along the costal and subcostal spaces, but extends again at the apex, as described by Brauer. On the hind wing it extends obliquely downwards over the whole basal half of the wing; but the middle of this part of the wing is much lighter, while towards the anal angle there is a slight submarginal band of dark brown, almost confluent spots.

C. Harterti, Karsch, from Sumatra, is certainly a distinct species, according to the description, owing to the much smaller number of cross-nervures in the costal and subcostal areas. But further information on the range and variation of *C. gigantea* would be very useful. Many of the larger dragonflies from abroad are rare in our collections, partly from their not having been much collected and partly from their strong flight, which renders them very difficult to capture.

I am not aware that the genus *Camacinia* has been previously recorded from any part of the Asiatic continent.

Neurothemis fulvia.

Libellula fulvia, Drury, Ill. Ex. Ent. ii. pl. xlvi. fig. 2 (1773).

A single male specimen.

Neurothemis tullia.

Libellula tullia, Drury, Ill. Ex. Ent. ii. pl. xlvi. fig. 3 (1773).

A single male specimen.

Trithemis festiva.

Libellula festiva, Ramb. Ins. Névr. p. 92 (1842).

A single male specimen.

Trithemis, sp.

A single male specimen, with 13 antenodal and 9 or 10 postnodal cross-nervures on the fore wings. It is one of the closely related forms allied to *T. aurora*, Burm., and cannot be properly determined without a series.

Orthetrum pruinosum.

Libellula pruinosa, Burm. Handb. Ent. ii. p. 858. n. 63 (1839).

A rather small male.

Orthetrum Delesserti.

Libellula Delesserti, Selys, Mitth. Mus. Dresd. iii. p. 314 (1878).

A very dark female, apparently belonging to this rather scarce species, with the tips of all the wings clouded as far as the inner edge of the pterostigma.

Orthetrum Nicevillei, sp. n.

Long. corp., ♂ 43–45 millim., ♀ 41 millim.; exp. al. 63–72 millim.; long. pter. 4 millim.

Male.—Head black, shining, the rhinarium, sides of nasus, mandibles, and lower mouth-parts testaceous; clypeus with very large punctures, deeply channelled in the middle and margined in front; frontal tubercle deeply concave; thorax and abdomen pruinose blue, the thorax much the darkest, abdomen strongly carinated; legs black, upper anal appendages nearly straight, slender, slightly pointed at the tips, rather longer than the ninth segment, lower appendage somewhat shorter, spatulate, rather broad, upcurved, and obtusely rounded at the extremity. Wings hyaline, with black nervures; costal nervures inclining to yellowish in front; fore wings very slightly marked with rufous-brown at the extreme base, with 14 or 15 antenodal and 9 to 11 postnodal cross-nervures, the first two or three postnodals not continuous; pterostigma testaceous yellow, between black nervures, nodal and subnodal nervures considerably waved, triangle traversed, followed by three rows of cells increasing, one supra-triangular nervure; subtriangular space consisting of 3 or 4 cells: hind wings rufous brown at the base, nearly as far as the cross-nervure in the lower basal cell; membranule small, blackish; triangle free, no supra-triangular nervures.

Female testaceous brown; thorax slightly æneous on the sides, with two broad oblique yellowish-white stripes; a nearly square pale space occupying the front two-thirds of its surface above, bordered with black at the sides and behind; abdomen with most of the segments to the seventh with long yellowish lateral stripes on the sides beneath; eighth segment perfoliate.

Described from three males and one female.

This species belongs to the group of *O. glauca* and *luzonica*, Brauer, in which the triangle of the hind wings is not traversed by a nervure.

The species of *Orthetrum* are numerous and closely allied, and, as a rule, do not vary much. It often happens that very familiar-looking species of this group from a fresh locality prove to be new as soon as they are carefully examined.

Agrionidæ.

Agrioninæ.

Neurobasis chinensis.

Libellula chinensis, Linn. Syst. Nat. (ed. x.) i. p. 545. n. 15 (1758).

Many specimens of this abundant East-Indian species.

Pseudophæa Masoni.

Euphæa Masoni, Selys, Bull. Acad. Belg. (2) xlvii. p. 377 (1879).

Two male specimens.

XIX.—*Description of a new Species of Nemertine.* By J. C. Sumner, Royal College of Science.

While looking over some *Codium* in search of Nudibranchs at Fowey, in Cornwall, I found a small Nemertine, which has proved, on subsequent examination, to be a species new to science. The specimen belongs to the genus *Tetrastemma*, and is like *T. dorsale* in the shape and form of the body. I propose to call it *T. maculatum*, on account of the conspicuous spots with which the animal is covered. Unlike *T. nigrum* (also found on *Codium*) this animal is easily seen, owing to its bright coloration showing up well against the dark green background of the seaweed. For this reason it is probable that it does not generally live on *Codium*, but with other surroundings which would render it less conspicuous.

Tetrastemma maculatum, sp. n.

Diagnosis. Animal about 8 millim. long. Body cylindrical and tapering, resembles in shape *T. dorsale* rather than the elongate forms, such as *T. flavidum* and *T. vermiculum*. General ground-colour pure white; dorsal surface beset by large black spots, which become smaller and less numerous on the sides, and almost disappear on the ventral surface.

Remarks. These spots have a slight tendency to arrange themselves in transverse bands, which for some reason or other, for which I am unable to account, become much more marked after death. The head is not very distinctly marked off from the body by the cephalic groove, which is only to be seen by careful scrutiny. The groove dorsally extends in a posterior direction and ventrally anteriorly. Laterally well-marked cilia are present. The eyes are situated very deep in the head, and are almost easier to see from the ventral surface than from the dorsal; they are pale brown in colour, and the posterior pair are wider apart than the anterior.

I have been unable to make out much of the internal anatomy, owing to the fact that the animal has not cleared very well in oil of cloves. So far as I can see, however, there is no material difference in this respect between this species and its nearest allies.

Undoubtedly *T. maculatum* is very closely allied to *T. nigrum*, and, indeed, is only to be distinguished by the great difference in colour.

XX.—*Descriptions of some new Coleoptera from Costa Rica.*

By C. J. Gahan, M.A., Assistant, Zoological Department, British Museum.

Monsieur H. Pittier de Fábrega, Director of the Instituto Fisico-Geografico Nacional de Costa Rica, has forwarded to Dr. Günther two or three small collections of Coleoptera, which were for the most part made on the little-explored Pacific slope of that country. With the aid of the splendid collections of Central-American Coleoptera presented to the Museum by Messrs. F. D. Godman and O. Salvin it has not been difficult for me to identify the large majority of the species sent by M. Pittier; but there still remain a few forms which I have been unable to find in those collections and which do not seem to be referable to any described species. These I now describe: for one—an interesting species of Carabidæ—I have found it necessary to institute a new genus.

Carabidæ.

Leptotomus, gen. nov.

Somewhat ovate or elliptic in outline. Head with two setigerous punctures above each eye; clypeus with a seta near each of the antero-lateral angles; labrum emarginate, sex-setose along margin; scrobe of mandible devoid of setæ; mentum emarginate, without tooth; ligula ending in a free median chitinous process, at the sides of and beyond which project the membranous lateral lobes (paraglossæ), which are rounded at tip; second joint of labial palpi bisetose near its extremity. Pronotum with a rather long seta near each of the hind angles. Elytra rounded at apex, their surface covered with very fine close longitudinal and parallel striæ, almost microscopic in character; each elytron with a row of setigerous punctures along the outer margin. Fore tibiæ emarginate; first four joints of fore tarsi (♂?) slightly expanded, subspinose underneath. Antennæ rather short, first three joints glabrous, the rest pubescent; first joint about equal in length to the second and third united; these joints subcylindrical; the joints from the fifth to the tenth each about as broad as long, the eleventh slightly longer but scarcely narrower than the tenth.

The short and ovate form of this genus suggest a position for it near *Barysomus* and *Bradybœus*.

Leptotomus Pittieri, sp. n.

Subovatus, rufo-brunneus; pronoto nitido, medio longitudinaliter impresso, lateribus paullo rotundatis. angulis anticis acutis, posticis subobtusis, margine basali leviter bisinuata; elytris longitudinaliter tenuissimeque striatis, utrisque serie marginali punctorum setigerorum.

Long. 6, lat. 3 mm.

Hab. Costa Rica, Buenos Aires (*H. Pittier*).

Short and somewhat ovate in form; reddish brown in colour. Head and prothorax glossy. Elytra more opaque, but exhibiting a soft silky lustre in certain lights; impressed with very fine and close-set longitudinal striæ, running parallel to one another, and only visible with the aid of a good lens or low power of the microscope; each elytron has a row of rather widely separated setigerous punctures close to the outer margin.

Menidius vittatus, sp. n.

Capite prothoraceque ferrugineis, elytris flavo-testaceis, vittis nigris ornatis—una suturali, una submarginali et subsinuata, una ab suturali ad marginalem oblique transeunte, una per medium discum a basi ad fasciam obliquam descendente.

Long. 7, lat. $2\frac{1}{2}$ mm.

Hab. Costa Rica, between Mata de lana and Rodeo, on the Pacific side.

This species has a close resemblance to *M. circumseptus*, Bates, but the sutural vitta extends right up to the scutellum, and there stops, instead of bifurcating and circling round the base of each elytron; there is, in addition to the submarginal black line, another which runs along the middle of each elytron from the base as far as the oblique fascia which joins the sutural with the submarginal vitta; the latter is somewhat removed from the margin in its anterior half, but beyond the middle, where the oblique fascia joins it, bends downwards and approaches the margin much more closely; at the junction of the oblique fascia with the sutural vitta at about the beginning of its posterior third there is a slightly expanded rhomboidal black area.

The prothorax is transversely strigose above, and is impressed with a median longitudinal groove.

Scarabæidæ.

Copris costaricensis, sp. n.

Oblongus; clypeo antice leviter emarginato; thoracis angulis anticis acutis postice sinuatis; elytris fortiter punctato-striatis, punctis approximatis. (♂) Cornu capitis erecto, vix recurvo; thorace quadridentato, dentibus mediis sulco usque ad basin prolongato et dense fortiterque punctato separatis; foveolis lateralibus et depressionibus inter dentes medios lateralesque fortiter denseque punctatis. (♀) Tuberculo frontali brevi, apice leviter emarginato; thorace antice dense punctato.

Long. 14–15 mm.

Hab. Costa Rica, San Francisco de Guadalupe, alt. 1200 m. (*H. Pittier*).

In having an acute, subdentate, antero-lateral angle to the prothorax, followed by a slight sinuation or obliquity of the margin, this species resembles *C. Sallei*, Har., and *C. Rebouchei*, Har.; from both it is distinguished by the more thickly and distinctly punctured mid-dorsal furrow of the prothorax, and by having the sides of the prothorax, from the lateral fovea up to the anterior margin, and the broad channels between the median and lateral teeth also thickly and strongly punctured in the male.

Bates has, in the 'Biologia Centrali-Americana,' recorded only two species of *Copris* from as far south as Costa Rica. These two—*C. incertus*, Say, and *C. armatus*, Har.—range northwards to Mexico. On examining the examples which Bates has placed together in the latter species, I have noticed that there is a rather marked difference in the punctuation of the male prothorax. In the Mexican examples the anterior part of the prothorax is distinctly punctured, with the punctures rather closely placed, but with evident intervals between them; in the other examples the surface of the front part of the prothorax is just as distinctly asperate. In the examples from Costa Rica there is a further difference, in that the elytra are much more feebly punctured along the striæ. It is possible, however, that with much larger series these differences would become less apparent.

Cerambycidæ.

Holonotus sternalis, sp. n.

Niger; elytris brunnescenti-testaceis, postice piceis; pronoto medio valde denseque punctato, versus latera crebrius rugoso-punctato; elytris dense fortiterque punctatis; mesosterno grosse tuberculato, ad apicem lateraliter compresso et cariniformi; antennis brevibus, prothoracis basin paullo superantibus.

♀. Long. 25, lat. 9½ mm.

Hab. Costa Rica, Cerro de la Voltea (*H. Pittier*).

Black, with the elytra almost entirely of a reddish-brown colour, a narrow space bordering the posterior margin being somewhat black. Pronotum (with the exception of a narrow median space extending for a short distance from a little in front of the base) strongly and thickly punctured, especially towards the sides, where the punctures are crowded together to form a rugose surface; sides subparallel or very slightly diverging for about one third of their length from the base, thence rather strongly converging to the anterior border. Elytra strongly and rather closely punctured; posterior margin rounded and denticulate, with a slightly larger tooth on each side where it joins the lateral margins. Mesosternum projecting as a strong tubercle which is laterally compressed, and at the tip smooth and keel-like.

This species may be distinguished from *H. minor*, Bates, which appears to be the most nearly allied form, by the shortness of the female antennæ, which extend only a very short distance beyond the hind margin of the pronotum, and by the prominence of the mesosternum, which, instead of fitting evenly into the emargination of the prosternum, projects somewhat below it. The pronotum also is more angulate at the sides and is more strongly and somewhat less closely punctured on the middle of its surface.

Callichroma Batesi, sp. n.

C. cosmica, Bates, Trans. Ent. Soc. 1872, p. 186.

Viridi-metallica, supra atro-viridis; pronoti vitta mediana, elytrorum sutura et vitta angusta utrinque viridi-nitidis, subglabris; prothorace utrinque fortiter acuteque tuberculato; corpore subtus viridi-nitido, vix pubescente; antennis pedibusque nigris, femoribus anticis intermediisque (basi exceptis) testaceis.

Hab. Nicaragua, Chontales (*Belt*); Costa Rica, Guanacaste (*H. Pittier*).

This species was determined by Bates to be the *C. cosmica* of White; but in the latter species the prothorax has a blunt tubercle on each side, which is feebly developed in comparison with the strong and spine-like tubercle occupying the same position in the present species. In *C. cosmica* the underside has a distinct, though thin, silvery-grey pubescence, which is easily seen in certain lights, and the lateral vitta of each elytron is reduced to a narrow streak near the base. In *C. Batesi* the underside of the body is almost impubescent, and the lateral vitta of each elytron extends as a distinct bright band from the shoulder as far as the apex.

Oncideres Pittieri, sp. n.

O. amputatori affinis; prothorace utrinque pone medium tuberculo nigro-nitido vix elevato, supra maculis tribus nigro-nitidis in serie transverso ante medium positis; elytris fulvo-maculatis, utrinque plaga magna elongata supra dilacerata, alba, basi dense nigro-nitido-granulatis, disco fere usque medium minus dense sed evidenter granulatis; corpore subtus, præcipue versus latera, prothoracisque lateribus albescentibus; segmentis abdominis postice fulvis. ♀.

Long. 23, lat. $8\frac{3}{4}$ mm.

Hab. Costa Rica, savannahs and forests of Limon, facing the Pacific (*H. Pittier*).

From *O. amputator*, Fabr., *O. putator*, Thoms., and other allied forms this species is to be distinguished by the somewhat larger and more closely placed shining granules on the base of the elytra and by the extension of these granules on the dorsal region almost up to the middle. The long white patch on the side of each elytron is also characteristic; this reaches the margin of the elytron on its outer side, while its inner border is very irregular and is broken by one large gap, which divides the patch into a larger anterior and a smaller posterior portion; near its anterior end, which lies a little behind the shoulder, a few isolated black granules are to be seen. The pubescence on the underside of the body is greyish white, distinctly white and rather dense on the sides of the prothorax and mid and hind breast. The abdominal segments are fulvous towards their hind borders.

Amphionycha ventralis, sp. n.

Capite testaceo, flavo-pubescente; prothorace albo-pubescente, supra prope basin infuscatis; elytris nigris, dense punctatis, griseo tenuiter pubescentibus, utrinque carinatis; corpore subtus nigro-fuscis et testaceis, segmentis duobus ultimis abdominis dense flavo-pubescentibus, coxis femoribusque pallide testaceis, tibiis tarsisque fuscis; antennis subtus sparse ciliatis, articulis quarto, quinto et sexti basi testaceis.

Long. 11, lat. $3\frac{1}{2}$ mm.

Hab. Costa Rica, Pacific side, between Mata de lana and Rodeo (*H. Pittier*).

Head testaceous, with a dense yellowish pubescence above. Prothorax with the basal margin turned slightly outwards, with a dense whitish pubescence, except near the base on the upper surface, where it is somewhat blackish. Elytra black, with a thinner dark grey pubescence, which does not entirely conceal the rather strong and closely placed punctures. Antennæ rather slender, sparsely ciliate underneath, dark brown, with the fourth and fifth joints and proximal half of sixth testaceous; the third joint, which is also very narrowly testaceous at the base, is about equal in length to the first and second taken together and is a little longer than the fourth. The last two abdominal segments are covered with a dense pale yellow pubescence, the rest of the underside being of a fuscous or dark reddish colour. The coxæ and femora are pale testaceous, the tibiæ and tarsi dark brown.

This species has a close superficial resemblance to *Isomerida picticornis*, Bates, but may be distinguished, *inter alia*, by the slenderer appearance of the antennæ, which are only sparsely ciliated and without the thick fringe which is present on the basal joints of the latter species.

The resemblances that hold between different species, even of distinct genera, in this group seem to be accounted for by their common mimicry of some forms of Lampyridæ and other Malacoderms.

XXI.—*Notes on the* Thelyphonidæ *contained in the Collection of the British Museum.* By R. I. Pocock, of the British Museum (Natural History).

[Plate II.]

Synopsis of the Genera of Thelyphonidæ.

a. The anal segment without ommatoids; the carapace angularly pointed in front and not furnished either with cephalic keels or with a ridge between the median eyes. *Thelyphonellus*, g. nov.
Type *amazonicus* (Butl.).

b. The anal segment bearing one or two ommatoids on each side; carapace bluntly rounded in front.

- a^1. Carapace not furnished on each side with a keel running forward from the lateral eyes; no distinct ridge between the median eyes.
  - a^2. Coxal apophysis of the chela with a distinct spine on its inner edge (*cf.* also secondary sexual characters of male) .... *Labochirus*, g. nov.
    Type *proboscideus* (Butl.).
  - b^2. Coxal apophysis of chela unarmed (*cf.* secondary sexual characters of male)........................ *Hypoctonus*, Thorell.
    Type *formosus* (Butl.).

b^1. Carapace furnished on each side with a keel running forwards from the lateral eyes.

- a^3. Median eyes not separated by an upstanding ridge ; hand in ♂ flat, twice as wide as the femur, which is long, slender, cylindrical, and about twice as long as the tibia. . *Mimoscorpius*, g. nov. Type *pugnator* (Butl.).
- b^3. Median eyes separated by a distinct elevated ridge; hand in both sexes strongly convex, subcylindrical, and at most only a little wider than the femur, which is shorter and thicker.
  - a^4. The genital operculum in the ♀ with its median area laterally sulcate and deeply impressed in the middle, its posterior border truncate and sinuate . . . . *Typopeltis*, g. nov. Type *P. crucifer*, Pocock.
  - b^4. Genital operculum in the ♀ without a deep median impression ; its posterior border convexly rounded.
    - a^5. Genital operculum in the ♂ large, with a deep narrow median groove, which terminates behind in a short transverse impression ; a spine on the second ventral plate (tarsi of first leg in ♀ (? always) modified).
      - a^6. With one ommatoid on each side of the anal segment. . *Thelyphonus* (Latr.), Thor. Type *caudatus* (Linn.), Thor.
      - b^6. With two ommatoids on each side of the anal segment. . *Tetrabalius*, Thor. Type *seticauda* (Dol.).
    - b^5. Genital operculum in ♂ without a fine median groove ; the second ventral plate without a spine (tarsi of ♀ unmodified).
      - a^7. Coxal apophysis of chela longer, thinner, and armed internally with a distinct tooth . . . . *Uroproctus*, g. nov. Type *assamensis* (Stol.).
      - b^7. Coxal apophysis of chela shorter, stouter, and not armed internally with a tooth. . . . . *Mastigoproctus*, g. nov. Type *giganteus* (Lucas).

THELYPHONUS (Latr.).

The British Museum has examples of the following species of this genus :—

Thelyphonus caudatus (Linn.). Java, Hong Kong.
—— *linganus*, Koch. Sumatra.
—— *lucanoides*, Butler. Borneo.
—— *johorensis*, Oates. Malacca, Singapore.
—— *Schimkewitschii*, Tarn. Siam.
—— *sepiaris*, Butler. India, Ceylon.
—— *doriæ*, Thorell. Sarawak.
—— *manillanus*, Koch. Manilla.
—— *insulanus*, L. Koch. New Hebrides.
—— *Hosei*, sp. n. (*Cf. infrà.*) Borneo.
—— *anthracinus*, sp. n. (*Cf. infrà.*) Borneo.
—— *Tarnanii*, sp. n. (*Cf. infrà.*) Billiton Island.

Moreover there is but little doubt that the following species, which are unknown to me, also belong to this section :— *Th. asperatus*, Thorell, *Th. papuanus*, Thorell, and *Th. australianus*, C. Koch.

Thelyphonus sepiaris, Butler.

Thelyphonus sepiaris, Butler, Cist. Ent. i. p. 131 (May 1, 1873).
Thelyphonus nigrescens, id. ibid.
Thelyphonus indicus, Stoliczka, Journ. As. Soc. Bengal, xlii. p. 138 (May 28, 1873).
Thelyphonus Beddomei, id. ibid. p. 142.

This species, of which the British Museum has examples from Ceylon, Madras, and Tenasserim, is closely allied to *Th. caudatus* (Linn.). The males of *sepiaris*, however, may be readily recognized by the coarse coriaceous texture of the abdominal sterna and by the approximate equality in size of the spines upon the trochanter of the chela.

Thelyphonus lucanoides, Butler.

Thelyphonus lucanoides, Butl. Ann. & Mag. Nat. Hist., Sept. 1872, p. 205.

The male of this species differs from that of *Th. caudatus* (Linn.) in having the tibial apophysis of the chela long and slender. It is so long, in fact, that when the "hand" is closed against the apophysis the tip of the latter reaches almost as far as the tip of the immovable digit; moreover the chelæ, which are coarsely and closely punctured, are much less robust distally, the tarsus or hand being narrower than the tibia. In addition there are six well-developed spines on the trochanter.

The locality of this species is said to be "Corea;" but it is in all probability Borneo, for several of the Arthropoda forming part of the same collection and also ticketed "Corea" are in reality referable to Bornean species.

Thelyphonus Hosei, sp. n. (Pl. II. figs. 1–1 *b*.)

♀. *Colour* of upperside of trunk and chelæ deep black; lower surface of trunk deep red; the legs with reddish tint, which becomes paler distally, the feet being distinctly pale red.

Carapace densely granular, the granules coarser upon the area behind and on the inner side of the lateral eyes; the area just on the inner side of and below the cephalic keels, as well as that on the middle of the interocular area and behind the median ocular tubercle, not granular; the tubercle quite smooth, high, and projecting some way in front of the eyes.

The *abdomen* densely covered with low squamiform granules, the median line visible upon the first three and on the eighth and ninth; the two anterior annular segments of the postabdomen smooth below, finely granular above and at the sides; the anal segment smooth, punctured, the ommatoids large, transverse, larger than any of the eyes; flagellum composed of 35 segments. *Genital operculum* mesially produced posteriorly, studded with coarse punctures, the interstices being smooth, with scarcely a trace of a median line, but with a pair of conspicuous impressions, densely punctulate laterally, not quite twice as wide as long, but as long as the fourth and half the fifth sterna. The second and third *sterna* about equally long in the middle line, sculptured like the first, the second with a median transverse thickening; the rest of the sterna smooth and polished, but sparsely and weakly punctured, the impressions elongate.

Anterior *sternum* of *cephalothorax* not keeled and scarcely granular.

Chelæ.—*Coxæ* polished, sparsely punctured below, densely punctured and subgranulate behind, the apophysis densely punctured, its inner border distinctly shouldered. The *trochanter* armed with 2 lower teeth, of which the distal is the largest and the proximal bifid, and above with 6 teeth, the 3 internal of which are well developed and subequal, the angular (fourth) is the largest, and the two anterior as large as the lateral; these are close together, but separated widely from the angular; this segment, like the femur, is densely punctured and subgranular above and below. The *femur* is armed with a large lower spine and a small but distinct upper one. *Tibia* smooth, polished, sparsely punctured, furnished with a small inferior anterior spinule; the apophysis stout, about as long as the anterior thickness of the tibia, armed with two or three teeth internally in front of the apex, and three more posteriorly, the posterior of which is on the inner edge of the tibia, its external edge coarsely serrate. *Tarsus* narrower than tibia, smooth, polished, sparsely punctured, with an anterior inferior spine, the movable digit normally sulcate and punctured, its inner border sinuate.

Legs.—Tarsus of first pair with the second segment distally incrassate, considerably longer than the third or fourth; the fifth and sixth segments short, the latter with its inner surface internally produced, thickened; the seventh longer than the fifth and sixth taken together, thickened externally and presenting the appearance of having been twisted on its own axis, coarsely punctured; the eighth about as long as the seventh, its upper surface depressed; the ninth as long as the eighth, unmodified.

The rest of the legs with femora finely granular externally.

Measurements in millimetres.—Total length 52, length of carapace 18·5, distance between lateral eyes and posterior border 13. Chela: length of femur (below) 8·5, of tibia (above) 6·3, of its apophysis 4+, of tarsus 5, of movable digit 5·2; width of femur 4·5, of tibia 5, of tarsus 4. First leg, length of third segment (femur) 12·5, of fourth 17·5, of fifth 16·5, of tarsus 8·5; fourth leg, length of femur 14, of patella 6·5, of tibia 15, of tarsus (three segments) 5·5.

A second specimen, an immature male, resembles the female described above, except that it is smaller, being 44 millim. long, and has the tarsi of the first pair of legs unmodified, the ninth segment being relatively longer than the eighth, and the eighth than the seventh. Moreover the posterior tooth on the lower surface of the trochanter of the chela is simple.

Loc. Mount Dulit, in Sarawak (N. Borneo). Collected by C. Hose, Esq.

This appears to be the largest described representative of the genus, using the term as restricted above, the average length of which appears to be less than 35 millim. The two that approach it nearest are *Th. manillanus* of C. Koch and *Th. doriæ* of Thorell, both of which may exceed 40 millim.

The latter, which was obtained in Sarawak (the neighbourhood of the town), differs from *Hosei* in having only one anterior spine on the trochanter of the chela, and this segment and the femur smoother, and the ocular tubercle much lower in front.

Thelyphonus anthracinus, sp. n.

This species is nearly allied to *Th. Hosei.* It differs in the following respects:—

The length of apparently an adult female is only 29 millim.

The lower surface of the abdomen is densely-covered with minute punctuation, which is particularly thick upon the first, second, third, and eighth sternal plates; on the intervening plates the punctuation can be perceived with a lens of low power.

In *Hosei* there is no perceptible fine punctulation on the sterna.

In the tarsi of the first pair of legs the third segment is as long as the second and a trifle longer than the fourth; the ninth is about as long as the seventh and eighth taken together, the latter two being unmodified; the fifth and sixth are slightly modified, the former, which is about as long as the fourth, has its upper surface impressed on its inner side, while the sixth, which is longer than the seventh or eighth and about as long as the second, has its inner surface black and flattened and its lower inflated.

In other respects, such as structure of the chelæ &c., this form does not seem to differ from *Hosei.* The smoother tracts on the interocular area of the carapace in the latter species are not noticeable in *anthracinus.*

Loc. Batu Song (Eastern Sarawak). Collected by C. Hose, Esq.

Thelyphonus Tarnanii, sp. n. (Pl. II. figs. 2–2 *b*.)

♀. Closely allied to *Th. Hosei*, but differing in the following features:—

Carapace more finely granular behind, and not granular but coarsely and finely punctured in front, with the ocular tubercle much lower on its anterior portion.

The posterior prolongation of the genital operculum more rounded.

The ommatoids are much less clearly discernible; but this is perhaps due to accident or the different method of preservation.

The coxal apophysis of the chela is much less squarely shouldered on its inner border. The segments of the legs are relatively shorter (*cf.* measurements as compared with length of carapace). The tarsi of the first pair are modified almost exactly as in *Hosei*, but the relative length of the segments is a little different, the eighth segment being noticeably shorter than the seventh.

Measurements in millimetres.—Total length about 47, of carapace 16; distance between lateral eyes and posterior border of carapace 11; first pair of legs, femur 9, patella 12·2, tibia 12, tarsus 7; fourth leg, femur 11, patella 5, tibia 10·5, tarsus (three segments) 5.

A single (dried) female from Billiton Island (off the S.E. extremity of Sumatra).

From the above measurements it may be seen that in the legs of the last pair the tibial segment is shorter than the distance between the lateral eyes and the posterior border of the carapace (11 : 10·5), whereas in *Hosei* the segment is longer than the above distance (*i. e.* 13 : 15). Similar comparisons will show that the segments of the legs of the first pair are shorter in *Th. Tarnanii.*

Typopeltis, gen. nov.

Allied to *Thelyphonus* (s. s.), but the genital operculum of the female having its middle third elevated and deeply mesially impressed, while the posterior border of the median area is not evenly rounded.

Type *Th. crucifer*, sp. n.

I also refer to this genus *Th. sinensis,* Butler, and the species that I identify as *Th. Stimpsonii* of Wood. I suspect, too, that *Th. amurensis* of Tarnani will come in here.

Loc. China, Japan, &c.

Typopeltis Stimpsonii, Wood. (Pl. II. figs. 3, 3 *a*.)

Thelyphonus Stimpsonii, Wood, Proc. Ac. Philad. 1862, p. 312.

Colour black; tarsi, flagellum, and lower surface ferruginous.

Carapace densely punctured in its anterior portion and lightly transversely wrinkled, covered in its posterior two thirds with rounded granules, the impressions not deep, the margin finely serrate, anteriorly studded with setæ; a pair of setæ on the ocular tubercle behind the eyes, another pair in front of the tubercle; the ocular keel complete, *i. e.* running from the lateral eyes and curving round to the front margin of the tubercle, which is smooth; the area between the summit of the tubercle and the middle of the front border sloping at an angle of about 50°, the area lying below the ocular keel vertical posteriorly. The median eyes black, the lateral amber-yellow; no accessory eyes.

Abdomen densely punctured above and covered thickly with low rounded granules; the last segment of the postabdomen shining, weakly granular; the *ommatoids* a little smaller than a lateral eye; *flagellum* bearing short setæ. The posterior *sterna* bearing laterally a few low granules, their median portion sparsely punctured.

The *genital operculum* (first sternite) marked with a very deep transversely oval impression in its anterior half, upon each side of which, that is posteriorly and laterally, there is a groove which, rising at a point on a level with the middle of the lateral side of the depression above mentioned, is directed obliquely inwards and backwards, but falls considerably short of the posterior border, which is distinctly emarginate on each side of the middle line, the external angle of each emargination marking the place where a horny process projects upwards on each side of a median membranous portion of the second; the second mesially very narrow, with its posterior border straight; third also with its posterior border straight.

Chelæ rather short; the *coxa* minutely and closely punctured and also coarsely and sparsely; the anterior processes without secondary teeth, and diverging from each other at an angle of about 50°. *Trochanter* (third segment) sharply granular in front, its inferior edge armed with 2 teeth, its upper edge with 4 (1 large angular, 2 small lateral, and 1 large anterior, the latter in one case bearing a minute external basal spinule); the upper surface roughened with small smooth crescentic elevations, which are situated behind setiferous pores. The *femur* provided in front above with a small tubercle, below with a sharp spine, ornamented above, below, and externally with crescentic impressions, passing into squamiform granules. *Tibia* somewhat coarsely punctured; its process stout, pointed apically, and almost as long as the terminal digital segment; its anterior border convex and serrate, its posterior border very lightly concave and armed with 1 prominent spine (rarely 2) behind the apex. *Tarsal segment* coarsely punctured, armed below with a single spine; its apophysis serrate along both its margins, the serrations on its anterior or inner margin continued from the corresponding border of the segment; *digit* with evenly arched external and internal edge, the latter longitudinally bisulcate.

Legs with *femora* ornamented in front with squamiform granules, behind with large punctures. *Patellæ* and *tibiæ* similarly but much more finely ornamented; the tibia (fifth segment) armed below with a single spine at its distal end, the segment following it furnished distally on each side with a single spine; the *feet* (terminal three segments) armed below with two parallel series of stout blunt spines, of which the distal two on each segment are the longest. *Tarsus* of first leg with segments 2 to 8 gradually decreasing in length, the ninth twice as long as the eighth, fusiform; lower edge of segments 5 to 8 black and thickened, but not notched or otherwise modified.

Measurements in millimetres.—Total length 47, of carapace 17; width of carapace across the angles of the lateral borders 9·5. Chela: length of segments along upperside, femur 3·5, tibia 5·5, tibial apophysis 4; tarsus 4·2; tarsal apophysis (immovable digit) 2·8, movable digit 4·5. First leg, length of femur 12, patella 15, tibia 14·5, tarsus 10·5; fourth leg, length of femur 13·6, patella 5·2, tibia 14, tarsus (distal four segments) 9·5; length of anterior three abdominal sterna (along middle line) 6·5; length of first sternum 5, width 10·5.

Two female examples from Oö-Sima (Lu-Chu Islands), collected and presented by Commander Alfred Carpenter, R.N.

Th. sinensis of Butler, from Hong Kong, of which *Th. Stimpsonii*, Butler, appears to be the young, is very nearly related to this species of Wood's; but it seems to differ in having the posterior border of the genital operculum much less noticeably biemarginate, and the furrows on each side of the median impression parallel, longer, and extending almost to the posterior border of the plate. Moreover the tarsi of the feet seem to be shorter, the length of those of the first and fourth pairs of legs being respectively 9 and 8, while that of the carapace is 16. In the structure of the palpi the two are very similar, but in *sinensis* the secondary tooth upon anterior border of the trochanter is well developed. I do not consider that the absence in the Lu-Chu specimens of the posterior spine on the inner border of the trochanter is sufficient to constitute a specific distinction between these examples and Wood's type from Japan, in which this spine is said to be present although small. *T. amurensis* of Tarnani (Zool. Anz. 1889, no. 301, and Horæ Soc. Ent. Ross. xxiv. p. 519, pl. iii. fig. 3) is allied to these two species, coming nearest apparently to *sinensis*; but the depression on the operculum is much wider and shallower, and the lateral grooves are curved inwards round the anterior part of the median elevated area.

Typopeltis crucifer, sp. n. (Pl. II. figs. 4, 4 *a*.)

Nearly related to *Stimpsonii*, but with the surface of the *genital operculum* marked with a deep Y-shaped median groove, on each side of which there is a shallow longitudinal impression parallel with its fellow of the opposite side and extending behind to the posterior angle of the plate; the posterior border of the operculum widely emarginate in the middle, with a short median rounded prominence in the middle of the emargination. This emargination leaves much more of the second segment uncovered than is seen in *Th. Stimpsonii*, *sinensis*, and *amurensis*.

Palpi like those of my specimens of *Stimpsonii*, but with the posterior tooth on the inner edge of the trochanter present, and with three teeth before the apex on the posterior border of the tibial apophysis. *Tarsus* of first leg with the segments distally decreasing in length almost as in *T. Stimpsonii*, distally incrassate, the eighth and ninth segments deeply notched below.

Measurements in millimetres.—Total length 38, length of carapace 14; first leg, femur 9·5, patella 12·5, tibia 12, tarsus 8; fourth leg, femur 10·7, patella 4·5, tibia 10·7, tarsus 7.

Three female specimens, without locality.

Uroproctus, gen. nov. (Pl. II. figs. 7, 7 *a*.)

Carapace like that of *Thelyphonus*.

The apophysis of the coxa of the chelæ with its inner edge straight and armed with a distinct spine, the whole process gradually narrowed towards the tip.

The *genital operculum* of the male not large, swollen at the sides, but without median groove; no spine on the second abdominal plate; the genital operculum of the female almost like that of *Thelyphonus*.

Tarsi of first leg in female unmodified.

Type and only known species is *Th. assamensis*, Stoliczka, of which the following is the synonymy:—

Thelyphonus assamensis, Stol. J. A. S. Bengal, 1869, pl. ii. p. 205; id. op. cit. 1873, pt. ii. p. 133.
Thelyphonus scabrinus, id. loc. cit. p. 130 (*teste* Oates).
Thelyphonus rufimanus, Lucas, Butler, Ann. & Mag. Nat. Hist., Sept. 1872, p. 202 (not *rufimanus* of Lucas).
Thelyphonus proscorpio, Latr., Butler, ibid. (not *proscorpio*, Latr.).
Thelyphonus psittacinus, Butler, Cist. Ent. vi. p. 129 (1873).

Loc. Assam, Sikkim.

This species differs from all the species of *Thelyphonus* (s. s.) in the different form of the genital operculum in the male and in the shape of the coxal apophysis of the chela, this process in *Thelyphonus* being stout, with its inner edge unarmed and abruptly narrowed at the apex.

Mastigoproctus, gen. nov.

Differs from *Thelyphonus* principally in the characters connected with the genital operculum set forth in the above synopsis.

Loc. Central America and Brazil.

The type of the genus has the following synonymy:—

Mastigoproctus giganteus (Lucas).

Thelyphonus giganteus, Lucas, Mag. Zool. pt. viii. (1835); Koch, Arachn. x. p. 21, figs. 767, 768.
Thelyphonus excubitor, Girard, Expl. of Red River, p. 265, fig. xvii.
Thelyphonus ? mexicanus, Butler, Ann. & Mag. Nat. Hist., Sept. 1872, p. 201.
Thelyphonus rufus, id. ibid. p. 205.

The British Museum has a large number of examples of this species from various parts of Mexico and a few from Texas.

I believe that the form named *mexicanus* by Butler is merely the male not quite adult; but I have not seen quite enough examples of this sex to be able to establish the truth of my belief.

I also refer to this genus the species described by Tarnani as *Thelyphonus maximus*, of which the Museum has a single male example from Matto Grosso, in Brazil. I suspect, however, that this so-called species is the male of *Th. brasilianus* of Koch, and I do not feel satisfied that *Th. brasilianus* of Tarnani is identical with the species so-named by the German arachnologist.

I provisionally refer to this genus *Th. proscorpio* of Latreille * (=*antillanus* of Koch and *caudatus* of Tarnani), of which the Museum has a considerable number of females from Haiti. But my ignorance of the male characters makes the reference doubtful. The same remarks apply to the species described below as *M. Butleri*.

Mastigoproctus Butleri, sp. n. (Pl. II. figs. 5, 5 *a*.)

Thelyphonus brasilianus, Butler, Ann. & Mag. Nat. Hist., Sept. 1872, p. 201.

Colour blackish red above, paler below.

Carapace thickly and rather coarsely granular throughout, the ocular keel complete and finely serrate, the area below it vertical, the anterior extremity of the carapace also almost

* Latreille expressly stated that the species he named *proscorpio* was an inhabitant of the West Indies. I consequently adopt this specific name for the form that Koch subsequently described as *antillanus*; but I cannot see that Tarnani has any grounds for calling this species *caudatus* of Linn., the latter being, as Stoliczka and Thorell have pointed out, a Javan form.

vertical; the thoracic fovea rather deep, the median groove conspicuous and smooth anteriorly.

Terga granular like the carapace, with a conspicuous series of granules along the posterior border; the terminal segment smooth, punctured.

Sterna.—First or genital operculum large, not twice as wide as long, smooth, polished, strongly impressed just above the stigma and laterally in front of the pulmonary sac, with two very faint impressions on each side of the middle line; a shallow median groove in its posterior half, and behind this a shallow transverse impression; second sternal plate finely granular and slightly elevated just behind the genital aperture, with an oblique ridge on each side of it and a low median crest behind it; the third sternite very narrow and transversely grooved; the rest of the sterna nearly entirely smooth.

The *metasternum* and *coxæ* of the cephalothorax smooth, sparsely punctured; the *prosternum* granular but not keeled.

Chelæ.—*Coxæ* (maxillæ) smooth below, coarsely but sparsely punctured, rugose behind, the processes projecting straight forwards parallel with each other, their external surface forming an obtuse angle with the anterior edge of the coxa. *Trochanter* rugose, but scarcely granular above, with 3 blunt tuberculiform teeth on the inner edge and a small tooth at the base of the larger angular tooth on its outer side, its lower edge armed with one strong tooth-like spine. *Femur* coarsely punctured, rugose above, armed in front with only one small inferior tubercle. *Tibia* coarsely punctured, with a conspicuous, blunt, cylindrical tooth at the base of the apophysis, which is slender, bluntly serrate in front, and smooth behind. *Tarsus* (manus) coarsely punctured, finely serrate internally, the serration passing on to the immovable digit, bearing the usual anterior inferior spine; the movable digit normally grooved, its internal edge conspicuously emarginate.

Legs finely granular; *tarsus* of first with the third segment the longest, the second and ninth about equal in length, fourth to the eighth becoming gradually shorter, all the segments cylindrical; *tarsi* of the rest armed below with two series of robust spines.

Measurements in millimetres.—Total length 39, length of carapace 16, width across angles of lateral margin 8·5. Chela: length of upperside of femur 4 5, of tibia 6·8, of tibial apophysis 3·5, of tarsus 5, of tarsal apophysis 2·5, of digit 4·7. First leg, femur 10·5, tarsus 10; fourth leg, femur 10·3, patella 5, last three segments (foot) 5·2; length of genital operculum 5·5, width 9·3.

A single (probably female) example from Brazil.

This species seems to be most nearly related to *Th. proscorpio* (Latr.); it may be at once recognized, however, by the spine-armature of the trochanter of the chela, this segment being peculiar in having only one large inferior spine. Moreover the absence of spines on the femur is peculiar; and the spine at the base of the tibial apophysis is unusually prominent. Mention may also be made of the parallelism between the two maxillary processes of the coxæ.

MIMOSCORPIUS, gen. nov. (Pl. II. fig. 6.)

Carapace like that of *Thelyphonus*, but there is no distinct ridge between the median eyes.

Genital operculum of male twice as wide as long, without trace of a median sulcus, laterally swollen, its posterior border mesially convex; the second sternum without a median spine.

Palpi in male peculiar; *femur* long, nearly cylindrical, almost four times as long as thick, with a single small inferior tuberculous spine on its anterior surface; the *tibia* about half the length of the femur and of about the same thickness, the apophysis very long and slender; the *tarsus* or *hand* twice as thick as the femur and flattened, its apophysis stout and strongly curved at the apex.

This genus is established for the reception of *Th. pugnator* of Butler *, from the Philippine Islands. The female of this species is unfortunately unknown, but the male differs in well-marked characters, both sexual and asexual, from the remaining species of the group. I have consequently not hesitated to regard it as a distinct genus.

LABOCHIRUS, gen. nov.

Carapace without cephalic keels and without an upstanding ridge between the eyes as in *Hypoctonus*.

The *coxal apophysis* of the chela with a distinct internal spiniform tooth.

Genital operculum of male swollen, not sulcate, a process on the posterior border of the second. Genital operculum of adult female with a pair of tubercular elevations, its hinder border produced.

Type and sole known species *L. proboscideus*, Butler, from Ceylon, of which the following is the synonymy:—

* Ann. & Mag. Nat. Hist., Sept. 1872, p. 204, pl. xiii. fig. 5.

Thelyphonus proboscideus, Butler, Ann. & Mag. Nat. Hist., Sept. 1872, p. 203, pl. xiii. fig. 3, ♂.
Thelyphonus parvimanus, id. Cist. Ent. i. p. 130, fig. 3 (1873), ♀.

This genus is nearly allied to *Hypoctonus*, Thorell, of which *formosus*, Butler, is the type—a genus which, according to Mr. Oates, is represented by several species in Burma. But, apart from the presence of the above-mentioned spine upon the coxal apophysis of the chela, *Labochirus* may be recognized by its striking secondary sexual characters. These are well shown in Mr. Butler's figure of *Th. proboscideus*, and a comparison between this and the same author's figure of *Hypoctonus formosus* will show better than words can explain the wide difference in the style of the sexual modification between the two genera.

THELYPHONELLUS, gen. nov.

Carapace gradually narrowed in front to a point, not furnished with ocular keels, the sides of the interocular area being smooth and convex, as in *Hypoctonus*. The median eyes lying flat upon the carapace, separated by a distance which is about equal to a diameter, and not divided by an upstanding ridge or tubercle.

Genital operculum of the male large, swollen mesially, polished, neither sulcate nor impressed, with its posterior border almost evenly convex; that of the female less swollen, but also with evenly convex posterior border, and without sulci and impressions.

Ommatoids absent.

Type *Thelyphonellus amazonicus* (Butler).

In addition to the female example from Santarem, which served as Mr. Butler's type, the British Museum has five more specimens which were collected in Demerara by Mr. W. L. Sclater. Two of these examples are males, and show that the chelæ in this sex are much longer than in the female.

There is a transverse impression behind the median eyes, and the anterior region of the carapace is furnished with three shallow longitudinal grooves.

Length up to 25 millim.

Revision of the Species identified or described in Mr. Butler's Papers.

♂ ♀. *Th. giganteus*, Lucas = *Mastigoproctus giganteus* (Lucas).
♀. *Th. rufus*, Butler = *M. giganteus* (Lucas).
The colour of this specimen is a sign of immaturity and not of specific distinction.

♂. *Th. mexicanus*, Butler	= *M. mexicanus* (Butler).

In the British Museum collection there are not enough intermediate forms to justify the view that this species is a synonym of *giganteus*.

?♀. *Th. brasilianus*, Koch	= *M. Butleri*, sp. n., not *M. brasilianus* (Koch).
♀. *Th. antillanus*, Koch	= *M. proscorpio* (Latr.) (*cf. suprà*).
♀. *Th. rufimanus*, Lucas	= *Uroproctus assamensis* (Stoliczka).
♀. *Th. proscorpio*, Latr.	= *U. assamensis* (Stol.).
♂. *Th. psittacinus*, Butler	= *U. assamensis* (Stol.).
♀. *Th. sepiaris*, Butler	= *Th. sepiaris*, Butler, ♀, = *indicus* ♂, and *Beddomei* ♀, Stol. (The name *sepiaris* has four weeks' priority over *indicus*.)
Th. caudatus (Linn.)	= *Th. sepiaris*, Butler, not *caudatus* (Linn.), Thorell (*cf. suprà*).
♂. *Th. nigrescens*, Butler	= *Th. sepiaris*, Butler.
♂. *Th. rufipes*, Lucas	= *Th. caudatus* (Linn.), Thorell.
♀. *Th. linganus*, Koch	= *Th. doriæ*, Thorell (not *linganus* of Koch).
♂. *Th. manillanus*, Koch	= *Th. manillanus*, Koch, ♀, = *Strauchii*, Tarnani, ♂.
♂ (yg.). *Th. philippensis*, Butler	= *Th. manillanus*, Koch.
♂. *Th. lucanoides*, Butler	= *Th. lucanoides*, Butler.
♀. *Th. australianus*, C. Koch	= *Th. insulanus*, L. Koch (not *australianus*, C. Koch).
♂. *Th. seticauda*, Dol.	= *Tetrabalius seticauda* (Dol.).
♂ (yg.). *Th. Stimpsonii*, Wood	= Young of *Typopeltis sinensis* (Butler).
♀. *Th. sinensis*, Butler	= *Typopeltis sinensis* (Butler).
♂. *Th. pugnator*, Butler	= *Mimoscorpius pugnator* (Butler).
♂. *Th. formosus*, Butler	= *Hypoctonus formosus* (Butler).
♂. *Th. proboscideus*, Butler	= *Labochirus proboscideus* (Butler).
♀. *Th. parvimanus*, Butler	= *Labochirus proboscideus* (Butler).
♂. *Th. amazonicus*, Butler	= *Thelyphonellus amazonicus* (Butler).

EXPLANATION OF PLATE II.

Fig. 1. *Thelyphonus Hosei*, sp. n., nat. size, ♀.
Fig. 1 *a*. Ditto. Tarsus of first leg from below.
Fig. 1 *b*. Ditto. Anterior end of carapace from the side.
Fig. 2. *Thelyphonus Tarnanii*, sp. n. Tarsus of first leg from below.
Fig. 2 *a*. Ditto. Anterior end of carapace.
Fig. 2 *b*. Ditto. Coxa of left chela.
Fig. 3. *Typopeltis Stimpsonii* (Wood), ♀. Anterior abdominal sterna.
Fig. 3 *a*. Ditto. Tarsus of first leg from the side.
Fig. 4. *Typopeltis crucifer*. Anterior abdominal sterna, ♀.
Fig. 4 *a*. Ditto. Tarsus of first leg from the side, ♀.
Fig. 5. *Mastigoproctus Butleri*, sp. n. Basal segments of chela from below.
Fig. 5 *a*. Ditto. Chela from above.
Fig. 6. *Mimoscorpius pugnator* (Butl.). Anterior sterna from below.
Fig. 7. *Uroproctus assamensis*, Stol. Anterior abdominal sterna of ♂.
Fig. 7 *a*. Ditto. Coxal process of chela.

XXII.—*New Species of Geometers and Pyrales from the Khasia Hills.* By Col. C. SWINHOE, M.A., F.L.S.

Tribe GEOMETERS.

Family **Geometridæ.**

Genus MAXATES, Moore.

1. *Maxates xanthochlora*, sp. n.

♂. Antennæ, palpi, head, and body greenish grey. Wings above dull green: fore wings with the inner two thirds pale greenish grey, containing a large green spot at the end of the cell and an incomplete green subbasal band; hind wings with the basal fourth grey, including a green spot. Underside greyish white, with green cell-spots and marks, and a broad discal greenish band across both wings, broader on hind wings, uniform and not reaching the costa on fore wings.

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

Cherra Punji. One example.

Family **Acidalidæ.**

Genus ANISODES, Guen.

2. *Anisodes hyperythra*, sp. n.

♂. Palpi beneath and shafts of the antennæ and top of head whitish; plumes of the antennæ, body, and wings above of a uniform brick-dust colour, densely irrorated with very minute brown atoms. Hind wings with a large black spot with white pupil at the end of the cell, in some examples the spot is white with merely a black rim; both wings with indications of several transverse grey bands, very indistinct, and only visible in certain lights. Underside with the body, legs, and wings of a uniform pale pinkish grey, unmarked.

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

Cherra Punji. Many examples.

Closely resembles *Perixera absconditaria*, Walker.

3. *Anisodes discofera*, sp. n.

♂. Pale dull straw-colour, sparsely irrorated with brown atoms. Wings crossed by indistinct grey sinuous lines—first subbasal, more apparent on hind wings; second medial, touching a large brown spot in the centre of each wing, the spot or patch very large on the fore wings; third discal, with black points on the veins, touching a brown patch above middle on the fore wings; fourth submarginal, almost obsolete on fore wings; the margin with black points in the interspaces. Underside paler, without irrorations, with a discal row of brown points on fore wings and some small brown marks.

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

Cherra Punji. Three examples.

Allied to *Anisodes heydena*, Swinh.; patches somewhat similarly disposed, but the transverse lines are sinuous, in *heydena* they are prominent and straight.

Genus Chrysocraspeda, Warren.

4. *Chrysocraspeda plumbeofusa*, sp. n.

♂. Of a uniform ochreous-red colour, the entire fore wing except the discoidal area and the costal area of hind wings suffused with a lead-coloured glaze. Fore wings with a large black lunular spot at the end of the cell, and with a few brown striations near the outer margin: hind wings with a small white spot ringed with brown at the end of the cell; cilia of both wings ochreous. Underside: fore wings pale black, with pale red apex and outer marginal space; hind wings pale red, with black suffusion at the base.

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

Cherra Punji. One example.

Nearest to *C. abhadraca*, Walker.

Family **Larentiidæ.**

Genus Cidaria, Treit.

5. *Cidaria subapicalis*, sp. n.

♂. Frons, head, and fore part of thorax ochreous grey; the remainder of thorax and abdomen darker. Fore wings pale ochreous brown, crossed by subbasal, antemedial, and postmedial sinuous brown bands, each intersected by a black line and edged by a black line on each side; the outer band has a pale line outside the black line, followed by another blackish-brown line, and has two outward dentations in its centre; in one example the two outer bands have the space between them suffused with black, forming one broad central band; a brown short band on the outer margin below the costa, angled inwards with two small dentations, which are edged with black, and two or three indistinct lunulate transverse brown lines in the pale discal space: hind wings pale ochreous brown, whitish on costal space. Underside with inner two thirds of fore wings black except the costal space, broadly brown on outer margin, leaving a broad ochreous-grey discal band, a small black spot at end of cell; hind wings ochreous grey, densely irrorated with brown atoms, and with a prominent black spot at end of cell.

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

Cherra Punji. Two examples.

Family **Boarmiidæ.**

Subfam. *Deiliniinæ.*

Genus Myrteta, Walker.

6. *Myrteta fuscolineata*, sp. n.

♀. Pure white, with some grey irrorations, thickest on costa of fore wings; a grey dot at the end of each cell; greyish-brown transverse lines very indistinct, first from basal third of abdominal margin of hind wings, and second from the middle of the margin, both terminating at the apex of fore wings; the first double on fore wings, only the second double throughout; another very indistinct line outside the second line, also a more distinct grey marginal line. Underside pure white and unmarked.

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

Cherra Punji. One example.

Allied to *Myrteta brunneiceps*, Warren, of which I have both sexes; the transverse lines (which in that species are ochreous and very distinct) are somewhat similarly disposed, but the shape and ground-colour are very distinct, and the head of *brunneiceps* in both sexes is bright ochreous.

Subfamily *Ennomiinæ.*

Genus Fascellina, Walker.

7. *Fascellina hypochlora*, sp. n.

♂. Antennæ, palpi, and frons dark red; thorax olive-green; abdomen olive-grey. Wings dark olive-green, smeared in parts with greyish white, fairly uniform in tint of colour, striated with black near the base and on the basal half of costa of fore wing, which has an antemedial transverse blackish thin band, nearly straight and acutely bent inwards on to the costa, where it is darkest; a broader dark green postmedial diffuse band, also nearly straight; a discal pale line angled outwards below the costa near the apex, which has a white smear, then sinuous downwards to the hinder margin nearly parallel with the outer margin, and across the hind wing a little beyond the middle, edged throughout with dark green on each side, and accompanied on the hind wings by a broad dark green central band, which narrows towards the costa; cilia of both wings dark green. Underside pale green, tinged with yellow at the base of fore wings and over the whole surface of hind wings, and striated throughout with black; fore wing with the white discal line with its inner side broadly black from costa halfway down, also black on costa at apex; below this apical patch there is a white space on the margin, and the inner costal space is also broadly white; hind wing with the discal line black, and another similar line between it and the margin.

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

Cherra Punji. One example.

The hinder margin of fore wings is not excavated as in *F. chromataria*, Walk., and *F. plagiata*, Walk.

8. *Fascellina hypochriseis*, sp. n.

♂. Antennæ and palpi reddish brown; head, body, and wings of a uniform olivaceous ochreous brown. Fore wings with a brown line from just before middle of costa, forming a small loop to the costa again before the apex, and then bending down below the apex; in the apical bend is a white streak, and both loops are smeared with white; the basal portion of the costa up to commencement of first loop is pale pink with brown irrorations; a white lunule at the end of the cell (absent in one example) and indications of two straight transverse dark thin bands, one before and the other beyond the middle, almost touching the outside of the lunule. Underside with the fore wings bright yellowish grey, smeared with white and striated with brown, with a white transverse discal line elbowed outwards below the costa, the elbow filled with rich chestnut-brown, which runs in a thin band close along the inner side of the white line; the outer portion of the wing pale grey at the upper and dark olive-coloured in its lower parts; hind wings bright ochreous at the base and tinged with orange on the outer portions, with a curved discal row of orange spots, ending in two dark orange-red lines on the costa.

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

Cherra Punji. Five examples.

With the hinder margin of fore wings excavated near the angle.

Subfamily *Macariinæ*.

Genus Macaria, Curtis.

9. *Macaria octolinearia*, sp. n.

♂. Grey, thickly irrorated with brownish-grey atoms; transverse lines antemedial, medial, discal, and marginal, greyish brown, all outwardly edged with whitish; the first obsolete on hind wings, the first and second nearly straight, the second crossed by a transverse brown short streak on costa of fore wings, which crosses end of cell; the discal line sinuous and outwardly curved, running through a square black spot or patch above middle of fore wings, and above it a smaller black spot through which the line also runs; a submarginal pale shade or band from costa near apex to the hinder angle. On the underside the wings are of a whitish ground-colour, densely striated in parts with blackish brown, with central and discal blackish shades or bands, and with submarginal pale spots on the fore wings; a discal black line runs through the discal shades and the entire surface of both wings has a pretty marbled look.

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

Cherra Punji. Three examples.

The black discal patch on fore wings gives the insect somewhat the appearance of *M. oliva*, Swinh., but the hind wings have the centre produced into a tail, as in *M. emersaria*, Walker, and the lines are very distinctively disposed.

Genus Krananda, Moore.

10. *Krananda oliveomarginata*, sp. n.

♂. Fore wings more falcate than in *K. semihyalina*, Moore; outer margin not toothed, only slightly scalloped between the veins; palpi and frons tinged with orange; a few orange hairs on the collar; thorax and abdomen olive-grey. Wings grey, semihyaline, but better clothed than in the type species, striated with olive-grey, forming two or three small patches on the costa and the base and the hinder margin beyond the middle; a broad marginal olive-grey band covering the outer third of fore wings and nearly half of hind wings, with the inner margin sinuous and accompanied by a pale line formed by a grey inner line; apex of fore wings pale, with a subapical pale sinuous short streak downwards from costa. Hind wings with a submarginal pale sinuous streak from the anal angle, ending in the interspace before vein 7; a small black dot at the end of each cell in both wings.

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

Cherra Punji. One example.

Subfamily *Boarmiinæ*.

Genus Boarmia, Treit.

11. *Boarmia glaucodisca*, sp. n.

♂ ♀. Antennæ of male brown, pectinated as in *B. admissaria*, Guen.; in the female they are simple, brown, with pale joints; head and thorax brown; abdomen grey, tinged with pale pink. Fore wings glaucous grey, irrorated with brown atoms, which are fewest in the disk; a black lunular prominent spot at the end of the cell; indications of an interior brown transverse line; a median brown line with black marks on the veins, duplex in the female; a similar inner line running up and curving inwards on to the costa round the cell-spot; a submarginal pale sinuous line, marked with black along its inner border, marginal black lunules in the interspaces: hind wings grey, tinged with pale pink, the tinge being deepest in the outer portions, where there are some brown striations; the basal portions are pale, and in some examples nearly white, and limited by a brown median sinuous band with black markings on the veins; a short similar subbasal band, also an indistinct submarginal band; in one example these bands are prominent, in others they are more or less obsolete; a black dot at end of cell and a black lunular marginal band. On the underside the wings are nearly pure white, with a broad black marginal band on fore wings and at apex of hind wings, with the black cell-spots large and prominent and the transverse lines more or less visible.

Expanse of wings $1\frac{4}{10}$–$1\frac{6}{10}$ inch.

Cherra Punji. Four males, one female.

Tribe Pyrales.

Family **Pyralidæ**.

Subfamily *Pyralinæ*.

Genus Omphalomia, nov.

♂. Fore wing twice as long as broad; costa bulged at base, with a strong fold beneath, reaching nearly one third of the length, concave in the middle, and convex again towards apex; apex blunt, outer margin slightly curved: hind wings with the angles rounded. Fore wings beneath with a tuft of hair-like scales along the subcostal, in the cell, and along the submedian fold. Antennæ simple; forehead hairy below; palpi flattened laterally, drooping, hairy.

Type: *Omphalomia accersita*.

Superficially very much like *Omphalocera*, but distinguished at once by the simple antennæ of the male and the tufts of hair-like scales on the under surface of the fore wings.

1. *Omphalomia accersita*, sp. n.

♂. Palpi brown, ochreous on the inner sides; head, body, and wings dark brown. Fore wings with the veins darker and some darker suffusions in parts; a small ochreous-grey subcostal streak near the base, a similarly coloured streak or line commencing at the costa close above the outer end of the short subbasal streak, and terminating at the lower end of the cell; a large, similarly coloured, rounded patch at the apex, with some brownish marks in it, ochreous-grey marginal points on the veins; cilia ochreous grey, thickly patched with brown: hind wings brown, paler than fore wings, uniformly coloured, unmarked except for some slight indications of a discal band; cilia concolorous with the wing, with a pale line at the base. Underside uniform brown; an ochreous subapical patch on costa and a band across the disk of both wings composed of ochreous marks on the veins; cilia brown, with a pale basal line; body and legs brown.

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

Cherra Punji. One example.

A female taken by me some years ago on the Khandalla Mountains, near Bombay, is in the B. M. collection.

Genus MICROMANIA, nov.

♂. Fore wings twice as long as broad; costa straight, apex rounded, outer margin bowed. Hind wings with rounded outer margin. Palpi porrect, rostriform; maxillary palpi porrect above labial; antennæ of male shortly ciliated; legs long, hind tibiæ with four spurs.

Type: *Micromania stigmatalis.*

2. *Micromania stigmatalis*, sp. n.

♂ ♀. Palpi black; antennæ, head, body, and wings dark brown. Fore wings with a large black reniform stigma at the end of the cell, with subbasal, interior, and exterior brown lines, the first and second uniformly curved outwards, the outer line much waved; it curves inwards and upwards at vein 3 and round the stigma, then zigzags down to the hinder margin, and is edged with pale ochreous grey outwardly; the two last lines are continued across the hind wings until they meet above the anal angle; beyond the outer line there is a dark band on both wings, a submarginal and a marginal row of ochreous-grey lunules, black marginal line, and interlined cilia, grey and brown. Underside: body, legs, and wings grey; wings with markings as above, with the addition of a black spot at the end of cell of hind wings.

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

Shillong and Cherra Punji. Many examples of both sexes.

Subfamily *PYRAUSTINÆ.*

Genus SPILODES, Guen.

3. *Spilodes pallidulalis*, sp. n.

♂. Of a uniform pale ochreous grey above; legs and body beneath white; palpi, frons, and pectus darker and more ochreous. Hind wings concolorous with fore wings; lines on fore wings hardly visible; an interior sinuous line from the hinder margin at one third to the costa at one fifth; an outer dentated outwardly curved line from the hinder margin at the middle to the costa at one fifth from apex. Hind wing with very faint indications of a sinuous, outwardly curved, discal line. Underside: fore wings with the space from and including the cell upwards suffused with dark grey; a grey apical band; a discal grey line or thin band, not corresponding with the line above, but more inwards, and partly running across hind wing, and brown marginal lunules on both wings.

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

Cherra Punji. Three examples.

Genus Piloptila, nov.

♂. Allied to the dark fuscous group of *Opsibotys*, Warren, but characterized by a thick fold of hairs, reaching for one fifth from the base of the costa of fore wings and lying along the underside, but generally visible from above; palpi shortly rostriform; tongue rather strongly developed; antennæ pubescent.

Type: *Piloptila nigricornalis.*

4. *Piloptila nigricornalis*, sp. n.

♂. Palpi dark red-brown, white beneath; antennæ, head, body, and wings of a uniform pale fuscous. Wings with a black comma-shaped mark at the end of each cell: fore wings with a black dot in the cell and the interior line below it; both wings with the exterior line blackish, much bent outwards in the middle, the incurve on fore wings well apart from the cell-spot, the line ending in a thick blackish mark on hinder margin at two thirds; cilia of both wings pale greyish. Underside pale grey, markings as above, but very distinct; cilia with a black interline of disconnected marks; body and legs white.

Expanse of wings 1 inch.

Cherra Punji. Three examples.

Genus Opsibotys, Warren.

5. *Opsibotys benenotata*, sp. n.

♂. Palpi dark brown, white beneath; antennæ, head, body, and wings olive-brown. Wings glossy, with the spots and lines black and distinct: fore wings with a lunular mark at the end of the cell and a small spot within the cell, just in front of the interior line, which is slightly waved and extends from costal fifth to the hinder margin more than one third from base; the outer line commences with a black spot on costa one fifth from apex, bends outward a little, and is dentated to vein 2, where it runs straight in and down in a short thick line to the hinder margin at two thirds, and is continued on the hind wing nearer the middle of the wing, and is curved outwards in its centre; on this wing there is also a lunule at the end of the cell; marginal line luteous, nearly white, composed of lunules on fore wings, joined together and in one example entire on hind wings; cilia luteous white, intersected by a brown macular band. Underside paler, markings as above; body and legs whitish, the latter with some brown bands.

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

Cherra Punji. Three examples.

The fore wings are unusually square, the hinder margin being very nearly as long as the costa.

Genus Ebulea, Guen.

6. *Ebulea intensalis*, sp. n.

♂. Chocolate-brown, very variable in colour, some examples nearly pure brown, and every intermediate between that colour and bright chocolate. Wings with the lines and spots brown, the former fairly distinct: fore wings with a spot at the end of cell, sometimes indistinct; interior line curving outwards from costa one sixth from base to hinder margin at one third; exterior line composed of lunules from costa one third from apex, curving outwards almost from the costa itself, with an evenly round curve to vein 2, where it bends inwards, and then straight down to the hinder margin at two thirds: hind wing with a discal line, with an outward curve in the middle, generally lighter than the fore wings, but not always; marginal line brown, with pale lunules; cilia brown, with pale tips, in some specimens half brown and half pale. Underside: body, legs, and wings pale chocolate-grey; wings with the outer line distinct, and composed of black spots on the veins; fore legs with brown bands.

Expanse of wings 1 inch.

Cherra Punji. Numerous examples.

Genus Circobotys, Butler.

7. *Circobotys acutangulalis*, sp. n.

♂. Palpi ochreous, with grey tip; antennæ, head, body, and wings pale ochreous. Fore wings very acute, with the costal space for two thirds from the base suffused with dark grey; a band of the same colour on the outer margin, extending for one third from the apex immediately below the costa, which is ochreous, straight down to the hinder angle of fore wings, including a darker band of grey from the apex running below the costal yellow line, and then straight down the outer side of the broad band, and this dark band is continued on the outer margin of hind wings, narrowing gradually and terminating before reaching the anal angle; transverse lines dark bright ochreous and nearly straight—one subbasal on fore wings, indistinct, continued on hind wings, inclining towards anal angle; the second at one third, also continued on hind wings and inclining towards anal angle; third medial; fourth a mere streak from costa a little on the inside of the marginal band. The hind wings are whitish on the costal and abdominal marginal spaces, and the two transverse lines are limited to the yellow portion of the wing; cilia grey, interlined with black, and the outer margin of the wings has some black points, which are more distinct on hind wings. Underside: body, legs, and wings white, the marginal band of the wings faintly visible.

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

Cherra Punji. Two examples.

Genus Crocidophora, Led.

8. *Crocidophora distinctalis*, sp. n.

♂. Palpi ochreous above, white beneath; antennæ, head, body, and wings above of a uniform warm dark ochreous, somewhat of the tint of *Sylepta caldusalis*, Walker, but clearer and darker. Fore wings with the costa brownish, a grey spot at end of cell; a sinuous, indistinct, thick grey discal line or shade from the centre of the hinder margin to the costa one fifth from apex and close to the upper end of a broad, submarginal, straight, and fairly uniform grey band, which is also continued across the hind wing; the costa of this wing is whitish, and there are indications of the continuance of the discal line of fore wings crossing its centre; cilia concolorous with the wings. Underside much paler, with the submarginal band distinct and the raised scales near base of fore wings blackish; body and legs whitish, fore legs with brown bands.

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

Cherra Punji. Three examples.

I have had an imperfect specimen of this species from Sikkim unnamed in my collection for some years.

9. *Crocidophora discolorata*, sp. n.

♂. Palpi dark ochreous, white beneath; antennæ, head, body, and wings dull ochreous, the tint of ground-colour of the wings being greyer than in *C. limbolalis*, Moore. Fore wings with the costal and basal portion suffused with dark greyish ochreous, and a broad marginal band of the same colour on both wings, widest on the costa, narrowing hindwards very gradually on both wings, leaving a pale discal band-like space, limited internally on both wings by the outer lines, which are nearly straight downwards; interior line on fore wings indistinct, from costal third to middle of hinder margin, on hind wings obsolete; cilia pale dull ochreous; a grey spot at end of cell of fore wings. Underside pale ochreous grey, markings as above; body and legs white, fore legs with brown bands.

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

Cherra Punji. Several examples.

A smaller insect than *C. limbolalis*, Moore; the marginal band narrower and paler, being merely a darker shade of the ground-colour of the wings, and not purple as in *limbolalis*; the transverse lines similarly disposed.

Genus Leucocraspeda, Warren.

10. *Leucocraspeda nissoralis*, sp. n.

♂. Palpi chestnut-red, white beneath; thorax and basal portion of abdomen white; head, fore part of thorax, and remainder of abdomen tinged with pale reddish grey; the lower basal half of fore wings and costal portions (broadly) of hind wings white, the rest of the wings with the ground-colour suffused with very pale luteous grey, and over this colour there is a darker suffusion of clear chestnut-red on the fore wings, on the basal half of costa, and the outer portions of the wing, with the exception of a large patch on the costa at the apex, which is left luteous grey; these two red spaces are joined together by a dark brown bar from the middle of the costa, which runs to a little below the middle of the outer margin: the hind wing has also the outer margin broadly suffused with chestnut-red. A brown lunule at end of cell of fore wings, a brown point at end of cell of hind wings; fore wings with an interior, outwardly curved, thin, and sinuous brown line, and a similar exterior line across both wings, dentated in the central outward curves on both wings; marginal line brown, lunular; cilia grey, interlined with brown. Underside: body, legs, and wings white, the bar on fore wing and outer lines visible.

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

Cherra Punji. Several examples.

Wings shaped as in *L. illectalis*, Walker; transverse lines similarly disposed.

Genus PALIGA, Moore.

11. *Paliga fuscicostalis*, sp. n.

♂. Palpi reddish ochreous, white beneath; antennæ, head, body, and wings ochreous grey, but darker and more ochreous than in either *P. damastesalis*, Walk., or *P. suavalis*, Walk. Hind wings with the costal portion whitish: fore wings with the costal border brownish and with a similarly coloured broad marginal band, with an irregular inner limitation, and which does not reach the apex; inner and outer transverse lines indistinct, the former hardly visible, the latter sinuated, bent outwardly above, then much bent inwards to the indistinct lunule at the end of the cell, then sinuous to the hinder margin beyond the middle; hind wings with a similar recurved discal line, very indistinct. Underside: wings, body, and legs whitish, with the brownish border of the upperside and the discal line visible.

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

Shillong. Two examples.

Genus PROTONOCERAS, Warren.

12. *Protonoceras humilis*, sp. n.

♂. Palpi brown, white beneath; head, body, and wings grey-brown; abdomen with pale segmental lines. Wings not uniform in colour, being irrorated with brown and black atoms, which are thick in parts; lines black: fore wings with interior line curved outwardly, invisible in most examples; exterior line from costa at one fifth from apex, curves a little outwardly from the costa, then incurved slightly, then outwardly in the middle (but only slightly), where it is formed of small lunules, again bent inwards and then to the hinder margin at two thirds: hind wings with a recurved discal line, with black suffusion in the middle in some specimens; both wings with a marginal lunular black line, grey cilia, interlined with brown and with brown tips. Underside whitish: fore wings with a brown spot in the cell, two at the end; hind wings with a spot at the end of the cell and the outer and marginal lines of both wings brown; fore legs brown.

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

Cherra Punji. Many examples.

13. *Protonoceras nictitans*, sp. n.

♂. Palpi brown, white beneath and at the tips, top of head pure white; body and wings purplish grey, somewhat as in *P. tropicalis*, Walker, but paler and glossed. Wings with the spots and lines brown: fore wings with a spot within the cell and another at the end, rather close together, and with a square white space between them; no interior line visible; exterior line formed of curved lunules, the central part of the line curving a little outwards, then bent inwards, then another small outward curve before it reaches the hinder margin at two thirds: hind wing with a similar discal line, but more deeply curving outwards in its middle; marginal line of both wings pale, with brown lunules; cilia concolorous with the wings; the apex of fore wings is pale, and there is a pale shade outside the upper portion of the exterior line. Underside: body, legs, and wings white, outer portion of wings and cilia grey; cell-spots and outer line distinct; a cell-spot on hind wings.

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

Cherra Punji. Several specimens.

Wings shorter than in either *P. tropicalis*, Walker, or *P. sericea*, Butler.

Genus PRIONOPALTIS, Warren, MS.

14. *Prionopaltis subdentalis*, sp. n.

♂. Palpi purple-brown; antennæ, head, body, and wings of a uniform greyish-olive colour. Wings with a brown mark at the end of each cell: fore wings with a small brown spot within the cell; interior line outwardly curved, but only indications of it; exterior line commences with two white lunular marks at the costa one fifth from apex, bulges out a little, forming an indistinct and rather flattened grey line, with pale dentations, then inwards on vein 2 and then to the hinder margin at two thirds, and is continued in the usual form across the hind wings, with an outward curve in the centre, and edged outwardly with whitish throughout; marginal points black; cilia concolorous with the wings, with white spots at its base. Underside: body, legs, and wings whitish, with the markings on the wings visible.

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

Cherra Punji. Several examples.

Genus ACHARANA, Moore.

15. *Acharana subalbescens*, sp. n.

♂ ♀. Palpi dark red-brown, white beneath; antennæ, head, body, and wings pale olive-brown. Wings with the spots and markings brown, a lunule at the end of each cell: fore wings with a dot within the cell rather close to the end; an interior line, slightly sinuous and outwardly curved; an exterior more or less lunular line from the costa almost straight down to vein 4, then it bulges out a little with three dentations to vein 2, where it abruptly runs in, and then straight to the hinder margin at two thirds, is continued across the hind wings with an outward curve in the middle; anteciliary line pale, cilia concolorous with the wing. Underside pale grey, with the cell-spots and outer lines distinct; body and legs white; fore legs with two brown bands.

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

Cherra Punji. Many examples.

A much larger insect than *A. otreusalis*, Walker; the colour darker, clearer, and smoother, the lines somewhat similarly disposed.

Genus Margaronia, Hübn.

16. *Margaronia warrenalis*, sp. n.

♂. Antennæ white; palpi dark brown-pink, white beneath; head, body, and wings silvery white; collar with a brown-pink band in front. Wings lightly clothed, nearly semi-hyaline: fore wings with a pale brown-pink costal band; a brown subcostal dot near base; a yellowish spot ringed with brown touching the costal band a little beyond; a pale lunule ringed with brown at the end of the cell; a pale brown-ringed spot near hinder margin just before the middle; a faint grey discal thick line, curving outwards and then inwards: hind wing with the discal line continued to the anal angle, and at the end of the cell a grey lunule with a brown dot at its lower end; marginal black points on both wings. Underside: wings, body, and legs pure white; wings with the markings showing through.

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

Cherra Punji. Many examples.

Between *M. celsalis*, Walker, and *M. nigropunctalis*, Brem., = *submarginalis*, Walker.

Genus Glyphodes, Guen.

17. *Glyphodes ernalis*, sp. n.

♂. Palpi blackish brown, yellowish grey beneath; head, body, and fore wings purplish brown. Fore wings with two large white spots—the first just before the middle, broad on the hinder margin, suddenly narrowing into a point within the cell; the other of a similar size, discal, diamond-shaped: hind wings with a little more than the basal half white and semi-hyaline, the outer half the same colour as the fore wing, this band broadest on the costa and gradually narrows downwards; cilia white, brown in the central portion of the fore wings. Body below and legs white; tibiæ brown above.

Expanse of wings 1 inch.

Shillong and Cherra Punji. Many specimens.

Between *G. actorionalis*, Walker, = *Zelleri*, Led., and *G. bicolor*, Swainson; has more pointed and longer wings than either, the spots are differently shaped, and the white line outside the discal spot, which terminates in a small white spot on the costa in both those species, is absent.

Genus Autocharis, Warren, MS.

18. *Autocharis amethystina*, sp. n.

♂. Palpi pinkish brown; antennæ, body, and wings luteous white; thorax with a pinkish-brown stripe on each side. Fore wings with the costal border pinkish brown; a broad pinkish-brown marginal band: hind wings with a narrow similar band; the inner edge of both bands dark brown, sinuous, with a dentation into the band on the fore wings in its centre; cilia of both wings pinkish white. Underside: legs, body, and wings white; the wings are semi-hyaline, and the marginal band shows through the wing.

Expanse of wings $\frac{6}{10}$–$\frac{7}{10}$ inch.

Cherra Punji; one example. North Kanara; two examples.

Allied to *A. fessalis*, Swinhoe, which Warren makes the type of the genus.

XXIII.—*Vestigial Stigmata in the Arachnida*. By H. M. Bernard, M.A. Cantab. (Huxley Laboratory, Royal College of Science, South Kensington).

In a preliminary note published in this Journal *, and later in a fuller paper published by the Linnean Society †, I called attention to a row of scar-like markings in certain Chernetidæ which segmentally repeat the functional stigmata. These markings are, so far as one can see with the best microscopic appliances, nothing but scars. Hansen ‡, who has also seen them, believes them to be lyriform organs. At first, after reading Hansen's paper, it seemed to me that they might well be very large lyriform organs (as to the functions and morphology of which we really know nothing §) and at the same time the remains of vanished tracheal invaginations. I have since compared the scars with lyriform organs in the Chernetidæ, Araneidæ, Solpugidæ, Thelyphonidæ, and Phrynidæ, and am convinced that they are not lyriform organs at all, but simply the scars of apertures which have now closed. I have mapped out the abdominal surface of my original specimen (figured in the second paper above referred to), measuring, by means of an eyepiece micrometer, the relative positions of the scars and the bristles, which, as is well known, tend in this group to be repeated segmentally. I am quite satisfied

* "Additional Notes on the Origin of the Tracheæ from Setiparous Glands," Ann. & Mag. Nat. Hist. 1893, xi. p. 24.

† "Notes on the Chernetidæ, with Special Reference to the Vestigial Stigmata and to a new Form of Trachea," Journ. Linn. Soc., Zool. vol. xxiv. p. 410.

‡ 'Organs and Characters in different Orders of Arachnids,' Copenhagen, 1893.

§ These organs are so minute and so scattered that it seems to me that no trustworthy experiments are possible (*cf.* Gaubert's "Recherches sur les Arachnides," Ann. Sci. Nat. xiii. 1892).

that these particular scars are the segmental repetitions of the stigmatic apertures, whether they are now anything more than scars or not. Hansen, however, points out that similar scars may be found on the anterior abdominal segments nearer the middle line concurrently with those that repeat the stigmata. This interesting fact, which I have since fully confirmed for two segments (II and III) in my original specimen, in no way affects the above conclusions. There must at one time therefore have been apertures here also which have now closed. It is hardly likely that they were tracheal invaginations, although there is no impossibility in there being two pairs to one segment—that is, if tracheal invaginations can be deduced from primitive setiparous glands. It is more probable that they were the openings of spinning- or cement-glands. Such glands exist in these very segments in many Chernetidæ; and in the Araneidæ, in addition to the large spinning-mammillæ, smaller ones may occur in the same segments nearer the median line. We are, however, here chiefly concerned with the fact that a row of scars segmentally repeats the functional stigmata along the whole length of the abdomen.

The bearing of this on the origin of the Arachnida I have already discussed in 'Nature' *. It points to the deduction of the Arachnida from an ancestral form with a pair of limbs and a pair of stigmata on *every* segment.

Further evidence of this has been slowly accumulating. Reserving for the present that which is specially connected with the Galeodidæ, one important item deserves to be separately discussed. If any collection of Thelyphonidæ be looked through carefully † it is impossible to avoid the conclusion that these Arachnids once possessed limbs with stigmata along at least seven abdominal segments. The specimens require to be dried and then held so that the abdomen reflects the light from the window. Very few indeed showed no traces at all. The large majority show on segments V, VI, VII, VIII, just laterally to the muscle-impressions, definite scar-like markings, or even sharply circumscribed areas, such as I have shown in figs. 1 and 2.

The posterior margin of this area is, as a rule, seen most distinctly. In some, however, the strongest mark is the inner posterior corner of the area; in others, again, the inner longitudinal side, which, however, then generally slopes outward posteriorly (*e. g.* many individuals of *Thelyphonus*

* "The Stigmata of the Arachnida as a Clue to their Ancestry," 'Nature,' Nov. 16, 1893.

† My best thanks are due to my friend Mr. R. I. Pocock for permitting me to examine many scores of specimens (both alcohol and dry) under his charge in the South Kensington Museum. I was enabled to examine specimens of five genera—*Thelyphonus, Thelyphonellus, Uroproctus, Mastigoproctus*, and *Typopeltis*.

sepiaris). There is great difference in the degree of distinctness even among specimens of one and the same species. The two figured were chosen at random; others even more distinct could doubtless be found.

Fig. 1.

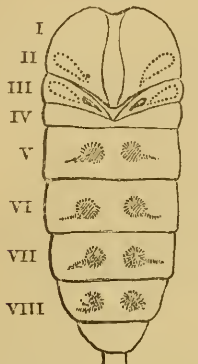

Fig. 2.

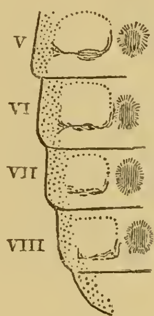

Fig. 3.

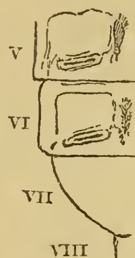

Fig. 1.—Abdomen of *Thelyphonus manillanus*, C. Koch, showing the stigmatic scars; the functional lung-books are marked by dotted lines.

Fig. 2.—*Typopeltis Stimpsonii*, Wood, showing the stigmatic scars along the posterior edges of definite areas.

Fig. 3.—*Prionurus australis*, Linn., showing the stigmata along the posterior edges of sharply defined areas.

While the anterior and outer (lateral) edges of the areas seem marked off more by change in the character of the surface of the chitin, the inner and posterior edges, especially the latter, are scar-like — often very pronounced scars indeed. It will be seen from fig. 1 that these areas repeat segmentally the positions (and the scars the apertures) of the lung-books in the second and third segments. Any doubt as to this seems to me to be set at rest by a comparison with *Scorpio*, in which we have almost exactly similar areas with stigmatic apertures along their posterior margins. Fig. 3 was drawn from the scorpion which happened accidentally to be nearest me on the table. Any scorpion will show similar areas more or less distinctly.

No one, I believe, doubts the homologies of the lung-books of *Scorpio* and *Thelyphonus*. The areas with these scars on segments V and VI of *Thelyphonus* must correspond with the areas with their stigmata on segments V and VI of *Scorpio*. If this reasoning is correct, *Thelyphonus* originally possessed at least seven pairs of lung-books, five pairs of which have now vanished.

Counting the genital opercula, we have therefore in *Thelyphonus* vestiges of eight pairs of abdominal limbs on the first eight segments.

This comparison of *Scorpio* with *Thelyphonus* makes it also evident that the tails in both these animals are not primitive structures. The tail is a later specialization, in *Scorpio* of five segments, in *Thelyphonus* of three. This follows from the fact that segments which in *Scorpio* form the tail, in *Thelyphonus* are typical abdominal segments, unspecialized in any way.

Further, if it is possible to homologize the anal glands of *Thelyphonus*, which open on each side of the soft circumanal membrane and which are said to secrete formic acid, with the poison-glands of *Scorpio*, and both these with the original invaginations of the scar found on each side of the anal papillæ in the Chernetidæ, it follows that all these tail-segments once possessed limbs with tracheal invaginations or their homologues. We now know, indeed, from *Thelyphonus* that the first tail-segment of *Scorpio* (the eighth) did actually at one time possess a pair of limbs (*cf.* figs. 2 and 3).

As I have shown in my paper on the Galeodidæ (still in manuscript), there is some evidence to justify us in believing that the areas under discussion in *Scorpio* and *Thelyphonus* represent limbs which have vanished. The primitive position of the stigmatic aperture was probably just behind the coxa, perhaps even on its posterior face. This is the position of the thoracic stigmata of *Galeodes* with reference to the fourth pair of limbs. If such a limb with a stigmatic aperture behind it were to become rudimentary, it might either fold backwards over the stigma, forming a kind of stigmatic operculum, or it might simply flatten down, leaving the stigma free on the sternal surface. Examples of both these processes may be found in the Arachnida, not only within the same group, but even in the same animal. For instance, in *Thelyphonus* the functional stigmata open under opercula in the squeezed-up anterior segments, whereas in the long segments their scars are found along the posterior edges of the areas, which I take to represent rudimentary limbs flattened down on the sternal surface. In *Scorpio* the rudimentary limbs have been simply flattened down, leaving the stigmata upon them. In the Galeodidæ in some genera the stigmata are under opercular folds, in others the folds have flattened down, leaving the stigmata exposed on the abdominal surface.

In reference to the origin of these areas in the Arachnida from rudimentary limbs which have disappeared by simply becoming flattened down, it is interesting to note that the stigmatic apertures in *Scorpio* very generally slope backwards. In some the slope is very pronounced and is often parallel with that of the pectines. It looks as if all these abdominal limbs in *Scorpio* had once sloped backwards, as the posterior functional limbs and the pectines still do. In some genera, again, the pectines slope much more than the stigmata, the genital aperture having been secondarily (and since the disappearance of the abdominal limbs) further pushed forward, almost totally obliterating a sternal area usually found in front of the genital opercula in those genera in which the pectines have only a moderate slope.

I refer again to my paper in 'Nature,' above cited, for some of the bearings of these vestigial stigmata on the primitive morphology of the Arachnida.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

March 7, 1894.—Dr. Henry Woodward, F.R.S., President, in the Chair.

The following communications were read:—

1. 'The Systematic Position of the Trilobites.' By H. M. Bernard, Esq., M.A., F.L.S., F.Z.S.

The Author, in his work on 'The Apodidæ,' endeavoured to show that *Apus* was the ancestral form of all existing crustacea except the Ostracoda, and as such might be expected to throw light upon the trilobites. Since the publication of this work he has been studying the organization of the trilobites themselves, and the results are given in the present communication. He discusses the great variability in the number of segments shown by the trilobites; the formation of the head by the gradual incorporation of trunk-segments; the bending round ventrally of the first segment; the 'wandering' of the eyes; the existence and modification of the 'dorsal organ'; and especially the character of the limbs.

As a result of this discussion, he states that the zoological position of the trilobites can now be fixed with considerable probability. The features described serve to connect the trilobites with *Apus*. *Apus* must be assumed to lie low in the direct line up from the original annelidan ancestor towards the modern crustacea, and the trilobites must have branched off laterally from this line, either once or more than once, in times anterior to the primitive *Apus*, as forms specialized for creeping under the protection of a hard imbricated carapace, obtained by the repetition on every segment of the pleuræ of the head-segments, which together form the head-shield.

The trilobites may be briefly described as fixed specialized stages in the evolution of the crustacea from an annelidan ancestor with its mouth bent round ventrally, so as to use its parapodia as jaws.

2. 'On the Discovery of Molluscs in the Upper Keuper at Shrewley, in Warwickshire.' By the Rev. P. B. Brodie, M.A., F.G.S.

Mr. R. B. Newton read a paper at the meeting of the British Association at Nottingham in 1893, on some lamellibranchs found at Shrewley by the Author of the present paper and Mr. Richards. In this paper details of the section where the shells were found are given, and their interest and importance pointed out, no shells having been previously detected anywhere in the New Red Sandstone in this country.

April 25, 1894.—Dr. Henry Woodward, F.R.S., President, in the Chair.

The following communication was read:—

'On a new Goniatite from the Lower Coal Measures.' By Herbert Bolton, Esq., F.R.S.E.

Sowerby in his 'Mineral Conchology' figures two fossils under the name of *Goniatites Listeri*, of which the left-hand figure is clearly *G. Listeri*, whilst the right-hand one differs considerably from it. The Author gives diagnoses of *Goniatites Listeri* and of a new species, which agrees with the form represented in Sowerby's right-hand figure. This species is limited to the shales forming the roof of the 'Bullion' or Upper Foot seam of the Lower Coal Measures, whilst *G. Listeri* ranges from the Lower Limestone Shales to the 'Bullion' seam.

MISCELLANEOUS.

The Ornithological Writings of Victor Lopez Seoane.

To the Editors of the 'Annals and Magazine of Natural History.'

Gentlemen,—The following three pamphlets by this author have fallen into my hands:—(1) "Sur deux nouvelles formes de Perdrix d'Espagne," Mém. Soc. Zool. France, vii. 1894, p. 92 &c.; (2) 'Aves nuevas de Galicia' [8vo], La Coruña, 1870, 10 pp.; (3) 'Revision del Catalogo de las Aves de Andalucia' [8vo], La Coruña, 1870, 18 pp. The last two bear the imprint—La Coruña (Imprenta y estereotipia de Vicente Abad (7—Plaza de Maria Pita—7) 1870.

With the first of these I have no quarrel, but the dates of the last two are open to grave suspicion. Indeed, when they reached me the ink in which they were printed was apparently fresh and easily smeared. The most awkward point, however, is the fact that M. Seoane refers in one of them to the 'Catalogue of the Birds in the British Museum' as "con preciosas [*sic*] descripciones, completa sinonimia, y algunas admirables láminas." The first volume of this work did not appear until 1874, or *four* years after the supposed date of M. Seoane's pamphlet.

The point at issue seems to be this: Mr. Howard Saunders published in 1872 (Proc. Zool. Soc. p. 153) a new species of Green Woodpecker from Spain (*Gecinus Sharpii*), and on seeing this description, presumably for the first time, M. Seoane has published at least one pre-dated pamphlet, in which he calls the bird *G. viridis galliciensis*, in order to gain priority. Curiously enough, the fact that M. Seoane has decided to describe these as new is noted in the French pamphlet (1) of 1894, and therein he refers to a Spanish pamphlet of 1891—'Examen critico de las Perdices de Europa y particularmente de las des España': Coruña, 1891. Is this the first intended title for 'Aves nuevas,' or shall we receive the 'Examen critico' when the ink is dry?

A similar example of this pre-dating is seen in the case of Reichenow's *Perdix hispaniensis*, a species which Seoane includes in his 1870 pamphlet 'Aves nuevas' under the name of *Perdix cinerea charrela*; and a still earlier example was pointed out by Boulenger (Zool. Record, 1885, Rept. p. 2), in which it is shown that Seoane endeavoured to anticipate Bedriaga over the nomenclature of a reptile by a falsely dated pamphlet.

I have unfortunately had to call attention in the 'Annals' to more than one case of dishonest methods to obtain priority; but this seems to me to be the most glaring example yet brought to light.

C. Davies Sherborn
(Index gen. et spec. anim.).

On Bees and Honeysuckles. By Thomas Meehan.

I was interested to-day (June 18th) in noting that while a few honey-bees persistently collected nectar from the mouths of honeysuckles, by far the larger number collected from the fallen flowers only.

The plant was *Lonicera japonica*, in the two forms known in gardens as *L. brachypoda* and *L. flexuosa*, both intertwining and flowering together. I have in the past satisfied myself that a bee which starts from the hive for pollen pays no attenti n to gathering nectar, while the one looking for nectar collects that only. Whether this is the course of labour for that trip from the hive only, or whether these particular tasks occupy the whole day or more, may be an interesting question. I had never noted bees collecting nectar from fallen flowers, indeed had not noted that fallen flowers had nectar; so that the attention of the bees to them gave the subject a double interest.

The flowers are white when freshly opened, the next day yellowish, the following they wither slightly and fall. Large numbers are collected by the leaves, on which they mostly lie till they turn brown and shrivel completely. Those which were badly shrivelled seemed preferable to the bees.

On cutting across the tube of a white corolla near the base, and then gently stripping the flower downwardly, a large globule of nectar protrudes. The same process executed on the older or yellow flower gives about the same quantity, as also does the faded flower of the third day. In the dried flower, taken before much shrivelling had occurred, nearly as much nectar was found. The completely shrivelled and twisted flower could not be "stripped" of its secretion in this way, but it was certainly present and as abundant. The bees carefully sought what would have been the mouth of the corolla, and then extracted the sweets from that point. It soon became evident that the shrivelling and contracting of the tube of the corolla acted in the same manner as the thumb-nail and finger in "stripping," lessening the diameter of the tube, and forcing the nectar towards the mouth and within the reach of the visiting insect.

As noted, the bees collecting nectar from these dead flowers never visited the fresh opening ones, while the few visiting the fresh flowers never visited the dead or dying ones; a very careful watch of half an hour satisfied me on this point. It was noted that the latter took considerable time and much laboured effort with each flower. There was an average of fifteen seconds to each flower, a very long time for the average honey-making bee. Those working on the drying flowers made no more than the ordinary effort of bees with fresh flowers. It was difficult to understand why in the same variety of insect each should have its own line of procedure. If it should be suggested that bees could profit by experience, and that those which confined themselves to the freshly opened flowers were young bees that had yet much to learn, there still remains the fact that they did not profit by the experience of the older bees. Sometimes almost side by side it might be supposed that any creature that could profit by experience would want to know what the one picking at a dried flower had found.

The relation between insects and flowers obtrudes itself here. Many plants, as I have placed on record, shed their pollen and cover the stigma before the opening of the corolla. Whether the stigma is in receptive condition or not, the pollen remains there till it is, and we may regard all such as "arranged for self-fertilization," if, indeed, there is any such special arrangement in the vegetable world wholly with this view, or with the special view of cross-fertilization. But in this honeysuckle the anther-sacs burst immediately on expansion, and the anthers are in such close position to the stigma that it can scarcely do aught but receive its own-pollen. All the flowers examined seemed to have the stigmas completely covered with pollen, and, I feel pretty sure, with own-pollen. My plants are, however, infertile, rarely a few berries mature. I should refer this to propagation from an infertile plant, as we frequently find to occur in all classes of ligneous plants, which fruit neither with own-pollen nor foreign pollen, rather than to any want of ability in own-pollen to produce fertilization as an abstract principle, as would be assumed by some.

There still remains to be discussed why all this large amount of nectar should be secreted by the flower with no apparent benefit to itself in any conceivable way. But it is not safe to say that, because we cannot see that any benefit results in relation to the visits of insects, it is of no value in some as yet undiscovered operation in the economy of nature. For aught we know it may be an excretion rather than a secretion, which it may be as much an advantage to get rid of when of no further use to the plant, as it is an advantage to get rid of the corolla itself.

A very curious circumstance in connexion with these observations was the discovery that each of these two forms of the *Lonicera japonica* have different times of the day for the opening of its blossoms. The expansion, as in so many points of growth, is rhythmic, and not a continuous effort. In the form known as *Lonicera flexuosa* the lobes of the corolla parted, so as to admit of the protrusion of the stamens, at 2 P.M. Further efforts at expansion rested till 4 P.M., when the act was resumed and completed. *L. brachypoda* commenced opening at 5 P.M., and completed the opening by 7 P.M.

There is no reason why variation may not occur in the behaviour of plants as well as in the parts of their structure; but it is difficult to conceive of any physiological value in these variations from any point of view in the economy of plant-life.—*Proc. Acad. Nat. Sci. Philad.* 1894, pp. 169–171.

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THE ANNALS
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INCLUDING
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CONDUCTED BY
ALBERT C. L. G. GÜNTHER, M.A., M.D., Ph.D., F.R.S.,
WILLIAM CARRUTHERS, F.R.S., F.L.S., F.G.S.,
AND
WILLIAM FRANCIS, Ph.D., F.L.S.

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

WITH FOUR PLATES.

Illustrative of Mr. E. A. Smith's Paper on Mollusca from the Bay of Bengal and the Arabian Sea, and Mr. O. L. Simmons's on the Development of the Lungs of Spiders.

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THE ANNALS

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MAGAZINE OF NATURAL HISTORY.

[SIXTH SERIES.]

No. 81. SEPTEMBER 1894.

XXIV.—*Natural History Notes from H.M. Indian Marine Survey Steamer 'Investigator,' Commander C. F. Oldham, R.N.*—Series II., No. 10. *Report upon some Mollusca dredged in the Bay of Bengal and the Arabian Sea.* By EDGAR A. SMITH.

[Plates III.–V.]

SEVERAL reports by Dr. A. Alcock and the late Professor J. Wood-Mason upon the Fishes, Crustacea, and other marine Invertebrates obtained during the surveys of the 'Investigator' have already appeared in the 'Annals' during the last five years; but only some brief observations have been made upon the Mollusca. These were published in 1891 in vol. vii. pp. 15–19, and vol. viii. pp. 443–448.

Previously to these surveys there does not appear to have been any dredging carried on in this part of the Indian Ocean at any great depths, and therefore it is not surprising that most of the species obtained at over a hundred fathoms are new to science. Up to the present nothing generically new has been discovered; but of the species some are especially interesting as bearing a close resemblance to others which occur in remote parts of the world. For instance, the *Lucina bengalensis*, dredged off the delta of the Godaveri in 410 fathoms, with the exception of a slight difference in form, is very like *L. lamellata* from 245 fathoms in the Straits of Magellan. *Turbo* (*Cantrainea*) *indicus* is possibly only a variety of *T. peloritanus*, a deep-water form occurring in the Mediterranean and Atlantic. The species of *Amussium* have close West-Indian and Atlantic representatives in *A. Dalli* and *A. lucidum*; and *Dentalium profundorum*, from 675 fathoms, and *Limopsis indica*, from 142–400 fathoms, are respectively only slight modifications of *D. capillosum* and *L. pelagica*, from the depths of the Atlantic.

A few forms of *Dentalium* are known, the shells of which are not regularly tubular. In *D. ensiculus*, Jeffreys, the shell is much compressed, and in *D. compressum*, Sowerby, a handsome Japanese species, in section it is oval. *D. insolitum* of the present collection is also remarkable on account of its irregularity in this respect; the two sides are a little flattened and slope or converge somewhat towards the excurved side, which is more convex than the opposite side. The two Pleurotomids, from 675 and 1043 fathoms, are also worthy of special attention, as they have quite the appearance of northern forms or inhabitants of cold regions, having the whitish chalky surface of some of the boreal Buccinids and *Chrysodomi*.

In addition to the species now enumerated and described, the following, also from dredgings of the 'Investigator,' have already been characterized as new:—

1. *Rostellaria delicatula*, Nevill, 1881.
2. *Solariella metalica*, Wood-Mason and Alcock, 1891.
3. *Pleurotoma symbiotes*, iid.
4. *Verticordia* (*Euciroa*) *eburnea*, iid. (= *V. optima*, Sowerby, 1894).
5. *Nucula* (*Acila*) *Fultoni*, Smith, 1892.
6. *Syndesmya maxima*, Sowerby, 1894.
7. *Glauconome sculpta*, Sowerby, 1894.

The types of the species, hereafter described, will be deposited in the Indian Museum at Calcutta; but one or more representatives of each have been retained, by permission, for the National Collection in the Natural History Museum at South Kensington.

1. *Conus australis*, Chemnitz. (Pl. III. fig. 1.)

Conus australis, Chemn., Reeve, Conch. Icon. vol. i. pl. iv. fig. 49; Sowerby, Thes. Conch. vol. iii. pl. ccvi. fig. 486; Kiener, Coq. Viv. pl. xli. fig. 2.

Hab. Swan River (*Reeve*); Australia, Moluccas (*Tryon*); China (*coll. Cuming*, and *Sowerby* for *C. laterculatus*); off Malabar coast, lat. 11° 05′ 45″ N., long. 75° 04 08″ E., in 36 fathoms ('*Investigator*').

C. gracilis, *C. duplicatus*, and *C. laterculatus*, all of Sowerby, are synonyms of this species. The Malabar specimens, although they appear to be adult, are very small, measuring only about 43 millim. in length. Two out of the three examples in the present collection exhibit a considerable amount of nodulation upon the transverse ridges of the body-whorl, a feature commonly seen in larger forms of the species. With the exception of the considerable difference in size these specimens are fairly typical, the general form, the spire, the colour and disposition of it, and the sculpture being precisely the same as in normal specimens. Sowerby's figure in the 'Thesaurus,' although a trifle slender, gives a very good idea of the general appearance of the present examples.

2. *Conus planiliratus*, Sowerby. (Pl. III. fig. 2.)

Conus planiliratus, Sow. Proc. Zool. Soc. 1870, p. 255, pl. xxii. fig. 1; Thes. Conch. vol. v. p. 265, pl. dxii. fig. 723; Weinkauff, Conch.-Cab. ed. 2, p. 352, pl. lxv. fig. 6; Tryon, Man. Conch. vol. vi. p. 73, pl. xxiii. fig. 76.

Hab. Off Calicut, west coast of South India, in 45 fathoms ('*Investigator*'); China Sea (*Sowerby*).

The original specimen described by Sowerby, now in the British Museum, is not quite adult. The largest example from Calicut, which appears to be full-grown, is 58 millim. in length and 27 in diameter at the shoulder.

3. *Conus coromandelicus*. (Pl. IV. figs. 1, 2.)

Testa breviter fusiformis, albida vel pallide carnea, epidermide diluto olivacea induta, spiraliter subnodose costulata et sulcata; spira conica, acuta; anfractus 10, sutura canaliculata sejuncti, superiores quinque in medio angulati, cæteri fere plani, costulis 3–4 spiralibus, subnodulosis cincti, ultimus paulo infra suturam ad costam sublævem subangulatus, inter costas lineis incrementi conspicuis striatus; apertura angusta, intus pallide fuscescens; labrum tenuissimum, intus sulcatum, ad marginem crenulatum, superne profunde sinuatum.

Longit. 37 millim., diam. 14; apertura 25 longa, $3\frac{1}{2}$ lata.

Var. Testa lævior, costis transversis haud nodosis.

Hab. Off Coromandel coast, lat. 14° 18′ 15″ N., long. 80° 18′ 30″ E., in 80–110 fathoms; and lat. 15° 4′ 7″ N., long. 80° 25′ 7″ E., in 128 fathoms.

The epidermis of this species is darker upon the spiral ridges than in the interstices or grooves between them, and is particularly dark between the faint nodules, so that the ridges have a somewhat spotted appearance. They are about twenty-six in number upon the body-whorl, of which two or three are above the slight angle or shoulder, which is marked by a peculiar, somewhat flattened, broad and smooth or scarcely nodulous costa. This winds up the spire a little above the suture, which consequently has a channelled appearance. The lip is very thin, finely undulated at the edge, and grooved within, the grooves corresponding to the external ridges.

It belongs to that section of the genus which includes *C. Orbignyi*, *C. cancellatus*, &c., which have the surface ornamented with transverse grooves and ridges. It is not sufficiently similar to any known species to suggest a comparison.

The variety differs only in having the ridges plain instead of nodulous. Some of the upper whorls, however, are noduled at the angle, as in the type.

4. *Conus turriculatus*, Sowerby.

Conus turriculatus, Sow. Thes. Conch. vol. iii. p. 328, pl. cclxxxviii. figs. 643, 644; Weinkauff, Conch.-Cab. ed. 2, p. 377, pl. lxix. figs. 10, 11; Tryon, Man. Conch. vol. vi. p. 75, pl. xxiii. fig. 89; Smith, Report 'Alert' Coll. p. 487.

Hab. Cheduba Island, Bay of Bengal, 20–30 fathoms ('*Investigator*').

I have already shown, in the 'Alert' Report, that *C. acutangulus*, Kiener (non Chemnitz), and *C. gemmulatus*, Sowerby, are synonymous with this species. It occurs in the Mascarene Islands, the China Sea, and the Philippines.

Tryon places this species among the synonyms of *C. cancellatus*, from which, however, it is perfectly distinct.

5. *Pleurotoma congener*. (Pl. III. figs. 4, 5.)

Testa fusiformis, robusta, alba, infra suturam pallide rufo-cingulata, inter tuberculos circa medium aufractuum rufo-punctulata; anfractus 10–12, convexi, infra suturam cingulo duplicato et circa medium altero planato tuberculato cincti, liris spiralibus paucis tenuibus incrementique lineis conspicuis ornati, ultimus infra cingulum liris 5–6 striisque intercalentibus cinctus, inferne angustatus, in rostrum productus; columella leviter obliqua, rectiuscula; labrum tenue, ad cingulum tuberculatum incisum; apertura intus lirata.

Longit. 52 millim., diam. 17; apertura cum canali 22 longa, in medio 7 lata.

Hab. Bay of Bengal, 128 fathoms; west of Colombo, Ceylon, 142–400 fathoms.

This species might almost be regarded as a short robust form of *P. Kieneri*, Doumet*, which it resembles in many

* Mag. de Zool. 1840, pl. x., = *Pl. carinata*, Reeve (non Gray), Con. Icon. fig. 56. *Pl. speciosa*, Reeve, *l. c.* fig. 9, = *P. carinata*, Gray, Griffith's Anim. Kingdom, vol. xii. p. 599, pl. xxiii. fig. 2.

respects. It differs in having a thicker stouter spire, a shorter canal, a thicker girdle at the top of the whorls, and a broader tuberculated zone around the middle.

The specimens obtained off the west of Ceylon are peculiar for a kind of nodule or swelling on the upper part of the columella. They are rather smaller, although full-grown, than the examples from the Bay of Bengal.

Of the two specimens examined one is 45 millim. in length, the other only 40.

6. *Pleurotoma* (*Surcula*) *symbiotes*, W.-M. & A. (Pl. III. figs. 7, 8.)

Pleurotoma symbiotes, Wood-Mason and Alcock, Ann. & Mag. Nat. Hist. 1891, vol. viii. p. 444, figs. 13 *a*, *b*.

Testa fusiformis, sordide albida, epidermide tenuissima pallide olivacea hic illic induta; anfractus 10, superne concavi, in medio nodosi, striis spiralibus lineisque incrementi tenuibus flexuosis sculpti, sutura leviter undulata sejuncti, ultimus antice angustatus; apertura intus fuscescens, lævis, longit. totius $\frac{1}{2}$ paulo brevior; labrum in medio prominens, valde arcuatum, superne late sinuatum; columella lævis, callo tenui pallide fuscescente induta, in medio parum arcuata, inferne obliqua; canalis anterior latus, paulo recurvus.

Longit. 57 millim., diam. 19; apertura cum canali 27 longa, 9 lata.

Hab. Off southern extremity of India, lat. 7° 04′ N., long. 76° 34′ 15″ E., in 1043 fathoms.

The nodules upon the central portion of the whorls (about twelve in number on the penultimate) become gradually more and more acute towards the top of the spire, where the suture also is more wavy than lower down the shell, becoming quite even in the last volution. The sinus in the outer lip, although wide, is not deep, and is situated in the depression or concavity below the suture. Neither the spiral lines nor the acuteness of the nodules upon the upper whorls are well shown in the figures referred to.

7. *Pleurotoma* (*Surcula*) *subcorpulenta*. (Pl. III. fig. 6.)

Testa *S. symbioti* similis, sed major, anfractibus supra minus excavatis, striisque spiralibus paulo prominentioribus, columella in medio plica obliqua plus minus prominente instructa.

Longit. 80 millim., diam. 29; apertura 42 longa, 16 lata.

Hab. Off Colombo, Ceylon, lat. 6° 32′ N., long. 79° 37′ E., in 675 fathoms.

It is probable that an extended series of specimens of this form and of *S. symbiotes* might prove that they ought to be regarded as variations of one and the same species. The difference of size, however, is considerable, and the relative length of the apertures is rather different. The colour of the aperture and columella is the same in both, and the character of the labral sinus is similar. One of the two specimens under examination has a distinct oblique fold on the columella, such as we find in *Fasciolaria* and *Latirus*, but placed somewhat higher up; it is only barely indicated in the second example, and is just traceable, in the form of a very slight prominence, in both specimens of *S. symbiotes*.

The operculum is normal, narrow, and pointed at the terminal nucleus.

8. *Murex malabaricus*. (Pl. III. fig. 3.)

Testa ventricose fusiformis, antice rostrata, albida, fascia unica rufa in medio anfractuum superiorum, tribus in anfr. ultimo ornata, supra rostrum rufo-fusco tincta, varicibus tribus æquidistantibus instructa; anfractus 9–10, convexiusculi, costis longitudinalibus parum prominentibus paucis nodosis instructi, lirisque tenuibus spiralibus numerosis ornati; varices valde prominentes, breviter frondosi, serrati, in medio anfractuum spina recurva acuta excavata instructi, in anfr. ultimo spinis 3–4 rectiusculis inferne muniti; apertura rotunde ovata, alba, indistincte trifasciata; labrum porrectum, ad marginem leviter crenulatum, rufo-fusco punctatum; labium valde prominens, album, leviter reflexum, superne labro junctum; rostrum rectiusculum, fere clausum, longit. totius $\frac{1}{2}$ adæquans; operculum ovatum, fortiter et subconcentrice costatum.

Longit. 114 millim., diam. 37; canalis ab apertura ad extremitatem rostri 58 longus; apertura 22 longa, 15 lata.

Hab. Off Malabar coast, lat. 11° 05′ 45″ N., long. 75° 04′ 08″ E., in 36 fathoms.

This handsome species is well characterized by its form, the style of coloration, and sculpture. The recurved hollow spine upon the varices about the middle of the upper whorls is a prominent feature in the ornamentation. The longitudinal slender costæ, which are nodulous where certain of the transverse liræ cross them, increase in number with the growth of the shell. In the last whorl there are about six in the space between any two varices, five to four on the penultimate, four to three on the preceding volution, two and then only one upon the uppermost whorls.

The transverse colour-bands, when examined closely, are found to consist of groups of coloured liræ.

In some respects this species resembles *M. Beaui*, Fischer and Bernardi, from the West Indies. It differs, however, in form, the rostrum being longer, and the spiral liræ are more numerous.

9. *Nassaria coromandelica.* (Pl. IV. fig. 3.)

Testa breviter fusiformis, solida, albida; anfractus 10, primi tres (nucleus) lævigati, convexi, cæteri convexiusculi, costis longitudinalibus numerosis leviter arcuatis, lirisque spiralibus circiter tres vel quatuor supra costas nodosis cancellati, inter liras striis filiformibus cincti, ad suturam quasi canaliculati, ultimus convexus, infra medium contractus; apertura supra pyriformis, inferne late canaliculata, salmoneo-rufo tincta; labrum ad marginem acutum, varice validissimo externo incrassatum, intus liris 7–8 haud ad marginem attingentibus instructum; columella superne arcuata, callo tenui induta, transversim lirata et tuberculata, lira suprema cæteris majori; canalis latus, profundus, obliquus, leviter recurvus.

Longit. 35 millim., diam. 15; apertura cum canali 17 longa, $6\frac{1}{2}$ lata.

Hab. Off Coromandel coast, lat. 14° 05′ 55″ N., long. 80° 25′ 20″ E., in 112–138 fathoms.

The spiral liræ are alternately larger and smaller, the former being nodulous on crossing the longitudinal costæ. Of the liræ within the aperture, the third from the top is rather more prominent than the rest. It differs from *Nassaria nivea* (Gmelin) in its larger size, more open, less oblique, and less recurved canal, the very strongly developed post-labral varix, the colour within the aperture, different tuberculation on the columella, and fewer liræ within the outer lip.

The *Triton carduus* of Reeve, which is united with *N. nivea* by Tryon (Man. Conch. vol. iii. p. 221), has no relationship whatever with that species. It undoubtedly belongs to the Tritoniidæ, and may be placed in the group Colubraria. Fine examples in the Museum collection were received from M. Robillard from the Mauritius. The type of *T. carduus* is a half-grown shell, the adult form having a length of 22 millim. Reeve's figure ('Triton,' fig. 95) is twice the length of the shell delineated. The reference to Gmelin should be p. 3495, and not 3504, as given by Tryon, the *Buccinum niveum* described upon that page being a species of *Terebra*.

The generic name *Nassaria* is rejected by Fischer (Man. Conch. p. 631) in favour of *Hindsia*, but upon what grounds is not evident. *Nassaria*, as established by Link, included a variety of species which are at the present time ranged under *Nassa, Phos, Clionella,* and *Cantharus*; but the first species he cites (under the name of *Nassaria lyrata*) is what we now call *Nassaria nivea.* Probably the Messrs. Adams, regarding this as the type of *Nassaria,* gave it preference to that of *Hindsia.*

10. *Latirus andamanicus.* (Pl. III. fig. 9.)

Testa fusiformis, albida, epidermide tenui pallide olivacea induta; anfractus 11, supremi tres (nucleus) albi politi convexi, cæteri convexiusculi, sed infra suturam leviter concavi, costis longitudinalibus circiter 8 (in anfractibus ult. et penult. plus minus obsoletis) instructi, liris tribus supra costas nodosis cincti, striisque filiformibus undique ornati, ultimus inferne longe et recte rostratus; apertura alba, cum rostro longit. totius $\frac{1}{2}$ paulo superans; columella leviter arcuata, plicis duabus obliquis parum conspicuis instructa; canalis fere rectus, angustus, elongatus, ad extremitatem vix recurvus.

Longit. 50 millim., diam. 12; apertura cum rostro 27 longa, $5\frac{1}{2}$ lata.

Hab. Off Port Blair, Andaman Islands, in 112 fathoms.

In general aspect this species resembles certain forms of the genus *Fusus*, but as two oblique folds, although but very feebly developed, are present upon the columella, it seems advisable to locate it in *Latirus.*

The longitudinal costæ are more prominent upon the upper portion of the spire, and become almost obsolete upon the body-whorl. The outer lip is very thin in both the shells examined, but it is likely to become somewhat thickened in more adult specimens, and probably would develop a few internal liræ. Both examples were more or less invested by a species of sea-anemone.

11. *Pyrula Dussumieri*, Kiener.

Pyrula Dussumieri (Valenciennes, MSS.), Kiener, Icon. Coq. Viv. p. 25, pl. xi.; Tryon, Man. Conch. vol. vii. p. 266, pl. v. fig. 30.

Ficula Dussumieri, Reeve, Conch. Icon. vol. iv. pl. i. fig. 2; Sowerby, Thesaurus, vol. iv. pl. ccccxxiii. fig. 5; Kobelt, Conch.-Cab. ed. 2, p. 10, pl. i. fig. 1.

Hab. China Sea (*Kiener, &c.*); Bay of Bengal, lat. 20° 18′ N., long. 90° 50′ E., in 65 fathoms ('*Investigator*').

The specimens dredged alive in the Bay of Bengal are very fragile, being only about half-grown. Their presence in this locality to some extent confirms Reeve's assertion that this species was "collected by M. Rousseau, a zealous naturalist attached to the Jardin des Plantes, Paris, during a voyage to Madagascar and the Seychelle Islands."

12. *Lacuna indica.* (Pl. IV. fig. 7.)

Testa umbilicata, sordide albida, spiraliter striata; anfractus 3, celeriter crescentes, perconvexi, ultimus magnus, antice oblique descendens et subsolutus, circa umbilicum augustum acute carinatus, lineis incrementi oblique curvatis sculptus; apertura magna, alba, patula, late lunata, longit. totius $\frac{7}{10}$ adæquans; columella obliqua, recta, incrassata, margine supero infra umbilicum paulo incurvato vel excavato; labrum tenue, arcuatum; operculum membranaceum, tenuissime striatum.

Longit. 10 millim., diam. maj. 8, min. 5; apertura 7 longa, 5 lata.

Hab. Off Madras coast, lat. 16° 01′ N., long. 81° 25′ E., in 410 fathoms.

The striæ are somewhat deeply incised, somewhat irregular and inæquidistant, and quite evident to the naked eye. There are about twenty-two upon the body-whorl.

13. *Natica rufa*, var. (Pl. IV. figs. 14, 14 *a*.)

Hab. Off Calicut, Malabar coast, in 45 fathoms.

The specimens from this locality are coloured like the variety named *N. Swainsonii* by Philippi, but differ in being very much smaller and in having the umbilicus much more closed up by the columellar callosity. These differences may be merely the result of age, for the operculum of these small specimens agrees exactly with that of larger shells.

It is shelly, thickened, white above, but stained at the spiral end with a dirty olive tint; parallel with the outer or curved margin are two grooves, leaving a flattened ridge between them. The straight or columellar edge is peculiarly striated and serrated; the lower flat surface is covered with a bright yellow epidermis.

14. *Sigaretus* (*Eunaticina*) *tener.* (Pl. IV. fig. 8.)

Testa anguste rimata, ovata, subconica, tenuis, sordide albida, limo ferrugineo plus minus induta, striis spiralibus tenuibus lineisque incrementi cancellata; anfractus 4, celeriter crescentes, convexiusculi, sutura subprofunda sejuncti; apex saturate fuscus; anfr. ultimus obliquus, elongatus; apertura obliqua, longit. totius $\frac{5}{7}$ adæquans; columella leviter arcuata, tenuis, superne anguste dilatata et reflexa.

Longit. 21 millim., diam. maj. 14, min. 10; apertura 15 longa, 10 lata.

Hab. Bay of Bengal, 96 fathoms.

This species is remarkable for its peculiar form and the thinness of the shell. The nuclear whorl is of a deep brown colour and hardly raised above the next, which is finely spirally striated, but looks somewhat smoother than the last two. The aperture is smooth within and tinted more or less with light brown. This is occasioned by the red-earthy deposit on the external surface being partially visible through the transparency of the shell.

15. *Capulus lissus.* (Pl. IV. figs. 4–6.)

Testa pileiformis, apice postice valde recurvato, sordide albida vel dilutissime rufescens, lineis incrementi striata, *haud radiatim sculpta*; anfractus 3, apicales duo (nucleus) globosi, læves; apex pone sed supra marginem aperturæ convolutus; apertura irregulariter rotunde ovata, pallide fuscescens; peristoma tenue, margine infra apicem incrassato.

Diam. maj. 11 millim., min. 8, alt. $5\frac{1}{2}$; apertura $8\frac{1}{2}$ longa, 7 lata.

Hab. Bay of Bengal, 90–102 fathoms.

The chief characteristic of this species is the absence of radiating sculpture, a feature common to most species of the genus *Capulus*.

16. *Turbo* (*Cantrainea*) *indicus.* (Pl. IV. figs. 13 *a–c.*)

Testa turbinata, imperforata, solida, alba; anfractus 4, superne declives, concavi, prope medium angulati vel carinati, celeriter crescentes, ultimus carinis 2–3 circa medium cinctus, striis spiralibus tenuibus plus minus conspicuis lineisque incrementi obliquis sculptus; apertura obliqua, subrotundata, argenteo-margaritacea; labrum crassiusculum, antice leviter effusum; columella obliqua, arcuata, crassa, in medio tuberculo obsoleto munita, callo submargaritaceo latissimo labro juncta.

Diam. maj. 28 millim., min. 23, alt. 26; apertura 13 longa et lata.

Operculum subplanum, album, in medio leviter concavum et subolivaceum, infra paulo convexum, corneum, olivaceo-fuscum; anfractus circiter septem, primi quinque lente crescentes, penultimus et ultimus celeriter ampliati.

Hab. Off Colombo, lat. 6° 29′ N., long. 79° 34′ E., in 597 fathoms.

This species is remarkable for the uniform white colour, the concavity at the upper part of the whorls, the median angle or carination, and the two or three keels upon the last whorl. Of these, the uppermost is continuous up the spire, the lowermost is at the periphery, and the third, when present, is intermediate between the other two. It is with some hesitation that I venture to separate these specimens specifically from the *T. peloritanus*, Cantraine, as determined by Jeffreys

(P. Z. S. 1883, p. 108). They agree with the Atlantic examples in general form and solidity, but are considerably larger, and the spiral striation is of a different character, being excessively fine in comparison. The figure given by Cantraine of *T. carinatus* (Mal. Méditerr. pl. vi. fig. 23), which is considered synonymous with *C. peloritanus*, if enlarged, would give a fair idea of the bicarinate example of the present species, excepting the aperture being too small. The opercula of both are identical.

17. *Scaphander andamanicus.* (Pl. IV. fig. 15.)

Testa ovata, tenuis, alba, hic illic ferrugineo tincta, transversim punctato-striata, superne et circa basin striis paucis haud punctatis cincta; spira immersa, concava; apertura magna, infra lata, superne angustata; labrum leviter arcuatum, tenuissimum, superne ad insertionem incrassatum callosum album; columella valde arcuata, intus convoluta, usque ad apicem perspicua, alba, incrassata.

Longit. 18 millim., diam. maj. 12, min. 9; apertura 18 longa, inferne 9 lata.

Hab. Andaman Sea, in 250 fathoms.

The punctured grooves, about 40 in number, are not always equidistant, and the punctures are also variable in size.

18. *Lepidopleurus similis.* (Pl. IV. figs. 9–12.)

Testa elongata, paulo angusta, in medio dorsi acute arcuata, sordide albida, intus alba, undique regulariter et eleganter granulata; areæ laterales modo leviter definitæ, lineas incrementi paucas exhibentes; valvæ medianæ (fig. 11) postice rectæ, breves; laminæ suturales parvæ sinu lato sejunctæ; laminæ insertantes nullæ; valva anterior (fig. 10) semicircularis, lamellis et fissuris haud instructa; valva posterior (fig. 12) mucrone centrali aliquanto acuto instructa; cingulum angustum, griseum, arenaceum, spiculis albis brevissimis, præsertim supra marginem externum, amictum.

Longit. 16 millim., diam. 7.

Hab. Off Colombo, lat. 6° 32′ N., long. 79° 37′ E., in 675 fathoms.

Allied to *L. alveolus*, Sars, but more strongly granulated, with the lateral areas of the central valves faintly defined by a slight depression.

19. *Dentalium profundorum.* (Pl. IV. fig. 18.)

Testa magna, solida, leviter arcuata, longitudinaliter tenuissime striata, lineisque incrementi obliquis sculpta, sordide lutescens,

postice fissurata ; apertura fere circularis, intus alba, ad marginem obliquum tenuis, acuta.
Longit. 90 millim., diam. max. 10.

Hab. Off Colombo, lat. 6° 32′ N., long. 79° 37′ E., in 675 fathoms.

This species rather closely resembles the fossil *D. grande*, Deshayes, but the style of striation is not quite the same, and the form is not quite so slender. The fine thread-like slightly rounded riblets are about eighty in number, and usually rather broader than the intervening striæ. None of the three specimens examined are perfect posteriorly, so it is impossible to describe the fissure properly. In the largest example a mere notch indicates the existence of a slit in the normal position.

In a second specimen there is a distinct *lateral* fissure 3 millim. in length, but whether this is an accidental fracture is not quite certain. The surface of this species appears to be subject to erosion, for patches are broken away here and there throughout the entire length of the shell.

D. capillosum, Jeffreys, is a closely allied species from the Atlantic, but somewhat more slender in form and not quite similar in sculpture.

20. *Dentalium usitatum.* (Pl. IV. figs. 16, 16 *a.*)

Testa parva, mediocriter gracilis, alba, parum arcuata, liris longitudinalibus tenuissimis circiter 20–25 æqualibus instructa, lineis incrementi obliquis sculpta, ad apicem haud fissa.
Longit. 31 millim., diam. max. 2·7.

Hab. Off Colombo, lat. 6° 32′ N., long. 79° 37′ E., in 675 fathoms, and Bay of Bengal in 597 fathoms.

The two specimens examined do not look as if they are young shells. The white colour is varied here and there with narrow oblique somewhat pellucid zones.

21. *Dentalium insolitum.* (Pl. IV. figs. 17, 17 *a.*)

Testa gracilis, conspicue arcuata, lævis, polita, subpellucida, alba, haud circulariter tubulata, utrinque leviter plana, lineis incrementi tenuissimis striata, ad apicem haud fissa.
Longit. 36 millim., diam. max. 2·5.

Hab. Bay of Bengal, in 597 fathoms.

The peculiarity of this species consists in its being a little compressed, so that the tube is not circular. It is broadest along the concave curve, which is not so round as the opposite side, and almost defined by lateral angles.

22. *Cytherea* (*Caryatis*) *pudicissima*. (Pl. V. figs. 3, 4.)

Testa parva, inæquilateralis, ovata, mediocriter convexa, alba, concentrice fortiter striata; margo dorsi posticus leviter obliquus, rectiusculus, anticus valde declivis, brevior; margo ventralis regulariter et late curvatus; umbones parvi, haud contigui, incurvati; lunula elongato-cordata, in medio prominens, incrementi lineis striata, linea impressa circumscripta; area nulla; cardo normalis, mediocriter fortis; pagina interna alba, lævis; cicatrices haud conspicuæ, pyriformes; sinus pallii haud profundus, obtuse cuneatus.
Longit. 13 millim., alt. 10·3, diam. 7.

Hab. Off Ganjam coast, 24 miles south-east of Gopalpur, in 89–93 fathoms.

This species in colour and sculpture is very like *Dione pura*, Deshayes *, from Callao in Peru, but differs from it in form, being less trigonal, and not narrowed posteriorly. The umbones also are less prominent and not quite so anterior in position.

23. *Abra maxima*, Sowerby. (Pl. V. figs. 5, 6.)

Syndesmya maxima, Sowerby, Proc. Malac. Soc. 1894, vol. i. p. 40, pl. v. fig. 5.

Testa fere æquilateralis, utrinque hians, oblonga, antice rotundata, postice acuminata, albida, nitida, lineis incrementi tenuissimis striata, striisque paucis radiantibus haud conspicuis sculpta; margo dorsi utrinque rectiusculus, declivis, ventralis late excurvatus; umbones parvi, acuti; lunula lanceolata, leviter excavata, utrinque carina marginata; valvæ tenues, dextra carina ab umbone usque ad extremitatem posticam instructa, sinistra sulco minime profundo in eodem loco sculpta; dentes cardinales subæquales, laterales valvæ dextræ tenues, æquidistantes; ligamentum internum perobliquum, externum tenue, angustum; pagina interna nitida, iridescens, radiatim et transversim substriata; cicatrix anterior angusta, elongata, postica latior, pyriformis; sinus pallii profundissimus, angustus, ad extremitatem rotundatus.
Longit. 33 millim., alt. 20, diam. 10.

Hab. Bay of Bengal, in 128 fathoms, dead shells only; off

* Cat. Conch. Biv. Mus. Brit., Veneridæ, p. 68; Römer, Monogr. *Cytherea* in Novitat. Conch. p. 84, pl. xxiii. figs. 1–1 *b*.

Kistna delta, lat. 15° 43′ 30″ N., long. 81° 19′ 30′ E., in 678 fathoms, living examples.

In the left valve within the keel which marks off the elongate lunule is a second keel, forming, as it were, an inner lunule. This feature is wanting in the opposite valve. The delicate external ligament is supported by thin reflexed nymphæ, that in the left valve jutting out behind like a lateral tooth. The single cardinal in this valve is triangular, acute above, and fits in between the two divergent teeth in the right valve.

The dead specimens from 128 fathoms have a pale pinkish tint; but this is probably due to staining after death.

24. *Cuspidaria* (*Myonera*) *caduca*. (Pl. V. figs. 9, 10.)

Testa fragilis, longe rostrata, alba, epidermide tenuissima induta, concentrice subfortiter plicata, striisque incrementi minutis sculpta; margo dorsi anticus leviter arcuatus, vix declivis, posticus valde incurvatus; margo anterior rotundatus, ventralis paulum convexus, prope rostrum parum inflexus; umbones mediocriter prominentes, postice inclinati; area dorsalis antica elongata, lævis, postica lanceolata, usque ad extremitatem rostri extensa, carina filiforme prope umbones marginata; carina secunda similaris in utraque valva ab umbone breviter postice producta; cardo edentulus; fossa ligamenti parva, postice declivis.

Longit. 32 millim., alt. 14, diam. 10.

Hab. Andaman Sea, in 188–220 fathoms.

The plicæ are rather acute, somewhat irregular near the middle of the valves, and are attenuated at the commencement of the rostrum, upon which they become mere striæ.

In general external appearance this species considerably resembles *C. chinensis*, Gray. It is, however, not so high, the rostrum is longer, the texture of the shell much thinner, and the strong posterior tooth of the right valve is wanting.

25. *Cuspidaria* (*Cardiomya*) *Alcocki*. (Pl. V. fig. 8.)

Testa paulo inæquivalvis, tenuissima, subglobosa, mediocriter longe rostrata, alba, subpellucida, antice oblique truncata, inferne rotundata, postice infra rostrum haud profunde sinuata; valvæ supra dimidium posticum carinis conspicuis arcuatis acutis quatuor aliisque paucis minoribus interjectis ornatæ, ante carinas radiatim tenuissime liratæ, lineisque incrementi subcancellatæ; rostrum supra levissime incurvatum, extremitatem versus angustatum, liris tenuibus 4–5 radiantibus in utraque valva instructum; umbones parvi, contigui, incurvati; dens cardinalis unicus pone umbonem valvæ dextræ brevis, prominulus; valva sinistra edentula; fossa ligamenti minima, triangularis.

Longit. 16 millim., alt. 9·5, diam. 7·3.

Hab. Bay of Bengal, lat. 6° 29′ N., long. 29° 34′ E., in 597 fathoms. (The longitude should probably be 92° not 29°.)

The prominent characteristics of this species are its form, the oblique truncation of the anterior end being peculiar, and the four prominent keels upon the hinder half of the valves. The right valve is a trifle smaller than the left, and this is most noticeable at the posterior end when the valves are closed. The inner surface exhibits grooves corresponding to the external costæ, which, being produced at the extremities, give to the ventral margin a festooned appearance.

Named in honour of Dr. A. Alcock of the 'Investigator.'

26. *Lucina bengalensis.* (Pl. V. figs. 1, 2.)

Testa mediocriter tenuis, irregulariter rotundata, paulo inæquilateralis, antice brevior; valvæ parum convexæ, cretaceæ, epidermide tenui grisea indutæ, lamellis concentricis tenuissimis striisque interjectis ornatæ, lunula lanceolata instructæ; margo dorsi posticus leviter arcuatus et declivis, anticus infra umbones paulo excavatus; ventris margo valde curvatus; dentes cardinales duo in utraque valva inæquales, divergentes, lateralis unicus anticus inconspicuus; pagina interna alba, minute subasperata; cicatrix antica elongata, angustissima, postica ovata.

Longit. 37 millim., alt. 31, diam. 13.

Hab. Off the delta of the Godaveri, lat. 16° 01′ N., long. 81° 25′ E., in 410 fathoms.

This species agrees very closely, excepting in form, with *L. lamellata*, Smith *, from the Straits of Magellan. The concentric lamellæ, however, are perhaps a trifle finer and closer together, and the anterior adductor scar is narrower.

27. *Limopsis indica.* (Pl. V. fig. 7.)

Testa inæquilateralis, crassiuscula, valde oblique ovata, antice arcuata, postice oblique subtruncata, alba, epidermide olivaceo-fusca hirsuta amicta, striis numerosis radiantibus aliisque concentricis decussata; umbones parvi, acuti; area ligamenti profunda, excavata, ligamento parvo mediano rhombiformi instructa; dentes cardinales circiter 14 in utraque valva; pagina interna alba, radiatim tenuissime striata, margine externo crasso plano circumdata.

Longit. 20 millim., alt. 18, diam. 9.

Exemplum alterum 17 longa, 16 alta, 10 crassa.

Hab. Colombo Lighthouse, S. 64° E. 13½ miles, in 142–400 fathoms.

* Report Lamellibranchiata 'Challenger,' p. 173, pl. xiii. figs. 1–1 *b*.

Many of the species of the genus *Limopsis* are very much alike, and it is chiefly on account of difference of locality and form that they have been separated. The present species considerably resembles *L. pelagica*, Smith, but is not of quite the same form, has thicker, more solid valves, and a coarser, more hairy epidermis. *L. Cumingii*, A. Adams, is also closely allied.

All the specimens are more or less coated with a rust-red earthy deposit.

28. *Amussium Alcocki.* (Pl. V. figs. 15-16.)

Testa fragilis, subdiaphana, albida, plus minus nitens; valvæ compressæ; valva dextra fere plana, dilutissime subrosacea, concentrice striata, marginem versus lamellis tenuissimis ornata, sinistra profundior, albo-pellucida, fere argentea, similiter striata, radiatimque exilissime lirata et striata, radiis tribus paulo prominentibus posterioribus exhibens; auriculæ minimæ, subæquales, lineis incrementi, et liris vel striis paucis radiantibus subobsoletis sculptæ; umbones acuti, ad angulum circa 115° convergentes; pagina interna nitida, liris undecim haud ad marginem extensis (illis valvæ dextræ paulo crassioribus) instructa.

Longit. 40 millim., alt. 41, diam. 8.

Hab. Laccadive Sea, in 740 fathoms; also west of Andaman Islands, lat. 13° 47′ 30″ N., long. 92° 36′ E., in 561 fathoms.

The three slightly raised rays down the posterior side of the left valve are indicated on the inner surface by corresponding shallow depressions.

The largest specimen from the latter of the above localities exhibits rather more concentric lamellation on the left valve than the examples from the Laccadive Sea.

This species is very closely allied to *A. Watsoni*, Smith, but is not so rounded; the right valve has more feeble concentric sculpture, and the radiating lines of the left valve are not so strong.

29. *Amussium andamanicum.* (Pl. V. figs. 13, 14.)

Testa *A. Alcocki* simillima, sed minus circularis, angulo apicali acutiore, lamellis valvæ sinistræ magis prominentibus, lineis radiantibus fere omnino carentibus, lirisque internis gracilioribus, præcipue illis prope medium valvarum plus minus obsoletis.

Longit. 25 millim., alt. 33, diam. 6·5.

Hab. Andaman Sea, in 688–922 fathoms.

Both in this species and *A. Alcocki* the straight hinge-line of the right valve is slightly serrated. The umbonal angle in this form is scarcely greater than 90°, and the general outline is higher in proportion to the length. The interior towards the outer margin is beautifully pearly.

30. *Amussium Jeffreysii*, Smith.

Amussium Jeffreysii, Smith, Lamellibr. 'Challenger' Exped. p. 310, pl. xxiii. figs. 2–2 *c*.

Hab. Off Koukan coast, lat. 15° 29′ N., long. 72° 41′ E., in 559 fathoms.

These specimens agree precisely with those obtained by the 'Challenger' off the Philippine Islands in 375 fathoms.

31. *Amussium caducum*, Smith.

Amussium caducum, Smith, Lamellibr. 'Challenger' Exped. p. 309, pl. xxiii. figs. 1–1 *c*.

Hab. Off delta of the Godaveri River, lat. 16° 01′ 00″ N., long. 81° 25′ 00″ E., in 410 fathoms.

The specimens from this locality correspond in every particular with the types from the China Sea obtained by the 'Challenger' in 700 fathoms.

32. *Amussium solitarium.* (Pl. V. figs. 11, 12.)

Testa subcircularis, pellucido-alba, subnitida; valva dextra leviter convexa, concentrice regulariter striata, sinistra æque convexa, liris tenuibus radiantibus paulo arcuatis instructa, lineisque incrementi substriata; auriculæ parvæ, haud radiatim sculptæ; umbones mediocriter acuti, ad angulum circa 130° convergentes; pagina interna nitida, liris undecim in utraque valva instructa.
Longit. 16 millim., alt. 16, diam. 4.

Hab. Bay of Bengal, lat. 12° 20′ N., long. 85° 8′ E., in 1803 fathoms.

Allied to *A. Watsoni*, but with the radiating liræ of the left valve more remote and without distinct cancellation. The internal liræ are curved, those of *A. Watsoni* being nearly straight.

EXPLANATION OF THE PLATES.

Plate III.

Fig. 1. *Conus australis.*
Fig. 2. —— *planiliratus.*
Fig. 3. *Murex malabaricus.*
Figs. 4, 5. *Pleurotoma congener.*
Fig. 6. —— (*Surcula*) *subcorpulenta.*
Figs. 7, 8. —— (——) *symbiotes.*
Fig. 9. *Latirus andamanicus.*

Plate IV.

Figs. 1, 2. *Conus coromandelicus.*
Fig. 3. *Nassaria coromandelica.*
Figs. 4, 5, 6. *Capulus lissus.*
Fig. 7. *Lacuna indica.*
Fig. 8. *Sigaretus* (*Eunaticina*) *tener.*
Figs. 9–12. *Lepidopleurus similis.*
Figs. 13–13 *c.* *Turbo* (*Cantrainea*) *indicus.*
Figs. 14, 14 *a.* *Natica rufa*, var.
Fig. 15. *Scaphander andamanicus.*
Figs. 16, 16 *a.* *Dentalium usitatum.*
Figs. 17, 17 *a.* —— *insolitum.*
Fig. 18. —— *profundorum.*

Plate V.

Figs. 1, 2. *Lucina bengalensis.*
Figs. 3, 4. *Cytherea* (*Caryatis*) *pudicissima.*
Figs. 5, 6. *Abra maxima.*
Fig. 7. *Limopsis indica.*
Fig. 8. *Cuspidaria* (*Cardiomya*) *Alcocki.*
Figs. 9, 10. —— (*Myonera*) *caduca.*
Figs. 11, 12. *Amussium solitarium.* Exterior of right and left valves.
Figs. 13, 14. —— *andamanicum.* Interior and exterior of left valve.
Figs. 15, 16. —— *Alcocki.* Exterior and interior of left valve.

XXV.—*On new Species of* Histeridæ. By G. Lewis, F.L.S.

This notice of new species of Histeridæ is supplementary to papers which from time to time have appeared in this Magazine; the last was published in June 1893 (ser. 6, vol. xi. pp. 417–430).

List of Species and new Synonymy.

Hololepta higoniæ, *nom. n.*
  parallela, Lew.
Anaglymma afra.
Platysoma uniforme.
—— chinense.
—— quadricolle.
Cypturus assamensis.
—— Thugi.
Phelister capensis.
Pachycræerus completus, *Gerst.*
—— elegans.
Pachycræerus puncticollis.
Eretmotus valens.
Sternocœlis acutangulus, *Lew.*
  punctulatus, Luc.
—— politus, *Sch.*
  cancer, Lew.
  Sedilloti, Lew.
Notolister Edwardsii, *Mars.*
Carcinops Blandfordi.
Tryponæus singularis.
Byzenia formicicola, *King.*

Hololepta higoniæ, nom. n.

I propose this name as a substitute for *H. parallela*, Lew. 1884, as I find that in 1868 G. v. Koch described a species under the name of *H. parallela*, Sturm (see 'Abhandlungen der naturhistorischen Gesellschaft' (Nürnberg), p. 93, Taf. B. fig. 2). I suppose Koch's species, for it is his and not Sturm's, is the same as *H. colombiana*, Mars. 1853; but it is impossible to say for certain without seeing the type. Koch's name does not appear in the Munich Catalogue, nor is it noticed in any volume of the 'Zoological Record.'

Anaglymma, Lewis, 1894.

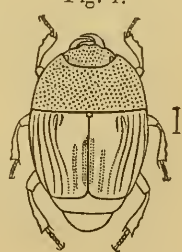
The discovery of a larger species of this genus from the Congo River will substantiate the genus as a valid one, as the African species possesses, even to minute details of sculpture, all the characters noticed in those from India and the Eastern Archipelago.

Anaglymma afra, sp. n. (Fig. 1.)

Breviter ovalis, depressa, nigra, nitida; antennis pedibusque dilutioribus; pronoto antice strigoso-punctato; elytris striis 1^{a}–4^{m} integris, 5^{a} apicali, suturali utrinque abbreviata.

L. 3 mill.

Fig. 1.



Shortly oval, depressed, black and shining, antennæ and legs piceous; the head concave anteriorly, densely punctured; the thorax densely and strigosely punctate at and behind the anterior angles, sparsely punctate at and near the posterior angles, disk before the scutellum transversely smooth, with a line of irregular punctures along the posterior edge, marginal stria complete and minutely crenulate and close to the edge behind the neck; the scutellum smooth and triangular; the elytra, striæ, subhumeral strong and complete, 1–4 complete and well-marked at the bases, 2–4 punctiform at the apices, 5 apical, short, punctiform, and split into two, sutural discal, similarly double, but punctiform throughout, the fourth stria is curved near the base; the propygidium and pygidium are distinctly but not very closely punctured; the prosternum smooth, lateral striæ divergent from the coxæ to the anterior suture; the mesosternum bisinuous anteriorly, with a stria in form like the outline of a Moorish arch, which is common to it and the metasternum.

Hab. Matadi, Congo River. Collected and kindly sent to me by Mr. J. A. Clark.

Platysoma uniforme, sp. n.

Ovatum, subconvexum, niger, nitidum; fronte impressa stria transversa recta; elytris striis 1^a–2^a integris, 3^a in medio late interrupta, 4^a apicali, 5^a dimidiata; prosterno haud striato.
L. $3\frac{1}{2}$ mill.

Oval, somewhat convex, black, shining; the head microscopically punctulate, impressed anteriorly with a transverse stria, well-marked and straight; the thorax arched at the sides, marginal stria complete, fine behind the neck, strong at the sides, and bent inwards at the base, interstice narrow, ante-scutellar fovea very minute; the elytra, striæ, subhumeral wanting, 1–2 complete, 3 short and basal with an apical appendage of the same length, 4 apical and similar to the appendage of the third, 6 apical but reaching the middle, with a wide interspace between it and the suture; the propygidium with a band of rather large punctures, posterior margin smooth; the pygidium impressed slightly laterally, with smaller punctures evenly set over the entire surface; the prosternum without striæ, constricted before the coxæ, anterior lobe finely and sparsely punctulate, anterior border marginate; the mesosternum somewhat deeply emarginate, marginal stria fine, entire, and at the emargination close to the edge.

Somewhat like *Platysoma mirandum*, Mars., in sculpture, but more oval and more convex.

Hab. Island of Buru (*Doherty*).

Platysoma chinense, sp. n.

Oblongum, parallelum, parum convexum, nigrum, nitidum; pronoto stria antice interrupta, stria pone oculos brevi et curvata; elytris striis 1^a–3^m integris, 4^a–6^m brevissimis; prosterno haud striato.
L. 4 mill.

Oblong, parallel, somewhat convex, black, shining; the head very minutely punctulate, frontal transverse stria straight; the thorax broadly margined with rather large punctures, lateral stria terminating behind the eye, and behind either eye is a short bent stria detached from the margin; the elytra, striæ 1–3 complete, 4 very short and apical, 5 apical, very short, almost a linear puncture, sutural usually as long as the fifth, but further from the apex; the propygidium with a few large punctures, closest generally near the outer margin; the pygidium with similar punctures, but smooth at the apex; the prosternum is without stria, and the mesosternum with a wide and feeble emargination and complete well-marked marginal striæ.

In facies very similar to *P. Dufali*, Mars., but broader and more robust; and it is also like *P. scitulum*, Lew., in the detached, but interrupted in *P. chinense*, stria behind the neck.

Hab. Chefoo. Three examples.

Platysoma quadricolle, sp. n.

Oblongum, parallelum, depressum, nigrum, nitidum; fronte impressa ad oculos striata; pronoto quadrato, stria laterali anterius integra; elytris striis 1^a abbreviata, 2^a–4^m integra, 5^a–6^a dimidiatis; pygidio utrinque valde impresso; prosterno bistriato, striis anticis divergentibus; tibiis anticis 4-dentatis.

L. $3\frac{3}{4}$ mill.

Oblong, parallel at the sides, depressed, black, and shining, legs and antennæ pitchy red; the head impressed anteriorly, striate over the eyes only, clypeus markedly distinct, finely, not very thickly, punctulate; the thorax as wide anteriorly as behind, straight at the sides, marginal stria fine and complete behind the head, and behind the eyes there is an area of fine punctures, but the disk, base, and lateral margin are smooth; the elytra, striæ fine and feebly crenulate, 1 shortened apically, 2–4 complete, 5 apical but reaching beyond the middle, 6 rather shorter and oblique, interstice between it and the suture widest behind; the propygidium distinctly punctured except on the posterior edge; the pygidium similarly punctured, slightly convex in the middle, lateral edges raised, with a well-marked canaliculation within them; the prosternum bistriate, striæ diverging in front of the coxæ, joining at the base, but anteriorly scarcely reaching the suture, anterior lobe immarginate and sparsely punctured; the mesosternum emarginate almost from angle to angle, marginal stria feebly interrupted in the middle.

More elongate and relatively narrower than *P. oblongum*, Fabr.; the thorax is quadrate and very widely cut out to receive the head.

Hab. Madagascar. Without precise locality.

Cypturus assamensis, sp. n.

Ovalis, convexus, niger, subtiliter punctulatus; fronte punctata; elytris, striis 1^a–4^m integris, 5^a dimidiata, suturali utrinque abbreviata; prosterno distincte punctato.

L. $4\frac{1}{2}$–5 mill.

Oval, convex, black, shining, with a fine punctuation between the dorsal striæ; the head, frontal stria complete, most visibly punctured on the anterior portion; the thorax, stria complete and close to the edge, distinctly punctured laterally, disk very finely punctulate; the elytra, striæ 1–4 complete, 5 apical but reaching the middle, sutural usually shortened at both ends; the pygidium and propygidium rather closely punctured throughout, punctures moderately large and mixed with some much smaller; the prosternum is distinctly punctured between the striæ (which meet anteriorly), with the keel wider (especially at the base) than that of *C. œnescens*, Er., and the acumination of the mesosternum is more prominent and more robust. In one sex there are two deep oval foveæ longitudinally placed at the apex of the pygidium.

The elytral striæ are variable in this species; the fourth is sometimes shortened, and the sutural in one specimen is joined to the fourth at the base. The punctuation of the elytral interspaces is sometimes scarcely perceptible.

Hab. Assam. Four examples.

Cypturus Thugi, sp. n.

Ovalis, oblongus, convexus, æneo-niger, nitidus; fronte strigosa; pronoto lateribus punctatis; elytris striis 1^{a}–4^{m} integris, suturali dimidiata, interstitiis lævibus; prosterno striis antice et postice conjunctis.

L. 4 mill.

Oblong-ovate, rather convex, brassy black; the head obscurely punctate, strigose between the eyes, stria interrupted anteriorly; the thorax, striæ complete, with a rather broad band of distinct punctures laterally, disk smooth, with a few antescutellar punctures placed transversely; the elytra, striæ 1–4 complete, fourth hamate at the base, fifth wanting, sutural abbreviated before the middle, with the interstice gradually widening from the apex of the wing-case, interstices quite smooth; the propygidium and pygidium punctate, punctures not thickly set; the prosternum, striæ complete and joining before and behind, keel smooth, anterior lobe with large punctures; the mesosternum, marginal stria complete.

Hab. Barway, in India (*Cardon*). One example in the National Museum of Brussels.

Phelister capensis, sp. n.

Ovalis, convexus, niger, nitidus; fronte punctulata, stria late interrupta; thorace punctulato, stria integra; elytris striis 1^{a}–4^{m} et suturali integris, 5^{a} basi abbreviata, interstitiis punctulatis.

L. $3\frac{1}{4}$ mill.

Oval, convex, black, shining; the head finely punctulate, lateral stria ceasing in front of the eye; the thorax distinctly punctulate throughout, punctures larger than those on the head, impressed before the scutellum with a cluster of somewhat larger punctures, marginal stria fine and complete, but not visible at the sides when viewed from above; the elytra, striæ 1–4 and sutural complete, fifth punctiform and evanescent towards the base, interstices punctulate but less distinctly on the disk than nearer the margins; the propygidium and pygidium distinctly and somewhat closely punctulate; the prosternum bistriate, striæ not meeting before or behind, feebly sinuous at the coxæ, keel distinctly but not closely punctulate; the mesosternum almost straight anteriorly, marginal stria fine and complete, transverse stria equally fine and minutely crenulate, surface punctulate like the keel of the prosternum.

This species is similar to *Phelister truncatus*, Sch., but it is larger and easily distinguished by the punctuation of the elytra.

Hab. Cape of Good Hope (*Lightfoot*).

The following isolated description is introduced here for the sake of easy reference, and because it appears to me to refer to *P. Raffrayi*, mihi, 1879. The colour of the species in this genus is, as a rule, remarkably constant, but it cannot be always relied on as a specific character.

Pachycrœrus completus, Gerst.

Pachycrærus completus, Gerst. JB. Hamb. Anst. i. p. 44 (1884).

"Truncato-ovatus, subparallelus, supra nigro-æneus, elytris viridescentibus; capite ubique punctulato, fronte marginata, sat profunde impressa; prothorace elytris dimidio breviore lateribus ad medium usque fere rectis, apicem versus sensim arcuato-angustatis, superficie ubique sat dense, sed discum versus subtilius punctata, inter puncta majora subtilissime punctulata, elytrorum striis septem catenatim punctatis, omnibus completis, basin et apicem attingentibus, suturali tantum antice paullulum abbreviata, interstitiis planis vage punctulatis."

L. 6 mill.

Hab. Masai-land.

Pachycrœrus elegans, sp. n.

Oblongo-ovalis, parum convexus, supra viridi-cyaneus; thorace subviolaceo, nitente; pedibus obscure rufis; elytris striis omnibus completis; prosterno bistriato; mesosterno stria marginali integra.

L. 4¾ mill.

Oblong-oval, somewhat convex, elytra greenish blue, the thorax with a violaceous tint; the head feebly impressed anteriorly, finely and evenly punctulate, lateral stria not well-marked and ceasing behind the mandibles, transverse stria absent; the thorax somewhat arched at the sides, marginal stria ceasing behind the eye, punctured at the sides, punctures gradually becoming microscopic on the disk, scutellar fovea very small; the elytra—humeral, subhumeral, and dorsal striæ all complete, the fifth alone being evanescent just before the base, striæ crenulate, interspaces evenly and microscopically punctulate; the propygidium with rather large shallow punctures, sparsely set, and with two shallow posterior impressions; the pygidium, punctures much smaller, with a small fovea on either side at the base; the legs are obscurely red.

In outline this species resembles *P. histeroides*, Mars., especially in the form of the thorax.

Hab. Natal (Durban). Two examples, one in the South-African Museum.

Pachycrœrus puncticollis, sp. n.

Oblongus, parallelus, convexus, virescens; pronoto undique punctato, stria marginali pone oculos interrupta; elytris striis 1^a–4^m integris, 5^a dimidiata, 6^a subintegra; prosterno bistriato; mesosterno stria integra.

L. 4½ mill.

Oblong, parallel at the sides, convex, elytra brassy green, thorax faintly coppery; the head impressed anteriorly, sparsely punctured at the base; ocular stria continues along the epistoma, with a transverse line (which marks the suture) angulate in the middle, the angle pointing towards the mouth (the reverse direction to that in *P. Ritsemæ*, Sch.); the thorax wholly and evenly punctured throughout, marginal stria widely interrupted behind the neck; the elytra, striæ 1–4 complete, 5 dimidiate, apical, with a fovea at the base, sutural only shortened before the scutellum, all the striæ slightly crenulate; the propygidium and pygidium are punctured like the thorax.

This species is similar in size and facies to *P. cyanipennis*, Mars., but differs in the thorax being punctate before the scutellum, the prosternum being wider between the striæ, and the mesosternal stria is complete anteriorly.

Hab. Central Africa.

Eretmotus valens, sp. n.

Orbicularis, convexus, niger, nitidus, supra *E. Lucasi* simillimus,

sed differt pronoto distincte punctulato et elytris lateralibus leviter punctulatis.
L. 3 mill.

Orbicular, convex, black, shining; the forehead flat, obscurely punctulate, with the stria well-marked and passing laterally along the epistoma, which is not depressed like that of *E. Lucasi*, Mars.; the thorax convex on the disk, depressed at the sides, very finely punctulate; the elytra, striæ short, basal, nearly obsolete, punctulate, except on the disk; the propygidium and pygidium finely and evenly punctulate; the prosternum, striæ and the surface between them somewhat built up from the sides, with the keel or space between the striæ a little convex, the striæ are sinuous between the coxæ and the punctuation of the keel is stronger than that of *E. cirtensis*, Lew. (see Ann. & Mag. Nat. Hist., Sept. 1892, pl. xix. fig. 3); the last-named species, moreover, has a flat keel, with the adjacent lateral parts on a level with it.

Above this species is extremely like *E. Lucasi*, Mars., but beneath the prosternum corresponds more with *E. kabyliæ* and *cirtensis*.

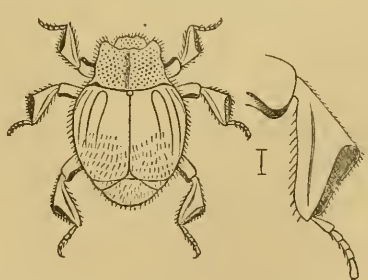
Hab. Bougie. I found a single example on the 30th April last in a nest of *Aphanogaster testaceopilosa*.

Sternocœlis acutangulus, Lew.

Sternocœlis acutangulus, Lew. Ent. Month. Mag. xxiv. p. 164 (1887); Ann. & Mag. Nat. Hist. ii. p. 146 (1888).

This species and *S. punctulatus*, Lucas, are peculiar in having the tibial grooves for the reception of the tarsi

Fig. 2.



markedly excavated. Figure 2 gives an outline of *S. acutangulus* and an enlarged drawing of the intermediate tibia.

Sternocœlis politus, Schmidt, 1888.

Having now a long series of this species I am able to say that *S. cancer*, Lew., is a large and mature form of *S. politus*, Sch., and that *S. Sedilloti*, Lew., is a small and colour variety also of the same species. I found all the varieties at Constantine this spring. Herr Schmidt's name has the priority of mine by a few months.

NOTOLISTER, gen. nov.

This genus is founded to receive *Sternaulax Edwardsii*, Mars., *Epierus imitans*, Lew., and *E. dux*, Lew., all from Madagascar. The essential characters are that the antennal *fossettes* are less open than in *Sternaulax*, the prosternum is truncate behind, and the mesosternum very feebly sinuous or straight, not emarginate; the tarsal grooves are straight and open on the outer side in the anterior tibiæ and the intermediate tibiæ are multispinose. In *Sternaulax* the tarsal grooves are deep and sinuous and the mesosternum emarginate. *Notolister* may be placed in the catalogue before *Epierus*.

Carcinops Blandfordi, sp. n.

Oblongo-ovalis, depressiuscula, nitidissima; capite thoraceque læte viridi-æneis; elytris purpureo-aureis; antennis piceis, clava flava.
L. $2\frac{1}{4}$ mill.

Oblong-oval, rather depressed, brightly metallic; the head and thorax brilliant brassy green, with the elytra of a rich golden purple hue; the head punctulate, punctures varying in size, with a small medial fovea before the neck; the thorax punctured like the head, marginal stria complete anteriorly, with a very distinct antescutellar fovea; the elytra, striæ 1–4 complete, 5 and sutural abbreviated at the base; the propygidium and pygidium golden green, punctured like the head; the prosternum, striæ sinuous in the middle and not meeting either before or behind; the mesosternum feebly and widely emarginate on the anterior edge, with a bisinuous stria along it. Beneath golden green; legs piceous, tarsi flavous.

This pretty species is at present the only brilliant *Carcinops* known.

Hab. Jamaica. Taken last year on the Blue Mountains by Mr. Maurice Blandford, after whom I have much pleasure in naming it.

Tryponœus singularis, sp. n.

Oblongus, rufo-piceus, nitidus; (♂) rostro apice reflexo in medio leviter carinato; thorace antice utrinque explanato; elytris macula media rufa, sparse punctulatis; prosterno plano, (♀) bistriato.
L. $4\frac{1}{2}$–$4\frac{3}{4}$ mill.

Oblong, pitchy red, shining, with anterior angles of the thorax, band before the base of the elytra, legs, and antennæ reddish brown; the male, snout reddish, obtuse, and distinctly reflexed, with a short median carina, lateral margins elevated, punctuation between the eyes very sparse; the thorax sparsely and irregularly punctulate, anterior angles arched and explanate outside the antennal fossettes, with a faint median impression behind the neck which reaches to the middle; the elytra punctulate like the thorax, with a rather broad yellowish-red band behind the base, band obscurely marked at the suture and on the outer margin, the apices of the elytra are also narrowly reddish; the propygidium and pygidium are rather closely and evenly punctured, the latter obtuse and hairy at the apex; the prosternum, keel flat, somewhat wide, and without striæ; the mesosternum obtusely acuminate anteriorly, with a complete marginal stria. The female: snout sparsely and faintly punctulate, apex emarginate and faintly impressed in the middle; the thorax much more distinctly punctulate than in the male, with the thorax scarcely explanate at the angles, and the apex of the pygidium very obtuse and feebly emarginate at the tip; the prosternum bistriate.

I believe the specimens described above are sexes of one species, which is a very remarkable one owing to the form of the thorax; and I do not know of any other species in which the prosternum is only striate in one sex.

Hab. Rio Janeiro (*Fry*, no. 4482). Two specimens in Mr. Fry's collection.

Chlamydopsis striatella, Westwood.

Byzenia formicicola, King, Trans. Ent. Soc. N. S. Wales, ii. pt. 1, p. 74, = *Chlamydopsis striatella*, Westw. Trans. Ent. Soc. Lond. p. 317 (1869); Thesaurus Oxon. 1874, p. 68, pl. iii. fig. 8.

Both these names were published in 1869, but Westwood's paper was published in August, while King only read his paper in November. King erroneously assigned the species to the Byrrhidæ.

Mr. Blandford having now published descriptions of the Japanese *Platypi*, I am able to give the names of the Japanese Histerids I found in their bores:—*Tryponæus fagi*, Lew., was feeding on *Platypus Severini*, Bland., and *T. venator*, Lew., on *P. calamus*, Bland.

XXVI.—*On* Micoureus * griseus, *Desm., with the Description of a new Genus and Species of* Didelphyidæ. By Oldfield Thomas.

In 1888 †, following the lead of previous writers, and, like them, without Paraguayan specimens for comparison, I identified Azara's "Micouré à queue longue" ‡, on which Desmarest's *Didelphys grisea* was based §, with the grey opossum of Minas Geraes and Rio Janeiro. This latter was named by Lund in 1841 *D. incana* ‖, a designation which, following the above identification, was naturally placed by me as a synonym of *D. grisea*.

In his work on Minas Geraes opossums Dr. Winge ¶ accepted my identification with a note of warning as to its having been based merely on Rio Janeiran and not Paraguayan specimens, and this warning proves to have been fully justified, for the British Museum has now received the skin of an opossum from Corrientes which, while obviously distinct from the Minas Geraes form, agrees far better with Azara's description than the latter does.

The specimen was presented by Mr. Thomas Perrens, and was collected by his brother Richard near Goya, on the Parana. The following is a description of it:—

* The subgenera of *Didelphys* admitted in the 'Catalogue of Marsupials' having been since used by several writers of eminence as full genera, it seems better, as they are unquestionably perfectly natural groups and no principle is involved, to sink my own opinion on the subject and to accept them as such. This course I have also adopted in the case of the groups of Cricetinæ, of which the majority of the American members were at one time joined, by American and European naturalists alike, into one genus "*Hesperomys*." If so joined, I still think, as formerly (P. Z. S. 1888, p. 133), that they should also be joined to *Cricetus*; but, split apart as they now are, they would all equally retain their own names, while *Cricetus* would again be used for Old-World forms only.

† Cat. Mars. B. M. p. 349.

‡ Quadr. Parag. i. p. 290 (1801).

§ Dict. Sci. Nat. xlvii. p. 393 (1827).

‖ Blik. Bras. Dyrev. Dansk. Afh. viii. p. 237.

¶ 'Jordfundne og nulevende Pungdyr fra Lagoa Santa,' p. 107; E Mus. Lundii, 1893.

Size rather less than in *M. murinus*. Fur very short, soft, and fine. General colour of the back soft mouse-grey, almost exactly similar to ordinary specimens of *Mus musculus*, a resemblance by which Azara was also struck. Instead of this colour, however, fading off gradually towards the flanks and there meeting the white of the belly, as in most species, it is sharply defined and separated from the white underside by a broad band of paler grey, which gives the species a quite unique appearance. The darker grey commences between the eyes, broadens out to cover the crown and back of neck, reaches its greatest breadth (about 20 millim.) in the centre of the back, and narrows again sharply and decidedly as it reaches the tail. The eyes are clearly ringed with black, as stated by Azara, while the continuance forward on to the frontal region of the pale grey lateral band causes the appearance of pale outer orbital rings, separated in the middle line by the darker median colour, an appearance which, admirably described by Azara, has caused much trouble and confusion to workers who have tried to fit his description on to other species. Ears large and leafy, uniformly grey; their anterior basal prominence little developed. Under surface from chin to anus pure sharply defined white. Shoulders slightly darker than the lateral pale band; front of forearm paler grey, upper surface of hands white. Hind limbs similarly coloured, the lower legs grey, the feet white. Tail long, naked except for its basal quarter inch; grey above for three fourths its length, the terminal fourth and the whole of the under surface white.

Dimensions (approximate) of the skin of a young specimen with $p.^4$ still in place :—

Head and body (apparently stretched) 105 millim.; tail 122; hind foot 14.

Skull: basal length (c.) 24; greatest breadth 14; interorbital breadth 4·1; nasals, length 10, greatest breadth 2·2; palate, length 13; combined lengths of $\frac{m.^{1-3}}{}$ 4·9.

The rediscovery of this pretty little opossum, of which, so far as I know, no naturalist has seen a specimen since Azara described it a century ago, is a matter of considerable interest, as it clears up a question which has puzzled many writers on the subject. The correspondence of Mr. Perrens's specimen with Azara's description is really remarkably close, as the dimensions agree exactly, the *Mus musculus*-like colour and texture of fur are present, and the puzzling outer pale rings round the eyes referred to by him are here produced by the division of the pale facial colour by the anterior extremity of the darker dorsal area.

Like Azara's, Mr. Perrens's specimen is young, having its milk-premolars still in position; and it is therefore to be hoped that he will obtain further and adult examples of this very beautiful little animal.

As to the affinities of the species, a comparison of its skull with those of other members of the group shows that it is really more nearly related to *M. elegans*, the Chilian opossum, than to *M. incanus*, as we should now call the Minas Geraes species, agreeing closely with the former in size and general form, and sharing with it the unique character of not having the nasals expanded posteriorly. In fact the only obvious distinction between the two skulls is the fact that the supraorbital edges of *M. griseus* are sharply square, even in the young specimen, and those of *M. elegans* are more or less rounded, at least up to an age considerably greater than that of the *M. griseus* now described. In external characters, however, the two are of course widely distinct.

DROMICIOPS, gen. nov.

General proportions much as in *Micoureus*. Ears short, hairy. Tail thick, incrassated at base, furry throughout (except just below extreme tip). Proportions of hind toes as in *Philander*.

Skull with a large rounded brain-case. Interorbital region broad, without ridges or postorbital processes. Broadest point of palate at front edge of $\underline{\text{m. }3}$. Bullæ very large, perfect, the posterior, petrosal, portion inflated as much as the anterior. Lower jaw with the anterior part of each ramus splayed outwards, and with an unusually short symphysis.

Teeth.—Incisors broad, spatulate; $\underline{\text{i. }1}$ more separated from its fellow of the opposite side than from $\underline{\text{i. }2}$. Canines very short, the upper one not reaching a line drawn from the tip of $\underline{\text{p. }4}$ to that of $\underline{\text{i. }1}$, and the lower one also scarcely higher than the last premolar. Two anterior upper premolars subequal, rather smaller than the posterior one; below, each premolar is slightly larger than the one in front of it. Molars more rounded than in *Micoureus*, and recalling, both in form and the curvature of their series, those of *Philander*.

This genus differs from all other opossums by the short furry ears, the thick and hairy tail, the perfect and doubly inflated bullæ, the shortened canines, and the peculiar form and positions of the incisors. In other ways it presents some points characteristic of *Philander* and some of *Micoureus*; and it is to this latter that I suppose it must be considered most nearly allied, although its differences are so great that, even were all the opossums still put in one genus, as formerly, its peculiar characters, and especially its doubly inflated bullæ, would nevertheless demand its generic distinction.

Dromiciops gliroides, sp. n.

Size and superficial appearance strongly recalling those of *Dromicia nana*, the Tasmanian Dormouse-Phalanger, a resemblance which has suggested the generic name. General colour above fawn-grey, the dorsal area decidedly darker than the sides. Face coloured as in *M. elegans*, that is, pale grey, with distinct black rings round the eyes. Ears short, rounded, their anterior basal prominence little developed; their backs covered basally with thick fur like that of the crown, and terminally with thin yellowish hairs; altogether they present a great contrast to the large and practically naked ears of *Micoureus*. Crown and nape of neck rufous brown or cinnamon, lighter on the sides of the neck, where the hairs have prominent subterminal white rings. Similarly on the sides of the body there is a large whitish patch just behind the shoulder, another in front, and a third just behind the hips, so that the whole animal, when viewed from the side, presents an alternation of light and dark areas, beginning with the whitish cheeks, followed in succession by a darker colour below the ears, then lighter on the sides of the neck, darker on the shoulder, centre of belly, and hips, each of these parts being separated by the lighter areas already mentioned. The dark of the shoulder is united above to that of the back, but that of the hips is separated by a narrow longitudinal light line passing approximately along the pelvic bones. These variations in colour are in no case very conspicuous or sharply defined. Belly dirty yellowish white, the grey of the bases of the hairs showing through. Outer sides of limbs and backs of hands brown; inner sides and backs of feet dull white. Soles with five very prominent transversely striated pads—a long one across the base of the hallux, three at the bases of the other toes, and a rather smaller postero-external pad. Terminal digital pads large, surpassing the claws, longitudinally striated. Tail very thick at its base and tapering rapidly and evenly to the tip, its basal third thickly clothed with shining fawn-coloured fur like that of the body; its terminal two thirds almost equally well clothed, but the hairs are straighter and nearly uniformly dark brown. Below, the hairs are brownish white throughout. The naked part of the tail is confined to a narrow strip about half an inch long on the underside of the tip.

Skull in its general form rather smooth and rounded, with a large rounded brain-case and short muzzle. Nasals expanded behind. Interorbital region broad, convex, scarcely flattened, its edges without beads or ridges; temporal ridges obsolete. Palate broad, the line of the incisors more semicircular than usual; anterior palatine foramina very short, only extending to the level of the back of $\underline{\text{i.}^{5}}$; broadest point of palate at the front of $\underline{\text{m.}^{3}}$ instead of at the back. Posterior nares broad, their mesial septum continued back some way as a narrow ridge along the base of the skull.

Teeth as described above.

Dimensions of the type (B. M. 92.5.9.3), an aged male, preserved as a skin:—

Head and body (c.) 126 millim.; tail (c.) 102; hind foot (damped and extended) 18; ear, from notch, 14.

Skull: basal length 26; greatest breadth 16·8; nasals, length 11·1, greatest breadth 4·4, least breadth 1·9; interorbital constriction 5·3; palate, length 14, breadth outside $\underline{\text{m.}^{3}}$ 10; palatal foramen 1·6.

Teeth: height of upper canine behind 1·3; horizontal length of $\underline{\text{p.}^{4}}$ 1·0; combined length of $\underline{\text{m.}^{1-3}}$ 4·6, of four lower molars 5·8.

Hab. Huite, N.E. Chiloe Island. "Taken in the fork of a large tree."

Coll. Dr. Robert O. Cunningham, H.M.S. 'Nassau,' May 20, 1868.

This interesting little opossum is that referred to by Dr. Cunningham, in his 'Notes on the Natural History of the Straits of Magellan' *, as *Didelphys elegans*, to which it has a certain superficial resemblance. The specimen was presented by him to Prof. Huxley, and in 1892 was given to the Museum by the latter's successor, Prof. G. B. Howes. The 'Catalogue of Marsupials' being finished, the skin was, on Cunningham's authority, put away as *D. elegans*, and it was only during the examination necessary in working out the first part of this paper that its striking characteristics were noticed.

* P. 362 (1871).

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

1. On the Ova and Young of *Hippoglossus vulgaris.*
2. On the Ova and Larvæ of *Gadus minutus.*
3. On the Ova and Larvæ of *Brosmius brosme.*
4. On the Ova and Larvæ of *Arnoglossus megastoma.*
5. On a Hermaphrodite Example of *Mytilus modiolus.*

1. *On the Ova and Young of* Hippoglossus vulgaris.

The ripe eggs of the halibut have hitherto escaped observation. The spawning-period, indeed, even in the case of Fishery Officers stationed where hundreds are landed monthly, is full of uncertainty, so much so that Dr. Fulton, in working up the returns in regard to reproduction, could come to no definite conclusion as to the spawning-period of this species.

Parnell was of opinion that the halibut spawned in spring. J. Couch, again, does not allude to the subject, though R. Couch, according to Day, gives April as the spawning-period. Buckland quotes the statement of Parnell, and adds that the roe is of a pale red colour and the ova numerous, a remark, however, that is applicable to many forms. Day adds nothing to the foregoing. Möbius and Heincke observe that the spawning-period occurs in spring, and state that Malm found on the Cattegat a ripe female on the 26th of April. Fulton, again, procured an advanced specimen, captured east of the Island of May, with the ovaries of a pinkish tinge, on the 18th of February, and others less advanced in June. The eggs in the former case were comparatively large, while in June they measured 1·27 millim. in diameter, but they were far from being ripe, as indeed were various specimens Dr. Fulton kindly forwarded to St. Andrews in May and June, 1891. No ripe example was seen amidst many hundreds from Iceland and Faroë on the pontoon at Grimsby about the middle of the latter month. About the beginning of May, 1892, Mr. Holt, who is carrying out important fishery work at Grimsby, kindly informed me that he had secured the fresh eggs of this species, and that they ranged from 3·07 to 3·81 millim. in diameter, were destitute of an oil-globule, and delicate to handle. The capsule had faint scribbled markings. The eggs collapsed and burst very readily, and he thought it possible that a large perivitelline space was formed after fertilization, as in the long rough dab. They are thus the largest pelagic eggs in our seas; indeed, Raffaele appears to have found none at

Naples over 3 millim. in diameter, though Wenckebach subsequently found one of 4 millim.

Immediately afterwards Dr. Fulton procured ripe eggs by the aid of Mr. R. Mackie, Assistant Fishery Officer, Peterhead, who removed them on the 27th April, 1892, from a fish which had been three days in a boat, which had been fishing on Bergen Bank, about 60 miles off the Fair Isle, and 150 miles E.N.E. from Peterhead. The specimen from which the ova were obtained weighed about 140 lbs., and the ovaries from 18 to 20 lbs. In other examples these organs have reached the weight of 28 lbs. The eggs had been preserved in a strong solution of picric acid, and had shrunk considerably, and the apparently mature were mingled with unripe eggs. The perfectly ripe eggs appeared to be nearly circular, and had a diameter of about 3·3 millim. Those less advanced, though fully 3 millim. in diameter, were more or less ovoid, as usual in unripe eggs; so far as could be ascertained, the comparatively thin *zona radiata* had the same structure as in other pelagic forms, and the external surface is marked by a series of fine creases or folds *. Many of the unripe eggs had a nearly uniform diameter of 1·9050 to 2·0574 millim. Other specimens were received from Dr. Fulton subsequently, and these had a diameter ranging from 3·4290 to 3·7619 millim., and before being immersed in sea-water resembled a slightly milky mass of young Salpæ, or boiled sago.

Mr. R. Duthie, Assistant Fishery Officer, Lerwick, whose zeal in such work deserves commendation, procured a fine series of perfectly ripe eggs on the 5th May, 1893, from a specimen 22 lbs. in weight and about 4 feet long, also captured on Bergen Bank. About half a gallon of ripe eggs was obtained from this fish. These fresh examples demonstrated that the *zona radiata* is of considerable toughness, as Capt. Dannevig also found in the Norwegian examples. Their diameter ranged from 3·0861 to 3·8 millim.

The ripe females of this species, therefore, have chiefly been met with towards the end of April or beginning of May. As in other forms the ripe males are often considerably smaller, some weighing less than 14 lbs., and they arrive at maturity somewhat earlier in the season than the females. It is probable that most of the eggs, which in a given season are ripened and shed in this and allied forms, grow to a size more or less uniform, but considerably less than the diameter of the mature egg; and that the subsequent increase to the

* The usual minute punctures occur all over the surface. The micropyle formed a simple orifice, of a slightly pinkish hue from refraction. No special arrangement of lines or pores surrounded it.

mature condition takes place more rapidly than the previous growth. Such is the general impression, though no exact observations have been made.

The halibut has thus one of the largest and most beautiful of pelagic ova; but since it has never been obtained in a tow-net, it is possible it may be less buoyant than the smaller eggs.

No fertilized ova having yet been obtained, the larval and the early postlarval stages are unknown. On the 28th of June, however, on Smith Bank, a well-known fishing-ground in the Moray Firth, a closely allied form, if not this species, was procured in the mid-water net along with young gadoids, gurnards, and pleuronectids. The total length is 9·5 millim. and the greatest depth 3·8 millim. It is distinguished by the thickness of the body (the depth of which, however, is comparatively moderate), by the character of the head, and the presence of branchiæ projecting behind the opercula. The thickness and firmness of the body and the condition of the branchiæ would lead to the conclusion that it is not a very young fish, yet the embryonic tail is still present. Before the young turbot reaches that length the condition of its tail is wholly different.

The head is characterized by its massive appearance. The eyes are lateral and of considerable size. The marginal fin is considerably injured, but it seems to have been of moderate depth, traces of true rays appearing both dorsally and ventrally, and especially in the caudal. The terminal curve of the notochord is pronounced but does not taper much, and the embryonic fin apparently forms a shorter lobe than in the other pleuronectids. The vent is situated a little in advance of the median line of the body, which, as well as the head, is speckled with minute blackish-brown points. Those chromatophores present on the abdomen have undergone considerable change, after immersion in spirit, viz. a spreading out of the marginal pigment, while a black speck is left in the centre. The chromatophores on the lateral region occur with some regularity. Indications of two pigment-touches appear in the marginal fin, viz. over the tip of the pectoral, and another about the centre of the post-abdominal region of the body. Ventrally a single patch is situated between the anus and the hypural region. The pigment invades the fin and thus resembles that in the pleuronectids generally. On viewing the dorsal edge from above, the cephalic and the two marginal touches, which extend on the fin, are best seen. Ventrally a little pigment over the abdominal surface and the patch in the anal fin are noticeable, while chromatophores are dotted round the anus. A few pigment-specks occur inside the abdominal cavity, as viewed from the ventral surface.

The thickness and elongation of the body suggest its relationship with the halibut, and it certainly contrasts strongly with young turbot, somewhat less in size, which were kindly sent for examination by Mr. Holt.

Specimens of very small halibut are extremely rare, apparently because they are found only in deep water near the great fishing-grounds, and because their mouths are too small to take the large hook used for the capture of the species. It is otherwise as soon as it exceeds a foot in length. The smallest examples hitherto examined at St. Andrews were obtained by a local trawler, the larger being a foot and the smaller a little less. On the 31st May, 1892, however, a specimen measuring 97 millim., or a little more than $3\frac{3}{4}$ inches, was procured at a depth of 105 fathoms about 80 miles from the coast of Norway, and about 220 miles from Aberdeen. It had been swallowed by a green cod. Its fin-formula is D. 97, A. 73 (?), caudal 19, pectoral 11, ventral 6, though it must be stated that digestion had considerably affected the fins.

The differences between this small example and that a foot long are the proportionally larger size of the eyes and their proximity to the anterior border of the snout, the smallness of the gape (the posterior angle of the mouth being somewhat in front of the eye, whereas in the larger it passes to the anterior fifth of the eye), and the maxilla is boldly marked. The arch of the lateral line behind the eye on the right is much more pronounced in the larger example, for in the smaller it is gently bent upward, and runs forward with a very slight declivity. On the left side the arch is more distinctly curved. Variations, however, are frequent in the larger examples. The caudal rays proceed from a nearly vertical line in the smaller, from a semicircle (*i. e.* a line convex backward) in the larger specimen. The opercular region also differs, but the gastric juice has affected the small example. The thickness and narrowness of the body are more or less diagnostic at this stage, which, if it pertains to the halibut, is probably about a year old.

2. *On the Ova and Larvæ of* Gadus minutus.

The eggs and larvæ of this species were briefly alluded to by Raffaele*, who stated that the arrangement of the pigment differed from that in the cod. Marion † likewise found

* Mitth. zoolog. Stat. Neap. Bd. viii. Heft 1, sep. Abth. p. 36, Taf. 1. fig. 25, and Taf. 2. figs. 20, 21 (1888).

† Ann. du Musée d'Hist. Nat. de Marseille, Zool. iv. p. 178, pl. 2. fig. 14.

both eggs and larvæ in the Gulf of Marseilles; while Mr. Cunningham * found the adults ripe in April, and the diameter of the eggs 1·02 millim., but he did not hatch them.

At St. Andrews the ripe ova fertilized at 9 A.M. on the 6th June were in the multicelled condition at 5.45 P.M. with a perivitelline space. Their diameter varied from ·9906 millim. to 1·0287 millim. On the 7th the embryo was outlined and the optic vesicles indicated. The eyes of the advanced embryos are silvery, their conspicuous condition being one of the marked features of the egg, and the body, yolk, and head have touches of yellowish pigment. A few were hatched on the 11th June, and the larva measured from 2·3 to 2·4 millim., and somewhat resemble the whiting. The eyes are silvery greenish, the entire head and body being dappled with minute yellow specks. Black chromatophores occur along the ventral border of the muscle-plates, the tip of the tail alone being free from them. A less distinct series runs along the dorsal edge, and a few finely branched specks occur on the head. The rectum terminates blindly at the posterior and upper part of the yolk. In the older larvæ the black pigment had increased along the dorsal and the ventral margins of the muscle-plates. The eyes are silvery by reflected, but have a gorgeous bronzed hue by transmitted light. The yellow specks, moreover, are less conspicuous; indeed in the oldest—that is, in the early post-larval stage (after the disappearance of the yolk)—this pigment appeared only on the cheeks.

Both eggs and larvæ are somewhat delicate, especially in warm weather.

3. *On the Ova and Larvæ of* Brosmius brosme.

The ova of the torsk have a diameter of 1·3335 millim., and are characterized by a zona furnished with a series of boldly marked punctures and a series of intercrossing lines or creases, somewhat like the brill or lemon-dab, and the presence of a large oil-globule of a pale reddish-brown hue under a lens, but pale red by transmitted light, and measuring ·2286 to ·2667 millim. in diameter. The micropyle resembles that of the haddock. They were fertilized in Shetland on the 21st May, and transmitted to the Marine Laboratory, where they were readily hatched. A feature of interest is the fact that the spermaries are comparatively small, even in a male of good size—reaching only from 2 to 3 inches in length, and having the form of small frilled cords. They thus differ

* Journ. Mar. Biol. Assoc. n. s. vol. i. p. 375.

from the male organs of most of the gadoids. The ovaries, on the other hand, are large.

On the fourth day (25th May) the blastopore was closing or closed, the optic vesicles formed, and a broad alar expansion extending outward on each side. A small perivitelline space is present.

Before hatching a greenish-yellow hue by transmitted light appeared on the head and on the tip of the tail. The larva measures about 4 millim., and is characterized by the large pinkish-brown oil-globule which is generally fixed at the posterior border of the yolk. In some the oil-globule, however, is freely movable, and by depressing the tail of the larva it glides forward to the middle of the yolk, while by elevating the head it mounts to the highest point, viz. the anterior border of the yolk. Nothing, indeed, could better illustrate the features formerly pointed out in regard to the movement of the oil-globule in the gurnard, and the passage of the brightly coloured globule through the yolk (not merely at the surface of the yolk as some imagine) was in this instance easily followed. The free condition of the globule was probably abnormal, but it is noteworthy.

The larval torsk is characterized by somewhat irregularly scattered chromatophores on the head, though the front view of the head *in ovo* shows that a more or less symmetrical series is present over each eye. The first patch or bar of finely ramose chromatophores on the trunk is placed rather behind the middle of the yolk, and it is rendered more conspicuous by the black pigment of the sub-notochordal region beneath. The next lies on the muscle-plates behind the vent, the last is at the tip of the tail, while a less definite one is intermediate. A slightly yellowish hue (greenish by transmitted light) pervades the head, yolk-sac, and the tip of the tail. The rectum is near the upper border of the marginal fin. The notochord is multicolumnar. The reddish oil-globule is situated at the posterior border of the yolk.

The changes which subsequently occurred may be summarized as follows:—increase of the greenish-yellow hue and the ramifications of the black chromatophores, increase of pigment in the eyes, which became greenish silvery, absorption of the yolk, and the gradual diminution of the reddish oil-globule, which has been drawn forward and almost concealed under the greatly increased black pigment of the upper region of the abdomen. The appearance of the embryonic rays in the tail was coincident with a more distinct yellowish tint of the marginal fin of that region, and the fan-like expansion of the black pigment of the tail. The larvæ are very hardy, and could readily be reared in suitable enclosures.

4. *On the Ova and Larvæ of* Arnoglossus megastoma.

The ova were procured from the fishing-grounds off Aberdeen in May, and, as Raffaele pointed out, possess a single oil-globule. They have a diameter of 1·1430 millim., and the oil-globule ·3048 millim. All are remarkably buoyant, and at an early stage of development possess a perivitelline space. The zona is distinguished by having elevated lines or ridges with very fine striæ between them, as in the brill and lemon-dab, and these ridges remain after hatching has taken place. The micropyle is sometimes situated in the centre of a radiate series of lines in a space bounded by other ridges. Development is comparatively rapid, so that on the fourth day the perivitelline space has considerably increased—from the diminution of the yolk, the tail of the embryo projects as far as the oil-globule, and its black chromatophores have commenced to ramify. The chromatophores under the oil-globule are minutely branched. The otocysts are formed, and faint pulsations of the heart are present. Some were hatched on the fifth day.

The larva possesses only black pigment somewhat uniformly scattered over the body, with a few specks on the head. They also occur both dorsally and ventrally in the marginal fin, and are V-shaped in the latter. The large oil-globule lies at the posterior and inferior part of the yolk, and in lateral views is somewhat elliptical. The notochord is multicolumnar. The solid strand of the rectum comes to the edge of the marginal fin, and a preanal portion of this fin occurs between it and the yolk. Two days afterwards a yellow pigment appeared amongst the black on the marginal fin and along the sides of the body posteriorly, but in some specimens, which were probably more normal in their emergence, yellow pigment was noticeable on the caudal region. The black pigment in the eyes was late in developing (fifth to sixth day). The mouth opens early, but the mandibular cartilages are less developed than in the gadoids, yet the aperture is proportionally large and the movements extensive. The canary-yellow pigment was conspicuous in the posterior part of the body in the oldest examples.

Briefly, then, the larva is recognized by the characteristic black chromatophores of the marginal fin dorsally and ventrally, the slightly elliptical outline of the oil-globule in lateral view, the pre-anal marginal fin, and the shape of the head.

5. *On a Hermaphrodite Example of* Mytilus modiolus.

In examining a series of 'horse'-mussels from Stream Sound, East Burra, Shetland, in February (5th), a specimen measuring $4\frac{1}{4}$ inches was observed to be peculiar. It had a somewhat small ovarian region chiefly developed in front of the posterior adductor, as far as the byssus, and of a tint less bright than usual. In front of the byssus the foot was enlarged and formed a somewhat crescentic elevation of a pale yellowish hue, with a free portion of the foot behind.

On section the ovary—extending, as just mentioned, as far forward as the byssus—presented numerous ova, but also a large amount of degenerating tissue and cells, with reddish-brown bodies and débris, as in the ovary of *Mytilus edulis* during the period of absorption after spawning.

The enlarged region of the foot showed a uniformly minute cellular structure, as in the testis of a male. The cells indeed closely agreed with the sperm-cells, only the mass seemed to have a larger amount of connective tissue.

The mussel had formerly received an injury to the left valve posteriorly, but it had been repaired.

XXVIII.—*Description of a new Siluroid Fish from Burma.* By G. A. Boulenger, F.R.S.

Macrones peguensis.

Depth of body $5\frac{1}{2}$ times in total length, length of head $3\frac{1}{2}$ times. Head $1\frac{1}{2}$ as long as broad, slightly granulate above; snout much depressed; diameter of eye 8 times in length of head, interorbital width 3 times; maxillary barbel reaching to middle of pectoral; mandibular barbels subequal, $\frac{2}{5}$ length of head. Vomerine teeth in a crescentic uninterrupted band. No separate interneural shield on the nape. Dorsal I 7; equally distant from end of snout and base of caudal; spine $\frac{2}{5}$ length of head, moderately strong, not serrated; adipose fin as long as dorsal, a little longer than anal. Anal 12. Pectoral spine $\frac{1}{2}$ length of head, strongly serrated on the inner edge; ventral reaching anus; caudal forked. Olive-grey above, white beneath; a series of blackish dotted lines cross the lateral line; dorsal and caudal fins dark, adipose fin blackish.

Total length 20 millim.

Closely allied to *Macrones planiceps*, C. & V., but distinguished by the much shorter barbels.

Two specimens from the Sittang River, near Toungoo; presented to the British Museum by Mr. E. W. Oates.

XXIX.—*New Pyrales from the Khasia Hills.*
By Col. C. SWINHOE, M.A., F.L.S.

[Continued from p. 149.]

Genus CHABULA, Moore.

19. *Chabula vedonalis*, sp. n.

♂ ♀. Coloured like *C. acamasalis*, Walker, and *C. telphusalis*, Walker, =*reniferalis*, Snellen; smaller but much darker than either, and the dark purplish-grey colour more uniform throughout; the first white spot on fore wings replaced by a white band across the wing, preceded and also followed by a slightly sinuous white line; the second white spot wedge-shaped and not reniform, broad on the costa, the point downwards, reaching down a little more than a third of the breadth of the wing, with a white line on each side which extend across the wing, meet together on the hinder margin one third from the angle, and are there joined by the second line, which curves along the hinder margin; cilia concolorous with the wings. The hind wings have the costal margin narrowly white, with three white streaks running downwards from it, all inside the nearly straight discal white line. On the underside the base of fore wings and all but the outer margin of hind wings are white; the bands and spots on fore wings same as they are above, on the hind wings there is a middle grey line.

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

Shillong and Cherra Punji. Numerous examples.

C. telphusalis, Walker, is very near *C. acamasalis*, Walker, but it seems to be a good species, the differences so distinctly described by Snellen being constant. I have received it in great numbers from the Khasia Hills. *C. vedonalis* is very distinct, and can at once be distinguished from both by its wedge-shaped outer spot on the costa of fore wings and by the absence of white on cilia at the angles.

Glyphodes terealis, Walker, from Borneo, also belongs to the genus *Chabula*, and is closely allied to the others, but apparently quite distinct.

Genus PAGYDA, Walker.

20. *Pagyda discolor*, sp. n.

♂. Palpi ochreous, with the hairs tipped with purplish brown; antennæ, head, body, and wings of a uniform grey colour, with a very slight purplish tinge. Wings with the lines brown, very straight; first line one fourth from base of costa of fore wings to the abdominal margin one third from anal angle; second commencing immediately below the lunular mark at the end of cell of fore wings and reaching anal angle; a straight streak from costa of fore wings one fourth from apex, and a submarginal line from below the costa near the apex towards the anal angle, which it does not reach; this line on the hind wings is slightly curved and corresponds to the shape of the outer margin, all the three lines crossing this wing are obsolete on the costal space, which is white; marginal line and anteciliary line brown, giving a double line to the margin; cilia whitish. Underside whitish, unmarked; fore legs with dark brown stripes and bands.

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

Cherra Punji. One example.

Larger than *P. salvalis*; lines similarly disposed; coloration very different.

Genus Botyodes, Guen.

21. *Botyodes maculalis*, sp. n.

♂. Palpi dark red-brown, white beneath; antennæ, head, body, and wings bright clear yellow, without, however, any gloss; abdomen with anal tuft black. Fore wings with a red-brown marginal band, narrow at the apex, bulging inwards opposite the cell and again on to the hinder margin, where it is broad, with a corresponding broad patch at the apex of hind wings; on the inner side of this patch and on both the curves on the fore wings is a dark brown suffused spot; both wings are covered with grey spots; a grey ringlet at the end of each cell; two grey spots within the cell of fore wings, the first forming with two spots below it the inner line; the outer line is also formed of similar spots almost straight across the wing, with a bend inwards before reaching the hinder margin: the hind wing has a central band composed of large spots joined together on the upper and lower portions of the wing with an outward curve of lunules; also a submarginal dentated line with grey points, and brown points between the veins close to the margin: cilia of fore wings brown, of hind wings grey, with pale tips. Underside paler, with the marginal band and some of the spots visible; legs white, fore legs with brown bands.

Expanse of wings $1\frac{8}{10}$–$1\frac{9}{10}$ inch.

Cherra Punji. Two examples.

The yellow coloration is clearer and brighter even than in

Meroctena tullalis, Walker, and except that the marginal band is not carried up broadly to the costa of fore wings, as in that species, the markings are very similarly disposed.

Genus Sylepta, Hübn.

22. *Sylepta nigriflava*, sp. n.

♂. Dark bright ochreous, body below and legs white. Wings with the spots and lines deep black; a spot at the end of each cell; exterior lines across both wings, interior line on fore wings only, these lines being composed of spots, the interior line on fore wings with a spot larger than the others in the middle, the line nearly straight, outer line curved outwardly and then bent inwards to a black spot below the cell-spot; on the hind wing the outer line runs down to a spot on the upper disk, from which it curves outwards and then inwards to another similar spot, and then to the hinder margin at two thirds. Underside duller ochreous, with some of the markings visible.

Expanse of wings 1 inch.

Cherra Punji. Many examples.

Wings shaped like *S. caldusalis*, Walker, but a smaller insect, much more brightly coloured, with ochreous cilia and deep black markings.

23. *Sylepta venustalis*, sp. n.

♂. Palpi brown; head, body, and wings dull ochreous, wings with the bands and spots pale black. Fore wings with an interior line from hinder margin at one third, curving round on to the costa near the base; a subbasal spot on the hinder margin (not always present), a spot within the cell, a larger spot at the end; a discal line of lunular spots joined together from costa at one third, curving inwards, then outwards, then bent inwardly to below the outer cell-spot and downwards to the hinder margin just beyond the middle: hind wing with the discal line with a straight, rather thick band running right through it, leaving the outwardly curved portion of the line only visible; both wings with marginal lunular thick line, with the extreme margin ochreous; cilia brown, tipped with white. Underside dull ochreous grey, most of the markings on the wings as above; body and legs white; fore legs with black bands.

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

Shillong and Cherra Punji. Several specimens.

A larger and stouter insect than *S. caldusalis*, Walk., with the lines and spots thick and prominent.

Genus Ceratarcha, nov.

♂. Fore wings elongate, narrow; costa straight till close before apex; apex prominent, subfalcate, outer margin concave below apex, bulging in the middle, concave below apex, and oblique towards anal angle. Hind wings with the apex prominent, the outer margin immediately below it slightly concave to the middle, thence straight, and at the anal angle rounded. Antennæ simple, three fourths the length of the fore wings; palpi broadly triangular, the second joint almost concealing the third, which is short and blunt and does not reach as far as the front of the second; tongue present; abdomen elongate, extending far beyond the hind wings; hind tibiæ with four spurs.

Type: *Ceratarcha umbrosa.*

24. *Ceratarcha umbrosa*, sp. n.

♂. Pale olive-grey, irrorated and striated with black atoms and short striations, which sparsely but evenly cover both wings. Fore wings with a small black spot within the cell and another below it; a large black spot at the end of the cell; some black marks on the costa near the base. Hind wings with a black spot at end of cell; a group of black irrorations clustered together like a short band alongside of it against the abdominal margin; both wings with a broad outer marginal brown band, limited by a recurved and deeply excavated black line of small spots, which are joined together and thickened on the hinder margin of both wings; in some specimens this band is opaque and nearly black, in others it is brown and studded with black irrorations like the rest of the wings; marginal line pale; cilia pale brown, interlined with dark brown. Underside pale olive-grey, with the cell-spots and irrorations prominent; body and legs olive-grey, legs with some brown bands.

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

Shillong and Cherra Punji. Many examples.

25. *Ceratarcha? clathralis*, sp. n.

♂ ♀. Palpi brown; antennæ, head, body, and wings pale luteous grey; antennæ with brown joints, thorax with a brown band in front. Wings sparsely irrorated with dark brown atoms: fore wings with an indistinct brown ringlet in the cell, another below it, and a more distinct and larger ringlet at the end of the cell; the irrorations somewhat clustered together in the middle of the wing, and a broad blackish marginal band, slightly curved and bulging inwards on the hinder margin, with a blackish line close to its inner margin: hind wings with a brown ringlet at end of cell, a blackish space at the apex, and a black marginal lunular line; cilia of both wings luteous, with a black macular line in it. Underside: body, legs, and wings whitish; wings with the ringlets at the ends of the cells distinct, and the marginal band grey with a short sinuous black band on its inner side; fore legs with brown stripes. The female differs from the male in having the marginal band only faintly indicated.

Expanse of wings 1 inch.

Shillong. One male and one female.

This species does not quite correspond in contour of fore wings with *C. umbrosa*; it has some affinity to the genus *Mimorista*, but at present I prefer leaving it here.

Genus Ravanoa, Moore.

26. *Ravanoa strigulosa*, sp. n.

♂. Palpi white, with a brown patch above towards the tips; body rubbed, but the abdomen has the anal portion ochreous, with a white band at the tip and a white and black band near the tip. Wings luteous white, with transverse brown bands, five on each wing, besides a thin marginal band; the cilia is long and is four-lined—luteous, brown, luteous, and brown,—making the wings look as if the marginal band was duplex and the cilia luteous tipped with brown; the transverse bands are nearly straight and at even distances, commencing near the base; on the fore wings the first two are complete, the third stops short of the costa near the commencement of the fourth, which only runs halfway down the wing, and also is connected along the costa with a short streak between the second and third; the fifth is submarginal and does not quite touch the hinder margin: the hind wing has a large ochreous patch at the anal angle, none of the bands touch the costa, and all run to the ochreous patch inclining towards the anal angle of the wing. Underside whitish throughout, with the bands faintly visible; fore legs with brown bands.

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

Shillong. One example.

Genus Charema, Moore.

27. *Charema subalbidalis*, sp. n.

Antennæ grey-brown; palpi dark brown, ochreous at the base on the underside; a small whitish space on the head at the base of the antennæ; rest of head, body, and wings above dark glossy brown, markings on fore wings very indistinct and only slightly darker than the wing-colour, consisting apparently of a cell-spot on fore wings, an inner line and a discal line, slightly recurved and bent inwards to the discal spot and then down to the middle of the hinder margin; cilia concolorous with the wings. Underside whitish, with cell-spot and discal line on fore wings distinct, and a cell-spot and discal recurved line on hind wings, with a spot at the end of each curve; this line is not visible above; legs and body white.

Expanse of wings 1 inch.

Shillong and Cherra Punji. Many examples.

The wings are broader and rounder than is usual in this genus.

28. *Charema fuscipennis*, sp. n.

♂. Antennæ reddish grey; palpi blackish brown; head, abdomen, and wings of a uniform dark dull brown. Fore wings with a dark brown spot in middle of cell, a lunule at the end; interior and exterior lines dark brown, indistinct, the latter bent outwards on the median vein, then curves inwards to the bottom of the cell-lunule, then downwards to the middle of the hinder margin. Hind wings with a discal lunule, a discal line with a similar outward bend in its centre; some indistinct black lunular points on the outer margin of both wings; cilia concolorous with the wings, with a pale basal line. Underside with the wings as above, but slightly paler; legs blackish brown, tarsi and body whitish.

Expanse of wings 1 inch.

Shillong and Cherra Punji. Many examples.

Transverse lines much as in *C. analis*, Snellen, = *albociliata*, Moore; the wings, however, are not so long nor so pointed, and the cilia brown, and not white as in that species.

29. *Charema carbonalis*, sp. n.

♂. Palpi black, white beneath; antennæ, head, body, and wings black; abdomen with a thin white band at the base and with the segments in fresh specimens marked with white. Fore wings with a deep black spot at the end of the cell and a black indistinct smaller spot within the cell; both wings crossed by a rather broad, nearly straight, and fairly uniform deep black band, which is discal on fore wings and medial on hind wings; the space outside the band with a bronze-like gloss upon it; anteciliary line pale; cilia black, tipped with grey. Underside much paler than above, with the cell-spot, transverse band, and outer bronzy gloss distinct; body and legs white, hind tibiæ black.

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

Cherra Punji. Four examples.

30. *Charema annubilata*, sp. n.

♂. Palpi, head, body, and wings dull purplish black; abdomen with pale segmental lines; spots and lines on wings black; a spot at end of each cell. Fore wings with a dot within the cell, an outwardly curved interior line just inside this spot; an exterior thick line, rounded from the costa to vein 2, where it bends inwards, and then straight to the hinder margin at two thirds, and is continued across the hind wings nearly in the middle, with an outward curve in its centre; marginal points black: wings grey, interlined with black. Underside of a uniform pale grey, brown dots at the end of each cell and an outer line across both wings composed of brown dots; body and legs whitish.

Expanse of wings 1 inch.

Cherra Punji. Many examples.

In some specimens the costal margin of the fore wings is slightly ochreous.

31. *Charema pernitescens*, sp. n.

♂. Palpi, antennæ, head, body, and wings above ochreous grey; wings with a shining cupreous tinge, with the outer borders broadly suffused with dark grey. Hind wings with the basal half of the costal portion whitish; spots and lines dark grey, a spot at the end of each cell. Fore wings with the interior line nearly straight, the exterior line with a small curve outwards in its centre, then deeply bent inwards below the cell-spot, then nearly straight to the hinder margin at its middle. Hind wing with a central line, rather indistinct, with a small outward curve in its middle; the hind wings are very slightly paler in colour than the fore wings; cilia grey, with a whitish basal line, grey towards apex of fore wings. Underside: wings paler, glossy, with markings as above; body and legs whitish, fore legs with brown bands.

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

Cherra Punji. One example.

Genus Cyclarcha, nov.

♂. Fore wings elongate, narrowed at base; costa straight but rounded towards apex, which is blunt; outer margin curved, hinder margin somewhat convex; palpi slender, rather long, upcurved in front of face; tongue long and slender; antennæ pubescent; hind tibiæ with two pairs of spurs, the inner one three times as long as the outer, scaling smooth and glossy, the veins all pale and the intervals dark.

Allied to *Denterarcha*, Meyrick.

Type: *Cyclarcha atristrigalis.*

32. *Cyclarcha atristrigalis*, sp. n.

♂. Palpi, antennæ, head, body, and fore wings of a uniform bright ochreous colour. Fore wings with black streaks in the interspaces, two along the costa, and the rest forming two broad bands across the wing—the first antemedial and straight, the second postmedial and outwardly curved. Hind wings paler, with a grey shade on the outer margin; cilia of both wings ochreous, with white tips. Underside pale ochreous; fore wings with the bands faintly visible; fore legs with black stripes.

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

Cherra Punji. Many examples.

33. *Cyclarcha flavinervis*, sp. n.

♂. Palpi ochreous, brown above, thicker and stouter than in *atristrigalis*; antennæ, head, and thorax dull ochreous; abdomen smoky brown, with an ochreous tip. Wings smoky brown: fore wings with the apex, costal margin, and all the veins ochreous throughout, and an ochreous mark at the end of the cell: hind wings with the veins distinct, giving this wing also a somewhat striped appearance; cilia of both wings ochreous. Underside: body, legs, and wings ochreous grey, fore wing with a smoky suffusion in the interior portions.

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

Cherra Punji. Many examples.

Genus Nagia, Walker.

34. *Nagia flavispila*, sp. n.

♂. Antennæ grey; palpi dark brown, ochreous grey beneath; head, body, and wings of a uniform dark purplish brown. Both wings with a large subquadrate ochreous-white spot across the wing; at the end of the cell in the fore wing there is a small similarly coloured spot near the hinder margin at its middle, and on the hind wings the spot has an outward curve in its centre; cilia concolorous with the wings, with a pale basal line. Underside much as on upperside, but the spot on hind wings forms a band from the costa to near the abdominal margin.

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

Cherra Punji. Two examples.

Allied to *Nagia quadrimaculalis*, Kollar, = *desmialis*, Walker; is much smaller, has the four large spots differently shaped, and the cell-spots absent.

35. *Nagia incomitata*, sp. n.

♂. Palpi brown, ochreous grey beneath; top of head ochreous grey; body and wings of a uniform dark purple-brown, except on the basal half of the costa of hind wings, which is whitish. Fore wings with a large central luteous white spot, deeply excavated on its upper outer side. Hind wings with a large nearly round similar spot; cilia of both wings concolorous with the wings, with a pale basal line. Underside: body and legs whitish; wings paler coloured than they are above, the basal portion of the hinder margin of fore wings whitish; spots as above.

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

Shillong. One example.

Between *quadrimaculalis* and *flavispila*, but quite different to either.

Genus Prorodes, nov.

Antennæ of male quite simple except at base; basal joint enlarged, second joint thickened and swelling in front, leaving a hollow between the joints, as in *Coptobasis*: labial palpi large, three times as long as the head, porrect and smoothly scaled, third joint nearly as long as second, bluntly oblong, and slightly inclined upwards; maxillary palpi shortly porrect above labial; tongue present. Fore wings more than twice as long as broad; costa straight, curving towards apex; apex distinct, outer margin obliquely curved. Hind wings with outer margin curved and both angles rounded. Abdomen long, reaching far beyond hind wings; scaling dull.

Type: *Prorodes mimica*.

Distinguished from *Coptobasis* by the palpi being quite differently shaped, and herein somewhat resembling *Anthæretis eridora* of Meyrick.

36. *Prorodes mimica*, sp. n.

♂ ♀. Palpi, antennæ, head, body, and wings above brown, with a slight purplish gloss. Wings with the spots and lines white: fore wings with a small spot in middle of cell, a larger spot at the end, another of equal size (sometimes larger) below it; inner line indicated by the spot in middle of cell and an indistinct spot on the hinder margin at one third; outer line commences with three largish lunules below the costa at one third from apex, followed by a few small dots in an outward curve, and two or three dots down to the hinder margin after the usual bend inwards, which sometimes can be traced: hind wing with the outer line as on fore wings, except that the lowest spot is only left of the three subcostal lunules; a dot at end of cell; cilia coloured like the wings, with a whitish basal line and pale tips. Below, wings paler, more glossy, markings much as above; body and legs whitish; fore legs with brown bands.

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

Shillong and Cherra Punji. Many examples.

The female only differs from the male in having the lines and spots finer; some of the well-marked males closely resemble *Coptobasis luctuosalis*, Guen.

Genus ORPHANOSTIGMA, Warren.

37. *Orphanostigma fulvistriga*, sp. n.

♂. Palpi brown; antennæ, head, body, and wings ochreous grey, the wings suffused with darker grey on the outer portions; costal portion of hind wings whitish. Wings with the lines fulvous; a mark of the same colour across the end of cell of fore wings; both wings with interior and exterior thick even lines, the former slightly curving outwards from costa of fore wings, rather close to the base of the hinder margin at one fourth, then on to the hind wings beyond the costal white portion almost straight to the anal angle; the outer line evenly curved outwards from the costa of fore wings at one fourth from apex, bends inwards abruptly to the cell-spot, then straight to hinder margin at the middle, and is continued on the hind wings straight towards the anal angle, terminating at vein 2; marginal border dark grey; cilia interlined, being ochreous grey, brown, and then white. Underside whitish; a dot at the end of each cell and discal line evenly curved on both wings; body and legs white.

Expanse of wings 1 inch.

Shillong. Two examples.

Genus ÆDIODES, Guen.

38. *Ædiodes ciliata*, sp. n.

♂. Deep black, very uniform in colour; antennæ white at the tips; frons with a white line on each side; abdomen with a white band near the base and another one third from the tip. Wings with large white spots: fore wings with one just before the middle and another, larger, on the upper disk; hind wings with one subbasal, touching the abdominal margin, and another of about the same size on the disk; cilia of both wings black, with white tips at the apex of fore wings and a white spot at the hinder angle. Underside: wings as above; abdomen white, with two black bands; legs black; tarsi white, with black bands.

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

Cherra Punji. One example.

Genus TRICHOPTYCHODES, nov.

♂. Fore wings narrow, elongate; costa straight for three fourths, then convex; apex blunt, outer margin rounded. Hind wings twice as broad as fore wings; the outer margin nearly straight, abdominal margin distorted from base to outer margin, raised above and hollowed below, the raised upper surface being clothed with a bed of dark hairs. Antennæ lamellate; palpi upcurved in front of face; hind tibiæ with four spurs, the upper inner one five times as long as the outer one.

Type: *Trichoptychodes delicata.*

39. *Trichoptychodes delicata*, sp. n.

♂. Palpi grey, pure white at the tip; head, body, and wings white. Fore wings with the basal third pale fulvous, tinged with orange colour, with a short white streak from the costa near its end, rather more than the outer third of the same orange colour, intersected by three short white streaks from the costa, two from the outer margin, and one from the hinder margin, where there is a blackish space or patch. Hind wings with a broad blackish suffused marginal band, which does not quite touch the white outer margin, is irregular on its inner side, and does not reach the anal angle; abdominal margin with a patch of black hairs. Underside white, with the marginal bands and streaks visible; body and legs white.

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

Cherra Punji. Four examples.

Genus AGROTERA, Schrank.

40. *Agrotera discinotata*, sp. n.

♂. Palpi brown, antennæ grey; head, body, and basal two thirds of abdomen golden yellow, marked with golden red, the abdomen striped with that colour on the segments; the anal third grey, with two red-brown segmental bands. Fore wings grey, with a yellow lunule at end of cell ringed with red; the basal fourth of the wing of that colour, marked with golden red; a black suffused patch in the disk, which includes the cell-lunule; the exterior line thin and black and wavy. Hind wings pale grey, with the exterior line indistinct and some black marks in the disk; marginal line of both wings black; cilia grey, partly interlined with darker grey and partly tipped with the same colour. Underside whitish, without any markings.

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

Cherra Punji. One example.

A very beautiful little insect.

Genus Antigastra, Led.

41. *Antigastra longipalpis*, sp. n.

♂. Palpi brownish above, white beneath; head, thorax, and abdomen white, with brownish sides. Wings thinly clothed, dull sordid grey, nearly white in parts, with some pure white flecks between the veins, which are brownish, the vein-lines being thick and entire on fore wings, more or less obsolete on hind wings (which are nearly white and nearly semihyaline), especially towards the basal and lower portions of the wing; in some specimens the hind wings are without any indications of the brown vein-lines; there are also some brown and some blackish short streaks between the veins on the fore wings, and in some specimens the interspace between veins 5 and 6 is filled with brownish; antennæ and legs grey.

Expanse of wings 1 inch.

Shillong and Cherra Punji. Many examples.

Genus Pleonectusa, Led.

42. *Pleonectusa planalis*, sp. n.

♂. Palpi dark brown, grey beneath and at the tips; antennæ, head, body, and wings of a uniform dark lilac-grey; thorax with a white mark in front. Fore wings with a brown lunule at the end of the cell, an outwardly curved inner line at one fourth, and a uniform outer brown line commencing at one fifth from costa of fore wings, curving uniformly almost to the shape of the outer margin to the hinder margin of the wing at two thirds, and then nearly straight across the middle of the hind wing; anteciliary line pale, cilia grey.

Underside grey; spot at end of cell and outer line pale brown, the latter composed of spots; body and legs whitish.

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

Cherra Punji. One example.

The apex of the fore wings is rounded, and not acute, as is generally the case in this genus; there are indications of a spot within the cell, but it is nearly obliterated by the inner line; the outer line is somewhat as in *P. adhæsalis*, Walker.

Genus Ambia, Walker.

43. *Ambia instrumentalis*, sp. n.

♂. White; palpi grey at the sides; thorax grey in front. Fore wings with some grey suffusion on the basal portion, with pinkish ochreous uniform straight bands—one subcostal, extending from near the base, connected with the costa by a short band, to the costa near the apex, where it bends up; another from near the base runs along the wing below the median vein to near the outer margin, then straight up submarginally to the costa near the apex, outside the termination of the other line, and is then joined to the apex by a small loop; also a third band runs just above the hinder angle, where it is also curved up for a small space on the outer margin. Hind wings with a broad suffused brown median band. Underside as above.

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

Shillong. One example.

A very pretty little insect; there are examples of it from Assam in M. Ragonot's collection.

Genus Nymphula, Schrank.

44. *Nymphula nigriplaga*, sp. n.

♂. Palpi brown, grey beneath, ochreous white at base and tip of last joint; antennæ, head, thorax, and wings black, with a pinkish tinge; abdomen pinkish ochreous. Fore wings with the costal space above the subcostal vein paler; two round white spots of equal size below and touching this vein, one at the end and one a little beyond it. Hind wings with a rather large white lunular spot at the end of the cell; both wings with an even pinkish ochreous marginal border, margined inwardly by a black line, on the inner side of which is an irregular pure white thin band; marginal lunules black; cilia grey, interlined with black. Underside: body and legs whitish; wings pale, whitish in parts, with the marginal bands and spots on fore wings visible.

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

Cherra Punji. Two examples.

Much resembling *Nymphula irisalis*, Walker, from Sierra Leone.

Genus CYMORIZA, Guen.

45. *Cymoriza albicomma*, sp. n.

♂. Reddish ochreous, suffused in parts with brownish. Wings with a small white spot ringed with black at the end of each cell: fore wings with a white comma-like mark from costa one third from base; a short white band from costa one fifth from apex to the middle of the wing; a short thin white streak inwards from this band near and parallel to the costa; another similar streak lower down, which runs into the cell-spot; a submarginal white line, which curves inwards above the hinder margin and is here thicker, also a fine marginal white line; all these white lines, bands, and streaks are bordered on each side with black, the black line on the inner side of the marginal white line being composed of black lunules: the hind wing has the white band from the costa near the apex and the submarginal and marginal lines similar to those on the fore wings, except that the submarginal line stops before reaching the anal angle.

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

Shillong. One example.

The fore wings are marked somewhat like *Ambia locuples*, Butler.

XXX.—*Development of the Lungs of Spiders.* By ORVILLE L. SIMMONS *.

[Plate VI.]

ALTHOUGH several persons † had suggested the close affinity of the Arachnids and *Limulus*, it was not until the appearance of Lankester's paper "*Limulus* an Arachnid" (1881[b]) that the view of such a relationship came into prominence. Since that date it has attracted more and more numerous advocates, until now the majority of the special students of

* From the 'American Journal of Science,' August 1894, pp. 119–128.

† Straus-Durckheim (teste Lankester), van Beneden (1870).

Arachnids and Xiphosures recognize the close relationships of the two groups. One of the special homologies insisted upon by Lankester was that existing between the lungs of the Arachnids and the gills of *Limulus.* But to explain the differences between these organs—the one being an internal air-breathing structure, the other an external apparatus for aquatic respiration—several hypotheses have been advanced, all based upon conditions existing in the adult.

At first Lankester evidently shared the common view that tracheæ were homologous structures throughout the Arthropoda, and so he sought for traces of them in *Limulus.* In his article "On Stigmata in the King-Crab" (1881[a]) he announced that he had found traces of stigmata. The position of insertion of each thoracico-abdominal muscle is marked by a deep funnel-like depression of the integument, which from the external surface appears as a stigma.

Later, in his paper "*Limulus* an Arachnid" (1881[b]) he formulates an hypothesis to show how the gills of *Limulus* and the lungs of *Scorpio* (taken because more primitive than Spiders) could have been derived from a common ancestor, which he describes as being an aquatic form, breathing by book-like gills. To derive *Limulus* from such a form would involve only a few changes in dimensions and other unimportant points. To obtain the condition occurring in *Scorpio* he assumes that the cup-like depressions behind the appendages, as seen in *Thelyphonus*, became deeper and larger, finally engulfing the whole appendage. The walls then gradually extended over the cavity, leaving only a slit for communication with the exterior. As change of habits went on this slit was closed up, and another slit, still within the area formed by the closure of the primitive opening of the cave of invagination, was formed. Air would enter by this slit, where in *Limulus* and the early Scorpion ancestors there was blood-space. Thus a blood-space has been changed to an air-space. In the same way an air-space (that of the investing sac) has been converted into a blood-space. The atrophy of the muscles which move the gills in *Limulus* and similar forms was considered very essential to this theory. The difficulties involved in the changes of blood- and air-spaces were so considerable as to prevent the acceptance of this hypothesis.

Later Lankester (1885) put forth a new theory. Because of discoveries concerning the muscles (veno pericardiac) of *Scorpio*, as well as on account of the insuperable difficulties of his previous view, he gave up his old and advanced a new hypothesis. In the latter the common ancestor is assumed to have had six pairs of mesosomatic appendages, of which five were lamelligerous. These latter in *Scorpio* became smaller and served only for respiratory organs, soon becoming air-breathing. The four hinder pairs took a "trick" of growth, viz. an invagination of the appendages, beginning at their distal ends, so that they grew into the scorpion's body, turning their outside in, just as a glove may be turned wrongside out, beginning at the ends of the fingers. Thus the appendages would be tucked into the blood-sinus instead of growing out normally. The blood-sinus would become a venous sac around the appendage. He explains the "trick" of growth by the least-resistance theory—the pressure being exerted on the embryo before it leaves the mother.

J. MacLeod (1882 and 1884) sets forth an hypothesis by which he develops Scorpions and similar forms from a *Limulus*-like ancestor. His first proposition is that the abdomen of *Limulus* be considerably elongated without other change. This would cause the imbrication of the members to cease—each appendage would stand out by itself although closely following each other. Then suppose that the sternal plate increase in size and unite with the ventral surface of the abdomen. Thus the gill-book cavity would be entirely filled up by the sternal plate except in those cavities on the ventral side which contain the gills or lungs, now greatly reduced in size. In this condition the lungs are quadrangular plates, attached by two edges only. Inserted on each plate is a number of lamellæ which are attached by one side only. In this condition when removed from the water the lamellæ would cling together and be imperfectly in contact with the air. To be of service the lamellæ would have to unite their lateral edges to the plate, leaving only the posterior edge free. Thus MacLeod developed the lamellæ and other structures of the lungs of Arachnida. By a comparison of structures in the adult form MacLeod came to the conclusion that the tracheæ of Spiders are developed from the lungs.

J. S. Kingsley (1885 and 1893) advances a much simpler explanation to account for the transition from a *Limulus* gill-book to the lung-book of a spider or scorpion. By a sinking-in of the whole appendage bearing the gill-leaves and an increase of the inpushings of the integument and a decrease in the outgrowths the whole matter is explained. This involves a diminution of growth on the anterior side of the appendage and an increase of growth on the posterior side. These conditions would carry the appendage within the body-wall, where it would be situated as seen in the adult—the spiracle at the posterior end of the lung-cavity and the lamellæ projecting toward the posterior end of the body. As Kingsley states, viewed from a histological standpoint, the description of the pulmonary organ of the spider or scorpion applies, almost word for word, to the gill-book of *Limulus*. He believes that the lungs of spiders are the primitive and the tracheæ the derived structures. The tracheæ of the Hexapoda have no relation to the tracheæ of spiders, having an entirely different origin.

Malcolm Laurie (1890), in his article on "The Embryology of a Scorpion," thinks the lung-books are undoubtedly comparable to the abdominal appendages of *Limulus*, but hesitates to decide which of two propositions he advances is the correct one. He inclines towards the view that the lung-books of Scorpions are invaginated, *i. e.* the edge of each lamella in the *Limulus* gill-book corresponds to the interior fold between the lamellæ in the Scorpion lung-book. He imagines that he sees difficulties in explaining his second proposition, which states that the whole appendage has sunk without invagination into a cavity in the abdominal surface. By either proposition the air-space of the primitive condition would be air-space in the derived condition.

On the other hand, many comparative anatomists, recognizing the homologies pointed out years ago by Leuckart as existing between the lungs and tracheæ of spiders, and believing that these last were the homologues of the structures known by the same name in the Hexapods, have failed to recognize the cogency of the reasoning of the advocates of the Arachnidan affinities of *Limulus*. Thus Arnold Lang, in his 'Lehrbuch der vergleichenden Anatomie' (ii. Heft, p. 548, 1890), writes that the respiratory organs of Arachnoidea are tracheæ—tubular and book-like tracheæ. His view of the morphological signification of the latter is that they are modified tracheal tufts which, standing close together, have been flattened into hollow plates. He believes that the view of those who would bring the gill-books of *Limulus* and the lung-books of Scorpions and similar types into close relationship is artificial and unsupported by comparative anatomy and ontogeny.

So, too, Bernard (1892), in 'The Apodidæ,' says it is easiest to believe that the lung-books of the various forms are only a specially concentrated arrangement of tracheal tubes. He regards the tracheæ, including the lungs of all "Tracheates," as having their origin in dermal glands which have gradually been modified for respiratory purposes. He also states that in considering the relationships of these various forms the limbs are of so little importance that one might almost be tempted to leave them out of account. In a later paper on the Chernetidæ Bernard (1893) repeats in substance his earlier views.

In a word, these authors, regarding the tracheal form of respiration as the primitive—a premise which the observations of Moseley on the tracheæ of *Peripatus* seemed to render valid —have looked upon the air-tubes of the Arachnids as the primitive and the lungs as the derivative condition.

The question thus brought into prominence can only be settled by tracing the development of the respiratory organs of the Arachnida. Several authors have touched upon this question. Thus Locy (1886) describes the later stages of *Agelena nœvia* as follows:—The lungs arise as a pair of extensive invaginations. In sagittal sections they appear as oblong plates of cells with the nuclei in parallel rows. These nuclei are flattened on one side and convex on the other. The cells of two adjoining rows unite by the edges toward which the convex sides of the nuclei project, and thus a lamella is formed. Later the nuclei of adjoining cells fuse, forming protoplasmic pillars, between which are the blood-lacunæ. Around each lamella is a chitinous membrane—the ventral and the dorsal being continuous at the free (posterior) end of the lamella. The cells of the ventral wall become arranged into two distinct layers. A part of the development described takes place after the hatching of the egg.

A. T. Bruce (1886–87) says that a lung-book of a spider may be regarded as an involuted appendage or appendages. He noticed that the abdominal appendages become less conspicuous and that slight folds appear on their *anterior* faces. He did not observe all the stages, and, judging from his text and figures, it is very evident that he was confused in some of his interpretations. K. Kishinouye (1890) states that in the basal part of the first abdominal appendage there is an ectodermic invagination, not deep or large. The wall of this pocket which faces the distal end of the appendage is thicker and its cells become arrranged in parallel rows. Two of these rows, adhering to each other, produce a lamella. He confirms Locy's description of the later stages. On the second abdominal appendage is another ectodermic invagination—a deeply invaginated tube which remains in about the same state of development until after hatching. The appendage shortens, but is not invaginated. He believes it is very probable that the lungs were derived from the respiratory apparatus of some *Limulus*-like aquatic form. He thinks that tracheæ are modified lungs.

Laurie (1890), beginning with his stage K, describes the changes in the abdominal segments of the Scorpion. At this stage the pectinæ and lung-book appendages are about equal in size and structure. In stage L the pectines have become folded in a direction transverse to their axes. The other appendages are pushed in, forming little cavities (directed forward) on the posterior sides of the appendages. In the stage M the pectines are separated from the body-wall at their distal ends. The lung-book inpushings are deeper and the cavities are divided up by lamellæ. In the last stage described (just before hatching) the pectines and lung-books have much the same structure as in the adult.

Morin (1888) * states that the lungs of the dipneumonous spiders arise in form of infoldings at the bases of the two appendages of the second abdominal segment. At the anterior end of the sac on the dorsal side is an infolding, which is the beginning of the lung-leaves. The space between two leaves connects directly with the body-cavity. Two adjoining leaves unite by the fusing of cells, as described by Locy. He agrees with Locy as to the later stages. Morphologically the lungs of Arachnida show great resemblance to the gills of *Limulus* and similar forms. He emphasizes the position of the infoldings on the posterior side of the appendage in both cases. The lungs of spiders are merely sunken gill-books of *Limulus*. As the appendage sinks the stigma is left as an opening between the posterior wall of the appendage and the body-wall. This author agrees with those who believe that tracheæ are modified lungs.

It must not be forgotten that Elias Metschnikoff (1870) described some features of the lungs of the Scorpions; but it is not easy to understand either his text or his figures beyond the fact that he states that the lungs develop behind the abdominal limbs.

As will be seen from the foregoing summary, the development of the respiratory organs of the Arachnids has not been followed throughout, and the gaps in our knowledge are at just the most critical points. To supply these deficiencies the investigations described below were undertaken.

The work was done in the Biological Laboratory of Tufts College. The eggs used were those of *Agelena nævia* and *Theridium tepidariorum*. The eggs were killed in water heated to 80° C. and hardened in alcohol, beginning with 50 per cent. The staining was usually *in toto* with alum cochineal. The sections described, unless otherwise specified, are sagittal.

* As summarized by Korschelt and Heider (1892), pp. 604–607. I cannot refer to the original text.

In the first stage studied, corresponding in general to Locy's fig. 6, somite VII is cut off from somite VIII. Somites VIII and IX are still united (Pl. VI. fig. 1), and the unsegmented mesoderm extends further back. The ectoderm is a single layer deep, except a portion over somite VII (possibly the incipient foundation of an appendage) and between VIII and IX. The infolding of ectoderm shows the first differentiation of external segmentation.

In the next stage (fig. 2), which is about midway between Locy's figures 6 and 7, the second abdominal somite is differentiated, and to a less extent the line between somite IX and somite X, which has developed, is marked off. The ectoderm has become thickened from somite VII to somite IX. It is to be noticed that the cœlomic pouches are flattened in all except somite VIII.

The succeeding stage (fig. 3) shows the same features carried still further. The XI somite has appeared. This stage corresponds to Locy's figure 7 or a stage a little earlier. I may note here that I have found at least as many cœlomic pouches as are described by Kishinouye in his "Note on the Cœlomic Cavity of the Spider," 1894.

After the stage just mentioned the appendages begin to be formed; no detailed account need be given of the external appearance of these, as in the main my observations are but the repetition of those of various authors, from Claparède to Kishinouye. They grow out, one on either side of somites VIII–X, as rounded knobs.

Pulmonary Organs.

In figure 4, which represents somites VII and VIII, the early appearance of the appendage is seen. In somite VII the cœlome is already greatly reduced, and no trace of an appendage is to be seen. In the next somite (VIII) the appendage is plainly visible. It is marked off from somite VII by a slight groove, while the groove separating it from somite IX is deeper and directed forward, giving the limb a markedly backward direction, a tendency which is even more pronounced in later stages. Its outer wall is formed of several layers of cells, while the cœlomic pouch sends into the budding appendage an outgrowth like that described by various authors.

With further growth the conditions just described become more strongly emphasized; the anterior demarcation of the appendage becomes more and more faint, while behind the inpushing becomes more and more marked, so that eventually a pit is formed, actually extending into the general body surface, the outer wall of the pit being formed by the appendage whose growth we are tracing. This pit forms the pulmonary sac and the opening of the inpushing persists as the respiratory stigma. At no time do the appendages rise to any considerable distance above the general abdominal surface.

The changes described can be seen by a glance at fig. 5, which, besides the points already mentioned, shows some other features worthy of notice. The cœlome of somite VII still persists; that of VIII has become divided into two portions, one of which remains in the appendage, while the other portion, reduced in size, has been pushed backwards by the ingrowing pulmonary sac. The sac itself is irregular in outline, its inner wall being slightly undulating, while its outer wall, *i. e.* the morphologically posterior surface of the appendage, has its ectoderm thrown into folds, the rudiments of the leaves of the lung-book. The ectoderm lining the inner wall of this sac is but a single cell in thickness, but that of the appendicular side is thicker, the nuclei being rather irregularly arranged, the pulmonary ingrowths forcing their way between them. In this stage but two lung-leaves are outlined, as shown in the figure.

In eggs of the same lot as the last a stage apparently a little older was found, and from it the section figured in 6 was drawn. In its general features the changes are slight, but there are some details of importance. From the fact that the plane of this section is not the same as that of the last, the appendicular cœlome is not shown, while the cœlomic cavity of the body is here much larger. So, too, the inner wall of the pulmonary cavity is shown to be thicker, a fact probably due to the obliquity of the section. In this stage four gill-leaves are shown, the most developed ones being the most distal ones. In these too the nuclei are already arranged with their major axes parallel to the plane of the leaves. Proximally the leaves are much shorter and the nuclei are irregularly arranged. These facts place it beyond a doubt that the growing-point of the organ is at the base of the appendage, a point of no little importance in comparison with the Xiphosures.

Figure 10 shows the ventral view of the embryo at the stage which figures 5, 6, and 8 represent in sections. This stage is about two or three days before the reversion of the embryo. Changes during this period are very rapid. In four to five days after this stage the lungs are almost fully developed and have about the same appearance as in hatched specimens, except in size and number of lamellæ. The embryo hatches in from seven to eight days after the stage figured in 10.

With the reversion of the embryo the changes rapidly proceed toward the adult condition. In fig. 7 I insert an illustration which serves to connect my account with the papers of Locy, Kishinouye, Laurie, and others. Here the gill-lamellæ have slightly increased in number while they have become greatly increased in length. In the figure the pulmonary sac is somewhat funnel-shaped, owing to a pulling open of the spiracle in some process of manipulation.

From this stage the transition to the conditions described by MacLeod and Locy is but slight; and although I have studied the later stages up to and even beyond hatching, my observations are but a confirmation of theirs, and so I do not repeat them here. The lungs are well developed and apparently ready to function as respiratory organs at the time of hatching. With the growth of the young spider the principal changes are an increase in the number of lamellæ and a corresponding increase in the size of the pulmonary organ, the new lamellæ being formed at the inner end of the sac.

Tracheæ.

The study of these has been a matter of considerable difficulty, and I have been able to follow with certainty only the earlier stages. The tracheæ arise behind the appendage on somite IX, which, in its earlier stages, has exactly the same history as appendage VIII. There is the same inpushing behind the limb, which results in its taking a position not pointing outward, but towards the median line and backward. In fig. 8 is seen the first differentiation of the tracheæ. The inpushing has given rise to the spiracle as before, but the sac which results does not show so markedly those infoldings of the appendicular wall which occur in the case of the lungs. There is at most but a slight undulation of this surface. At the inner end, however, two ingrowths are seen, the earliest indications of the formation of the tracheal twigs. It is, however, easy to see that these inpushings are to be compared with the infoldings which produce the lamellæ, while the undulations just referred to admit of the interpretation that they are aborted lung-leaves.

After the reversion of the embryo the same parts can be recognized (fig. 9). The inpushing has been carried to a greater extent, and sections in other planes show that this ingrowth is tubular in character. The cells lining its walls are elongate and are already taking the character shown in the tracheæ of the adult. At the inner end of the tracheal trunk thus formed the nuclei are arranged in a radiating or bush-like manner, apparently indicating that here is the place where the trunk is about to divide into the tracheal twigs; but I have not been able to trace any tracheal lumina between these cells. I have not followed the later history of the tracheal system with any detail, but think that the foregoing is sufficient to justify my thesis that the tracheæ and the lungs are to be regarded as homologous structures.

Conclusions.

From the preceding it will be seen that:—

I. The lungs of the spider arise as infoldings upon the posterior surface of the appendages of the second abdominal somite in the same manner as described by Kingsley (1885 and 1893) for the gills of *Limulus*. They have the same growing-point at the base of the appendage and form the lung-leaves in exactly the same way that the gill-leaves arise. In other words, the lung-book of the Spider (and presumably of all Arachnids which possess one) arises at first as an external structure upon the posterior surface of the abdominal appendages. These appendages sink in without any inversion or other complications, in exactly the manner theoretically deemed probable by Kingsley, so that there can no longer be any doubt as to the exact homology existing between the lungs of the spider and the first pair of gills in the horseshoe-crab.

II. The tracheæ develop from the next pair (third abdominal somite) of limbs. In their earlier stages these appendages show on their posterior surface a folding similar to that on the preceding members. From this it follows that the lung-book condition is the primitive, the tracheæ of the Arachnids being derived from it. And with these facts there is left no ground for those who regard the "Tracheata" as a natural group of the animal kingdom.

Tufts College, Mass.,
May 25, 1894.

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EXPLANATION OF PLATE VI.

Reference letters.

a^1–a^{11}. Appendages.
c^7–c^{11}. Cœlomic cavities.
e. Ectoderm.
m. Mesoderm.
pc. Pulmonary cavity.
pl. Pulmonary leaves.
s. Spiracle.
so. Somatopleure.
sp. Splanchnopleure.
t. Trachea.
y. Yolk.

All figures except fig. 10 are magnified 125 diameters.

Fig. 1. A sagittal section showing the cœlomic cavities of the vii, viii, and ix somites.

Fig. 2. A sagittal section through the same region as the preceding at a little later stage. The cœlomic pouch of the x somite is seen as well as the inpushings of ectoderm behind somites vii and viii.

Fig. 3. A section cut under conditions similar to those of the two preceding sections. The stage is a little later than fig. 2, and shows the cœlomic cavity of somite XI and further inpushings of the ectoderm. In all of the preceding sections the somatopleuric wall is the thicker.

Fig. 4. In this figure the cœlome of somite VII is much reduced in size. The cœlome of VIII is beginning to thrust itself into the appendage, which is marked off by a shallow groove in front and by a deeper inpushing, which has a forward direction, between somites VIII and IX.

Fig. 5. In this section the inpushing seen in fig. 4 has gone much further, dividing the cœlome of somite VIII into two parts. On the inner wall of the appendage are two inpushings, which are the beginnings of the lamellæ of the lung-book.

Fig. 6. A section of the appendage of somite VIII cut at a different angle from the preceding. Here four lamellæ are seen.

Fig. 7. A sagittal section from a stage just after the reversion of the embryo.

Fig. 8. A section of the appendage of the IX somite, showing at the inner end of the inpushing the beginning of the tracheal tubes.

Fig. 9. A section of the tracheal region after the reversion of the embryo.

Fig. 10. This figure is a representation of the ventral surface of an embryo which is about the same age as those from which sections seen in figs. 5, 6, and 8 were cut.

XXXI.—*Descriptions of some new Species of* Prionidæ. By C. J. Gahan, M.A., of the British Museum (Natural History).

Prionocalus Gunteri, sp. n.

♂. Niger, subnitidus; femorum basibus subtus, tibiis, tarsis, palpis antennisque piceo-castaneis, his basi nigrescentibus; mandibulis elongatis, curvatis, sat dense sed non rugose punctatis; capite prothoraceque fortiter creberrimeque rugoso-punctatis; capite supra bicarinato, carinis leviter curvatis, sat prominentibus, lateraliter utrinque pone oculum tuberculo conico magno instructo; elytris sat brevibus, subtriangularibus, supra passim creberrime vermiculato-rugosis; margine laterali ad apicem prominentiæ humeralis acutissime angulato vel dentato; abdomine minutissime punctulato.

Long. corp. 45 mm., mandib. 15 mm., lat. max. elytrorum 19 mm.

Hab. Zoruma, in Ecuador (*T. F. Gunter*).

This species seems to be on the whole most nearly allied to *P. iphis*, White, though it is easily to be distinguished at first sight by the relatively shorter and broader form of the elytra. It differs further in having a very sharp angle or tooth at the apex of the somewhat backwardly-turned prominence placed at the shoulder of each elytron, and by having the mandibles less closely and less roughly punctured. The mandibles are also quite different in form from those of the small male type of *P. iphis*, being elongated, strongly curved, rather cylindrical, and unarmed towards the base, and dilated and compressed to a thin cutting-edge at the extremity, as in the larger males of *P. cacicus*, White, and *P. Buckleyi*, Waterh. This difference, however, is not greater than might be expected to occur between forms of major and minor development within the limits of a single species, and must not be looked upon as a character for distinguishing the species. The two prominent and very distinct ridges on the upperside of the head, running back from the antennal tubercles, the absence of smooth callous areas from the base of the pronotum, and the feebleness of the punctuation of the abdomen are characters that readily distinguish the present species from *P. Buckleyi*, Waterh., and presumably also from the *P. Whymperi* and *P. trigonodes* of Bates, who has not mentioned any of these characters as distinguishing his species from *P. Buckleyi*.

Acanthophorus modicus, sp. n.

♂. Piceo-niger, nitidus; prothorace supra medio vix punctato, versus latera sat dense et subrugose punctato, disco bituberculato, tuberculis sat remotis, obtusis et paullo elevatis; elytris leviter coriaceis, minute haud dense punctatis, nitidis, apicibus rotundatis, utrisque ad suturam breviter dentatis; antennis medium elytrorum longe superantibus, articulis 6^{o}–10^{m} apice intus breviter angulato-productis.

Long. 45, lat. 15 mm.

Hab. Lahore in the Punjab (*Capt. Illingworth*).

Resembles in colour and in many points of structure the South-African species, *A. capensis*, White, but has the joints of the antennæ from the sixth to the tenth only slightly produced and less acutely angular at the inner apex; the eyes are rather more widely separated above, and behind each there is a rugose and depressed area, which extends a little further upwards than does the eye itself; the mid-dorsal region of the head forms with the front a continuous nitid and almost impunctate area with an impressed line along the middle; the underside of the head and the sides of the breast have a shorter and thinner pubescence, and this pubescence is greyish rather than tawny in colour. The mandibles in the two males of the present species are short, toothed along the inner edge, and in form quite like those occurring in the females and smaller males of the species of this genus.

Acanthophorus rugiceps, sp. n.

♂. Piceo-niger, subnitidus; capite sat valde irregulariterque rugoso, area angusta longitudinali levi, oculis supra distantibus; pronoto (in medio excepto) sat dense punctato et versus latera rugoso; elytris subcoriaceis minute punctulatis, area parva utrinque paullo pone basis medium sat dense fortiusque punctata; mandibulis elongatis, valde punctatis, utrisque intus paullo ante apicem dentibus tribus vel quatuor armatis; antennarum articulis 6^{o}–10^{m} apice intus breviter angulato-productis.

Long. corp. 60, mandib. 16 mm.; lat. ad hum. 20 mm.

Hab. Bombay?

Blackish brown in colour. Head irregularly and rather strongly rugose, except along a narrow median longitudinal area; eyes widely separated above (the interval between them equals 8 millim. in the male type), each limited at its inner or upper border by a rather prominent ridge, which is continued a short way beyond the hind border of the eye. Mandibles elongated, curved, pointed at the apex, and each furnished with three or four teeth on its inner side beyond the middle of its length. Pronotum rather closely and strongly punctured, except along a narrow mid-dorsal area, and distinctly rugose towards the sides. Elytra slightly rugulose and somewhat coriaceous in appearance, very feebly and sparsely punctured except over a small area on each, which is placed a short way behind the middle of the base.

Orthomegas similis, sp. n.

O. cinnamomeo persimilis, sed paullo major, mandibulis (♂) spina dorsali multo altiore armatis; oculis supra latius separatis.

Long. 62–74 mm.

Hab. Brazil.

Mandibles horizontal, each in the male with a strong dorsal spine directed almost perpendicularly upwards, and, like the mandibles themselves, fringed with tawny hairs on the inner side. Head with the eyes separated from one another above by a rather broad interval ($2\frac{1}{2}$–3 millim.). First joint of the antennæ devoid of pubescence. Sides of the prothorax each with two or three short spines, in addition to the anterior and the strong posterior spine; two of these spines are generally distinct and acute, the third (that next the anterior spine) is very small and sometimes obsolete.

From *O. cinnamomeus*, Linn., the present species is distinguished by the much stronger dorsal spine with which each of the mandibles is provided, and by the wider interval which separates the eyes from one another on the upperside of the head. As minor points of difference may be noted the complete absence of pubescence from the first joint of the antennæ in both sexes and the presence of two tolerably distinct, though short, spines between the anterior and posterior on each side of the prothorax.

Rhaphipodus andamanicus, sp. n.

Badius; capite, antennis pedibusque plus minusve fuscis; pronoti lateribus in utroque sexu antice convergentibus, angulis anticis haud rotundatis; elytris subtilissime granulatis et subopacis, antice circum scutellum et prope suturam levioribus nitidioribus.

♂. Pronoto confertissime punctulato et opaco, plaga angusta transversa ad basin, plaga triangulari disco utrinque et plagis duabus minoribus exterioribus sparse punctulatis et subnitidis, instructo; scutello confertim punctulato, margine levi nitido; corpore subtus confertissime punctulato et opaco, area triangulari medio metasterni, segmento quinto abdominis et marginibus posticis præcedentum, nitidis.

♀. Pronoto sparse punctato, medio nitido; scutello sparse punctulato.

Long. 49–67 mm.

Hab. Andaman Islands (*Roepstorff*).

This fine species may be distinguished by the somewhat trapezoidal form of the prothorax in both sexes. In the male, as in the female, the outer margins of the pronotum, furnished with a series of rather strong spines, distinctly converge anteriorly, and each forms with the front margin a tolerably acute and slightly projecting angle. In the male the pronotum is very closely and rather minutely punctured and opaque, with a narrow transverse space at the base, a triangular area on each side of the middle, and two smaller areas external to it, sparsely punctured and more or less glossy. In the female the pronotum has two slight swellings on each side of middle of the disk; it is sparsely punctured and subnitid over the whole central area, but is somewhat more thickly punctured and less nitid towards the sides. The elytra are very minutely granular and only slightly glossy over most of their surface, but are smoother and glossier alongside the anterior part of the suture.

Basitoxus rugosus, sp. n.

Piceo-fuscus, fortiter subrugoseque punctatus; tibiis omnibus apice extus spinosis.

♂. Lateribus pronoti subparallelis, breviter denticulatis; disco basi et plaga utrinque prope medium sparse punctatis nitidis.

♀. Lateribus pronoti antice paullo convergentibus, fortius denticulatis; basi anguste et plaga media disci nitidis, sparsissime punctatis.

Long. ♂ 62, ♀ 68 mm.

Hab. Cayenne (*Lacordaire*).

Dark brown. Head thickly and coarsely punctured above; cheeks prominent, each projecting downwards and forwards to form a rather sharp and distinct tubercle. Mandibles strong, sharply curved, pointed at the apex, and each furnished with two strong cutting-teeth on the inner border, one a little behind the apex, the other near the base. Antennæ of the male scarcely reaching to the middle of the elytra; third joint half as long as the first, fourth equal to the third, the succeeding joints gradually and very slightly increasing in length. Pronotum of male very closely punctured, except over a narrow basal area, and over two areas placed one on each side of the middle; these are sparsely punctured and nitid. The lateral margins of the pronotum are nearly parallel, and are furnished with a series of very short teeth, of which the hindmost on each side is the strongest; between the margin and the nitid area of the disk there is on each side a rather distinct depression. The elytra are strongly rugose-punctate. The underside of the prothorax is thickly and rather strongly punctured, and is strongly convex from side to side; the flanks of the male prothorax are somewhat swollen, but are scarcely visible from above; there is no trace of the suture which usually separates the episternum from the prosternum. The tibiæ of the two posterior pairs are almost unarmed along the outer border, those of the anterior pair are distinctly enough spined; all the tibiæ are produced at the outer distal angle into a tolerably strong spine.

This species, which is the *Mallodon rugosum* (Dupont) of Dejean's Catalogue, might perhaps be regarded as the type of a new genus, distinguishable from *Basitoxus* by having the tibiæ all armed with a spine at the outer distal angle.

Eurypoda Batesi, sp. n.

♂. Fusca, elytris rufo-castaneis, pronoto confertissime minuteque punctulato, area mediana magna subpentagonali nitida sparseque punctulata et postice arcuatim foveato-impressa; elytris dense distincteque punctatis.

Long. 33 mm.

Hab. Yumaguchiya, in Japan. In the collection of Mr. G. Lewis.

Head thickly and rather strongly punctured. Mandibles rather large for this genus and provided with a well-marked dorsal ridge. Pronotum slightly angulate behind the middle on each side, finely and very closely punctured except over a large median area somewhat roughly pentagonal in shape, of which one side is contiguous with the base, one angle with the anterior margin. This area is somewhat glossy and sparsely punctured. The elytra, of a reddish chestnut-colour, are glossy and rather thickly and distinctly punctured. The underside of the prothorax is very closely and finely punctured, and bears some minute and sparsely scattered granules; the sides of the breast are rather thickly, the middle more sparsely, punctured; the abdomen is rather sparsely punctured, except along the middle of the last segment, where the unctures are larger and more thickly placed. The basal joints of the antennæ are rather sparsely punctured, and the joints from the third to the fifth are slightly flattened above.

This species is distinguished from *E. antennalis*, Saund., by its broader form, its larger mandibles, the shape of the central shining area of the pronotum, and the less closely punctured antennal joints. In *antennalis* the pronotum has, in addition to the central shining area, two lesser areas cut off from it, one on each side.

Ægosoma Bowringi, sp. n.

Fusco-ferrugineum, pube fulvescente sat dense obtectum; prothorace lateraliter vix dentato; utroque elytro lineis tribus acute elevatis—duabus dorsalibus, postice in una conjunctis, tertia prope marginem externam antice evanescente, apice ad suturam spinoso; antennis (♂) corporis longitudine æqualibus, ferrugineis, tenuiter asperatis, articulo 3° quam 1° duplo longiore, (♀) quam corpore paullo brevioribus.

Long. 20–35 mm.

Hab. N. India, Sylhet (*Bowring*).

This species may be distinguished from *Æ. sulcipenne*, White (to which it appears most nearly allied), by its close covering of short fulvous or greyish-fulvous pubescence. In *sulcipenne* the pubescence is much sparser, and allows the colour of the derm to show up distinctly, and on the elytra is confined to linear tracts along the depressed groove-like intervals between the costæ; whereas in the present species it covers the whole upper surface, with the exception of the raised lines. In the females a reddish callous spot is to be seen on each side of the prothorax just under the lateral carina.

Ægosoma Buckleyi, sp. n.

Nigro-fuscum; capite supra granuloso-punctato; prothorace utrinque trispinoso, spina antica minima, dorso dense punctato, breviter sparseque villoso; elytris piceo-brunneis dense interrupteque rugulosis utrisque lineis duabus elevatis sat distinctis, instructis; antennis (♂) quam corpore paullo longioribus, articulis 1°–3^{m} asperatis, opacis, (♀) quam corpore brevioribus, articulis 1°–3^{m} vix asperatis.

Long. ♂ 40, ♀ 45 mm.

Hab. North India (*Colonel Buckley*).

This species seems most nearly allied to *Ægosoma tibiale*, White, from which it may be easily distinguished by its interruptedly rugulose (or granulated) elytra. It also bears some affinity to *Æ. cingalense*, White; but in the latter there is no anterior tooth on the side of the prothorax, the disk of the prothorax has a depression in the middle, and the elytra of the male are closely covered with a tawny pubescence. In examples which I believe to be the females of *Ægosoma cingalense* the elytra are naked and finely granulate; and they were such forms that Bates characterized as a distinct species under the name of *Ægosoma angustatum*.

XXXII.—*Description of a new Species of Dragonfly* (Dythemis Broadwayi) *from Trinidad.* By W. F. Kirby, F.L.S., F.E.S., Assistant in Zoological Department, British Museum (Natural History), South Kensington.

The present species was sent over by Mr. Broadway, of the Botanic Gardens, Trinidad, some time ago, but has remained undescribed till now, as I have not been working at South-American dragonflies till lately.

Dythemis Broadwayi, sp. n.

Long. corp. 35–40 millim.; exp. al. 54–61 millim.; long. pter. 3 millim.

Head yellow, darker above; mandibles and suture of labrum black; occiput black, shining, with the occipital triangle, two contiguous spots just below it, and a spot on each side yellow. Thorax ferruginous, with three short yellow streaks above, the middle one very slender; a line on the front of each tegula, and a row of spots on the middle line, between the wings, yellow; sides of thorax slightly metallic, with six yellow stripes—the first rather narrow, angulated, and nearly interrupted, the second broad, very short, the third slender above and broad below, the fourth broader, rather irregular, the fifth short and broad, and the sixth broad and long, followed by a yellow spot; there are also two short transverse yellow bands at the back of the pectus. Legs black; coxæ red; front trochanters and femora yellow beneath. Abdomen black; the basal segments banded and striped with yellow, varied with red; the others with long yellow dorsal stripes, as far as the 7th segment, where the stripes, which are separated by the dorsal carinæ, are most conspicuous; anal appendages of male as long as the 8th segment, the lower one not much shorter; upper ones black; lower one red, black-pointed, nearly as long as the upper ones; appendages of the second segment of the abdomen small. Wings of a slightly yellowish hyaline, stained with saffron at the extreme base of the hind wings; pterostigma brown, slightly inclining to yellowish between the nervures: fore wings with thirteen or fourteen antenodal and nine postnodal nervures, the last nodal and the first two or three postnodals not continuous, nodal sector slightly waved before the middle; triangle traversed, followed by three rows of cells, increasing towards the hind margin; three post-triangular cells: hind wings with nine to eleven antenodal and nine or ten postnodal nervures; membranule of moderate size, grey.

Much resembles a species which I have just described from St. Vincent (and var.? from Grenada), West Indies, under the name of *D. multipunctata*; but in that species the markings differ somewhat, and the frontal tubercle is always violet-blue, whereas it is concolorous in *D. Broadwayi*.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

June 20, 1894.—Dr. Henry Woodward, F.R.S., President, in the Chair.

The following communications were read:—

1. 'The Bargate Beds of Surrey, and their Microscopic Contents.' By Frederick Chapman, Esq., F.R.M.S. (Communicated by Prof. T. Rupert Jones, F.R.S., F.G.S.)

This is an attempt to correlate the Bargate Beds of Guildford and its vicinity with the members of the Lower Greensand as known elsewhere in the S.E. of England.

1. The strata at Littleton quarry, near Guildford, are described in detail; the *remanié* fossils, oolitic ironstone, and other material derived from older rocks are noticed; the abundant occurrence of Ostracoda and Foraminifera in a particular clay-band is noted,

and the method adopted for getting them free from the matrix is described. The residuary minerals left from the washed sand of this clay-band, and comprising zircon, rutile, tourmaline, kyanite, quartz, felspar, and glauconite, have been carefully studied and described for the Author by Dr. W. F. Hume, F.G.S., who states that the minerals present are of the same size as those from the Bagshot Sands and three times as large as those from the Chalk-marl of the Isle of Wight. The constitution of the compact Bargate Stone, with its sponge-spicules and silicified shell-structures, is described in detail; and a rare corallina and numerous arenaceous foraminifera are noticed.

2. The Bargate Series is well shown, along the lane crossing the hill below St. Martha's Chapel at Chilworth, with its pebbly beds, clay-seams, limestone, and sponge-beds. Dr. Hinde's descriptive notes on the sponge-spicules are given. Some detrital fragments of fossiliferous Oolitic rock described as of Jurassic age occur in these Neocomian strata, and are comparable with some of the material obtained from the deep boring at Richmond, Surrey, and probably derived from the old Jurassic ridge to which Godwin-Austen formerly made reference. The Author has found evidence in this neighbourhood of the Folkestone Sands lying unconformably on the Bargate Beds.

The clay-beds noticed by Dr. Fitton at Holloway Hill, Godalming, the Author refers to the Bargate Series. South of Dorking, also, Mr. Chapman found sand and clay of this Series on the Horsham Road.

The Ostracoda and Foraminifera found abundantly in some of the Bargate Beds in Surrey are then described in detail. Of the former there are 20 species and varieties, 7 of which are new; 9 have been previously described from Cretaceous strata, whilst 4 are Jurassic forms. Of the Foraminifera there are 139 species and varieties. Of these, 11 are described for the first time. There are besides 107 which have hitherto been unrecorded from beds of Neocomian age. The following 10 species and varieties have been known previously only from recent deposits, viz.:—*Haplophragmium foliaceum*, Brady; *Virgulina subdepressa*, Brady; *Ehrenbergina pupa* (d'Orb.); *Polymorphina sororia*, Reuss, var. *cuspidata*, Brady; *P. oblonga*, Will.; *P. regina*, Brady, Parker, and Jones; *Discorbina Bertheloti* (d'Orb.); *D. concinna*, Brady; *D. Vilardeboana* (d'Orb.); and *D. araucana* (d'Orb.). The large number of forms new to the Neocomian fauna is undoubtedly due to the fact that the deposits of the Bargate Series belong almost exclusively to the 'Laminarian' and 'Coralline' zones. Taking into consideration the facts that 23 per cent. of the forms recorded are almost peculiarly Neocomian types, that these added to known Cretaceous and Tertiary species amount to 122, or 87 per cent. (the latter additions probably being due to the circumstance that the Neocomian strata have not been so extensively examined in regard to their rhizopodal fauna as might have been desired), it is extremely probable that the microzoic fauna of the Bargate Series is almost entirely, though not quite (since we have a few Jurassic species present), indigenous to the deposit.

In conclusion, the Author states his indebtedness to Prof. T. Rupert Jones, F.R.S., and Prof. J. W. Judd, F.R.S.; to Dr. W. F. Hume, F.G.S., Dr. G. J. Hinde, V.P.G.S., Dr. J. W. Gregory, F.G.S., and Graf Solms-Laubach; and to George Murray, Esq., F.L.S.,—for valuable aid during the preparation of the present work.

2. 'On Deposits from Snowdrifts, with Special Reference to the Origin of the Loess and the Preservation of Mammoth-remains.' By Charles Davison, Esq., M.A., F.G.S.

When the temperature is several degrees below freezing-point, snow recently fallen is fine and powdery, and is easily drifted by the wind. If a fall of snow has been preceded by dry frosty weather, the interstitial ice in the frozen ground is evaporated, and the dust so formed may be drifted with the snow and deposited in the same places. The snowdrifts as a rule are soon hardened by the action of the sun or wind, and the dust is thus imprisoned in the snow. As the snow decays, by melting and evaporation, a coating of dust is extruded on the surface of the drifts, and, increasing continually in thickness as the snow wastes away, is finally left upon the ground as a layer of mud, which coalesces with that of previous years. The deposit so formed is fine in texture, unstratified, and, as experiments show, mica-flakes included in it are inclined at all angles to the horizon.

The Author describes several such deposits both in this country and in the Arctic regions; and suggests (1) that the loess is such a deposit from snowdrifts, chiefly formed when the climate was much colder, but still very slowly growing; (2) that mammoths suffocated in snowdrifts are subsequently embedded, and their remains preserved, in the deposits from them; and (3) that the ground-ice formation of Alaska, etc., is the remains of heavy snowdrifts when the coating of earth attained a thickness greater than that which the summer heat can effectually penetrate.

3. 'Additions to the Fauna of the *Olenellus*-zone of the North-west Highlands.' By B. N. Peach, Esq., F.R.S., F.G.S. (Communicated by permission of the Director-General of the Geological Survey.)

New material obtained by the Officers of the Geological Survey has been placed in the Author's hands, and as a result he is enabled to add information concerning the species of *Olenellus* previously described by him (*O. Lapworthi*); he also describes a new variety of this species, three new species of the genus, a new subgenus of *Olenellus*, and a form provisionally referred to *Bathynotus*.

He discusses certain theoretical points based upon the study of the remains described in the paper, and states that these make it probable that the dispersal of the Olenellids was from the Old World towards the New.

4. 'Questions relating to the Formation of Coal-Seams, including a New Theory of them: suggested by Field and other Observations made during the past decade on both sides of the Atlantic.' By W. S. Gresley, Esq., F.G.S.

A number of new facts are described, and the bearing of these and of previously recorded facts upon the origin of coal is discussed, special reference being made to the Pittsburgh Coal. The Author lays stress on the stratification of coal, the sharp line of demarcation between coal and underclays, the character of the plants in the underclays and their asserted root-nature, the existence of partings in such seams as the Pittsburgh Coal, which partings sometimes contain *Anthracosia*, and really separate the coal into distinct seams. He describes the occurrence of 'rods' of vegetable origin whose exact nature is not known, which, with ferns, he suggests contributed largely to the formation of some coals. He maintains that the evidence points to the formation of coal on the floor of an expanse of water, by vegetable matter sinking down from floating 'islands' of vegetation, which may have been of very large size, and enumerates cases of such 'islands' or 'rafts' of vegetation which have been described as existing in modern times.

MISCELLANEOUS.

Researches on the Structure, Organization, and Classification of the Fossil Reptilia.—Part IX. Section 4. *On the Gomphodontia.* By H. G. Seeley, F.R.S.

The Gomphodontia is a group of Anomodont reptiles characterized by Theriodont dentition, in which the molar teeth are expanded transversely, more or less tuberculate, and have the crowns worn down with use, as in ungulate and other mammals. The orbit of the eye is distinct from the zygomatic vacuity, which is conditioned as in the Cynodontia, there being a long narrow parietal crest dividing the temporal vacuities. There are two well-defined occipital condyles united at the base, in a way that is closely paralleled in some mammals. The occipital plate is triangular, as in mammals, with no perforation except the foramen magnum. A deep superior notch defines the occipital plate from the lateral external squamosal bar. The malar bone, which forms the larger part of the zygoma, behind the orbit has a slight descending process, which varies in development. The hard palate terminates transversely in the middle length of the molar teeth. There is a descending transverse palatine arch situate behind the orbits. The incisor teeth are small and pointed; the canine teeth may be inconspicuous, but are usually large, compressed, and serrated; the premolars are small, circular, and usually tuberculate; the molars are usually single-rooted, in close-set series which diverge as they extend backward, with crowns which vary in form, but are commonly wider than long, and usually have the external and internal cusps more prominent than the other tubercles on the crown.

The group is based chiefly upon the genera *Gomphognathus*, known from skulls, a vertebra, and fragments of limb-bones; *Trirachodon*, known from skulls only; and *Microgomphodon*, in which the canine teeth are no larger than the incisors. The last genus appears to make known the more important parts of the skeleton.

These specimens, collected by the author at Lady Frere, by Dr. Kannemeyer near Burghersdorp, and by Mr. Alfred Brown near Aliwal North, are all from the Upper Karroo rocks on or about the horizon of the Coal Beds.

Of *Gomphognathus* there is a complete skull, with the lower jaw attached, about 9 inches long, a second skull which displays the palate, and a separate lower jaw in connexion with part of the back of the skull. These specimens show four incisor teeth in each premaxillary bone, with sharp lateral serrated borders. The mandibular canine is covered when the jaws are closed. The maxillary canine is a powerful tooth; its extremity is worn obliquely. There appear to be six premolar teeth, all contained in a length of half an inch. The maxillary teeth are packed in close succession, as in Rodents. There are nine molar teeth. In the middle, where they are largest, four occupy the length of one inch. The contour of the crowns of these molars is convex from front to back, as in many mammals; and in this genus they are all behind the hard palate. The external cusp is prominent, and a ridge descends inward and backward from it upon the large flattened ledge of the crown, which is worn almost level, as though there were a rodent-like horizontal movement of the lower jaw.

A lumbar vertebra, found in developing the back of the skull, may possibly belong to this genus.

With the skulls a right humerus was found, which is $5\frac{1}{2}$ inches long. It shows the reptilian transverse elongation of the proximal articulation, combined with characters which are paralleled in the marsupial mammals and Carnivora.

The genus *Microgomphodon* is known in the first place from a skull $2\frac{1}{2}$ inches long, shaped much as in *Galesaurus*, but distinguished by the comparatively large size of the front pair of mandibular incisors and the strong, conical, pointed character of the incisor teeth. The canine teeth are not differentiated from the incisors. The molars show in lateral aspect small blunt cones, but on their palatal aspect have flattened crowns with many small cusps. All the teeth have short roots. There are three incisors on each side in both the mandible and skull, one canine, and five molars.

There is ground for associating with this genus an imperfect skeleton, which, in addition to indicating ten early dorsal ribs and fourteen lower dorsal vertebræ and ribs in advance of the acetabulum of the femur, shows the left humerus, portions of right and left scapulæ, portions of the coracoid, clavicle, interclavicle, the pelvic bones, all the bones of the hind limb, distal ends of ulna and radius, carpus, metacarpus, and five digits. With these a fragment of a skull is associated, which has the maxillary and mandibular teeth in contact, showing the animal to be Gomphodont; while so much as is preserved closely resembles the skull of *Microgomphodon*, and apparently the canine was not larger than the premolar. This skeleton demonstrates a close general resemblance of plan between the Gomphodontia and Cynodontia. The lower dorsal ribs have a transverse lozenge-shaped enlargement, which, however, is less developed than in *Cynognathus*. The pelvis is exposed on the ventral side. As in most, if not all, South-African Therosuchia, it shows no indication of median division between the pubic bones, while the ischia retain their individuality.

The pubis articulated to a short tubercle on the ilium. The blade of the ilium is thin, but imperfectly exposed, and the ischia are shaped as in *Pliosaurus*, but the pubis does not closely resemble that of any reptile. The femur has the inferior internal trochanteric ridge only slightly developed. There is no neck defining the head of the bone from the shaft. The fibula is slender; no indication of a patella is preserved. Below the stout tibia the proximal row of the tarsus appears to consist of two bones—an inner astragalus with hemispherical proximal surface, and a narrow elongated bone which appears to be the calcaneum. There were three or four bones in the distal row of the tarsus, but only one is preserved. The digits are nearly parallel with each other, and the foot has a compact character like that of *Dicynodon*.

The scapulæ have the pre-scapula developed on the same plan as in *Cynognathus*, and the anterior margin of the bone reflected upward, so as to form the spine of the scapula, terminating in the acromion. The two ends of the humerus are twisted at an angle of 45 degrees, and the bone is expanded as in many Saurischian reptiles. The carpus shows three bones in the proximal row, a large reniform carpal below the ulna, regarded as the pisiform bone; a comparatively small middle carpal is identified as the cuneiform bone. The third bone corresponds with the scapho-lunar of *Theriodesmus*; it is beneath the radius. There is no indication of any pre-pollex. There are four bones in the distal row of the carpus. There are five digits.

In the pelvis and the limb-bones this Anomodont type approximates to the Saurischia and Mammalia, just as the Ornithischia approximate to birds in the same parts of the skeleton.

Trirachodon is founded on four individuals which have the skull about 4 inches long. Like the other Gomphodont genera, this type has the dentary bone developed so as to occupy the length of the mandible, but the lower jaw is composite, the internal bones filling the space which in mammals is occupied by the meckelian cartilage. The postfrontal and prefrontal bones are well developed. The species differ in the character of the teeth, especially in number and form of the premolars.

In one species from Aliwal North the molar teeth are transversely wide, ornamented with three transverse ridges, which terminate in a slight cusp both on the external and internal margins. There are not more than nine molars. The crown of the first premolar in one specimen is elongated from front to back, and shows a small coronet of rounded marginal cusps. In a species from Lady Frere the molar teeth are narrower and the premolar teeth more numerous, small, and circular in the broken sections.

Although these skulls are mammalian in aspect, and in some respects make new transitions towards mammals, in technical characters they retain a sufficient number of reptilian structures to permit no doubt that they are true reptiles. The mammalian resemblances in the skull being paralleled in the other parts of the skeleton, it may be affirmed that these fossils demonstrate a closer affinity between reptiles and mammals than had previously been evident.—*From the Proceedings of the Royal Society.* (Communicated by the Author.)

The Transformation of the Aortic Arches in the Frog. By M. S. Jourdain.

In the course of investigations which for several years I have pursued upon frogs I have had occasion to study, by the aid of injections, the transformations undergone by the large vessels which spring from the bulb of the aorta at the time of transition from aquatic to aerial life. The results of my observations differ to such an extent from those which are recorded in the treatises on zootomy, that I have decided to present them to the Academy.

We know that in the tadpole of the frog the gills are four in number. The fourth, which is situated behind the rest, is considerably less developed than the other three.

In order to render my description more intelligible I shall have to modify the customary terminology in certain respects. I designate the great vessels, four in number, which carry the venous blood to the gills, *bulbar arches* (*crosses bulbaires*); *hypobranchial vessels* is the term that I apply to the portion subdivided from each of these arches which distributes itself to the gills, and by *epibranchial vessels* I mean the portion which brings back the aerated blood to the origin of the arteries which spring from these epibranchials. These arteries are, in the case of the first arch, the carotid linguals; in that of the second the aorta; in that of the third and fourth the cutaneous respiratory and the pulmonary.

The epibranchial vessels are united one to another on each side, at a short distance from the point of their emergence from the gill, by anastomotic branches, which have a longitudinal direction and are termed by me *connective branches* (*rameaux connectifs*).

Finally, it is important to note the presence of a short and wide anastomotic plexus, to which I shall apply the term *interbranchial*, and which establishes a more and more free communication between the hypo- and the epibranchials towards the point where these latter issue from the gill.

In a general way the constitution of the definitive type of the circulatory system is realized by the direct inosculation of the bulbar arches with the origin of the arteries arising from the epibranchials, by the medium of the interbranchials, and the disappearance of the entire branchial circulatory system with the gill itself.

We will now see what takes place in the case of each of the branchial arches.

First arch.—The short vascular plexus which represents the interbranchial establishes a direct communication between the first bulbar arch and the carotid lingual, which then constitutes the termination of the former. The interbranchial becomes the carotid gland. The connective between the first and second arches disappears.

Second arch.—An open anastomosis is formed, by means of the interbranchial, between the second bulbar arch and the origin of the aorta. The connective between the second and third arches atrophies.

Third and fourth arches.—In the case of these arches a more complex transformation takes place.

By means of the third interbranchial and of the connective between the third and fourth arches, which persists, the third bulbar arch becomes continuous with the afferent vessel of the lung, or pulmonary artery, which chiefly arises from the epibranchial of the fourth arch.

The fourth bulbar arch, which is merely a subdivision of the third, loses its function and atrophies.

The pulmonary artery of the adult, constituted by the various sections which I have just enumerated (third bulbar arch, third interbranchial, and the connective between the third and fourth arches), gives rise, on a level with the third gill, to a vessel which may be ascribed to the epibranchial of that gill, and which forms the extremely interesting branch of the pulmonary artery known as the *cutaneous respiratory.*

When the pulmonary sac begins to develop it receives a vessel fed by the epibranchial of the fourth arch and also by the connective between the third and fourth. The result of this arrangement is that this pulmonary vessel, which is none other than the pulmonary artery, receives *already aerated* blood, mingled with a small quantity of venous blood coming from the interbranchial anastomoses. Thus in reality at the outset this artery is a nutritive vessel like the other arteries.

Towards the close of larval life, when the lung is a functional respiratory organ, the artery maintains its nutritive *rôle*, but, in addition to this, the blood that it contains is aerated afresh and the pulmonary veins bring back pure arterial blood to the heart.

Finally, in the adult the pulmonary artery conveys almost pure venous blood, and thus commences to realize the conditions exhibited by the circulatory system of vertebrates with separate ventricles.—*Comptes Rendus,* t. cxix. no. 1 (July 2, 1894), pp. 98–100.

Branchiate Pulmonates. By M. Paul Pelseneer.

I. Among the aquatic pulmonate Mollusca of Madagascar there is found a sinistral form which normally exhibits, below the pulmonary aperture and to the left of the anus, a well constituted *gill.* This gill is *plicated*, and not pectinated (that is to say, that it is formed like that of the Opisthobranchs), and is attached merely by its base. But it is not homologous with the gill or ctenidium of the rest of the Gastropoda : it is, as a matter of fact, situated entirely outside the pallial chamber, while in the latter it is contained within it. It is therefore a new formation.

II. The appearance of this organ upon a Pulmonate is explained by the study of our indigenous forms, certain of which already possess this gill, but in a less developed condition : *Planorbis* and *Ancylus* may be taken as instances.

Planorbis corneus exhibits, outside the pallial or pulmonary chamber and to the left of the anus, a flattened, smooth, and extensile tegumentary lobe, the structure of which reveals its respiratory function ; the same lobe, proportionately smaller, exists in *Planorbis marginatus.*

Ancylus also possesses this lobe (on the right side in *A. lacustris*), which in this case has for a long time already been designated the *gill*, and which performs the functions of such an organ in a continuous manner, for in this genus *there is no longer any trace of a pallial chamber* (*or lung*). Now we know that *Planorbis* is of a much less aerial habit than *Limnæa*, and we are also aware that in pure water *Ancylus* remains almost entirely immersed (which explains the disappearance of its lung).

These Pulmonates, having lost the original molluscan gill (or ctenidium), but having subsequently reverted to an aquatic life, there is nothing astonishing in the fact that they have developed a fresh gill, morphologically different from the former, although in the case of the Pulmonate from Madagascar it has a similar conformation ; we have here merely a remarkable example of *homoplasy* and of the irreversibleness of evolution, that is to say of the powerlessness of an organ which has been lost to reappear.

III. The mollusk from Madagascar in question is only known conchologically, and bears the name *Physa lamellata.* But its whole organization shows that it does not belong to the genus *Physa* ; I confine myself here to pointing out the absence in the latter (as in *Limnæa*) of the para-anal branchial apparatus.

Physa lamellata constitutes the type of a genus very closely allied to *Planorbis*, which I propose to term *Pulmobranchia.*—*Comptes Rendus*, t. cxix. no. 5 (July 30, 1894), pp. 354, 355.

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WILLIAM CARRUTHERS, F.R.S., F.L.S., F.G.S.,

AND

WILLIAM FRANCIS, Ph.D., F.L.S.

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

WITH TWO PLATES.

Illustrative of Mr. R. I. Pocock's Paper on the Pedipalpi of the Family *Tarantulidæ* in the British Museum.

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THE ANNALS

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XXXIII.—*On the Freshwater Crustacea of the Indian Archipelago, with Observations on the Fauna of Freshwater in General.* By MAX WEBER *.

IMPORTANT contributions to our knowledge of the Crustacean fauna of the freshwaters of the Indian Archipelago have been furnished in the foregoing communications printed in this second volume.

Five Cladocera, two Copepods, and a Branchiopod were introduced by Herr J. Richard and six Ostracods by Herr R. Moniez, all of which were collected by myself in Sumatra and Celebes. Beyond doubt this gives us but a first glimpse of the Entomostracan fauna of the Indian islands, which is, at any rate, richer than this. It is, however, impossible sufficiently to emphasize the fact that Entomostraca are incomparably less numerous than in our European waters. It is important to observe the number of the individuals of *Daphnella excisa*, and especially of *Moina Weberi* and *Diaptomus orientalis*, which occurred only in the pelagic region of the great freshwater lakes of Singkarah and Manindjau, the altitude, extent, and situation of which were described at length in the introduction to this work. In these large basins I captured the species mentioned in thousands, together with a smaller number of *Cyclops simplex*; in the evening they were met with on the top of the water, but

* Translated from "Zoologische Ergebnisse einer Reise in Niederländisch Ost-Indien, herausgegeben von Dr. Max Weber," Bd. ii. Heft 2, Leiden, 1892, pp. 528–543.

during the day at a depth of half a metre to a metre beneath the surface. In the present communication I shall be able to add the description of a new *Argulus* to the descriptions of Entomostraca already published.

In opposition to the Entomostraca, Decapod Crustacea play an important part in the islands of Sumatra, Java, Celebes, Saleyer, and Flores visited by me. The number of species of Brachyura which I collected in these localities has been determined by Herr J. G. de Man to be thirty-four, and of Macrura thirty-five. When compared with the freshwater Decapods of Europe, which only include *Astacus*, *Telphusa fluviatilis*, *Pilumnus tridentatus*, Maitland, *Hemicaridina Desmarestii*, Millet, *Leander Edwardsii*, Heller, and *Palæmonetes varians*, Leach—the latter four of which are also found in brackish water—as well as the cave-shrimp, *Troglocaris*, the number of Decapods in the Indian Archipelago is very considerable. Not only the number of species, but also that of individuals, is very great in all lakes, ponds, rice-swamps (Sawahpfützen), and sluggish and rapid brooks and rivers, so that they give quite a distinct impress to the fauna. It will subsequently be shown in greater detail that genuine marine and also brackish-water forms, especially among the Brachyura, furnish their contingent not merely in the lower courses of the rivers, but also further inland.

Our sketch of the freshwater Crustacean fauna would, however, be left incomplete if we omitted to mention a small number of Amphipods and Isopods. It is true that these are by no means conspicuous either on account of their numbers or the frequency of their occurrence. They are, however, of interest by reason of biological peculiarities, and throw an important light on the origin of a portion of the freshwater fauna of India, whereby perhaps they also afford some elucidation of the origin of the tropical freshwater fauna in general.

In spite of extensive investigations of numerous freshwaters, I succeeded in discovering none but marine Amphipods and Isopods therein; and the exceedingly scanty statements of my predecessors, among which, as a matter of fact, the careful communications of von Martens are alone deserving of mention, furnish the same result. Again in opposition to Europe, to the fauna of which Gammaridæ and Asellidæ belong, both of these families are wanting in the Malay Archipelago. Here I found only the genus *Orchestia* in Java, Celebes, and Flores, but solely in four localities in spite of diligent searching, and, moreover, under such conditions as proved that one of the species met with had already entirely abandoned an *aquatic* life and was existing under damp wood and stones. In the three other localities, each of which furnished a new species, the creatures had already become, at any rate, amphibious, since they also existed under stones at the edge of the water, similarly to our marine species of *Orchestia*, especially *O. cavimana.* No less a contrast to European conditions is shown in the complete absence of Asellidæ from the Malayan freshwaters. In their stead we meet with quite a number of genuine marine Isopods, which, however, are all parasites belonging to the families Cymothoidæ and Bopyridæ. Upon freshwater fishes in the Lake of Singkarah I found *Rocinela typus*, Milne-Edwards, and *Tachæa lacustris*, sp. n., the closest allied species to which was discovered by von Martens upon the coral-reefs off Singapore. In brooks and rivers far in the interior I met with the peculiar species *Ichthyoxenus Jellinghausii*, Herklots, upon Cyprinidæ, while Palæmonidæ yielded seven species of *Bopyrus.*

Can there possibly be a greater difference between the European freshwater Crustacean fauna and that of the Indian Archipelago? To this we shall be obliged to reply in the negative, and thus we come into conflict with the ever-increasing inclination to attribute a similar character to the freshwater faunæ of the globe.

To account for this inclination, reasons very different in value can be shown to exist. In the first place we have two points, which apparently might be left entirely to speak for themselves: namely, the insufficient and incomplete state of our knowledge of the local freshwater faunæ of the earth, and, further, the very imperfect determinations of the forms discovered therein, which serve as the basis for reports and communications in the form of generalizations upon the freshwaters of foreign countries. While it is precisely in such questions of animal distribution, which have a statistical character, that it is impossible to have sufficient accuracy in the determination of the genus and species, a portion of the literature dealing with freshwater faunæ is of a very preliminary kind, and could furnish nothing but altogether isolated items of evidence in favour of the thesis that the fauna of fresh water has a uniform character. Herein the one-sided prominence given to the Invertebrates, and among these again in the most marked degree to the groups with which the European investigator is acquainted from the beginning, plays a conspicuous part.

These objections are not intended to obscure the fact that an important nucleus of truth lies at the bottom of the assumption that the freshwater fauna of the earth has in part a similar character, in so far as there are a whole number of identical species, or at any rate genera, which are widely distributed over the world. I need but recall to mind many Protozoa, Spongillidæ, *Hydra*, Hirudinea, Naidæ, Turbellaria, and various Bryozoa and Entomostraca. A common characteristic of these forms, however, is smallness of body and easy transportability occasioned thereby or by other qualifications; still more, however, such a constitution of their germs that these can sustain changes of temperature and drought, and by means of wind or other mode of conveyance can be readily transferred from one freshwater station to another. Pregnant instances of this are already recorded in numbers in the writings of Darwin, Forel, Semper, and Zacharias, and in the latest suggestive work of Simroth *, and are known to everyone. It is enough to remind the reader of encysted Protozoa which are carried away in the mud on the feet of birds and also in their droppings; or of the shell-protected egg of *Hydra*, which like *Hydra* itself is easily transported. Species may also be carried by means of leaves, which are caught up by the wind from a pool which is drying up, as I observed in the case of Spongillidæ in India. The gemmulæ of freshwater sponges are, as is well known, especially fitted for such and similar modes of transport; this applies in quite a peculiar degree to those of *Spongilla decipiens*, a species described by myself, the numerous gemmulæ of which, surrounded by tissue containing air, float upon the water equally as well as the statoblasts of Bryozoa, which I likewise met with in abundance in India. All these germs, precisely like the "winter" eggs (Dauereier) of the Cladocera in their ephippia, are driven or wafted to the shore as they float upon the surface of the water, and are then an easy sport of the winds or other transporting medium.

It has only recently been shown by de Guerne † how Hirudinea are carried by birds, while Blanchard ‡ and Megnin § have pointed out that a similar result is also brought about by mammals.

All the species mentioned hitherto, which in one form or another are readily transported, and for this reason alone, apart from any other, may be more generally distributed over the earth, we will term "*universal*" freshwater animals. Besides these the freshwaters of the different districts contain

* Simroth, 'Entstehung der Landthiere.' Leipzig, 1892.

† J. de Guerne, Comptes Rendus hebd. d. l. Soc. de Biologie, 1892, p. 92; and Ann. Mag. Nat. Hist. ser. 6, vol. x. pp. 117–120.

‡ Blanchard, Bull. Soc. Zool. de France, xvi. 1891, p. 218.

§ Megnin, Bull. Soc. Zool. de France, xvi. 1891, p. 222.

local species in varying numbers and variety, or, at least, such as have a more restricted area of distribution. To these forms we will apply the designation "*regional*" freshwater animals. The question now arises whence these latter are derived, and how their more limited distribution is to be explained.

In connexion with this question various considerations have to be taken into account, which at present render it impossible to return a comprehensive answer. For instance, it is difficult to account for the fact that *Apus* and *Branchipus* are absent from the Indo-Malayan region, although the eggs of both genera are so exceptionally constituted for being carried about from place to place.

It is above all among Vertebrates, Mollusks, and Malacostracous Crustacea that the forms occur which are not universally distributed. I need but refer to Urodeles, which with the exception of the Cœcilians are absent from the tropics and the southern hemisphere; or to the regional occurrence of Ganoids, Dipnoi, Siluroids, Labyrinthici, and other freshwater fish. Allusion may also be made to the Astacidæ, Palæmonidæ, and freshwater Brachyura, while the absence of Asellidæ and Gammaridæ in the Indo-Malayan region may likewise be pointed out.

Now Vertebrates, Mollusks, and the Crustaceans mentioned are all animals of some size, which for this reason alone could not or could hardly be carried about. The same applies to their eggs, which are not suited for passive dissemination. Herein we already have a conspicuous reason for their to a certain extent emphatically regional distribution.

Here and there we find the idea expressed that the above-mentioned denizens of fresh water, to which we have applied the term "universal," are of especially high geological antiquity, which may be taken as a partial explanation of their wide distribution.

In many cases this may certainly be correct. I shall, moreover, attempt to show directly that as a matter of fact, as opposed to the more ancient forms, there are also more recent freshwater animals, which evidently derive their origin from the sea. But to contrast the whole of the "universal" freshwater forms, as being geologically the more ancient, with the "regional" ones, as geologically more recent, would undoubtedly, in such general terms, be incorrect. Why among universal forms *Spongilla*, for instance, and many Entomostraca or Bryozoa are to be considered historically more ancient than perhaps *Apus*, *Branchipus*, *Asellus*, *Gammarus*, Dipnoi, Ganoidei, and Urodeles, it is certainly impossible to perceive. Lower organization of a species is not in itself a proof of greater antiquity. In the case of more lowly organized animals the formation of species is no more limited in time than in that of more highly organized forms.

Now in my opinion it is possible to demonstate the marine origin .of a considerable fraction of the freshwater animals which are of regional occurrence. Naturally I am not speaking here of the hypothesis that in the end all freshwater animals are derived from the primeval ocean.

In the first instance I am thinking of the "relic-animals" (Relicten-Thiere), yet only in the sense in which they are so regarded by Lovén and Credner. Accordingly I consider as "relics" only such animals as are really of a marine nature and inhabit freshwater basins, that can be proved by geology to have been once filled with sea-water and to have been in connexion with the ocean. The numerous "relic-lakes," with which zoological fancy has covered the earth, for the most part do not bear geological criticism, any more indeed than they sustain more precise zoological examination. Besides a number, small it is true, of genuine marine relics, fresh water is peopled by numerous marine forms; these, however, have not been "left behind," but are *immigrants*, *active* or *passive*, as the case may be.

I would therefore divide the freshwater fauna as follows :—

1. Universal freshwater animals.
2. Regional " "
   - *a*. Local genuine freshwater animals, which form an already ancient stock.
   - *b*. Marine forms.
     - *α*. Relics.
     - *β*. Immigrants.
       - β_1. Active immigrants.
       - β_2. Passive "

The larger portion of these immigrants wander actively from the sea into the brackish estuaries and further into the lower course of the rivers, to gradually ascend until they penetrate far into the interior. From the nature of the case the *rôle* played by passive immigrants is a subordinate one, since they are carried almost exclusively as parasites from the sea into the rivers, and in this manner finally also reach the lakes, like *Tachœa lacustris* and *Rocinela typus*, which will be dealt with later on. A certain participation on the part of the animal that is passively transported is self-evident.

The communications of Günther, Sauvage, von Kennel, and Stuhlmann already point to the fact that the marine immigrants in the tropics at any rate play an important part, as is even still the case; for I am convinced that immigration is still taking place at the present time, and that it shows us the process of the formation of the freshwater fauna *.

I should like to prove this by means of the Crustacean fauna of the freshwaters of the Indian Archipelago; for my material bearing upon this question is already accurately worked out, and was collected by myself with my own hands, with the exception of the Crustacea of Timor and Rotti, for which I am indebted to my fellow-traveller Prof. A. Wichmann, of Utrecht. Since, however, the latter was well acquainted with the questions which interested me, I have before me absolutely precise statements with reference to the origin of these specimens also. The latter point is of paramount importance in this question, in which we have to consider the nature of the water, whether fresh, brackish, or sea-water, in which the animals were collected.

If the specimens were obtained in the lower course of a river, it is necessary to notice whether any and what change takes place in the water in that portion of the stream at flood-tide. Close attention was paid to all these points.

Now since such observations were not, or not to a sufficient extent, connected with the Crustacea previously collected in the Indian Archipelago, I was hardly able to derive further statements from the literature on the subject. A solitary exception is constituted by the excellent communications of E. von Martens, to whom altogether we owe the most comprehensive and best information, not merely for the Indian Archipelago, upon this subject. For the rest I depend exclusively upon my own experience.

The following list of the freshwater Crustacea of the Indian Archipelago gives at once statements as to their occurrence in the different islands:—Sumatra (S.), Java (J.), Borneo (B.), Celebes (C.), Saleyer (Sal.), Flores (F.), Timor (T.), and the Moluccas (M.); as also as to their occurrence in fresh, brackish, or sea-water, or upon the land in damp surroundings.

Certain species, which are absent from my collection, and as to which I have no personal experience, are indicated by spaced type. The statements in brackets—( ), [ ]—as to occurrence imply that the observations in question do not emanate from me.

This list will be followed by a few remarks and conclusions, as well as by a description of the Argulidæ, Isopoda, and Amphipoda which I collected.

* With regard to these questions, I consider it my duty to remind the reader of the valuable but largely forgotten paper by Rütimeyer—'Ueber die Herkunft unserer Thierwelt,' 1867, p. 17.

Freshwater Crustacea of the Indian Archipelago.

	Fresh Water.	Land.	Brackish Water.	Sea-Water.	
BRANCHIOPODA.					
1. Cyclestheria Hislopi, *Baird* ..	*	..	..	..	C.
CLADOCERA.					
2. Daphnella excisa, *Sars*	*	..	..	..	S.
3. Moina Weberi, *Richard*	*	..	..	..	S.
4. Macrothrix spinosa, *Sars*	*	..	..	..	C.
5. Ilyocryptus longiremis, *Sars* ..	*	..	..	..	C.
6. Alona Sarsi, *Richard*..........	*	..	..	..	C.
OSTRACODA.					
7. Cypris Weberi, *Moniez*	*	..	..	..	C.
8. —— Richardi, *Moniez*	*	..	..	..	C.
9. —— odiosa, *Moniez*	*	..	..	..	C., S.
10. —— Sarsi, *Moniez*	*	..	..	..	C.
11. Stenocypris Malcolmsonii, *Brady*	*	..	..	..	C.
12. Cyprinotus pyxidatus, *Moniez* ..	*	..	..	..	C.
COPEPODA.					
13. Cyclops simplex, *Poggenpol*	*	..	..	..	S., C.
14. Diaptomus orientalis, *Brady* ..	*	..	..	..	S.
BRANCHIURA.					
15. Argulus indicus, *M. Weber*	*	..	..	..	J.
ISOPODA.					
16. Ichthyoxenus Jellinghausii, *Herklots*	*	..	..	..	S. [J.]
17. Tachæa lacustris, *M. Weber* ..	*	..	..	..	S.
18. Rocinela typus, *Milne-Edwards*	*	..	..	(*)	S. [B., Bay of Bengal.]
19. Palægyge Borrei, *Giard & Bonnier*	*	..	..	..	F.
20. —— fluviatilis, *M. Weber*	*	..	..	..	C.
21. —— Bonnieri, *M. Weber*	*	..	..	..	C., F., T.
22. ——, sp.	*	..	..	..	F.
23. ——, sp.	*	..	..	..	F.
24. —— de Mani, *M. Weber*	*	..	..	..	S.
25. Probopyrus Giardi, *M. Weber*..	*	..	..	..	S.

Freshwater Crustacea of the Indian Archipelago (continued).

	Fresh Water.	Land.	Brackish Water.	Sea-Water.	
AMPHIPODA.					
26. Orchestia floresiana, *M. Weber*	*	*	..	..	F.
27. —— Martensii, *M. Weber*	*	*	..	..	F.
28. —— parvispinosa, *M. Weber*	..	*	..	..	J.
29. —— montana, *M. Weber*	*	*	..	..	C.
DECAPODA.					
30. Cardisoma carnifex, *Herbst*	..	*	*	*	C., F.
31. Geotelphusa Kuhlii, *de Man*	*	*	..	..	J.
32. —— sumatrensis, *Miers*	*	*	..	..	S.
33. Telphusa granulata, *de Man*	*	*	..	..	J.
34. —— Larnaudii, *Milne-Edw.*, var. brevimarginata, *de Man*	*	*	..	..	J., S.
35. —— celebensis, *de Man*	*	..	..	..	C.
36. Paratelphusa tridentata, *Milne-Edwards*	*	..	..	..	J. [T., Solor.]
37. —— convexa, *de Haan*	*	..	..	..	J. [T., New Guinea, Solor,
38. —— maculata, *de Man*	*	..	..	..	S. Borneo.]
39. Ocypode cordimana, *Latreille*	*	..	..	*	F. [Generally distributed.]
40. Gelasimus acutus, *de Man*	..	..	*	*	S., C.
41. —— triangularis, *Milne-Edw.*	..	..	*	*	S.
42. —— coarctatus, *Milne-Edwards*	..	..	*	*	C.
43. Varuna literata, *Fabricius*	*	..	*	*	S., C., Sal., F., T.
44. Utica gracilipes, *White*	*	..	*	..	F.
45. Pseudograpsus barbatus, *Rumph.*	*	..	?	..	F.
46. —— crassus, *Milne-Edwards*	*	..	?	..	F.
47. Pyxidognathus granulosus, *Milne-Edwards*	*	..	..	..	F.
48. Ptychognathus dentatus, *de Man*	*	..	..	..	C.
49. —— Riedelii, *Milne-Edwards*	*	..	..	..	F., C.
50. —— glaber, *Stimpson*	*	..	..	(*)	F.
51. —— pusillus, *Heller*	*	..	..	(*)	F. [Malay Archipelago.]
52. —— pilipes, *Milne-Edwards*	*	..	..	..	T.
53. Sesarma melissa, *de Man*	*	..	*	(*)	F.
54. —— bidens, *de Haan*	..	..	*	*	C.
55. —— impressa, *Milne-Edwards*	*	..	?	(*)	F.
56. —— Edwardsii, *de Man*	*	..	?	(*)	F.
57. —— Lafondii, *Homb. & Jacq.*	*	..	?	?	S.
58. —— Smithii, *Milne-Edwards*	*	..	..	*	
59. —— Mœschii, *de Man*	*	..	..	(*)	S.
60. —— frontalis, *Milne-Edwards*	*	..	..	(*)	F.
61. —— trapezoides, *Guérin*	*	..	?	(*)	F.
62. —— Weberi, *de Man*	*	..	*	..	F.
63. —— maculata, *de Man*	*	*	*	..	F.
64. Geosesarma nodulifera, *de Man*	*	..	..	..	J.
65. ——, sp.	*	*	..	..	J.

Freshwater Crustacea of the Indian Archipelago (continued).

	Fresh Water.	Land.	Brackish Water.	Sea-Water.	
66. Geosesarma, sp.	*	..	..	..	C.
67. —— sylvicola	..	*	..	..	S.
68. Metasesarma Rousseauxi, *Milne-Edwards*	*	..	?	(*)	F. [Malay Archipelago.]
69. Remipes testudinarius, *Latreille*	*	..	(*)	*	F., T., C.
70. —— denticulatifrons, *White*	*	..	(*)	(*)	T.
71. Atya moluccensis, *de Haan*	*	..	..	..	Generally distributed.
72. —— brevirostris, *de Man*	*	..	..	..	F., T.
73. —— Gustavi, *Ortmann*	*	..	..	..	S.
74. —— dentirostris, *Thallwitz*	*	..	..	..	C.
75. Caridina typus, *Milne-Edwards*	*	..	..	..	F., Sal., C.
76. —— Weberi, *de Man*	*	..	..	..	F., Sal., C., S.
77. —— parvirostris, *de Man*	*	..	..	..	F.
78. —— lævis, *Heller*	*	..	..	..	J.
79. —— multidentata, *Stimpson*	*	..	..	..	C.
80. —— pareparensis, *de Man*	*	..	..	..	C.
81. —— serratirostris, *de Man*	*	..	..	..	F., Sal., C.
82. —— Wyckii, *Hickson*	*	..	*	..	F., Sal., C.
83. —— brevicarpalis, *de Man*	*	..	..	..	C., F.
84. —— gracilirostris, *de Man*	*	..	*	..	C., F., Sal., S.
85. Alpheus rapax, *Spence Bate*	*	..	..	*	C.
86. Palæmon carcinus, *Fabricius*	*	..	*	*	Generally distributed.
87. ? —— Rosenbergii, *de Man*	?	..	?	?	[New Guinea.]
88. —— Weberi, *de Man*	*	..	..	..	C.
89. —— dispar, *von Martens*	*	..	..	..	Widely distributed.
90. —— sundaicus, *Heller*	*	..	*	..	J., F., C.
91. —— elegans, *de Man*	*	..	..	..	J.
92. —— lar, *Fabricius*	*	..	*	..	Generally distributed.
93. —— equidens, *Dana*	*	..	..	*	S.
94. —— javanicus, *Heller*	*	..	..	..	J., B., S., C.
95. —— Horstii, *de Man*	*	..	..	..	C.
96. —— scabriculus, *Heller*	*	..	..	..	Sal., C.
97. —— endehensis, *de Man*	*	..	*	..	F.
98. —— modestus, *de Man*	*	..	..	..	F.
99. —— pilimanus, *de Man*	*	..	..	..	S., J.
100. —— latimanus, *von Martens*	*	..	*	..	T., F., Rotti, Adonare,
101. —— placidus, *de Man*	*	..	..	..	S. Amboina.
102. —— placidulus, *de Man*	*	..	..	..	Sal., C., F., T.
103. —— lampropus, *de Man*	*	..	..	..	C., T.
104. —— bariensis, *de Man*	*	..	..	..	F.
105. —— lepidactyloides, *de Man*	*	..	..	..	F.
106. —— latidactylus, *Thallwitz*	*	..	..	..	C.
107. —— idæ, *Heller*	*	..	..	..	B., J.
108. —— esculentus, *Thallwitz*	*	..	..	..	C.
109. —— dulcis, *Thallwitz*	*	..	..	..	C.
110. Miersia compressa, *de Haan*	*	..	..	..	Adonare.
111. Leander concinnus, *Dana*	*	..	*	(*)	C., Sal., F.
112. Penæus monoceros, *Fabricius*	*	..	*	*	C.

The above list suggests the following remarks and conclusions:—

To the relative paucity of Entomostraca allusion has already been made. Even though they are undoubtedly more numerous than this list would lead us to suppose, they are nevertheless of very much less frequent occurrence than in European waters. *Branchipus* and *Apus* too are absent; for, even if Entomostraca have not been described hitherto from the region with which we are dealing, still the two genera in question, had they been present, must by reason of their size have attracted the attention of previous investigators also. But neither did von Martens meet with them in the Indian Archipelago, nor did Semper observe them in the Philippines.

An important lesson is taught us by the Isopods.

In the first place, Asellidæ are entirely wanting, as also Sphæromidæ, certain species of which are likewise known from fresh water. *The whole of the species observed by me are exclusively stationary or permanent parasites, and belong either to marine species, to marine genera, or, at least, to marine families.*

Of Cymothoinæ our list includes *Ichthyoxenus Jellinghausii*, Herklots, *Rocinela typus*, Milne-Edwards, and *Tachæa lacustris*, sp. n.

Ichthyoxenus Jellinghausii was previously found in Java, and I met with it myself in rivers in Sumatra upon species of *Puntius*. A second species, *Ichthyoxenus montanus*, Schiödte and Meinert, is known from rivers in the Himalayas as parasitic upon *Puntius sophore*.

A single specimen of *Rocinela typus*, Milne-Edwards, was met with by von Martens in Borneo, in the Kapuas River near Sintang, upon *Notopterus hypselonotus*, a freshwater fish. I obtained numerous specimens from Cyprinoids in the Lake of Singkarah, at an altitude of 362 metres above the sea. Before this *Rocinela typus* was collected in the Bay of Bengal.

It is certainly by no means hazardous to suppose that this species, which belongs to an entirely marine genus, is also capable of sojourning upon such marine fishes as visit the mouths of rivers. It can be proved that *Rocinela typus* temporarily leaves the fish in order to live upon the bottom, for the sake of reproduction and perhaps also of undergoing ecdysis. In seeking out a new fish our parasite may easily attach itself to one of the numerous river-fishes which at the same time also visit the brackish estuary, and thus gradually for generations adapting itself to fresh water become a freshwater animal. The freshwater form described by von Martens and myself perhaps also already differs somewhat from the marine form. At any rate, it follows that we are acquainted with this species from the sea (Bay of Bengal), from a river (Kapuas River), and from an elevated freshwater lake (Lake of Singkarah). Passive immigration—of course with a certain amount of assistance on the part of the animal itself—may therefore probably be assumed in this case also.

The occurrence of *Tachœa lacustris*, sp. n., upon Cyprinoids, likewise in the Lake of Singkarah, is to be explained in a similar manner. This new species differs but little from *Tachœa crassipes*, Schiödte and Meinert, which von Martens discovered upon the coral-reef of Singapore, consequently under conditions as marine as possible.

According to the mode of explanation which has prevailed hitherto the Lake of Singkarah consequently contained two most excellent examples of genuine relic-animals; later on we shall be able to indicate yet other marine forms from the same locality. An immigration on the part of these animals into this lake is, however, the much more natural explanation of their presence, and is at the same time in accordance with the geological facts, which furnish no proofs that the region of the lake, either during or subsequent to the formation of its basin, was inundated by the sea, or that the lake was at any time filled with sea-water.

Moreover other species of Cymothoinæ are known, which have become adapted to freshwater life, but occur especially in the lower courses and at the mouths of rivers—indications that it is immigration with which we are dealing in this instance.

Besides my three species mention must be made of *Ichthyoxenus montanus*, Schiödte and Meinert, already alluded to, from rivers of the Himalaya; also of two species that apparently are allied to this—*Lironeca laticauda*, Miers, from Manchuria, and *Lironeca daurica*, Miers, from the River Onon in South-east Siberia—and, further, of *Cymothoa amurensis*, Gerstf., in Siberian rivers, and *Asotana formosa*, Sch. & Mein., from the River Iça in Peru.

The following species were found at the mouths of rivers, or, at any rate, in the adjoining lower portion of the stream:—*Nerocila fluviatilis*, Sch. & Mein., in the Rio Plata near Monte Video; *Lathrœna insidiosa*, Sch. & Mein., in the mouth of the River Santos, in Brazil, upon *Centengraulis edentulus*; *Telotha lunaris*, Sch. & Mein., in the Rio das Velhas, Brazil, upon *Sternarchus brasiliensis*, Rht.; *Telotha Henselii*, v. Mart., in a river near Porto Alegre, Brazil, upon a species of *Geophagus*; *Cirolana elongata*, H. M.-Edw., in the mouth of the Ganges; while *Olencira prægustator*, Latrobe, lives upon the coast of North America, but is found besides in rivers in that region. With regard to *Glossobius laticauda*, M.-Edw., it is stated by Schiödte and Meinert that it is found in all warm seas upon species of *Exocœtus*, and when we find the River Continguiba (Maroin) included among the localities, we can only conclude that the authors are here speaking of the mouth of the river, which is probably the only portion sufficiently salt to enable *Exocœtus* still to exist in it *.

Now if we further consider that, besides numerous marine species which are inexactly described, we have, especially owing to the work of Schiödte, Meinert, and Hansen, a more precise knowledge of over one hundred and eighty species of Cymothoinæ, we shall be obliged to regard this family as genuinely marine, and from the statements and *résumés* given above we may conclude that an immigration into fresh water is partly in progress and partly, as in the case of the three Indian species *Ichthyoxenus Jellinghausii*, *Rocinela typus*, and *Tachœa lacustris*, already completed.

In our list there also appear two genera nearly allied to the genus *Bopyrus*, with at least seven species. Semper was the first to announce the occurrence of *Bopyrus* in the fresh water of the Philippines. Thereupon Giard and Bonnier described *Probopyrus ascendens* and *Palægyge Borrei*, two species which were found living upon freshwater Palæmonids in the Indian Archipelago—the former upon *Palæmon lar*, Fabr., and the latter upon *P. dispar*.

To these I am consequently able to add further forms living upon other species of the genus *Palæmon*.

It is well known that the family Bopyridæ is thoroughly marine. Our potamophilous species must therefore be immigrants into fresh water, and this at the same time implies the assertion that the genus *Palæmon* has also penetrated from

* It is true that J. v. Kennel ('Arbeiten a. d. Zool. Institut zu Würzburg,' 1883, p. 276) mentions "a Crustacean belonging to the genus *Æga*" as having been found by himself in fresh water upon the island of Trinidad; but no indication whatever of the species is given, as is much to be desired in this case, considering the very ambiguous use that is made of the name *Æga*. Von Kennel states that the occurrence of *Æga* in the fresh water of the Palau Islands had already been made known by Semper, and this is also repeated by Simroth. In spite of much search, I have not been able to find the statement alluded to. In Semper's 'Existenzbedingungen der Thiere' (p. 102) a blind "Cymothoon" from "slightly brackish water" is certainly figured, but the genus to which it belongs is not determined.

the sea into the rivers and lakes. For since each species of *Bopyrus* is attached to a distinct species of *Palæmon*, with a regularity which, according to Giard, is characteristic of the Epicaridæ in general, we cannot suppose that the progeny of a Bopyrid whose host was a *Palæmon* which perhaps frequented the vicinity of the mouth of a river, made their way into a genuine river-*Palæmon*. The truth must rather be that *Bopyrus* has immigrated with *Palæmon*, and that the subsequent development of species of the latter has been accompanied by a parallel development of species among the Bopyridæ.

The Isopod freshwater fauna in the Indian Archipelago consequently differs altogether from that of Europe, and consists exclusively of marine forms, although the precise method of their immigration from the sea is not directly obvious.

Of the order Amphipoda our list includes only the genus *Orchestia*, with four species. There appears to be a lack of statements as to the occurrence of Amphipoda in the fresh water of the Indian Archipelago, which is probably in itself a proof of their rarity. Moreover it was only in four localities, widely distant one from another, that I succeeded in discovering the species which are described below.

To reflect, however, that the fauna of the Indian islands has been augmented by a few new members is to regard these four new species of *Orchestia* from the less interesting point of view. The following considerations are of greater importance.

Orchestia floresiana was taken by me near Maumeri, on the north coast of East Flores, in and under fallen leaves at the edge of a pool of fresh water, which lay in a small copse at a distance of about 100 metres from the beach.

On the south coast of the same island I found in the neighbourhood of the village of Lella, in the small stream of the same name, a few hundred metres distant from its mouth and in perfectly fresh water, *Orchestia Martensii* under stones, some in the stream itself, others on the bank. Both species have consequently become adapted to fresh water and at the same time to a mode of life that is to a certain extent amphibious, since they also exist outside the water, beneath damp leaves and stones.

Similar to this was the mode of life of *Orchestia montana*, which I met with near Loka at an altitude of 1150 metres, in the highlands near Bonthain (Celebes), in direct proximity to a mountain-stream.

Finally, I captured the fourth species, *Orchestia parvispinosa*, beneath the trunk of a fallen tree and under stones at the side of a road in the neighbourhood of Tjibeurrem, near Tjibodas (Java), at an altitude of 1575 metres, and at a distance from watercourses. The two last-mentioned species have therefore emancipated themselves from marine conditions to the utmost possible extent, while the two species from Flores were, so to speak, only about to become terrestrial forms, though they had, however, already relinquished existence in sea-water or on the beach, and had exchanged it for life in and beside fresh water.

From these points of view my four species of *Orchestia* afford a not uninteresting contribution to the instances of terrestrial members of this genus with which we are already acquainted. These are *Orchestia sylvicola,* Dana, from the extinct crater of Taiawai, New Zealand, and from woods in the same island, together with *Orchestia telluris,* Bate; *Orchestia tahitensis,* Dana, under leaves and similar objects, at an altitude of 1500 metres in Tahiti; and *Orchestia cavimana,* Heller, at an altitude of 4000 metres upon Olympus (Cyprus), which was rediscovered by Hoek at different localities in Holland, a long way from the sea. Finally, von Martens found *Orchestia humicola* beneath fallen leaves in the vicinity of a wood near Yokohama, while more recently still de Guerne has described * *Orchestia Chevreuxi* from Caldeira de Tayal, in the Azores, at an altitude of 1000 metres above the level of the sea; and Chevreux himself † was able to report this same species from Teneriffe, where he found it in a wood about 500 metres above the sea. De Guerne has already drawn attention to the fact that all these typical terrestrial species of *Orchestia* ‡, which have entirely emancipated themselves from the sea, occur upon islands—as yet with the solitary exception of *Orchestia cavimana,* which Hoek also found in Holland. This remark on the part of de Guerne receives material support from my four species from the Indian Archipelago.

Once more we derive especial interest from the fact that *the Amphipod fauna also of Indian fresh waters is totally different from that of Europe. While Gammaridæ are entirely absent, Orchestiidæ are only rarely met with, and these were without doubt originally immigrants from the sea.*

The long list of Decapods furnishes various important results.

* Bull. Soc. Zool. de France, 1888, p. 59.

† *Loc. cit.* p. 92.

‡ We here leave out of the question the fact that genuinely marine species of *Orchestia* are able in many places to withdraw to a distance from the sea, e. g. *Orchestia littorea.*

1. In the first place, out of the twenty genera that I met with in fresh water, only *Telphusa*, with *Geotelphusa* and *Paratelphusa*, and *Atya* occur in fresh water exclusively.

2. The genera *Caridina* and *Palæmon* show only a preponderance of freshwater forms; they contain species that also occur in sea- or brackish water. Among ten species of *Caridina* I found *Caridina Wyckii* and *C. gracilirostris* also in brackish water. Out of twenty species of *Palæmon* from fresh water I took *P. carcinus* also in the sea and in brackish water. In the latter I further obtained *Palæmon sundaicus*, *P. lar*, *P. endehensis*, and *P. latimanus*.

3. We next come to genera that exist equally as well in the sea as in rivers, with an intermediate habitat in brackish water. This has already been recorded by Semper for *Varuna literata*; I also found this animal in these three kinds of water. Besides this species, however, and under similar conditions—*Ocypode cordimana*, *Utica gracilipes*, and ten species of *Sesarma*. Among the latter is one, *Sesarma maculata*, which had already adapted itself to life upon land in moist surroundings; while among four species of *Geosesarma* I met with one species upon land alone, and two others there and also in fresh water. Lastly, *Metasesarma* also belongs to the same division; although I met with it, as also certain species of *Sesarma*, only in fresh water, they will undoubtedly on further search all be found also in the brackish or saline portion of the river-mouths. *Sesarma bidens* I obtained only in sea- and brackish water.

4. Finally we have genera, such as are usually reckoned as being exclusively marine, but which I likewise found in fresh water. Here are to be mentioned two species of *Pseudograpsus*, *Pyxidognathus granulosus*, five species of *Ptychognathus*, *Leander concinnus*, *Penæus monoceros*, and, as very noteworthy, *Alpheus rapax*, *Remipes testudinarius*, and *R. denticulatifrons*. The two latter were met with by my friend A. Wichmann in the River Koinino, in Timor, in fresh water.

The four groups thus indicated, regarded in reversed order, emphasize with sufficient clearness the immigration, still in progress or already complete, of marine Decapods into the rivers. This is obvious at once with respect to groups 3 and 4, but it also applies to *Caridina* and *Palæmon*. With reference to *Palæmon*, I have already pointed out that immigration from the sea is demonstrated to a certain extent by means of the numerous species of Bopyridæ which are parasitic upon these Indian freshwater prawns.

In the list are also included *Cardisoma carnifex*, three species of *Gelasimus*, and *Sesarma bidens*. These genuine marine animals I obtained, it is true, not in fresh, but still in brackish water. They have consequently arrived to some extent at the first stage of immigration.

Our list thus teaches us that of seventy-six species of Decapods found in fresh water, and therein mentioned, twenty-nine certainly live both in brackish and salt water, and the latter total undoubtedly falls a long way short of the truth. Further, while among Decapods fresh water in Europe contains only *Astacus fluviatilis*, *Telphusa fluviatilis*, Latr., *Pilumnus tridentatus*, Maitland, *Hemicaridina Desmarestii*, Millet, *Leander Edwardsi*, Heller, *Palæmonetes varians*, Leach, and *Troglocaris Schmidtii*, in the Indian Archipelago it yields in all probability considerably more than eighty species.

Consequently with regard to the Decapods also the freshwater fauna of India is as different from that of Europe as it can possibly be; and as to these Decapods, it may be asserted that the majority are distinctly immigrants from the sea. On summing up the results of our discussion the following conclusion may well be pronounced :—

The Crustacean fauna of the fresh water in the Indian Archipelago is composed of two different kinds of elements:

1. Forms of universal occurrence, belonging to the Entomostraca. In comparison with the fauna of Europe this autochthonous freshwater constituent, which has numerous means of dissemination, is but scantily developed. *Apus* and *Branchipus* are absent.

2. Regional or local animals, which are destitute of the aids to dissemination afforded by smallness of body and special arrangement of the branchiæ. It is true that, in so far as they are parasites, they are capable of being transported.

These regional Isopods, Amphipods, and Decapods derive their origin directly or indirectly from the sea, and that by means of immigration, which is also still in progress at the present time, so that even now fresh elements are still continually being added to the freshwater fauna.

This portion of the fauna is entirely different from that of Europe, and the Indian freshwater fauna thus receives an impress of quite another kind *.

* [The remainder of the part is devoted to the description of new species.—Transl.]

XXXIV.—*On Recent Contributions to the Classification of the Lepidoptera by Prof. J. H. Comstock* * *and Dr. T. A. Chapman* †.

Prof. Comstock's discovery of the method of uniting the fore and hind wings in the Hepialidæ and Micropterygidæ by means of what he terms a "jugum," and that the same organ exists in the Trichoptera, is of the greatest interest to entomologists. This jugum consists of a membranous lobe from near the base of the underside of the fore wing, holding the base of the costa of hind wing as in a vice, between it and the inner margin of the fore wing. In most of the other families of Lepidoptera the wings are united by the frenulum, a strong bristle, single in the male, usually multiple in the female, arising from the base of the costa of the hind wing and articulating with the retinaculum on the underside of the fore wing, which generally consists, in the male, of a membranous bar or plate from below the costa or a fold of the costa itself, in the female of a tuft of hair from the median nervure. In many families and genera, however, the frenulum has become aborted and an expansion of the costa of the hind wing prevents the displacement of the wing. The frenulum originally consisted of a tuft of hair, and retains its primitive form in some female Cossidæ and other lowly organized forms, but in most moths has been developed into three strong bristles in the female and a compound single bristle in the male; though in the Noctuid genus *Stictoptera* and in the Phycitinæ it is single in both sexes, in the latter—a subfamily of the Pyralidæ—the retinaculum, in both sexes, consisting of a tuft of hair from the median nervure.

That the Hepialidæ and Micropterygidæ are widely separated from all the other families of Lepidoptera has long been recognized by reason of their having twelve veins to the hind wing as in the fore wing, no other family having more than eight; but that they are closely related to each other has been constantly denied, owing to the great difference in form and size and the existence of highly developed biting mouthparts in the Micropterygidæ, whilst in the Hepialidæ the proboscis and usually the palpi are wanting; so that the discovery of a specialized common structure in the jugum is a fact of great importance.

* J. H. Comstock, "Evolution and Taxonomy," Wilder Quarter Century Book, Ithaca, N. Y., 1893, pp. 37–113.

† T. A. Chapman, Trans. Ent. Soc. 1893, p. 97, and 1894, p. 335.

On the other hand, the Micropterygidæ have often been compared with the Trichoptera, owing to their resemblance in form and structure; and the discovery of the jugum being common to the two groups should go far to prove the derivation of the Lepidoptera from the Trichoptera, and to disprove the alternative theory of a Hymenopterous ancestor based on the resemblance between the larvæ of Lepidoptera and of sawflies.

Dr. Chapman's discovery of the larva of the lower of the two Micropterygid genera—*Eriocephala*—with its antennal and anal appendages, complete set of legs to each somite, spiculate tubercles, and abdominal sucker, tends to complete our knowledge of the group.

After dividing the Lepidoptera into Jugatæ and Frenatæ, Prof. Comstock proceeds to subdivide the latter into families which retain the frenulum and others that lose it; but this is certainly not a natural arrangement, as the loss of the frenulum occurs in scattered genera in many families of Lepidoptera, such as:—*Himantopterus* in the Zygænidæ; the Arbelidæ, closely allied to the Cossidæ; *Cleosiris* in the Callidulidæ; many genera of Drepanulidæ, such as *Phalacra*, *Drapetodes*, *Oreta*, and *Cilix*; *Ratarda* in the Lymantriidæ; the Uraniidæ, nearly related to the frenulated Epiplemidæ; and in the Geometridæ, *Hypulia* and *Genusa* in the Boarmiinæ, and many genera of Geometrinæ.

Prof. Comstock again subdivides his groups by the reduction of the inner area of the fore and hind wings, after doing which he leaves his other families undefined till he completes his study of them. But it is not correct to talk, as he does, of the reduction of the inner area; it is vein 1 *c*, not vein 1 *a*, that becomes aborted in each wing, and it is only in such families as the Saturniidæ, Endromiidæ, Drepanulidæ, and Geometridæ, where vein 1 *a* terminates on the inner margin before the anal angle or is absent altogether, that the inner area of the hind wing is somewhat reduced. The inner area of the fore wing, on the other hand, is somewhat extended by the migration of the subcostals, carrying with them the cell from its original medial position, towards the costa in order to strengthen that margin for purposes of flight—the subcostal nervules becoming crowded close together and their combinations more complex and liable to vary, and characters based on them consequently of less value in the higher than the lower forms.

That the primary division of the Frenatæ into "frenulum losers" and "frenulum conservers" is faulty is recognized by

Mr. H. G. Dyar *, who has worked out Prof. Comstock's system in relation to the setiferous tubercles of the larvæ; and it seems to me that a better primary character is to be found in the migration of vein 5 of the fore wing from its original position at the middle of the discocellulars towards either the lower or upper angles of the cell, as used by myself in my 'Moths of India' †. This, indeed, is practically admitted by Prof. Comstock himself, for he says, at p. 45 of his paper :—

"The loss of the frenulum in certain Frenatæ renders necessary the use of some other character or characters by the systematists as recognition characters."

And at p. 89 :—"And in the Drepanidæ, where the frenulum is usually wanting, it persists in one sex in certain genera." It would be more correct, however, to say that the frenulum is usually present in both sexes, but wanting in several genera. Whilst of vein 5 of the fore wing he says at p. 76 :—

"The union of vein V_1 [vein 6] with radius [the subcostal nervure] and of vein V_3 [vein 4] with cubitus [the median nervure] after the abortion of the base of the media [the radials] is what would be expected. But in which direction would one expect the base of vein V_2 [vein 5] to migrate? Occupying an intermediate position between radius and cubitus, it may go either way. It is like a stream in the middle of a level plain, a trifle may change its course. And thus we find that in some families it migrates towards the cubitus, making this vein apparently four-branched, whilst in other families it goes towards the radius, leaving cubitus apparently three-branched. This difference may be looked upon as a difference in kind of specialization, and is frequently of high value as indicating a *dichotomous division* of the line of descent. It is obvious that in a family where vein V_2 has migrated far towards cubitus, and has thus established its chief source of air-supply in that direction, it is not probable that genera will arise in which vein V_2 is more closely united to radius than to cubitus. To resume the figure, the plain through which the stream is flowing is an elevated plateau, a pebble may determine which of two slopes it shall descend, but when started down one it cannot traverse the other."

A more curious instance of the failure to apply his own principles is to be found on pp. 97, 98, and 108, where the Zygænidæ are divided into two sections falling into widely

* Ann. N. Y. Acad. Sci. viii. p. 202.
† 'Moths of India,' vol. i. p. 9 (1893).

separated groups of families: the first section, as a matter of fact, being the Syntomidæ, erected as a family first by Herrich-Schäffer in 1845, dominant in America but poorly represented in the Old World, and closely related in the form of larvæ and pupæ, as shown by Dr. Chapman, to the Arctiidæ; whilst the second section, the Zygænidæ proper, hardly represented in America but numerous in the Old World, is related, as Dr. Chapman has also shown, to the Limacodidæ and the lowest families of the Frenatæ; these relationships of the two families being fully borne out by the structure of the imago.

One of the many points of interest in Prof. Comstock's paper is his confirmation of the fact that vein 4 is really a part of the three-branched radial nervure, its connexion with the two-branched median nervure being only secondary, as Spuler * first demonstrated from a study of its development.

The suggestion of the relationship of the Hesperiidæ to the Thyrididæ is interesting, and is based on the origin of veins 6 to 11 of the fore wing directly from the cell, which is a character common in the lowest Frenatæ, such as the Zygænidæ and Sesiidæ. The small Oriental day-flying family—the Callidulidæ—akin to the Thyrididæ, has some forms which are so like the Hesperiidæ in flight and general appearance as to be indistinguishable on the wing. In the Callidulidæ and Thyrididæ, however, vein 5 of the fore wing has migrated to the lower angle of the cell, whilst in the Hesperiidæ it arises near the middle of the discocellulars—from slightly above or below—so that it would be from some ancestral form before the migration of vein 5 became fixed, and not from the Callidulidæ themselves, that the development took place. Again, in the Thyrididæ and Callidulidæ vein 8 of the hind wing approaches vein 7 after its origin from the cell, whilst in the Hesperiidæ they are widely separate, though in the Callidulid genus *Herimba* there is an approach to the Hesperid form, this genus being also of interest from the retinaculum of the male consisting of a tuft of hair from the median nervure of fore wing, which is the usual female form. In the Hesperiidæ also this tuft of hair is often developed, and to a certain extent articulates with rough hair from the costa of the hind wing, possibly representing the primitive form of the frenulum. In other Callidulidæ the frenulum is entirely absent, whilst the Australian *Euschemon Rafflesia*, Westw., is a typical Hesperid in every point of

* A. Spuler, 'Zur Phylogenie und Ontogenie des Flügelgeäders der Schmetterlinge.'

structure except in the possession of a fully developed frenulum and retinaculum.

Dr. Chapman's contributions to the classification of the Lepidoptera are entirely derived from a study of the early stages, more especially the segments of the pupæ. He shows that in most of the families of what are usually termed Macro-Lepidoptera, and also in the Pyralidæ and some of the higher subfamilies of the Tineidæ, the movable segments of the pupæ are the fifth and sixth abdominal in both sexes, that they have no power to emerge (as pupæ) from the cocoon, and that dehiscence on the emergence of the imago is by irregular fracture. On the other hand, in all the lower families of the Micro-Lepidoptera the pupa is much less solid, the appendages often partially free, the free segments may extend to the third abdominal, and the seventh segment is always free in the male, fixed in the female. Also that dehiscence is accompanied by freeing of the segments and appendages previously fixed, and that the pupa has the power of progression and emerges from the cocoon, except in the Pterophoridæ. And he proves that the Sesiidæ, Psychidæ, Cossidæ, Hepialidæ, Zygænidæ, and Limacodidæ belong to this lower group of families, in which he is entirely supported by the structure of the imago.

The following key is intended to summarize our present knowledge of the relationships of the various families of Lepidoptera, the minor distinctions which are in general use being omitted, and the families numbered from the bottom upwards in what seems to be the most natural order of arrangement:—

A. Hind wing with 12 veins as in the fore wing and united to the fore wing by a jugum ...... 1. *Micropterygidæ*. 2. *Hepialidæ*.

B. Hind wing with not more than 8 veins and retained in position by a frenulum or an expansion of the base of the costa.

Fore wing with vein 1 *c* present.

3. *Limacodidæ*. 4. *Zygænidæ*.
5. *Castniidæ*. 6. *Megalopygidæ*.
7. *Psychidæ*. 8. *Heterogynidæ*.
9. *Cossidæ*.

Fore wing with vein 1 *c* absent *.

Fore wing with vein 5 from the middle of the discocellulars, the other veins given off from the cell arising at nearly even distances on each side of it.

13. *Sesiidæ*. 14. *Tineidæ*.
15. *Alucitidæ*. 16. *Pterophoridæ*.

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* Except in some genera of Tineidæ, such as *Methypsa* and *Tortricomorpha*.

Fore wing with vein 5 arising much nearer 4 than 6.

Hind wing with vein 8 curved and nearly or quite touching 7, or connected with it by a bar after its origin from the cell.

17. *Pyralidæ.* 18. *Thyrididæ.*
19. *Drepanulidæ.* 20. *Callidulidæ.*
11. *Lasiocampidæ.*

Hind wing with vein 8 remote from 7 after its origin from the cell ....

10. *Arbelidæ.* 12. *Endromiidæ.*
21. *Syntomidæ.* 22. *Arctiidæ.*
23. *Lymantriidæ.* 24. *Pterothysanidæ.*
25. *Hypsidæ.* 26. *Agaristidæ.*
27. *Noctuidæ.*

Fore wing with vein 5 from the middle of the discocellulars or nearer 6 than 4 *, the veins not arising at even distances round the cell ....

28. *Cymatophoridæ.* 29. *Sphingidæ.*
30. *Notodontidæ.* 31. *Dioptidæ.*
32. *Geometridæ.* 33. *Epiplemidæ.*
34. *Uraniidæ.* 35. *Epicopeidæ.*
36. *Bombycidæ.* 37. *Eupterotidæ.*
38. *Ceratocampidæ.* 39. *Brahmæidæ.*
40. *Saturniidæ.* 41. *Rhopalocera.*

After the development of the Frenatæ we may picture the ancestor of all this group of families of Lepidoptera to have been a form with a frenulum, the fore wing with vein 1 *c* present, veins 2 to 11 given off at regular intervals round the cell, the hind wing with eight veins, 1 *a*, *b*, *c*, all present, vein 8 free from the base, but connected with the cell by an oblique bar, the remains of one of the lost subcostals, and the forked stalk of the radial vein still present in the cell of each wing—a form which almost exactly survives in some of our present Zygænidæ and Cossidæ, and to which families 3 to 9 are all closely allied. From this Zygæno-Cossid form has arisen :—

I. Through *Alavona*—the Tineidæ, Pterophoridæ, and Alucitidæ, by the loss of vein 1 *c* of the fore wing and of the oblique bar connecting vein 8 with the cell of hind wing; and, as a further development, the Sesiidæ, by the loss of vein 8 of the hind wing.

II. The families in which, besides the loss of vein 1 *c* of the fore wing, vein 5 has migrated towards the lower angle of the cell, the bases of some of the subcostals of the fore wing usually becoming united.

(1) The Arbelidæ, Endromiidæ, and Lasiocampidæ, by the loss of the frenulum; the bar between vein 8 and the cell

* Except in some genera of Dioptidæ.

of hind wing being retained, or vein 8 being united to 7 after its origin.

(2) The Pyralidæ, Thyrididæ, Drepanulidæ, and Callidulidæ, by the loss of the bar, vein 8 bending down and becoming connected with 7 after its origin; the frenulum in the last two families being often lost.

(3) The Hypsidæ and Lymantriidæ, retaining the frenulum and the bar between vein 8 and the cell of hind wing.

(4) The Pterothysanidæ, by the loss of the frenulum and the freeing of vein 8 of hind wing.

(5) The Syntomidæ, by the loss of vein 8 of hind wing.

(6) The Arctiidæ, by the coalescence of vein 8 of hind wing with the cell to a greater or less degree.

(7) The Noctuidæ and Agaristidæ, by vein 8 being connected with the cell at a point near the base only.

III. The forms where vein 1 *c* of fore wing is lost, but vein 5 retains its position at the middle of the cell or has migrated towards the upper angle.

(1) The Dioptidæ, in which vein 5 of the fore wing has not become fixed, for whilst it retains its medial position in most forms, in some it has migrated to the lower angle of the cell, vein 8 of the hind wing being free.

(2) The Geometridæ, in which vein 5 often migrates towards the upper angle of cell; vein 8 of the hind wing retains the bar in the lowest subfamily, Orthostixinæ, anastomoses strongly with the cell in the Larentiinæ, becomes quite free except near the base in the Acidaliinæ and Geometrinæ, and entirely free but closely approximate to the cell in the Boarmiinæ, the lowest forms of which, however, *Abraxas* and its allies, often retain the bar; in many genera the frenulum becomes aborted.

(3) The Epiplemidæ and Epicopeidæ, in which vein 8 becomes quite free and widely separated from the cell, the latter having the frenulum rudimentary.

(4) The Uraniidæ, Bombycidæ, Ceratocampidæ, Saturniidæ, and Brahmæidæ, in which the frenulum is lost, vein 8 being entirely free except in a few forms of the Bombycidæ, where the bar is retained, and in *Brahmæa*, where it becomes closely connected with 7.

(5) The Eupterotidæ, in which both the bar and the frenulum are retained.

(6) Whilst branching off in another direction from the ancestor of this group were developed the Notodontidæ, which retain the bar in the lower forms from which arose the Sphingidæ, retaining the bar and with vein 8 closely connected

with 7, and the Cymatophoridæ, in which the bar is lost and vein 8 anastomoses with 7.

(7) The Rhopalocera, which have lost the frenulum, but in some of the lower forms of which traces of vein 1 *c* and the stalk of the radial vein are retained; vein 5 of the fore wing is given off either above or below the middle of the discocellulars, and vein 8 of the hind wing has become entirely free. In the lowest family—the Hesperiidæ—the subcostals of the fore wing are all given off from the cell, the union of their bases only occurring in the higher families.

G. F. Hampson.

XXXV.—*On some Small Collections of Odonata (Dragonflies) recently received from the West Indies.* By W. F. Kirby, F.L.S., F.E.S., Assistant in Zoological Department, British Museum.

The British Museum has recently received some collections of insects of various orders from the West-Indian Exploration Committee. Among these were nineteen species of Dragonflies which were collected by Mr. H. H. Smith in St. Vincent and Grenada, an account of which is furnished in the present paper. Four species have been described as new, one of which is regarded as the type of a new genus, while two or three others are new to the collection of the British Museum; and two specimens, probably new, but belonging to obscure and imperfectly known groups, are left undetermined for the present, the material at hand being insufficient for their elucidation.

The whole of the information which accompanied them is here published, being placed between inverted commas. About nineteen species were received, belonging exclusively to the subfamilies Libellulinæ and Cœnagrioninæ.

The species described as new are as follows:—

Brechmorhoga (g. n.) *grenadensis.*
Dythemis multipunctata.
Cannacria Smithii.
Micrathyria (?) *pruinosa.*

All these belong to the Libellulinæ.

Libellulidæ.

Libellulinæ.

1. *Pantala flavescens.*

Libellula flavescens, Fabr. Ent. Syst. Suppl. p. 285 (1798).

The most widely ranging dragonfly known, occurring commonly in most parts of the world, except Europe, where the sole record respecting it is a reported capture by Sparshall at Horning many years ago.

4 St. Vincent (Windward side).

"Rare."

"The male and female of this species are alike. Hermitage Estate, Cumberland Valley, 1000 feet. Open stagnant pools."

2 Grenada.

"Swamp by Leeward coast, 1 mile E. of St. George's Bay, Aug. 24."

2. *Tramea abdominalis.*

Libellula abdominalis, Ramb. Ins. Névr. p. 37 (1842).

Not an uncommon species. The British Museum has specimens from Brazil (Rio?), Para, and Jamaica.

In the male the dark space on the hind wings extends to the inner margin and anal angle; in the female it does not reach either.

3 Grenada.

"184."

"Mount Gay (Leeward), 150 feet, Sept. 6. Open marshy land, over pools."

3. *Trithemis abjecta.*

Libellula abjecta, Ramb. Ins. Névr. p. 83 (1842).

Originally described from Colombia.

Distinguished from *T. fusca* by the much smaller dark spot at the base of the hind wings. It may be the same as *T. fraterna*, Hag. The numerous American species of this group are very imperfectly worked out at present, and many of them are still undescribed.

8 St. Vincent.

"Windward side, no. 190."

"Leeward side, 500 feet, May."

"Hermitage Estate, Cumberland Valley, 1000 feet, Dec. 20. Open stagnant pools."

"Great Head Swamp, southern end of island, near sea, Dec. 24."

4. *Trithemis fusca.*

Libellula fusca, Ramb. Ins. Névr. p. 78 (1842).

Originally described from Cayenne. It also occurs in Colombia.

9 Grenada.

Nos. "56," "106," "205," and "233."

5. *Trithemis pulla.*

Libellula pulla, Burm. Handb. Ent. ii. p. 855. n. 41 (1839).
Libellula unimaculata, Burm. (nec De Geer, Ramb.), *l. c.* n. 43 (1839).
Diplax ochracea, Hag. (nec Burm.) Neur. N. Amer. p. 181 (1861).
Libellula fervida, Erichs. Schomb. Reisen in Brit.-Guiana, iii. p. 584 (1848).
Libellula justina, Selys, Sagra, Hist. Cuba, Ins. p. 450 (1857).

All these references appear to me to belong to the same species.

Both *unimaculata*, De Geer, Ramb., and *ochracea*, Burm., should have only two rows of post-triangular cells, instead of one or more rows of three, followed by one or more rows of two increasing, as in typical *Trithemis*. The species which Erichson calls *unimaculata*, and of which he describes the female, may be called *T. Erichsoni*, and differs from *pulla* in the adult male being pruinose, and the vertex steel-blue in both sexes.

28 Grenada.

Nos. 21, 42, 53, 94, 205, 223, 233, and 235.

"3rd coll. no. 75."

"Swampy forest by seashore, north of Granville, May 9."

6. *Trithemis umbrata.*

Libellula umbrata, Linn. Syst. Nat. (ed. x.) i. p. 545. n. 13 (1758).

An extremely common species throughout tropical America. It varies a little in size and in the breadth and depth of colour of the dark band in the male.

7 St. Vincent.

"Great Head Swamp, southern end of island, near sea, Dec. 24."

"Hermitage Estate, Cumberland Valley, 1000 feet, Dec. 20. Open stagnant pools."

"Grand Sable (Windward), by pools near sea, Jan. 4."

47 Grenada.

Nos. 101, 124, 184, 205, 223, 233.

"3rd coll. nos. 74, 75."

"Common on open swamp near seashore, north of Granville, May 9."

"Swamp on Leeward coast, 1 mile N. of St. George's, Aug. 22."

"Mustique Island, Grenada, June."

7. *Orthemis ferruginea.*

Libellula ferruginea, Fabr. Syst. Ent. p. 423. n. 19 (1775).

A common tropical American species.

1 Union Island, October.

7 St. Vincent.

"Windward side, 1500 feet."

"Leeward, 500 feet, October, common."

"Hermitage Estate, Cumberland Valley, 1000 feet, Dec. Open stagnant pools."

"Grand Sable, by pools near sea, Jan. 4."

"Windward side, no. 190, seashore."

"Cumberland, Leeward, by seashore, Dec. 20."

3 Grenada.

"No. 106"; "3rd coll. no. 79."

"Gay Estate, Leeward, 150 feet, Sept. 6. Open marshy land, over pools."

Brechmorhoga, gen. nov.

Male.—Frontal tubercle bifid; abdomen much longer than the hind wings, moderately slender, inflated at base, and gradually thickened towards the extremity. Wings moderately long and broad; pterostigma moderately long: fore wings with 12 or 13 antenodal and 6 or 7 postnodal nervures, the last antenodal and two first postnodals not continuous; triangle slightly oblique, free (or, more rarely, traversed), followed by two rows of cells, increasing; the post-triangular space has a loop-nervure above, enclosing 7 or 8 cells, and is half as broad again at the hind margin as at the triangle; subtriangular space consisting of three cells: hind wings with 8 or 9 antenodal and 7 to 9 postnodal nervures, the two first postnodals not continuous; upper anal appendages longer than the eighth segment, hairy, not much thickened laterally before the extremity, which is pointed; lower appendage nearly as long as the upper: legs long; femora slightly thickened and denticulated in front, with a double row of bristles. Other characters as in *Macrothemis*, Hagen.

In *Macrothemis* the frontal tubercle is not bifid, the post-triangular space on the fore wings has no loop-nervure, and the two rows of cells only increase close to the hind margin, where the space is scarcely, if at all, broader than at the triangle.

8. *Brechmorhoga grenadensis*, sp. n.

Long. corp. 40–42 millim.; exp. al. 54 millim.; long. pter. 2½ millim.

Male.—Reddish brown or blackish; head with the frontal tubercle and clypeus (except at the sides below) violet-blue, mouth-parts sometimes black; thorax with an L-shaped greenish band on each side above, thicker, and turned towards each other; pleura with two broad greenish bands and a narrow one between, which is interrupted in the middle; there are also sometimes pale spots between the wings above; behind the last broad lateral stripe is a pale spot above, and a pale stripe on the median line below; abdomen inflated at base, with three pale spots on each side; the uppermost are followed by three long spots as far as the front of the fourth segment; the last is sometimes followed by a line; on the seventh segment is a reddish stripe on each side, not extending to the suture either before or behind. Wings hyaline, more or less tinged with yellow at the base and sometimes towards the costa; pterostigma brown or yellow, between black nervures; membranule dark grey.

Dythemis mendax and *præcox*, Hagen, probably belong either to this genus or to *Macrothemis*.

Two male specimens from Grenada, nos. 106 and 119.

9. *Dythemis multipunctata*, sp. n.

Long. corp. 36–39 millim.; exp. al. 50–56 millim.; long. pter. 3 millim.

Reddish brown, abdomen darker; face yellow, shading into rusty towards the frontal tubercle, which is violet-blue, and towards the tips of the mandibles and adjacent mouth-parts, which are black, as well as the centre of the labium; occiput black, shining, spotted with yellow on the sides; thorax with three short yellow stripes in front, the middle one linear; behind each of the lateral stripes is a detached, slightly curved, yellow stripe; all the parts of the thorax on the median line are yellow, and there are several yellow dots at the base of the wings; the sides of the thorax beneath the wings have three alternating yellow and black stripes, the latter inclining to brassy green; in front of these is the commencement of a fourth yellow stripe, followed by two small yellow spots; the middle yellow band is broken into three, the hindermost is hooked at the top and is followed below by two large irregularly-triangular spots, followed by a broad transverse semicircular mark; abdomen with double, nearly continuous, central lines on the upperside; there are some yellow markings and spots at the base and sides, followed by a double row of linear markings on segments 2 to 7, that on segment 6 smallest and that on segment 7 largest; legs black, front trochanters and femora yellow beneath; anal appendages black, as long as the eighth segment, the lower appendage yellow, except at the sides, above and below, and nearly as long as the others. Wings hyaline, slightly tinged with yellow at the base, but sometimes yellowish or smoky hyaline, with even the tips clouded; pterostigma brown, sometimes yellowish in the centre; fore wings with 12 or 13 antenodal and 7 to 9 postnodal nervures; post-triangular space with 3 cells increasing, subtriangular space consisting of three cells; hind wings with 9 or 10 antenodal and 7 to 10 postnodal nervures.

10 St. Vincent.

"Great Head Swamp, southern end of island, near sea, Dec. 24."

"Pools near Bannonallie, Jan. 12."

"Richmond (Leeward), near sea-level, Dec. 14. This species is rather rare about open streams."

"Hermitage Estate, Cumberland Valley, 1000 feet, Jan. 20. Open land, rare."

10. *Dythemis multipunctata*, var. (?).

These specimens are clouded hyaline, with dusky tips, and the antenodal and postnodal cross-nervures are rather closer together; but I cannot find sufficient characters to separate them specifically at present.

2 Grenada, nos. 213 and 235.

11. *Cannacria Smithii*, sp. n.

Long. corp. 42–44 millim.; exp. al. 70–80 millim.; long. pter. 3–4 millim.

Differs from *Cannacria Batesii*, Kirb., the type of the genus, in having only 9 antenodal and 8 postnodal nervures on the fore wings, and 6 antenodal and 8 postnodal nervures on the hind wings, and the abdomen is somewhat shorter and broader; but in every other respect this species exhibits all the characters of my genus *Cannacria*.

Rufo-testaceous, frontal tubercle darker, shining, and bifid in front; abdomen with a more or less distinct dark band above, commencing on the fourth segment, and contracted into an hour-glass-shape between each two incisions; sometimes it is brown and hardly visible, at other times it is blackish, but is always darkest towards the extremity of the abdomen.

Wings clear hyaline; pterostigma yellowish, between dark brown nervures: hind wings stained with yellow at the base; membranule small, brownish grey, with a paler line towards the upper end.

2 St. Vincent.

"Grand Sable, Windward. Pools near sea, Jan. 4."

3 Grenada.

Nos. 106 and 213.

"Near Mount Maitland, Sept. 13. Leeward, 600 feet. Open hillside."

12. *Micrathyria æqualis.*

Dythemis æqualis, Hag. Neur. N. Amer. p. 167 (1861).

I believe I have correctly identified this species. The triangle of the fore wings is untraversed, and there are two rows of subtriangular cells, followed by three increasing.

3 Grenada.

"3rd coll. no. 74."

"One pair taken *in coitu.*"

13. *Micrathyria* (?) *pruinosa*, sp. n.

Exp. al. 50 millim.; long. pter. 3 millim.

Male.—Head: frontal tubercle strongly bifid in front, violet-blue, as are also the upper lobes of the clypeus, except at the sides; face yellowish white; mandibles, suture of labrum, and occiput black, the latter with two yellow spots on each side; prothorax and pleura bronzy green, with two lateral yellow lines converging behind, on the front two thirds of the prothorax; median line very slightly marked, but commencing at a small yellow crescent in front; sides and hinder edge of prothorax bordered by a pale yellow zigzag line; pleura with three broad pale yellow stripes, the first slightly contracted in the middle and broadest below, the third broader than the second; interalary space above and base of abdomen, which is inflated, pruinose blue, except the sutures. Under surface pruinose bluish grey, segments 2 to 4 of abdomen slender, black, with a long pale yellow lateral spot on the sides of each at the base; those at the base of the second segment least marked, but divided by the carina; the remaining segments missing. Wings clear hyaline; pterostigma dark reddish brown, between black nervures: fore wings with 11 antenodal and 9 or 10 postnodal nervures, the last antenodal and first two postnodals not continuous; triangle rather broad, traversed, followed by one row of three cells and five or six of two, followed again by three; no loop-nervures, except below the subnodal sector; subtriangular space consisting of three cells: hind wings with 9 antenodal and 10 postnodal nervures; membranule rather small, blackish.

A slender species, with the frontal tubercle more strongly bifid than in the more typical species of the genus.

1 Grenada, no. 233.

14. *Lepthemis vesiculosa.*

Libellula vesiculosa, Fabr. Syst. Ent. p. 421. n. 7 (1775).

1 St. Vincent, "Windward side, May."

10 Grenada, nos. 136, 223, 205, 184, 233, 101.

"Swamp on Leeward coast, 1 mile north of St. George's. This species is common in Grenada, near sea-level, both sides of island, Aug. 22."

2 Union Island, October.

Agrionidæ.

Cœnagrioninæ.

15. *Argia insipida.*

Argia insipida, De Selys, Bull. Acad. Belg. (2) xx. p. 387 (1865).

24 St. Vincent.

Nos. 189, 190.

"Sea-level."

"St. Vincent, Windward side, 500 feet."

"Bowwood Valley, near Kingstown, 1000 feet, by mountain-stream, Dec. 23."

"Richmond Valley Forest, 1800 feet, by mountain-stream, Dec. 21, 31. Colours blue and black."

"Pools near Bannonallie, Jan. 12."

"Forest, Soufrière Volcano, 2000 feet, Jan. 5."

"Hermitage Estate, Cumberland Valley, 1000 feet, Dec. 20. Open stagnant pools."

7 Grenada.

"Balthazar (Windward), 250 feet, second growth."

Nos. 56, 64, 164, 219, 229.

16. *Argia*, sp.

1 St. Vincent, near Kingstown.

A single specimen of a very dark species, probably new, but which it would be useless to describe without a series.

17. *Cœnagrion*, sp.

In this case also it is better to wait for a series than to describe a probably new species prematurely.

1 Grenada.

"Grand Étang (Mountain Lake), 1700 feet, March 9. Common along the shore."

18. *Micronympha senegalensis.*

Agrion senegalense, Ramb. Ins. Névr. p. 276 (1842).

17 St. Vincent.

"No. 190."

"May."

"500 feet."

"Grand Sable (Windward), by pools near sea, Jan. 4."

"Hermitage Estate, Cumberland Valley, 1000 feet, Dec. 20. Open stagnant pools."

"Great Head Swamp, southern end of island, near sea, Dec. 24."

9 Grenada.

Nos. 53, 64 (pair *in coitu*), 71 (3rd collection), and 229.

"Grand Étang (Mountain Lake), 1700 feet, March 9. Common along the shore."

4 "Mustique Island, Grenada, June."

19. *Lestes spumaria.*

Lestes spumaria, De Selys, Bull. Acad. Belg. (2) xiii. p. 309 (1862).

Originally described from Porto Rico.

2 Grenada, nos. 204 and 221.

XXXVI.—*A List of the Bornean Species of the Genus* Opisthostoma, *and Descriptions of Four new Species.* By EDGAR A. SMITH.

A POPULAR account of the species of *Opisthostoma* from Borneo was published by the writer in March of this year in the first number of the new series of 'Science Gossip.' In addition to the ten different species there referred to, I have now to mention one described by Dr. Boettger and four new forms, of which diagnoses are now given.

All the known species, with the exception of *O. otostoma*, Boettger, have been figured; and as the present paper is unillustrated, it is proposed to give figures of the new forms in a future report on some Bornean land-shells, now in course of preparation. It is a satisfaction to record that the British Museum possesses examples of all the known forms, and the types of the nine species described by myself have been most liberally presented by Mr. A. Everett, to whom the chief credit is due of having discovered the majority of these very remarkable shells.

The following is a complete list of the known species, arranged in order of publication :—

1. *Opisthostoma Decrespignyi* (H. Adams).

Plectostoma De Crespignii, H. Adams, Ann. & Mag. Nat. Hist. 1865, vol. xv. p. 177.
Opisthostoma De Crespignii, W. T. Blanford, Ann. & Mag. Nat. Hist. 1867, vol. xix. p. 305.
Plectostoma Decrespignyi, Issel, Ann. Mus. civ. Storia nat. 1874, vol. vi. p. 439, pl. vi. figs. 13–15.
Opisthostoma Decrespignyi, Godwin-Austen, Proc. Zool. Soc. 1889, p. 350.

Hab. Labuan (*H. Ad.*), Borneo (*Issel*).

2. *Opisthostoma Wallacei* (Ancey).

Plectostoma Wallacei, Ancey, Bull. Soc. Mal. France, 1887, p. 276.
Opisthostoma Wallacei, Smith, Journ. Linn. Soc. 1893, Zool. vol. xxiv. p. 347, pl. xxv. figs. 14, 14 *a*.

Hab. Borneo (*Ancey*), Busau, West Sarawak (*Smith*).

3. *Opisthostoma grandi-spinosum*, Godwin-Austen.

Opisthostoma grandi-spinosum, G.-A., Proc. Zool. Soc. 1889, p. 350, pl. xxxviii. figs. 2, 2 *a*.
Geothauma grandispinosum, Crosse, Journ. de Conch. 1892, p. 283, pl. iv. figs. 1–1 *c*.
Opisthostoma grandispinosum, Smith, Science Gossip, 1894, vol. i. p. 6 (cut).

Hab. Niah Hills, Sarawak.

4. *Opisthostoma pulchellum*, Godwin-Austen.

Opisthostoma pulchella, G.-A., Ann. & Mag. Nat. Hist. 1890, vol. vi. p. 245, pl. vii. fig. 1.

Hab. Baram (*G.-A.*); Mulu, Tampasang, and Barit Mountain (*A. Everett*).

The specimens from Barit Mountain have a thicker and less conical spire than typical examples; but as they agree in every detail of sculpture, I think it advisable to regard them at present in the light of a variety rather than as a distinct species.

5. *Opisthostoma Hosei*, Godwin-Austen.

Opisthostoma Hosei, G.-A., Ann. & Mag. Nat. Hist. 1890, vol. vi. p. 246, pl. vii. fig. 2.

Hab. Baram district, North Sarawak.

6. *Opisthostoma mirabile*, Smith.

Opisthostoma mirabile, Smith, Journ. Linn. Soc., Zool. 1893, vol. xxiv. p. 346, pl. xxv. figs. 11, 11 *a*; id. Science Gossip, 1894, vol. i. p. 6 (cut).

Hab. Gomanton Hill, North Borneo.

7. *Opisthostoma Everetti*, Smith.

Opisthostoma Everetti, Smith, Journ. Linn. Soc., Zool. 1893, vol. xxiv. p. 346, pl. xxv. figs. 12, 12 *a*.

Hab. Jambusan, south-west end of Sarawak.

8. *Opisthostoma jucundum*, Smith.

Opisthostoma jucundum, Smith, *op. cit.* p. 347, pl. xxv. figs. 13, 13 *a*.

Hab. Mantanani Island, off British North Borneo.

9. *Opisthostoma baritense*, Smith.

Opisthostoma baritense, Smith, *op. cit.* p. 347, pl. xxv. figs. 15, 15 *a*.

Hab. Barit Mountain, North-west Borneo.

10. *Opisthostoma busanense*, Smith.

Opisthostoma busanense, Smith, *op. cit.* p. 348, pl. xxv. figs. 16, 16 *a*.

Hab. Busan, south-west end of Sarawak.

11. *Opisthostoma otostoma*, Boettger.

Opisthostoma otostoma, Boettger, Nachrichtsbl. deutsch. mal. Gesell. 1893, p. 194.

Hab. Brunei, North-west Borneo.

12. *Opisthostoma Cookei.*

Testa conica, perforata, pallide rufescens; spira subtiliter concave conica, ad apicem obtusiuscula; anfractus 6–7, superiores convexi, læves, inferiores minus convexi, oblique et tenuissime lamellati, ultimus ad peripheriam obtuse angulatus, antice constrictus, retroversus, ascendens, conspicue solutus, lamellis validioribus distantioribus bicristatis ornatus; apertura rotundata, intus

rufescens, ad marginem duplicatam expansam pallida, usque ad suturam tertiam vel quartam sursum porrecta.
Longit. 2 millim.; diam. maj. $2\frac{2}{3}$, min. $1\frac{1}{2}$.

Hab. Sarawak (*C. Hose*).

Five specimens of this species were presented to the British Museum by Mr. Charles Hose, but the particular part of Sarawak where they were collected is unknown.

O. Hosei and *O. Decrespignyi* are the nearest allies of this species. The former is about the same size, but has a more robust spire, smoother and fewer whorls; but the last is much more strongly lamellated, and has only a single crest, whereas in the present species there are two. *O. Decrespignyi* has a less conical spire, more rounded volutions, and the body-whorl is scarcely crested at all.

I have much pleasure in naming this species after the Rev. A. H. Cooke, who has kindly undertaken to figure it in his forthcoming volume on the Mollusca in the 'Cambridge Natural History.'

13. *Opisthostoma depauperatum.*

Testa *O. baritense* similis, sed minor, minus elongata, lamellis distantioribus ornata, anfractu ultimo valde soluto, antice magis ascendente.
Longit. $1\frac{1}{2}$ millim.; diam. maj. 2, min. 1; apertura $\frac{2}{3}$ lata.

Hab. Barit Mountain, North-west Borneo.

The smaller size, more distant sculpture, and the more uncoiled last whorl distinguish this species from *O. baritense*; also in that form the body-whorl is not produced upward so much anteriorly, the top of the peristome being about on a level with the second suture, whereas in the present species it almost reaches the third.

14. *Opisthostoma Austeni.*

Testa dextrorsa, conica, angustissime perforata, pallida vel plus minus rufescens; anfractus 6, convexi, regulariter crescentes, sutura profunda sejuncti, liris obliquis tenuissimis curvatis (in anfr. ultimo sensim crassioribus et distantioribus) instructi; anfr. ultimus constrictus, ad aperturam valde ascendens et retroversus, haud solutus; apertura rotunde angulata; peristoma leviter incrassatum, porrectum, vix expansum, extus lamella tenui angusta circumdatum.
Longit. $2\frac{1}{2}$ millim.; diam. maj. $2\frac{3}{4}$, min. $1\frac{1}{2}$; apertura cum perist. $1\frac{1}{4}$ longa et lata.

Hab. Rumbang, Sarawak.

The upper whorls of this species are sometimes pale and sometimes reddish; this, however, may be due to staining from the animal. The last whorl is invariably reddish, especially the first half.

It is closely related to *O. otostoma*, but may be distinguished by its less convex whorls, the different form of the aperture, and the more thickened peristome, which is scarcely lobed above, and also by the body-whorl being adnate to the spire, whereas in *O. otostoma* it is quite free.

15. *Opisthostoma pumilio.*

Testa *O. Austeni* similis, sed minor, minus conica vel pyramidalis; anfractus 5, perconvexi, liris obliquis leviter distantioribus instructi.

Longit. 2 millim.; diam. maj. $2\frac{1}{4}$, min. $1\frac{1}{4}$; apertura $\frac{3}{4}$ longa et lata.

Hab. Rumbang, Sarawak.

This very small species closely resembles *O. Austeni* in its general features. It is, however, quite distinct. It consists of one whorl less, is of smaller size, has rather more distant liræ or lamellæ, and also a more obtuse or less conical spire. The coloration is the same as in that species.

XXXVII.—*Notes on the Pedipalpi of the Family* Tarantulidæ *contained in the Collection of the British Museum.* By R. I. Pocock, of the British Museum (Natural History).

[Plates VII. & VIII.]

Family **Tarantulidæ**.

Subfam. *Tarantulinæ.*

(Simon, Ann. Soc. Ent. Fr. 1892, p. 50.)

Three generic names have been employed for the species of this subfamily, i. e. *Tarantula*, *Phrynus*, and *Admetus*. *Tarantula* was first used by Fabricius in 1793 for the species called *Phalangium reniforme* by Linnæus. *Phrynus*, on the contrary, which was also erected for the reception of the same *reniforme*, is not at present known to have appeared in print before 1801; it was then used by Lamarck, who cited the genus as Olivier's (Syst. Anim. p. 175). In the following year Latreille also published the name, and ascribed it to

Olivier (Hist. Nat. Crust. Ins. iii. p. 48). In the face of these facts it seems probable that it was Olivier's intention to establish the genus *Phrynus* for *reniforme*, and that both Lamarck and Latreille were acquainted with his purpose. Nevertheless, since Olivier does not seem to have used the name in print prior to or during 1801, we are compelled to look upon Lamarck as its parent and upon 1801 as the date of its birth. *Tarantula* of Fabricius is consequently its elder by eight years; and the right to the inheritance of the name *reniformis* belongs beyond dispute to the firstborn.

This is the solution of the first difficulty. The second is involved in the identity of *reniformis* of Linnæus. Pallas seems to have been the first to start the confusion on this point, for he identified as *reniformis* a species belonging to a group of which *chiracanthus* of Gervais may be regarded as typical. This opinion was adopted without further question by Dr. Karsch (Arch. Nat. 1879, p. 197), and subsequently by Mons. Simon (Ann. Soc. Ent. France, 1892, p. 51); but, as I have already pointed out (Journ. Linn. Soc. xxiv. p. 406, 1893), Linnæus took as the type of *reniformis* the figure of a species from Antigua which was published by Browne in his 'History of Jamaica'; and this figure represents a specimen which is not congeneric with the *chiracanthus* group, but with what may be termed the *palmatus* group. Moreover, if further evidence in support of this opinion be needed, it may be urged that species of the *chiracanthus* group are unknown in the West Indies, while those of the other section are exceedingly abundant *.

It seems therefore to be perfectly clear that the name *Tarantula* is to be applied to the Neotropical species of Amblypygi, of which *palmatus*, Herbst, seems to be an unmistakable representative.

There is, however, one more name to be taken into consideration. This is *Admetus* of Koch ('Uebersicht des Arachnidensystems,' 1850, p. 81). Four species were included in this genus, namely *pumilio*, *fuscimanus*, and *margine-maculatus* of C. Koch, and *palmatus* of Herbst, occurring in the order named. But the last three are admittedly referable to the group which I have shown should be called *Tarantula*. *Pumilio*, however, belongs to the *chiracanthus* section, and at first sight it seems reasonable to suppose that the species *pumilio* should stand as the type of *Admetus*, in which case the latter name would embrace all the species of

* See Supplementary Note on p. 297 on the identity of *Tarantula reniformis* (Linn.).

the *chiracanthus* group. But the diagnosis of *Admetus* evidently applies to species like *palmatus*, and not to those like *chiracanthus*, and it seems certain that C. Koch would not have placed a species related to *chiracanthus* into *Admetus* if he had known the adult animal. We may therefore conclude that *pumilio* was merely included in *Admetus* owing to the accident of the immaturity of the type specimen.

On these grounds I consider that one of the other species, say *fuscimanus*, should be looked upon as the type of *Admetus*; and in this case *Admetus* must be regarded, like *Phrynus*, as a synonym of *Tarantula*. It thus appears that no authors have given a name that can stand to the *chiracanthus* section of species. I have therefore proposed to term it *Heterophrynus*, with *chiracanthus* as the type (Journ. Linn. Soc., Zool. xxiv. p. 527, 1894).

To these two genera of Tarantulinæ I now propose to add a third, namely *Phrynopsis*. The three may be diagnosed as follows:—

a. Without a backwardly directed apophysis upon the trochanter of the chelæ. Chelæ armed with very many spines, short, stout; femur flat in front, the tibia flat in front and below, nearly straight externally, its upper inner edge more or less produced internally.

a[1]. Second tarsal segment of the feet partially divided by a transverse membranous line; frontal border of carapace denticulate or dentate. Tarsus of chela usually armed with 6 spines, two of which are much longer than the others; upper edge of tibia armed with many long spines .... *Tarantula*, Fabr. Type *reniformis* (Linn.).

b[1]. Second tarsal segment of feet entire; frontal border of carapace armed with long spiniform teeth. Tarsus of chela armed with but one long spine above and one below; only two of the spines on the upper inner edge of the tibia noticeably longer than the rest .... *Phrynopsis*, g. nov. Type *spinifrons*, sp. n.

b. With a backwardly directed apophysis on the trochanter of the chela. Chelæ armed with fewer spines, long and slender; the femur and tibia nearly cylindrical, the latter distinctly bowed. (Second tarsal of foot undivided.) .... *Heterophrynus*, Pocock. Type *chiracanthus* (Gerv.).

To the structural features already mentioned by Simon as characteristic of this subfamily may be added the entire absence of the small semicircular appendages which are found upon the second abdominal sternite of most of the Old-World species of the group.

The sexes may be always recognized without difficulty. Beneath the genital operculum in the male there is a pair of soft, muscular, weakly chitinized, indistinctly bisegmented, apically bifid organs, which probably function as penes, and may be homologous to appendages *. When the operculum is raised these organs protrude from the aperture. In the female, on the contrary, there are no protrusible organs like the penes beneath the operculum, but there is a pair of rounded membranous eminences affixed to the lower surface of the operculum, each one bearing a pointed, inwardly directed, chitinous claw-like rod. That specimens possessing this structure are females is shown by the fact that they carry egg-sacs and that no specimens of those with the penes have been found with young. Moreover, the latter possess as a rule longer palpi and limbs, characters which by analogy appertain to the male (*vide* Pl. VII. figs. 8, 8 *a*).

In some of the Old-World genera of this group these sub-opercular structures are not so easy to determine.

Genus Tarantula, Fabr.

Synopsis of the Species contained in the Collection of the British Museum.

a. Tibia of the chela armed above with 9 spines, of which the third from the proximal end and the fourth from the distal end are the longest, there being *two* spines between those just mentioned.

- a^1. The spines on the chelæ longer, the longest on the tibia longer than the width of this segment; the fourth and fifth spines from the proximal end of the upper edge of the tibia very unequal in size, owing to the smallness of the fifth; median ocular tubercle larger, higher than the lateral eye-clusters; frontal process less covered.

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* The possibility of there being a direct homology between these organs and the missing pectines of the scorpions should be borne in mind. I have already suggested (Ann. & Mag. Nat. Hist., Jan. 1893) that the fact of there being an abdominal sternite missing in the Pedipalpi, the tergites being numerically one in excess of the sternites, might perhaps be explained by the enlargement and backward growth of the genital operculum over the second sternite, which in scorpions bears the pectines. If this has taken place, remnants of the pectines might be retained beneath the genital operculum, where, in fact, these penes of *Phrynus* are situated.

a^2. Ocular tubercle strikingly high; spines on the chela very long, the first on the upperside of the tarsus much larger than the distal one .... *macrops*, sp. n.

b^2. Ocular tubercle lower, spines on chela shorter, the first on the upperside of the tarsus smaller than the distal .... *lævifrons*, sp. n.

b^1. The spines on the chelæ shorter, the longest on the tibia shorter than the width of the segment: ocular tubercle low, not noticeably higher than the lateral eye-clusters; frontal process more concealed, fifth spine from proximal end of upper edge of tibia only a little shorter than the fourth.

a^3. The distal spine on the upper edge of the tarsus longer than the proximal .... *viridiceps*, Pocock.

b^3. The distal spine on the upper edge of the tarsus shorter than the proximal........ *azteca*, sp. n.

b. Tibia of chela armed above with 7 or 8 spines, of which the third from the proximal end and the fourth or third from the distal end are the longest, there being only *one* spine between these two. The number of spines sinks to 7 when what is the anterior spine or spinule in some species disappears in others.

a^4. The second spine on the tibia of the chela very short, about $\frac{1}{3}$ of the length of the third and $\frac{1}{2}$ of the fourth; there are thus only 3 long spines on this segment, and, owing to the disappearance of the distal spinule, only 7 spines altogether .... *Whitei* (Gerv.) *.

b^4. The second spine on the upper edge of the tibia of the chela long, nearly as long as the third and almost always longer than the fourth; there are thus at least 4 long spines in this series.

a^5. Tibia of chela slender, spines longer, the longest spine exceeding the width of the segment; lateral eye-clusters mostly closer together, the distance between them only a trifle more than half the median length of the carapace, the anterior margin of which is more coarsely dentate laterally than in the middle; the median eyes not far from the anterior margin; mandible with enlarged tubercle.

a^6. The 6 spines on the tarsus of the chela well developed; frontal process almost concealed.

a^7. Legs exceedingly long; length of femur of first and tibia of third greater than twice the width of the carapace; second tibial of fourth leg equal to distance between eyes .... *longipes*, Pocock.

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* The type of this species is ticketed Burdwan (India), but probably erroneously.

b^7. Legs shorter; length of first femur and third tibia less than twice the width of the carapace; second tibial of fourth leg less than distance between the eyes.

a^8. Femur of chela armed below with 6 spines; the first spine on the upper edge of femur longer, equal to about half the second .... *spinimana*, Pocock.

b^8. Femur of chela armed below with 5 spines, first on upper edge of femur less than half the second .. *Thorellii*, sp. n.

b^6. The first and third inferior spines on tarsus of chela nearly obsolete; frontal process prominent .... *tessellata*, Pocock.

b^5. Tibia of chela stouter, spines shorter, none of them so long as the thickness of the segment.

a^9. The first and third inferior tarsal spines of chela moderately long.

a^{10}. Femora of legs not distinctly spotted, pattern of abdomen obscure; eyes more widely separated .... *santarensis*, sp. n.

b^{10}. Femora of legs distinctly spotted with yellow, a yellow ring round the tergal impressions; eyes closer together .. *pulchripes*, sp. n.

b^9. The first and third inferior tarsal spines of chela minute.

a^{11}. Distance between the lateral eyes equal to about half the median length of the carapace; of larger size ...... *reniforme* (Linn.) *.

b^{11}. Distance between the lateral eyes greater than half the median length of the carapace.

a^{12}. Distance between the median ocular tubercle and the anterior edge of the carapace less than the long diameter of the tubercle; first superior tarsal spine distinct but small.

a^{13}. Frontal process invisible from above; darker, variegated .... *Gervaisii*, sp. n.

b^{13}. Frontal process completely visible from above; abdomen pale, of a uniform colour .... *barbadensis*, Pocock.

b^{12}. Distance between the median tubercle and the anterior edge equal to twice the diameter of the tubercle; first upper tarsal spine almost obsolete .... *latifrons*, Pocock †.

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* Syn. *Pallasii*, Blanchard; see Note, p. 297.

† The species I described as *Keyserlingii* in Journ. Linn. Soc., Zool. xxiv. p. 539, is referable, I now think, to this species. On p. 540 of the above paper I compared *Keyserlingii* to a species named *scabra*; for *scabra*, *Pallasii*, Blanch., should be substituted, the former being the name I had applied to the species before discovering that Blanchard had already given it a name. (See also Note, p. 297.)

Tarantula lævifrons, sp. n. (Pl. VII. figs. 1, 1 *a*.)

Colour blackish brown, with ferruginous spots on the upper surface and on the borders of the carapace; others marking the muscle-impressions and the postero-lateral angles on the terga; two indistinct flavous spots on the femora.

Granulation of the upper surface not coarse.

The frontal portion of the *carapace* not abruptly sloped mesially, although more so at the sides; the distance between the lateral eyes less than half the median length of the carapace and twice the distance between either tubercle and the lateral or front border; median tubercle tolerably high, scarcely wider than long, separated from the front border by a space which is less than its longitudinal diameter; the anterior border, concealing the median frontal spine, straight and scarcely at all denticulate.

Mandibles almost smooth above, without enlarged terminal tubercle.

Chelæ robust, not coarsely granular; the first inferior spine on the *femur* long, as long as the height of the segment, the length of which is one third greater than the distance between the eyes; on the upperside of the segment the second and third spines are much longer than the fourth and fifth, which are short. *Tibia* moderately broad, its upper inner edge armed with 9 spines, the first small, the second medium, the third very long, as long as the sixth, the fourth a little shorter, the fifth of medium size, the seventh a little bigger than the fifth, the eighth and ninth quite small; the longest of these spines, *i. e.* the third, is equal to the width of the tibia. *Tarsus* a little longer than the width between the lateral eyes, armed with the usual three spines above, but in addition there is an extra spine just in front of the third, the first and third of the inferior spines of medium size.

Legs.—Femur of first nearly twice as long as the width of the carapace, of the second much longer than the width of the carapace, slightly shorter than that of the third and as long as the femur and patella of the fourth; tibia of the second as long as the femur, of the third slightly longer, of the fourth considerably longer; in the fourth the second and third tibials together are equal to the protarsus and almost three quarters the length of the first tibial; the second tibial more than half the length of the third and equal to two thirds of the distance between the eyes.

Measurements in millimetres.—Total length 24; carapace, width 13·5, median length 9, distance between lateral eyes 4. Chela: length of femur 6, height 3, length of longest spine 3;

tibia, length 9·2, thickness 3·5, length of longest spine 3·5; length of tarsus 4·5, of digit 5. Legs: femur of first 33·5, of second 17, of third 17, of fourth 15; tibia of second 17, of third 19, of fourth 18.

Loc. West coast of America (probably Ecuador or Colombia). Collected by the officers of H.M. ships 'Herald' and 'Pandora.'

The British Museum has three examples, one adult (the type) and two young. In the latter the yellow spots on the legs and trunk are much more conspicuous than they are in the adult.

Tarantula azteca, sp. n. (Pl. VII. fig. 2.)

Colour almost entirely blackish brown, without distinct flavous spots or bands.

Granulation not very coarse.

Carapace with its frontal region gently sloped downwards and forwards; distance between the lateral eyes less than the longitudinal length of the carapace and about twice the distance of either lateral eye-cluster from the anterior or lateral border of the carapace; median tubercle nearly spherical, separated from the anterior border by a space which is about equal to its long diameter. The anterior border rather narrow, distinctly emarginate, evenly and moderately coarsely denticulate.

Mandibles smooth or nearly so above, without enlarged tubercle.

Chelæ elongate, robust, the spines short; the *femur* above nearly twice as long as the distance between the eyes, armed above with 6 spines, of which the first, the double one, is noticeably shorter than the second, which is equal to the third; the fourth minute, the fifth a little larger than the fourth, the sixth minute, about the size of the fourth; below, the first three teeth are long and subequal, the first being slightly the longest; the fourth and sixth spines very minute, the fifth of medium size; the first shorter than the height of the femur. *Tibia* much wider than its longest spine, its upper edge armed with 9 spines, the eighth and ninth minute, the first also minute, the second less than half the length of the third, which is longer than the fourth, which is longer than the fifth, sixth about equal to the fourth, seventh about equal to the second; armed below with 5 spines and some interspersed spinules. The first and third inferior spines of the *tarsus* very short.

Legs.—Femur of first greater than the length of the carapace by about one third of its length; femur of second greater than the width of the carapace, a little shorter than that of the third and considerably exceeding that of the fourth; tibiæ of second, third, and fourth about equal to the femora; first and second tibials of the fourth nearly two thirds the length of the first tibial, but distinctly shorter than the protarsal, the second tibial about half the length of the third and barely equal to half the distance between the eyes.

Measurements in millimetres.—Total length 23; carapace, width 12 8, median length 7·8, distance between the eyes 3·5. Chela: length of femur 6·8, height 3, length of longest spine 2; tibia, length 9·5, thickness 3·5, length of longest spine 2·5; tarsus 4·3, digit 4. Legs: femur of first 19, of second 15, of third 15·5, of fourth 13; tibia of second 13·8, of third 15·2, of fourth 14.

Loc. Mexico (Tuxtla and Oaxaca).

I have seen four examples of this species from Tuxtla—the type, which is the largest, and three others—and one from Oaxaca, and one ticketed merely Mexico.

The example from Oaxaca presents the curious anomaly, which may perhaps be termed atavistic, of having the posterior tibia on one side undivided and on the other divided into only two segments, as in the type of *santarensis*. In other characters, however, this example agrees with the type.

Tarantula macrops, sp. n. (Pl. VII. figs. 3, 3 *a*.)

Colour of carapace and chelæ nearly black, the marginal spots on the former indistinct; the principal terga adorned on each side with a reddish-yellow patch, which embraces the muscular impression and spreads outwards and backwards towards the posterior angle. Spots on the femora visible but indistinct.

Granulation of the upper surface of the trunk not coarse and somewhat sparse.

Carapace with frontal region convex anteriorly; area in front of the lateral eyes nearly vertical; distance between the eyes less than the median length of the carapace and twice as great as the distance between the eyes and the anterior or lateral border; median tubercle very high, shining, with vertical sides, wider than long, separated from the anterior border by a space which is distinctly less than its longitudinal diameter; anterior border straight from side to side, very weakly denticulate, only very slightly overlapping the median frontal process, the apex of which, being slightly turned forwards, is just visible from above.

Mandibles very slightly granular, with two terminal tubercles a little enlarged.

Chelæ rather slender; spines long and arranged upon the same plan as in *T. azteca*, but the spines are much longer, the first and second on the lower surface of the femur being subequal and much longer than the third, which is about equal to the fourth; the first greater than the height of the segment; spines on the upper edge of the tibia very much longer than in *azteca*, the longest being greater than the width of the segment; the first spine on the upper edge of the tarsus long, the third minute, the first and third on the lower surface minute.

Legs long; femur of first more than twice the width of the carapace, that of the second greater than this width by one third of its length, shorter than that of the third and about equal to that of the fourth; *tibia* of the second about equal to its femur, that of the third greater by about the length of the patella, that of the fourth still greater as compared with its femur; the second and third tibials about two thirds the length of the first, about equal to the protarsus, the second less than half the length of the third and equal to about two thirds of the distance between the eyes.

Measurements in millimetres.—Total length 19; carapace, median length 7, width 11, distance between eyes 3·2. Chela: length of femur 5, height 2, length of longest spine 2·8; tibia, length 8, width 2·8, longest spine 3·5, tarsus and digit 4. Legs: femur of first 24, of second 16, of third 17·5, of fourth 15·5; tibia of second 16, of third 18·5, of fourth 18·2.

Loc. S. America. A single dry male example.

Tarantula Thorellii, sp. n. (Pl. VII. fig. 7.)

Colour chestnut; abdomen pale, without distinct pattern; femora of legs feebly spotted.

This species is nearly related to *T. tessellata* and *T. Pallasii*, but it is much smoother than either. The distance between the lateral eyes is less than half the median length of the carapace; the median tubercle is separated from the anterior border by a distance which is about equal to its longitudinal diameter; this border is emarginate and dentate, as in *T. Pallasii* and *T. tessellata*, but the median frontal process does not project forwards as in *T. tessellata*, being considerably overlapped by the carapace.

The *chelæ* are long and slender, as in *T. tessellata*, the trochanter armed with 4 spines, as in *Pallasii* and *tessellata*; spine-armature of femur and tibia approximately the same as in *T. tessellata* and *Pallasii*, but the first superior femoral spine is much shorter, being scarcely more than one third of the length of the second. The rest of the spines are on the whole longer than in *tessellata*, and the first and third on the lower surface of the tarsus are long and acute, these same spines, especially the third, being short in both *Pallasii* and *tessellata*.

Legs almost as in the male of *T. tessellata*, but with the femur of the fourth almost as long as that of the second (*cf.* measurements), and the second tibial of the fourth leg almost more than three quarters the length of the third tibial and about three quarters of the distance between the eyes.

It is also related to *longipes*, as shown by the presence of three well-developed spines on the lower edge of the tarsus of the chela.

Measurements in millimetres.—Total length 22; median length of carapace 8·5, width 12·8, distance between eyes 3·6. Chela: femur, length 6·5, height 2·5, length of longest spine 2·6; tibia, length 9·5, width 3, length of longest spine 4; length of tarsus 5, of digit 4·5. Legs: femur of first 24·5, of second 16, of third 16·5, of fourth 15; tibia of second 16, of third 18, of fourth 17.

Loc. ——?

A single male example.

Tarantula pulchripes, sp. n. (Pl. VII. figs. 6, 6 *a*.)

Colour blackish, with distinct flavous marginal spots on the carapace; a flavous ring round the muscular impressions of the terga, one flavous spot on the upperside of the trochanter, and three on the femora of the posterior three pairs of legs.

Granulation of the trunk rather fine.

Carapace with its front border lightly emarginate and conspicuously and evenly dentate, completely overlapping the median process, which is thus concealed from above; distance between the lateral eyes about half the median length of the carapace, twice as great as the distance between a lateral eye and the anterior border, and more than twice the distance between the lateral eye and the lateral border; the frontal region gently sloped downwards and forwards, steeper below the lateral eye; the median tubercle wider than long, separated from the front border by a space which is a little less than its longitudinal diameter.

Mandibles very slightly granular above, with the external distal tubercle slightly enlarged.

Chelæ robust; *femur*, which is longer by about one third of its length than is the distance between the eyes, coarsely granular above; spine-armature of the appendage as follows:—femur above 5 and some spinules, below 5 (the proximal two very long) and a small sixth; *tibia* above 8, a very minute ninth, below 5 and some spinules; tarsus above 4 (the distal minute), below 3; the first and third spinules on the lower edge of the tarsus long, the longest on the tibia, *i. e.* the third from the proximal end, is less than the width of the segment, and the longest on the femur less than the height of the segment.

Legs.—Femur of first longer than width of carapace by one third of its length, that of the second a little longer than width of carapace, a little shorter than the femur of the third and as long as the femur and patella of the fourth; tibia of the second equal to its femur, of the third a little longer, of the fourth still longer than its femur; the second and third tibial of the fourth a little longer than the protarsal and about two thirds the length of the first tibial; the second tibial half the length of the third and half the distance between the lateral eyes.

Measurements in millimetres of largest specimen.—Total length 17; carapace, median length 7, width 11, distance between eyes 3·5. Chela: femur, length 5·2, height 2·8, length of spine 1·8; tibia, length 8, width 3·3, length of spine 2·5; length of tarsus 3·7. Legs: femur of first 17, of second 13·8, of third 14·5, of fourth 12; tibia of second 13·5, of third 15·5, of fourth 13.

Loc. Colombia (Goudot coll.).

I have seen three dried examples of this species, namely the type (which is probably a male), a female with egg-sac, and a smaller example, which is probably also a female. The latter two differ from the type in having shorter chelæ and legs; for instance, the upperside of the femur of the chela is only very slightly longer than the distance between the eyes, and the femur of the second leg is about as long as the width of the carapace.

Tarantula santarensis, sp. n.

No detailed description of this species is necessary, on account of the closeness of its relationship to *T. pulchripes*. It appears to differ in the following particulars:—

There are no definite yellow spots on the femora of the legs, these segments being rather describable as ferruginous, with faint fuscous patches; so, too, with the abdomen—the upperside of this region, instead of being black, with very clearly defined yellowish-red rings round the black muscular impressions, is in this form ferruginous, with three faintly defined fuscous patches on each tergite, one being median and the others lateral.

The lateral *eyes* are a little further apart.

The lower surface of the femur and tibia of the *chela* are smoother below than in *pulchripes*, and the third spine on the upperside of the tarsus more nearly approaches the second in length; moreover, the second long spine on the upperside of the femur is longer than the first, and not noticeably shorter than it as it is in *pulchripes*.

Measurements in millimetres.—Total length 20; median length of carapace 7, width 12, distance between eyes 4. Chela: length of femur 4·5, of tibia 7·5; tarsus 3·8, digit 3·4. Legs: femur of first 16, of second 12·5, of third 13·5, of fourth 10·5; tibia of second 10·5, of third 12, of fourth 10·5.

Loc. Santarem, Brazil (*Wickham Coll.*).

The type and only known example of this species is a female. Curiously enough it presents a remarkable abnormality in the development of its posterior tibiæ, that on the right side being undivided and that on the left divided into only two segments.

Tarantula Gervaisii, sp. n. (Pl. VII. figs. 5, 5 *a*.)

Colour as in *T. pulchripes*, but with the spots upon the legs and trunk much less clearly defined.

Resembling *T. pulchripes* in size and general appearance, but apparently differing in the following features:—The anterior border of the *carapace* is wider, straighter, and more finely and less closely denticulate; the lateral eyes are equidistant from the anterior and lateral edge on each side, and the distance is distinctly less than half the space between the eyes, which is noticeably greater than half the median length of the carapace, and almost equal to the length of the upperside of the femur of the chela.

Mandibles smooth above, with no enlarged terminal tubercle.

Chelæ in shape and spine-armature resembling those of *T. pulchripes*, but the first and third spinules on the lower side of the tarsus are short, the fourth on the upperside is not noticeably elongate, and there is no spinule below the eighth on the upper edge of the tibia.

Legs shorter than in the type of *T. pulchripes*, but approximately the same length as those of the female of that species; the femur of the first longer than the width of the carapace by about one quarter of its length, that of the second about equal to that of the third, a little greater than, and that of the fourth a little less than, the width of the carapace; tibiæ of the same comparative length as in *T. pulchripes*, the second tibial of the fourth leg equal to about one third of the distance between the eyes.

Measurements in millimetres of type.—Total length 11·5; carapace, median length 7, width 11·5, distance between eyes 4·5. Chela: length of femur 5, tibia 7·5, tarsus 3·7, digit 4·3. Legs: femur of first 16, of second 12·5, of third 13·3, of fourth 10·5.

Loc. Colombia (Magdaleine). Goudot Coll. Type. Also specimens of apparently the same species from Venezuela, Trinidad, and British Guiana.

Genus Phrynopsis, nov.

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

a. The spine between the two longer ones on the upper edge of the tibia of chela as long as the third spine from the distal end of this segment; the spines forming the proximal half of this series smaller, the spinules larger .... *coronatus* (Butl.).

b. The spine between the two longest on the upper edge of the tibia minute, much smaller than the third from the distal end; the spines forming the proximal half of this series larger, the spinules smaller .... *spinifrons*, sp. n.

I have seen one example of each of these species. That of *coronatus*, contained in the late Count Keyserling's collection, is dried and much mutilated and has no locality assigned to it. It agrees, however, so far as I can judge, with Mr. Butler's figure and description of the type, which is in the hands of the Rev. O. P. Cambridge. The example of *spinifrons* from Ciudad, in Mexico, will be figured and more thoroughly described in a future publication.

Genus Heterophrynus, Pocock.

Heterophrynus, Pocock, Journ. Linn. Soc., Zool. xxiv. p. 527 (in note).

This genus contains *H. pumilio*, C. Koch (Die Arachn. viii. p. 15), from Brazil, and *H. gorgo*, of Wood (Tr. Am. Phil. Soc. xiii. p. 440), from Peru.

We have neither of these species, to my knowledge, in the British Museum. *H. pumilio*, however, will very probably prove to be the young of one of the four enumerated below.

The species that I have succeeded in identifying are:—

H. chiracanthus (Gervais), Journ. Inst. Soc. Phil. Paris, 1842, p. 72; Ins. Apt. iii. p. 4.
H. Batesii, Butler, Ann. & Mag. Nat. Hist. (4) xii. p. 120.
H. longicornis, id. *t. c.* p. 123.

The four may be briefly diagnosed as follows:—

a. Spines on femur of chela $\frac{5}{4}$, on tibia $\frac{6}{5}$; tarsus externally granular .... *cervinus*, sp. n.
b. Spines on femur of chela $\frac{6}{5}$, on tibia $\frac{7}{6}$; tarsus externally smooth.
- *a*[1]. Chelæ in males short, the femur only a little longer than the width of the carapace; second spine on lower edge of tibia much shorter than the first and third, distal spine on lower edge of tibia longer and stronger than the one that precedes it. *longicornis* (Butl.).
- *b*[1]. Chelæ, at least in the adult males, exceedingly long and slender, about twice the width of the carapace; distal spine on lower edge of tibia not longer than the one that precedes it.
  - *a*[2]. Second spine on the femur of the chela subequal to the first and third; chelæ stouter, spine-armature stronger ...... *chiracanthus* (Gervais).
  - *b*[2]. Second spine on femur noticeably shorter than first and third; chelæ thinner, spines shorter and weaker .... *Batesii* (Butl.).

Heterophrynus chiracanthus (Gervais).

Of this species we have three adult examples from Demerara (types) and one which has no locality. The specimen from New Granada which Butler referred to this form belongs, I think, to his *Batesii*. Mons. Simon (*loc. cit.* p. 51) wrongly referred this species to the *palmatus* group.

Heterophrynus Batesii (Butl.).

Very nearly allied to the preceding. We have dry examples (types) from the Upper Amazons, one (also dry) from New Granada, and three in spirit ticketed S. America.

Heterophrynus longicornis (Butl.).

Four (including type), dry, from Para, and one, in spirit, from Santarem.

The example from Para that Mr. Butler identified as *H. gorgo* of Wood was one of the specimens of *H. chiracanthus* which had exchanged labels with one of the examples of *longicornis*.

Heterophrynus cervinus, sp. n. (Pl. VIII. fig. 1.)

Colour nearly black, legs and lower surface ferruginous.

Carapace of normal form, the cephalic region coarsely granular, the posterior portion with about three radiating rows of granules, the rest smooth; the anterior border straight, finely denticulate, the median tubercle, which is high and bears two tubercles on its summit, separated from the anterior border by a space which equals half a diameter; distance between the lateral eyes considerably less than half the median length of the carapace.

Mandibles finely granular, a small terminal tubercle.

Chelæ.—*Coxæ* finely granular internally, more coarsely granular behind, the rest smooth; *trochanter* smoothish in front, with a row of fine denticles above and four spines below, three on the inferior edge, of which the median is very long, and one at its distal angle; *femur* less than twice the width of the carapace, thickly and coarsely granular, armed with five spines above, the first two rising from the same base, the third the longest, the fourth and fifth decreasing in length, the lower edge armed with four spines, which gradually decrease in length from the first to the fourth; *tibia* coarsely granular, longer than the femur, with only one spine behind the three principal ones on the upper edge, the last spine much longer and stouter than the penultimate, lower edge armed with 5 spines, of which the third from the end is the longest, although the last is longer and stouter than the one that precedes it; *tarsus* granular outside and inside, the first spine long, considerably more than half the length of the second.

Legs long; femur of first three and a half times the width of the carapace, that of the second about twice its width, that of the third a shade longer than that of the second, which is longer than that of the fourth (for the rest see measurements).

Abdomen.—Terga with a row of granules along posterior border; for the rest the terga are nearly smooth, there being only two or three granules on each side of the middle. *Sterna* sparsely granular. *Genital operculum* coarsely granular.

Measurements in millimetres.—Total length 31; width of carapace 17, median length 11, distance between eyes 4. Chela: length of femur 30, width 2·5; length of tibia 34·5, of tarsus 9·5, of digit 6. Legs: femur of first 59, of second 33·5, of fourth 32; tibia of second 35·5, of third 39, of fourth 39, first tibial of latter 5·5.

A single male example from New Granada, ticketed, probably by either Gervais or Goudot, *Phrynus chiracanthus*.

Subfam. *Phrynichinæ*.

(Simon, *loc. cit.* p. 49.)

The following three genera of this subfamily are known to me:—

a. Tibiæ of the fourth pair of legs undivided, mandibles larger .... *Phrynichus*, Karsch. Type *lunatus* (Pall.).

b. Tibiæ of fourth pair of legs bisegmented, mandibles smaller.

*a*¹. Second abdominal sternum furnished with a pair of half-moon-shaped appendages; larger .... *Titanodamon*, g. nov. Type *Johnstonii*, sp. n.

*b*¹. Second abdominal sternum without appendages; smaller .... *Nanodamon*, g. nov. Type *annulatipes* (Wood).

The genus *Damon* of C. Koch, of which the type is *variegatus* of Perty, also belongs to this group. According to Simon it is congeneric with the West-African forms to which I have given the name *Titanodamon*. Unfortunately I have had no opportunity of examining either *variegatus* or any allied species from the same geographical area (*i. e.* South America); and my reasons for proposing the two new generic names given above are: (1) my ignorance as to whether *variegatus* of Perty possesses the abdominal appendages or not, and (2) my opinion that the South-American forms, if indigenous, possess in all probability some hitherto undiscovered characters by which they may be generically recognized from the two African genera. This *à priori* supposition may of course prove erroneous; but analogy justifies its conception until proof on the matter is forthcoming.

Genus Titanodamon.

The British Museum has examples of the three following species:—

a. Frontal process small, vertical, with its apex acute and turned forwards.

*a*¹. The posterior of the three long spines on the tibial segment of the chela short, not half the length of the median spine; the second tibial segment of the fourth leg less than, or, at least, not greater than, the distance between the eyes. *tibialis* (Sim.).

b^1. The above-mentioned spine long, about two thirds the length of the second spine; the tibial segment greater than the distance between the eyes. *bassamensis* (Luc.).

b. Frontal process directed downwards and forwards and ending in a bluntly rounded apex; eyes spaced as in *tibialis*; the tibial spine as in *bassamensis* . . *Johnstonii*, sp. n.

Titanodamon bassamensis (Lucas).

Phrynus bassamensis, Lucas, in Thomson's Archives Ent. ii. p. 434 (1858).
Phrynus granulosus, Butler, Ann. & Mag. Nat. Hist. (4) xii. p. 122, pl. vii. fig. 10 (1873).
Phrynus Savatieri, Rochebrune, Bull. Soc. Philom. viii. p. 28.
Phrynus medius (Herbst), Simon (at least formerly); Butler, *loc. cit.* p. 120 in part.

We have ten examples that I believe to be referable to this species. Some are without localities; others, however, are ticketed Sierra Leone and Ashanti. It is on the strength of these latter two localities that I venture to regard *Savatieri* and *bassamensis* as identical. The former was recorded from Senegal and the latter from Grand Bassam, which is close to the locality Dixcove, in Ashanti, whence one of the British Museum examples came.

The type of *granulosus*, Butler, *i. e.* the specimen figured, which is provided with ova and preserved in alcohol, is referable to the same species; but its locality, which, by the way, is indicated as doubtfully S. America, is probably erroneous. The dried specimen mentioned by Mr. Butler as belonging to this species is an example of the South-American species *Heterophrynus chiracanthus* (Gerv.).

Why this species should be identified as *medius* of Herbst* I cannot understand. Herbst's figure represents an animal with much stouter and shorter chelæ, and the tibia has no less than four large spines upon it, the fourth large spine from the distal end being approximately equal to the third. In this character it differs from all the species of the genus known to me.

Titanodamon Kochii, Butler (*loc. cit.* p. 120), established for the specimen probably wrongly identified as *T. medius* (Herbst) by Koch, is perhaps identical with *bassamensis*; but I do not think the union of the two at present justifiable. The specimen in this Museum identified by Mr. Butler as *T. Kochii* may be correctly named; but since it has neither carapace nor locality, I cannot be sure of the point.

* Nat. ungeflügelt. Ins. pt. i. p. 77, pl. iv. fig. 1.

Titanodamon tibialis (Simon).

Phrynus tibialis, Simon, Bull. Soc. Zool. Fr. 1876, p. 12.

We have two examples that I refer to this species—one ticketed Congo, the other West Africa. They were identified by Mr. Butler as *bassamensis* of Lucas; but, judging from the locality, it seems to me more probable that they are to be referred to *tibialis*, the type of which also came from the Congo.

Titanodamon Johnstonii, sp. n. (Pl. VIII. figs. 2–2 *b*.)

Colour nearly black, with two whitish patches on the femora and indications of spots of the same colour upon the muscular impressions of the terga and upon the posterior angles of these plates.

Carapace thickly granular, the lateral margin spicular, the front margin also slightly spicular; distance between the lateral eyes a little greater than half the median length of the carapace and three times as great as the distance between either of the lateral tubercles and the nearest point of the anterior border. Median tubercle smooth, shining, on the anterior border, the frontal process conspicuous, directed downwards and forwards and ending in a bluntly rounded apex.

Mandibles granular above, with two enlarged distal tubercles.

Chelæ.—*Coxa* granular distally; *trochanter* armed with an upper ridge of spinules, one longer inferior spine, and a number of shorter spines of varying lengths; *femur* granular throughout, the granules of the anterior surface very fine, those of the lower surface a little coarser, those of the upper much coarser and pointed; the upper anterior edge armed with 6 spines, 1 and 2 close together, the latter longer, 3 and 4 about equal to 1, the space betweeen 2 and 3 equal to the space between 3 and 4, 5 and 6 a little smaller than 3 and 4, the space between them about equal to that between 4 and 5 and twice that between 3 and 4; the above described spaces occupied by larger and smaller spinules, the 6th separated from the distal end by a space which is greater than a third of the length of the femur; the lower edge armed with 5 longer spines, which gradually decrease in length distally, the first being about twice the length of the fifth, which is not much longer than some of the spinules which lie between the spines; between the first and the proximal angle of the femur there are three of these spinules, the lower of which is the smallest. *Tibia* with the customary upper and lower longitudinal crest of granules, the lower and anterior surface weakly and sparsely granular; in addition to the three normal long distal spines, the upper edge is furnished with two or three smaller spines evenly spaced and decreasing in size posteriorly, the posterior one being always minute and sometimes scarcely recognizable amongst the rest of the spinules; the first of the three long spines about two thirds or more of the length of the second, which, like the third, is serrate anteriorly; the inferior distal spine of normal length and strength, the rest of the lower edge armed with about 4 spines and many spinules. *Tarsus* polished, the first spine of the upper surface about one third the length of the second.

Legs.—Femora spicular above, below, and in front; femur of first less than twice the width of the carapace, that of the second a little shorter than that of the third and a little longer than that of the fourth; tibia of second shorter than its femur, that of the third a little longer, that of the fourth still longer, the second tibial about equal to the distance between the lateral eyes.

Measurements in millimetres of type (♂).—Total length 32·5; carapace, width 17·5, median length 10, distance between eyes 5·2. Chela: length of femur 27·5, of tibia 30. Legs: femur of first 32·5, of second 21, of third 22, of fourth 20.

Locality of type.—Rio del Rez, near Old Calabar (*H. H. Johnston*); of other examples Old Calabar and the Cameroon Mountains (*H. H. Johnston*); Fernando Po and Gaboon.

The example selected as the type of this species is not the largest. Thus a male from Old Calabar has the carapace 19 millim. wide, and the femora of the five appendages measure respectively 35, 41, 23, 24·5, and 22; and the largest female from the Cameroons has the carapace 21 millim. wide, and the femora measure respectively 33, 42, 24, 25, and 23.

The three species of this genus known to me may be readily recognized by the characters given in the synoptical table; but it is not to be supposed that the distinctness of the species necessarily rests solely upon those characters that are mentioned in the tabular diagnosis. The above-mentioned example from Fernando Po was identified by Mr. Butler as *P. medius*, Herbst.

Genus Nanodamon, nov.

I am acquainted with three species of this genus:—

a. External surface of tarsus of chela granular like the tibia; trochanter with one long inferior spine; ocular tubercle granular.
  a[1]. Granulation of chelæ very coarse, the granules long, conical, the third spine from the extremity of the tibia very short in the adult .. *annulatipes* (Wood).
  b[1]. Granulation much finer, the granules low and rounded; the third spine from the end of the tibia considerably longer .... *cinctipes*, sp. n.
b. External surface of tarsus of chela normally smooth; a second longish spine on the lower edge of the trochanter; ocular tubercle smoother.................................. *diadema* (Sim.).

Nanodamon diadema (Simon).

Phrynus diadema, Simon, Bull. Soc. Zool. Fr. 1876, p. 13.

I can find no other description (!) of this species than the one referred to above; so that the correctness of my determination of some specimens in the British Museum as *diadema* is a matter of doubt. Whether rightly or wrongly determined, however, the species seems to be not uncommon in the region of Lake Nyasa, whence we have received from time to time from the Universities Mission about seven specimens of both sexes.

This is a very brightly coloured species, the whole of the upper surface being prettily striped with yellow and black.

Nanodamon annulatipes (Wood).

Phrynus annulatipes, Wood, Tr. Am. Phil. Soc. xiii. (n. s.) p. 441 (1869).

This species is evidently abundant at Natal, whence we have received ten examples of both sexes, dry and in spirit, from Gueinzius and H. A. Spencer.

The males of this species present the interesting feature of having the articles of the tibial segment of the legs of the first pair very much thicker than in the females.

Nanodamon cinctipes, sp. n.

Colour.—Carapace fuscous in the middle, the anterior border and lateral portions flavo-ferruginous, the lateral border with four brighter spots; abdomen fuscous, with a median reddish-yellow stripe, and a ring of the same colour surrounding the impression; chelæ fuscous, dactylus and tips of spines ferruginous; legs flavo-ferruginous, femora banded with fuscous.

Carapace coarsely granular; distance between the eyes much greater than half its median length; median tubercle rather coarsely granular upon the anterior border, frontal process vertical, coarsely granular.

Mandibles coarsely granular above.

Chelæ.—*Trochanter* coarsely granular above, spined in front, with one inferior long spine; *femur* armed above with 4 spines, of which the first and second are close together; the second, third, and fourth equally spaced and gradually decreasing in length distally; armed below with 5 spines, the first on the proximal angle short, the second to the fifth decreasing in length. The *tibia* armed above with the normal two long granular distal spines, and behind them there is another spine about half as long as the others, and posteriorly to this another spinule; armed below with one long distal spine and two shorter ones behind it, the rest of the edge being armed with spinules. *Tarsus* normally spined, two above, the first short and vertical, and one below.

Legs less coarsely granular than in *N. annulatipes*.

Measurements in millimetres.—Total length 18; carapace, width 11·5, median length 6·5, distance between eyes 4. Chelæ: femur, length 9·5, width 2; tibia, length 11, width 2·5, length of superior distal spine 3·8. Legs: femur of second 12, of third 12, of fourth 11·5; tibia of second 11·3, of third 12, of fourth 11·8; second tibial of latter 3.

A single female example ticketed South Africa.

This species seems to lie almost midway between *annulatipes* and *diadema*. It is, on the whole, paler in colour than *annulatipes*, in which the legs are fuscous with flavous spots.

Genus Phrynichus, Karsch.

Phrynichus Jayakari, sp. n. (Pl. VIII. fig. 3.)

♂.—*Colour*. Carapace ferruginous, head-region darker; chelæ and mandibles nearly black; legs ochraceous.

Carapace not coarsely granular, head-region elevated; distance between the eyes more than half the median length of the carapace; anterior border straight, apex of frontal process just visible from above; a lateral tooth-like process on each side opposite the outer surface of the mandible.

Mandibles granular above.

Chelæ immoderately long and slender; *coxæ* granular, with a series of spiniform hairs on inner edge; *trochanter* armed below with one strong spine and with another at the distal extremity of its anterior surface; the superior crest composed of small, close-set, subequal spinules. *Femur* armed above on its proximal third with three evenly spaced spines, of which the first is the longest and close to the joint; between it and the joint, however, there is a shorter spine, and another one lies amongst the spinules between the first and second spine; the lower surface is armed with one longish spine near the joint, and with another much shorter one nearer the middle; the rest of this edge furnished with variously sized minute spines which decrease in size distally. *Tibia* cylindrical, granular, armed above distally with three long spines, the posterior of these more than half the length of the others; armed below with three spines, two apical normal, the third small but distinct, lying further back. *Tarsus* with a small basal superior spine as well as the normal long one.

Legs granular.

Measurements in millimetres.—Total length 22·5; carapace, width 12·5, median length 7·8, distance between eyes 4·2. Chela: length of femur 40, width 1·2; length of tibia 40, of its longest spine 6. Legs: femur of first 35, of second 18, of third 18·5, of fourth 17·5; tibia of second 20, of third 21, of fourth 22.

♀. Like the male, with shorter chelæ &c. Total length 17 millim., width of carapace 10, length of femur and tibia of chela 33, femur of first leg 20, of second 11, &c.

Two examples from Muscat (*Dr. A. G. Jayakar*).

Evidently very nearly allied to *P. Deflersi* of Simon (Bull. Soc. Zool. Fr. 1887, p. 454) from Obock and Aden, but differing in colour and in some particulars of spine-armature, the posterior of the three spines on the tibia of the chela being in *Deflersi* minute, and no mention being made of the third, the posterior, spine on the lower surface of this segment, and none of the lateral spine on the anterior border of the carapace, &c.

Phrynichus Phipsoni, sp. n. (Pl. VIII. fig. 4.)

? *Phrynus nigrimanus*, C. Koch, Die Arachn. xv. p. 69.

♂. Very closely allied to *P. Jayakari.*

Colour darker; carapace deep chestnut; abdomen olivaceo-flavous; chelæ ferruginous; legs olivaceo-flavous, spotted with pale markings.

Carapace a little smoother, flatter, its anterior border without a lateral tooth on each side.

Chelæ much shorter; *trochanter* with more anterior spines, its superior crest formed of a few separated spines; spine-armature of *femur* and *tibia* as in *Jayakari.*

Legs with femora much less coarsely and more sparsely granular.

Measurements in millimetres.—Total length 21; carapace, median length 7, width 12·3, distance between eyes 4. Chela: length of femur 20, of tibia 20·2. Legs: femur of first 23, of second 14, of third 14·5, of fourth 13·3.

Loc. Bombay (*H. M. Phipson*), one specimen; also a dried example from the same locality (*F. Moore*).

The species *P. Deflersi*, *P. Jayakari*, and *P. Phipsoni* may be recognized by the following table:—

a. Ridge on upperside of trochanter of chela consisting of a series of small closely packed spinules.
- *a*¹. The first spine on the tibia of the chela minute; two distinct spines on the lower side of this segment .... *Deflersi*, Sim.
- *b*¹. The first spine on the tibia of the chela about two thirds of the length of the second; three distinct spines on the lower edge of the segment .... *Jayakari*, sp. n.

b. Ridge on upper edge of trochanter of chela consisting of a small number of larger and smaller spines; chelæ dentate, almost as in *Jayakari* .... *Phipsoni*, sp. n.

Phrynichus pusillus, sp. n.

Colour.—Carapace reddish brown; abdomen paler, without pattern; chelæ reddish brown, the trochanter and the tarsus fuscous; legs not distinctly variegated.

Belonging to the same group as *lunatus* (Pallas), but differing in having the carapace much more coarsely, and at the same time less closely, granular. The frontal process invisible from above.

Chelæ closely resembling in spine-armature those of *P. lunatus*, but there are two strong equal spines at the base of the upperside of the femur.

The half-moon-shaped appendages on the second abdominal sternite obsolete, being merely represented by slight folds of the integument.

Measurements in millimetres.—♂. Total length 14; width of carapace 9·8, median length 5·5, distance between eyes 3·5. Chela: length of femur 15, of tibia 16. Legs: femur of first 17·5, of second 11, of third 12, of fourth 11.

♀. Total length 15; width of carapace 9; length of femur and tibia of palp 19; femur of first leg 12, of second 8.

Loc. Punduloya, Ceylon (*E. E. Green*); Ceylon (*Keyserling Coll.*).

Supplementary Note on the Identity of Tarantula reniformis (*Linn.*).

Whilst the proof-sheets of this paper were in my hands for correction I quite unexpectedly received from Mr. C. A. Barber, the Superintendent of Agriculture of the Leeward Islands, a couple of specimens of a *Tarantula* from Antigua. These specimens prove to belong to the same species as those which I have spoken of, both in this paper and in Journ. Linn. Soc., Zool. vol. xxiv., as *T. Pallasii* (Blanchard). But the chief point of interest connected with the acquisition of examples from Antigua in particular lies in the fact, which I have more than once insisted upon, that Linnæus's description of *Phalangium reniforme*, the type species of the genus *Tarantula*, was based upon a figure of one of these animals that came from the island in question. Of course it is not possible to assert positively that Browne's figure is certainly a representation of a specimen belonging to the same species as those that Mr. Barber has just obtained; but the probability that it is so is undeniably great, and is enhanced by the fact that the available information respecting the size and colour of the original example agrees with what is known of these characters in *T. Pallasii*. It is consequently scarcely an exaggeration to say that we are now almost as sure of the identity of *T. reniformis* as we are of the identity of any other species established by Linnæus. And since we cannot reasonably hope ever to get nearer the truth of the matter than we are at present, every one will, I think, recognize the expediency of regarding these Antiguan specimens procured by Mr. Barber as being in reality referable to *T. reniformis*.

If this conclusion be accepted, the known synonymy of the species will stand as follows:—

Phalangium reniforme, Linn. Syst. Nat. ed. x. p. 619 (based upon fig. 3, pl. xli. of Browne's 'History of Jamaica').
Tarantula reniforme, Fabr. Ent. Syst. ii. p. 432.
Phrynus Pallasii, Blanchard, Organisation du Règne Animal, Arachnides, pl. xv. p. 170, pl. x.
Tarantula Pallasii, Pocock, Journ. Linn. Soc., Zool. xxiv. p. 533, pl. xl. fig. 3.

The known distribution of the species is Antigua, Montserrat, and Martinique.

In conclusion, I wish to express my great indebtedness to Mr. C. A. Barber for his spontaneous act of kindness in sending to the British Museum the specimens of the species, which he recognized as a desideratum for the National Collection.

EXPLANATION OF THE PLATES.

Plate VII.

Fig. 1. *Tarantula lævifrons*, sp. n. Carapace and chela, × $1\frac{1}{2}$.
Fig. 1 *a*. Ditto. External view of upper edge of tarsus.
Fig. 2. *Tarantula azteca*, sp. n. Carapace and chela, × $1\frac{1}{2}$.
Fig. 3. *Tarantula macrops*, sp. n. Carapace and chela, × $1\frac{1}{2}$.
Fig. 3 *a*. Ditto. Lateral view of anterior end of carapace.
Fig. 4. *Tarantula Whitei* (Gerv.). Carapace and chela, × $1\frac{1}{2}$.
Fig. 4 *a*. Ditto. External aspect of tarsus.
Fig. 5. *Tarantula Gervaisii*, sp. n. Carapace and chela, × $1\frac{1}{2}$.
Fig. 5 *a*. Ditto. External aspect of tarsus.
Fig. 6. *Tarantula pulchripes*, sp. n. Carapace and chela, × $1\frac{1}{2}$.
Fig. 6 *a*. Ditto. External aspect of tarsus.
Fig. 7. *Tarantula Thorellii*, sp. n. Carapace and chela, × $1\frac{1}{2}$.
Fig. 8. *Tarantula tessellata*, Pocock. Penes of male protruding between genital operculum and second sternite.
Fig. 8 *a*. Ditto. Lower side of genital operculum of female.

Plate VIII.

Fig. 1. *Heterophrynus cervinus*, sp. n. Right chela, nat. size.
Fig. 2. *Titanodamon Johnstonii*, sp. n. Nat. size.
Fig. 2 *a*. Ditto. Genital operculum and second sternite, to show bud-like appendages.
Fig. 2 *b*. Ditto. Anterior half of carapace from above, to show frontal process.
Fig. 3. *Phrynichus Jayakari*, sp. n. Carapace and chela, × $1\frac{1}{2}$.
Fig. 4. *Phrynichus Phipsoni*, sp. n. Carapace and chela, × $1\frac{1}{2}$.

XXXVIII.—*Abnormal Variability in the Antennal Characters of* Cosmophila erosa, *Hübn.* By Arthur G. Butler, Ph.D. &c.

The structure of the male antennæ in moths has very frequently been used as the sole character for distinguishing genera. Mr. Hampson, however, has decided to regard all characters found only in one sex as of secondary importance, and consequently has degraded all genera which can only be separated when both sexes are known, or by the male sex apart from the female, to the rank of sections (or subgenera).

Antennal structure frequently differs widely in species which unquestionably are very nearly related, as, for instance, in *Bombycia*, the males of *B. viminalis* having the antennæ strongly pectinated, whereas in *B. persimilis*, which has the same pattern and coloration, they are serrate-fasciculated.

The genus *Cosmophila*, according to Guenée, has the antennæ sometimes filiform and slightly pubescent, sometimes very distinctly furnished with thick hairs, serrate and pubescent. Of *C. erosa* he says "*Antennes filiformes*," thus giving one the impression that in *C. xanthindyma*, *indica*, and *auragoides* they are not so. Of *C. xanthindyma* he says, "Les antennes du mâle sont nettement et fortement ciliées." The four supposed species separated by M. Guenée have precisely the same variations in form, pattern, and coloration; but at one time I believed that *C. erosa* and *C. xanthindyma* could be separated by antennal characters. Mr. Hampson, however, assured me that these also varied.

In the Museum series we have fifty-seven examples of the genus, twenty-five of which are males possessing antennæ, the result of an examination of which is as follows:—

1. *Antennæ finely ciliated.*

Two specimens from St. Domingo and one from Venezuela.

1 *a*. *Less finely ciliated.*

One from São Paulo.

2. *Serrate-fasciculated.*

Two from Alabama, one from Australia.

3. *Pectinated.*

One from Alabama, one from Aden, one from Kulu, one from South India, one from Ceylon, four from Java.

3 *a*. *Strongly pectinated.*

One from Solun, one from the Nilgiris, one labelled simply N. India, one from Java, one from Ceylon, one from Moreton Bay, one from Fiji, and one from the Marquesas Islands.

So far as our specimens show, the ciliated type of antenna would appear to be confined to South America, but it is connected with the pectinated type of the Old World by the intermediate serrate-fasciculated type of the United States and Australia. Indeed there is not the slightest doubt that the variation in the structural characteristics of the antennæ in this widely distributed and abundant species are individual and have no significance, so that the supposed four species of M. Guenée, as well as Walker's *Cirrœdia variolosa* and *C. edentata*, represent nothing more than sports of one variable species.

The colour-variations of *C. erosa* range from light to dark, from brightly to dull-coloured, the New-World examples, as a rule, having paler secondaries than those from the Old World; but even this character is by no means constant, the hind wings being sometimes almost white, sometimes golden ochreous, sometimes again smoky grey with white-tipped fringes; the dark lines on the primaries never seem to vary, only the ground-colouring, and this varies to an extraordinary degree; so that from the same locality and collection one may receive specimens having these wings of a nearly uniform golden ochreous tint, or divided into two nearly equal light and dark areas, always, however, showing the same silvery spot in the cell and dark (sometimes nearly black) transverse irregular lines.

Cosmophila erosa is the only species at present known to me which exhibits this abnormal variability of antennal structure, unless it should turn out that I was correct in referring the Indian specimens of *Bombycia* (since named by Mr. Hampson *B. persimilis*) to *B. viminalis*. This is just possible, but, judging from the constancy of our European examples in this particular, not probable.

The fact nevertheless that any one species of moth is capable of such marvellous inconstancy in the structure of the male antennæ seems quite to justify Mr. Hampson in regarding peculiarities in these organs as of secondary importance when confined to one sex, and should make all lepidopterists hesitate to use them alone for distinguishing new genera.

XXXIX.—*Description of a new Species of* Vespertilio *from China.* By Oldfield Thomas.

Among a collection of small mammals from Foochow, South China, presented to the National Museum by Mr. C. B. Rickett, occur two specimens, one in spirit and the other a skin, of a very striking new species of bat, which may be termed

Vespertilio (*Leuconoë*) *Ricketti*, sp. n.

General Characters.—Size large. Fur short. Feet and claws enormously developed.

Detailed Characters.—Fur soft, close and velvety. Muzzle well-clothed, set with bristly whiskers, very much as in *V. mystacinus*. Hind legs, both above and below, clothed to the ankles, as is the basal half of the interfemoral and the surface of the calcar. Wings quite naked. Ears of medium length, laid forward in a spirit-specimen they do not reach to the tip of the muzzle; their inner basal lobe small, square, but not sharply angular; inner margin at first straight, then evenly convex to just below the tip, where there is a slight concavity, tip narrowly rounded off; outer margin slightly concave in its upper, convex in its lower half; a notch opposite the base of the tragus. Tragus rather short, slightly curved outwards; inner margin convex, outer straight, tip rounded off; outer basal lobe well developed. Thumb with a very long slender claw. Interfemoral membrane very acute-angled in the centre, the tail projecting by one vertebra from it; calcar very long, extending fully four fifths towards the tail. Hind feet exceedingly large and provided with remarkably elongated claws, whose length, measured in a straight line from base to tip, is greater than the distance from tip to tip of the upper canines; the length of the whole foot with the claws is nearly equal to that of the lower leg.

Whole of upper surface drab (*Ridgway*), the region between the ear and muzzle somewhat darker. Under surface white, the bases of the hairs inconspicuously plumbeous.

Upper incisors large, subequal, the inner bi-, the outer tricuspid. Second premolar in both jaws small, internal to the tooth-row. Lower incisors transverse, overlapping.

Dimensions of the type (B. M. 94.9.1.22), an adult female in spirit:—

Head and body 69 millim., tail 48, ear 18, tragus (inner margin) 6·2, forearm 58, middle finger 94; lower leg and foot with claws 38, lower leg only 22; calcar 18; longest claw 6·3.

The forearm of the skin measures 55 millim.

Hab. Foochow, S. China. Coll. C. B. Rickett, April and November 1894.

This bat at first sight, mainly from its size and general coloration, resembles *Vespertilio murinus*, but is clearly a member of the subgenus *Leuconoë* as defined by Dobson, and among the species of that group there does not appear to be any one to which it is especially closely allied, while it is considerably the largest of them all.

The object of its extraordinarily long and pointed claws it is difficult to guess; and I hope that Mr. Rickett may follow up his discovery of the species by finding out something as to its habits which may afford an explanation of this structural peculiarity.

XL.—*Descriptions of new Coleoptera from New Zealand.* By Captain Thos. Broun.

Since the publication of my last paper in the Ann. & Mag. Nat. Hist. for 1893 (vol. xii.) the researches of several gentlemen, whose names appear in the following pages, have enabled me to add nine new genera and ninety-five species to the list. The species now known to exist amount in round numbers to two thousand seven hundred and sixty.

The numbers ("No. 2324," for instance) refer to species described in the 'Manual of New Zealand Coleoptera.'

List of Species.

Group Cnemacanthidæ.

Mecodema scitulum.
—— lineatum.
Metaglymma modicum.
—— oregoide.

Group Licinidæ.

Dichrochile cephalotes.

Group Anchomenidæ.

Ctenognathus actochares.
Tarastethus strenuus.
—— dubius.
—— simulans.

Group Feroniidæ.

Pterostichus Lewisi.
Sympiestus modestus.

Group Zolidæ.

Zolus femoralis.

Group Anisodactylidæ.

Lecanomerus pallipes.

Group Hydrophilidæ.

Cyloma Stewarti.

Group Aleocharidæ.

Ocalea crepera.
Calodera sericophora.
—— granifer.
—— diversa.
—— vestita.
—— tumidella.
—— bituberculata.
—— fungicola.
Aleochara semifusca.
Encephalus latulus.

Group Xantholinidæ.

Othius puncticeps.

Group Staphylinidæ.

Cafius algophilus.
Quedius sciticollis.
—— conspicuellus.
—— scutellaris.
—— puncticollis.
—— ambiguus.
—— taieriensis.

Group Pæderidæ.

Lithocharis cæca.
Hyperomma sanguineum.

Group Omaliidæ.

Omalium fusciventre.
—— australe.
—— Philpotti.
—— perplexum.

Group Cnemacanthidæ.

Mecodema scitulum, sp. n.

Shining, black, tarsi and antennæ nigro-piceous.

Head constricted immediately behind the eyes, this part with fine punctures; it is nearly smooth behind; the lateral rugæ, as well as those in front, are neither numerous nor deep; on the forehead there are six deep longitudinal striæ, near each eye there is a puncture with four or five setæ. *Labrum* smooth, broadly rounded in front, with six setigerous punctures. *Eyes* distant from thorax, rather small, very prominent, the genæ swollen below them. *Mandibles* elongate, wrinkled. *Antennæ* stout, the basal four joints nude, the others pubescent. *Thorax* slightly broader than long (7 × 6 millim.), widest near the front, very gradually narrowed backwards, a good deal but not abruptly narrowed near the base, the posterior angles obtusely rectangular, apex slightly and widely incurved, base subtruncate; the lateral margins are entire, somewhat dilated and rounded in front, with eight or ten setigerous punctures along each; basal fossæ not large, close to the sides but not reaching the base; there is a slight impression between them, the central groove hardly extends beyond the frontal curvate impression, the short longitudinal striæ near the front and base are scarcely discernible, and the transverse striolæ on the disk are rather fine and do not reach the sides. *Elytra* elongate, a little narrowed towards the shoulders; they are punctate-striate, the punctures are rather close and moderately fine throughout; the seventh and ninth interstices are slightly elevated, the former have about four punctures; the sculpture of the lateral channels is shallow and indefinite, but several irregularly-placed punctures are visible; there are two large punctures behind the scutellum, the base itself is rather depressed and smooth; there are very few setæ behind. *Legs* elongate; *front tibiæ* simple, the middle pair somewhat angulate at the outer extremity.

Underside shining black, nearly smooth. *Head* with six setigerous punctures in a transverse series on the raised part behind the mentum. *Last ventral segment* with one puncture near each side.

In *M. simplex*, Castelnau, the outer striæ of the elytra have large square punctures; there are several other differences, but, on the whole, it is the nearest ally.

♀. Length $13\frac{1}{2}$, breadth 4 lines.

Northern Wairoa. The Hon. E. Mitchelson was kind enough to send me a specimen.

Mecodema lineatum, sp. n.

Elongate, slightly convex, shining; black, legs nigropiceous, the palpi and glabrous joints of the antennæ rufopiceous.

Head not broad, the back part with rugæ and punctures intermingled; the sides and forehead bear longitudinal wrinkles, the middle is nearly smooth; near each eye there is a large puncture, with a cluster of four or five long setæ arising therefrom. *Labrum* rounded in front, with six setigerous punctures there; there is a central depression at the base from which several rugæ radiate. *Mandibles* rather short and thick, wrinkled. *Eyes* prominent. The *antennæ* reach to beyond the middle of the thorax, the last six joints bear fine pubescence. *Thorax* almost as long as broad ($5\frac{1}{2} \times$ 6 millim.), abruptly contracted near the base, which is a little emarginate; this narrow portion has straight sides and rectangular angles; the sides, from the anterior angles backwards, are but little rounded for two thirds of their length, the margins are subcrenate, having eight or ten setigerous punctures along each; the front and base have short longitudinal rugæ, the transversal striæ on the disk become deeper near the sides, the median groove does not attain the apex, the basal fossæ are rather small, they are close to the sides and become sulciform towards the base. *Elytra* elongate-oval, slightly and gradually narrowed towards the shoulders, with numerous elongate setæ behind; on each elytron, near the suture, there are two nearly regular series of moderate punctures, connected by very feeble linear marks that can hardly be termed striæ; the punctiform sculpture outside these is more irregular and a little coarser, the posterior sculpture is coarse and confused, and is mixed with many fine wrinkles; on the dorsum there are numerous short, transversal, feebly impressed lines. *Legs* elongate; *intermediate tibiæ* moderately asperate; *front tarsi* with the external angles of the basal three joints somewhat prolonged.

Underside black. *Mentum* with two setigerous punctures, its central tooth almost bifid. Penultimate articulation of the *labial palpi* bisetose. Back of the *head* covered with short rugosities. *Prosternum* medially rounded in front, nearly smooth along the middle, its flanks with rather shallow distant punctures. *Mesosternum* transversely wrinkled, its sides with punctiform sculpture. *Metasternum* nearly smooth, there being only a few rugæ behind. *Terminal ventral segment* with two setigerous punctures at each side of the middle.

I do not think this can be Castelnau's *M. crenicolle*, which is larger and differently marked. Redtenbacher's *M. crenaticolle* is described as being "obscure cupreo-æneo," a term manifestly inapplicable to *M. lineatum*. These seem to be the nearest allies.

♂. Length $11\frac{1}{2}$, breadth $3\frac{1}{2}$ lines.

Papakura (Ligar's Bush). One male.

Metaglymma modicum, sp. n.

Glossy, black; legs, antennæ, and palpi pitchy red.

Head rather large, smooth, constricted behind the eyes, and with a fine linear transverse impression above, the inter-antennal furrow deep. *Eyes* convex and prominent. *Mandibles* estriate, long and stout. *Antennæ* with fine distinct pubescence on the six terminal joints, the basal joint quite red. *Thorax* about one seventh broader than long, very much but not abruptly contracted behind; the sides moderately rounded, with rather narrow simple margins; posterior angles rectangular but blunt, the base and apex only slightly incurved; the disk is smooth and slightly convex, the dorsal groove is not deep and does not reach the apex; the basal fossæ are rather small, deep, and punctiform, they are situated close to the sides but at some little distance from the base. *Elytra* oblong, narrowed towards the shoulders, broadly rounded behind; each elytron has eight dorsal, well-marked, closely and distinctly punctured striæ; the two sutural are not so deep as the outermost; the first, third, and fifth interstices are a little wider than the others; the smooth area between the eighth and marginal striæ is somewhat convex, the posterior sculpture is coarse and irregular, the base is smooth. The outer extremity of the *front tibiæ* is prolonged but not dilated externally, the middle pair are but little asperate and only moderately dilated, and the posterior are smooth and hardly at all incrassate at the apex.

The fourth (apical) *ventral segment* has two punctures on each side of the middle at the apex, and each side of the thorax bears about six setæ, the normal condition in this genus. The *labrum* is usually broadly rounded, but in this species it is widely emarginate in the middle.

This is smaller than No. 2324, its nearest ally; the thoracic fossæ are not large, nor do they extend inwards as in that species; the legs are more slender and the hind tarsi are more elongate, besides other differences.

Underside smooth and shining.

♂. Length 7, breadth $2\frac{1}{4}$ lines.

Wellington. Mr. J. H. Lewis caught this on the sea-beach.

Metaglymma oregoide, sp. n.

Elongate, moderately narrow, slightly convex; brilliant, pitchy black, the legs, antennæ, and palpi piceo-rufous.

Head smooth, with a well-marked transverse linear impression behind the eyes; the inter-antennal furrow is not deep, and there is no longitudinal groove between the side of the forehead and the mandible. *Eyes* small but prominent. *Labrum* rounded. *Thorax* elongate ($3\frac{3}{4}$ millim. long by 4 broad), only slightly wider before the middle than it is elsewhere, very gradually narrowed posteriorly, its sides but little curved and only indistinctly marginated, the hind angles obtuse and indistinct; the surface is smooth, the central channel is rather fine and does not reach the apex, the basal fossæ are small and punctiform and are about as far from the sides as they are from the base. *Elytra* oblong-oval, finely margined, the shoulders rounded; on each elytron there are eight rather fine striæ, they are only feebly impressed near the smooth base, the eighth does not extend as far forwards as the middle thigh; they are only finely punctured, the sculpture becomes coarse and irregular behind.

The *antennæ* reach backwards to the middle of the thorax, their five or six terminal joints bear more fine pubescence than do those of *M. monilifer*. The external apical prolongation of the *front tibiæ* extends about as far as the apex of the basal joint of the tarsi, the outer extremity of the middle pair is angularly produced to the same extent as that of *M. monilifer*, the posterior are only slightly incrassate. The terminal joint of the *maxillary palpi* is moderately slender.

There is no species of *Metaglymma* like this; it looks more like Castelnau's *Oregus inæqualis*. The thorax is very similar, there being no abrupt posterior contraction; the space beyond the eighth elytral stria and also the marginal channel are nearly smooth, there being only some shallow punctures.

Length $7\frac{1}{2}$, breadth $2\frac{1}{4}$ lines.

Christchurch. Found by Mr. Suter in his garden.

Group **Licinidæ.**

Dichrochile cephalotes, sp. n.

Subdepressed; the head, thorax, and scutellum dull pitchy black, with dense minute granular sculpture; elytra shining, violaceo-piceous, the margins paler; the legs and basal joint of the antennæ pale brown, joints 4 to 11 of these latter darker, opaque, and pubescent.

Head large, as long (mandibles exclusive) but not as broad as the thorax; the sides but little rounded and only slightly narrowed behind the eyes; there are four more or less evident interocular punctures. *Eyes* only moderately convex. *Antennæ* filiform, attaining the middle thighs, their second joint obviously shorter than the third. *Thorax* about a third broader than long, widest before the middle, more, yet only very gradually, narrowed behind than in front; posterior angles rounded, the anterior nearly rectangular; lateral margins rather fine, the apical and basal still finer; the apex widely, the base more deeply incurved; its surface rather flat, with some indistinct transverse rugæ, the central channel not abbreviated; basal fossæ represented by elongate impressions extending about halfway towards the front, they are hardly broader than the median groove; there are two shallow curvate impressions near each side in front. *Elytra* oblong-oval, obliquely, but hardly at all sinuously, narrowed apically; their striæ are sharply impressed but impunctate; there is a short scutellar stria on each, 3 to 7 are more or less irregularly interrupted or confused behind; interstices broad, not convex, third bipunctate, sixth sometimes punctured.

Underside piceous; the head with a broad smooth line along the middle, elsewhere finely wrinkled.

This species may be distinguished from *D. anthracina*, its nearest ally, by the silky opacity of the anterior half of the body, the larger head, unusually thick mandibles, more basally narrowed thorax, and by the peculiar colour of the elytra.

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

Ngatira, near the Rotorua railway. One female.

Group **Anchomenidæ.**

Ctenognathus actochares, sp. n.

Black, shining; the femora and the first and third antennal joints more or less piceous; the remaining joints of the latter, as well as the tarsi and palpi, are rufous; tibiæ usually pitchy red.

Head oviform, the constriction behind the eyes continued above as a more or less evident impression; the middle is convex. *Thorax* large, only about a sixth broader than long, widest near the middle; its sides rounded, with broad channels and reflexed margins; they are sinuate-angustate behind, but there is a very short straight space near the posterior angles; these are nearly rectangular, but generally obtuse; the base is truncate or almost so in the middle, but its sides are slightly curved forwards; the dorsal furrow is broad, and, as seen from the sides, does not reach the base or apex; the disk has some obsolete undulating striæ, and the depression or fossa near each hind angle is more or less curvedly prolonged forwards inside the lateral channel. *Elytra* broad, their sides slightly rounded and a good deal obliquely narrowed posteriorly; the base is incurved and has distinct raised margins; the striæ are deep and regular, the interstices are broad and slightly convex, the subapical puncture on the third is seldom distinct. The *tarsi* are grooved along each side of the middle, the anterior less evidently than the others.

This should be placed near No. 45, which most nearly resembles it. The thorax of *C. actochares* is more cordiform, it seems longer, and the basal portion and angles are very different. The eyes are rather longer. The last ventral segment has five punctures along each side of the middle in some examples, but only two in others.

♂. Length $6\frac{1}{3}$, breadth $2\frac{3}{8}$ lines.

Wellington. Found inside the harbour and along the coast outside by Mr. J. H. Lewis.

Tarastethus strenuus, sp. n.

Shining, rufo-castaneous; palpi fulvescent, legs and antennæ chestnut-yellow.

Head with broad frontal impressions, the space between the antennæ distinctly punctured. *Thorax* about one fifth broader than long, the apex almost, if not quite, as wide as the base, this latter feebly emarginate; its sides moderately rounded, behind the middle they are narrowed but hardly at all sinuate, with rectangular posterior angles; the central channel is not deep and nearly reaches the apex, the basal fossæ are obsolete, the whole basal region is rather closely punctured. *Elytra* broader than the thorax, ovate-oblong, the lateral margins broad as far as the apical sinuosities; they are only moderately punctate-striate.

Larger than *T. puncticollis*, the thoracic margins finer; the elytra more broadly rounded apically, the striæ less deep and their punctures less coarse and not so close; the outer striæ obsolete near the shoulders; the subapical plicæ are well developed. As my specimen is a little immature, the ordinary colour is probably piceous.

In *T. alpinalis* the eyes are less convex, the basal fossæ of the thorax are well marked, but the punctures near the base are not nearly so numerous or close, the central space (and that near each side) is nearly smooth, and the basal region, as seen from behind, appears depressed.

♀. Length $2\frac{3}{4}$, breadth quite $1\frac{1}{8}$ lines.

Napier (Hastwell). One, found by Mr. H. Suter.

Tarastethus dubius, sp. n.

Nitid, piceous, slightly rufescent; the legs, antennæ, and palpi rufo-testaceous.

Head more or less punctate across the middle. *Thorax* about a sixth broader than long, slightly narrower in front than at the base, the sides only moderately curved, gradually and not sinuously narrowed behind; basal angles rectangular; the discoidal furrow almost reaches the base and apex, the whole basal region is rather flat and closely punctate, but the fossæ are shallow, narrow, and indistinct. *Elytra* broader than the thorax, their grooves and punctures rather fine, the former more distinct behind, but more or less obliterated near the base; the posterior carinæ normal.

This is closely allied to *T. strenuus*, and future research may prove that it is a varietal form only; the elytra, however, are certainly different in shape, they are gradually narrowed backwards from the middle thighs, and the sides and margins become narrow before reaching the apical sinuations.

Length $2\frac{3}{4}$, breadth $1\frac{1}{8}$ lines.

Wellington. A mounted specimen was sent to me by Mr. G. V. Hudson, numbered 141. The abdomen is not distinctly punctured.

Tarastethus simulans, sp. n.

Rufo-piceous, shining; legs reddish, the antennæ, palpi, and tarsi rufo-testaceous.

This makes a near approach to *T. puncticollis* (No. 1799), but differs therefrom in having rather larger but less convex *eyes*. The *forehead* is more or less distinctly punctured, The *thorax* is broader, its posterior narrowing is longer and more gradual; the basal fossæ are large, when seen from the side they appear well limited, but they extend towards the middle as broad depressions, which is not the case in No. 1799; the basal punctuation is not so close, some parts being nearly smooth; the lateral rims are finer towards the front, the disk is quite free from the minute scattered punctures visible in Sharp's *T. puncticollis*, and there is a curvate impression in front. The *elytra* are less narrowed posteriorly; the apices, indeed, are rather broadly rounded, and the outer striæ are not so deeply impressed. The *anterior tarsi* have the fourth joints somewhat prolonged underneath in the form of membranous lobes.

Underside more or less punctate; the middle of the abdomen, the epipleuræ, and the flanks of the prosternum are smooth.

Length $2\frac{5}{8}$, breadth $1\frac{1}{8}$ lines.

Capleston, Westland. Two examples found by Mr. Cavell.

Group **Feroniidæ.**

Pterostichus Lewisi, sp. n.

Elongate, subparallel, only slightly convex, shining; black, the tarsi and antennæ piceous.

Head rather large, much narrower than the thorax, with a few fine, sometimes obsolete, transverse striæ behind, and some oblique or curved ones between the eyes; frontal impressions elongate. *Thorax* not appreciably broader than long ($6 \times 6\frac{1}{2}$ millim.), slightly wider near the front than it is elsewhere, the sides but little rounded, gradually and slightly narrowed behind the middle; the posterior angles are rectangular, but in one example there is a slight thickening of the margins that causes the angles to appear prominent; across the surface there are some fine striæ; the deep dorsal channel is somewhat expanded towards, but does not reach, the front margin; there is a rounded impression near each anterior angle; the basal fossæ are a little flattened externally and generally exhibit a smaller outer fovea in each; the middle of the base is slightly depressed and wrinkled. *Elytra* slightly narrowed towards the dentiform shoulders, the apices broadly rounded; each elytron has seven discoidal striæ, these are much interrupted; here and there the elongate impressions are replaced by punctures, the sculpture becomes coarser behind.

Scutellum striate. *Thorax* with four or five setæ on each side. The last *ventral segment* in the male has two punctures at each side of the middle, the female has three.

Like No. 1791 (*P. irregularis*). The surface less glossy; the genæ more swollen behind the eyes; the inter-antennal groove shorter, in the transverse direction; the second joint of the antennæ rather longer; the sculpture of the head and thorax very much finer; the humeral angles are more dentiform and the sculpture of the elytra is different, the large punctiform depressions seen in *P. irregularis* being almost absent in this species.

Length $9\frac{1}{2}$, breadth $3\frac{1}{8}$ lines.

Wellington. Four examples were found in a ravine behind the city at different times by Mr. J. H. Lewis, whose name has been given to the species.

Sympiestus modestus, sp. n.

Oblong, subparallel, shining, pitchy black; legs rufo-piceous, antennæ red, tarsi and palpi pale red.

Head evidently narrower than the thorax, with large, broad, smooth frontal impressions. *Eyes* very convex and prominent. *Thorax* subquadrate, about one fifth broader than long, its sides slightly sinuate-angustate behind the middle, posterior angles exactly rectangular, the anterior rounded; the dorsal groove scarcely reaches the apex and is very narrow near the base; the basal fossæ are elongate and sulciform, the space between these is slightly depressed. *Elytra* ovate-oblong, the three sutural striæ on each are distinctly punctured, but the punctuation becomes obsolete behind; the fourth is interrupted or less distinct at the base, the outer striæ are more or less effaced.

In this genus the species are difficult to separate satisfactorily unless they are compared side by side. The following notes will aid their identification.

No. 1804, the typical species, is larger than *S. modestus*; the basal joint of the antennæ is darker than the others, the elytra are less glossy than the thorax, which latter has slightly obtuse basal angles. These characters are not applicable to *S. modestus*.

No. 1338.—Frontal impressions distinctly sculptured, almost quite punctate; eyes less convex than in *S. modestus*.

No. 1805.—Striæ of elytra narrow and finely punctured, so that the striæ are more conspicuous than their punctures, just the reverse of what is seen in the other species; its eyes are like those of No. 1338 but are rather smaller.

No. 2439.—This is a larger insect with very conspicuous eyes.

♂. Length $2\frac{1}{2}$, breadth $\frac{7}{8}$ lines.

Dyer's Pass, Canterbury. One example, found by Mr. Suter in June 1893.

Group **Zolidæ**.

Zolus femoralis, sp. n.

Subovate, rather elongate, a little convex, shining; pitchy black, elytral margins and mandibles red, the antennæ, palpi, tibiæ, and tarsi yellowish red.

Head rather small, with a groove near each eye, the frontal impressions elongate and rather shallow. *Thorax* almost as long as it is broad, a little wider at the base than in front; the sides before the middle are moderately rounded, near the base they extend outwards, only very slightly, however; between the base and the middle there is a moderate sinuation; the posterior angles are rectangular; the dorsal groove almost reaches the apex and is quite distinct behind; the basal fossæ are very large, but become shallow near the central groove; the punctuation near the base is feeble, the plica near each side is well marked. *Elytra* oval, much broader than the thorax, the lateral margins and channels broad; their striæ, though distinct, are not deep nor broad, and they are only very finely punctured; the fifth is bordered behind by distinct carinæ; interstices broad, not convex, the third tripunctate; at each side near the shoulder there are three or four setigerous punctures, there are similar ones behind.

There are two setigerous punctures on the *forehead* and one near the back part of each eye. The *antennæ* barely attain the middle thighs; their second joint is as long as the first, it is nearly glabrous; the third is nearly bare at the base. The *front tarsi* are narrow; their basal joint is shorter than the terminal one, the second is longer than broad; the third and fourth are cordiform, the latter is shorter than the former.

The nearest species is *Z. carinatus* (No. 1339). This is a little narrower, with a shorter thorax; its sides are more rounded at and before the middle and more sinuated behind; the basal impressions are larger, but the punctures there are much finer and less numerous; the last puncture on the third interstice is situated behind the posterior femur, in No. 1339 it is placed in line with the front of the thigh; the scutellar striolæ are represented by series of fine punctures; the apices of the elytra are more broadly rounded; the hind tarsi are feebly grooved above.

♀. Length $3\frac{5}{8}$, breadth $1\frac{3}{8}$ lines.

Wellington. I received my specimen from Mr. J. H. Lewis; he found it on the 2nd September, 1893.

[To be continued.]

MISCELLANEOUS.

A new instance of Commensalism: Association of Worms of the Genus Aspidosiphon *with Madreporarian Polyps and a Bivalve Mollusk.* By M. E.-L. Bouvier.

In their 'Monographie des Turbinolides,' published in 1848, Milne-Edwards and Jules Haime mentioned the association of Gastropod mollusks with Madreporarian polyps, which they subsequently assigned ('Histoire naturelle des Coralliaires,' t. ii. p. 51, 1857, and

t. iii. p. 63, 1860) to the genera *Heterocyathus*, *Heteropsammia*, and *Stephanoseris*. This phenomenon of commensalism likewise attracted the attention of Deshayes ('Catalogue des Mollusques de l'île de la Réunion,' p. 65, 1863), who considered the commensals of the polyps to be Gastropods with disunited whorls, and formed for them the genus *Cryptobia* in the family Vermetidæ. Deshayes gives a precise description of the respiratory perforations which traverse the skeleton of the polyps, to terminate at the body of their host; he observes, moreover, that the shell of the mollusk persists as far as the external orifice in *Heteropsammia*, but not in *Heterocyathus*, that its disunited whorls have not the smooth and glossy surface possessed by those which remain in contiguity, and, finally, that there is reason to attribute this difference to a "progressive dissolution of the skeletal matter of the coral, the pores of which would have been filled up by the mollusk."

Thanks to the rich material which Dr. Jousseaume collected at Aden, and very kindly handed over to me, I have been able to renew the study of this question, and have arrived at the following curious results:—

The polyps belonging to the genera *Heterocyathus* and *Heteropsammia* attach themselves, probably on emerging from the embryonic stage, to the *empty* but always very small shells of *various* Gastropods; as soon as they have become fixed they receive as commensals young Gephyreans of the genus *Aspidosiphon*, which take up their abode in the cavity of the shell and coil themselves into a corresponding spiral. The two commensals then develop simultaneously—the polyp spreading more and more over the shell, which it completely covers, and finally extends beyond; the worm growing on its part in the shape of a spiral with disunited coils, and producing in the calcareous tissue of the polyp a cavity of the same shape, which prolongs that of the shell and opens to the exterior by a rounded orifice.

Simultaneously with the growth of the polyp and its host the latter *secretes a tube* in prolongation of that of the shell, but differing from it by being less thick, by its intimate union with the skeleton of the coral, as also by the aspect of its internal surface, which is neither smooth nor lustrous like that of the shell: in *Heteropsammia* the tube thus formed extends in the majority of cases to the external orifice; in *Heterocyathus*, on the other hand, it develops more slowly, and does not reach this aperture. In order to keep itself in direct communication with the respirable medium, the worm dissolves the surrounding calcareous elements, following certain lines normal to its surface, and thus gives rise to linear perforations which serve for the entry and exit of the ambient water. The formation of air-holes of this description is doubtless due to the solvent action exerted upon the calcareous matter by the secretion of certain cutaneous glands.

The worms commensal with the polyps are provided with a long extensile proboscis and two solid shields, formed by the juxtaposition of corneous pieces. The proboscis terminates in a peribuccal wreath of short tentacles, and exhibits upon its surface a number of transverse rows of pointed hooks; it is a prehensile organ employed by the animal to capture its prey; but it also serves, thanks to its hooks, for the locomotion of the two commensals, for M. Jousseaume has seen it protruded by the worm and applied to the bottom, as if to find a point of support, and then contracted so as to drag the polyp along. The shields are two in number, as in all the species of the genus *Aspidosiphon*: the first is grooved with transverse striations in front and longitudinal striations behind, and is situated at the base of the proboscis, near the anus; the second occupies the posterior extremity of the worm, and is circular in shape, with radial grooves. I know not what is the *rôle* of this latter, but the anal shield closes the orifice of the tube when the animal is retracted, and consequently acts as a defensive operculum.

These worms belong to two new species, one of which inhabits *Heteropsammia* and the other *Heterocyathus*. The former greatly resembles *Aspidosiphon mirabilis*, Théel, from the Swedish seas, but differs from it by reason of its habitat, in the shape of its nephridia, and in the number of the coils in its digestive tract; the latter is allied to a Malayan species, *Aspidosiphon ravus*, Sluiter, from which it is readily distinguished by the grooves in its shields. Since Deshayes has proposed for the Gastropods which he believed to be commensal with the two polyps the names *Cryptobia heteropsammiarum* and *C. Michelini*, it will be well to designate the Gephyrean of *Heteropsammia Aspidosiphon heteropsammiarum*, and that of *Heterocyathus A. Michelini*.

The commensalism of the *Aspidosiphon* is complicated, at least in the case of *A. Michelini*, by the presence of the young of a very small Lamellibranch mollusk (*Kellia Deshayesi*, Jousseaume, sp. n.), which takes up its abode in the cavity inhabited by the worm, and shelters itself in the depressions in the surface of the latter; when the commensals are adult the number of these bivalves amounts to about a dozen. They derive their sustenance from the current of water which passes into the interior of the spiral cavity through the linear perforations of the polyps.

We may sum up our results as follows:—(1) The commensal of *Heteropsammia* and *Heterocyathus* is a worm of the genus *Aspidosiphon*, and not a Gastropod; (2) each polyp has its particular species, and develops concurrently with it; (3) the polyps attach themselves to various shells, and not to those of a distinct genus; (4) the rugose tube by which the shells are continued does not belong to their substance, but is formed by the worm; (5) the association of the worm and the polyp is complicated, at least in the case of *Heterocyathus*, by the presence of a third commensal in the shape of a bivalve mollusk.

Setting aside this latter animal, the commensalism of *Aspidosiphon* with the polyps reminds us in every respect of that of *Parapagurus pilosimanus* with the colonies of *Epizoanthus*.—*Comptes Rendus*, t. cxix. no. 1 (July 2, 1894), pp. 96–98.

The Poison-Gland of Chilopod Myriapoda.
By M. O. Duboscq.

In spite of the recent investigations of MacLeod, Soulié, Zograf, and Herbst, the poison-gland of Chilopod Myriapods is not well understood. We know that in all Chilopods the orifice is situated on the buccal side of the tip of the fang, that this orifice is succeeded by a tubular chitinous duct which extends as far as the coxa of the poison-claw, and that around the duct a tissue of a nacreous white constitutes the gland, which has a cylindrical shape in *Scolopendra*, but is piriform in the rest of the Chilopoda. But as to the actual structure of the glandular tissue authors are entirely at variance. Some (MacLeod, Herbst) describe around the duct large radiating cells, which are said to have a nucleus at the base. Their opponents (Soulié, Zograf) regard these pretended cells as glandular tubes with multiple secreting cells. As for the muscles of the gland, since no one has seen any sign of such structures, all suppose that the gland is compressed by the adductor muscles of the poison-claws, the result of which, however, would be to cause the poison to issue at each movement of these foot-jaws.

According to my own researches the structure of the gland in *Scolopendra* (*Sc. cingulata*, Latreille) is as follows:—

The excretory duct, which consists of very thick chitin, is divided into two portions, an anterior one, which is non-glandular and presents no peculiarity except more or less parallel thickenings, giving it a faint resemblance to a trachea; and a posterior glandular portion, of the same thickness and the same calibre, but pierced with olive-shaped foramina. These foramina have been taken by many to be little hollow protuberances attached around the excretory duct; this is due to the fact that the lining chitin is denser than the uniting chitin, which is pale, whence the appearance of relief. They do not occupy the whole of the surface of the posterior portion, but only three fourths of it. The external region, to which the groove of the gland corresponds, is destitute of them throughout its length.

The glandular tissue seems to be disposed all round the excretory duct, which apparently has a central position. In reality the duct is superficial, since it is at the bottom of a longitudinal groove in which ramify the tracheæ and the arteries of the gland. (The nerves of the gland, derived from the nerve of the poison-claw, spread out on the side opposite to the groove.) At the bottom of the groove the chitin of the duct is not bare, but is clothed with a columnar epithelium.

Around the duct and perpendicular to it there radiate a number of glandular tubes, one of which inosculates with each foramen in the duct. Each tube is conical or pyramidal in shape, with the foramen in the duct as the apex of the cone. Their walls are constituted by a delicate basal membrane, slightly chitinized, in which we observe granular oval nuclei at intervals. The base alone is occupied by little gland-cells, engaged in active proliferation. Each tube accordingly produces and contains a large quantity of poison. The tubes have their common sides united together, and are, in short, deep alveoli.

Between the tubes we find attached to their walls a number of striated muscular fibres, which are readily distinguishable in well-fixed preparations. These fibres are inserted on the one side by their branching extremities in the excretory duct, on the other they lose themselves in the external tunic of the gland, which is a muscular plexus of a similar nature. They exhibit the ordinary transverse striation, with alternating thick and thin disks, and a longitudinal striation, which shows that they are composed of fibrillæ. They have a number of oval granular nuclei, which are ordinarily superficial; sometimes, however, they occur in the thickness of the fibre.

The external tunic of the gland is nothing but a muscular plexus, the meshes of which are united by a chitinized basal substance. Authors, having seen only the nuclei of the muscles, have described it as an endothelium. This plexus is thick and composed of several layers on the face of the gland opposite to the groove. In the neighbourhood of the groove the fibres are fewer in number and less stout; they have the same structure as the deep fibres intercalated between the tubes.

Thus there is constituted a rich muscular apparatus for the compression of the gland and the expulsion of the poison.

In the other Chilopods the structure is essentially the same. Thus the poison-gland of *Cryptops* (*C. hortensis*, Leach) is fairly similar; but the tubes are more elongated and not perpendicular. There is no groove, and the duct is perforated over the whole of its circumference. The muscles are very greatly developed, especially in the tunic, and are disposed as in the case of *Scolopendra*.

The gland of *Geophilus* (*G. longicornis*, Leach) resembles that of *Cryptops*. But the muscles of the tunic are no longer plexiform; they are large fibres as long as the gland, parallel one to another, in a single layer, and fairly similar to all the muscular fibres of the body.

In *Lithobius* (*L. forficatus*, Linn.) the tunic is a plexus of fibres; their muscular nature, however, is no longer evident. They are fibres which, when treated with acids, prove to be composed of a number of parallel fibrillæ, which are devoid of all trace of striation. On their surface are large elliptical nuclei, with a very small nucleolus. Since they resist the action of boiling water and acids, I compare them with the muscular fibres, without believing in their contractility.

The structure of the gland in *Scutigera* (*S. coleoptrata*, Linn.) from a histological point of view is similar to that of *Lithobius*. But the excretory duct remains short, and, since the gland descends right into the coxa, the elongation of the poison-claw has here occasioned an extreme elongation of the tubes.

At a future date I shall publish conclusions as to the nature of the poison and its effects.—*Comptes Rendus*, t. cxix. no. 5 (July 30, 1894), pp. 352–354.

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CONDUCTED BY

ALBERT C. L. G. GÜNTHER, M.A., M.D., Ph.D., F.R.S.,
WILLIAM CARRUTHERS, F.R.S., F.L.S., F.G.S.,
AND
WILLIAM FRANCIS, Ph.D., F.L.S.

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

WITH ONE PLATE.

Illustrative of Dr. R. H. Traquair's Paper on Palæozoic Fishes.

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THE ANNALS

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[SIXTH SERIES.]

No. 83. NOVEMBER 1894.

XLI.—*On* Euskclesaurus Brownii (*Huxley*). By H. G. Seeley, F.R.S.*

Euskelesaurus Brownii was discovered by Mr. Alfred Brown, of Aliwal North, at Barnard's Spruit, Ward, 15 miles south of Aliwal North. The remains were collected with some difficulty at intervals, and three separate collections of bones of the same animal were sent by Mr. Brown to Europe before the further specimens in his possession were intrusted to me in September 1889. Mr. Brown assures me that other portions of the animal are still in the rock. He at first intended his fossil for the National Museum, but forwarded it to Sir R. I. Murchison, not knowing that the Geological Society, Geological Survey, and Geological Department of the British Museum were distinct institutions. The first collection was the subject of a memoir by Professor Huxley Quart. Journ. Geol. Soc. vol. xxiii. p. 1, 1867). It gives an elaborate discussion of the characters of the femora, which in many ways resembled *Megalosaurus*. The tibia, fibula, and tarsus are described. The collection included other bones, some of which are recorded as fragments of two very large flat bones, the large metatarsal and metacarpal, and fragments which were not determined. Unfortunately no figure was given of any of these specimens, and some of the less important I have not seen. A second collection was sent to

* Read before the Geological Society as Part 7 of "Contributions to Knowledge of Saurischia," June 22, 1894.

Sir R. I. Murchison, and acknowledged by him; but no account of it was published, and I have been unable to trace the specimens. Mr. Brown, finding that his fossil aroused less interest in this country than might have been expected from the interest taken in his discoveries in Cape Colony, consigned a third box of the remains to the Museum of the Jardin des Plantes, where the specimens are exhibited. Some were figured by M. Paul Fischer (Nouv. Archiv. du Muséum, Mém. tome vi. pls. x., xi.), and give evidence of caudal vertebræ with chevron bones and the neural arch, distal row of the tarsus, phalanges, and the nearly entire pubis, which I found to be similar to the pubis of *Massospondylus* in January 1889.

The further specimens entrusted to me by Mr. Brown comprise the maxillary and premaxillary bone, a chevron-bone, the expanded proximal part of a rib, three claw-phalanges (and a fourth imperfect), and six digital phalanges of the foot.

There are two vertebræ in the Albany Museum from Penhoek which are probably referable to the same species. One of these gives the characters of the dorsal region, the other is apparently a late caudal vertebra.

The osteology of the animal is therefore very imperfectly known, since no part of the fore limb or shoulder-girdle appears to have been preserved in the three known collections. The vertebral column is almost untouched, and is apparently still in the rock. The few specimens now available for study seem to substantially support Prof. Huxley's interpretation of 1866 * in indicating resemblances to *Megalosaurus*; the resemblances are especially interesting with *Massospondylus*, so that the type may be placed in the Saurischia in near association with the latter genus and *Zanclodon*, though with a nearer approximation to *Megalosaurus*.

The evidences for these conclusions are given in the following account of the several bones.

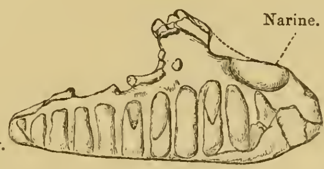
Premaxillary and Maxillary Bones of Euskelesaurus Brownii (*Huxley*). (Fig. 1.)

The left maxillary and premaxillary bones are exposed on the internal aspect of the jaw, so as to define its form fairly well except at the extremities of the premaxillary in front,

* Mr. R. Lydekker (Cat. Foss. Rept. Brit. Mus. pt. 4, 1890, p. 252) refers this genus to the Stegosauridæ; but no evidence has been given in support of this determination, and I have observed no character common to it and the Ornithischia.

the termination of the maxillary behind, and the extremity of the ascending facial process above. The specimen has been much decomposed by weathering, so that the palatal plate is lost, as is almost all the internal bone defining the alveoli;

Fig. 1.



Left maxilla of *Euskelesaurus Brownii*, showing successional teeth in three alveoli. $\frac{1}{10}$ nat. size.

so that they are mostly exposed as parallel oblong grooves, in some of which the successional teeth are preserved. As preserved the jaw is $17\frac{1}{2}$ inches long and 8 inches deep below the facial process.

The inferior alveolar border is gently convex in length, especially beneath the facial process. Its margin appears to be entire in front. The premaxillary suture is shown ascending in a straight line, at right angles to the alveolar margin and oblique to the alveoli. It is within about $2\frac{1}{2}$ inches of the anterior extremity, as indicated by the impression, from which the bone is broken away below the nasal vacuity. There are no indications of teeth in the premaxillary bone exposed, and if the teeth were of the same size as in the maxillary, there could not have been more than two alveoli within its limits. In the maxillary bone eleven sockets are easily traced, and there appear to have been twelve. The jaw is formed much on the type of *Megalosaurus* from the Stonesfield slate, except that there is no indication of a similarly extended posterior attenuation of the maxillary bone, and the nasal vacuity has a lower lateral position at the side of the snout, indicating relatively small depth anteriorly for the tooth-sockets. The measurement below the narial margin is $2\frac{3}{4}$ inches, so that the premaxillary teeth may have been smaller than the maxillary teeth. The nasal vacuity is longitudinally ovate, $3\frac{1}{2}$ inches long and $1\frac{3}{4}$ inch deep in the anterior half; its anterior border is well rounded, and a thin plate of the premaxillary ascends to define its superior border. There is no certain indication of the nasal bone on its upper border; but this may be due to conditions of preservation, for the strength and breadth and direction of the facial maxillary process tend to the conclusion that the head was deep in front of the orbit. The measurement from the alveolar border to the summit of the nasal vacuity in its middle length is $5\frac{1}{2}$ inches.

The sockets for the teeth are deepest and widest at the back of the nasal vacuity and below the facial process, where they are in the maxillary bone; and they become shorter and narrower as the jaw extends backward. The palatal contour may probably be indicated by a line drawn through the bases of the tooth-sockets, in which case it would be somewhat concave in length, the middle region being straight and the extremities descending concavely. The largest sockets are more than 4 inches deep, while the hindermost can be little more than 1 inch deep. Anteriorly the width of the sockets is $1\frac{3}{20}$ inch, posteriorly it is barely $\frac{8}{10}$ inch. The sockets are vertical and parallel, separated by bony interspaces, which are three or four tenths of an inch wide anteriorly, but narrower behind. The depth of the jaw below the facial process is fully 4 inches and its length behind that process is about 8 inches. The superior contour of this region is irregular and broken.

Two successional teeth are preserved within the alveoli, so as to give some conception of the form and character of the crowns, which are compressed from side to side, broad, convex on the anterior border, straight on the hinder border, with the extremity well rounded; the anterior and posterior margins are sharp and crenulate. The teeth have a very compressed aspect, all the more remarkable from their extreme width; indications of these teeth in the maxillary bone are seen in its third, fifth, and sixth alveoli in different stages of development. As compared with *Megalosaurus* they are much broader and less pointed.

The facial process extends for $3\frac{1}{2}$ inches behind the hinder margin of the nasal vacuity, which appears to indent its base in front. Its anterior margin inclines backward at an angle of about 45°, and this surface is flattened as though for contact with the nasal bone. The posterior margin, as preserved, is somewhat irregular, but nearly vertical, and it shows a vertically ovate foramen about $\frac{1}{2}$ inch in diameter near to the border. There is nothing to indicate that it is the lachrymal foramen. It is obviously situate in the position of the infraorbital foramen, which is preorbital.

Without entering now into the general question of the nomenclature of the similar bones from Stonesfield referred to *Megalosaurus*, from the Stonesfield slate, and from the Inferior Oolite of Sherborne, which may possibly, from their different proportions, belong to diffeient species or genera, it is evident that in general massiveness this South-African fossil departs perceptibly from those English types, and rather approximates towards the shorter headed *Teratosaurus*, which is provisionally identified with *Zanclodon* from the Trias, and the American *Ceratosaurus*, which is said to be from Jurassic rocks. In proportion of jaw the form is intermediate between *Ceratosaurus*, *Megalosaurus*, and *Zanclodon*; but the teeth in the relative width and flatness recall *Zanclodon* rather than other types.

The only other fragment known to me which may possibly be referable to this type is a specimen in the Museum of the Jardin des Plantes, recorded in my notebook as "small fragment of a jaw, much broken and not deep, with large teeth in sockets. The teeth are compressed, of an oval form in section, with a large pulp-cavity, which is closed at the base."

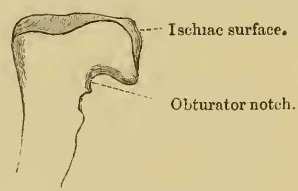
Left Pubis. (Fig. 2.)

M. Paul Fischer gave an excellent discussion of the pubis of *Euskelesaurus*. There can remain no uncertainty as to its osteological determination after comparison with the pubis in *Belodon*, *Staganolepis*, *Zanclodon*, and *Massospondylus*, in which genera all the pelvic bones are known. They have the pubis more or less distinctly modified from the same plan. M. Fischer's figure (Nouv. Arch. Mus., Mém. t. vi. pl. xi. fig. 15) is reversed, and represents the external aspect of the left pubis. The bone is rather more than 24 inches long, thin and flat, with the anterior margin approximately straight, but concave in its proximal half and slightly convex in its distal half. The distal end, as preserved, is fully 8 inches wide. The posterior border is less perfectly preserved. The width of the bone steadily diminishes proximally till, at the obturator notch, the width is $3\frac{1}{2}$ inches. Above that notch the bone expands transversely in a hook-like form, to make the superior articulation with the ilium, which is transverse to the shaft, and the ischiac articulation at right angles to it. The transverse width here is 7 inches. The thickness of the bone at the acetabular and iliac surfaces is 3 inches. In the upper fourth of its length the pubis is twisted, so that the proximal surface makes an angle of about 45° with the flat plate of the distal end. From this twist the inference may be drawn that the ischium and pubis receded inward below the acetabular part of the ilium. The anterior half of the proximal surface has the aspect of having articulated with the ilium; but the posterior half is somewhat concavely excavated, as though it had contributed to the acetabulum.

The surface which appears to be the articulation for the ischium is remarkably strong and irregularly four-sided, $2\frac{1}{4}$ inches deep, and wider above than below. It shows a cartilaginous surface, and may possibly have been connected with the ischium by a cartilage.

The pubes appear to have been directed downward and forward, and, as M. Fischer has stated, to have met in the median line; for at the transverse distal extremity along the inner margin an oblique articular surface extends over the bone, about an inch deep in the middle and rather narrower towards the inner and outer borders.

Fig. 2.



External aspect of proximal end of left pubic bone of *Euskelesaurus Brownii.* $\frac{1}{10}$ nat. size.

The pubis is constructed on the same plan as that of *Massospondylus*, but differs in having the obturator foramen or notch relatively smaller. The formation of the backwardly directed process above the obturator foramen is very similar in the pubes of *Zanclodon*, figured as sternum by Plieninger (Jahreshefte, Württ. 1857, t. xi. fig. 1), in which the bone appears to retain the width of the plate from the distal end upward to the obturator notch. But in the Tübingen specimen, which I have referred to as *Teratosaurus Quenstedti*, there is no such development of a subacetabular process, and the acetabular notch is much larger. In *Staganolepis* the bone is apparently similar at the proximal end so far as the subacetabular process is concerned; but these are the only genera known in which the pubis has a similarly expanded blade and a hook-like proximal end.

I have no knowledge of the ischium or ilium.

Vertebral Column.

The only vertebræ of *Euskelesaurus* hitherto known are the early caudals collected by Mr. Alfred Brown, which are in the museum of the Jardin des Plantes. The further materials which are known to me are a fine chevron bone in the collection of Mr. A. Brown and two vertebræ in the Albany Museum, obtained from the top of Penhoek, about 500 feet above the coal. One of these is a dorsal centrum and the other a late caudal. There is necessarily no proof that they belong to the same species; but they are preserved in a similar yellowish matrix, and, being above the coal, belong to the Stormberg or Zanclodont horizon, which I regard as Trias. In osteological character and size they are similar to the specimens collected by Mr. Brown.

Dorsal Vertebra.

The centrum has a massive compact aspect, rather suggesting that of a large Pliosaur. It is somewhat oblique. The lateral margins are broken in front, and the inferior margin is fractured behind, and from this circumstance probably the anterior articular face appears to be narrower and deep, while the posterior articular face appears to be wider. The centrum is $4\frac{1}{2}$ inches long or a little more, but the measurement augments slightly under the neural canal, indicative of an arching of the back. The length corresponds closely with that of the early caudal vertebræ at Paris, which vary from $4\frac{1}{2}$ to 5 inches. The articular faces are flattened, but slightly concave. The posterior face, which is best preserved, is $6\frac{1}{4}$ inches wide, and was originally deeper. The neural canal excavates a concave channel in the upper part of the centrum; it is 2 inches wide by 2 inches deep, and the articular face of the centrum extends above its base both in front and behind. There is no certain indication of sutural union between the neural arch and the centrum, and the bone above the summit of the neural canal is broken away. The base of the centrum is rounded from side to side and moderately concave from back to front. Above the middle of the side of the centrum the vertebra is compressed from side to side and marked on each side by a longitudinal concavity. The buttresses at the side of the neural arch (which are usually developed below the transverse process) diverge downward towards the anterior and posterior margins of the centrum, so as to leave a well-defined wedge-shaped notch excavation between them, which is continuous with the side of the centrum below.

There is no evidence that this vertebra is a portion of Mr. Alfred Brown's animal; but it is manifest from the size of the early caudal vertebræ that the limbs were very short relatively to the allied reptiles of Europe.

Right Dorsal Rib.

Only one example of a dorsal rib has been collected by Mr. Brown; it is numbered 57, *a*, *b*, *c*. The proximal extremity is not preserved, and it is imperfect distally. The fragment is $10\frac{1}{2}$ inches long; it shows a convex curve directed outward and backward, is compressed from side to side towards the proximal end, where it deepens. The vertical measurement, as preserved, is $3\frac{1}{2}$ inches, but the articular head attached to the side of the centrum is lost, and the neck is $1\frac{1}{2}$ inch deep, convex in front, a little concave behind, narrow above, and nearly an inch from side to side below. The facet for attachment to the transverse process, about an inch from side to side, appears to have been nearly vertical, notching out the superior border of the rib. External to it the bone contracts in dimensions; but as the superior surface, which is at first narrow, is prolonged outward it becomes widened and flattened, reaching a width of more than 1 inch at the distal termination, where the bone is $1\frac{1}{4}$ inch deep and subtriangular in vertical section. The anterior aspect is flattened and the posterior surface is marked by a groove in its upper third, which originates behind the transverse process and is produced parallel to the superior contour down the length of the bone. This dorsal rib is relatively small, and from the other evidence may be regarded as not improbably one of the last of the series. The want of definition of the tubercular surface by a distinct neck may be in favour of this position in the skeleton. No affinities are deducible from the characters here shown.

Early Caudal Vertebræ.

The tail of *Euskelesaurus* is shown by the early vertebræ described by M. Fischer to have been both strong and elongated. The centrum is about $4\frac{1}{2}$ inches long in most vertebræ. The transverse process, as preserved, only extends outwards for about 3 inches.

The neural arch is compressed from side to side above the transverse processes. The zygapophyses are well developed. The anterior process is directed forward and the facet looks upward; the posterior facet looks downward. The posterior pair were separated by a narrow notch. The neural spine is broken away. The height of the neural arch, as preserved, is 4 inches; its transverse width at the base exceeds 3 inches;

it does not appear to be in close sutural union with the centrum. The longest centrum is fully 5 inches long on the base and $4\frac{1}{2}$ inches along the neural canal, showing that in natural sequence the caudal vertebræ were concave on the superior contour. The posterior face of that centrum is 6 inches high.

The chevron bones in the Jardin des Plantes in some cases are preserved *in situ*, and in every case the extremity of the bone is imperfect, the longest specimen being only 8 inches long. They are inclined obliquely backward, attached chiefly to the posterior face of the centrum. The bone is compressed from side to side and cleft at the proximal end for 3 inches.

The transverse width over the fork is $2\frac{3}{4}$ inches and the antero-posterior extent is $1\frac{3}{4}$ inch. In front the forked part of the process is flattened; as it extends distally it becomes rounded. At the distal fracture the bone is $\frac{7}{8}$ inch thick and $1\frac{1}{2}$ inch wide.

The Chevron-Bone. (Fig. 3.)

Mr. Brown's chevron-bone appears to be 14 inches long; but it is in two portions, $10\frac{1}{2}$ and $4\frac{1}{2}$ inches long, and the continuity between them (fig. 3, A A) is not quite certain, though they correspond in size and thickness. The proximal surface is $3\frac{1}{4}$ inches wide, crescentic, fully $1\frac{1}{4}$ inch deep in the middle, convex on the anterior margin, flattened or concave on the posterior margin, and concave from side to side. It would appear to have articulated with the hinder margin of the centrum, as in the specimens figured by Mons. Paul Fischer. There appears to have been a transverse connexion of the articular facets of the two sides, in the manner described by Professor Huxley in some genera of Dinosaurs; but a fracture having traversed the median line, this condition is not absolutely certain. The V-shaped excavation beneath the articular surface is small in front, not being more than $2\frac{1}{2}$ inches long and less than $\frac{1}{2}$ inch wide. On the posterior surface the width appears to be greater. Below the articulation the bone rapidly contracts in width, and in its compressed form, with the parallel anterior and posterior borders, has much the aspect of a costal rib. The anterior convexity in length is most marked towards its lower part. The bone is somewhat flattened in front in its middle portion, though convex from side

Fig. 3.

Chevron-bone of caudal vertebra of *Euskelesaurus Brownii.* A A, contact-surfaces. $\frac{1}{10}$ nat. size.

to side in its upper part, and compressed from side to side in what I regard as its distal extremity. The posterior border is much more compressed than the anterior border. In the middle length the antero-posterior measurement is $1\frac{5}{8}$ inch and the thickness 1 inch. In the last two inches the anterior border retreats, so that the extremity becomes smaller, though it widens a little from side to side, and terminates in an ovate surface $1\frac{1}{4}$ inch from front to back and about $\frac{7}{8}$ inch wide. This surface is rough, as though it were cartilaginous and somewhat convex. This chevron-bone is probably from an early caudal vertebra, and helps to give an idea of the great depth of the tail; for if the neural spine were developed to anything approaching a corresponding length, the vertical depth of the tail would have approached three feet if the spines and processes had been vertical; but, owing to their oblique direction, it is probable that the depth of the tail did not exceed 18 inches. There are no data for even approximately estimating the length of the tail, since the *Pœkilopleuron Bucklandi* is the only example of a carnivorous type which might be compared. It is, however, probable that the tail was long.

Late Caudal Vertebra.

This imperfect vertebra has an elongated form, and when perfect had a length of about 5 inches. It is regarded as caudal from the small size of the neural canal and apparent absence of articular processes for ribs, notwithstanding a certain general resemblance to the early cervical vertebræ of *Massospondylus* and *Zanclodon.*

The neural arch is small and is penetrated back and front by an excavation which has the aspect of a compressed canal above the neural arch, but of smaller size.

The anterior face of the centrum is lost, together with the pre- and postzygapophyses and the neural spine. The fracture shows that the neural canal contracts greatly towards the middle.

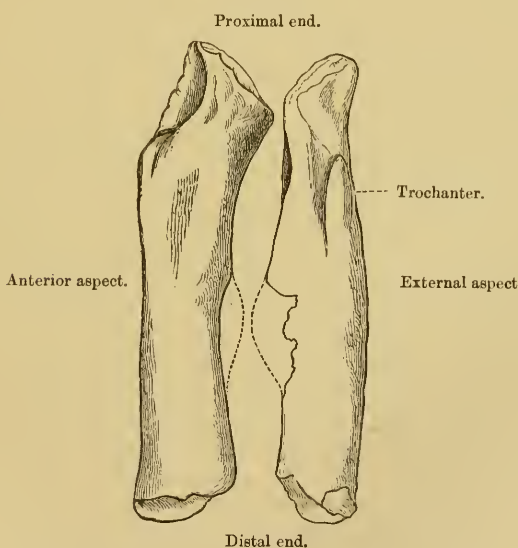
The posterior face of the centrum, imperfectly preserved, is $2\frac{3}{4}$ inches wide by less than 2 inches deep. The articular surface is concave and has the aspect of being crushed from the underside.

The base of the centrum contracts in the middle to a width of $1\frac{1}{2}$ inch. It is flattened and rounds convexly into the sides; those surfaces are somewhat vertical, concave in length, and are margined above by a narrow longitudinal ridge, beneath the middle of which there appears to be a foramen. This lateral ridge is on about the line of junction of the centrum and the neural arch, and descends a little as it extends forward; seen from above its longitudinal contour is slightly concave. Above the ridge the neural arch is strongly compressed from side to side, with a forward inclination; but it is too imperfectly preserved to give any idea of the form of the neural spine, the relation of the supraneural excavation to the development of the spine, or of the development of the zygapophyses. The transverse width of the neural arch is less than 1½ inch. The arch does not reach within an inch of the hinder margin of the centrum, and the neural canal at its extremities must have been less than 1 inch wide. The total height of the fragment, as preserved, is 3½ inches.

Femur. (Fig. 4.)

The right femur is 26 inches long as preserved, but it has lost the proximal and distal articular surfaces, though the missing extremities would probably not have extended the

Fig. 4.



Right femur of *Euskelesaurus Brownii.* $\frac{1}{10}$ nat. size.

length more than about 3 inches. The bone is remarkably robust relatively to its length; the shaft is rounded. Seen from above the bone widens a little proximally and curves inward, so that the inner margin is more concave than the external border is convex; seen laterally the bone has a slight sigmoid curve, the head being inclined with a somewhat Megalosauroid curve, which is also seen in the more Crocodilian types like *Palæosaurus* and *Belodon*.

The head of the bone is fully 7 inches wide as preserved, and was originally wider. Below the articular surface the neck of the bone, if it may be so named, is compressed from front to back, being flattened posteriorly, convex from side to side in front, and $3\frac{1}{2}$ inches thick in the middle, and concave from above downward; but there are no lateral concavities or constrictions to define it from the head or shaft on those borders. The neck may be considered to end at 6 inches from the proximal extremity as preserved, where the bone thickens from back to front, and the proximal trochanter is developed on the anterior external lateral angle.

The great trochanter is not divided from the shaft at its proximal extremity, but is simply a laterally compressed elevation on the outer angle of the bone. It is about 4 inches long, with the base about $1\frac{1}{2}$ inch wide; proximally its sides are compressed to a somewhat sharp angle, and distally it rounds into the convex surface of the shaft, being only marked by slight inflation and the rugosities of muscular attachment.

The circumference of the head of the bone is 18 inches. The circumference below the proximal trochanter is 16 inches, and 15 inches in the lower third of the shaft. The great infero-lateral trochanter—trochanter minor—in the middle of the shaft is broken away, though its limits are indicated. It was directed backward, as Prof. Huxley has indicated, in accordance with the Megalosaurian type. It begins 11 inches from the proximal end, and may have been 6 or 7 inches long, with the base 2 inches wide. A strong muscular attachment is seen proximally on its inferior surface.

The shaft has a slight curve forward; its sides below the neck are subparallel, widening a little distally towards the fracture, where the transverse measurement is 6 inches and the thickness about 4 inches. As usual, the inner surface is vertical at the distal end, and the postero-lateral surface is oblique. The principal condyle is broken away, but strongly indicated at 4 inches from the distal extremity, so that the bone has probably lost but little of its length.

The proximal end is stouter and wider than in *Megalosaurus*; the distal end is much less expanded than in *Zanclodon*. As a whole, the bone is not more slender than in *Massospondylus*. It is well distinguished from all other genera by the form of the proximal end and position of the lateral trochanter. It is closely related to *Massospondylus*, but distinguished as a genus. The Zanclodonts are the nearest European allies.

Tibia and Fibula.

These bones are represented by the distal extremities of the bones of the right and left limbs and their proximal extremities on the left side * of the animal. Mr. Brown's specimens (20 *a*, 20 *b*), referred to (*l. c.*) as fragments of a large metatarsal and metacarpal, I have been able to fit together as portions of one bone, and have fitted this to the hinder fracture of the left fibula, so as to complete the distal end of that bone. Some matrix has been removed from the proximal end of the tibia, to exhibit the contour of the head of the fibula. It is possible that the anterior margin of the fibula, as a consequence of injury, may have been anchylosed to the tibia; but its hinder portion is certainly free, and the bone is displaced backward, while the surface of the tibia beneath it in front has a fractured aspect.

The Distal Ends of the Bones.

The distal end of the tibia is of subtrapezoidal form, about 7 inches wide in front, parallel to the posterior surface, which is narrow, with the external and internal sides of the bones converging backward, and the margins rounded where the two pairs of sides meet. The antero-posterior thickness of the bone is 4 to 5 inches, the difference being due to conditions of fossilization. The posterior and lateral surfaces are of about the same width ($3\frac{1}{2}$ inches). The lateral surfaces of the tibia approximate towards each other as they ascend, so that the transverse width of the shaft rapidly diminishes; and at the superior fracture, 5 inches above the transversely truncated distal end, the distinction between the several surfaces of the bone is almost obliterated, the section being subtriangular, with the angles well rounded, with a transverse measurement of $3\frac{1}{2}$ inches in the right tibia and 4 inches in the left.

The distal end of the fibula measures 5 inches from back to front and about $2\frac{1}{2}$ inches from side to side on its rounded

* Professor Huxley (Quart. Journ. Geol. Soc. vol. xxiii. p. 4) describes the distal end of the right tibia and fibula. The fibula is lost from this specimen. Mr. Lydekker suggests that Prof. Huxley mistook the left bone for the right; but the right tibia and astragalus referred to are described by Mr. Lydekker (R. 1625 *c*) as fragmentary undetermined bones (Cat. Foss. Rept. Brit. Mus. Suppl. pt. iv. p. 253).

anterior edge, and is narrower posteriorly. The distal articulation appears to descend downward and outward obliquely below the tibia, and to have a trochlear surface convex from side to side, concave from front to back. The fibula is only preserved on the left side, and its distal extension (if not due to displacement) appears to indicate that the calcaneum, which is not preserved, must have been distinct from the astragalus and have been a relatively small bone, longer than wide.

The astragalus shows no indication of an ascending process, in this respect resembling *Scelidosaurus* and *Cumnoria* rather than any other English types; this implies no affinity, although the astragalus in *Euskelesaurus* is completely separate from the tibia; the resemblance is rather with the Zanclodontidæ, which Professor Marsh has characterized as having the astragalus without an ascending process.

The anterior face of the tibia is flattened, but without any indication of an impression for the intermedium, which may have been a small separate bone, as in *Hortalotarsus*, which is not preserved in this fossil. The astragalus is transversely oblong, measuring $5\frac{1}{2}$ inches from side to side in front by $3\frac{1}{4}$ to 4 inches deep. It is preserved in both the right and left limbs. Its proximal surface is horizontally truncated and the distal surface trochlear, having a wide median channel, which is shallow and convex from front to back. In the right limb the external margin of the bone takes the form of an unarticular talon on the posterior side, but of this there is no trace in the left limb. Its presence may suggest a reduction in the number of digits in the hind limb. There is no evidence that the fibula articulated with the astragalus.

The Proximal Ends of the Tibia and Fibula.

The left tibia and fibula are only preserved for about 7 inches below the proximal articular surface. The contour of the outline of the proximal surface of the tibia is the usual subtriangular form, measuring 7 inches from front to back and $5\frac{1}{2}$ inches from side to side. The posterior margin is slightly concave from side to side, and the posterior surface of the bone is markedly concave from above downward. The internal border is oblique to the hinder border in the usual way, and this part of the shaft is convex as it extends forward to form the cnemial crest, the proximal extremity of which is broken away. The external surface is short and concave from front to back, and approximately at right angles to the posterior surface; but it is obscured, because the fibula lies in contact with it, displaced backward, with the tibial surface imperfectly preserved, as though there had been anchylosis with the anterior margin of the fibula; six inches below the proximal end the shaft is ovate in section, 5 inches from back to front, $3\frac{1}{4}$ inches from side to side. Hence the expansion of the proximal end is small, and the cnemial crest is not much developed; so that, although the proximal surface is stout and wide, it does not differ materially from *Massospondylus*, *Agrosaurus*, &c., and makes no approach to the expanded tibia in *Zanclodon*, seen in the skeleton described by Plieninger.

The fibula has a front to back measurement of $5\frac{1}{2}$ inches at the proximal end; its external surface is convex, being $2\frac{1}{2}$ inches thick in the middle and thinning to the lateral margins. The internal surface is flattened on the posterior aspect, and the anterior margin is slightly expanded, as though a film from the tibia might be adhering to it. It rapidly diminishes in size, for at 3 inches from the proximal end the transverse measurement is $1\frac{1}{2}$ inch and the back to front measurement is 3 inches. The anterior and posterior margins are concave in length and convex from side to side.

Considered as a whole these bones are robust and characterized by the fibula being expanded at both ends, so as to be as deep as the tibial surface, with which it is in contact.

The form of the distal end of the bone separates the tibia widely from all genera with an ascending astragalus or coossified intermedium. It seems a somewhat more primitive type than *Ornithotarsus*.

I regard the cranial and pelvic evidence as supporting the conclusion that characters in which this region of the skeleton of *Euskelesaurus* diverges from *Zanclodon* are due to persistence rather than modification of those parts of the bones which are most liable to vary.

The Hind Foot.

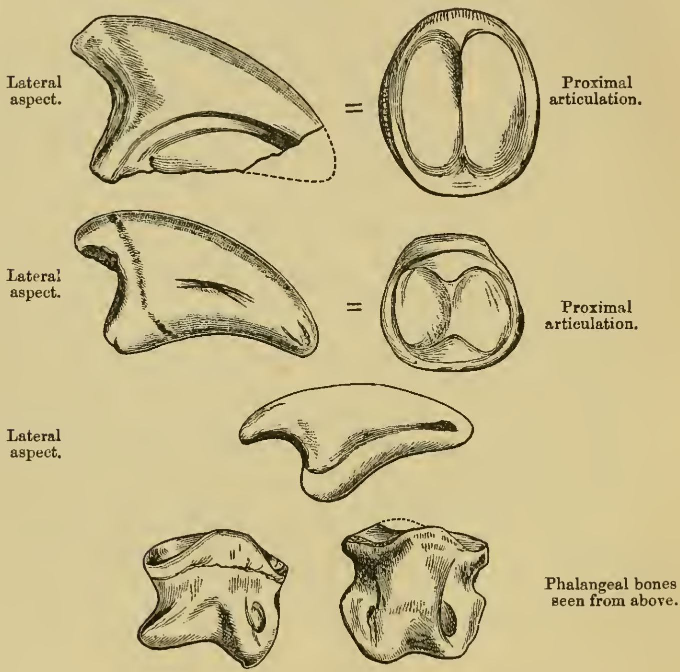
M. Fischer figured (*l. c.* pl. x. fig. 6) a mass of bones which I regard as the distal row of the tarsus. It shows three bones in close contact, and there is a broken portion of a metatarsal in connexion with the mass. Seen from the front the transverse measurement is 6 inches and the vertical measurement of the middle bone is $2\frac{3}{8}$ inches. This is narrow in proportion to the width of the tibia, but not quite conclusive as to whether four or five digits were developed. The proximal convex surface corresponds to the concavity below the astragalus.

Of the digits, M. Fischer described two imperfect phalanges and a more imperfect terminal claw-phalange.

Mr. Brown's additional specimens, which are parts of the same foot, comprise three nearly perfect claw-phalanges and a terminal fragment of a fourth, possibly referable to the specimen at Paris. There is also a doubtful fragment, imperfect at both ends, which has some appearance of being a

Fig. 5.

Claw-phalanges.



Claw-phalanges and phalangeal bones of *Euskelesaurus Brownii* (Huxley). $\frac{1}{3}$ nat. size.

claw-phalange. There are also six digital phalanges and indications of two others, which are subcubical, with well ossified trochlear extremities. It would thus appear that there is evidence of four digits if all come from the same limb, and between these fourteen phalanges are distributed; but there is no evidence that the number in each digit was the same. It may be inferred that the number of bones followed the formula 5 . 4 . 3 . 2, and that the fifth was undeveloped, as in *Hortalotarsus*. The foot appears to have been short and small, with the claw-phalanges wider from side to side than in any other carnivorous Saurischian, but about intermediate between the depressed claw of *Iguanodon* and the compressed claws of Megalosaurs.

The digital phalanges are relatively short and all substantially of the same type, only varying a little in dimensions with the size of the digit. The longest and largest are the two bones in the Paris collection, the more proximal of which exceeds $2\frac{1}{2}$ inches in length in the middle, which is the least length, and the second is about $1\frac{1}{2}$ inch in the same measurement; but the total length of the two bones as naturally connected exceeds $4\frac{1}{2}$ inches. The bones are characterized by a well-rounded, distal, pulley-shaped end, with the inferior surface widening and becoming more inflated and elevated as it extends backward. A shallow median concavity divides the distal surface into two nearly equal right and left parts, and behind and above the channel in front there is usually a considerable depression. At the sides of the pulley are deep concavities for ligamentous union. The inner side is the more nearly vertical, the outer more inclined. The superior surface is more or less flattened, with a tendency to convexity from side to side and concavity from behind forward. The proximal end increases in depth and width, being always wider than deep, forming the half of a vertical ellipse, the contour of the base being flattened and the sides and upper surface being convex. The superior and inferior outlines of the proximal end are convex from side to side, owing to the middle part of these surfaces being prolonged as a sort of talon upon the adjacent trochlear surface of the bone which is proximal to it in position. This proximal margin is roughly ligamentous all round.

Although eight digital phalanges are indicated by Mr. Brown's specimens, they are all more or less imperfect, and three are only fragments. One of the smaller specimens, numbered by him 16, is $1\frac{5}{8}$ inch deep at the proximal end, where it is rather less than 2 inches wide, this surface being evidently slightly narrower than the distal end of the bone, which fits into the proximal surface. The distal end is less than $1\frac{1}{8}$ inch deep; its transverse width does not exceed $1\frac{1}{4}$ inch. The length in the middle of the side is on the inner side $1\frac{3}{8}$ inch and on the outer side less than 1 inch. In some specimens the base is divided into two nearly equal parts by a transverse groove behind the distal pulley, but in other specimens the trochlear surface appears to be relatively smaller. What appears to be the outer side is frequently concave.

The distinctive features of these phalanges are the comparatively flattened base, the superior and inferior median extension backward of the proximal articular surface, the large amount of vertical motion upon each other indicated by the forms of the articular ends of the bones, and the strong development of ligamentous surfaces. The smallest phalange preserved is $1\frac{1}{8}$ inch long and about $1\frac{3}{8}$ inch wide at the distal end.

Claw-Phalanges. (Fig. 5.)

The claw-phalanges are more distinctive of *Euskelesaurus* than the other bones of the digits, though perhaps they conform most nearly to the type of *Dimodosaurus*, with which the other phalanges are also best compared. There are indications of four which progressively decrease in size, but are marked by a transverse width at the proximal end which is almost equal to the vertical depth. The fragment figured by Fischer (*l. c.* pl. x. fig. 7) gives an imperfect idea of the form of the claw. In the largest bones, including the Paris fragment and the largest nearly perfect claw belonging to Mr. Brown, the bone is higher than wide at the proximal end. In the latter specimen the dimensions are $2\frac{1}{2}$ inches high by $2\frac{1}{4}$ wide near to the articular surface, but the articular surface itself is only $1\frac{3}{4}$ inch deep and nearly 2 inches wide, owing to the way in which the superior margin of the bone descends and indicates a strong ligamentous attachment towards the point from which the first measurement is taken. The superior surface of the phalange is strongly inflated, very convex from side to side, and also convex from behind forward. The sides of the bones are characterized by deep grooves, which divide the lateral surfaces by their arched contour into a smaller inferior and a larger superior portion.

The base is comparatively flat, being only gently convex from side to side and moderately concave in length. The form combines the height of the Megalosauroid claw with almost the width of the Iguanodont claw, and is therefore more massive than either. But the extremity of the claw is not so much recurved as in Megalosauroids. The largest specimen is imperfect at the extremity and measures 4 inches long in greatest extent, and was probably half an inch longer; so that it is less than twice as long as deep. A smaller specimen is fully $3\frac{3}{4}$ inches long and more than 2 inches deep. The smallest specimen is much more slender, $3\frac{1}{4}$ inches long and about $1\frac{5}{8}$ inch deep. As already indicated, the depth of the bone at the articular end slightly exceeds its width, though the depth of the articulation is always rather less than its breadth. It seems probable that the ungual phalanges decreased in size, as in *Dimodosaurus*, in passing from the inner to the outer digit. The great width of the superior surface of the phalange best distinguishes it from the French type, which in other parts of the skeleton shows differences from *Euskelesaurus*, which probably show that the two genera were not so nearly related as the aspect of the phalanges might at first suggest. The length of the longest digit, exclusive of the metatarsus, does not appear to have exceeded 9 inches. The corresponding measurement of the four phalanges of the third digit in *Dimodosaurus* appears to be fully 10 inches.

On the Lower Jaw of Euskelesaurus; *probably referable to* E. Brownii (*Huxley*). (Fig. 6.)

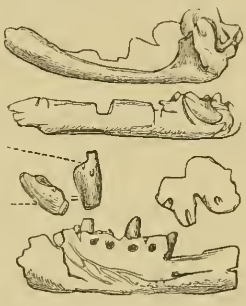
On my visit to Aliwal North in September 1889 I examined, in company with Dr. W. G. Atherstone, F.G.S., and Mr. Thomas Bain, under the guidance of Mr. Alfred Brown, a locality on the Kraai River, to the south-east of Aliwal North, which we anticipated might furnish Euskelesaurian remains. The only specimens which rewarded us were found on the waggon-track, lying close to the surface, and very much broken, owing to their superficial position and exposure. They were in hard red shale and consisted of important fragments of the jaw and less useful fragments of vertebræ. I am unable to say that the vertebræ and jaw belong to the same individual, being only found within a foot or so of a spot which yielded no other vertebrate fossils.

The jaw fragments comprise the posterior articular extremity of a lower jaw and the anterior dentary extremity. Both are quite unlike anything previously known. The articular extremity shows the articular bone, hitherto unknown in any Saurischian, which is massive, lying on the inner side of the angular bone. This bone appears to develop a large internal plate which extends horizontally inwards but is imperfectly preserved. There appears also to be a small subangular bone, forming the anterior margin of the articular surface, though it is possible that this appearance of suture may only be a fracture. There is no indication of any coronoid process, the superior and inferior surfaces being horizontal and parallel, and the depth of the jaw towards the articulation is extremely small.

The articulation is 4 inches wide, about $1\frac{1}{2}$ inch long in the middle, and somewhat longer at the sides, so that it is transversely reniform, with the concavity on the posterior margin. The surface is concave from front to back, divided into two portions by an oblique median ridge separating the inner part, formed by the articular bone, from the outer and anterior margin, formed by the angular bone, which rises in front in a sharp transverse ridge to define the articulation. Posteriorly the articulation is bounded by an elevated margin of the

Fig. 6.

Articular end of the left ramus of the mandible, seen from above.



Anterior part of left ramus of the mandible, showing broken serrated teeth.

Mandible of *Euskelesaurus* from the Kraai River. $\frac{1}{10}$ nat. size.

articular bone, behind which transverse ridge, chiefly developed on the inner side, is a very slight heel. This massive articular bone is $3\frac{3}{4}$ inches long and about $3\frac{1}{2}$ inches wide; it terminates in front in a cartilaginous surface, which is rounded and was presumably invested in bone which is now broken away. It terminates behind in a somewhat vertical truncated surface. Internally it gives off an obtuse process and externally there appears to be a similar process embedded in the angular bone. On the base the internal process is defined by a longitudinal groove, and there is also a groove in front of it. The ramus of the jaw is prolonged forward from the outer margin of the articulation. It is at first $1\frac{7}{8}$ inch deep, the surface, as preserved, is flat, inclined so as to look upward and outward, slightly convex in length, rounded from side to side at first on the upper margin, which is about $\frac{5}{8}$ inch thick. This margin becomes an angular ridge, dividing the inner from the outer surfaces as it extends forward. The horizontal plate, which extends inward below the anterior end of the articular bone, appears to be directed downward, and is given off below the middle of the depth of the side. It appears to consist of two layers—an upper layer nearly $\frac{3}{8}$ inch thick, and a thin lower layer; and these two layers have the aspect of being connected by a horizontal suture. As the superior surface is traced forward a deep groove extends above it, so that it excavates a wide concavity in the angular bone, and the horizontal plate passes into the inferior margin of the jaw, which it presumably deepens, though this is not evident from the condition of preservation. The entire length of the fragment is 13½ inches, of which 10 inches are in advance of the anterior margin of the articulation.

In close proximity with the articular end of the jaw already described, and in the same line with it, but without the intervening bone being preserved, was the anterior dentary part of the lower jaw, almost complete at its extremity. It measures a foot in length, and presuming that the two pieces are portions of the same jaw, it would probably have been fully 30 inches long when perfect; so that it would not be inferior in size to *Megalosaurus, Ceratosaurus*, and types which present a similar dentition. There is no proof that it is the lower jaw of a species of *Euskelesaurus*, since the teeth are more slender than those already described in the maxillary bone. The number of teeth in the jaw is small, and they do not appear to have exceeded the number in the maxillary bone of *Euskelesaurus Brownii*. The jaw is remarkable for the evidence it gives of composite character on its inner side. A bone extends along the inner alveolar border, which is distinct from the dentary, forms the inner half apparently of the alveoli, and makes more than half the depth of the jaw, and appears to extend almost to its anterior extremity; and posteriorly there is a groove between this splenial element above and the thickened basal ridge of the dentary bone, which appears to have lodged another bone, presumably the forward tapering extremity of a large coronoid. Professor Marsh remarks that in *Ceratosaurus* the splenial bone is large, extending forward to the symphysial surface, and forming in that region a border to the upper margin of the dentary bone. There is one remarkable character, however, in which this jaw differs from almost all known Saurischia—in the jaw becoming deeper as it extends forward. At the hindermost tooth-socket preserved the depth is about 3 inches, but within 3 inches of the fractured anterior extremity the depth is 3½ inches. The jaw is remarkably straight and compressed from side to side. The width at the hindermost tooth-socket, 9 inches from the front, is 1⅛ inch; but it becomes a little inflated on the outer side anteriorly, though this character may be partly the result of distortion.

The external surface is vertical, somewhat rugose, with vascular impressions, and with a row of shallow pits corresponding to the teeth an inch below the alveolar border. There is a convex rounding of the side on to the alveolar margin, and a more distinct and marked rounding of the side towards the base, which appears to be slightly curved in front, but forms a sharp ridge behind, which separates it from the flat inner side of the bone. There is no indication of a symphysial surface, unless it be in the slightly rugose extremity of the inner surface of the dentary bone; but that surface could only be regarded as symphysial on the hypothesis that the bone has there been distorted by pressure.

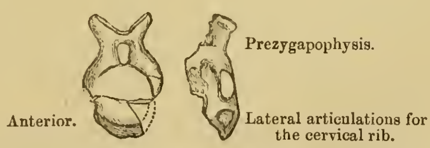
The alveolar border, as preserved, is somewhat concave from front to back. A groove which runs along the splenial bone, from a quarter to half an inch below the alveolar margin, is also concave in length, and a number of oblique impressions, as of blood-vessels, descend from this margin downward and backward over the splenial. It is thus evident that, although the teeth are here contained in sockets, any less development of the superior border of the splenial bone would give them the appearance of a Lacertilian mode of implantation. In *Megalosaurus Bucklandi* the outer alveolar margin rises much higher than the inner margin, so that all stages of intermediate development between the condition now described and the Pleurodont or Acrodont attachment of the teeth may be looked for in Saurischia. The contact between the teeth and their sockets in this specimen is extremely close, and there is some appearance of the bone of the superior alveolar surface having grown up around the tooth so as to invest it. Indications are apparently preserved of eleven teeth, without any reason for inferring that the hindermost of the series is present. The eighth tooth is preserved in natural attachment. It is directed upward, outward, and a little backward; its root or unenamelled part rises fully an inch above the alveolar border. On this base the root is transversely ovate in section, $\frac{5}{8}$ inch long, $\frac{1}{2}$ inch wide, but becoming somewhat narrower posteriorly. This upper portion of the root has somewhat the appearance of having been invested in a sheath of hard thick skin. The crown in this specimen has only its basal part preserved; it is enamelled, rounded in front, and compressed behind to a sharp ridge, which is marked with transverse serrations quite on the pattern of *Megalosaurus*, but much finer than those seen in the maxillary teeth of *Euskelesaurus Brownii*. The enamel is remarkably smooth and the extremities of the serrations appear to be rounded. Further forward a portion of a loose root was found just indicating the base of the crown, and in what I take to be the fourth socket on the inner side is a successional tooth not quite perfectly exposed, but showing the external surface of the crown for a depth of about $\frac{5}{8}$ inch. It is about $\frac{1}{2}$ inch wide, very convex on the external surface, and the convexity gives the tooth the aspect of curving a little inward. Both the anterior and posterior margins are beautifully marked with denticles, which have almost the appearance of a chain of small beads extending up each edge; and when seen from the side these denticles have their lateral borders converging to a sharp V-shaped cutting-edge, and they are apparently separated from each other to their bases. Therefore this crown shows that in all details there is a close correspondence between the teeth of *Megalosaurus* and those of this Euskelesaurian. The crown of the tooth, like its side, shows delicate transverse waving of the enamel, but there is no indication of any vertical waving or fluting.

It is remarkable as a point of difference from *Ceratosaurus* that there is no certain indication of a foramen in the lower jaw; and, presuming that the articular end belongs to the same specimen, it is noteworthy that the depth of the jaw in front of the articulation is scarcely more than half its depth in the anterior dentary region, which is the exact converse of the condition in *Ceratosaurus*. Presumably the horizontal inward plate in connexion with the articular region is not found in *Ceratosaurus* or in any other known Saurischian, since it has not been previously recorded.

Cervical Vertebra. (Fig. 7.)

Only one vertebra was collected in sufficient preservation to give an idea of the character of the neck, and this has lost the neural arch behind the prezygapophyses and a portion of

Fig. 7.



Cervical vertebra of *Euskelesaurus Brownii.* $\frac{1}{10}$ nat. size.

the base of the hinder part of the centrum. The vertebra is distinguished by its short antero-posterior measurement, which is about 2 inches. From the neural canal to the base of the centrum in front is $3\frac{3}{4}$ inches, and the transverse width above the middle of the centrum is $4\frac{1}{4}$ inches. The anterior articular face is slightly concave, but becoming convex towards the external border, and at the base there is an oblique area about $\frac{7}{8}$ inch deep, which has the aspect of having given attachment to a subvertebral ossification. The margin of the posterior surface is broken away; but it is evident that the base was deeply concave from front to back and convex from side to side.

The anterior half of the side of the centrum is occupied by two large articular facets for the rib. Into the upper facet the base of the neural arch appears to enter; it is vertically ovate, about $1\frac{1}{4}$ inch deep and $\frac{3}{4}$ inch wide; but the articular surface is broken; it is separated from the inferior facet by an interval of $\frac{1}{4}$ inch. This facet is about an inch wide and nearly $1\frac{1}{4}$ inch deep, subtriangular in form; it is margined by an elevated rim, except in front, and is slightly concave. These articulations are closer together than in *Megalosaurus*, and less elevated from the side of the centrum.

The neural arch is strong and extends the entire width of the centrum. The neurapophyses have a broad base of nearly 4 inches, and almost meet in the median line. They are thick and enclose a neural canal about $\frac{7}{8}$ inch high and $\frac{5}{8}$ inch wide, wider above than below, and deeper apparently behind than in front, where the base of the canal excavates the centrum. The neurapophyses expand transversely and anteriorly in two zygapophyses, which are inclined a little forward. The articular facets are almost flat, ovate, inclined to each other at about an angle of 50°, as in *Megalosaurus*; separated by a median interval of about half an inch, without any notch between them, being scarcely raised above the adjacent bone. Each measures rather less than 2 inches from within outward and about 1 inch transversely. Laterally there is a convex inflation below the outer border of the zygapophysis. The least transverse measurement over the concave lateral contour of the neurapophyses at the neural canal is $2\frac{1}{4}$ inches, and the transverse measurement over the zygapophyses exceeds $3\frac{1}{4}$ inches. The vertical height from the base of the centrum to the base of the zygapophysial facet is $5\frac{1}{4}$ inches, and to the summit of the facets $6\frac{1}{2}$ inches.

In general character the vertebra most resembles the cervical of *Megalosaurus*, but is much shorter in proportion to its depth, indicating, if correctly referred, that *Euskelesaurus* was a short-necked type, different from the long-necked *Massospondylus*, which resembles *Zanclodon*. This fact is the more interesting since the forms of the pubic bones are so similar in these two South-African genera that, had this cervical vertebra been unknown, its Megalosauroid shortness could not have been suspected.

XLII.—*Coccoliths*. By Ernest H. L. Schwarz, A.R.C.S. (From the Geological Research Laboratory, Royal College of Science.)

Coccoliths were first discovered by Ehrenberg * in chalk, and described as inorganic bodies like those constituting "agaric-mineral" (calcium carbonate precipitated from solution in natural mineral water) or kaolin; according to him they were flat bodies having concentric rings on their surface, and later he gave them the name of "chalk morpholiths" †. Huxley ‡ and Wallich § declared these bodies occurring in the chalk to be the same as those existing in the sea at the present day; the former called them, "for convenience," coccoliths—a term which has supplanted Ehrenberg's morpholith. Huxley ‖ distinguished two forms, one simple, the other double, and called them respectively discoliths and cyatholiths, which Hæckel ¶ later rechristened monodiscs and amphidiscs. In both the latter papers they were described as being formed as crystalloids in a giant Amœba—*Bathybius*—which had all the appearance of protoplasm, fibrillar network, &c., but which Murray and Buchanan ** proved to be gelatinous calcium sulphate precipitated by the alcohol in which the soundings were preserved. Up to this point they were not considered to be organisms themselves; but Sorby †† put forward this idea, which was stoutly contested by Barrois ‡‡, who, with many others, *e. g.* Harting §§, considered them to be mineral concretions. Gümbel ‖‖ and Carter ¶¶ considered them to be connected with the reproduction of calcareous algæ—*Melobesia* &c.—and the former described

* Monatsber. Berlin Acad. 1836; Poggendorff's 'Annalen,' 1836, vol. xxxix. pl. i. fig. 2 b.

† 'Microgeologie,' Leipzig, 1854, pl. xxv. fig. B, 16.

‡ Appendix to Capt. Dayman's Report of Soundings taken in H.M.S. 'Cyclops,' 1858.

§ Ann. & Mag. Nat. Hist. 1868, ii. p. 317.

‖ Quart. Journ. Micr. Sci. viii. 1868.

¶ Biol. Studien, Beiträge zur Plastidentheorie, p. 85 (1870).

** Proc. Roy. Soc. Lond. vol. xxxiv. p. 605.

†† Ann. & Mag. Nat. Hist. 1861, viii. p. 193.

‡‡ Ann. des Sci. Nat., Zoologie, 6 sér. t. iii. p. 70 (1876); 'Recherches sur les terrains anciens des Asturies,' Lille, 1882.

§§ 'Recherches de Morphologie synthétique,' Haarlem, 1872.

‖‖ "Ueber Cocc. et Nullipores," Wien. Verhandl. Geol. 1870, p. 201; also Neues Jahrbuch, 1870, p. 752, 1873, p. 299.

¶¶ I quote this on the authority of Barrois, having looked through most of Carter's papers in vain. [Mr. Carter's paper here referred to appeared in Ann. & Mag. Nat. Hist. ser. 4, vol. vii. 1871, pp. 184–189, "On *Melobesia unicellularis*, &c."—Eds.]

their occurrence in all the known strata, even the earliest. Wallich first noticed that they were joined into spherical masses, which he called coccospheres *; in his later papers he considered these spheres as nothing else than embryonic foraminifera covered with coccoliths as spicules, and figures a *Nodosaria* and *Textularia* made up of such coccospheres. Sir Wyville Thomson, according to Wallich, noticed that, if threads be hung in sea-water overnight, they will be found to be full of coccoliths in the morning; so that these bodies are really found on the surface of the ocean, and not only at great depths, as those who do not believe in their organic nature have maintained.

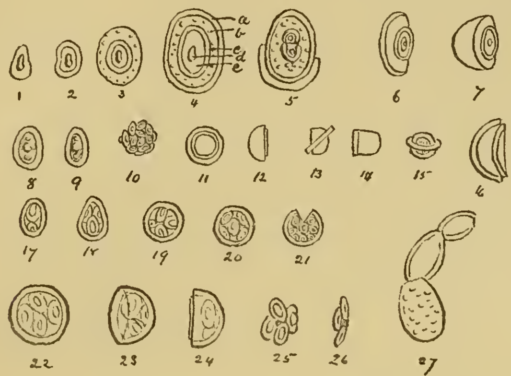
I first came to notice coccoliths when systematically washing the clays from the lias of the Dorset coast, where I found them in about 60 per cent. of the zones treated. They were most abundant, however, in a grey micaceous clay containing *Ammonites* (*Schlotheimia*) *angulatus*, Schloth., and a foraminifer, *Nodosaria*, which, according to Mr. F. Chapman, resembles *N. calomorpha*, Reuss. The coccoliths in this clay are peculiar in their transparency and for the great numbers of the double cyatholith forms, which nowhere else have I found in such abundance; and the following details have been obtained mostly from this material, though I have also used the chalk of Taplow and the gault of Folkestone.

The adult discoliths are minute oval bodies $\frac{1}{2100}$ inch (Wallich) in their long diameter (figs. 2, 8, 9). In their centre is a bright highly refractive body, the "Centralkorn" of Hæckel, which is usually slightly, but frequently also markedly, raised above the surface as a knob when seen from the side; but I have never seen it forming a projecting rod, as Sollas † has figured from the Cambridge greensand. In the flat area surrounding the central point, the "Markfeld" of Hæckel, there are two or four slightly raised points, similar to the central one, but not nearly so much differentiated. Round the "Markfeld" is the "mark-ring," which is a refractive ring of calcite forming a thick rounded rim to the little plate, and in the older examples is slightly beaded. Hæckel then notices that this, which I consider to be the adult coccolith, surrounds itself with a granular ring (fig. 3), and finally with another brightly illuminated outer ring (fig. 4). This I take to be the first stage of the discolith (adult cocco-

* Ann. & Mag. Nat. Hist. 1860, vi. p. 457; ibid. 1861, viii. p. 52; ibid. 1862, ix. p. 30; Royal Institute Proc. 1858, p. 299; Franklin Institute Journal, xlii. 1861, p. 237; Quart. Journ. Micr. Sci. 1869, 1870, 1871, 1877, 1878.

† Geol. Mag. 1876, pl. xxi. fig. 17.

lith) transforming itself into a cyatholith (reproductive stage); the granular ring, which I have not observed in my fossil forms, being protoplasmic, and the outer ring the commencement of one of the cups. Still following Hæckel, we see that the internal discolith then divides (fig. 5), and traces of the



Figs. 1–7.—After Hæckel. 1. Incomplete form. 2. Fully formed discolith. 3. One with the granular ring. 4. Commencing cyatholith: *a*, outer ring; *b*, granular ring; *c*, mark-ring; *e*, Markfeld; *d*, central point. 5. One with dividing discolith and portion of the larger cup forming. 6, 7. Cyatholiths.
Figs. 8, 9.—*Coccolithus oceanicus*, the mature form (discolith).
Fig. 10.—Young discoliths just released from the cyatholith (coccosphere).
Figs. 11, 12.—Two positions of the fully formed cyatholith.
Figs. 13–15.—Cyatholith with the rim broken off.
Fig. 16.—Diagrammatic section through a cyatholith.
Figs. 17–21.—Successive stages in the division of the discolith.
Figs. 22–26.—A cyatholith containing four discoliths, which was turned over and then dissolved with acetic acid, setting the contents free, which were then moved about.
Fig. 27.—*Nodosaria calomorpha*, Reuss, associated with coccoliths in the clay containing *Schlotheimia angulata* (Schl.).

second, larger cup appear; the two cups are then completed, and the dividing discolith is shut in between them, the smaller cup forming a lid to the cavity of the larger (figs. 11, 12, 16). In the early stages of division the form is still oval (figs. 17, 18), but soon the cups become rounded, and the divisions go on irregularly till there are sixteen or more embryonic discoliths; intermediate forms with four, five, six, seven, &c. are frequent. In the later stages the cups of the cyatholith become brown and opaque, and finally, failing to adhere, they set free the baby discoliths in a mass (fig. 10); the empty shells are seen in almost every slide.

The discoliths seem to be imbedded in a common membrane, for they cohere in a mass for some time—in fact till they are mature, or nearly so—and then they constitute what is known as coccospheres, which have all the appearance of spheres; but when they are lifted on to their side they are seen to be really flat, or, rather, halves of hollow spheres. At first I took both the cyatholiths and coccospheres to be actually spheres; but on agitating the water on the slide containing them I noticed that, while some readily followed the flow of the water, others remained stolidly fixed and refused to move even when great masses of débris knocked against them; but suddenly, when the motion became too violent, they gently turned on their sides and revealed the hollowness of their nature. In the first instance they were, of course, resting on their convex surfaces, but when they refused to move they were with their concave surfaces downward. Sollas (*loc. cit.*) has figured these cyatholiths in the Cambridge greensand as "coccospheres, covered loosely with the oval form of the coccolith." Some of the cyatholiths seem to have grown their larger cup too far forward, and the projecting part has then broken off, and appears surrounding the cyatholith like a Saturn's ring (figs. 13, 14, 15); by carefully agitating the water the ring may be made to slip on to its proper place and off again.

The dividing discoliths here described were seen through the transparent calcite of the cup. To make sure that these really were discoliths within the cyatholith I ran in a little weak acetic acid on the slide (working with a $\frac{1}{8}$-inch objective without a cover-glass); the cups became dissolved and the conjoined discoliths set free, when there was absolutely no mistaking the form. On running in a little magenta the outline of the cup reappeared, so that they are in all probability formed of a framework of horny material filled in with calcium carbonate. A very curious fact is that, while the two cups of the cyatholith dissolve freely in weak acid, the discoliths require fairly strong acid before they will disappear; and, comparing the rate of dissolution of both with that of a *Rotalia* in a washing containing all three from the gault, the cups went at about the same rate as the foraminifer, but the discoliths remained long after the latter had disappeared. Hence I am inclined to think that the discoliths are largely composed of calcium phosphate, a view which I was led to entertain from the fact that the phosphatic chalk of Taplow contains the discoliths (with few cyatholiths) in vast quantities.

Wallich considered the coccospheres to be embryonic foraminifera, such as *Globigerina* *, and later † he figured them joining into linear aggregates to form *Nodosaria* or in alternate lines to form *Textularia*; but I have not been able to see from his figures whether he is dealing with the conventional coccospheres or really Foraminifera, in the external sarcode of which the discoliths have become imbedded; for he says the latter are arranged at *regular intervals* over the surface of the former.

When I first worked out the above details, some eighteen months ago, Prof. Judd, to whom I am indebted for much help, threw doubt on my results, because they were derived from fossil forms, while nothing of the kind had been seen in the recent ones, even when treated with greater skill and with better instruments than I could command; but I have gone over all the work again lately, and I can only conclude that the protoplasm of the recent ones obscured the details of their internal structure.

To recapitulate my results, then :—

The discolith represents the adult stage of the coccolith, and is a separate organic individual consisting of a phosphatic disk surrounded apparently with protoplasm. When they wish to reproduce themselves the protoplasm surrounds itself with a calcareous envelope consisting of two cups, one deep and enclosing the discolith, the other functioning as a lid. Division of the discolith then proceeds irregularly till some sixteen or more minute bodies, representing embryonic discoliths, are formed ; the cups then separate and set their contents free in a mass. The latter then continue to grow, retaining the cup-like form of the cyatholith, and constitute the coccospheres of Wallich, Huxley, and Hæckel ; finally the colony is disbanded, and the discoliths float about freely on the surface of the ocean.

As to their nature, I think there can be no doubt as to their being organic, and that they belong to that class of organisms which the zoologist and botanist have equal right in claiming to belong to his favourite kingdom ; but they seem to have a preponderance of botanical resemblances, and may be put provisionally among the Phycochromaceæ, near to *Glæocapsa*, *Chroococcus*, &c., to which they seem to be allied by their reproduction.

As to their name, though Ehrenberg's morpholith undoubtedly preceded Huxley's coccolith, he used the word as descriptive and one which could, with equal propriety, be applied to

* Ann. & Mag. Nat. Hist. 1860, vi. p. 457.
† *Ibid.* 1862, ix. p. 30.

kaolin crystals &c., while Huxley definitely called these bodies, and these only, coccoliths. Since the above description of their reproduction settles them finally to be self-contained organisms, there arises the necessity for a true generic and specific name. Here, however, the differentiation of species, if they exist, is not possible, since they are so minute that different illuminations make them appear entirely different in contour and markings. Hence I propose for all the forms hitherto described, recent and fossil, the one name *Coccolithus oceanicus*, mihi.

P.S.—By a strange oversight I missed Carter's paper above referred to till my paper was printed. He considers coccoliths to be the cells of *Melobesia* living separately, and calls the oval and round *cyatholiths* respectively *M. unicellularis* and *M. discus*; but as the *discolith* is undoubtedly the adult form, it does not seem advisable to apply either of these specific names, clearly defined for a definite thing in one stage, to the same thing in another stage.

XLIII.—*Descriptions of some new Neotropical* Muridæ. By Oldfield Thomas.

The British Museum has recently received two small collections of rodents from Peru and Venezuela, among which are several new species; and in working these out the opportunity has been taken of re-examining and, where necessary, describing the species contained in the general collection of South-American Muridæ. Among others, the two series from Peru obtained by Messrs. Stolzmann and Jelski, and worked out by me in 1882 and 1884 *, have proved to need a considerable amount of revision in their determinations.

The first to be described represents a new genus, and is again the discovery of Mr. J. Kalinowski, the finder of the interesting fish-eating rat described last year †.

Neotomys, gen. nov.

General form much as in *Sigmodon*; ears broad and rounded; fur very thick; tail short; thumb with a nail.

Skull with the nasals much expanded anteriorly; inter-

* P. Z. S. 1882, p. 98, 1884, p. 447.
† P. Z. S. 1893, p. 337.

orbital region very narrow, narrower than the muzzle, its edges square, but not beaded; interparietal bone broad, ribbon-like, its antero-posterior about one third its transverse diameter; walls of infraorbital foramina as in *Sigmodon*, the anterior edge cut back underneath a prominent projecting point; palatine foramina very large, but the dividing septum also very large, nearly filling them up; posterior part of palate with two deep excavations between $\frac{m.2}{}$ and $\frac{m.3}{}$, divided by a mesial ridge, and strongly recalling the same part in *Microtus*; pterygoid fossæ broad and shallow. Lower jaw very short and high, but the coronoid processes reduced to low blunt triangular elevations.

Dentition.—Upper incisors extremely broad, smooth, and slightly concave in front so far as the internal five sixths of their surface is concerned, but along their outer edge there is a sharply cut groove or bevel, most visible from the side, whence it suggests the bevelled grooving of *Gerbillus* or *Zapus*; the inner border of the groove forms an anteriorly projecting ridge, internal to which the face of the tooth gradually curves inwards to meet its fellow of the opposite side. (To suppose the inner half of a *Zapus* incisor flattened in front and enormously broadened, while the outer half retains its natural size and position, would give the best idea of these peculiarly grooved incisors.) Molars more like those of *Sigmodon* than of any other Cricetine, but they are even more antero-posteriorly compressed, with the result that the grinding-surfaces somewhat recall those of *Microtus*, with separated enamel loops and islands. On the whole, however, the loops appear to correspond to those of *Sigmodon*, except that $\frac{m.3}{}$ is more lengthened and there are four projecting angles on its outer side instead of three. Lower incisors broad and flat in front, and curved very rapidly upwards, so as to produce a very short diastema.

The above description will show how widely different this peculiar little animal is from any hitherto described. Both in external and cranial characters it has a curious resemblance to *Otomys*, on which I have based its name. Its long fur, large round ears, anteriorly expanded nasals, and narrow interorbital region are all points in the resemblance, although of course there can be no possible connexion between the two genera. Its really nearest ally is probably *Sigmodon*; but even this is very different in many characters, notably in the general form of the skull and the structure of the incisors. The *Sigmodon*-like *Rhithrodon* described by me in 1880 *

* P. Z. S. 1880, p. 691.

shows the grooving of the incisors, different as the details of this are; but the typical and still unique specimen has its molars too worn to say whether they at all approach those of *Neotomys.*

Neotomys ebriosus, sp. n.

Size and general proportions about as in *Rhithrodon pictus*, although the feet and tail are rather shorter. Fur long and straight, the underfur of the back about 13 and the bristle-hairs about 19 millim. long. Ears large, nearly circular in outline, laid forwards they reach just to the back of the eye; well clothed with brownish-fulvous hairs on both surfaces.

General colour, so far as can be made out in a spirit-specimen, grizzled greyish brown (not unlike *Sigmodon hispidus*), the tip and sides of the muzzle bright cinnamon-rufous, a colour which is also present on a few hairs at the base of the ears and on the rump. Belly-hairs plumbeous basally, white terminally. Upper surfaces of feet dirty whitish, with a tinge of cinnamon. Palms and soles quite naked, pads 5–6; fifth hind toe reaching nearly to the end of the first phalanx of the fourth. Claws small and delicate, the anterior smaller than the posterior. Tail rather shorter than the body, bicolor, the upper surface blackish, the sides and lower surface white. Palate with the usual three undivided ridges, then follow two divided ones at the front end of $\underline{\text{m.}^1}$; but behind these there are no regular ridges, the surface of the palate being smooth, with several irregular and unsymmetrical projections upon it.

Dimensions of the type (an adult male in spirit):—

Head and body 100 millim.; tail 61; hind foot 21·5; ear, from notch, 15·8 by 13·2 broad; forearm and hand 27; heel to front of last foot-pad 10.

Skull: basal length 23·6, basilar length from henselion 21·3, greatest breadth 15·7; nasals, length 12·8, greatest breadth 5·5; breadth between anteorbital fossæ 4; interorbital breadth 3·4; interparietal, length 3·1, breadth 9·4; length of outer wall of infraorbital foramen 2·4; palate, length from henselion 11·9; palatal foramina 5·5; diastema 6·5; length of upper molar series 5·2. Lower jaw: condyle to incisor-tip 17; tip of coronoid to angle 9·8; length of lower molar series 5·6.

Hab. Valley of Vitoc, East Central Peru. Coll. J. Kalinowski.

Type: B.M. 94.10.1.1.

This interesting little animal adds another to the number of South-American small mammals presenting to a greater or less extent the peculiar and characteristic coloration of a grey or brown body, with red nose, rump, feet, and tail. See below under *Acodon Jelskii*.

Oryzomys Kalinowskii, sp. n.

Size slightly greater than in its ally "*Thomasomys*" *cinereus*. Fur very long and soft, the hairs of the back some 16 millim. in length. General colour finely grizzled brownish grey all over, without special markings anywhere; the hairs of the back dark slate except at their tips, where there is a narrow terminal or subterminal band of dull yellow. These yellowish tips are broader and more prominent on the belly, to which they impart a general dirty fulvous tone. Whiskers long, numerous, whitish. Ears very large, laid forwards in a spirit-specimen they reach in front of the anterior canthus of the eye; almost circular in outline, their anterior edge without a basal prominence; their surface well haired and fringed, with long light-tipped hairs like those of the back on the anterior half of their outer surfaces, and with shorter brownish hairs on their posterior halves internally. Dark colour of body running down on hands and feet to the end of the metapodials mesially, while the sides and the whole of the fingers and toes are silvery white. Palate-ridges 3—5. Fifth hind toe reaching to the end of the first phalanx of the fourth. Soles naked, pads very high and prominent. Tail long, very like that of *Mus rattus*, nearly uniformly black, not pencilled, but well and finely haired throughout, the under surface slightly paler in colour than the upper.

If the immature female mentioned below is the same species as the type, of which I have little doubt, the mammæ may be recorded as 1—2 = 6.

Skull thin and lightly built, smooth and rounded in its general outlines, without cranial or supraorbital ridges. Muzzle long and slender; interorbital region rather narrow, its edges just marked, not absolutely rounded, but quite without beading. Palatal foramina a little longer than the molar series. Pterygoid fossæ shallow, with a large circular foramen in the middle of their posterior half. Lower jaw elongate, of medium strength; coronoid process rather light, hooked backwards.

Incisors smooth, rather narrow. Molars broad, heavy, and rounded, with opposite cusps, as in true *Oryzomys*.

Dimensions of the type (an adult male in spirit):—

Head and body 140 millim.; tail 155; hind foot 32·8; ear 22 × 17; forearm and hand 38; heel to front of last foot-pad 15.

Skull: greatest length 36, basal length 30·6, basilar length 28·7, greatest breadth 18·5; length of nasals 14·7; interorbital breadth 5·2; interparietal, length 3·6, breadth 12; palate length to henselion 15·5; palatal foramina 7; diastema 10·6; length of upper molar series 4·9. Lower jaw: condyle to incisor-tip 23·6; coronoid to angle 10; height of ramus below $\overline{\mathrm{m.\,1}}$ 4·3.

A second specimen is contained in the collection (an immature female), which I have little hesitation in referring to the same species.

Hab. Valley of Vitoc, East Central Peru. Coll. J. Kalinowski.

Type: B.M. 94.10.1.2.

As in the case of "*Hesperomys cinereus*" *, to which they are undoubtedly nearly allied, I have had great difficulty in assigning this and the next species to their proper genus, as, although Dr. Coues † has attempted to cut the knot by forming for *H. cinereus* a special group, I do not feel satisfied that it is one worthy of retention. Although the addition of the two species now described to the group would seem to support its position as a separate genus or subgenus, yet there seems to be such a gradation from *cinereus* through *Kalinowskii*, *albigularis*, and *meridensis* into typical *Oryzomys*, that I think it better for the present to use the latter name for them all.

Oryzomys incanus, sp. n.

Similar to *O. Kalinowskii* in all essential respects, in colour, proportions, and general skull-characters, but distinguished by its conspicuously smaller size, slenderer muzzle, broader interorbital space, much smaller teeth, and also by the disproportionate slenderness and delicacy of the lower jaw.

Dimensions of a male preserved in spirit:—

Head and body 104 millim.; tail 115; hind foot 25; ear 17 × 14; forearm and hand 29·5; heel to front of last foot-pad 10·7.

Skull: greatest length 30·7, basal length 25, basilar length 23, greatest breadth 14·7; length of nasals 12·6; interorbital breadth 5·2; interparietal, length 3, breadth 9·2; palate length to henselion 12·1; palatal foramina 6·1; diastema 8·3; length of upper molar series 4·4. Lower jaw: condyle to incisor-tip 19; coronoid to angle 7; height of ramus below $\overline{\mathrm{m.\,1}}$ 2·7.

Hab. Valley of Vitoc, Central Peru. Coll. J. Kalinowski.

Type: B.M. 94.10.1.4.

* P. Z. S. 1882, p. 108.

† Am. Nat. xviii. p. 1275 (1884).

Oryzomys meridensis, sp. n.

Size moderately large. Fur thick, of medium length, the hairs on the back about 11 millim. long. General colour dark rufous, heavily lined with blackish, especially along the median line of the back, while the head is more brown than rufous. Sides clearer and brighter rufous. Chest pure white, the hairs white to the base; sides of muzzle, chin, and belly grey-mixed white; line of demarcation on sides well-marked. Ears very large, thinly clothed with dark brown hairs; anterior edge without projection. Palate-ridges 3—5. Hands and feet very thinly haired, whitish; fifth hind toe reaching nearly to the end of the first phalanx of the fourth. Tail long, thinly hairy, brown, rather paler below.

Skull strong, with widely expanded zygomata; nasals long, well-expanded anteriorly; interorbital region long, flattened above, but quite rounded and without beads laterally; anterior palatine foramina rather short, although not so short as in *O. albigularis*.

Dimensions of the type (an adult skin):—

Head and body 139 millim.; tail 143; hind foot (moistened) 30·7; ear (shrunk) 21; heel to front of last foot-pad 14·2.

Skull: tip of nasals to back of interparietal 34·5, greatest breadth 18·7; nasals, length 13·6, breadth 4; interorbital breadth 5·4; interparietal, length 3·4, breadth 10; outer wall of infraorbital foramen, length 4; palate length to henselion 15; diastema 9·5; palatal foramina 5·9; upper molar series 5·5. Lower jaw: condyle to incisor-tip 23·5; height of ramus below $\overline{\text{m. 1}}$ 5.

Hab. Merida, Venezuela. Coll. A. Mocquerys, April 1894.

Type: B.M. 94.9.25.13.

This species seems to be allied to *O. albigularis*, Tomes, by its general coloration, short palatine foramina, and rounded supraorbital edges, but it differs conspicuously by its very much larger ears.

It may also be related to *O. velutinus*, All. & Chapm., but is distinguished by its larger size, heavier teeth, and longer fur.

Oryzomys flavicans, sp. n.

Size rather small, build rather Myoxine. Fur long, straight, and close, hairs of the back about 13 millim. long. General colour rich fulvous, lined with brown on the back, clearer and more yellowish (approximately ochraceous buff of Ridgway) on the sides, along which from cheeks to rump there is a fairly marked line of this colour. Under surface pale yellowish buff, whiter on the chest; belly-hairs slaty grey only at their extreme bases. Ears rather small, their substance brown, but their thickly set hairs fulvous. Upper surface of hands and feet dull whitish buff; fifth hind toe, without claw, reaching to the end of the first phalanx of the fourth. Tail thinly haired, brown, rather paler beneath, especially proximally.

Skull broad and rather flattened, strongly made; muzzle short and broad; interorbital region broad, flattened, with marked supraorbital ledges overhanging the orbits and running back as well-marked ridges to the back of the parietals. Palatine foramina short, of moderate breadth.

Dimensions of the type (an adult male in skin):—

Head and body 116 millim.; tail 129; hind foot (moistened) 23·8; ear (shrunk) 14·5; heel to front of last foot-pad 10.

Skull: tip of nasals to front of interparietal 26; greatest breadth (c.) 16·5; nasals, length 11, breadth 3·5; interorbital breadth 5·2; interparietal, length 4·1, breadth 10·2; length of outer wall of infraorbital foramen 3·1; palate length from henselion 13; diastema 7·7; palatal foramina 4·8 × 2·1; upper molar series 4·8. Lower jaw: condyle to incisor-tip 18·8; height of ramus below $_{\text{m. 1}}$ 4·5.

Hab. Merida, Venezuela. Coll. A. Mocquerys, April 1894.

Type: B.M. 94.9.25.14.

Although this species seems allied to the Trinidad *O. speciosus* and *trinitatis*, All. & Chapm., there are too many differences in the detailed skull measurements for it to be assigned to either of them.

Oryzomys ferrugineus, sp. n.

Size rather large. Fur thick and straight, the hairs of the back about 11 millim. in length. General hue a brilliant rust-colour (near "orange-rufous" of Ridgway) all over the head and upper surface, in brilliancy far exceeding any other species known to me, and even killing the colour of *Neotoma ferruginea*. The head and centre of the back are somewhat lined with black, but the cheeks and sides are quite clear and bright. Under surface white, with a decided wash of yellowish on the belly; no slate-colour at the bases of the hairs; line of demarcation on sides sharply defined. Upper lip rust-coloured like the rest. Eyes without a dark ring, the blackness of the lids reduced to a minimum; but a blackish spot present at the roots of the whiskers, just in front of the anterior canthus of the eye. Ears rather small, well-clothed, wholly rust-coloured; but there are a few whitish hairs just behind their posterior bases. Upper surface of hands pale reddish brown, the rusty of the forearm gradually passing into the brown; on the hind limbs the rusty goes down to and covers the ankles, and passes along the outer side of the foot nearly to the base of the fourth toe; inwards of this there is a broad whitish patch covering the metatarsals of the first three digits, and beyond this again the basal phalanges of the digits are dark brown all across the foot, while the terminal ones are whitish; fifth hind toe long, reaching almost to the middle of the second phalanx of the fourth. Tail very long, thinly haired, uniformly dark brown. Mammæ 2—2=8.

Skull long, rather narrow, with well-defined beaded but not overhanging supraorbital edges; interparietal large; palatal foramina long and open. Molars broad, rounded, their cusps unusually high and prominent, not apparently wearing flat with age.

Dimensions of the type (a well-made skin):—

Head and body 148 millim.; tail 187; hind foot (moistened) 32·5; ear (moistened) 17 × 14.

Skull: lambda (front of interparietal) to nasal tip 32, greatest breadth 19; nasals 14 × 4·3; interorbital breadth 5; interparietal (in another rather larger specimen), length 5·2, breadth (c.) 11·5; length of outer wall of infraorbital foramen 3; palate length from henselion 15·1; diastema 9·3; palatal foramina 7·8 × 2·9; length of upper molar series 5·9. Lower jaw: condyle to incisor-tip 22; height of ramus below $\overline{\text{m. 1}}$ 5.

Hab. Rio Janeiro.

Type: B.M. 76.12.8.3.

Of this very handsome species the Museum possesses three specimens, and as these came from three different dealers at different times, there are probably many others in the various European museums. One of the specimens came with the alternative names of *Mus vulpinus*, Brants *, and *M. leucogaster*, Brandt †, and the next with that of *M. cinnamomeus*, Pictet ‡. The hind foot of the new species being, with the claws, 1 inch 3 lines French measure in all three specimens, it is clear that "*Mus vulpinus*," with a hind foot of over 2 inches, and *M. leucogaster*, with one of 1 in. 7 lin., are both too large, just as *M. cinnamomeus*, with one of 1 in. 0 lin., is too small. *M. leucogaster* is "*e flavo fuscus*," and has its "cauda

* Het Gesl. der Muizen, p. 137 (1827).

† Mém. Ac. Pétersb. (6) iii. pt. 2, p. 428 (1835).

‡ Anim. Nouv. Mus. Genèv. p. 64 (1841).

in individuo exsiccato albida, in vivo carnea." *M. cinnamomeus* has a "*teinte générale jaune*" and a tail only 121 millim. long.

Of other species the nearest seems to be *Hesperomys russatus*, Wagn.*, but this has "cauda corpore paululum breviore, . . . pallida" and "*pedibus albidis*." *Mus physodes*, Licht.†, which our specimens had been formerly supposed to be, proved, on a personal examination of the type in the Berlin Museum, to be quite a different animal, coloured more like *Oryzomys laticeps*, Lund. One other species needs mention, namely *Mus vulpinus*, Lund ‡, nec Brants, on which *M. vulpinoides*, Schinz §, and *Calomys laticeps*, Winge ||, nec Lund, are based; but this is shown by Winge's admirable figures to be again more nearly allied to the true *O. laticeps* than to the animal before us.

Oryzomys xanthœolus, sp. n.

Size and general characters of *O. galapagoensis*, Waterh., to which I had previously assigned it. Fur harsher and shorter than in that species, the hairs on the back about 10 or 11 millim. in length. General colour coarsely grizzled yellow and black, the mixture approximating to tawny olive of Ridgway. Cheeks and sides clearer yellow, or rather buff. Under surface white, the slate-coloured bases of the hairs scarcely showing through; line of demarcation on sides well defined. Eyes with a rather lighter ring surrounding them. Ears large, their substance apparently brown, thinly clothed with yellowish hairs. Hands and feet very thinly haired, almost naked, their few scattered hairs white; fifth hind toe (without claw) reaching to the middle of the first phalanx of the fourth. Tail very long, thinly haired, brown above and whitish below.

Skull with a short broad muzzle, sharply edged and beaded supraorbital margins, and medium palatal foramina, about equal in length to the upper molar series.

* Abh. Ak. München. v. p. 312 (1850).

† Darst. Säug. pl. xxxiv. (1827–34).

‡ Blik Bras. Dyrev. pt. iv. p. 63 (1842).

§ Syn. Mamm. ii. p. 193 (1845).

|| Rodents of Lagoa Santa (E Mus. Lundii), 1887, p. 143. Dr. Winge, with sublime disregard of the nomenclature rules which other people find it necessary to obey, has shifted the name *laticeps* from the species to which Lund gave it (dubbing that *saltator*), and assigned it to the form which Lund had called *vulpinus*. The change is, of course, perfectly invalid, and cannot be recognized by any one who acknowledges the principle of priority.

Dimensions of the type (a skin):—

Head and body 121 millim.; tail 139 *; hind foot 30; ear from notch 18·5.

Skull: front of interparietal to nasal tip 28·3, greatest breadth 16; nasals 12·7 × 4; interorbital breadth 5·1; length of outer wall of infraorbital foramen 3·4; palate length from henselion 13·4; diastema 8; palatal foramina 5·5 × 2·5; length of upper molar series 5. Lower jaw: condyle to incisor-tip 20; height of ramus below $\overline{\text{m. 1}}$ 4·4.

Hab. Tumbez, N. Peru. Coll. Dr. J. Stolzmann.

Type: B.M. 85.4.1.47.

This species is undoubtedly very nearly allied to *O. galapagoensis*, but may be distinguished by its yellowish instead of brownish colour, its shorter fur, and longer tail. One would also expect, almost as a matter of course, that the insular form of the Galapagos Islands would be specifically distinguishable from that of the mainland.

Oryzomys phæopus, sp. n.

General appearance somewhat of the *O. laticeps* type, but size smaller and tail shorter. Fur straight and rather harsh, about 11 millim. in length on the back. Colour above coarsely grizzled fulvous and black, the general tone near Ridgway's "vandyke-brown," scarcely paler or clearer on sides. Whole of under surface dirty buff, the hairs pale plumbeous basally, dull buff terminally; line of demarcation not sharply defined. It may be noted that the colour above exactly matches the cheeks, and below, the belly, of a July example of the English water-vole. Ears short, thinly haired, scarcely darker than the general colour of the head. Upper surfaces of metacarpals and metatarsals well clothed with dark brown hairs; digits more thinly clothed and rather paler. Tail comparatively short, very finely haired, in fact almost naked; brown above, paler below, but the difference not conspicuous.

Skull somewhat like that of *O. laticeps*, but smaller and with a shorter muzzle. Interorbital region convex, broad, its edges with a fine supraorbital bead. Palatine foramina just about the length of the upper molar series. Coronoid processes of lower jaw long, well hooked backwards.

Dimensions of the type (a male in skin):—

Head and body 112 millim.; tail 98; hind foot (moistened) 24; ear (shrunk) 14; heel to front of last foot-pad 11·5.

* Imperfect at tip; the tail of another specimen is of about the same length as that here given.

Skull: back of interparietal to nasal tip 28·6, greatest breadth 15; nasals 12 × 3·6; interorbital breadth 5·5; interparietal 2·7 × (c.) 8; length of outer wall of infraorbital foramen 3; palate length from henselion 13·2; diastema 7·7; palatine foramina 4·8 × 2·1; upper molar series 4·6. Lower jaw: condyle to incisor-tip 18·5; height of ramus below $\overline{\text{m. 1}}$ 4·1.

Hab. Pallatanga, Ecuador. Coll. L. Fraser.

Type: B.M. 59.11.1.9.

This species is based on a specimen marked in Mr. Tomes's handwriting "*Hesperomys arvicoloides*, Pictet," and is therefore evidently not his own *H. caliginosus*, with whose description externally it somewhat agrees. There are also, as Mr. Allen has pointed out *, other reasons for thinking *H. caliginosus* to have been an *Acodon*, an opinion on which I based my original determination of the specimens in Messrs. Stolzmann and Jelski's collections.

Pictet's *arvicoloides*, although withdrawn by its author in favour of *Renggeri*, Waterh., might have to stand for Bahian examples of the *olivaceus* group; but in no case has it anything to do with the present species.

Oryzomys phæopus obscurior, subsp. n.

Similar to the typical variety in most essential respects, but the feet are shorter and more delicate, and the colour is much darker throughout, especially on the posterior back, where the fur is practically black, only relieved by a few yellow-tipped hairs. Upper surface of hands and feet, and tail, both above and below, brownish black. Fifth hind toe only reaching to the base of the first phalanx of the fourth.

The muzzle of the skull is even shorter than in the typical form; but this may be due to the fact that the type of *phæopus* is a very aged specimen, while that of *obscurior* is only just adult.

Dimensions of the type (in skin):—

Head and body 111 millim.; tail (imperfect at tip) 89 + ?; hind foot (moistened) 22·4; heel to front of last foot-pad 9·5.

Skull: bregma (back corner of frontals) to nasal tip 19; greatest breadth (c.) 15; nasals 10·5 × 3·4; interorbital breadth 5·9; palate length from henselion 12·2; diastema 7·4; palatine foramina 4·5 × 2·1; upper molar series 4·5. Lower jaw: condyle to incisor-tip 18; height of ramus below $\overline{\text{m. 1}}$ 3·7.

Hab. Concordia, Medellin, Colombia. Coll. J. K. Salmon.

Type: B.M. 73.11.5.5.

* Bull. Am. Mus. N. H. iii. p. 210 (1891).

Oryzomys Stolzmanni, sp. n.

Hesperomys longicaudatus, Thos. P. Z. S. 1882, p. 104 (nec Benn.).

In size and proportions clearly belonging to the *O. longicaudatus* group. Fur of medium length, rather close and stiff. General colour dark rufous brown, finely lined with black, the resulting tone approximately similar to "Prout's brown" of Ridgway. Head greyer and less rufous. Ears rather small, laid forwards in a spirit-specimen they reach just to the middle of the eye; brown, finely mixed with rufous, not prominently darker than the general colour. Palate-ridges 3—5. Chin white; chest and belly dull buffy yellow, the bases of the hairs slate. Upper surface of hands and feet white; fifth hind toe, without claw, reaching to the end of the first phalanx of the fourth. Tail very long, finely haired, uniformly dark brown throughout, or the underside faintly paler. Mammæ 2—2 = 8.

Skull very much as in *O. longicaudatus*, but the edges of the interorbital region seem to be rather more evenly concave and the palatal foramina are shorter, not reaching to the level of the front of $\frac{\text{m. 1}}{}$.

Dimensions of the type (measured as a spirit-specimen in 1882):—

Head and body 82 millim.; tail (from anus) 137; hind foot 22·5; ear (of a specimen now in spirit) 12 × 10; forearm and hand 25.

Skull: greatest length 25·5, basilar length 19; nasals 9·2 × 2·8; interorbital breadth 3·7; interparietal 3 × 9; palate length from henselion 10·1; diastema 6·4; palatal foramina 4·3 × 1·5; length of upper molar series 3·5. Lower jaw: condyle to incisor-tip 14·3; coronoid to angle 6·4; height of ramus below $\frac{}{\text{m. 1}}$ 3.

Hab. Huambo, N. Peru, 3700 feet. Coll. Dr. J. Stolzmann, April 1880.

Type: Specimen *b* of the list given, P. Z. S. 1882, p. 104. B.M. 81.9.7.11.

This species is distinguishable from typical *O. longicaudatus* by its darker back, buff-coloured belly, and shorter feet. Tomes's description of *Hesperomys minutus* from Pallatanga, Ecuador, based on a young specimen, would have prevented my giving a name to this mouse had it not been that the Museum possesses an adult from the same place which agrees sufficiently well with that description to be in all probability the same species. This animal differs from *O. Stolzmanni* by its much more rufous coloration, above and below, and by the almost complete suppression of the projecting plate of the anterior zygoma-root.

Oryzomys gracilis, sp. n.

Size small, form very slender and delicate. Fur short and velvety, the hairs of the back only about 4 millim. in length. General colour finely grizzled yellowish brown, perhaps nearest to Ridgway's "raw umber;" the hair-tips dull yellow, mixed with the blackish longer hairs. Sides clearer and more fawn-coloured, especially along the edge of the white belly-hairs. Whole of under surface white, the bases of the hairs slate, line of demarcation on sides fairly well defined. Ears short, thinly haired, except on the anterior half of their outer surfaces, where they are closely covered with fine shining black hairs, which contrast markedly with the general hue of the upper surface. Uppersides of hands and feet thinly haired, white, probably flesh-coloured in life; fifth hind toe, without claw, reaching nearly to the middle of the first phalanx of the fourth. Tail slender, thinly haired, brown above and white below proximally, the lower surface darkening distally until the terminal fourth of the tail is uniform brown all round.

Skull with narrow parallel-sided nasals, sharply square supraorbital edges, with a very faint trace of beading. Palatal foramina rounded, open, rather longer than the molar series. Molars narrow, delicate, but distinctly *Oryzomys*-like in character.

Dimensions of an adult female skin:—

Head and body 106 millim.; tail 105; hind foot 24·6; ear 13.

Skull: tip of nasals to front corner of interparietal 23·6; nasals, length 10·4, breadth 2·5; interorbital breadth 5; length of outer wall of anteorbital foramen 2·5; diastema 6·3; palatal foramina 4·5; length of upper molar series 3·8. Lower jaw: condyle to incisor-tip 15·5; height of ramus below $\overline{\mathrm{m.1}}$ 3·3.

Hab. Concordia, Medellin, Colombia. Coll. J. K. Salmon.

Type: B.M. No. 73.11.5.4.

This species may be readily distinguished from its allies by its graceful form, small black ears, slender feet and tail, and narrow, delicately built nasal region.

Oryzomys microtinus, sp. n.

Size rather small; form more or less Arvicoline. Fur rather short, straight and harsh, the hairs of the back about 10 millim. in length. General colour coarsely grizzled brown, the hairs dark slate proximally, with dull yellow tips; many black-tipped hairs intermixed. As a result the colour is not unlike that of some of the darker voles, say *Microtus agrestis* or *riparius*, although not so finely grizzled as in the latter. Below, the yellowish tips to the hairs gradually become dirty white, the slaty-grey bases of the hairs still showing through. Palate-ridges 3—5. Ears of medium length, almost naked, their anterior prominence little developed. Upper surface of hands and feet dull whitish brown; fifth hind toe, without claw, reaching just beyond the base of the fourth; pads small, rounded, distinct. Tail short, tapering, nearly naked; its upper surface brown, its lower very slightly paler. Mammæ 2—2=8.

Skull thick and strongly built; nasals long, parallel-sided; supraorbital edges strongly diverging, sharply edged, with a fine bead along them; interparietal of moderate size; outer wall of anteorbital foramen long, convex forwards; palatine foramina unusually large and open, the breadth across both of them almost half their length. Molars small, but very much worn down in the type.

Dimensions of an aged female in spirit:—

Head and body 115 millim.; tail 84; hind foot 24·5; ear 16×13; forearm and hand 28; heel to front of last foot-pad 11.

Skull: greatest length 29·7, basal length 24·8, basilar length 23, greatest breadth 16; nasals, length 13, greatest breadth 3·7; interorbital breadth 4·7; interparietal, length 2·3, breadth 8·5; palatal length from henselion 12·6; diastema 8·1; palatine foramina, length 6·3, breadth 3; length of upper molar series (c.) 4·1. Lower jaw: condyle to incisor-tip 19·6; height of ramus below $\overline{\text{m. 1}}$ 4·5.

Hab. Surinam. Coll. E. Bartlett.

Type: B.M. No. 66.8.11.16.

This is one of the species which make the subdivision of the group into genera so difficult. In all its characters except the shortness of its tail it is a true *Oryzomys*; but in this respect it approaches *Acodon*, especially through such species as *A. punctulatus*, which has beaded supraorbital edges. However, in view of its general skull-structure, it seems best for the present to call it an *Oryzomys*, directing attention at the same time to its Acodont external proportions.

Oryzomys (?) *venustus*, sp. n.

Size small, tail short; ears rather large. Fur very long, soft and fine; on the back the hairs are about 13 millim. in length. General colour soft drab (*Ridgway*) on the back, lightening to sandy buff on the sides, the tips of the hairs being buff finely lined with blackish. Face like sides.

Under surface pale buffy white, the hairs slaty blue for three fourths their length, buffy white at their tips; chin-hairs without slaty bases; line of demarcation on sides not sharply defined. Ears rather large, almost approximating to the species of *Phyllotis*, their visible parts when folded thinly hairy, brown; at their anterior bases a tuft of buff-tipped hairs. Hands and feet well-haired, white; fifth hind toe short, not or scarcely reaching to the base of the fourth. Tail short, about the length of the body without the head, well-haired, but not tufted; distinctly bicolor, brown above, white on the sides and below.

Skull, in proportion to its size, strongly built; muzzle broad; interorbital region flat, its edges sharply marked and angular, slightly overhanging the orbits posteriorly. Anterior palatine foramina long, extending backwards to the level of the middle prominence of $\underline{\text{m. 1}}$.

Dimensions of the type (an aged male in skin):—

Head and body 94 millim.; tail 72; hind foot (moistened) 21; ear (shrunk) 16; heel to front of last foot-pad 8·9.

Skull: lambda (front of interparietal) to nasal tip 23·5, greatest breadth 14·5; nasals 10·5 × 3·1; interorbital breadth 4·5; length of outer wall of infraorbital foramen 3·1; palate length from henselion 11·6; diastema 6·7; anterior palatine foramina 5·7 × 1·8; length of upper molar series 4·3. Lower jaw: condyle to incisor-tip 17; height of ramus below $\overline{\text{m. 1}}$ 3·9.

Hab. Cosquin, Cordova, Argentina. Coll. E. W. White, Sept. 10, 1882.

Type: B.M. 83.4.16.1.

This pretty little species, although by its skull apparently an *Oryzomys*, much resembles externally a diminutive *Phyllotis* both in general coloration, character of fur, and size of ears; but I know no species of that or any other group with which it could be confounded.

Acodon Jelskii*, sp. n.

Hesperomys (*Habrothrix*) *scalops*, Gay, Thomas, P. Z. S. 1884, p. 455, pl. xliii. fig. 1 (animal), pl. xliv. figs. 1, 15, and 16 (palate and skull); nec Gay.

Since the above determination was published the discovery of several other species with more or less the peculiar coloration of this animal, as shown in the plate quoted, has so much reduced the relative importance of this by itself as a specific characteristic, that I feel no longer able to ignore the differ-

* Meyen, 1833.—Syn. *Habrothrix*, Waterh. 1837.

ences between M. Jelski's Peruvian specimens and Gay's description merely in consideration of their similarity in colour.

The Peruvian species having been fully described, I need only now point out that it differs from Gay's Central Chilian one by its much longer tail, the body-length being less, and by its longer palatine foramina, Gay's figure showing these but little longer than the molar series, while in *A. Jelskii* they are almost twice as long (see body and skull measurements, *l. c.*). Besides these differences there may be many others, as Gay's description, although not very short, deals chiefly with characters which are of generic or family rather than specific value.

Hab. Junin, Central Peru. Coll. C. Jelski, 1872.

Type: the figured skin, B.M. No. 85.4.1.44.

Acodon Jelskii pyrrhotis, subsp. n.

Hesperomys (*Habrothrix*) *scalops*, Thos. *l. c.* partim (specimens *h* and *i*, from Maraynioc).

While the Junin specimens of *A. Jelskii* (see above) all precisely agree with the type specimen figured in the original paper in having their ears only partly rufous, the outer surface especially being greyish brown, in having their tails dark brown above (at least terminally) and pale rufous yellow laterally and below, and in having their digits whitish as compared to the rich rufous metapodials, the Maraynioc ones have the whole of their ears, inside and outside, the whole of their tails, above and below, and the whole of their feet, metatarsals and phalanges, uniform rich chestnut-rufous. These differences appear to be of sufficient importance and constancy to demand recognition by name, at least subspecifically.

Dimensions as given for specimen *h* (l. c.).

Hab. Maraynioc, Central Peru. Coll. C. Jelski.

Type: Specimen *i*, which has now been skinned out of spirit. B.M. 94.10.7.4.

Acodon punctulatus, sp. n.

Size about the same as *A. Jelskii*. Fur much shorter and crisper than is usual in *Acodon*, that of the back about 7 millim. in length. General colour finely punctulated grey and yellow, the resulting tone on the back when viewed from a distance not far from Ridgway's "raw umber," greyest on the anterior back, and lightening on the cheeks, sides of neck, flanks, and sides of rump to "tawny olive," or perhaps rather more rufous than that, especially on the last-named part. Throughout the colour is made up of a finely grizzled mixture of grey, black, and yellowish in varying proportions. Head concolorous with back. Under surface dirty yellowish white, the bases of the hairs slate-coloured. Ears small, well-haired, brown, with a slight admixture of yellowish. Upper surface of hands and feet brownish white. Fifth hind toe short, barely reaching to the base of the fourth. Tail short, dark brown above, dirty fulvous below.

Skull evenly convex above in profile, with a short muzzle and long narrow brain-case. Supraorbital edges sharply beaded, even slightly overhanging, and forming slight angular postorbital processes. Interparietal small. Palatal foramina long, nearly twice the length of the molar series. Molars apparently of normal *Acodon* structure, but too much worn in the type for accurate description.

Dimensions of the typical skin:—

Head and body (stretched) 132 millim.; tail 71; hind foot (moistened) 22; ear (dried) 14.

Skull: length from just above foramen magnum to tip of nasals 29·6; greatest breadth (c.) 15; nasals, length 10·5; interorbital breadth 4·8; interparietal, length 2, breadth 5·5; outer wall of foramen magnum 3·4; diastema 8·5; length of palatal foramina 7; upper molar series 4·2.

Hab. Ecuador (probably Pallatanga). Coll. L. Fraser.

Type: B.M. No. 59.11.1.8.

This peculiar-looking species is of somewhat doubtful position, as its comparatively short crisp fur and, especially, its beaded supraorbital edges separate it widely from any other *Acodon*. In fact I think it is nearly certain hereafter to require generic or subgeneric separation; but this can only be done when our knowledge of the whole group is much further advanced than it is at present. It is, however, possible that, in company with some other beaded species which have been referred to *Acodon* on account of their external proportions, such as *A. lasiurus*, Lund, *A. punctulatus* should properly be placed in *Oryzomys*, of which it and they would then form a special group of short-tailed species.

Acodon macronyx, sp. n.

Similar to *A. megalonyx*, Waterh., in size, general proportions, and especially in the enormous development of the claws. It differs, however, by its much more greyish general colour, which matches Ridgway's "hair-brown," more whitish under surface, and by its shorter, broader, heavier, and more rounded skull. Palatal foramina extending back to the level of the anterior inner notch of $\frac{m.1}{}$.

Ears short, hairy, similar in colour to the rest of the upper surface.

Hind feet short and broad, the six pads large, rounded, and prominent; fifth hind toe reaching, without claw, to the middle of the short first phalanx of the fourth. In the type the claws are so much worn down that their present length does not show their unusual dimensions; but in a second specimen, somewhat younger, the middle anterior claw measures 6·2 millim. in a straight line.

Dimensions of the type (an aged female in skin):—

Head and body (c.) 118 millim.; tail (c.) 47; hind foot (moistened), without claw 22, with claw 24·5; heel to front of last foot-pad 10.

Skull: greatest length 30, basal length 25·8, basilar length 24·2, greatest breadth 16·3; nasals 12·5 × 4; interorbital breadth 5; interparietal, length 1·4, breadth 4·2; length of outer wall of infraorbital foramen 2·8; palate length from henselion 13; diastema 7·8; palatal foramina 6·6 × 1·7; length of upper molar series 5·1. Lower jaw: condyle to incisor-tip 20; coronoid to angle 8·5; height of ramus below $\overline{m.1}$ 4·3.

Hab. East side of the Andes, near Fort San Rafael, Province of Mendoza. Coll. T. Bridges.

Type: B.M. 60.1.5.14.

Of this group of long-clawed Acodons two other species have been described, both by Philippi, namely "*Oxymycterus*" *valdivianus* * and *O. niger* †; but both are from the Chilian side of the Andes, and both are said to be darker in colour than *A. megalonyx*, while *A. macronyx* is conspicuously lighter.

Acodon mollis, sp. n.

Hesperomys olivaceus, Thos. P. Z. S. 1882, p. 110, and 1884, p. 456 (nec Waterh.).

Closely similar in almost every respect to *A. olivaceus*, Waterh. Size and colour identical. Tail decidedly longer, but coloured and clothed quite similarly. Fifth hind toe, without claw, reaching to the middle of the first phalanx of the fourth. Palate-ridges 3—4.

Skull readily distinguishable by its much broader interorbital space, which, being broader instead of narrower than the muzzle, gives quite a different appearance to the general

* Arch. f. Nat. 1858, i. p. 303.

† Zeitschr. ges. Naturwiss. (9) vi. p. 445 (1872).

contour of the skull. Supraorbital edges rounded. Palatine foramina reaching to the middle internal prominence of $\frac{m.1}{}$.

Dimensions of the type (a skin):—

Head and body (c.) 110 millim.; tail 85.

Of an old male in spirit from the same locality:—

Head and body 95; tail 75; hind foot 22; ear from notch 15·3 × 13; heel to front of last foot-pad 9·5.

Skull (of the spirit-specimen): greatest length 27, basal length 24·2, basilar length 22·5, greatest breadth 14; nasals 9·3 × 3·6; interorbital breadth 5·1; interparietal 1·5 × 6·6; palate length to henselion 12; diastema 7·6; palatal foramina 6 × 2·4; length of upper molar series 4·2. Lower jaw: condyle to incisor-tip 17·6; tip of coronoid to angle 7; height of ramus below $\overline{m.1}$ 3·6.

Hab. Tumbez, N. Peru. Coll. Dr. J. Stolzmann. There are also specimens in the Museum collection from Maraynioc (*Jelski*) and Vitoc (*Kalinowski*).

Type: B.M. No. 85.4.1.49.

This species is evidently the northern representative of *A. olivaceus*, which ranges over Bolivia, Chili, and Patagonia, and which it replaces in Ecuador and Peru. In distinguishing the two, I have examined six skulls of the northern and ten of the southern form.

Peromyscus * *leucurus*, sp. n.

Size large, slightly less than that of *P. mexicanus* or *P. californicus*. Fur soft and close, the hairs on the back 7 or 8 millim. in length. General colour cinereous grey, finely lined on the back with blackish, clearer on the sides, where it is approximately "drab-grey" of Ridgway. Chin white, rest of under surface "grey no. 8;" the bases of the hairs slate, the tips white. Eyes without any prominent dark ring round them, although the extreme edges of the lids are, as usual, black. Ears large, but not so large as in *P. Truei* or *P. californicus*, finely hairy, blackish brown. Hands and feet white; fifth hind toe, as in most other *Peromysci*, reaching to the middle of the second phalanx of the fourth. Tail long, more thinly haired than usual; brown above and whitish below for the proximal, wholly white all round for the distal half; a few hairs at the extreme tip are, however, brown.

Skull, for a *Peromyscus*, strong and well built, most similar in its proportions, of those available for comparison, to that

* Gloger, 1841.—Syn. *Sitomys*, Fitz. 1867. An analysis of Gloger's generic names is now in course of preparation, and will be published shortly.

of *P. aztecus*, De Sauss. It is, however, larger, with more strongly developed supraorbital edges, narrower posterior nares, and longer pterygoid processes. Molars strictly as in *Peromyscus*.

Dimensions of the type (a well-made skin, male):—

Head and body 118 millim.; tail 142; hind foot 25·5 (with claws 26·5); ear from notch 17·5.

Skull: greatest length 30·3, greatest breadth 15; nasals, length 11·2, breadth 3·4; interorbital breadth 5·1; interparietal, length 3·9, breadth 10; palate length from henselion 11·9; diastema 7·6; palatal foramina 5·8 × 2·4; length of upper molar series 4·5. Lower jaw: condyle to incisor-tip 18·2; coronoid to angle 7·4; height of ramus below $\overline{\text{m. 1}}$ 3·7.

Hab. Tehuantepec (*A. Boucard*).

Type: B M. No. 79.1.6.3.

This species is founded on the Tehuantepec specimen referred by Alston in the 'Biologia'* to "*Hesperomys californicus.*" It differs from that species by its smaller size, smaller ears, much paler colouring, and more thinly haired tail. It is perhaps most nearly related to the *P. Truei*-group, of which it may be said to be a large small-eared member.

Mr. Allen's *Peromyscus nudipes* † from Costa Rica is decidedly larger and more darkly coloured than *P. leucurus*, while no other described Central-American species attains its size.

Peromyscus gymnotis, sp. n.

Size medium; ears long, tail short. General colour, so far as can be made out in a spirit-specimen, very dark, almost bistre-brown. Under surface dirty buff, the slate-coloured bases of the hairs showing through. Ears long, laid forward in a spirit-specimen they reach 3 or 4 millim. in front of the anterior canthus of the eye; perfectly naked, no hairs being discernible upon them (except at their bases posteriorly) even with a lens ‡; their substance plumbeous in colour. Palate-ridges 3—5. Hands and feet thinly covered with fine silvery-white hairs; fifth hind toe reaching to the base of the second phalanx of the fourth; soles practically naked along median line, a few scattered white hairs being only found on this

* Mamm. p. 146 (1880).

† Bull. Am. Mus. N. H. iii. p. 213 (1891).

‡ A second examination with a more powerful lens shows that there are a few widely scattered minute whitish hairs on the ears, but they are so few and so small as practically not to affect the statement in the text.

part. Tail slightly shorter than the head and body, slender, very thinly clothed with minute brown hairs, which are everywhere of the same colour, while the skin of the tail itself is also dark brown above and below for its whole length.

Skull, as compared to that of *P. aztecus*, decidedly more lightly built and flatter above when viewed in profile; muzzle longer and narrower; supraorbital edges square but not beaded; palatal foramina widely open; bullæ rather smaller.

Dimensions of the type (an adult male in spirit) :—

Head and body 99 millim.; tail 92; hind foot 22 (with claws 23); ear 17 × 13·5; heel to front of last foot-pad 10.

Skull: greatest length 30·5, basal length 25, basilar length to henselion 23·1, greatest breadth 15·4; nasals 12 × 3·3; interorbital breadth 4·6; interparietal 3·7 × 10; palate length from henselion 12·4; diastema 8·2; palatine foramina 5·8 × 2·3; upper molar series 4·1. Lower jaw: condyle to incisor-tip 18; coronoid to angle 7·3; vertical height of ramus below $\overline{\text{m. 1}}$ 3·6.

Hab. Guatemala. Coll. Bernoulli.

Type: B.M. 86.5.13.4.

The only species that I know of related to this peculiar dark-coloured short-tailed *Peromyscus* are two in the Museum collection from "S. Mexico," Coll. Sallé. One is, however, larger and the other smaller than *P. gymnotis*, and both have more or less bicolor tails and hairy ears. These two species are, I believe, both undescribed; but, in view of the fact that their exact locality is not known and that there is reason to hope for a proper American revision of the Mexican *Peromysci*, based on Mr. Nelson's magnificent collections, I prefer to refrain from describing them.

XLIV.—*Natural History Notes from H.M. Indian Marine Survey Steamer 'Investigator,' Commander C. F. Oldham, R.N.*—Series II., No. 10. *Report upon some Mollusca dredged in the Bay of Bengal and the Arabian Sea.—Appendix.* By Edgar A. Smith.

Since the publication of the above report in the September number of the 'Annals' I have received from Mr. Alcock, the Superintendent of the Indian Museum at Calcutta, two species of Mollusca which have already been figured and briefly described in the earlier accounts of the dredgings of the 'Investigator' by Messrs. Alcock and Wood-Mason. Of one of the species I have drawn up a detailed description, and of the other, which proves to belong to a previously described species, I append the synonymy.

Pirula investigatoris.

Sycotypus, sp., Wood-Mason & Alcock, Ann. & Mag. Nat. Hist. 1891, vol. vii. pp. 15, 16 (cut, fig. 2).
Sycotypus investigatoris, Wood-Mason & Alcock, MSS.

Testa ventricose pyriformis, mediocriter tenuis, dilute fucescens, hic illic longitudinaliter saturatius strigata, undique spiraliter tenuiter lirata, lineis incrementi arcuatis tenuissimis cancellata; spira aliquanto elata; anfractus 7, celeriter accrescentes, convexiusculi, supremi $2\frac{1}{2}$ (nucleus) læves, ultimus ventricosus, infra medium constrictus; apertura elongata, longit. totius $\frac{7}{8}$ fere æquans, antice in canalem obliquam latem producta, intus albida, subsulcata; labrum tenue, in medio arcuatim prominens, postice ad suturam subsinuatum; columella spiraliter convoluta, usque ad apicem intus visibilis, callo tenuissimo albo supra suturam producto induta.
Longit. 97 millim., diam. maj. 56, min. 47; apertura cum rostro 81 longa, in medio 27 lata.

Hab. Off Ganjam coast, east coast of India, in 98 to 102 fathoms, on a sandy bottom.

The distinguishing features of this interesting species are its ventricose form, high spire, thin texture, and the smoothness of the sculpture. The spiral or transverse riblets are very fine and close together, a little flattened, and generally, but not constantly, alternately more slender. The longitudinal raised lines are thread-like, very much curved, and chiefly visible between the riblets. The colour of the shell is light brown or "warm cinnamon," with longitudinal streaks of a darker tint in the same curve as the lines of growth. "Colour of the animal delicate pink, the edges of the mantle shading into a lemon-yellow."

Solariella infundibulum, Watson.

Trochus (Margarita) infundibulum, Watson, Report Gaster. 'Challenger,' p. 84, pl. v. fig. 3.
Solariella infundibulum, Pilsbry, Man. Conch. vol. xi. p. 319, pl. lxvi. fig. 97.
Trochus infundibulum, Dall, Nautilus, vol. iii. pp. 2–4 (description of soft parts).
Solariella metallica, Wood-Mason & Alcock, Ann. & Mag. Nat. Hist 1891, vol. viii. p. 444, figs. 12 *a*, *b*.

Hab. Off Bermuda, 1075 fath.; off Marion Island, in the Southern Ocean, 1375 fath. ('*Challenger*'); 100 miles east-ward of the entrance to Chesapeake Bay, 1685 fath. (*Dall*); Gulf of Manaar, Ceylon, 738 fath. ('*Investigator*').

This is another remarkable instance of wide distribution among deep-water mollusks—another link in the chain of proof (if that were needed) regarding the cosmopolitan character of the deep-sea fauna.

The soft parts of this species have been examined and described by Mr. W. H. Dall, and are remarkable in several respects.

The shells from the Gulf of Manaar have the acute tubercles somewhat larger and less numerous than in the 'Challenger' shells or Mr. Dall's specimen, which he liberally placed in the British Museum collection.

In other respects they agree. The width and character of the umbilicus, the general form, colour, and texture are similar, and the number and relative proximity of the ribs on the lower half of the body-whorl also correspond, the ridge bordering the umbilicus being more crenulated than the rest.

On account of the extra size of the nodules on the two upper ridges the aperture exhibits two corresponding conspicuous rows of indentations, a feature but feebly developed in the more finely tuberculated forms.

I have followed Wood-Mason and Alcock in placing this shell in *Solariella*, as it agrees conchologically more closely with that group than with *Margarita*. It is, however, probable that the characters of the soft parts are sufficiently distinctive to warrant the formation of a new genus.

XLV.—*Notes on Palæozoic Fishes.*—No. I. By R. H. Traquair, M.D., LL.D., F.R.S.

[Plate IX.]

DEVONIAN.

Diplacanthidæ.

Parexus.

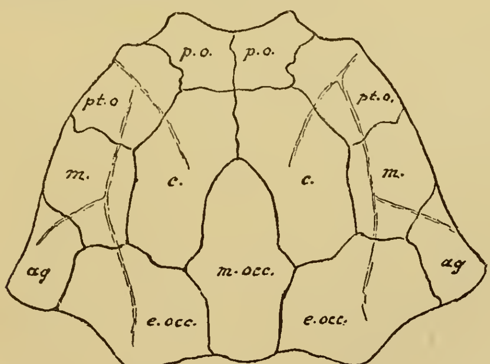
In the Powrie Collection, now in the Edinburgh Museum, there is a spine belonging to this genus, from the Old Red Sandstone of Cradley, Herefordshire. It is $2\frac{1}{8}$ inches in length, slender, tapering, gently curved, and showing, along the concave side, one of the two rows of denticles, with distally directed apices, characteristic of the genus. The surface of the spine is otherwise not well preserved; but, so far as one may judge from its condition, it shows no peculiarity distinguishing it from the well-known *Parexus recurvus*, Ag., of the Forfarshire beds.

The occurrence of *Parexus* in the west of England area of the Old Red Sandstone has not, so far as I am aware, been hitherto recorded, and is interesting as bringing out still more strongly the resemblance between the Lower-Devonian fish-fauna of that region and that of the widely separated central Scottish area. I may take the opportunity of stating here that I have never been able to find any actual corroboration of the alleged occurrence of *Parexus* in the Old Red of Caithness.

Coccosteidæ.

Phlyctænaspis anglica, Traq.

In my original description of this genus * I gave as one of the marks of distinction between the two known species, *P. acadica* and *P. anglica*, that in the former the external angle of the cranial shield was divided by a shallow notch into two, the postero- and antero-external angles, whereas in the latter these two angles were confluent and formed one prominent postero-external projection.



Cranial Shield of *Phlyctænaspis anglica*, restored sketch (ethmoid and pineal plates omitted).—*m.occ.*, median occipital; *e.occ.*, external occipital; *ag.*, angular; *c*, central; *m.*, marginal; *pt.o.*, postorbital; *p.o.*, præorbital.

That such a peculiar difference should exist between two closely allied species seemed strange from the beginning; but light is thrown on the matter by a specimen of *Phlyctæn-*

* Geol. Mag. (3) vol. vii. 1890, p. 60.

aspis anglica in the Museum of Practical Geology, Jermyn Street. Here it is clearly shown that the postero-external extension of the shield in this species is due to the presence of a small plate (woodcut, *ag.*), which seems to be absent in all the specimens of *P. acadica* which I have hitherto seen. It will be noticed in the restored sketch (p. 369) of the arrangement of the cranial shield-elements in *P. anglica* that the line of suture which divides this plate, *ag.*, from the rest of the shield repeats pretty exactly the re-entering angle seen at the same place on the margin in the Canadian species. The inference is therefore unavoidable that the plate in question was also present in *P. acadica*, but was prone to be lost through not having been anchylosed. This plate, to which from its position we may give the name of "*angular*," is apparently absent in the cranial shield of *Coccosteus*, the arrangement of the elements of which otherwise agrees in general plan with that in *Phlyctænaspis*.

Acanthaspis prümensis, sp. n. (Pl. IX. fig. 1.)

Among some fossils obtained a few years ago for the Edinburgh Museum from Mr. B. Stürtz, of Bonn, are two specimens, or, rather, impressions of the anterior ventro-lateral plate, with attached spine, of a species of *Acanthaspis* from the Lower Devonian of Prüm, in the Eifel. Of these the smaller and more perfect is here figured.

As indicated by the impression, the plate, somewhat quadrate in form, was ornamented externally by a minute, often vermicularly confluent tuberculation. From the anterior two thirds of its outer margin a pointed process passes outwards and backwards, to the antero-external border of which is fixed a long, tapering, slightly curved hollow spine. The direction of this spine in the complete animal must have been obliquely backwards and outwards; that it was hollow is shown by a small portion of the stony core of the interior, which still adheres at one point near its middle. The impression also shows that the spine was ornamented externally by fine longitudinal ribs, showing a minute sharp tuberculation of the same character as that in the North-American *Acanthaspis armata* of Newberry. The entire length of the spine is rather more than twice that of its supporting plate; its greatest width is contained over eight times in its length. Length of the plate (anterior ventro-lateral) $1\frac{3}{16}$ inch, of the spine $2\frac{1}{2}$ inches. The other specimen, which is not so good, is somewhat larger, the spine having a length of 3 inches.

There can be no doubt that the above-described fossil, to which the specific name *prümensis* may be given, belongs to the genus *Acanthaspis* of Newberry, which was supposed by its founder to be related to the Cephalaspidæ *. Mr. Smith Woodward, however †, in describing an apparently allied form from Spitzbergen, *A. decipiens*, inclined to the belief that the genus was most nearly related to the Asterolepidæ, and that the spine, here fixed and immovable, represented the articulated pectoral limb of *Asterolepis* or *Pterichthys*. But from the resemblance of the plate and spine to the corresponding parts in *Phlyctænaspis*, I cannot doubt that, whatever *A. decipiens* of Smith Woodward may be, *Acanthaspis armata* of Newberry is a Coccostean ‡.

CARBONIFEROUS.

Cestraciontidæ.

EUPHYACANTHUS, gen. nov.

Dorsal spines with a few longitudinal ridges on the anterior aspect, which, at the apex, likewise cover the sides. Two rows of recurved denticles on the posterior area, *within* the angulated margins by which the latter is bounded.

This genus resembles *Tristychius*, Agassiz, save in the position of the denticles, which are within and not on the limiting margins of the posterior area.

Euphyacanthus semistriatus, sp. n.
(Pl. IX. figs. 2–6.)

These spines (Pl. IX. figs. 2 and 3) attain sometimes a length of 5½ inches. When the apex is preserved unabraded it may show four or five ridges extending over its sides, but as we pass downwards these become limited to the anterior aspect, leaving a bare space between them and the postero-lateral margin. Towards the base of the exserted portion of the spine there may be a variable number of these ridges on each side of the anterior and median marginal one—two, three, four, or more—and the number is sometimes increased by intercalation. The posterior area shows a median groove (figs. 4 and 6), on each side of which, but within the margin separating the area from the side of the spine, is a row of rather small, sharp, and strongly recurved denticles (fig. 5). Two forms of this spine are observable—one straight, more tapering, and with fewer ridges (fig. 2), and a second, stouter,

* Geol. Surv. Ohio, vol. ii. pt. ii. (1875) p. 37, pl. lv. figs. 1–6.
† Ann. & Mag. Nat. Hist. (6) vol. viii. pp. 4–6.
‡ R. H. Traquair in Geol. Mag. (3) vol. x. 1893, p. 149.

more curved, and having the ridges in greater number (fig. 3). Though the slender form is more abundant than the stout one, I am inclined to regard both as belonging to the same species and as representing respectively the anterior and posterior dorsal spines of the fish to which they belonged.

From the Lower Carboniferous of the Edinburgh district. Rare in nodules above the "Broxburn" oil-shale at Straiton and in shale in connexion with the "Blue" coal at Niddrie. More abundant in the roof-shale of the "South Parrot" coal-seam at the last-mentioned locality.

Acanthodidæ.

Acanthodopsis microdon, sp. n. (Pl. IX. fig. 7.)

This is the articular moiety of an Acanthodian mandible about $\frac{3}{4}$ inch in length, and showing on its upper margin eleven conical, blunt, incurved teeth, apparently to some extent laterally compressed, and with a slight apical enlargement. Bases of teeth not so broad in proportion as in *A. Wardi*.

As the small size and somewhat different shape of the teeth strikingly distinguish this mandible from that of the well-known *Acanthodopsis Wardi* of Hancock and Atthey, its claims to specific distinction seem to be clear and undoubted.

From the Upper Carboniferous; Woodhouse Coal, Cheadle Coal-field. The specimen, from the Ward collection, is now in the British Museum, but was previously lent to me by Mr. Ward for description.

Position uncertain, probably Chimæroid:—

Harpacanthus major, sp. n. (Pl. IX. fig. 8.)

One specimen only. Spine slender, pretty strongly curved, and at the base again slightly recurved; $2\frac{3}{4}$ inches in length, but, being broken off distally, it must originally have been longer; rounded in transverse section at the base, but becoming laterally flattened further on, and with the convex margin slightly sharper than the concave one. On the distal third of the concave margin, presumably the anterior, are seen three stout recurved denticles, their apices $\frac{3}{8}$ inch apart from each other; at the broken distal extremity is seen the cross section of a laterally compressed internal tubular cavity.

This spine obviously belongs to the genus *Harpacanthus*, which I proposed some years ago * for the *Tristychius fimbri-*

* Ann. & Mag. Nat. Hist. (5) vol. xviii. 1886, p. 493.

atus of Stock, but differs from that species not only in being a larger spine, but also in the much greater proportional size, stoutness, and smaller number of the recurved denticles. In both species these denticles form a single row.

Lower Carboniferous; in shale in connexion with the "Blue Coal," Niddrie Colliery, near Edinburgh.

Prof. Anton Fritsch, of Prague, has thrown out the suggestion that *Harpacanthus* may be not an Elasmobranch or Chimæroid spine, but a "bezahnter Kiemenbogen"—a teleostomous gill-arch with anchylosed gill-rakers, as in his *Trissolepis* from the Bohemian gas-coal *. I have, however, elsewhere shown † that the configuration of these bodies renders this view untenable, and my belief is that they were, like the spine of *Squaloraia*, median appendages on the heads of Chimæroid fishes.

Palæoniscidæ.

Eurylepis anglica, sp. n. (Pl. IX. fig. 9.)

This is the posterior part of a cranial shield, representing the fused parietals, frontals, and squamosals; it is $\frac{1}{4}$ inch in length and the same in breadth across the parietal region. It is ornamented with tolerably coarse rounded ridges, which are comparatively slightly elevated and mainly follow a direction concentric with the margins of the respective bones, except at the anterior angle of each frontal, where there is a group of ridges, which pass obliquely inwards and a little backwards, so as in the middle line to meet those of the opposite side at an obtuse angle.

This little relic is almost identical with the similar cranial shield of *Eurylepis tuberculata*, Newberry ‡, from the Coal-measures of Linton, Ohio, but differs in the ornament being more of a ridged than tuberculated character.

Messrs. Hancock and Atthey mention, without description, the occurrence of a fish in the Northumberland coal-field, which they suspected might belong to Newberry's *Eurylepis*; but there cannot be any doubt of the generic position of this, the first figured English specimen.

From the Ash Coal-shale, Upper Carboniferous, Longton, Staffordshire. Collected by Mr. J. Ward, F.G.S., by whom it was lent to me for description; the specimen is now in the British Museum.

* 'Fauna der Gaskohle und der Kalksteine der Permformation Böhmens,' Band iii. Heft 2.

† Geol. Mag. (3) vol. x. 1893, p. 178.

‡ Geol. Survey Ohio, Palæontology, vol. i. p. 350, pl. xxxviii. fig. 2 *c*.

EXPLANATION OF PLATE IX.

Fig. 1. *Acanthaspis prümensis*, Traq. Natural size.
Fig. 2. *Euphyacanthus semistriatus*, Traq. Slender form; natural size.
Fig. 3. The same. Stout form. Natural size.
Fig. 4. The same. Portion of the posterior area; magnified.
Fig. 5. The same. Posterior denticles; magnified.
Fig. 6. The same. Outline of transverse section; magnified.
Fig. 7. *Acanthodopsis microdon*, Traq. One half larger than natural size.
Fig. 8. *Harpacanthus major*, Traq. Natural size.
Fig. 9. *Eurylepis anglica*, Traq. Greater part of cranial roof; magnified two diameters.

XLVI.—*On the Genus* Phryniscus *of Wiegmann.* By G. A. Boulenger, F.R.S.

The last number of Hilgendorf's 'Archiv für Naturgeschichte' (lx. i. Heft 2) contains an article by Dr. R. A. Philippi, of Santiago, entitled "*Phryniscus* Bibron ist nicht *Phryniscus* Wiegmann," a proposition which everyone who carefully compares the original descriptions will readily endorse. It has been my fault to follow tradition in applying the name *Phryniscus* to a genus of frogs for which it was not originally intended. I am therefore bound to tender an apology for not having detected before the error into which all my predecessors had fallen, and to offer some further remarks on this matter of nomenclature, which it is desirable to settle with a full knowledge of the literature, which, unfortunately, Dr. Philippi does not appear to possess.

I am all the better able to give an opinion on the matter, as the British Museum is now in possession of specimens of the true *Phryniscus nigricans* of Wiegmann, collected at Tarapacá, Chili, by Mr. Lane, and presented by the late Mr. H. B. James. This Batrachian bears no relation to the Eastern form currently named *Phryniscus nigricans*, D. & B.; it is a *Bufo*, closely allied to *B. variegatus*, Gthr., which is the type of Günther's genus *Nannophryne* (1870), a name which is therefore a strict synonym of *Phryniscus* (1834). But as I cannot regard, in this case, the absence of a tympanum as a character justifying generic separation, *Phryniscus* must lapse into the synonymy of *Bufo*, Laur. (1768), and *Phryniscus nigricans* should be called *Bufo nigricans*.

As to the Engystomatoid genus which has hitherto passed under the name of *Phryniscus*, it is clear that it must receive that of *Atelopus*, Duméril and Bibron (1841)*,

* This name has priority over that of the fish-genus *Ateleopus*, Schleg. (1846).

which stands next on the list of synonyms. The name *Chaunus*, Tschudi (1838), cannot be used, as the genus was established by Wagler (1828) for a species of *Bufo*. The specific name *Phryniscus formosus*, Tschudi, suggested by Philippi to replace *Phryniscus nigricans*, must be rejected, as nothing but a *nomen nudum*, and *Phryniscus guttatus*, Philippi, 1861, appears to be a synonym of the true *P. nigricans*. The only name available is *Phryniscus Stelzneri*, Weyenbergh, Period. Arg. i. 1875, p. 331; and the species should henceforth be designated *Atelopus Stelzneri*.

The other species of the genus *Atelopus* are:—

Atelopus proboscideus, Blgr., *A. ignescens*, Cornalia (*lævis*, Gthr.), *A. seminiferus*, Cope, *A. varius*, Stann., *A. longirostris*, Cope, *A. flavescens*, D. & B., *A. pulcher*, Blgr., *A. cruciger*, Mart., *A. elegans*, Blgr., and *A. Bibronii*, Schmidt.

XLVII.—*Description of a new* Anolis *from Antigua, West Indies.* By G. A. Boulenger, F.R.S.

A small collection of Reptiles from Antigua was presented to the Natural-History Museum by Mr. Francis Watts, of the Government Laboratory, Antigua. It contains examples of four species, viz.:—*Typhlops lumbricalis*, *Thecadactylus rapicauda*, *Anolis Leachii*, and a new *Anolis*, a description of which is given in this note.

Anolis Wattsii.

Head nearly twice as long as broad, longer than the tibia; snout rather strongly depressed; forehead concave, with distinct ridges; upper head-scales smooth; scales of the supraorbital semicircles strongly enlarged, in contact in the middle; six or seven enlarged keeled supraocular scales, separated from the supraorbitals by one row of granules; occipital smaller than the eye-opening, separated from the supraorbital semicircles by three or four rows of small granular scales; canthus rostralis sharp, canthal scales three; loreal rows five; six or seven labials to below the centre of the eye; ear-opening moderately large, vertically oval. Gular appendage moderately large, merely indicated in the female; gular scales keeled. Body compressed, without dorso-nuchal fold. Dorsal scales minutely granular, enlarged and keeled on the vertebral line; ventral scales a little larger than vertebrals, much smaller than antefemorals, strongly keeled, imbricate. Limbs moderately long; the adpressed hind limb reaches the anterior border of the orbit; digital expansions well developed; 23 lamellæ under phalanges II and III of the fourth toe. Tail compressed, with a serrated crest of strongly enlarged keeled scales. Male with enlarged postanal scales. Olive above, with the vertebral line lighter; some blackish longitudinal lines on the throat.

	♂. millim.	♀. millim.
Total length (tail reproduced)	80	62
Head	15	13
Width of head	8	7
Body	32	31
Fore limb	21	19
Hind limb	39	34
Tibia	11	10

Apparently nearest allied to *A. Krugi*, Peters, from Porto Rico, but distinguished by the smaller occipital scale.

XLVIII.—*On Two new Species of Agamoid Lizards from the Hadramut, South-eastern Arabia.* By John Anderson, M.D., F.R.S.

Aporoscelis Benti, sp. n.

Head moderately large, curved downwards and forwards from the vertex to the labial margin; cheeks of the male much swollen, those of the female hardly perceptibly so; snout very short, moderately pointed; canthus rostralis absent; nostrils directed forwards and outwards; ear a high vertical slit, its anterior border with a dentate margin of four or more strong triangular scales. The scales on the upper surface of the head and on the cheeks are smooth, irregular in size, and tessellated in arrangement, except on the occipital region, where they are slightly imbricate, and a few tending to be keeled; a line of enlarged scales below the eye; labials very small. The scales on the upper surface of the body are rather small, juxtaposed, faintly imbricate, and perfectly smooth; on the nape and on the sides they are smaller than on the back, but on the sides they become enlarged as they approach the ventrals; ventrals more or less subquadrangular and arranged in transverse lines, but less so on the chest; the scales on the throat are the smallest on the body, and as they approach the chest become almost granular. On the upper surfaces of the limbs the scales are enlarged, most so on the hind limbs, and are smooth, but, on the tibial portion of the hind limb, there are some very large keeled and spiny or conical scales. The limbs are of moderate length, but the hind limb does not quite reach to the axilla. The tail is much flattened above, and its broadest part is as broad as the head, while its length equals that of the body and one half of the head; it has 24 (or may be more or less) well-defined annuli, each furnished with from 10 to 12 spines, strongest and longest on the external border. On the sides of the neck and on the throat the skin is loose and thrown into folds.

The male is olive-grey above, covered with numerous dark brown lines, irregular in form and distribution, many tending to define round spots or ocelli of the general colour. On the head, but especially on its sides, the lines are more strongly marked and deep bluish black. The belly and upper surfaces of the limbs are greenish yellow, but the chin, throat, and chest are yellowish, broadly marbled with deep bluish black; and the greater part of the belly and under surfaces of limbs are marked with similarly coloured blotches. The tail above is uniform yellowish brown, and its under surface pale yellowish.

The females are much paler than the males and generally olive-grey, but the markings of the upper surface, in some, are reduced to fine dark brown spots, without any trace of lines or ocelli. The underparts are pale yellowish, with a few dark spots on the throat. The tail is pale yellowish brown, and in some the spines are marked with dark brown.

	♂. millim.	♀. millim.
Total length	330	310
Head	33	31
Width of head	37	33
Body and head	177	169

This species is distinguished from the other two members of the genus by its long tapering tail, by its scales, and also by its denticulated ear.

Six examples of this handsome lizard, three males and three females, were captured on Mr. Bent's expedition to the Hadramut by my collector, who, owing to the courtesy of Mr. Bent, was permitted to accompany him throughout his journey. They were obtained near Makulla, below the plateau.

Phrynocephalus arabicus, sp. n.

Head flat and rounded; forehead convex. Scales on the upper surface of the head moderately large, flattened, smooth, and tessellate, but slightly imbricate on the temporal region.

Nasals in contact or separate; nostrils directed upwards. No spiny scales on the sides of the neck. Upper surface of the body covered with smooth, rather small, imbricate scales, with a few slightly enlarged ones intermixed. Scales on the upper surfaces of the limbs perfectly smooth. The scales of the upper surface and sides of the tail generally, with the exception of a limited area on the mesial line of the tail at its root, are carinated and pointed. The scales on the entire under surface, from the chin to the vent, and also those of the under surfaces of the limbs, are smooth, but those on the belly are pointed. Fingers and toes are well fringed, especially the outer border of the fourth toe. Tibia rather long, equalling the length of the head and neck; the hind limb, when laid forwards, extends beyond the snout. Strong gular and lateral cervical folds and a fold along the sides.

General colour of the upper surface pale yellowish, rather densely covered with brown, yellowish, and salmon-coloured round spots. The upper surfaces of the limbs tending to be barred with brown, and more or less spotted like the trunk; hands and feet yellowish. Under surface white. The under surface of the tail salmon-coloured in its proximal half, with three or four black bands towards its end.

	♂. millim.	♀. millim.
Total length	76	78
Length of head	9·6	9·7
,, of head and body	37	36·5
,, of tail	39	41·5
,, of tibia	12	12
,, of hind limb	33·6	35

This species is most closely allied to the *P. luteoguttatus*, Boulenger, from northern Baluchistan, with the types of which it has been compared. It differs from it, however, in its smaller dorsal scales, and in the scales generally of the head, and upper and under surfaces of the body and limbs being smooth. It is further distinguished from *P. interscapularis*, Lichtenstein, by the upper surface of the head having large smooth scales, and by its dorsal region being covered with much larger, and smooth scales, and by the absence of projecting spinose scales on the sides of the neck, and of a fringe on the hinder aspect of the thighs.

This interesting discovery extends the southward distribution of the genus *Phrynocephalus* to within 16 degrees of the equator. The specimens, two in number, were obtained on the plateau of the Hadramut, on Mr. Bent's expedition.

XLIX.—*Descriptions of new Coleoptera from New Zealand.* By Captain Thos. Broun.

[Continued from p. 312.]

Group **Anisodactylidæ.**

Lecanomerus pallipes, sp. n.

Subdepressed, oblong-oval, shining; piceo-fuscous, the palpi, antennæ, and the sides and apices of the elytra testaceous; the sides of the thorax narrowly bordered with fusco-testaceous; the labrum, mandibles, and elytral suture rufescent; legs very pale yellow.

Thorax one third broader than long, its sides regularly rounded, so that the base and apex are of about equal width; posterior angles curvate and quite obtuse; the slender basal margin is obsolete near the middle; the dorsal groove is not deep and it is abbreviated; there is hardly any trace of basal fossæ. *Elytra* oblong-oval, with fine simple striæ; the interstices broad and plane.

This most nearly resembles No. 98; it is a little less convex, the thorax is not straight, or nearly straight, behind the middle and appreciably wider near the front than it is at the base, as is the case in *L. fuliginosus*; the elytra are more oblong, less narrowed posteriorly, and a little flatter above; the legs are thinner and very much paler, and the hind tibiæ are less curvate.

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

Dyer's Pass, Canterbury. Mr. Suter sent me a specimen in June 1893.

Group **Hydrophilidæ.**

Cyloma Stewarti, sp. n.

Convex, ovate-oblong, glabrous, shining; fuscous, the front of the head, sides of thorax, the shoulders, sides, and apices of elytra, and a large transverse space on the top of the posterior declivity fusco-testaceous; the legs and palpi of nearly similar pale colour; antennæ and tarsi yellowish, club dull and slightly infuscate.

Head narrowed in front of the eyes, distinctly and rather closely punctate, much more finely in front; clypeus truncate. *Eyes* prominent, distinctly facetted. *Thorax* transverse, gradually narrowed towards the anterior angles, which are rounded, its sides finely margined, the base slightly sinuate; its sculpture resembles that of the head, but becomes finer near the sides. *Elytra* oblong, slightly wider than the base of the thorax, rounded behind; their whole surface is finely punctured, each has ten series of large closely placed punctures, those nearest the suture become obsolete towards the base; there is a well-marked sutural stria behind.

Underside fuscous, closely sculptured, finely pubescent.

This differs much in appearance from *C. Lawsonus*, which is more convex and broadly oval. The form is more like that of *Saphydrus*. The *mentum* is depressed in the middle and emarginate in front. The *prosternum* has no carina. The *mesosternum* is furnished with a similar but rather smaller process, which is acuminate in front. The *metasternum* is obtusely elevated in the middle; this part is more coarsely but not so densely punctured as the sides. *Posterior femora* finely punctured and pubescent. The basal joint of the *hind tarsus* is shorter than the second. The *antennæ* are 8-articulate, the club is laxly jointed.

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

Tarukenga, near Rotorua. Mr. James Stewart, C.E., the engineer of the Rotorua railway, found two specimens on the ground. I have much pleasure in naming the species in his honour.

Obs. Var. $2\frac{1}{8} \times 1\frac{1}{8}$.—Rather more oviform, eyes more prominent, sculpture a little coarser, sides of thorax nearly quite straight instead of being slightly curvate.

Mount Pirongia. One, December 1893.

Group **Aleocharidæ.**

Ocalea crepera, sp. n.

Shining, smoky brown; legs fusco-testaceous; the tarsi and first joint of the antennæ testaceous; the fine depressed pubescence is yellowish, the coarse lateral setæ are fuscous.

Head not quite as wide as the middle of the thorax, rather finely and not closely punctured. *Eyes* oviform, not prominent. *Antennæ* as long as the head and thorax, pubescent, fuscous; joints 4 to 10 become shorter and broader, tenth quadrate, eleventh large, subovate. *Thorax* rather longer than broad, slightly rounded near the front, the sides nearly straight; its surface is finely but not closely punctate. *Elytra* subquadrate, much wider than the thorax, their punctuation rather more distinct. *Hind body* elongate, attenuate posteriorly.

Like *Ocalea socialis* (No. 165), the clothing more conspicuous, the antennæ rather longer and with but one pallid joint.

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

Tarukenga, near Rotorua. A single individual, taken off foliage.

Calodera sericophora, sp. n.

Elongate, moderately nitid; elytra red, head and thorax fusco-rufous, hind body variegated castaneous, legs and antennæ pale reddish, tarsi and palpi yellow; clothed with slender, decumbent, pale yellow, silky pubescence, the abdomen with coarser yellow hairs.

Head subovate, nearly the length of the thorax; its punctuation very fine, not at all close, and rather shallow. *Eyes* prominent. *Antennæ* rather short, gradually incrassate; second joint nearly as stout and elongate as the first, third a little longer than broad, fourth subquadrate, fifth shorter than fourth, sixth to tenth transverse, eleventh large. *Thorax* but little longer than it is broad, slightly and gradually narrowed behind, much rounded and narrowed in front, the base slightly curvate; its surface sculptured like the head, the broad central depression appears shallow and interrupted in the middle, but when looked at from the side it appears continuous. *Elytra* quadrate, broader than the thorax, parallel-sided, more distinctly and closely punctured than the head. *Hind body* elongate. *Legs* moderately long and slender, finely and rather densely pubescent.

This is very different from Nos. 171, 172, 173, 174, and 175. In No. 1693 (*C. algophila*) the thorax is almost parallel-sided, and its greyish hairs are disposed transversely; the elytra are distinctly broader at the base than they are behind; the head is evidently narrower than it is in *C. sericophora*.

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

West Plains, Invercargill. One, sent by Mr. A. Philpott.

Calodera granifer, sp. n.

Elongate; the head, thorax, and elytra rufo-fuscous and subopaque, each elytron with a large dark space near the hind angle; hind body glossy castaneous, the last two segments and the legs chestnut-red; antennæ dull red.

Head moderately large and broad, distinctly and closely punctured, nearly quite smooth in front. *Antennæ* elongate and stout, gradually incrassate, with erect fuscous setæ; joints 5 to 10 slightly asperate, third joint elongate, rather longer than the first, distinctly longer than the second; fourth longer than broad, fifth a little shorter and thicker; joints 8 to 10 transverse, eleventh nearly twice the length of the tenth. *Thorax* rather longer than broad, widest before the middle, its punctuation slightly finer than that of the head, still finer in front; near the base in the middle there is a fovea-like depression; when looked at from the side there appears to be a fine dorsal furrow; the base is broadly rounded and margined; the pubescence is yellow, but very scanty and slender; there are also some fine fuscous setæ along the sides. *Elytra* subquadrate, much broader than the thorax, with rounded shoulders; their sculpture is distinct, close, rugose or granular, but becomes finer towards the apices; the yellowish pubescence is most conspicuous across the middle and near the hinder portion of the suture. *Hind body* with more distinct but more scanty clothing; the depressed basal portion of the first four segments with elongate punctiform impressions arranged in transverse series; the fifth, behind, with two or three rows of oviform granular elevations across it; the sixth much rounded, with numerous rather coarse granules. *Legs* elongate, with fine pubescence.

This may be placed near *C. œraria* (No. 173); it has, however, longer antennæ and a broader head. It may be distinguished from all the previously described species by the obvious granular sculpture of the terminal abdominal segments. In No. 171, a very different insect, the granules on these segments are finer and more distant.

Length $2\frac{1}{4}$, breadth $\frac{1}{2}$ line.

Waitakerei Range. One example.

Calodera diversa, sp. n.

Elongate; head and thorax dark red, elytra pale yellowish red, abdomen rufo-castaneous and more nitid than the thorax, legs and antennæ obscure red.

Closely allied to *C. granifer*, more brightly coloured; the *thorax* has a more evident dorsal furrow, which is expanded near the extremities; the sculpture is rather closer and finer, and it is rather densely clothed with fine silky yellow hairs; the *elytra* are much more finely and distantly sculptured and not at all rugose, their pubescence is dense and bright yellow; the fifth *dorsal segment* is not granulate: the *antennæ* differ, they are rather shorter and are without erect fuscous setæ; their first three joints, though elongate, are shorter, the fourth and fifth joints are not longer than broad, being just about quadrate; joints 6 to 10 are transverse.

Length $1\frac{7}{8}$, breadth quite $\frac{3}{8}$ line.

Howick. One individual only.

Calodera vestita, sp. n.

Elongate; abdomen glossy fuscous, head and thorax fusco rufous and only slightly shining, the legs, antennæ, and elytra red; pubescence slender, yellow, not so conspicuous on the head and thorax as on the elytra.

Antennæ longer and stouter than in *C. sericophora*, their three basal joints elongate, the third shorter than the first or second, fourth about as long as broad, fifth to tenth transverse, the terminal conical and large; they bear fine pubescence, and short, erect, slender setæ. *Head* slightly narrowed behind the eyes, distinctly and closely punctured, more indistinctly behind, smooth in front. *Thorax* oviform, about as broad as it is long, its sculpture like that of the head, the central groove broad and deep near the base and apex. *Elytra* subquadrate, rather finely and not closely punctured, more indistinctly behind. *Hind body* finely and indistinctly sculptured, but with coarser punctures across the base of the four first segments, the fifth distantly and minutely asperate, the sixth retracted but apparently granulate. *Legs* long and slender, with short pubescence.

Somewhat similar to No. 173, the wing-cases and antennæ longer, the punctuation of the head and thorax neither so close nor distinct. It is larger and less shining than *C. sericophora*, with much more evident punctures on the head and thorax.

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

West Plains, Southland. I am indebted to Mr. Alfred Philpott for my specimen; it was found in August 1893.

Calodera tumidella, sp. n.

Elongate, subopaque, hind body shining castaneous; the head, thorax, and elytra obscure red; femora and three basal joints of the antennæ red; the two hind pairs of tibiæ and joints 4 to 10 of the antennæ fuscous; pubescence yellowish grey, rather dense on elytra.

Head rather large, rounded behind, its punctuation distinct and close, quite dense near the sides. *Antennæ* rather short and stout, the basal three joints elongate and nearly equal, fourth about as long as broad, fifth to tenth transverse, eleventh conical. *Thorax* about as broad as it is long, widest before the middle; distinctly and closely punctured, finely and densely near the front, less distinctly near the base; the sculpture on some parts appears minutely rugose; there is a central basal fovea, but no dorsal channel. *Elytra* hardly longer than broad, closely sculptured, slightly rugose, quite densely and minutely sculptured at each side of the scutellum, less closely near the apices; on each elytron, nearly as far from the suture as from the base, there is a small swelling. *Abdomen* elongate, finely sculptured, the base of the first four segments evidently punctured, fifth and sixth simple; it bears distinct yellow hairs.

In this species the sculpture of the anterior portion of the body is denser than usual. It may be identified at once by the small callosity on each elytron. The pubescence in fresh examples is probably more conspicuous; on the wing-cases it is nearly grey.

Length $1\frac{7}{8}$, breadth $\frac{3}{8}$ line.

Woodhill, near Kaipara railway. One specimen only.

Calodera bituberculata, sp. n.

Shining, chestnut-red; legs and antennæ paler; pubescence slender, greyish yellow.

Head oviform, moderately finely and not closely punctured. *Eyes* oval, not convex, nearly half the length of the sides of the head. *Antennæ* stout, joints 6 to 10 transverse. *Thorax* rather broader than long, finely margined, the base and sides a little rounded; posterior angles nearly rectangular, but not distinct; the sculpture is nearly similar to that of the head, there is a small transverse impression before the scutellum but no distinct dorsal groove. *Elytra* quadrate, slightly wider than the thorax, with coarser sculpture; it is, however, rather indefinite, and appears to consist of punctures or minute granules, according to the light; on each elytron, close to the suture, before the middle, there is an evident tubercle or nodosity. *Hind body* elongate, narrower than the elytra, parallel, broadly marginated; its sculpture is granular, on the pale fifth segment the granules are most apparent, the fourth is slightly piceous.

The well-developed elytral nodosities and the granular sculpture of the dorsal segments render its recognition easy. The head is much narrower than that of *C. tumidella*, which, moreover, is a larger insect, with coarser and different sculpture.

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

Howick. One, found under a log.

Calodera fungicola, sp. n.

Robust, not parallel, glossy; variegate rufo-fuscous, more or less bronzed; the legs and the basal two joints of the antennæ reddish, tarsi paler; pubescence conspicuous, yellowish.

Head oviform, rather narrow, distantly punctured. *Labrum* large, transverse, truncate in front. *Eyes* moderately large, oval. *Antennæ* stout, reaching backwards beyond the base of the thorax, the basal three joints nearly equally elongate; 4 to 10 become shorter and broader, dull piceous, and densely pubescent, eleventh large. *Thorax* quite as long as broad, the base subtruncate in the middle, apex rounded; the posterior angles obtuse, but nearly rectangular; the anterior rounded and much depressed, so that the front appears much narrowed; at each side there is a slight sinuation behind the middle; the fine central longitudinal groove terminates in a transverse fovea near the base; the surface is distinctly but not closely punctured. *Elytra* ample, quadrate; the suture is a little depressed near the base and slightly raised behind; they are moderately closely but not very coarsely punctured. *Hind body* elongate, not quite the breadth of the elytra, finely and remotely punctate.

This may be located near *C. vulcanica*, Fauvel; the head of that species is broader behind the eyes, the thorax is oviform and densely sculptured, the elytra appear slightly asperate, and the dorsal segments of the abdomen are finely granulate near the base.

Length $1\frac{1}{2}$–$1\frac{3}{4}$, breadth quite $\frac{3}{8}$ line.

Ngatira, near the railway to Rotorua. Five specimens, taken out of fungi.

Aleochara semifusca, sp. n.

Elongate, moderately nitid; pubescence flavescent, dense, slender and depressed; head fuscous, thorax and elytra pale rufo-fuscous, hind body æneo-castaneous, legs red, tarsi yellowish.

Head not broader than the front of the thorax, moderately closely and rather finely punctured, the narrow inter-antennal portion smooth and shining. *Eyes* longitudinally oval and a little convex. *Antennæ* pubescent, about the length of the head and thorax; joints 4 to 10 each shorter and broader than its predecessor, 8 to 10 strongly transverse; the elongate basal three and the terminal one are reddish, the others fuscous. *Thorax* nearly one half broader than long, the sides and base finely margined and curvate, posterior angles nearly rectangular; its punctuation moderately fine, rather closer than that of the head. *Elytra* about a third shorter than broad; apices very obtusely rounded individually; there is a notch near the sides, so that the hind angles are directed backwards; their sculpture is like that of the thorax, but slightly deeper. *Hind body* elongate, more distantly punctured.

No. 166 (*Aleochara puber*) is very much like this species.

Length $1\frac{3}{4}$, breadth $\frac{1}{2}$ line.

Mount Pirongia. Three examples, on the ground amongst decaying leaves.

Encephalus latulus, sp. n.

Broad, oblong-oval, shining, obscure fusco-rufous; thorax darker, abdomen glossy, with a brassy tinge, the apical segments nearly testaceous; the four or five terminal joints of the antennæ are fuscous, the remainder are paler but not testaceous; tarsi testaceous.

Head narrowed anteriorly, nearly smooth. *Eyes* moderately large. *Antennæ* elongate, joints 5 to 10 with dark outstanding hairs; the basal two joints nearly equally stout and elongate, third about the same length as the second, but much more slender; fourth distinctly longer than broad, dilated towards the extremity; fifth rather thicker than the preceding one, sixth to tenth gradually incrassate, ninth and tenth transverse, eleventh longer. *Thorax* transverse, its angles nearly rectangular; the anterior are depressed, thus causing the sides to appear more narrowed in front than is really the case; the base is subtruncate; its surface is closely but minutely and indistinctly punctured. *Elytra* about thrice as broad as they are long, of the same width as the base of the thorax; the sides are ridged towards the outer extremity, so that the hind angles appear to project backwards; the suture is smooth, the rest of their surface is closely and finely but not distinctly punctured. *Hind body* as broad as the elytra, curvedly narrowed from the fourth segment backwards, indistinctly sculptured and pubescent; on the fourth and fifth segments there are two minute tubercles near each side and two widely distant ones nearer the middle close to the apical margins; the third has two near each side, but none on the middle.

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

Wairoa North. One from Mr. G. Campbell Munro.

[To be continued.]

MISCELLANEOUS.

Researches on the Structure, Organization, and Classification of the Fossil Reptilia.—Part IX. Section 5. *On the Cynodontia.* By H. G. Seeley, F.R.S.

The Cynodontia is a division of the Theriodontia in which there are long and large temporal vacuities in the skull, formed chiefly by the squamosal and malar bones; in which there is no descending pedicle to the squamosal bone; in which the occipital condyle is crescentic and imperfectly divided into two lateral parts; and in which the hinder molar teeth, larger than the incisor teeth, develop anterior and posterior cusps, are compressed from side to side, and overlap with shear-like action the teeth of the mandible. The principal new genera included in this group are *Cynognathus*, which is known from several skulls and one fairly complete skeleton, and the genus *Tribolodon*, which does not differ in a striking way from the small Cynodonts previously known, referred to the genera *Galesaurus*, *Nythosaurus*, and *Thrinaxodon*.

The skeleton of *Cynognathus crateronotus* was found at Lady Frere, near Queenstown. A single tooth of this genus had already been obtained by Mr. Alfred Brown at Aliwal North. The skull is between 15 and 16 inches long, 8 inches high at the orbits, and higher at the occiput, where it was about 9 inches wide. The lateral aspect is remarkably mammalian, owing to the great development of the dentary bone, which forms a new type of lower jaw, and has a greatly developed coronoid process, and to the form of the zygoma. On the palate the palatine and transverse bones form a descending arch between the rami of the mandible, as in crocodiles, *Sphenodon*, and Lizards. The composite structure of the lower jaw is seen on its inner side. The prefrontal and postfrontal bones remain distinct. There is a small quadrate bone embedded in the large squamosal bone. The latter resembles that of mammals, both in its extension along the zygoma and its expansion as a squamous plate on the side of the brain-case.

There are four incisors in each premaxillary; their margins are serrated. There appear to be but three mandibular incisors on each side, so that the type resembles *Cynochampsa*; but there is no evidence of close affinity with that genus. The canine teeth are large, worn on the anterior border, and serrated on the hinder margin. Remnants of canine teeth are indicated which have been replaced by those which persist. There are nine molar teeth, of which the first five are smaller than the posterior teeth. Those teeth are more than half as wide again from front to back as the anterior teeth. The hinder teeth have the principal cusp directed backward, with one subordinate pointed cusp on the front margin and two subordinate cusps on the hinder margin. The crowns of the teeth stand high above the alveolar margin in this species. They are intermediate in form of crown between *Canis* and *Zeuglodon*.

The nares are terminal, divided, lateral, and arch forward in front of the alveolar margin. The orbit of the eye is 8 inches behind the extremity of the snout, nearly circular, and separated from the temporal vacuity by the postfrontal bone. The postfrontal bones converge backward along the parietal crest. The malar bone develops a slight descending process on its inferior margin. There is no interorbital septum ossified. The type species of *Cynognathus* shows on the one side preserved a small postorbital foramen, comparable to that of *Procolophon*, and the author considers that the enlargement of this foramen makes an essential difference in plan between the skulls of Teleosaurs and Theriodonts, and regards the mammalian zygoma as resulting from the obliteration of the postorbital vacuity which defines the superior and inferior temporal arcades in Saurischia and other Reptilia.

In general structure of palate *Cynognathus* resembles *Lycosaurus*. There is no transverse boundary to the hard palate, but the palatonares are lanceolate. The author finds that the downward development of the bones of the palate at the posterior borders of the nares, while thoroughly reptilian, approximates to the condition in mammals.

The form of the lower jaw approximates to that of the older mammals and lower mammalian types, leading to the conclusion that the mammalian lower jaw consists essentially of the dentary bone. The dentary bone is compared to that of *Micronodon* in form and development of the angle of the jaw.

The shoulder-girdle consists of a large scapula, small coracoid, and compressed pre-coracoid. The scapula demonstrates the origin of a spine like that of the scapula in mammals by outward development of the anterior border of the scapula in reptiles. This spine is defined by a prescapular development anteriorly. The spine may have been originally a separate ossification, such as in *Pareiasaurus* has been named epiclavicle. It terminates in an acromion which is reflected forward.

The humerus is imperfectly preserved, but has the distal condyles well developed; and the proximal crest has a form which is seen in marsupials, but the articular head is transverse.

The vertebral column measures 37 inches from the body of the atlas to the last lumbar vertebra, and its total length is 45 inches; but the extremity of the tail is lost. There appear to be only six cervicals defined by the form and direction of the transverse processes for the tubercles of the ribs. The head of the rib is attached to the intercentral suture, and in the first vertebra reaches the intercentrum. There are 29 presacral vertebræ, of which 18 may be counted as dorsal and 5 as lumbar. The most distinctive feature of the vertebral column is the interlocking of the ribs in the lower dorsal and lumbar region, where the ribs become transversely expanded and anchylosed to the side of the centrum. The neural arch in the lumbar region also interlocks by an arrangement resembling the zygosphene and zygantrum of serpents. No dorsal rib is completely preserved.

The sacrum is small and the sacral ribs are smaller than the lumbar ribs. They are four in number. The middle two vertebræ are anchylosed. The caudal vertebræ are short, only four are preserved; they indicate a considerable movement. There is no evidence of dermal armour. The characters of the vertebral column described by Professor Cope in *Dimetrodon* and allied genera closely resemble *Cynognathus*.

The pelvis consists of three bones; the ilium forms an expanded plate more resembling *Megalosaurus* than *Dicynodon*. There is a large longitudinal obturator foramen between the pubis and the ischium. The anterior transverse border of the pubis is cartilaginous, and there is no evidence of pre-pubic bones. The ischium is larger than the pubis. The author compares the anomodont pelvis with that of Plesiosauria, although *Pliosaurus* in the form of the ilium more closely approaches *Dicynodon* than *Cynognathus*.

The femur is imperfectly preserved. It was characterized, as in all Theriodonts known to the author, by the development of an immense inferior plate or ridge at the proximal end, which distinguishes it from allied animals. In this specimen the ridge is broken away. The head of the bone is greatly expanded transversely, and the distal end is not preserved.

Under the name *Cynognathus Berryi* the author describes imperfect evidence of a smaller skull of *Cynognathus*, which is distinguished from *C. crateronotus* with some doubt; but, if distinct, it is defined by the relatively large size of the middle mandibular incisor, the apparent presence of ten molars, in all of which the crowns overlap each other, and the roots are barely shown at the alveolar border. In the small species the cutting-margin and the cusps of the posterior teeth are better defined.

If the species are identical, the teeth have probably yet to be replaced by a successional series; but no known specimen of any genus shows such replacement.

The skull of *Cynognathus platyceps* was obtained by Dr. Kannemeyr at Wonderboom. It is a small species distinct from *Cynognathus crateronotus*. The skull has lost the extremity of the snout. It is remarkable for its depression. The teeth, however, are similar to those of the larger species; they have five denticles. The composite structure of the lower jaw is well shown, and the dentary bone behind the angle of the jaw retreats, so as to expose the elements which form the articulation.

The occipital plate of a large Theriodont skull from Lady Frere is described, which shows a circular foramen magnum and the perfectly preserved occipital condyles, which are not quite so completely separated as in mammals, having only a median groove between them on the ventral surface.

Another fragment of a skull preserved in the Albany Museum has only the preorbital portion preserved, and is remarkable for the small size of its incisor teeth, widely separated from each other, and for having two canine teeth parallel to each other. On both sides the crowns are imperfectly preserved. The molar teeth are on the type of *Cynognathus*, with a principal cusp flanked back and front by a small cusp, with a smaller accessory posterior cusp in the four hindermost teeth. As in all species of the genus the mandibular symphysis is long, oblique, and completely obliterated. There is a large pit with sharp margin in the median line in front of the orbits, which may be a generic difference from *Cynognathus*, since it occurs in the area in which other specimens show indications of a thin supra-nasal ossification flanked by a pair of small hemispherical concavities. It is indicated as *C. leptorhinus.*

Tribolodon frerensis is the name given to a dentary bone with few three-pronged teeth widely separated from each other standing high above the jaw. With this jaw is associated a femur which shows the transverse development of the great trochanter as strongly developed at the proximal end of the bone as in *Ichthyosaurus*, so that the trochanter minor of mammals only represents that of Theriodonts in miniature, the trochanter being more developed than in Saurischia or any other reptiles. With it is associated a right tibia, which is somewhat curved and nearly as long as the femur.

These Cynodont remains have given no certain evidence of the extremities of the limbs; but, with this exception, they make known the entire skeleton for the first time in an African Theriodont, furnishing data for comparison with mammals and reptiles in every part of the skeleton preserved.—*From the Proceedings of the Royal Society.* (Communicated by the Author.)

The Faunal Regions of Australia. By C. Hedley, F.L.S.

The discrimination of the various provinces into which the Australian fauna and flora group themselves has been frequently attempted. To the earlier naturalists, from a study of scanty material and with little or no personal knowledge of the continent, four divisions of east and west, temperate and tropical, seemed natural and sufficient. Hooker's 'Essay on the Australian Flora' paved the way for a better understanding of the relations which various localities bore to each other. Owing to fundamental errors of his interpretation of Australian geology, Wallace's treatment of the subject in 'Island Life' is of but slight value. To the writer, the most successful arrangement of the various biological regions yet proposed is that sketched by Professor Tate, in his address to the first meeting of this Association. This author accepts two main biological divisions—the *Autochthonian*, developed in west Australia, and the *Euronotian*, seated in eastern Australia and Tasmania; a subsidiary division, less in value and derivable from both the above, is the *Eremian*, or desert fauna and flora.

Taking this disposition as the basis of my remarks, I would observe that eastern Australia contains two distinct biological populations, where Professor Tate has located one—the *Euronotian.* This title, I propose, should be reserved for that fauna and flora characteristic of Tasmania, Victoria, and southern New South Wales; while the second and very distinct fauna and flora developed on the coasts of Queensland and northern New South Wales would best be described as Papuan. Indeed, so distinct is this latter, that a separation of Australian life into Papuan and non-Papuan seems to the writer to be the primary divisions into which fall the Australian fauna and flora.

The types encountered by a traveller in tropical Queensland, or rather in that narrow belt of tropical Queensland hemmed in between the Cordillera and the Pacific, all wear a foreign aspect. Among mammals may be instanced the cuscus and tree-kangaroo; among reptiles, the crocodile, the *Rana* or true frog, and the tree-snakes; among birds, the cassowary and rifle-birds; among butterflies, the *Ornithoptera*; among plants, the wild banana, orange and mangosteen, the rhododendron, the epiphytic orchids, and the palms; so that, in the heart of a great Queensland "scrub," a naturalist could scarcely answer, from his surroundings, whether he were in New Guinea or Australia. It may be supposed that late in the Tertiary epoch Torres Straits, now only a few fathoms deep, was upheaved, and that a stream of Papuan life poured into Australia across the bridge so made.

Sharply defined from the tropical jungle above mentioned are areas occupied by strictly Australian vegetation, which are left invariably in possession of the poorest tracts of land. From the rich lands, formerly no doubt possessed by them, everywhere have they been ousted by the invading flora.

Regarding the origin of the *Euronotian* fauna and flora, sundry facts collected by Mr. H. O. Forbes, in his paper on the Chatham Islands, would suggest a South American source. Assuming that, in or before the Miocene, continuous land extended from Tierra del Fuego to Tasmania, the derivation of the Australian marsupials appearing in the Pliocene from their South American allies *Prothylacinus* and *Amphiproviverra* of the Eocene would be clear. Mr. Forbes adduces strong confirmatory evidence from Professor Parker, who, on embryological grounds, does not hesitate to assume as ancestors of certain Australian crows a form allied to the American *Dendrocalaptine* birds. The distribution of the parrots and the cystignathous frogs appear also to sustain the theory. The extinct alligator, *Pallimnarchus*, found in Queensland and New South Wales, associated with *Diprotodon*, strengthens the chain of evidence, as does the occurrence in Tasmania and South Australia of *Gundlachia*, otherwise exclusively an American mollusk.

As the name implies, the *Autochthonian* is the oldest member of the Australian faunas and floras. The date of its arrival in Australia and the route which it traversed are lost in antiquity. Seeing that many resemblances exist between our vegetation and that of Timor and the south-east Austro-Malayan islands, perhaps these lands afforded the passage to Australia.

Summary.—Superimposed one above another may be distinguished three divisions of Australian life. The earliest is the *Autochthonian.* Possibly this arrived from the Austro-Malayan islands in or before the Cretaceous era, and spread over the whole of Australia. The next is the *Euronotian*. Probably this reached Tasmania from South America not later than the Miocene epoch; many of the original inhabitants, particularly on the east coast, probably disappeared before the invaders. Thirdly, a contingent of Papuan forms seized on the Queensland coast late in the Tertiary, and likewise largely exterminated their predecessors.—*From an advance proof of unpublished vol. from the writer, having been read at the Adelaide Meeting of the Australasian Association for the Advancement of Science, held September* 1893.

Note on a Species of Eubolina *six times described by Walker.* By A. G. Butler, Ph.D. &c.

In his 'Catalogue of Lepidoptera Heterocera,' vol. xv. p. 1688, Walker described a small moth from Venezuela under the name of *Celæna diffundens*.

The genus *Celæna* belongs to the first group of Noctuæ distinguished by the trifid character of the median branches of the secondaries; but *C. diffundens* clearly belongs to the quadrifid group, in which the radial vein is given off close to the third median branch.

In volume xxxiii. of his Catalogue Walker described the same species as *Homoptera excavata*, from St. Domingo, at page 879; as *H. minuscula*, from St. Domingo, and *H. scitior*, from Honduras, at p. 880; as *H. perpusilla*, from Honduras, at p. 881.

Lastly, in volume xxxiv. he again described the same species as *Pyralis? noctualis*, from Venezuela, at p. 1231.

This kind of work needs no comment—it sufficiently condemns itself; but it is important that the facts should be recorded. The following, then, will be the synonymy:—

Eubolina diffundens.

Celæna diffundens, Walker, Lep. Het. xv. p. 1688.
Homoptera excavata, Walker, *l. c.* xxxiii. p. 879.
Homoptera minuscula, Walker, *l. c.* p. 880.
Homoptera scitior, Walker, *l. c.*
Homoptera perpusilla, Walker, *l. c.* p. 881.
Pyralis? noctualis, Walker, *l. c.* xxxiv. p. 1231.

Venezuela, Honduras, and St. Domingo.

Description of a new Australian Snake. By J. Douglas Ogilby.

The habitat of the new species (*Hoplocephalus Waitii*), which differs mainly from *H. pallidiceps*, Günth., in having 21 series of scales round the body instead of only 15, appears to be the central district of New South Wales, whereas *H. pallidiceps* is a North Queensland form.—*From the Abstract of Proceedings of the Linnean Society of New South Wales*, May 30, 1894, p. ii.

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THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY,
INCLUDING
ZOOLOGY, BOTANY, AND GEOLOGY.

CONDUCTED BY
ALBERT C. L. G. GÜNTHER, M.A., M.D., Ph.D., F.R.S.,
WILLIAM CARRUTHERS, F.R.S., F.L.S., F.G.S.,
AND
WILLIAM FRANCIS, Ph.D., F.L.S.

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

WITH ONE PLATE.

Illustrative of Mr. A. S. Woodward's Paper on some Fish-remains from Queensland.

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THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SIXTH SERIES.]

No. 84. DECEMBER 1894.

L.—*Additions to the Cryptozoic Fauna of New Zealand.* By ARTHUR DENDY, D.Sc., Professor of Biology in the Canterbury College, University of New Zealand.

HAVING for the last six years devoted a considerable amount of time to the study of the cryptozoic * fauna of Australia, and especially of the Land-Planarians, the Nemertine *Geonemertes*, and *Peripatus*, which are so frequently found beneath logs and stones in the Australian bush, I have naturally turned my attention to the same groups of animals since my arrival in New Zealand at the beginning of this year.

The cryptozoic animals of New Zealand have certainly not received the attention which they deserve, and they still offer an almost untouched and very promising field for investigation to local naturalists.

The New Zealand *Peripatus*, indeed (*P. novæ-zealandiæ*, Hutton), has escaped the general neglect, having been the subject of an important memoir by Captain F. W. Hutton, F.R.S., published in the Ann. & Mag. of Nat. Hist. for November 1876; while Miss Sheldon has since published various observations on its anatomy and development in the Qu. Jour. of Micr. Sci.

None but the ordinary thirty-legged form has, however, as yet been recorded. In the present paper I shall have to note

* I proposed this term some years ago for the curious assemblage of animals, commonly found beneath logs and stones and in similar situations (*vide* 'Victorian Naturalist,' December 1889).

the occurrence of a form with sixteen pairs of legs instead of fifteen.

Of Land-Planarians only three species have as yet been described from New Zealand! The first was Moseley's *Geoplana Traversii*, received from Mr. Travers when H.M.S. 'Challenger' was at Wellington, and described by Professor Moseley in the Qu. Jour. of Micr. Sci.

In the Trans. New Zeal. Inst. for 1880 Captain Hutton described two more species from Dunedin and Wellington, which he named *Geoplana Moseleyi* and *Rhynchodemus testaceus* respectively. The latter, however, proves to be also a *Geoplana*.

The Land-Planarian fauna of New Zealand promises to be exceedingly rich, and I am already able to add thirteen species to the above list, four of which were found in my own garden at Christchurch, while for others I am indebted to the kindness of many friends who have interested themselves in the matter on my behalf. The additions include a *Rhynchodemus* and a *Bipalium*. The latter, however, is almost certainly introduced, and possibly also the former, the specimens of which appear to be identical with an Australian species. The majority of the species of Land-Planarians seem to be very closely related to Australian forms, but distinguishable by some slight difference in colour or pattern.

The most interesting addition to the cryptozoic fauna which I have to record, however, is an indigenous Land-Nemertine, quite distinct not only from the Australian species (*Geonemertes australiensis*, Dendy *) but also from any other previously described form. This will be described in the sequel under the name of *Geonemertes novæ-zealandiæ*, and its discovery brings the total number of known terrestrial Nemertines up to six.

I will now give a list of the cryptozoic animals above referred to, together with information sufficient for identification of the new forms. Fuller details will, I hope, be published in the 'Transactions of the New Zealand Institute.'

List of the Land-Planarians.

1. *Geoplana Traversii*, Moseley.

Geoplana Traversii, Moseley, Qu. Jour. Micr. Sci. vol. xvii. n. s. p. 284.

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* A detailed account of *Geonemertes australiensis* is given in the 'Proceedings of the Royal Society of Victoria' for 1891.

2. *Geoplana Moseleyi*, Hutton.

Geoplana Moseleyi, Hutton, Trans. N. Z. Inst. vol. xii. 1880, p. 277.

3. *Geoplana testacea*, Hutton, sp.

Rhynchodemus testaceus, Hutton, Trans. N. Z. Inst. vol. xii. 1880, p. 277.

It appears to me almost certain that this species is identical with Moseley's *Geoplana sanguinea* from Australia, and that Fletcher and Hamilton's *G. rubicunda* and my own *G. alba*, from New South Wales and Victoria respectively, are also identical. I have received specimens from Auckland, and have collected it myself at Tarawera township in the centre of the North Island; while Captain Hutton records it from Dunedin and Wellington.

I have not seen any specimens without eyes, as in the original description, and I believe that they are always present, though not so evident as in other members of the genus. It must, however, be remembered that in the closely related Tasmanian *G. typhlops* * the eyes appear to be certainly wanting.

4. *Geoplana triangulata*, sp. n.

This is a large species, commonly about 5 inches long when crawling and rather broad. In general form and habits it resembles *G. testacea*, to which it appears to be nearly related. It is, however, distinguished from that species by the presence of characteristic markings. There is a very broad band of a dark purplish-brown tint, occupying the middle two thirds or thereabouts of the dorsal surface. Outside this band the margins of the body are thin and translucent, and of a pale yellowish colour peppered with numerous minute specks of dark grey. The ventral surface is pale yellowish, thickly peppered with minute grey specks.

The name *triangulata* is given on account of the presence, under certain conditions, of a strongly-marked median dorsal ridge, a character also found in the Victorian *G. alba*.

This worm is very common in gardens about Christchurch. It feeds upon earthworms and is frequently dug up with the spade. It is also found under old wood &c. as usual.

A variety of this species occurs at Dunedin, characterized by the absence of the grey specks from the margins and ventral surface. A specimen of this variety in the Dunedin

* Dendy, Proc. R. S. Victoria, 1893, p. 184.

Museum measures 8 inches in length and $\frac{1}{3}$ inch in breadth, even after preservation in spirit. I propose for it the varietal name *australis*, but it comes very near to *G. testacea*.

5. *Geoplana splendens*, sp. n.

When at rest very broad and flat, when crawling convex above and flat beneath. Dorsal surface with three emerald-green stripes alternating with four rather broader dark brown stripes, and with narrow pale grey margins. Ventral surface pale purplish grey without stripes. Peripharyngeal aperture near the middle of the body, and the genital one about halfway between it and the posterior end.

This very handsome species was found at Jackson's, west of the Otira Gorge, in the South Island.

6. *Geoplana gelatinosa*, sp. n.

When at rest the body is very broad, flat, and extremely thin, with crinkled edges. The dorsal surface is dark olive-brown, with irregular rounded splotches of a lighter colour, like the knots in wood, and also with small whitish specks.

The colour and markings of the worm formed a close imitation of the piece of wet rotten bark on which it lay, and on which it appeared like a mere slimy patch. The ventral surface is light yellowish brown, finely speckled with dark brown. The peripharyngeal aperture in spirit is well behind the middle (but in the middle third) and the genital one about halfway between it and the posterior end.

The thin translucent character of the body in this species is very remarkable for a terrestrial Planarian.

Locality same as last.

7. *Geoplana Mariæ*, sp. n.

This species closely resembles the Australian *G. Fletcheri* and the Tasmanian *G. Mortoni*. The characteristic shape of the body is the same in all, and in all the ground-colour is yellow, with more or less well-developed brown speckles. In the present species there are no continuous longitudinal stripes of brown, but the dark specks are closely aggregated on either side of a narrow mid-dorsal band to form a pair of ill-defined dark bands. The pale yellow ventral surface is also speckled with brown. The position of the apertures is much the same as in *G. Fletcheri*.

Locality same as last.

8. *Geoplana Laingii*, sp. n.

When crawling about 3 inches long and $\frac{1}{8}$ inch broad; much flattened below and ridged on the dorsal surface, so as to be triangular in cross section; tapering gradually in front and behind. Slimy and sticky as usual, but with the dorsal surface minutely rugose or warty (granulated). When at rest short and thick, slug-like. External apertures very far back. Dorsal surface yellowish brown, finely mottled with a darker tint of the same. In the mid-dorsal region is a narrow band of dull orange, divided into two by a very fine median line of darker brown, and edged on each side by a fine black line. Anterior tip pinkish. Ventral surface pale yellow, finely mottled with pale brown.

This species was found under stones at the foot of Lake Taupo in the North Island by Mr. R. M. Laing.

9. *Geoplana Graffii*, sp. n.

Body when at rest very broad and flat and rather abruptly pointed at both ends. Under surface very flat; upper surface sloping up on each side to a median longitudinal ridge, so that the body is obtusely triangular in section. When crawling long and narrow and more oval in section, narrower in front than behind. Attains a length of about 2 inches when crawling. The greater part of the dorsal surface is very dark purplish brown, sometimes nearly black in colour. Along the median ridge is a narrow band of much paler tint, in which fine irregular longitudinal stripes or marblings of greenish, bluish, or brownish tint may appear. Usually the lateral margins of the dorsal surface are occupied each by a narrow band of paler brown. The whole dorsal surface is flecked with small specks and dashes of pale greenish blue, clearly visible to the naked eye, and giving the animal a very handsome appearance. The ventral surface is of a somewhat paler brown than the dorsal, with a still paler median band and margins. It is flecked all over with very minute specks of whitish or very pale blue, and may have a finely marbled appearance. In spirit the dorsal surface is strongly convex and the ventral flattened, and the anterior end abruptly narrowed. The peripharyngeal aperture is about central, and the genital about halfway between it and the posterior extremity.

This species is very common in gardens about Christchurch, and I have also received it from Dunedin and Ashburton.

10. *Geoplana subquadrangulata*, sp. n.

In shape, size, and general coloration this little Planarian closely resembles the Victorian *G. quadrangulata* and *G. ventropunctata*. In some respects it appears to connect these two species; and I am very doubtful whether all these three should not be considered as mere varieties of the same. The chief distinguishing feature of the New Zealand form is the presence of three well-marked stripes of dark brown on the dorsal surface, one very narrow median stripe and a pair of much broader ones.

The lateral and ventral surfaces may or may not be mottled with dark brown, and thus we have two varieties of the New Zealand form corresponding to the Victorian *ventropunctata* and *quadrangulata* respectively; but these two varieties are in New Zealand connected by intermediate forms, and occur mixed up together in the same localities.

The species is very common at Christchurch, Ashburton, and Dunedin, while at the Bluff, in the extreme south, I found what seems to be another variety of the same with three dark stripes on each side of the mid-dorsal stripe.

11. *Geoplana inæqualistriata*, sp. n.

The body in life is flat ventrally and convex dorsally. When fully extended (about $2\frac{1}{2}$ inches in length) it is long and narrow and tapers gradually to each end. The dorsal surface is dark brownish grey, with streaks of pale dull yellow arranged as follows:—a narrow median stripe continuous from end to end; on each side of this comes an uninterrupted band of the dark grey, occupying about one quarter of the total width of the dorsal surface. The outer quarter of the width on each side is also of dark grey ground-colour, but is interrupted by long, narrow, discontinuous, overlapping stripes of pale yellow. Towards the lateral margins the yellow comes to preponderate over the grey, and thus appears to form the ground-colour. The anterior extremity is pink. On the ventral surface the yellow colour predominates, and thus forms the ground-colour, which is streaked with irregular, discontinuous, narrow, close-set stripes of dark brown. A very narrow band on each side of the ventral surface is free from the dark streaks. The peripharyngeal aperture in spirit is a little behind the middle, and the genital much nearer to it than to the posterior end.

I found this worm on the asphalt path in my garden near Christchurch.

12. *Geoplana sulphurea*, Fletcher and Hamilton, var.

Two specimens collected by Mr. Thomas Steel at Albert Park, Auckland, differ from the common New South Wales form only in the presence of minute specks of brown scattered over the yellow ground-colour, between the inner and outer dark brown stripes on the dorsal surface.

13. *Geoplana cœrulea*, Moseley, var.

Mr. Steel also collected at Albert Park, Auckland, three specimens of the blue-tipped variety of this species, indistinguishable from those found in gardens near Melbourne, and probably introduced. Messrs. Fletcher and Hamilton originally recorded this blue-tipped variety from Sydney. It has never been found in the native bush, so far as I am aware, and appears to have been widely distributed by man's agency.

14. *Geoplana purpurea*, sp. n.

It is perhaps doubtful whether this species ought to be separated from the Australian *G. cœrulea*, from which it differs only in colour. The body when crawling is long and slender, tapering very gradually at each end, with strongly convex dorsal and not very much flattened ventral surface. The ground-colour of the dorsal surface is rather dark reddish purple, interrupted only by a very narrow median band of nearly white. The anterior tip is paler, pinkish. The ventral surface is paler purple, under a lens appearing very finely mottled in two shades. In spirit the peripharyngeal aperture is about central, and the genital at about one third of the distance from it to the posterior extremity.

I have received three specimens of this worm from Ashburton, in the South Island, obtained for me by Mr. Fooks and Mr. Mayne.

15. *Rhynchodemus Moseleyi*, Fletcher and Hamilton.

Rhynchodemus Moseleyi, Fletcher and Hamilton, Proc. Linn. Soc. N. S. W. vol. ii. 1887, p. 371.

With this species I identify a number of small specimens of *Rhynchodemus* collected by Mr. T. Steel at Albert Park, Auckland. It is quite possible that the species has been introduced with plants, and we cannot yet say with certainty that the genus *Rhynchodemus* is indigenous in New Zealand.

16. *Bipalium kewense*, Moseley.

Bipalium kewense, Moseley, Ann. & Mag. Nat. Hist. ser. 5, vol. i. p. 238.

This widely distributed Land-Planarian was also found at Albert Park, Auckland, by Mr. Steel.

[Captain Hutton informs me that the record of *Bipalium* in his essay on the New Zealand fauna * was based upon a mistake for which he is not responsible.]

Observations on a new Land-Nemertine.

Geonemertes novæ-zealandiæ is at present known only from two spirit-specimens which I found among collections of Land-Planarians given to me for investigation by Captain Hutton and Mr. Suter. One of the two specimens was collected at Toi-Toi, Southland, by Miss Rich; the exact locality of the other is unknown, but it is very likely that it came from the same place. Both specimens exhibited a characteristic and identical arrangement of alternate dark and light longitudinal bands on the dorsal surface, although the colour of one was much faded. In the fresher-looking specimen the light bands were very pale yellow and the dark bands deep chocolate-brown. The arrangement of the bands is as follows:—(1) A broad median light band; (2) a dark band of about the same width on each side of the median band; (3) a narrower light band outside the last; (4) a very narrow band of dark brown at the junction of the dorsal and ventral surfaces. The ventral surface is pale yellow.

In shape and size the specimens closely resemble the Australian *Geonemertes australiensis*. The larger of the two specimens measures nearly an inch in length in spirit, without the proboscis.

The mouth opens into the rhynchodæum, as in *G. australiensis*.

Lateral organs, with cephalic pits, are present in the usual position.

A cephalic gland is present, as in *G. australiensis*.

I could find only four eyes, situated on the rounded anterior extremity of the body. Two of these are much larger than the other two, and lie more ventrally and a little more anteriorly. In the number of eyes the New Zealand species

* Trans. N. Z. Institute, vol. v. 1872, p. 23. Quoted by Moseley in the Qu. Jour. Micr. Sci. vol. xvii. n. s. p. 275.

differs markedly from the Australian one, and conforms to the more usual type amongst Land-Nemertines.

The stylets and their arrangement closely resemble those of *G. australiensis*; in the specimen examined I have detected four reserve-sacs.

The sexes are probably distinct, for in the specimen of which I cut sections I can find only eggs.

Observations on a Variety of Peripatus novæ-zealandiæ *with Sixteen Pairs of Legs.*

Having received from Mr. Suter three specimens of supposed *Peripatus novæ-zealandiæ* from Stratford, in the North Island, I was greatly surprised to find on examination that all of them had sixteen pairs of claw-bearing legs. I have carefully compared the specimens with the usual form (with fifteen pairs of legs) obtained from both the North and South Islands, and can find no other points of difference, the coloration and the structure of the feet and jaws agreeing closely.

It is well known that the number of legs in the Australasian species of *Peripatus* is usually constant, although in some other species it varies. I therefore think the three specimens under consideration should be regarded as belonging to a distinct local variety, for which I propose the name *Peripatus novæ-zealandiæ*, var. *Suteri*.

It is interesting to note that the genital aperture in the new variety is still between the legs of the last pair (the sixteenth) and that the special nephridial apertures are on the legs of the fourth and fifth pairs as usual.

Christchurch, New Zealand,
September 1894.

LI.—*Dimorphism in the* Miliolinæ *and in other Foraminifera.* By Prof. T. Rupert Jones, F.R.S., F.G.S.

In 1826, when revising the work of previous authors, Alcide D. d'Orbigny (Ann. Sci. Nat. vol. vii. pp. 297–304) placed various forms which had been included by earlier observers in the generic terms *Miliola*, *Miliolites*, *Serpula*, *Vermiculum*, and *Lagena* into six genera, which he called *Biloculina*, *Spiroloculina*, *Triloculina*, *Articulina*, *Quinqueloculina*, and *Adelosina*, concluding that the definite external segmentation of the test was of real generic importance.

In 1858 W. C. Williamson, in his 'Recent Foraminifera of Great Britain' (Ray Society), united three of these genera, namely *Triloculina*, *Quinqueloculina*, and *Adelosina*, under the one (new) name *Miliolina*. His chief ground for this amalgamation may be given in his own words :—"This genus differs from *Biloculina* and *Spiroloculina* in the circumstance that the convolutions, instead of being wound in one plane, continually alter their direction." At the same time he pointed out that the chambers, whatever their convolutions, always retain a parallelism with the polar axis of the test; also "that all the characteristic features of these genera frequently occur in one and the same species;" nor did he consider a definite number of segments to be an essential feature in this consolidated genus (*Miliolina*).

In 1860 "*Miliola*" was used by Parker and Jones as a comprehensive generic term (Ann. & Mag. Nat. Hist. ser. 3, vol. v. p. 469); but, as Dr. H. B. Brady has explained ('Challenger' Report, 1884, pp. 137, 156, &c.), it is advisable to retain *Biloculina*, *Fabularia*, and *Spiroloculina* as separate genera, and to keep *Triloculina*, *Quinqueloculina*, and *Adelosina* grouped together under the name *Miliolina* given by Williamson. These four genera constitute the subfamily Miliolininæ; the other subfamilies Nubecularinæ, Haueramininæ, Peneroplidinæ, Alveolininæ, and Keramosphærinæ completing the family Miliolidæ.

MM. Munier-Chalmas and C. Schlumberger, in their researches on the existence of two conditions of growth in many species of Foraminifera, as first indicated for Nummulites and Orbitoides by Parker and Jones (Ann. & Mag. Nat. Hist. ser. 3, vol. viii. 1861, p. 233; Geol. Mag. 1864, p. 103; Catal. Foss. Foram. Brit. Mus. 1882, p. 93), and more fully studied by Ph. De la Harpe (see letter dated Oct. 1, 1879, Catal. Foss. Foram. Brit. Mus. 1882, pp. 91–93; Mém. Soc. Paléont. Suisse, vol. vii. 1880–81, pp. 63 &c.), discovered that such "twin forms," "couples," or "dimorphs," termed by them "A" and "B," occur in other genera besides Nummulites (Bull. Soc. géol. France, ser. 3, vol. viii. 1880, p. 300; Compt. Rend. vol. xcvi. 1883, pp. 862–866, and pp. 1598–1601; Ann. & Mag. Nat. Hist. ser. 5, vol. xi. 1883, pp. 340, 341). Among the "Miliolidæ" they separated and defined, by means of carefully prepared internal sections, showing the relative size of the primordial chamber and the arrangement and character of the segments of the test, the following forms:—*Biloculina*, *Dillina*, *Fabularia*, *Lacazina*, *Triloculina*, *Trillina*, *Quinqueloculina*, *Pentellina*, and *Heterillina*. Subsequently * *Idalina*, *Adelosina*,

* Assoc. Franç., Congrès Rochelle, 1883, pp. 230–232; Congrès Rouen, 1884, pp. 520–527; Bullet. Soc. géol. France, sér. 3, vol. xii. 1884, pp. 629, 630, vol. xiii. 1885, pp. 273–323, vol. xv. 1887, pp. 573–584; Bull. Soc.

Periloculina, *Massilina*, *Spiroloculina*, and *Sigmoïlina*; besides others, as—*Nodosaria*, *Dentalina*, *Cristellaria*, *Siphogenerina*, *Orbulina*, *Rotalina*, and *Amphistegina* (see E. Van den Broeck, Bull. Soc. Belge Géol. Paléont. et Hydrolog. vol. vii. 1893, pp. 6–41).

In 1884 H. B. Brady (in the Report 'Challenger,' pp. viii and ix) gave a succinct account of dimorphism in the two different senses in which it had been applied by rhizopodists from the time of d'Orbigny to that of Munier-Chalmas and Schlumberger.

Signor C. Fornasini has noted the existence of the two forms above-mentioned, "A" and "B," in *Biloculina* *, *Nodosaria* †, and *Frondicularia* ‡.

In his 'Éléments de Paléontologie,' part i. 1893, pp. 83–86, M. Félix Bernard gives a *résumé* of the views on "Dimorphism" published by MM. Munier-Chalmas and Schlumberger, with a page of figures wrongly numbered for the most part.

Dr. A. Goës notices § that there are intermediate forms between those with large and those with small initial chambers, which are varying conditions of evolution; and he regards the successive embryonal, larval, and adult stages, such as are visible in *Frondicularia*, as constituting polymorphism rather than dimorphism in Foraminifera.

The persistence of the original or initial style of growth in adults may be normal in evolution; but the recurrence of embryonal after an advanced style of growth in adult forms appears to be deterioration by reversion to early conditions, and the features arising from the latter process can scarcely be regarded as really specific characters; and yet sometimes they have been taken as of even generic value (as *Amphicoryne*). Where, however, one type of growth is succeeded by that of another type, as *Cristellaria* by *Polymorphina* (see Goës, K. Sv. Vet.-Akad. Handl. vol. xix. no. 4, pl. iii. fig. 40; and Brady, Report 'Challenger,' pl. lxxi. fig. 10), there may appear to be some reason for recognizing a specific status.

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zool. France, vol. xi. 1886, pp. 544–557; Mém. Soc. zool. France, vol. iv. 1891, pp. 542–578, vol. vi. 1893, pp. 57–80.

* Boll. Soc. geol. Ital. vol. v. fasc. ii. 1886, p. 261, pls. iv. and v.

† *Op. cit.* vol. vi. fasc. i. 1887, p. 29, footnote (with M. Schlumberger's remarks); *op. cit.* vol. ix. fasc. ii. 1890, pp. 345–347, pl. viii.

‡ Mem. R. Accad. Sci. Istit. Bologna, ser. 5, vol. i. 1891, pp. 480–483, and plate; Signor D. E. Dervieux has also remarked A and B *Frondiculariæ*, Bull. Soc. geol. Ital. vol. xi. fasc. ii. 1893, pp. 241 &c., pl. iv.

§ Bihang Vet.-Akad. Handl. (Stockholm), vol. xv. part 4, no. 2 (14 pages and 1 plate), 1889; and in the Annuaire géol. &c. vol. viii. fasc. 4, 1893, pp. 844–846, and vol. ix. 1894, pp. 911–913.

To return to "dimorphism" as treated by Munier-Chalmas and Schlumberger—P. Fischer and G. Dollfus think that the megalospheres * (A) indicate oviparous individuals, and the microspheres (B) those that reproduce by gemmules or by fissiparity. Some think that the two forms should be separately indicated by a modified specific name, or by a sign, or otherwise. A. Tellini affixes "sub" for the megalospheric form of a species; but G. Dollfus prefers a contrary arrangement.

The researches of MM. Munier-Chalmas and C. Schlumberger have gone far to show that the Miliolines can be divided, with a certain amount of exactitude, into various "genera" if their internal structure be examined by means of microscopic sections, and if the differentiation be of sufficient zoological value. Not only does the "dimorphism" occur in the many forms examined, but the arrangement and disposition of the chambers follow definite laws and are constant.

The structural differences among the Miliolidæ and others discovered and illustrated by MM. Munier-Chalmas and Schlumberger are of very great interest, adding much to our knowledge of Foraminifera. They are often associated with external features sufficiently recognizable for the use of the trivial names already in vogue, and the zoological standing of the members of the group is not interfered with. Indeed their mutual relationships have strong evidence in the new observations. Thus the structure of *Biloculina depressa,* form B, shows that this form passes through (1) a biloculine, (2) a triloculine, (3) a quinqueloculine, and (4) a biloculine stage in reaching completion; whilst *B. comata* has (1) a biloculine, (2) a quinqueloculine, (3) a quadriloculine, (4) a triloculine, and ultimately (5) a biloculine stage. *Adelosina,* after its unilocular form, has biloculine, triloculine, quadriloculine, and quinqueloculine stages. The early changes constitute what is termed "Initial Polymorphism" by MM. Munier-Chalmas and Schlumberger. It is apparent that by these and the later changes, all within the agathistegian cycle, not only is the real generic value of *Miliolina* more firmly established, but that it has a right to include *Biloculina* and *Spiroloculina* (as applied by Dr. A. Goës).

M. Schlumberger states that in the *Biloculinæ* and *Triloculinæ* having a small initial chamber (the form B) the first chambers are as in *Quinqueloculina*; subsequent chambers

* The word "megasphere," thus shortened by ellipsis, is preferred by the authors mentioned.

take the arrangement that they have in the other form (A, with a large initial chamber) of each of the two genera, namely on two planes or surfaces of symmetry for *Biloculina*, and on three for *Triloculina*. He observes (Bullet. Soc. zool. France, vol. xi. 1886, p. 557):—"In the three species of *Adelosina* under notice and in the three groups of *Biloculinæ* already mentioned the form B presents a special character common to all the individuals of each of the groups. In the *Adelosinæ* this is a megasphere, completely enveloped by the first chamber, which becomes lenticular. In the *Biloculinæ* it is the megasphere with two series of chambers on two planes of symmetry. I could cite also the *Triloculinæ* and the *Quinqueloculinæ*, in which the megasphere is encircled with three, or with five series of chambers.

"In the form B of these four genera, on the contrary, the microsphere is always encircled with a cycle of five chambers; and this grouping is sometimes regularly or irregularly persistent, and sometimes it is differently arranged.

"I conclude, then, that, in the classification of the Miliolidæ, a megaspheric form (A) will determine the genus and the microspheric (B) the species." He also mentions that many of the *Quinqueloculinæ* are of the genus *Adelosina*.

Signor Fornasini observes that the form B in general is larger than the A form, and has the *microsphere* succeeded by more numerous chambers than in the corresponding A form of the species. Also that *Biloculina* has the first set of chambers, in B, arranged on the quinqueloculine, the second on the triloculine, and the last on the biloculine planes of symmetry, and that in *Biloculina bulloides* the microsphere is succeeded by numerous chambers, arranged at first as 5, then as 4, next as 3, and lastly as 2.

The thickening of the shell-walls in various degrees, forming labyrinthic interiors and cribriform apertures, already noticed in Miliolidæ, as in Lituolidæ and other Foraminifera, has been further illustrated by MM. Munier-Chalmas and Schlumberger, whether it be formed by the outside of the chamber last invested or by a subsidiary and intermediate shell-growth.

As the recognition of the separate species and varieties for general purposes can, for the most part, be based on the external features of the test, and these are liable to a wide range of variability in individual growths, there is little need of altering the names as given in most of the current literature on Foraminifera, and as used in the 'Monograph of the Foraminifera of the Crag' (1866), of which Part ii. is now in preparation, except with regard to *Triloculina* and *Quinqueloculina* (pp. 7–14), the necessity for which change the synonymy of *Miliolina oblonga* (pp. 7 and 8) sufficiently supports in the direction of the views above referred to.

The special biological value of the presence of either a *large* or a *small* initial chamber in any Foraminifer was at first a chief subject of study by De la Harpe and other observers above-mentioned; but completely definite results have not yet been arrived at*. Specimens having a large primordial segment or chamber (*megasphere*—for megalosphere) are classed as "A," and the others (with a *microsphere*) are the "B" forms. The late Ph. De la Harpe had noticed eleven such pairs or couples of Nummulites in 1880–81; and since then numerous other such twin forms among the Foraminifera have been described. It has been thought by some that the A forms are the young and B the adults; others have regarded A and B as distinct species; others have looked on them as individual modifications of the same species; and hypothetical views have been held as to one sort and not the other being capable of producing germs, that the central portion may have been absorbed and reconstructed, and so on. At all events those Nummulites grouped under A are generally "free-growing individuals, soon arriving at the limit of growth" (P. & J., 1861), whereas the others (B) attain a larger relative size. This variation in the individuals of one species M. Munier-Chalmas at first (1880) termed "dimorphism," with a different application to that of *Dimorphina* (d'Orbigny, 1846), and "dimorphous" (P. & J., 1860) and "trimorphism" (P. & J., 1863), which have reference to successive stages from one style of growth to another. The later expositions, however, by Munier-Chalmas and his colleague of the growth of the Miliolidæ (as noticed above) may be said to give the term its full meaning as to the passage-forms in individuals altering their plan of growth, with or without reference to the primordial chamber. As the dimorphous forms of *Miliolina*, *Peneroplis*, *Lituola*, *Tex-*

* From Mr. J. J. Lister's "Contributions to the Life-History of the Foraminifera" (Proceed. Roy. Soc. vol. lvi. no. 337, September 1894, pp. 55–160), and a recent letter, we gather that in *Polystomella* the microspheric form contains many comparatively small nuclei, while the megalospheric form has a single large nucleus. Also that the megalospheric form of a species is much more numerous than the microspheric. While in some instances the parent of megalospheric young has been found to be microspheric, in others it was megalospheric; and in one species (*Orbitolites complanata*) both the megalospheric and microspheric forms have been found producing megalospheric young. In *Polystomella*, after certain nuclear changes, the protoplasm of a megalospheric shell produced flagellate swarm-cells (isospores); and similar bodies were seen escaping from a whole shell. Mr. Lister suggests that the two forms of Foraminifera represent recurring generations.

tilaria, *Valvulina*, *Polymorphina*, and some of the *Nodosarinæ* &c., though severally grouped under "generic" names*, are plainly referable to their zoological type-forms, so the Miliolidæ and allied groups still hold their suzerainty over the more or less differentiated forms, whether species, subspecies, or varieties, elucidated of late by the careful diagnoses elaborated by our esteemed fellow-workers in France.

There is, of course, great difficulty in deciding the relative value of differences among individuals (of all the groups) showing often inconsiderable modifications or deviations from the zoological type, whether due to idiosyncrasy of the individual or to evolution among the many—for they may have been caused by accidents of growth, or they may show ontogenetic variation, due to progression, or even to deterioration, of the special form.

Although Foraminifera, like other organisms, should be classified on true morphological characters, we all know it is good that the differences of individual forms, and of limited groups of such varieties, should be carefully noted and made serviceable to collectors and systematists; and the only acceptable plan for the purpose is (as has often been said) to apply the usual nomenclatorial terms, without regarding them as of the same value as when applied to members of the groups of higher animals. Keeping this in mind, we are glad to use the results of the judicious and discriminative labours of MM. Munier-Chalmas and C. Schlumberger, as in the case of earlier rhizopodal workers, and to give full references to their descriptions and figures whenever fit opportunities occur.

LII.—*On some new Longicorn Coleoptera obtained by Mr. Th. Greenfield in Somali.* By C. J. Gahan, M.A.

A small collection of Coleoptera made by Mr. Th. Greenfield in Somali, and recently presented by him to the Trustees of the British Museum, contains a good proportion of species which had not previously been represented in the National Collection. Amongst the Longicornia I find four species which do not seem to have been yet described. The characters of these and of a new genus are given in the following paper.

* Such as *Articulina*, *Spirolina*, *Haplophragmium*, *Bigenerina*, *Spiroplecta*, *Gaudryina*, *Clavulina*, *Amphicoryne*, *Flabellina*, *Marginulina*, *Dimorphina*, *Sagrina*, &c.

Cantharoctenus somalius, sp. n.

♂. Rufo-piceus; mandibulis falcatis, apice obliquiter truncatis et bidentatis; capite fronte dense punctato, supra sparsius minutiusque punctato; prothorace disco nitido haud dense punctato, versus latera crebre fortiterque punctato; elytris dense punctatis; antennis 19-articulatis, articulis 3°–18^{m} infra ad apicem processu lamelliformi vix emarginato instructis, articulis 4°–18^{m} infra ad basin bidentatis.

Long. 23–24, lat. 9 mm.

Hab. Somali.

This species so closely resembles *C. Burchelli*, Westw., that I was at first sight inclined to consider it the same. It differs, however, in two important characters. The antennæ are 19-jointed, and not 18-jointed, as described by Westwood for the male of *C. Burchelli*. The lamelliform process with which each of the joints from the third to the eighteenth is provided on the underside at the distal extremity is only very slightly emarginate at its lower free border (the emargination on some of these processes is, in fact, scarcely observable). The corresponding processes in *C. Burchelli* are rather deeply incised, while in *C. insignis*, Gerst., the incision is carried down to the base. In the latter species the antennæ are described as having twenty joints. I question whether Gerstaecker was right in regarding his type as a male, inasmuch as the mandibles are of a different form to those of the males of *C. Burchelli* and of the species now described, and quite resemble the mandibles of a female *C. Burchelli* from Damaraland, in the British Museum collection. At the same time it is quite possible that the males of this, as of other Prionid genera (e. g. *Cacosceles* and *Priotyrannus*), may exhibit dimorphism in the structure of the mandibles.

The chief differences between the three species of *Cantharoctenus* may be briefly recapitulated as follows:—

Antennæ 20-jointed. Distal process of antennal joints very deeply divided	*C. insignis*, Gerst. Endara.
Antennæ 18-jointed. Distal process of antennal joints deeply incised	*C. Burchelli*, Westw. Damaraland.
Antennæ 19-jointed. Distal process of antennal joints feebly emarginate..................	*C. somalius*, Gahan. Somali.

Taurotagus Greenfieldi, sp. n.

Rufo-piceus, pube grisco-sericea sat dense obtectus; prothorace

lateraliter obtuse tuberculato, supra inæquali, haud plicato; antennis (♂) quam corpore vix brevioribus.
Long. 38, lat. 11 mm.

Hab. Somali.

Closely resembles *T. Klugii*, Lac., especially in the character of the elytral pubescence, which exhibits a much ruffled or somewhat wavy appearance. It is distinguished from *Klugii* by its shorter antennæ, those of the male scarcely reaching to the apex of the elytra, and by the character of the prothorax, the disk of which is not transversely wrinkled, but owes its unevenness to a number of slightly raised areas, of which one is submedian in position, the others placed more laterally; the prothorax is somewhat swollen on each side, where it presents two minor protuberances, one nearly median in position, the other lying between the middle and the anterior margin.

The prosternum is strongly arched, and bears near the middle of its posterior face a small somewhat laterally compressed tubercle.

Idactus maculicornis, Gahan.

A male example of this species was taken by Mr. Greenfield. It differs from the described female type as follows:—Antennæ more than half as long again as the body. Last ventral segment of abdomen much shorter and without a median impressed line. Besides this difference in structure there is a slight disagreement in the markings. In the Somali specimen there is a pale brown patch, partly surrounded by a distinct white line, placed obliquely near the middle of each elytron. In the female type there is a dark brown patch under each shoulder not present in the second example. This specimen may therefore belong to a distinct local variety.

Prosopocera lutulenta, sp. n.

♀. Picea; pube cinerea sat dense obtecta; prothorace lateraliter inermi, supra antice posticeque recte sulcato; elytris griseis, cinereo minute maculatis, utrisque plaga obliqua albo-cinerea, fusco-bipunctata ante medium instructis; antennis quam corpore fere sesquilongioribus.
Long. 17, lat. $5\frac{1}{2}$ mm.

Hab. Somali.

Prothorax unarmed at the sides, crossed above by two almost straight transverse grooves, one anteriorly, the other posteriorly. Two marginal grooves are also present, but are very indistinct, except towards the sides. The elytra are moderately thickly punctured, with the punctures near the base slightly asperate in character; the pubescence is grey, speckled with minute ashy-white spots, and each elytron has an indistinct ashy-white band placed obliquely between the base and middle, and on which may be seen two small rounded brown spots, one towards the outer and anterior end of the band, the other towards its inner extremity. The mesosternum is very feebly tubercled. The antennæ of the female are nearly half as long again as the body, and the third joint is about half as long again as the first.

In a small male specimen from Senegal (the *Prosopocera lutulenta*, Buq., of Dejean's collection) I can find no characters which would lead me to believe it specifically distinct from the female described above. In this male the antennal joints from the third to the fifth are somewhat thickened; the front of the head is not armed with tubercles or other processes.

Pterolophia albocincta, sp. n.

Elongata; pube fulvo-brunnescente cinereo-sparsuta obtecta; capitis fronte fere omnino cinerea; prothorace fere regulariter cylindrico, quam longitudine paullo latiore, lateribus discique maculis nonnullis minutis cinereis; scutello fusco; elytris area parva circum scutellum et fascia arcuata sat lata pone medium albescentibus, utrisque fasciculis duobus pilorum—unus paullo pone basin, alter prope suturam pone fasciam submediam—instructis; antennis medium elytrorum vix superantibus.

Long. 10, lat. 4 mm.

Hab. Somali.

In this species the prothorax is rather smaller and the elytra somewhat longer than is usual in the genus *Pterolophia* (=*Praonetha*). The pubescence is of a brownish tawny colour, with some small scattered spots of an ashy-white colour. The front of the head, the sides of the thorax, and a small elytral area around the scutellum are almost wholly ashy white, while a very distinct curved band of the same colour is placed a little behind the middle of the elytra. The legs exhibit a number of scattered black points; similar points are to be seen along the sutural margin and on the posterior part of the elytra. Each elytron, narrowly truncate and feebly emarginate at the apex, has two small tufts of fulvous hairs, one placed on a very small tubercle a little behind the base, the other standing near the top of the posterior slope at a little distance behind the hind margin of the white band. The pubescence on the abdomen is dense and of a pale fulvous-white tint; but at the extreme apex there is a fuscous patch. The antennæ, which have a spotted appearance, extend very little beyond the middle of the elytra.

Very few African forms of this genus have yet been described. I do not know of any near ally to the present species, which in general shape seems to resemble most one or two of the Japanese species (*P. angusta* and *zonata*) described by Bates.

Amongst other fine species which are new to the British Museum collection there is an example of one described by M. Fairmaire under the name of *Zographus alboguttatus* (Ann. Soc. Ent. de France, 1887, p. 336). This species presents very distinct structural characters which ought to exclude it from the genus *Zographus*, and I therefore propose for it he name

BALIESTHES, gen. nov.

It is to be distinguished from *Zographus* by the following characters:—Scape of antennæ smooth, without cicatrice at the apex. Elytra without trace of longitudinal grooves or costæ. Intercoxal process of prosternum much narrower and simply arched, instead of being vertical and bituberculate in front. Mesosternal process also somewhat narrower, declivous instead of being vertical in front, and having a small median cariniform tubercle near the middle of its length.

I should prefer to place this new genus near *Phymasterna* rather than near *Zographus*. *Phymasterna pictor*, Fahr. (? *Solymus pictor*, Lac.), a South-African species of much smaller size, differs little in structural detail.

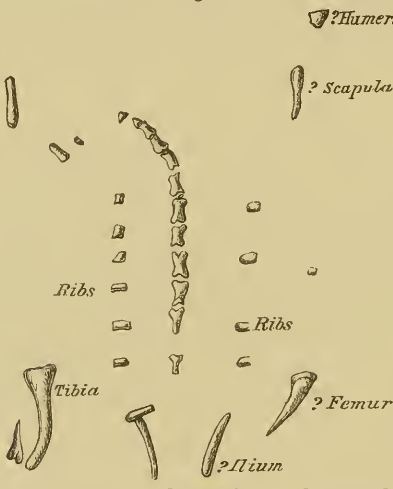
LIII.—*On* Hortalotarsus skirtopodus, *a new Saurischian Fossil from Barkly East, Cape Colony.* By H. G. SEELEY, F.R.S.*

IN the Albany Museum, Grahamstown, are a few remains of a skeleton, known locally as the Bushman Fossil, discovered by Mr. William Horner Wallace at "Eagle's Crag," Barkly East, Cape of Good Hope, 11th June 1888. A sketch of the specimen (fig. 1) was made by Mr. D. Rudlin, of Kelvin Grove, Barkly East, which shows what appear to be the superior

* Read before the Geological Society of London, June 22, 1892, as Part 8 of "Contribution to Knowledge of the Saurischia of Europe and Africa."

margins of the ilia, which are thin and diverge as they extend forward. At the left side, somewhat displaced, is the tibia, curved and wide at the proximal end, and at its distal end a part of the proximal end of the metatarsus is exposed, flexed forwards. On the right side the proximal end of the right tibia or femur is seen. Some distance in front of the pelvis ten or eleven dorsal vertebræ are shown in sequence. They appear to be more slender in front than behind, have the centrum somewhat elongated, concave at the sides, and cupped at the articular ends. At the sides are seen transverse sections of the ribs, from which it would appear that the neural arches had perished, together with the parts of the ribs between the

Fig. 1.



Skeleton of *Hortalotarsus* before it was destroyed by blasting.

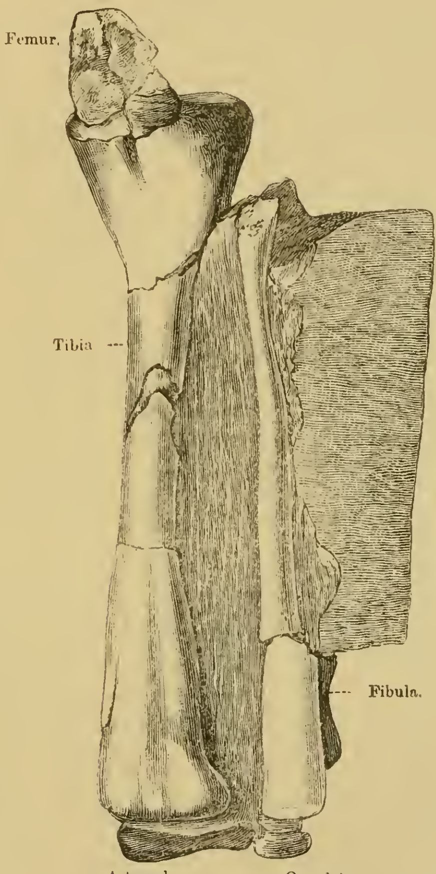
centrums and the sections exposed in the rock. Anteriorly are two bones placed laterally, probably the scapulæ, and on the right side may be an indication of the humerus. An attempt made to remove the block of slate by a charge of gunpowder scattered the pieces so that they were never found, with the exception of a few small fragments. Two of these were entrusted to me; they promised to show characters of the tibia and fibula. Everything which skill could achieve in removing the matrix has been done for me by Mr. Richard Hall, with the result that, although the specimen is imperfect, it makes an important addition to knowledge of the structure of the tarsus * in animals which have been grouped as Dino-

* In Ornithischia the tarsus shows two family types. In Iguanodontia the ascending intermedium impresses the tibia in front. In the

sauria, indicating a new type, which I propose to call *Hortalotarsus skirtopodus*.

At the proximal end of the tibia is the distal inner condyle of the right femur, probably in natural flexed position, for its

Fig. 2.



Posterior aspect of fore leg of *Hortalotarsus*.

flattened inner side appears to have been flush with the inner side of the head of the tibia. Its distal articular surface is

Scelidosauria there is no ascending process impressing the tibia. In the Saurischia the Megalosauria have the distal end of the tibia impressed obliquely or laterally. The condition is the same in the Cetiosauria; but in the Euskelesauria the distal end of the tibia is no more modified than in the Scelidosauria.

well ossified and well rounded from back to front, and concave on the hinder margin in the usual way between the condyles, though the right condyle is not preserved.

The tibia and fibula are in natural association, but the proximal articular end of the fibula is lost, and the proximal end of the tibia is slightly broken. Both bones have large central cavities, like *Palæosaurus* and the allied Triassic reptiles of Europe.

The tibia (fig. 2) is $7\frac{7}{10}$ inches long. The transverse width of its distal end is $1\frac{1}{2}$ inch. The width at the proximal end is $1\frac{1}{10}$ inch as preserved, but may have been slightly more. The antero-posterior measurement at the proximal end is $2\frac{1}{10}$ inches and at the distal end is $\frac{9}{10}$ inch. Thus the two ends of the bone have the aspect of being twisted nearly at right angles to each other, as in many other Dinosaurs. In general form and size the bone resembles *Agrosaurus*, and, in a less degree, *Palæosaurus*.

The proximal articular surface is flat, truncate, slightly inclined backward and slightly inclined outward. It appears to have been subtriangular, wide behind, with a slight notch between the condyloid eminences on the posterior surface. The internal contour of the articulation was rounded from behind forward to the cnemial crest, which is small, rounded in front, and defined by a slight shallow fibular groove placed anteriorly, posterior to which was the large condyle on the external or fibular side.

Seen from the internal aspect the anterior vertical contour of the bone is nearly straight, being very slightly concave; but the posterior contour is concave in its proximal third, owing to the backward extension of the condyles, and then straight almost to the distal end; the bone has an aspect of being compressed from front to back in the lower part of the shaft. If there is an appearance of slight distal expansion, it is due to the way in which the metatarsal bones are crushed upon the tibia in front. On the posterior aspect the shaft contracts above the middle length to about $\frac{6}{10}$ inch. It is well rounded from side to side in the middle, but flatter towards the distal end. Both inner and outer contours are concave in length, but the concavity at the distal end is only marked on the fibular side. This is due partly to crushing and partly to extension of the bone towards the fibula. If there is any notch on the distal fibular border of the tibia it is not exposed. There does not appear to be any notch or groove on the anterior side at the distal end, the condition of the bone in this respect resembling the tibia of *Euskelesaurus*. The absence of the distal notch on the tibia is a distinction from all known allies in the Trias of Europe.

The fibula is parallel to the tibia, and is exposed on its external side. It is well preserved on the posterior aspect. It shows no indication of close contact with the tibia at the distal end. It appears to be slightly curved in length, being bowed outward, so that, although the extremities of the two bones came near together, there is a fusiform interspace between them which is eight or nine tenths of an inch wide in the middle. About $1\frac{1}{4}$ inch of the proximal end of the fibula is lost. The fracture shows the bone to be compressed from side to side, flat on the tibial side, convex externally, $\frac{8}{10}$ inch from front to back and $\frac{1}{2}$ inch from within outward. As the bone extends distally it probably becomes subcylindrical in the middle, and then makes an oblique twist as it widens to $\frac{7}{10}$ of an inch at the distal end, where the antero-external face is flattened, with the external margin inclined backward, so that the end of the bone is somewhat oblique to the tibia and its inner angle extends above the astragalus. The posterior distal end of the fibula is more convex from side to side. The transverse measurements over the distal ends of tibia and fibula is $2\frac{4}{10}$ inches, which is probably more than the corresponding measurement over their proximal ends, since both bones are compressed in form from side to side proximally and expanded from side to side distally.

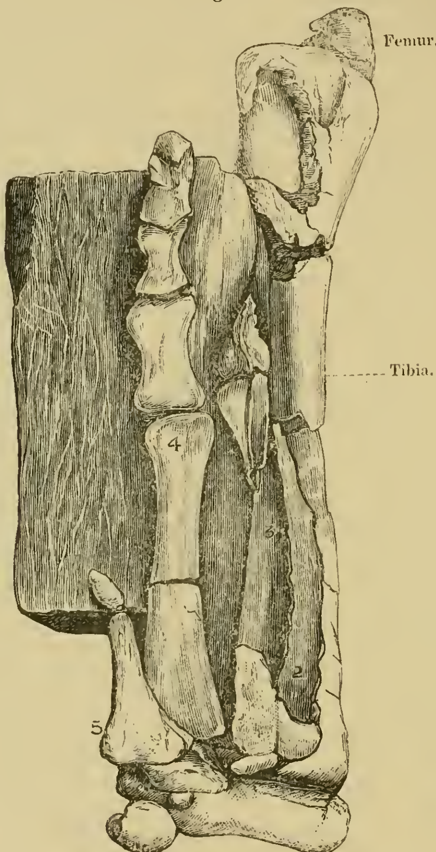
The tarsus consists of two rows of bones (fig. 3). The distal row is imperfectly preserved, but the proximal row consists of astragalus, calcaneum, and a small intermedium. I am not aware that the intermedium has previously been observed as a separate ossification in any Saurischian, though Professor E. S. Morse has identified the ascending process of the astragalus with that bone in both Ornithischia and Aves *.

The astragalus is a transversely oblong bone which fits on to the distal end of the tibia, and closely corresponds to it in form, except that it is wider, extending a little beyond its external margin. Its transverse measurement is $1\frac{7}{10}$ inch; it is $\frac{1}{2}$ inch deep in front, but posteriorly the depth is very small, though it thickens a little towards the internal side. The inner side has an antero-posterior measurement of $\frac{9}{10}$ inch; the external border is about two thirds as wide. The anterior margin is slightly concave, the posterior margin slightly convex, and the short sides incline a little backward. The articular surface is convexly rounded from front to

* E. S. Morse, "On the Identity of the Ascending Process of the Astragalus in Birds with the Intermedium," Anniversary Memoirs of the Boston Society of Natural History, 1880. In that memoir the intermedium is found and figured in embryos of tern, petrel, sea-pigeon, herring-gull, eider-duck, southern black-backed duck, penguin.

back and slightly concave from side to side. There is no anterior ascending process to the astragalus. The bone is not in very close union with the tibia.

Fig. 3.



Anterior aspect of bones of the fore leg and inferior aspect of metatarsal bones 2–5 and phalanges.

The calcaneum is relatively small and fits on to the distal end of the fibula. It is not intimately united to the astragalus, but simply articulated. It is about $\frac{7}{10}$ inch wide and $\frac{6}{10}$ inch deep; it is convexly rounded, especially in front, but the external lateral border is occupied by a ligamentous pit, which contributes to make the transverse measurement on the anterior side less than that on the posterior side.

The intermedium (or naviculare) is a small ossification which lies upon the anterior and superior external margin of the astragalus, appearing in front as a small ovate ossicle beneath the inner angle of the fibula, which may be produced upward as a thin film in the outer part of the suture between the astragalus and tibia.

The separate condition of the astragalus and calcaneum is paralleled in *Ornithotarsus* and many American types. The intermedium is so small that it might be easily overlooked or lost in removing the matrix. It may hereafter be found in Saurischia, in which the tarsal elements remain separate. It is not recognized in *Euskelesaurus*.

While the proximal row of the tarsus is in close contact with the tibia and fibula, the distal tarsal row is in association with the extremities of the metatarsus, upon which the bones of the fore leg are pressed down in close contact. There were probably four bones in the distal tarsal row, the three cuneiform and cuboid; but, if so, the first two cuneiform bones are lost with the metatarsals. The third cuneiform is imperfect and gives attachment to the third metatarsal; and the cuboid, which lies below the calcaneum and part of the astragalus, articulates with the fourth and fifth metatarsals. A vertical division like a suture passes through the middle of the cuboid; but there is no conclusive evidence that it is not a fracture.

In transverse measurement the cuboid is $1\frac{1}{10}$ inch; it is wedge-shaped, narrower on the outer proximal margin ($\frac{3}{10}$ inch) than on the inner side, which is less than $\frac{1}{2}$ inch wide on the proximal surface, which is convex from front to back, concave on the anterior and posterior borders, and rounded at the two extremities. It is fully $\frac{3}{10}$ inch deep; but the distal surface, which is smaller than the proximal, is not exposed.

No trace is preserved of the first digit.

Of the second digit only an impression remains of the proximal half of the metatarsal, with a small portion of its proximal articular surface indicating $2\frac{1}{10}$ inches of the length of the bone, which was flattened on the superior surface.

The third metatarsal is 4 inches long, with the bone preserved at the two extremities. It obliquely underlaps the second metatarsal at the proximal end, is flat on the upper surface, expanded at the distal end, and convex from above downward on the distal articular surface; but the convexity does not extend on to the inferior distal surface. A large ligamentous pit is excavated on the external margin. Only a small part of the proximal phalange of this digit is preserved, which shows its articular surface to be concave from above downward and somewhat deeper than the distal end of the metatarsal.

The fourth metatarsal is perfect, $3\frac{4}{10}$ inches long, $1\frac{1}{10}$ inch wide at the proximal end, which is compressed from above downward and apparently only half as thick as the corresponding parts of the second and third metatarsals. The bone is flattened on the underside; its sides are concave, so that the width in the lower third diminishes to $\frac{4}{10}$ inch, but widens again at the distal articulation to $\frac{7}{10}$ inch. The distal end also thickens, especially on the inner side. Three entire phalanges are preserved in this digit and a fragment of a fourth. They steadily decrease in length and width. The first is $1\frac{1}{20}$ inch long, transversely truncate proximally, $\frac{13}{20}$ inch wide at both extremities, with the sides concave and the under surface concave and flattened, with the inferior margins of the distal articulation prominent on the under surface. The second phalange is $\frac{8}{10}$ inch long and $\frac{6}{10}$ inch wide, of similar broad depressed aspect to the first phalange, but differing in having the inferior proximal articular margin convex from side to side; a character also seen in the proximal end of the third phalange, which is $\frac{13}{20}$ inch long, $\frac{11}{20}$ inch wide proximally, and narrower distally. On the inner side at the distal ends there are large ligament-pits on the lateral border of these three bones; but the pit is absent on the metatarsal bone. Similar pits probably exist on the more compressed external margins of the phalanges, but are not exposed.

The fifth digit is rudimentary. The fifth metatarsal has its proximal end entirely beneath the fourth metatarsal, except at the inclined external border. It is $\frac{17}{20}$ inch wide, much depressed, $1\frac{6}{10}$ inch long, with the sides concave and converging distally to a width of less than $\frac{3}{10}$ inch. The external border is about $\frac{3}{10}$ inch thick, and obliquely flattened at the proximal end. One phalange was developed, which is an oblong rudiment $\frac{9}{20}$ inch long and $\frac{5}{20}$ inch wide, which has lost its extremity in removing the matrix.

In so far as this foot can be compared it approximates nearest to *Dimodosaurus* *; but the metatarsals are less robust and the phalanges more compressed from above downward; and although the forms of the distal tarsals, especially the cuboid, appear to have something in common, the proximal row of the tarsus is dissimilar. In the preservation of the intermedium as a separate ossification not yet blended with

* Gaudry, 'Fossiles Secondaires,' 1890, p. 219. It may also be compared with the foot of *Anchisaurus polyzelus* (Hitche), figured by O. C. Marsh (Am. Journ. Sci. vol. xliii. pl. xvi., June 1892). See also Quart. Journ. Geol. Soc. vol. xlviii., Proc. p. 191, and Proceedings for June 1892.

the astragalus there is a more embryonic condition than in any known Dinosaur, which is a well-marked generic separation of this type from all known Saurischia, with which the hollow bones and their conformation probably associate it. The embryonic condition of the intermedium may account for the absence of the distal notch in the articular surface of the tibia, which otherwise characterizes the Saurischia. It makes a good distinctive character by which the Euskelesauridæ, to which I refer this fossil, may be distinguished from Megalosaurian allies found in Europe.

I express my thanks to the Committee of the Albany Museum for the opportunity of describing this fossil.

LIV.—*Descriptions of new Coleoptera from New Zealand.* By Capt. Thos. Broun.

[Continued from p. 386.]

Group **Xantholinidæ.**

Othius puncticeps, sp. n.

Elongate, subparallel, slightly shining; head and thorax piceo-fuscous, elytra and hind body fusco-castaneous; the legs, antennæ, palpi, and mandibles reddish; pubescence yellowish, conspicuous, but on the head and thorax there are only a few dark elongate setæ.

Head gradually and slightly narrowed anteriorly, longer than broad, with numerous scattered punctures; the central portion, however, is impunctate. *Thorax* about a fourth longer than broad, its sides subparallel, with rounded angles; there are two punctures near the middle and some smaller ones near the margins. *Elytra* subquadrate, apex obliquely incurved or emarginate, their surface rather closely and coarsely punctured, the interstices minutely sculptured. *Hind body* elongate, finely and irregularly punctate.

Much smaller than *O. adustus*; the eyes much smaller, palpi shorter, head and thorax relatively longer and narrower, the sculpture different. *O. angustus* is larger and differently marked.

Length 5–5½, breadth ¾ line.

Mount Pirongia. Two examples, December 1894.

Group **Staphylinidæ.**

Cafius algophilus, sp. n.

Black, head and thorax shining; elytra and hind body dull, densely covered with cinereous pubescence; legs and antennæ rufo-fuscous, tarsi paler.

Head oblong, a little narrowed anteriorly; the broad space along the middle is almost quite smooth, the rest of the surface is distinctly and rather closely punctured, behind the eyes the punctures are more shallow; it bears many slender flavescent setæ. *Labrum* deeply notched in the middle. *Eyes* oviform, rather small. *Mandibles* elongate, dark red. *Antennæ* somewhat variegate, basal joint piceous, nearly the length of the next two; fourth evidently longer than broad; joints 5 to 10 become a little shorter, the tenth, however, is not transverse, eleventh longer than the preceding; pubescence short. *Thorax* longer than broad, widest near the front, rounded there, its sides gradually narrowed backwards but nearly straight, base subtruncate, with rounded angles; along each side of the smooth dorsal space there is a series of moderately small, closely placed punctures, sometimes duplicated; outside these (except on an elongate spot before the middle and a smaller one near each hind angle) the punctuation is close and distinct; its whole surface, though apparently smooth, is densely and minutely sculptured, it is more scantily clothed than the head. *Scutellum* large, triangular, finely asperate and pubescent. *Elytra* oblong, closely and finely punctate, slightly asperate near the base. *Hind body* narrower than the elytra, strongly marginated laterally, closely and finely punctate. *Legs* finely pilose; *front tarsi* with the basal four joints moderately expanded, the first joint of the other two pairs hardly as long as the following three taken together.

Though similar to *Cafius maritimus* (No. 202) in its general aspect, this species may be easily separated therefrom by the denser sculpture of the head and thorax.

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

Mokohinou Island. Found by Mr. Sandager amongst gravel under sea-weeds.

Quedius sciticollis, sp. n.

Robust, elongate, shining; head and thorax piceous, the former with violaceous, the latter with iridescent reflexions; elytra, tarsi, and palpi rufo-castaneous; hind body and legs of a rather darker chestnut colour, more or less iridescent.

Head oviform, narrower than the thorax, distantly, finely, and irregularly punctured; there are three large punctures along the inside of each eye, two distant ones near the base, and one or two at each side behind the eyes. *Labrum* deeply notched in the middle, with coarse, erect, fuscous setæ, and with a pale frontal appendage. *Clypeus* pallid and membranous. *Eyes* half the length of the side of the head. *Antennæ* fuscous, joints 4 to 11 opaque and densely pubescent, first shining, piceous, nearly double the length of the next one, which is rather shorter than the third; this and the second are pale castaneous. *Thorax* rather broader than long, gradually narrowed anteriorly, front angles rounded; its punctuation like that of the head, but becoming even finer and more distant behind; there are two large punctures near the apical margin, two before and two behind the middle, the last pair widely distant, and a few others along the basal and lateral margins; there is a feeble discoidal stria along the middle. *Elytra* quadrate, densely transversely sculptured, with depressed greyish hairs. *Hind body* elongate, its sculpture longitudinal, pubescence greyish; terminal styles long, rufescent. *Scutellum* large, punctate. The front tarsi with the basal four joints dilated.

The beautifully iridescent head and thorax and their sculpture show that this is distinct from the other New Zealand species. Its proper position is near No. 1844.

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

Waiorongamai, near Mount Te Aroha. One, November 1893.

Quedius conspicuellus, sp. n.

Glossy, black; hind body violaceous, with more or less conspicuous patches of yellow hairs; basal joint of antennæ piceous, its apex and all the second joint castaneous, 4 to 10 dull.

Head broadly oval, wider than the thorax, with three large punctures along the inner margin of the eye, two close to the base; a shallow transverse impression on the forehead can hardly be said to consist of two confluent punctures; immediately behind this there is another feebly marked transverse impression. *Clypeus* membranous, dark. *Labrum* deeply emarginate in the middle. *Eyes* moderately prominent, occupying half the side of the head. *Antennæ* long, reaching the thoracic base, second joint shorter and thicker than the third, tenth slightly longer than broad. Thorax a little broader than long, with two large punctures before the middle and a few marginal ones. *Scutellum* large, punctate. *Elytra* not longer than broad, closely and finely sculptured, with slender cinereous and yellowish hairs. *Hind body* finely sculptured, apical styles castaneous. *Tarsi* variegated pitchy red, the anterior only moderately expanded.

♀. Head narrower, frontal impressions obsolete, tenth antennal joint hardly longer than broad; there is one round impression between the eyes in front.

This, without doubt, comes near Sharp's *Q. latifrons*, but there are no flavescent spots on the wing-cases, and the labrum is not rounded in the middle.

Length $4\frac{3}{4}$, breadth quite $\frac{7}{8}$ line.

Te Aroha. The pair I have were sent by Mr. J. H. Lewis.

Quedius scutellaris, sp. n.

Glossy, black, the legs and antennæ piceo-rufous, tarsi red; pubescence ash-coloured.

Head broadly oviform; there is a shallow angulate mark in front; two punctures along inside of each eye, two behind the eye, and two or three close to the base. *Clypeus* membranous, rather pale. *Labrum* reddish, short, with a deep central emargination, and bearing long, coarse, dark setæ. *Eyes* rather small, not extending halfway along the side of the head. *Antennæ* stout, not attaining the base of the thorax, the basal three joints reddish, second shorter than the first or third; joints 5 to 10 subquadrate and dull. *Thorax* rather broader than long, rounded and depressed anteriorly; base rounded, posterior angles obsolete; there are small punctures before the middle of the disk, two close to the apex, and three or four near the sides. *Scutellum* large, triangular, impunctate. *Elytra* quadrate, only moderately and not very closely punctured. *Hind body* elongate, finely sculptured, styles piceous. *Front tarsi* dilated.

The perfectly smooth scutellum is an exceptional feature, and the reduction in number of the interocular punctures is unusual. It is quite distinct from Sharp's *Q. antipodum*.

♂. Length $5\frac{1}{2}$, breadth nearly 1 line.

Ashburton. Mr. W. W. Smith presented me with his specimen, which is still unique I believe.

Quedius puncticollis, sp. n.

Shining, black, the legs testaceo-fuscous, tarsi pale infuscate red, mandibles rufescent.

Head nearly as broad as the thorax, with four large punctures in a transverse series between the eyes, two oblique longitudinal rows (three or four in each) further back near the sides; the lateral space behind the eye is more finely punctured; it bears some dark elongate setæ. *Eyes* half the length of the head. *Labrum* very short, but with a large frontal membrane. The *antennæ* reach the base of the thorax, the basal three joints are shining piceous, the slender stalk-like basal portions of the fourth and fifth are quite red, joints 4 to 11 opaque and, except the eleventh, obconical. *Thorax* almost as long as broad, anterior angles depressed, sides nearly straight, base rounded; on each side of the middle there is a longitudinal series of three very distinct punctures, one nearer the head is not in line with either of these series, being situated more towards the side; there are a few other punctures near the sides and basal margin. *Scutellum* large, closely punctate. *Elytra* subquadrate, finely and closely punctured, densely covered with fine cinereous pubescence. *Hind body* elongate, finely sculptured, its clothing greyish yellow, styles moderate.

This can hardly be confounded with Sharp's *Q. insolitus*; the shape of the thorax is different, the head is differently marked, and the posterior tarsi of *Q. insolitus* have short basal articulations.

Length $3\frac{1}{2}$, breadth $\frac{3}{4}$ line.

West Plains, Invercargill. Mr. Alfred Philpott kindly forwarded one of each sex.

Var. ♀.—Antennæ shorter, first joint pale castaneous; head nearly smooth behind the eyes; thorax with four punctures in each longitudinal series, exclusive of the supplementary frontal one, the punctures near the basal margin indistinct or absent; the pubescence on elytra yellow.

Quedius ambiguus, sp. n.

Elongate, black; head and thorax brilliant, hind body iridescent.

Head almost as broad as the thorax, with a row of four punctures along the inner margin of each eye and two larger ones between the series in front. *Labrum* not deeply notched; the membranous space behind it is short and dark. *Eyes* slightly prominent, large, occupying two thirds of the side of the head. *Antennæ* as long as the head and thorax, the basal two joints dark red, 4 to 11 opaque, tenth longer than broad. *Thorax* rather broader than long, with a pair of punctures before the middle. *Elytra* slightly broader than long, closely and finely punctate, with slender ash-coloured pubescence. *Hind body* more or less æneo-violaceous, its clothing a little more flavescent than that of the elytra. *Legs* variegated castaneous or piceous.

This closely resembles *Q. enodis* (No. 207), but may be separated therefrom by the two frontal interocular punctures.

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

Tarukenga, about 8 miles from Rotorua.

Quedius taieriensis, sp. n.

Black, hind body hardly at all iridescent; elytra elongate, densely covered with depressed flavescent pubescence; legs and antennæ variegated rufo-fuscous.

Head oviform, the centre and the forehead smooth, the rest of its surface moderately finely punctured. *Eyes* not extending halfway along the sides of the head. *Clypeus* membranous, pale. *Labrum* short, slightly emarginated. *Antennæ* longer than the head and thorax, all the joints evidently longer than broad. *Thorax* longer than broad, base subtruncate, very smooth, with two deep punctures before the middle; behind this the sides are almost straight. *Scutellum* triangular, punctate and pubescent. *Elytra* oblong, a third longer than broad, a little narrowed towards the base, their close punctuation rendered indistinct by the clothing. *Hind body* elongate, finely sculptured, styles dark. *Anterior tarsi* only moderately expanded.

In general outline this resembles *Q. agathis* (No. 2453), but the latter has a narrower head and more rounded thorax. It is also somewhat similar to *Q. insolitus*, but the thorax is less narrowed anteriorly and the basal joint of the hind tarsi is not so short.

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

Taieri, Otago. My specimen was given to me by Mr. S. U. Fulton.

Obs. When computing the size of the eyes in all the foregoing species the side of the head has been reckoned from the point of the antennal insertion backwards.

Group **Pæderidæ.**

Lithocharis cœca, sp. n.

Slender, elongate, subparallel, shining; pale ferruginous, sometimes flavescent, the legs, antennæ, and palpi testaceous.

Head longer than broad, gradually narrowed anteriorly, moderately finely and distinctly punctured, more densely near the sides than on the crown; the forehead truncate. *Eyes* exceedingly minute, hardly visible. *Antennæ* minutely pubescent, first joint as long as the next two, both of which are longer than broad and about equal; joints 4 to 10 decrease in length, tenth transversely quadrate, eleventh conical. *Peduncle* well developed. *Thorax* longer than broad, widest near the front, gradually narrowed backwards, with obtuse angles; the punctuation is like that on the front of the head, there is an indistinct discoidal line. *Elytra* very short, subquadrate, a little narrowed near the shoulders; their sculpture is moderately close but indefinite, appearing punctate or granulate; they bear fine, short, pale pubescence. *Hind body* elongate, finely sculptured, rather thickly covered with fine pallid pubescence, the fifth segment much longer than the preceding ones. *Femora* thick, especially the anterior. *Tarsi* short, the basal four joints of the front pair transverse.

The abortive eyes, short wing-cases, and slender build are distinguishing characters.

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

Mount Pirongia and Te Aroha. Two found at each locality on the ground.

Hyperomma sanguineum, sp. n.

Nitid, elongate, dark vinous red, the antennæ, palpi, and tarsi fulvescent; sparingly clothed with ash-coloured hairs.

Head rather longer than broad, the genæ slightly rounded; it has some large almost serial punctures, which, however, do not extend to the middle; there are also many minute irregularly distributed punctures. *Thorax* about one third longer than broad, almost as wide at the base as it is in front; all its angles are rounded; along each side of the middle there is a not very regular series of about fifteen punctures; several similar punctures are distributed near the sides, and numerous minute ones are visible over the whole surface. *Elytra* short, hardly longer than broad, the shoulders rounded, with distinct sutural striæ; their sculpture consists of large punctiform impressions and small punctures. *Hind body* elongate, finely sculptured, with conspicuous styles.

Rather larger than No. 2454, the head and thorax longer and differently sculptured; the *mandibles* are shorter and stouter and each has a large median tooth on the inside; the *antennæ* are more elongate and slender; the *maxillary palpi* differ, the penultimate joint being rather longer and less dilated towards the extremity, whilst the terminal one, instead of being short and conical, is about two thirds the length of the preceding one.

Length $4\frac{3}{4}$, breadth $\frac{5}{8}$ line.

Mount Pirongia. One (minus a leg), found in December 1892.

Group Omaliidæ.

Omalium fusciventre, sp. n.

Elongate, subparallel, shining, sparingly clothed with short, rather fine, yellowish hairs; those on the hind body are, however, rather longer and more easily seen; head, thorax, and antennæ red; elytra brighter and paler red, but with the suture near the base and the hind part of each side fuscous; abdomen fuscous, its extremity paler; legs testaceous.

Head finely and not very closely punctured, the frontal impressions rather shallow. *Eyes* moderate, but little convex. *Antennæ* pubescent, first joint stout and finely sculptured, second little more than half the size of the basal one, longer than broad, oviform; third longer than broad, rather slender; fourth and fifth small and bead-like; 6 to 10 evidently broader than the preceding ones, 8 to 10 transverse, eleventh large. *Thorax* rather broader than long, its sides distinctly margined and well rounded in front; behind the middle they are gradually narrowed and nearly straight; the posterior angles are rectangular but not acute; its surface is rather more distinctly punctured than the head, the two dorsal impressions are well marked, and there is a fovea-like depression at each side. *Elytra* oblong, wider than the thorax, slightly narrowed towards the base, their hind angles rounded; the suture is well defined and rather more elevated behind than in front; their punctuation is regular and almost serial, but becomes a little less distinct behind. *Hind body* of the same width, but rather longer than the elytra, finely sculptured, fifth segment longest. *Legs* simple. *Tarsi* with the basal joints, taken together, much shorter than the terminal one.

This most resembles No. 1861; the head is more distinctly punctured, the eyes are less convex, and the enlarged joints of the antennæ are more transverse. No. 1854 also is somewhat similar.

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

West Plains, Invercargill. My specimen was found by Mr. Alfred Philpott.

Omalium australe, sp. n.

Body rather broad, narrowed anteriorly; pubescence yellowish, moderately elongate, conspicuous behind; on the sides of the thorax there are some long, slender, erect setæ; head and thorax red, darker than the elytra and antennæ; hind body rufo-castaneous; legs testaceous.

Head nearly as large as the thorax, finely but not closely punctured; the frontal impressions large and rather deep, so that the margins over the antennal insertion appear raised. *Eyes* prominent. *Antennæ* with fine outstanding setæ; first joint stout; second rather small, not much longer than broad, oviform; third longer than the second; fourth and fifth oviform, slightly longer than broad; 6 to 10 incrassate, sixth and seventh subrotundate, 8 to 10 transverse, eleventh larger than tenth. *Thorax* subcordate, about as long as it is broad, much narrowed behind, basal angles not prominent; it is rather more distinctly punctured than the head; the two dorsal impressions are deep, especially behind, and are rather distant from the base; there is a distinct impression at each side. *Elytra* less than twice the length of the thorax, gradually narrowed towards the base; their punctuation rather fine, not close nor serial, and becoming more indistinct near the apices; behind the base there is a slight transverse impression and there is another alongside the suture on each. *Hind body* quite as long and broad as the elytra, finely sculptured, with conspicuous pubescence. The basal joints of the *tarsi* are half the entire length.

O. sagoloide, Sharp, is undoubtedly the nearest ally, but this species has no basal callosities on the elytra, and the suture, owing to the longitudinal impressions, appears elevated.

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

West Plains, Invercargill. One example from Mr. Philpott.

Omalium Philpotti, sp. n.

Subparallel, elongate, moderately shining; fusco-castaneous, the hind portion of the elytra darker than the basal; legs testaceous; the basal five joints of the antennæ red, remaining joints fuscous and opaque.

Head rather finely and not at all closely punctured, interocular foveæ small, frontal impressions shallow. *Thorax* rather small, transverse, its sides moderately rounded, narrowed behind, posterior angles rectangular; discoidal impressions broad, shallow in front; the lateral fossæ indistinct; its punctuation more distinct than that of the head, but not closer. *Elytra* about a third longer than broad, closely and rather finely punctate. *Hind body* as long as the wing-covers, finely sculptured; apical segment testaceous.

Underside reddish chestnut, finely punctured and pubescent.

O. australe has the thorax much more contracted behind and the elytra distinctly narrowed towards the base. *O. fusciventre* has a cordiform thorax with well-marked lateral foveæ, which this species has not. *O. perplexum* is larger and altogether different.

Var.—Body more rufescent, apical half of antennæ not infuscate.

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

West Plains, Invercargill. This species bears the name of its discoverer, Mr. Alfred Philpott.

Omalium perplexum, sp. n.

Subparallel, rather flat, shining, piceous; the thorax and shoulders (sometimes the whole base of the elytra) chestnut-red; legs paler, tarsi testaceous.

Head much narrowed in front of the eyes, with two broad longitudinal impressions, its punctuation moderately coarse and close, but nearly quite wanting in front. *Eyes* large and prominent. *Antennæ* as long as the head and thorax, the basal five joints shining red; second joint thicker but hardly as long as the third, the following small and bead-like, 6 to 10 about twice the width of the preceding one, densely pubescent and opaque, eleventh larger than tenth, also dark. *Thorax* broader than long, front angles rounded, its sides finely margined and nearly straight behind; basal angles rectangular, but not acute; its sculpture is a little coarser than that of the head, but the narrow space along the middle is smooth; at each side of this smooth space there is a large but not very deep impression, which approaches the base more than it does the apex; there is another impression at each side. *Elytra* evidently longer than broad, parallel-sided; their sculpture consists of almost regular series of distinct punctures, interstices very slightly raised; near the apices the punctuation becomes irregular; they bear only a few short, slender, scarcely noticeable hairs. *Hind body* not larger than the elytra, finely punctate, with fine but quite distinct pubescence; the basal three segments broadly margined, the fourth more finely margined and a good deal longer than the third; its apex and the terminal segment are castaneous. *Tibiæ* with fine, short, erect setæ. Sexual characters normal.

♀. Slightly larger, darker; the pubescence on the head and thorax, though fine, can be easily seen.

O. Helmsi, Fauvel, in. litt., is very much like this species, but it has the sides of the thorax more rounded before the middle, and its punctures are almost disposed in longitudinal rows; the setæ on the tibiæ are more numerous and the coloration is different.

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

Invercargill. Mr. Philpott, one pair.

[To be continued.]

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

RHOPALOCERA.

Nymphalinæ.

Genus Cynthia, Fabr.

Cynthia pura, sp. n.

♂. Ferruginous ochreous, much paler and brighter than even the Andaman form of *C. erota*; markings similar. Hind wings with a slight angle in place of the usual tail; palpi and frons crimson. Underside brightly coloured, the basal third tinged with crimson and with the sinuous lines crimson.

♀. Tail less like that of the male, with a broad white band across both wings, limited by the interior and submarginal lines on fore wings and the interior line and transverse dark shade, which extends from costa near apex to anal angle on hind wings; the basal portion of this wing is also more or less suffused with white, and the basal and outer portions of both wings suffused with ochreous, the suffusion bright and clear on the outer portion of the hind wings; palpi and frons tinged with crimson. Underside paler and more yellow than in the male, the basal third tinged and marked with crimson as in the male.

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

Cherra Punji. Three males, one female.

Genus Parthenos, Hübner.

Parthenos nella, sp. n.

♂. Markings much as in *P. virens*, Moore, both above and below, the black macular inner bands on the upperside of the hind wings of *virens* being replaced by broad complete bands, becoming conical towards the costa, as in *P. gambrisius*, Fabr.; but the colour is quite different, being dark green-black above, with no blue whatever in it. Underside pale blue-green on the basal half, almost exactly with the tint of the underside of *P. lilacinus*, Butler.

Expanse of wings 4 inches.

Sandakan, Borneo. A fine series, all males.

With a tint of coloration quite different to any species of the genus *Parthenos* known to me.

Genus Cyrestis, Boisd.

Cyrestis neela, sp. n.

♂. Upperside with the coloration of *Chersonesia risa*, Doubl., slightly darker, transverse lines somewhat similar, but not so uniform; the second and third meet on costa of fore wings, the fourth and fifth become wider above the median vein and bend inwards, the two lines in the cell also bend in a corresponding manner, and there is a third black line below them; on the hind wings also the double line in the cell is well separated from the third line, and the fifth, sixth, and seventh lines bend outwards on the costa; the tail is also longer. On the underside the colour is similar to the coloration of the underside of *C. risa*, the disposition of the lines differing as they do on the upperside.

Expanse of wings 2 inches.

Sandakan, Borneo. Five examples.

Very like *Chersonesia risa*, but does not belong to that subgenus, being a true *Cyrestis*, having the second subcostal nervure emitted before the end of the cell.

Lycænidæ.

Genus Horaga, Moore.

Horaga holothura, sp. n.

♂. Upperside: both wings azure blue; fore wings with the costa and outer borders broadly black, the band broadest at the apex and touching the large white discal patch, which is of the same size as in *H. onyx* ♀, but not pointed upwards as in that species: hind wings with costa broadly black, a submarginal row of black spots, divided from the black outer margin by a thin blue line; tails black, tipped with white; cilia white. Underside: both wings olivaceous brownish-ochreous, as in *H. onyx*; the white band in the same position, but rounded above on the fore wings, not produced beyond the upper end of the cell; the markings at the anal angle of hind wings similar.

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

Malang, Java. Four examples.

HETEROCERA.

Cymatophoridæ.

Genus POLYPLOCA, Hübn.

Polyploca galema, sp. n.

♂. Olive-brown; head black: fore wings covered with grey scales; a black spot at lower end of cell; antemedial and postmedial transverse lines black, double, sinuous, each with an even outward curve; a black marginal line with dentations into the cilia opposite the veins; a brown suffusion on the antemedial lines, which widens downwards on to the hinder margin; a deep black short streak at the apex, which is bent in its middle: hind wings dark brown; cilia interlined grey and brown, with pale tips.

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

Cherra Punji. One example.

Allied to *P. orbicularis*, Moore, but is a much larger insect, with the bands on fore wings wider apart, more regular, and with a pointed apex.

Genus GAURENA, Walker.

Gaurena solena, sp. n.

♂. Grey, tinged with yellow, and irrorated in parts with brown atoms; a broad, central, transverse, dark band, broadly suffused on each side with dark pink, and traversed by a number of black sinuous lines; the outer portion of the wing clear grey, with some black markings on the upper part; a submarginal black crenulated band, a black marginal line with dentations opposite the veins into the white cilia. Hind wings dark grey, with broad brown borders, and a brown central band, not much darker than the ground-colour of the wing; cilia white, containing black marks opposite the veins.

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

Cherra Punji. Two examples.

Micronidæ.

Genus PSEUDOMICRONIA, Moore.

Pseudomicronia simpleifascia, sp. n.

♂. White: fore wings with the costa with brown thin transverse marks; transverse bands ochreous grey, first rather thick, from costa of fore wings a little before the middle to the anal angle of hind wings; second from costa of fore wings one third before apex to the submarginal line in the hind wings one third before the anal angle; submarginal line double, well separated on fore wings, meeting together on hind wings, where it is joined by the second line; below this there are a number of thin grey lines; the marginal line of fore wings is grey and thin, on the hind wings it is brown and thicker, with blackish spots in the interspaces, the largest being at the base of the tail.

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

Aberdeen, Andaman Islands. One example.

Geometridæ.

Larentiinæ.

Genus Larentia, Treit.

Larentia combusta, sp. n.

♂. Upperside: fore wings dull red, thickly irrorated with brown atoms and smeared with white on lower outer portions; the wings crossed by many indistinct brown bands, and with two white patches on the costa, one before and the other beyond the middle: hind wings greyish white, with a pale brown medial line; grey suffusion close to outer margin, on which there is a black line. Underside of a uniform pale grey; a black spot at end of each cell and an indistinct discal transverse line of brown dots on each wing.

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

Cherra Punji. One example.

Genus Cidaria, Treit.

Cidaria fulvidorsata, sp. n.

♂. Head and palpi ochreous; body brown, with dorsal ochreous spots on abdomen: fore wings brown, the basal two thirds tinged with chocolate-colour, limited by a white discal line, which curves inwards on all the veins below the median; the outer third tinged with green; a brown triangular subcostal patch on the outer margin lined with white; a red patch below near the hinder angle; a transverse white line one third from base, elbowed outwardly in its centre: hind wings greyish white, with a brown spot at end of cell, with two darker grey indistinct discal bands, most distinct towards the abdominal margin. Underside grey, a brown dot at end of each cell; fore wings with a discal brown transverse line, hind wings with two discal lines; marginal line on both wings dark brown.

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

Cherra Punji. One example.

Genus GANDARITIS, Moore.

Gandaritis maculata, sp. n.

♂ ♀. Head and body yellow, with pale black bands; wings white, with transverse bands of large elongated pale black spots in the interspaces; the fore wing with three at equal distances from the base, the third double above the median vein; a narrow white space, followed by two bands close together, the outer one on the margin: hind wings with a band a little before the middle and two on the outer border; small black patches on the cilia of both wings at the extremities of the white veins. Below, the wings are marked as above, the legs yellow.

Expanse of wings, ♂ $1\frac{5}{10}$, ♀ $1\frac{8}{10}$ inch.

Asama Yama, Japan. Two males and three females.

ACIDALIINÆ.

Genus ERITHROLOPHUS, Swinh.

Erithrolophus semiustus, sp. n.

♂. Head and abdomen pinkish ochreous; thorax and fore wings purplish brown; a large pinkish-ochreous apical patch, crossed by a red line and some whitish dots, the costa above the patch brown. Hind wings pinkish ochreous, with the costa broadly purplish brown, the ochreous portion sparsely irrorated with red atoms and crossed by two red sinuous lines, medial and discal; marginal line brown; cilia grey. Underside grey, tinged with pink; the basal and lower portions of fore wings suffused with brown; lines as above.

Expanse of wings 1 inch.

Cherra Punji. One example.

Drepanulidæ.

Genus ALBARA, Walker.

Albara erpina, sp. n.

♂. Lilacine grey, of the same tint of colour as *A. lilacina*, Moore; fore wings with a transverse straight antemedial brown line, another curving slightly inwards from hinder margin one third from angle to the costa near apex; costal and outer marginal lines brown; a white straight submarginal line; four pure white speckles at end of cell. Hind wings paler, with two short brown lines, ante- and postmedial, from the abdominal margin; a brownish shade containing a short white line near the anal angle.

Expanse of wings 1 inch.

Cherra Punji. Three examples.

The fore wings are not so falcate as in *A. lilacina*; the outer line in fore wings is single, and there are no submarginal brown spots as in that species. *A. lilacina* has also no white speckles, which are distinctive in this species.

Genus Drepana, Schrank.

Drepana mecasa, sp. n.

♂. Brown: fore wings with two black spots at the end of the cell, one being at upper end and the other in the middle; a dark brown diffuse band from apex of fore wings to abdominal margin of hind wings one fourth from base, the band in places appearing duplex: hind wing with a straight discal band of three thick brown lines, but not very distinct; submarginal black dots on both wings. Underside grey, with two black dots at the end of each cell and a band of three indistinct pale brown discal lines on both wings.

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

Cherra Punji. Two examples.

Genus Oreta, Walker.

Oreta olga, sp. n.

♂ ♀. Antennæ of male bipectinated, of the female ciliated, the outer margin of the hind wing in both sexes excised above the anal angle. Upperside brown, tinged with yellow, sparsely striated with brown: fore wings with a slight white smear below the apex; both wings crossed by a brown medial curved line, outwardly marked with ochreous grey, this line is sharply bent inwards below the costa of fore wings, and is angled outwards above the middle in the hind wings; cilia dark brown. Underside paler, tinged with pink, the striations prominent, the line indistinct.

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

Shillong. One pair.

The female is paler and more yellow than the male.

Genus PHALACRA, Walker.

Phalacra nudobia, sp. n.

♂ ♀. Olive-brown; two black spots at the end of each cell: fore wings with two brown indistinct bands, one from the base subcostal, the other from middle of hinder margin to the apex: hind wings with a central brown band, limited inwardly by a brown line, above which is a broad ochreous band. Underside grey, with three transverse grey discal lines.

Expanse of wings, ♂ $1\frac{2}{10}$, ♀ $1\frac{4}{10}$ inch.

Cherra Punji. One pair.

This species has the hind wings not angled at vein 6.

Lymantriidæ.

Genus ORGYIA, Ochs.

Orgyia nucula, sp. n.

♂. Antennæ, thorax, and fore wings chestnut-brown, the latter with a subbasal brown band, with a pale line on each side of it and a white mark adjoining its outer lower portion; a discal brown band rather close to the margin, also with a pale line on each side; a small whitish patch at the apex and some whitish marks along the margin below it. Hind wings deep black; cilia of both wings ochreous. Underside: both wings uniform deep black, with ochreous cilia.

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

Fort Stedman, Shan States, one example; Cherra Punji, one example.

Genus OLENE, Hübner.

Olene orimba, sp. n.

♂ ♀. Antennæ, thorax, and fore wings brown, the last with a discal double band of acutely angled black marks, larger and more distinct in the female; a submarginal line of black lunular marks. Hind wings grey; cilia grey, with a whitish line at its base. Underside grey, with traces of a brown outwardly curved discal line on each wing.

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

Shillong. One pair.

Genus ADLULLIA, Walker.

Adlullia oreosaura, sp. n.

♀. Antennæ, head, thorax below, and legs bright yellow;

thorax above dark chocolate-colour. Fore wings bright yellow, with a large chocolate-coloured band which covers nearly the whole surface of the wing, leaving only the outer margin, the costa, and an inwardly excavated rounded space, including the outer half of the cell, yellow; a large prominent black spot at the end of the cell in the yellow space: hind wings blackish brown, with a yellow outer border, and the costa more or less suffused with yellow; abdomen black, with a yellow anal tuft. Underside yellow, with the interior portion of both wings suffused with black.

Expanse of wings $2\frac{4}{10}$ inches.

Cherra Punji. One example of this very handsome moth.

Arctiidæ.

Genus Rhodogastria, Hübner.

Rhodogastria negrita, sp. n.

Creatonotus negritus, Swinh. MS.; Hampson, Faun. Brit. Ind., Moths, ii. p. 28 (1894).

♂ ♀. Palpi and antennæ black; frons and thorax pure white; top of head and collar crimson; abdomen black, with yellow bands. Wings black: fore wings with costal line towards apex crimson; a white streak from base to end of cell, another along the entire length of the interno-median interspace, and a short basal white streak on the hinder margin: hind wings with the base and abdominal margin suffused with white; cilia of both wings white. Underside same as upperside, but wings blacker; thorax white; legs white, with crimson stripes; tarsi black; abdomen black, with white bands.

Expanse of wings, ♂ 2, ♀ $2\frac{4}{10}$ inches.

Cherra Punji. Two males and five females.

The colour of the wings varies much in tint, some examples being deep black and some much paler.

Lithosiidæ.

Genus Baroa, Moore.

Baroa vatala, sp. n.

♂ ♀. Of a uniform dark ochreous grey, thorax with black spots. Fore wings with two black spots at the base, one at the end of the cell, and two outwardly curved transverse rows of black spots, the first before the middle; in the male there are only two spots, in the female there are four; the second row is discal, consisting of a spot in each interspace in both sexes: hind wing with a discal band on the underside showing through the wing. Underside coloured as above, with a discal black band, divided by the veins across both wings; anal tuft on abdomen ochreous in both sexes.

Expanse of wings, ♂ $1\frac{2}{10}$, ♀ $1\frac{4}{10}$ inch.

Shillong. Four males and three females.

Allied to *Baroa punctivaga*, Walker, from Java.

Genus Scaptesyle, Walker.

Scaptesyle integra, sp. n.

♂ ♀. Head, thorax, and abdomen deep black; collar, tegulæ, and wings bright golden yellow; abdomen with some greyish-yellow hairs at the end. Fore wings with a deep black narrow basal space, and both wings with deep black borders, occupying the outer third of fore wings, narrow in the hind wings, and gradually fining hindwards to a thick line towards the anal angle.

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

Shillong and Cherra Punji. A fine series.

Allied to, but perfectly distinct from, *S. bicolor*, Walker, which is uniformly more ochreous and has broad black borders covering nearly half the wings.

Genus Æmene, Walker.

Æmene amnœa, sp. n.

♂. Head, thorax, and fore wings white; thorax with black spots in front and two longitudinal black stripes. Fore wings—a spot at the base, a transverse subbasal band of three spots, followed by a similar band before the middle, a spot in the cell, an irregular broad band beyond the middle, which includes a deep black spot at the end of the cell, is dentated on both sides, and dislocated below the centre; a submarginal band of large lunular black spots; black spots on the margin including two much larger than the others, and running into the white cilia, one at the apex and the other a little below it: hind wing blackish brown, without markings. Underside: both wings suffused with brown.

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

Shillong. One example.

Looks like a *Tarache* of the Noctuid family Acontiidæ.

Genus Barsine, Walker.

Barsine fuscifera, sp. n.

♂. Of a uniform orange ochreous: fore wings with a black spot at the end of cell, and slightly suffused with brown, except on the outer portions: hind wings with a similar but darker suffusion. Underside with the coloration brighter, the whole of the fore wings with the exception of the borders covered with black: hind wings with a black subcostal streak towards the apex; the interior of the wing very slightly suffused with brown: abdomen brown, with small ochreous tuft; legs ochreous and brown.

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

Cherra Punji. One example.

Barsine eschara, sp. n.

♂. Yellow: fore wings with a brown thick line on the outer margin and two transverse similar lines, the first from the middle of the costa to the base below the median vein, where it runs into a longitudinal line, which extends from the base to the outer margin; second from the costa near apex, where it is joined by the marginal line to the hinder margin one third from the angle; this line throws out two others above its centre to the outer margin, and from its centre an inner line which curves upwards, passing across the first transverse line, and runs to the base of the costa. Hind wings paler and without markings.

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

Cherra Punji. Three examples.

Allied to *B. distributa*, Walker, from Borneo.

Genus Setina, Schr.

Setina leacrita, sp. n.

♂ ♀. Bright ochreous: fore wings with three transverse rows of small black spots, and one spot at the base; first row a little before the middle consisting of three, second discal, outwardly curved, a spot on each vein; third submarginal, irregular, a spot in each interspace: hind wings slightly paler than fore wings and without markings. Underside: both wings coloured like the hind wings above, with some indistinct submarginal dots on both wings.

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

Yokohama and Asama Yama, Japan. Three males and one female.

Genus CACYPARIS, Walker.

Cacyparis prunifera, sp. n.

Cacyparis prunifera, Swinh. MS.; Hampson, *t. c.* p. 127.

♀. Fore wings white, closely striated with dark purple-brown; a short antemedial band composed of three chocolate-brown lunular marks from hinder margin; a very large, outwardly pale-edged chocolate-brown spot in the upper disk, which is variegated with orange and purple; some purple patches on lower half of outer margin. Hind wings greyish brown; cilia whitish. Head and thorax brown, mottled with white; tegulæ with tufts of long whitish hairs; abdomen greyish brown.

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

Ceylon; one example, in Mus. Oxon. Sikkim; one example, in coll. Swinhoe.

Lasiocampidæ.

Genus ODONTOCRASPIS, nov.

Antennæ short, stout; the pectinations very stout, short, and gradually decreasing to the tips. Fore wings with the costa arched, outer margin excised above the middle; a falcated production below the apex at the end of vein 6; hinder margin long and straight; wing narrow; veins 6 and 7 branched nearly halfway beyond the end of the cell. Hind wings with the costa straight and very short; outer margin round, regularly excised and very long; the abdominal margin long; the anal angle narrow; veins 4 and 5 stalked, 8 curved upwards and then down to 7, which it joins a little before the base.

Odontocraspis hasora, sp. n.

♂. Rich chestnut-brown: fore wings with some orange speckles in the cell and a group of them at the end of the cell, with two small white spots on the outside; a hyaline outwardly excavated spot near the margin above vein 6, and a similar smaller one in the next interspace above it; two transverse, sinuous, brown discal bands: hind wings with the costal space paler than the rest of the wing. Underside duller brown; a whitish lunule at the end of the cell; a broad bluish-white central band not extending to either margin; marginal space cupreous tinged.

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

Shillong. Eleven examples.

A very curious-looking insect.

Cossidæ.

Genus Azygophleps, Hampson.

Azygophleps nurella, sp. n.

♂. Palpi and frons black; top of head, thorax, abdomen, and both wings grey, tinged with ochreous; a brown band behind the head; abdomen with grey bands. Fore wings with a grey costal border, the inner portion of the wing suffused with darker ochreous; both wings without markings. Below, of the same uniform colour, without markings, except the legs, which have black bands on the tarsi.

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

Cherra Punji. One example.

Genus Arbela, Moore.

Arbela phaga, sp. n.

♀. Brownish grey, thorax speckled with olive-brown. Fore wings with a discal band of large round olive-brown spots from apex to hinder margin beyond the middle, the whole wing between this band and the base covered with bands of similar spots packed closely together; interno-median interspace filled with white hairs, making a whitish streak from base to outer band; some smaller olive-brown spots on the outer margin: hind wings dark grey, without markings; cilia of both wings ochreous grey, interlined with brown. Underside: both wings dark brownish grey, without markings; cilia as above; legs with white and brown hairs.

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

Cherra Punji. One example.

Hepialidæ.

Genus Palpifer, Hampson.

Palpifer cœrulescens, sp. n.

♂. Dark chocolate-brown: fore wings with a prominent subbasal white spot; two indistinct brown transverse discal bands, white dots on the outer, and an indistinct discal row of similar dots, which are continued to the base above the hinder margin: hind wings darker than the fore wings, with a whitish patch on the middle of the cilia, extending a little on to the wing. Underside dark dull brown, without any markings; legs with grey hairs.

Expanse of wings 1 inch.

Cherra Punji. One example.

Syntomidæ.

Genus Syntomoides, Hampson.

Syntomoides quisqualis, sp. n.

♂ ♀. Antennæ simple, black, with white tips; frons white; thorax and abdomen black, the former with a large ochreous spot in front and another behind, abdomen with five broad ochreous bands. Wings deep black: fore wings with a large hyaline patch filling the outer two thirds of the cell, a hyaline space occupying the whole interno-median area up to vein 2 (this space is in some specimens cut in two by a black bar), a band of three large hyaline discal dots; hind wings hyaline, with black margins, broadest on costa and at apex.

Expanse of wings $1\frac{4}{10}$–$1\frac{7}{10}$ inch.

Shillong. Five males and one female.

Much like *Syntomis thelebus*, Fabr., from China and Japan; the body similar, but the frons is white, and not ochreous as in that species; the hyaline spots are similarly disposed but larger. *S. thelebus* is, however, a true *Syntomis*, and this species is a *Syntomoides*—the fore wing with vein 3 from before end of cell, 4 and 5 from the end; hind wing with vein 3 absent.

Genus Eressa, Walker.

Eressa ginorea, sp. n.

♂. Deep black; abdomen with a broad golden band in front, black hairs at the tip: fore wings with two bands of hyaline spots—first in the middle, consisting of three, two long and the centre one round, occupying the outer line of the cell and the interspaces below it; the second discal, of four spots in pairs: hind wings with a small round hyaline spot near the middle of the abdominal margin.

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

Cherra Punji. One example.

Allied to *E. aperiens*, Walker.

Zygænidæ.

Genus Phacusa, Walker.

Phacusa sizala, sp. n.

♂ ♀. Black; frons metallic green, tongue crimson; head, collar, and fore part of thorax powdered with metallic green.

Wings hyaline, with black veins and black borders, thinnest on the costa of fore wings and on abdominal border of hind wings; a small white anal tuft to the male; tip of antennæ white on one side in both sexes.

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

Shillong. One pair.

Chalcosiidæ.

Genus Heteropan, Walker.

Heteropan leis, sp. n.

♂ ♀. Antennæ black, the branches of the male with pale ends. Body and wings dark blackish green: hind wings black, with a dull ochreous band, broad, short, and rounded at each end, in the upper disk of the male, but extending over two thirds of the wing in the female, leaving the costa thinly and the outer border and abdominal margin broadly black; a small space in the cilia below the apex white on each wing. Underside black, paler in the male than in the female, with a dull ochreous upper discal patch more or less connected with the base in the male, very large in the female, and on the hind wings of the same size and shape as it is above; in the female also the outer border of the hind wing is metallic green; cilia as above.

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

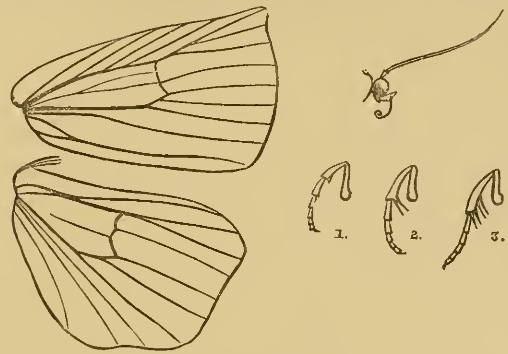
Shillong. A fine series of both sexes.

Genus Chalcosiopsis, nov.

♀. Palpi short and porrect; antennæ simple. Fore wing with the costa slightly excised before the apex, which is produced to a lobe; the outer margin much excurved; vein 1 *a* forming a large fork with 1 *b*; 1 *c* present and running close along the median vein to middle of cell, 3 from before angle of cell, 4 from the angle, 5 from below centre of discocellulars, 6, 7, and 8 stalked; 12 short, to middle of costa; a forked veinlet in cell. Hind wing with vein 1 *a* short, 1 *c* present, 3 from before angle of cell, 4 from the angle, 5 from above centre of discocellulars, 6 and 7 stalked, 8 curved and nearly touching the subcostal vein at middle of cell; a veinlet in middle of cell; frenulum fully developed; apex somewhat produced, outer margin excurved at centre; legs with the tibial spurs long.

Chalcosiopsis variata, sp. n.

♀. Upperside: body and fore wings black; fore wings with a broad white band from the costa a little before the middle to near the outer margin, terminating on vein 3; a short costal, subapical, broad white streak: hind wings white, with a black basal subcostal streak and broad black borders,



Chalcosiopsis variata.

in some examples occupying half the wing-space; cilia of both wings black, with a white basal line, pure white at apex of hind wings. Underside: wings as above; body and legs white.

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

Shillong. Four examples.

Genus HAMPSONIA, nov.

♂. Branches of antennæ short; frons produced. Wings long and narrow: fore wings with the costa arched; apex round; outer margin curving inwards in its middle; venation much as in the genus *Amesia*: hind wings with the apex and outer margin rounded; veins 4 and 5 stalked beyond lower end of cell; 6 and 7 emitted together from upper end.

Hampsonia pulcherrima, sp. n.

♂. Antennæ, body, and legs metallic green-black: fore wings black, with two large ochreous subbasal spots joined together, another inside the cell, two joined together below it, one discal between veins 3 and 4, another near the margin in the interspace above, the cell-spot being the largest: hind wings black, with broad crimson streaks; subcostal commencing from the base with a yellow streak, then crimson to the apex, and four large crimson streaks almost filling up each interspace along the margin; abdominal border yellow.

Expanse of wings $2\frac{4}{10}$ inches.

Cherra Punji. One example.

A very brightly coloured beautiful insect.

[To be continued.]

LVI.—*On some Fish-remains, of the Genera* Portheus *and* Cladocyclus, *from the Rolling Downs Formation (Lower Cretaceous) of Queensland.* By A. Smith Woodward, F.L.S.

[Plate X.]

Through the kindness of Mr. R. L. Jack, Government Geologist of Queensland, and Mr. George Sweet, of Brunswick, Melbourne, the writer has been favoured with the opportunity of examining some further remains of fishes from the Lower Cretaceous of Queensland. With the exception of a few Selachian teeth and vertebræ * and a fine species of *Belonostomus* † no cretaceous ichthyolites of importance have hitherto been described from this colony; and the discovery of the two additional species now to be placed on record is thus one of considerable interest. The genera represented have been found in the Cretaceous both of Europe and America, and the second, like *Belonostomus*, also occurs in Brazil. The species, however, appear to be distinct from any already described, and sufficiently characteristic portions of the first are preserved to admit of a precise diagnosis.

Portheus australis, sp. n. (Pl. X. figs. 1, 1 *a*.)

Type.—Anterior two thirds of the jaws with part of the base of the cranium exposed on both sides, but more or less abraded and fractured; Museum of Queensland Geological Survey.

Sp. Chars.—A species of medium size, about two thirds as large as the type species. Premaxilla with four relatively large closely arranged teeth. Maxilla not much deepened in front, the dentigerous border nearly straight, the teeth well spaced and those anteriorly not much enlarged.

Description.—The left side of the type and only known specimen is shown of two thirds the natural size in Pl. X. fig. 1, and an abraded horizontal section of the right premaxilla, with the four teeth, is given in fig. 1 *a*. There is nothing worthy of remark in the fragmentary cranium, and the comparatively delicate, toothless, pterygoid arcade (*pt.*) is only imperfectly shown. The robuster portion of the palatine (*pl.*), however, interposed between the maxilla

* *Lamna appendiculata* and *L. Daviesi*, R. Etheridge, Jun., Proc. Linn. Soc. N. S. Wales, [2] vol. iii. (1888) p. 156, pl. iv.

† *Belonostomus Sweeti*, R. Etheridge, Jun., and A. S. Woodward, Trans. Roy. Soc. Victoria, 1891, p. 1, pl. i.

and prefrontal (*pf.*), and articulating with each of these bones, is conspicuous on both sides of the fossil. The maxilla (*mx.*) exhibits the usual broad laminar process (*pr.*) extending inwards at its anterior extremity, to be covered by the premaxilla; and the bone is not much less deep behind than in front. The hinder portion of the upper margin of this element exhibits the slight longitudinal groove noted in other species, and the inferior or dentigerous margin is nearly straight. The maxillary teeth are much broken even on the left side, but all are shown to be stout and hollow, separated by irregular intervals wider than the teeth themselves, while those in the anterior third of the bone are not much longer than those behind. Both premaxillæ are displaced and much abraded, but they appear to have been comparatively robust, and the bases of four teeth are indicated in the bone of the right side, these teeth being much larger than any of those of the maxilla. An imperfect section of the premaxilla is given in fig. 1 *a*, and it will be observed that the teeth are closely pressed together, their extero-internal diameter being the greatest. Of the cheek-plates there are no satisfactory remains, and of the ossified sclerotics only part of that on the right side is preserved.

Comparison.—The fossil thus described is readily distinguished from all the known species of *Portheus* by the characters noted*. To mention only a few points: the Australian species differs from *P. molossus* and *P. thaumas* in the greater development of its premaxillary dentition; from *P. lestrio*, *arcuatus*, *Mantelli*, and *Daviesi* in the straightness of the dentigerous border of the maxilla; from *P. Mudgei* and *P. gaultinus* both in the form of the maxilla and the regularity of its dentition. The new fossil may therefore be regarded as representing a hitherto unknown species, appropriately named *P. australis*, in allusion to its being the first evidence of the fish from the Southern Hemisphere.

Formation and Locality.—Rolling Downs Formation (Lower Cretaceous); Clutha Station, near Hughenden, Gidgery Creek, Queensland.

Cladocyclus Sweeti, sp. n. (Pl. X. figs. 2–6.)

Type.—Detached scale; collection of George Sweet, Esq., F.G.S., The Close, Brunswick, Melbourne.

* Descriptions of the known species of *Portheus* are given by E. D. Cope, "Vertebrata of the Cretaceous Formations of the West" (Rep. U.S. Geol. Surv. Territ. vol. ii. 1875), and by E. T. Newton, "On the Remains of *Hypsodon, Portheus*, and *Ichthyodectes* from British Cretaceous Strata," Quart. Journ. Geol. Soc. vol. xxxiii. (1877) pp. 509–520.

Description.—A series of scales, of which five examples are shown of the natural size in figs. 2–6, belong to the provisionally-named genus *Cladocyclus*, already known by similar fossils from the Cretaceous of Europe, North America, and Brazil. Though exhibiting much diversity in form and characters, they probably all represent one species, the differences not being greater than such as are commonly explained by differences in state of preservation and original position on the body of the fish.

The type scale (fig. 2) is nearly as broad as deep, but the state of preservation does not allow the limits of the exposed sector to be determined. Only the fine concentric lines of growth are shown, and remains of the exposed surface exhibit a few large, rounded, flat-bottomed pits, irregularly arranged and mostly well within the marginal area. An equally broad scale (fig. 3), still more imperfect, belongs to the lateral line. Three much smaller scales are relatively narrow and deep, and all show the limits of the exposed sector. The specimen represented in fig. 4 is a curious impression, with minute points of calcareous matter indicating the position of the original pits; and there are traces of a few well-spaced short transverse grooves at the hinder margin of the scale, imparting the aspect of an extremely coarse crimping. Fig. 5 also represents an impression in which the radiating lines on the covered area are conspicuous, while the pittings on the exposed sector distinctly appear. The small imperfect scale shown in fig. 6 has the tissue itself preserved, and is marked on the exposed sector with grooves and pittings and on the covered area with radiating lines.

Specific Determination.—Such fossils are, of course, worthless for specific determination, and it may even be doubted whether "*Cladocyclus*" is not a refuge for the detached scales of more than one fish already known under another name. Four "species," however, have already been described, namely: *C. lewesiensis* from the English Chalk *, *C. Gardneri* from the Brazilian Cretaceous †, *C. occidentalis* from the Cretaceous of Nebraska ‡, and *C. strehlenensis* from the Chalk Marl of Saxony §. From all these the Queensland scales now made known appear to differ in their larger more sparsely arranged pittings; and they may thus, for convenience of

* L. Agassiz, Poiss. Foss. vol. v. pt. i. (1844) p. 103, pl. xxv. *a*, figs. 5, 6.

† L. Agassiz, Edinb. New Phil. Journal, vol. xxx. (1841) p. 83.

‡ J. Leidy, "Extinct Vert. Fauna W. Territ." (Rep. U.S. Geol. Surv. 1873), p. 288, pl. xvii. figs. 21, 22, pl. xxx. fig. 5.

§ H. B. Geinitz, Denkschr. Ges. f. Naturk. etc., Dresden, 1868, p. 43, with figs.

reference, receive the provisional name of *C. Sweeti*, in honour of their discoverer. Most of the scales of *C. lewesiensis*, including those of the lateral line, are much deeper than broad, and both these and the scales named *C. occidentalis* are marked externally with very closely arranged small pits, while the radiating lines on the covered portion are always very conspicuous. The scales of *C. Gardneri* sometimes exhibit the slight approach to crimping of the hinder margin noted in *C. Sweeti*, and some of the scales of *C. strehlenensis* are remarkably smooth.

Teleostean Vertebræ. (Pl. X. fig. 7.)

A chain of five caudal vertebræ from the same horizon as the scales described above so closely resemble the corresponding bones of *C. Gardneri*, as shown by a specimen in the British Museum (no. 28901 *a*), that they quite possibly belong to the same genus. Two are represented of the natural size in Pl. X. fig. 7. The inner cone of the centrum appears as a sharply defined rim at each end of the vertebra. The slender neural and hæmal arches are not fused with the centrum, but loosely inserted in elongated pits. There are also two very deep pits on each side of the centrum extending almost from end to end.

Vertebræ of this form, however, are also met with in *Portheus*, *Ichthyodectes*, and other Cretaceous fishes. There can thus be no certainty in their determination until they are found actually in position in the skeleton.

EXPLANATION OF PLATE X.

Fig. 1. *Portheus australis*, sp. n. Anterior portion of skull, left lateral aspect, two thirds nat. size.—Lower Cretaceous; Clutha, Queensland. [Museum of Queensland Geological Survey.] *d.*, dentary; *mx.*, maxilla; *pf.*, prefrontal; *pl.*, palatine; *pr.*, anterior process of maxilla; *pt.*, portion of pterygoid arcade.

Fig. 1 *a*. Ditto. Abraded horizontal section of premaxilla of same specimen, showing four teeth.

Figs. 2–6. *Cladocyclus Sweeti*, sp. n. Type scale and four others provisionally ascribed to the same species.—Lower Cretaceous, Queensland. [Collection of George Sweet, Esq., F.G.S., Melbourne.]

Fig. 7. Teleostean caudal vertebræ, possibly referable to *Cladocyclus Sweeti*.—Lower Cretaceous; Station Creek, Afton Downs, Queensland. [Queensland Museum.]

[Unless otherwise stated, the figures are of the natural size.]

LVII.—*On Two new Species of Tenebrionid Coleoptera from Namoa Island.* By G. C. Champion, F.Z.S.

In the current volume of this Magazine, pp. 49–71, 98–110, an account is given of the zoological collections made at Damma Island by two of the officers of H.M.S. 'Penguin.' The two species of Tenebrionidæ described below were obtained by Mr. J. J. Walker at Namoa Island, South-east China, during the same voyage.

Specimens of *Leichenum seriehispidum*, Mars., hitherto known only from Japan, were also captured at the same locality.

Trachyscelis, Latr.

Trachyscelis chinensis, sp. n.

Short ovate, ferrugineo-testaceous, shining, the apices of the tibiæ, the femora beneath, and the ventral segments, except at the sides, more or less pitchy brown; the marginal ciliæ sparse. Head and prothorax impunctate, the latter nearly three times as broad as long; elytra widest a little behind the middle, very finely punctate-striate, the sixth, seventh, and eighth striæ faint but distinct, the others sharply defined, the marginal stria deep and impunctate, the outer interstices perfectly flat, the inner ones feebly convex; beneath sparsely punctured, the middle of the metasternum and the propleuræ almost smooth; metasternum convex in front, depressed in the middle behind, deeply canaliculate.

Length $2\frac{1}{4}$–3, breadth $1\frac{1}{3}$–$1\frac{2}{3}$ millim.

Numerous examples. Closely allied to the Australian *T. lævis*, Champ.*, and differing from it as follows:—The sixth to the eighth elytral striæ are more distinct and the inner ones deeper, the inner interstices slightly convex; the tibiæ are infuscate at the tip; and the under surface is more sparsely punctured, the metasternum almost impunctate and shining in the middle, and also more convex anteriorly. *T. pallens*, Champ., from Ceylon, and *T. sabuleti*, Lewis, from Japan, are less closely allied forms.

Ammophthorus, Lacord.

Ammophthorus asperatus, sp. n.

Oval, very convex, subopaque, black or piceous; the elytra sometimes reddish brown; the antennæ and legs ferruginous,

* Ent. Month. Mag. xxix. p. 254 (1893).

the femora piceous beneath; the prothorax and elytra sparsely ciliate at the sides, and also with scattered, shorter, semierect, yellowish-cinereous hairs, which are serially arranged on the elytra. Head coarsely granulate; prothorax nearly twice as broad as long, feebly rounded at the sides, slightly narrowed in front, the surface densely covered with small, flattened, subtriangular elevations, these being sometimes absent from a smooth narrow line on the anterior half of the disc; elytra short-oval, widest about the middle, obliquely narrowed behind, densely covered with small flattened triangular elevations, which are more raised and granular towards the apex; beneath densely granulate and sparsely pubescent.

Length $2\frac{3}{4}$–$3\frac{1}{4}$, breadth $1\frac{2}{3}$–$1\frac{3}{4}$ millim.

Many specimens. Closely allied to the European *A. rufus*, Luc. (=*rugosus*, Rosenh.), but duller, the elytra more obliquely narrowed behind, and with the flattened subtriangular elevations much more crowded, becoming tuberculiform towards the apex.

The other described species of the genus are *A. insularis*, Reitt., from Corsica, and *A. dilatatus*, Reitt., from Astrachan.

LVIII.—*A Preliminary Revision of the Bornean Species of the Genus* Mus. By Oldfield Thomas.

Considering the great richness in rats and mice which Mr. John Whitehead's exploration of Mount Kina Balu in 1888 showed Borneo to possess, no part of the world has until recently been so badly represented by specimens in scientific collections as that island. Happily, however, in 1893 and 1894, the British Museum acquired from Mr. A. Everett two large collections of Muridæ from Kina Balu and other localities, and it is to these collections that the possibility of making even the present rough revision of the members of this group is due. Mr. Whitehead was the first discoverer, as it turns out, of the majority of the peculiar Bornean species; but the absence at the time of lowland specimens for comparison prevented my recognizing all the new forms when the paper on his collections was written *. Now, however, that Mr. Everett has obtained examples both from high up and low down on Kina Balu, besides sending good series from Labuan, the Penrisen Hills, Palawan, and elsewhere, while

* P. Z. S. 1889, p. 228.

Mr. Hose has contributed some from Mounts Dulit and Mulu and the lowlands of Baram, I am enabled to work out the whole series somewhat more satisfactorily.

But even now it has been found impossible to do more than give a rough synopsis of the species as yet recognized to occur in Borneo, without making any observations on the Murine fauna of the other great East-Indian Islands, where no doubt many of the same species also occur.

Similar or better series will be needed from those islands before anything of the sort can be attempted.

The characters given in this synopsis are such as may be observed by any one on the spot, with good skins for examination, and do not need any technical knowledge for their recognition beyond the power of distinguishing adult from young specimens. Detailed technical descriptions of the new species are, of course, appended.

Although it is hoped that the present paper marks an advance on our previous limited knowledge of these animals, yet there is clearly an enormous amount more to be learnt as regards their ranges, vertical and horizontal, their sexual and seasonal differences, and many other points, on most of which we are entirely ignorant. For this purpose we want infinitely more material and that better collected, especially in the form of skins, with perfect skulls, and with the exact localities, altitudes, and flesh-measurements carefully marked on the labels. These remarks, if true of Borneo, are much more so as regards the other great islands of the East Indies, from all of which good material is urgently needed.

Rough Synopsis of the Species of Mus *known to occur in Borneo.*

1. *Mus infraluteus*, Thos.

Size very large, form thick and heavy; hind foot about 50 millim.* Tail about equal to head and body, black, short-haired. Fur soft, but with longer harsher bristles intermixed. Colour hoary blackish grey; belly dirty greyish buff, not sharply defined. Hands and feet blackish.

Mount Kina Balu (*Whitehead*, *Everett*).

"Tankulom" of Dusuns (*Everett*).

2. *Mus Muelleri*, Jent.

Size large, form normal; hind foot about 42 millim. Tail rather longer than head and body, brown, short-haired. Fur

* Measured from heel to tip of longest toe, *without claw.*

coarse, without spines or longer bristles. Colour coarsely lined black and yellowish. Belly whitish buff, almost or quite without slaty bases to hairs; not sharply defined. Metapodials brown, digits naked. Mammæ 2—2=8.

Batang Singalan *, Sumatra (*Müller*, *Leyden Mus.*); Sadong, Sarawak (*Wallace*); Kina Balu, Paitan, and Gomanton Cave, N. Borneo (*Everett*); Mount Dulit, 2000 feet (*Hose*); Claudetown (*Hose*); Labuan (*Everett*).

3. *Mus sabanus*, Thos.

Size large; hind foot about 41 millim. Tail much longer than head and body, rather more hairy than in the previous species, its colour variable, more or less bicolor. Fur thinly spinous. Colour coarsely lined rufous, clearing to bright rufous on sides. Belly pure sharply defined white or pale yellow. Centre of metapodials dark brown, their sides and whole of digits white. Mammæ 2—2=8.

Mount Kina Balu (*Whitehead*, *Everett*); Mount Dulit, 5000 feet (*Hose*); Niah Caves, Sarawak (*Hose*); Bunguran Island, Natunas (*Everett*).

4. *Mus rajah*, sp. n.

Size medium, but feet proportionately very long, so as to be nearly as long as in the last species (circa 39 millim.). Tail about as long as the head and body, thinly haired, bicolor. Fur thickly spinous. Colour varying from isabelline to rufous, in all more rufous on sides. Under surface white, generally sharply defined; a rufous collar in some specimens. Hands and feet white. Mammæ 2—2=8.

Mount Batu Song (*Everett*); Paitan, N. Borneo (*Everett*); Kina Balu (*Everett*); Labuan (*Low*, *Everett*); Penrisen Hills, W. Sarawak (*Everett*); Bunguran Island, Natunas (*Everett*); Palawan (*Whitehead*, *Everett*).

5. *Mus alticola*, Thos.

Size medium; hind foot about 32 millim. Tail about equal to head and body, practically naked, bicolor. Fur long, spiny. Colour uniformly bluish grey above, pale yellowish white below; line of demarcation not sharply marked. Feet whitish.

Mount Kina Balu, 8600 feet (*Whitehead*).

6. *Mus ochraceiventer*, sp. n.

Proportions and other characters as in last, but fur

* The type locality is always put first.

shorter and more spiny, and colour different. Back coarsely grizzled brown and fulvous rufous; belly brilliant fulvous yellow ("ochraceous").

Mount Kina Balu, below 3000 feet (*Everett*).

7. *Mus Whiteheadi*, sp. n.

Size small; hind foot about 27 millim. Tail about length of head and body, nearly naked, bicolor. Fur spiny. Colour rufous above, but the tips of the spines wholly brown or black, ochraceous, with slaty bases, below not sharply defined. Hands and feet white; soles slate-coloured. Mammæ 2—2=8. Bullæ small; palatal foramina short. Teeth of normal size.

Kina Balu (*Whitehead*, *Everett*); Poeh Mountain (*Everett*); Penrisen Hills (*Everett*); Banguey Island (*Everett*).

"Ahun-Ahun" of Kian Dusuns (*Everett*).

8. *Mus bæodon*, sp. n.

Hind foot 25 or 26 millim. Proportions and characters of feet and tail much as in the last species. Fur very spiny. Colour rufous, faintly speckled with yellow; the spines, at least on flanks, with yellow terminal or subterminal rings; belly-hairs wholly whitish buff, not sharply defined. Mammæ 2—2=8. Bullæ and palatal foramina as in *Whiteheadi*. Teeth very small.

Mount Kina Balu (*Everett*).

9. *Mus Jerdoni*, Bly.

Size very variable, some specimens almost as large as *M. rajah* and others as small as *M. ephippium*; hind foot ranging from 25 to 30 millim. Tail very long, considerably longer than the head and body; more hairy than in other species, and finely tufted at the end; uniformly brown in some, partly or wholly bicolor in others. Fur spiny. Colour rich rufous, strongly lined with black along the centre of the back. Belly pure sharply defined white or pale yellow. Upper surfaces of hands and feet with a brown patch on the metapodials, the remainder pure white. Mammæ 2—2=8.

Sikim and other continental localities. Mount Kina Balu (*Whitehead*, *Everett*); Mount Dulit (*Hose*); Niah Coast (*Hose*); Penrisen Hills (*Everett*).

"Rapit" of Kian Dusuns (*Everett*).

[The difference in size between the various specimens referred to *M. Jerdoni*, even among series from single localities, is so great that it would at first sight appear impossible that they should all belong to one species; but the intergradation seems to be so complete that I have for the present no alternative but to include them all under one name. Larger series will, however, be necessary before a thoroughly sound conclusion can be arrived at.]

10. *Mus Margarettæ*, Thos.

Size very small; hind foot about 19 millim. (16 in subsp. *pusillus*). Tail very long, nearly twice the length of the head and body, naked, unicolor brown. Fur soft, spineless. Colour rich rufous, brighter on sides; belly pure white. Hands and feet whitish, but with brown metapodial patches; claws very small; thumb and great toe opposable. Mammæ 1—2=6.

Penrisen Hills (*Everett*). Subspecies *pusillus*, Mount Kina Balu (*Everett*).

11. *Mus ephippium*, Jent.

Size as in *M. Whiteheadi*. Tail rather longer than head and body, unicolor brown. Fur coarse, rather spiny. Colour dull grey, varying to rufous, especially in very old specimens. Spines white, tipped with dark brown. Belly dirty greyish white, the bases of the hairs grey. Hands and feet white. Mammæ 2—2=8. Bullæ large, palatal foramina long. Teeth normal.

Sumatra (*Leyden Museum*); Kina Balu (*Whitehead, Everett*); Labuan (*Everett*); Kayan Country, Upper Baram River (*Hose*); Penrisen Hills (*Everett*); Palawan (*Everett*).

[Lastly, there remains to be considered the group to which the European house-rats belong, a group which has been the bane of workers on Oriental Muridæ, and which at present, owing to want of material, it is quite impossible to bring into any sort of order. Fortunately, so far as the present paper is concerned, there is a Bornean name available, and this I propose to use for the lowland rats of the group, without expressing any opinion as to their relationship with extra-Bornean species.]

12. *Mus neglectus*, Jent.

Size of *Mus rattus*; hind foot about 35–38 millim. Tail ranging from a little shorter to a little longer than the head and body, unicolor dark brown, fairly well haired, but not tufted. Fur short and harsh, almost or quite spineless. Colour above dark grizzled black and rufous; belly dirty grey, varying to brown, especially on the middle line of the chest. Hands and feet whitish, but their metapodials often dark brown along the centre; sometimes wholly brown. Mammæ 2—3 = 10 (rarely 3—3 = 12).

Banjer-massing, S. Borneo (*S. Müller*); Mount Kina Balu, about 3000 feet (*Whitehead*, *Everett*); Labuan (*Everett*); Mantanani Island (*Everett*); Baram (*Hose*); Simanggang, Batam Lupar, Sarawak (*Everett*); Balabac (*Everett*).

[In spite of the apparent differences involved in the wording of the above diagnosis, these specimens are all fairly uniform in appearance, and are readily distinguishable from every species hitherto referred to except *M. Muelleri*, to which they have a certain superficial resemblance. Their smaller size and possession of three inguinal pairs of mammæ will, however, always separate them from that animal.

But within the group there is a second Bornean form which I now think it necessary to describe, namely the representative of *M. neglectus* from the heights of Kina Balu.]

13. *Mus baluensis*, sp. n.

Very similar to *M. neglectus* in size, proportions, and colour, but the fur quite long and soft, and the belly of a uniform dirty buffy hue.

Mount Kina Balu, 8000 feet (*Whitehead*), 7000–10,000 feet (*Everett*).

Detailed Diagnoses of the New Species.

Mus rajah.

Size medium, but the feet proportionately long. Fur thickly intermixed with spines. No longer bristle-hairs. Colour a dull rufous clay-colour, darker along the back, where the spines are tipped with brown, paler on the sides, where they are white throughout. Belly white, the hairs white to their roots; line of demarcation on sides fairly well defined. Centre of belly in old specimens with a large discoloured patch, apparently due to some glandular exudation. Ears medium, rounded, naked; laid forwards in a spirit-specimen they reach about to the middle of the eye. Upper surface of hands and feet white; the digits almost naked; soles grey, smooth, with the usual six prominent pads; fifth hind toe reaching barely to the base of the fourth. Tail about the length of the head and body, thinly haired, the scales large and prominent, about eight to the centimetre; bicolor slaty grey above, white below, and commonly at the end all round for an inch or two; no terminal tuft of hairs.

Skull strongly built, with a broad heavy muzzle. Frontal region remarkably flattened, even concave in old specimens; supraorbital ledges very strongly developed, overhanging the orbits, and forming marked postorbital angles, behind which they run back to the antero-external angles of the interparietals. Anterior edge of interparietal approximately transverse. Plate of zygoma but little developed, its anterior edge vertical. Palatal foramina short, widely open, their posterior limit two or three millim. in front of $\frac{\text{m.}1}{}$.

Teeth rather small in proportion to the size of the skull.

Hind foot of the typical skin (♂) 39 millim.

Dimensions of an adult male in spirit (from Paitan, N. Borneo):—

Head and body 196 millim.; tail 196; hind foot* 37·5; ear 22×16; heel to front of last foot-pad 19·5.

Hab. (of type). Mount Batu Song, Baram district, Sarawak. Coll. A. H. Everett, Oct. 1891.

Type: B.M. 92.9.6.15.

M. rajah is the species which I have hitherto looked upon as *M. Hellwaldi*, Jent., and it is mentioned under this name both in my own papers and in Hose's 'Mammals of Borneo.' I still regard it as closely allied to *M. Hellwaldi*, which was described from Celebes; but, in view of the entire spinelessness of the three Celebean specimens I have seen, and the uniform spininess of the sixteen Bornean ones before me, of all ages and seasons, I am compelled to consider this character of sufficient constancy to demand the specific distinction of the latter from the former.

Some specimens of this species have a rufous or greyish collar dividing the white of the chin from that of the chest, and this is especially noticeable in immature individuals. Kina Balu examples have this collar at a maximum, but further skins are needed before the local constancy of the character can be proved. An immature specimen from the Penrisen Hills and another from Bunguran both have collars, while other examples from the same localities are without them.

* Although a good typical representative of the ordinary lowland form of *M. rajah*, this specimen has unnaturally swollen and probably shortened feet. The hind foot of another spirit-specimen, from Palawan, is 40 millim.; heel to front of last foot-pad 20.

Mus ochraceiventer.

Proportions and essential characters as in *M. alticola*, Thos., of which it may be looked upon as the representative at the base of Kina Balu. Fur more spiny and shorter than in *alticola*, a dorsal spine about 10 as against 16 or 17 millim. in length. The colour above instead of being uniform dark bluish grey is a coarsely speckled fulvous and black, the tips of the spines being black or brown, while those of the hairs are fulvous. Nape and sides of neck more markedly fulvous. Whole of under surface a brilliant and most unusual ochraceous colour, almost exactly matching Ridgway's "tawny ochraceous," and wholly different from the yellowish white of *M. alticola*. Both spines and hairs are tipped with ochraceous, although their extreme bases are grey, which latter colour is predominant in young specimens. Hands and feet thinly covered on the metapodials with fine white or pale brown hairs; the digits naked. Tail as in *alticola*, practically naked, slaty grey above, white or yellowish below, the contrast specially marked terminally. Palate-ridges 3—4. Mammæ 2—2 = 8.

Skull apparently as in *alticola*, except that the palatal foramina are shorter and broader behind, and the anterior edge of the zygomatic plate is nearly vertical, instead of slanting backwards.

Hind foot of the typical skin (♂) 31·8 millim.

Dimensions of an adult male in spirit:—

Head and body 146 millim.; tail 153; hind foot 31·5; ear 16 × 13·5; heel to front of last foot-pad 15.

Skull: see p. 459.

Hab. Mount Kina Balu, below 3000 feet. Coll. A. Everett, Jan. 1894.

Type: B.M. 94.7.2.27.

A considerable number of this remarkable-looking species were obtained by Mr. Everett's native collectors in January 1894, and although (as in the case of the other Kina Balu specimens brought in by the same men) no trustworthy record of the altitude has been preserved, Mr. Everett informs me that it is practically certain that none of them were collected above 3500 feet.

Considering their close alliance in essential characters it is just possible that specimens intermediate between *M. alticola* and *M. ochraceiventer* will be found at intervening altitudes, in which case the latter will have to be reduced to a subspecies of the former; but until such specimens are obtained it would be impossible to allow such different-looking animals to pass under the same name.

Mus Whiteheadi.

Size small. Fur of medium length, thickly mixed with spines. General colour above tawny rufous, lined with black; the spines slaty white, with black tips. Under surface ochraceous, more or less pure according to the degree to which the slaty bases of the hair are visible. Ventral spines white-tipped. Sides paler, no sharp line of demarcation between the upper and lower colours, which are, indeed, except for the black tipping of the dorsal spines, very like each other. Ears of medium length, laid forward in a spirit-specimen they reach about to the middle of the eye; naked. Upper surfaces of hands and feet white or pale buff; palms white, soles slaty blue; fifth hind toe reaching nearly to the middle of the first phalanx of the fourth; sole-pads usually only five in number, the postero-external being suppressed in all but two of the specimens examined. Tail scarcely longer than head and body; very finely haired, practically naked, not pencilled at tip; bicolor, slate-coloured above, white below. Palate-ridges 3—5; mammæ 2—2 = 8.

Skull: interorbital region broad, with strong supraorbital ledges, which, after forming a sharp postorbital angle, run back along the parietals. Anterior margin of interparietal nearly directly transverse. Projecting plate of anterior zygoma-root well developed, convex above. Anterior palatine foramina just about the length of the upper molar series, but sometimes rather shorter, not quite reaching to the level of the front side of $\frac{\text{m. 1}}{}$; their combined outlines forming a long even oval.

Hind foot of the typical skin (♀), moistened, 27 millim.

Dimensions of a specimen in spirit (♂):—

Head and body 102 millim.; tail 110; hind foot 27; ear 15·5 × 13; heel to front of last foot-pad 13.

Skull: see p. 459.

Hab. Mount Kina Balu.

Type obtained by J. B. Whitehead at 3000 feet, March 18, 1888.

This species is that referred to in my own previous papers and in Hose's 'Mammals of Borneo' as *Mus Musschenbroeki*, Jent.; but a renewed comparison of it with my notes on Dr. Jentink's type in the Leyden Museum shows that the Celebean species is a larger animal with, among other differences, a molar length of 6·1 millim. and a hind foot of 30 millim. The palatal foramina are also markedly longer.

Mus bœodon.

Size small, about as in *M. Whiteheadi.* Fur nearly wholly spinous, with less wool-hairs intermixed than in any of the allied species; the spines of the back about 9 millim. long. General colour rufous brown (browner on the head, more rufous on the rump), finely speckled with yellowish. Each spine is whitish basally, gradually darkening to brown terminally, but with a narrow terminal or subterminal band of yellow. Throat and chest dull rufous; belly pale buffy yellow, the hairs and spines of this colour throughout; line of demarcation on sides not sharply defined. Hands and feet white; fifth hind toe reaching nearly to the end of the first phalanx of the fourth; soles smooth, with the usual six high and prominent pads. Tail rather shorter than the head and body, practically naked; bicolor; scales about twelve to the centimetre. Palate-ridges 3—4; mammæ 2—2=8.

Skull with the usual supraorbito-parietal ridges normally developed. Anterior edge of zygomatic plate slanting backwards; palatal foramina small, well open, their posterior boundary nearly 2 millim. in front of $\underline{\text{m. 1}}$. Molars remarkably small and delicate (see measurements), the total molar length only just equal to the least distance between the first molars of the two sides.

Dimensions of the type, an adult female in spirit:—

Head and body 119 millim.; tail 111; hind foot 26; (ears destroyed); heel to front of last foot-pad 11·7.

Skull: see p. 459.

Hab. Mount Kina Balu. Coll. A. H. Everett.

Type: B.M. 94.7.2.81.

This peculiar little species may be readily recognized from all its allies by its diminutive teeth, which are smaller in proportion to the size of the skull than in any other species of *Mus* known to me.

An immature skin, also from Kina Balu, agrees with the adult in most respects, but has a larger proportion of wool-hairs mixed with the spines, and the spines of the back are broadly brown-tipped, without yellowish rings.

Mus baluensis.

Size about as in *M. neglectus.* Fur quite spineless, long and soft, the dorsal wool-hairs about 17 millim. in length, and the longer bristle-hairs, which are numerous, attaining about 30 or 35 millim. General colour coarsely grizzled orange and black, the resulting tone not unlike Ridgway's "raw umber." Whole of under surface, including the chin, dirty buff, the hairs slaty grey basally, buff terminally; line of demarcation on sides not sharply defined. Ears of medium size, laid forward in a spirit-specimen they almost reach the anterior canthus; thinly haired, brown or black. Metapodials brown mesially, whitish laterally and on the digits; fifth hind toe reaching to the end of the first phalanx of the fourth. Tail rather longer than head and body, unicolor, dark brown, fairly well haired, but not tufted. Palate-ridges 3—5, the three anterior interdental, as usual in this and the *ephippium* group, with a sharp backwardly-directed projection in the centre. Mammæ 2—3 = 10.

Skull distinguished from that of *M. neglectus* by its much broader and rounder brain-case, on which the parietal ridges are more widely bowed outwards, by its broader and shorter interparietal, and by its less widely open anteorbital foramina, of which the outer walls are less projected forwards.

Hind foot of the typical skin 33·5 millim.

Dimensions of a spirit-specimen (♂):—

Head and body 171 millim.; tail 194; hind foot 32; ear 20 × 17.

Skull: see below.

Hab. Mount Kina Balu, 8000 feet. Coll. J. Whitehead, Feb. 4, 1888.

The specimens referred to as being soft-haired examples of *Mus rattus* in my original paper on Mr. Whitehead's mammals, together with two spirit-specimens sent by Mr. Everett, are those on which *Mus baluensis* is now founded. What its ultimate position will be, when all the group is worked out with proper material, I am unable to say; but I am convinced that, as a local form, whether species or subspecies, it is quite distinct from anything hitherto described.

Skull-measurements of the New Species above described.

	rajah. ♂.	*ochraceiventer.* ♂.	*Whiteheadi.* ♂.	*bæodon.* ♀.	*baluensis.* ♂.
Greatest length	(c.) 51	40	33·6	32	43·2
Basilar length to henselion	(c.) 41	30·5	25·4	25	35
Greatest breadth	22	13	16	15	20·4
Nasals, length	19	15	11·4	12	15·5
Interorbital breadth	7·5	7·6	6·1	6	6·8
Interparietal, length	5·8	5·8	5·0	6	5·9
,, breadth	10	10·4	9·0	9·2	12·5
Length of zygomatic plate	4·2	2·9	3·2	2·3	4·5
Palate length from henselion..............	22	16·2	13·6	12	21·3
Diastema	14·5	11·2	8·9	8·9	12·6

Skull-measurements (continued).

	rajah. ♂.	*ochracei-venter.* ♂.	*White-headi.* ♂.	*bæodon.* ♀.	*balu-ensis.* ♂.
Palatal foramina, length..	7·6	5·1	4·8	4·6	8
" " combined breadth	4·2	2·8	2·6	2·5	3
Length of upper molar series	6·8	5·1	5·1	4	7
Lower jaw, condyle to incisor-tip..........	32	24·5	20·2	20	28
Lower jaw, coronoid to angle	13·6	10·2	8·6	8·1	13

Except in the case of *Mus bæodon*, the above measurements are not taken from the skulls of the actual types, as skins have been whenever possible selected as types, and the native skinners have unfortunately always cut off the backs of the skulls during the process. These measured skulls have been extracted from spirit-specimens which have been carefully compared and found to agree with the typical skins.

LIX.—*Descriptions of Two new Bats of the Genus* Kerivoula. By Oldfield Thomas.

Mr. John Whitehead's expedition to the Northern Philippines has resulted in the discovery of one, and Mr. Charles Hose's explorations in Eastern Sarawak in that of the other, of the two following new species, which, belonging to the group comprising *K. Hardwickei, K. pellucida*, and *K. papillosa*, are clearly distinct from any of them. Of these three old species the last-named is at once distinguishable from either of the new ones by its much greater size, and *K. pellucida* by its longer ears, so that *K. Hardwickei* is the only one with which it is necessary to compare them.

Kerivoula Whiteheadi, sp. n.

Size and proportions about as in *K. Hardwickei*, but the ears are slightly longer and the lower legs shorter. Upper surface of wing-membranes to a line drawn from the elbow to the foot, whole of interfemoral membrane except the terminal half-inch, and surface of lower limbs to feet thinly but distinctly clothed with long orange-coloured hairs, these parts in *K. Hardwickei* being practically naked. Forearm, carpus, and index also thinly clothed. Hinder edge of interfemoral with a few short hairs along it, scarcely forming a fringe.

Colour above rufous-orange, the slaty bases to the hairs showing through; below dark slaty, the lighter tips scarcely affecting the general dark tone.

Upper inner incisors slender, with a distinct posterior secondary cusp, to the tip of which the unicuspid outer incisor just reaches. Other teeth apparently as in *K. Hardwickei.*

Dimensions of the type (an adult male in alcohol):—

Forearm 32 millim. (=1·25 inch).

Head and body 39; tail 39; head 16; ear from notch 13·5; tip to tip of ears across head 28·5; length of index 31·5, third finger (exclusive of cartilaginous tip) 61, fifth finger 47; lower leg 16·2; hind foot without claws 8.

Hab. Isabella, N.E. Luzon. Coll. J. Whitehead, May 1894.

Type: B.M. 94.10.9.2. Presented by the subscribers to the Whitehead fund.

This species is undoubtedly very close to *K. Hardwickei*, but may be distinguished by its hairy interfemoral and by the different structure of its upper incisors. It may be noted that a Mindanao specimen of the older known species shows no approximation to *K. Whiteheadi.*

Kerivoula pusilla, sp. n.

Size decidedly smaller than in *K. Hardwickei*, and, indeed, than in any other known species except *K. africana*. Ears short, laid forward they do not reach to the tip of the muzzle, their anterior edge even more convex forward than usual, their outer upper notch very close to the tip, and their outer basal lobe much developed. Tragus as usual in this group. Hairiness of limbs and membranes almost exactly as in *K. Whiteheadi*, although rather thinner, and the proximal half of the interfemoral only hairy.

Colour pale rufous above, the extreme bases of the hairs slaty; under surface greyish, decidedly paler than the upper.

Skull with a remarkably slender and delicate muzzle and small narrow brain-case, differing markedly in these respects from *K. Hardwickei*, in which (for a *Kerivoula*) the muzzle is stout and strong and the brain-case large and well-rounded.

Dentition very light and delicate, the teeth, as a rule, both shorter and thinner than those of the allied form. Upper inner incisor with one distinct and a second indistinct secondary posterior cusp, to the former of which the unicuspid outer incisor reaches. Two anterior premolars subequal in all dimensions, decidedly smaller than the last one, their transverse less than their longitudinal diameters, the converse being the case in *K. Hardwickei* and other species. Lower incisors in the direction of the jaws, not overlapping, the outer ones tricuspid and longer (horizontally) than either of the two middle ones. Lower premolars, as in the upper jaw, very narrow and delicate.

Dimensions of the type (an adult female in spirit):—

Forearm 28 millim. (=1·12 inch).

Head and body 33; tail 39; head 14; ear from notch 11·6; tip to tip of ears 25; length of index 28·5, third finger 56, fifth finger 42; lower leg 14; hind foot without claws 6·2.

Skull: greatest length 12·7; interorbital breadth 2·8; breadth of brain-case 6.

Hab. Mount Mulu, Eastern Sarawak. Coll. C. Hose.

Type: B.M. 94.9.29.17.

This interesting little species differs so markedly from all others by its small size and far more delicate skull and dentition that no detailed comparison of it with its allies is necessary.

Besides two specimens in spirit from Mount Mulu, Mr. Hose has also sent a skin of *K. pusilla* from Lake Ansok, River Baram, collected in October 1893, which only differs by having its throat nearly pure white.

LX.—*Descriptions of a new Lizard and a new Fish obtained in Formosa by Mr. Holst.* By G. A. Boulenger, F.R.S.

Tachydromus formosanus.

Head moderately elongate. Nasals in contact behind the rostral; a series of granules between the supraoculars and the supraciliaries; a small shield separates the large anterior supraocular from the loreal; temporal scales very small and keeled; three pairs of chin-shields. Six longitudinal series of large strongly keeled shields, separated on the vertebral line by one or two series of smaller shields; eight or ten series of strongly keeled ventral shields, with two or three series of smaller shields on each side. Two inguinal pores on each side. Olive-brown above; a dark brown or blackish lateral band from the end of the snout to the base of the tail, passing through the eye, edged below, and usually also above, by a whitish streak; the upper light streak, if present, originates above the tympanum and runs along the outer series of dorsal shields; the lower extends from the end of the snout to the thigh, passing through the tympanum and following the upper series of ventro-lateral shields; a whitish, black-edged streak along the hinder side of the hind limb; lower parts whitish.

	millim.
Total length	186
Head	10
Width of head	6
Body	44
Fore limb	15
Hind limb	21
Tail	122

Several specimens, from Taiwanfoo and Central Formosa.

Homaloptera formosana.

Body much depressed, nearly twice as broad as deep; depth of body 7 times in total length, length of head 5 times. Snout broad and rounded, strongly depressed, sharp-edged; distance of eye from end of snout 3 times its diameter, from opercular border 2 times; interorbital width $2\frac{1}{3}$ times in length of head; upper lip fringed, barbels small, simple, subequal. Dorsal with 8 rays, originating above anterior third of base of ventrals, and slightly nearer end of snout than base of caudal. Anal very small, with 6 rays. Pectorals extending to origin of ventrals. Lower caudal lobe a little longer than upper. Scales very small; breast and belly naked; lat. l. 70. Dark olive above, pale-dotted; lemon-yellow beneath; vertical fins barred.

Total length 90 millim.

A single specimen, from Central Formosa.

BIBLIOGRAPHICAL NOTICE.

Éléments de Paléontologie, par FÉLIX BERNARD, D. ès Sci. &c. Seconde Partie (pages 529–1168). Titlepage, Preface, and Index. With 251 figures in the text. 8vo. Baillière, Paris, 1895 (*sic*).

THE First Part of this useful work was duly noticed by us in June 1893. In this Second Part we have (1) the Mollusks, continuing the Lamellibranchs, and treating of the Scaphopods and Cephalopods; (2) the Vertebrates, divided into Fishes, Batrachians, Reptiles, Birds, and Mammals. Further, it contains nearly 90 pages devoted to the palæontology of Plants, which are grouped as: 1. Thallophytes, 2. Mosses, 3. Vascular Cryptogams, and 4. Phanerogams,—the last being the Gymnosperms and Angiosperms. Their phylogeny and geological distribution are carefully explained, as is also the case with the several great groups of fossil animals. Their range in time, as proved by their occurrence in geological formations and in existing habitats, is shown in numerous successive tabular diagrams of the usual kind with improved details.

This manual or text-book of palæontology has been, of course, prepared more especially for the use of French students. Continental authors have supplied much new matter of late years in the various branches of palæontology; and M. Bernard has largely availed himself of these additions to science. English works have also been used to some extent; but some improved views have been neglected—such as A. S. Woodward's determination of *Ptychodus* as a Batoid or Ray, W. Hind's elucidation of *Anthracomya* and *Anthracoptera*, &c.; and the division of the Batrachians from Reptiles as Amphibia is ignored.

On the other hand, great pains have been bestowed on various important subjects, such as the character, development, and classification of the Ammonites (pages 639–677, with upwards of thirty illustrations, in many instances composed of several figures).

The Author has more especially kept in view the relationship of Palæontology with Biology, and has thus dealt with generic rather than with specific forms, except in the case of unique or very rare fossils, such as *Archæopteryx* and *Triceratops*. The comparison of the fossil with recent animals and plants has been carried out, as far as practicable, with respect to their morphology, intimate structure, and embryological development, thus aiming at the improvement of their classification.

The Author gratefully acknowledges the kind help received from Munier-Chalmas, Boule, Filhol, Haug, Œhlert, Renault, Steinmann, Gaudry, Remy Perrier, and the late Dr. Fischer; as well as the advantages he has had from the information found in the several large manuals of Palæontology by Steinmann and Döderlein, by Nicholson and Lydekker, and especially the treatise by Zittel. To the last he refers students for bibliographic references previous to its publication; while those of later date are mostly to be found in the text and footnotes of the book before us.

The Index for the whole volume fills twenty pages, with three columns of small print in each, indicating by different printer's types the names of genera separately from those of families and orders, and from those of classes and divisions.

In whatever respects M. Bernard's book and teaching may differ here and there from the views of other palæontologists, and whatever the shortcomings in printer's and author's errata, he has done good service in producing a comprehensive and philosophical elaboration of what is known about fossil animals and plants, clearly expressed, excellently well illustrated, and enriched with references to many original workers and thinkers.

MISCELLANEOUS.

The Dates of Moore's 'Lepidoptera Indica.'

To the Editors of the 'Annals and Magazine of Natural History.'

Gentlemen,—In the 'Annals' (ser. 6, vol. xi. 1893, p. 260) a list of the correct dates of publication of F. Moore's 'Lepidoptera Indica' was given. As the strictures there passed on the method of deceptive dating employed by this author were apparently not observed by him, it will be useful to call attention to the dating of parts that have subsequently appeared:—

Pt. XIV.	pp. 33–64,	April **1893**.	*Not Aug. and Oct.* 1892, *as stated in the signatures!*
XV.	„ 65–88,	July **1893**.	*Not Nov.* 1892, *as stated in the signatures!*
XVI.	„ 89–112,	Oct. **1893**.	*Not February* 1893, *as stated in the signatures!*
XVII.	„ 113–136,	April **1894**.	*Not February* 1893, *as stated in the signatures!*
XVIII.	„ 137–160,	June **1894**.	*Not April* 1893, *as stated in the signatures!*
XIX.	„ 161–176,	Oct. **1894**.	*Not July and Oct.* 1893, *as stated in the signatures!*

I notice that Mr. Moore is a Fellow of the Zoological Society, as well as an Honorary Associate of the Linnean Society; and it might be well if the Councils of these Societies took cognizance of authors who misdate their works, as the question of nomenclature is already one of extreme difficulty.

If Mr. Moore wishes to date his signatures, let him by all means do so, but it must be done with the rigid honesty of Godman and Salvin, who, in their 'Biologia Centrali-Americana,' also give a strict account on the outer wrapper of the contents and date of each part.

C. Davies Sherborn
(Index gen. et spec. anim.).

Researches on the Structure, Organization, and Classification of the Fossil Reptilia.—Part IX. Section 6. *Associated Remains of two small Specimens from Klipfontein, Fraserburg.* By H. G. Seeley, F.R.S.

The author obtained parts of two skeletons from the summit of the Karroo rocks which form the Nieuwveldt range. They resemble Theriodonts in their general marsupial characters. The fragments of skulls are not in the same slabs with the other bones.

Theromus leptonotus shows the fore limb and some vertebræ. The humerus is determined to be Theriodont by the transverse extension of the proximal articulation. The bone is $1\frac{4}{10}$ inch long, resembling in form that of the Phalangers. The entepicondylar foramen is more vertical than in the marsupials, and, as among marsupials, the radial crest, if prolonged distally, would be continuous with the bridge over that foramen. The vertebræ are each $\frac{3}{10}$ inch long; they show a transverse suture between the neural arch and the centrum.

The anterior part of the skull, very imperfectly preserved, indicates three incisor teeth with the root of a relatively large maxillary canine; but the region of the molar teeth is lost. There is also a posterior fragment of a skull, which makes known the bones of the palate and the base of the brain-case seen from above. Enough is shown to indicate Theriodont characters, but the animal appears to diverge from the Theriodonts towards the Dicynodont type. If the base of the skull belongs to the same individual as the snout, it indicates a head nearly $4\frac{1}{2}$ inches long.

The second specimen shows fourteen dorsal vertebræ, which occupy a length of $5\frac{1}{4}$ inches; each slightly exceeds $\frac{3}{10}$ inch in length, so that this animal, named *Herpetocheirus brachycnemus*, is similar in size to the fossil previously described.

The centrum is deeply biconcave. There is no indication of a capitular articulation for the ribs. The ribs are slender, and the longest are $2\frac{1}{2}$ inches in length. There is no trace of the transverse expansion seen in *Cynognathus*, although the ribs preserved indicate twenty dorsal vertebræ. The humerus is $1\frac{6}{10}$ inch long and is exposed on the superior aspect. It is distinguished from the type already described by wanting the tuberosity on its inner distal border, which has a convexly rounded contour. The radius is stronger than the ulna, but there is no indication of an olecranon process exposed. The ulna is no stouter than a rib. These bones are an inch long. The carpus shows one large bone below the radius; there is a smaller bone on its outer side which corresponds to the distal end of the ulna; but there is no trace of a third bone preserved, and there is only one central bone preserved. There are three phalanges in a digit. The femur is $1\frac{9}{20}$ inch long; its articular head appears to be small and hemispherical. There is a large internal trochanter extending down the shaft, which corresponds with the similarly placed ridge in the femur of Megalosaurs and other Saurischia.

The slender character of the ribs, which are different from those in known Theriodonts, suggests the possibility that these remains belong to a group distinct from both the Cynodontia and Gomphodontia.

A small badly preserved fragment of a skull found near to this fossil is described; but there appears to be no sufficient evidence for associating it with the other remains.—*From the Proceedings of the Royal Society.* (Communicated by the Author.)

Note on the Japanese Species of Cistelidæ *and* Melandryidæ.

The publication of the paper mentioned Ann. & Mag. Nat. Hist. ser. 6, vol. xiii. p. 483, with a plate of twelve figures, is unavoidably postponed until 1895.

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END OF THE FOURTEENTH VOLUME.

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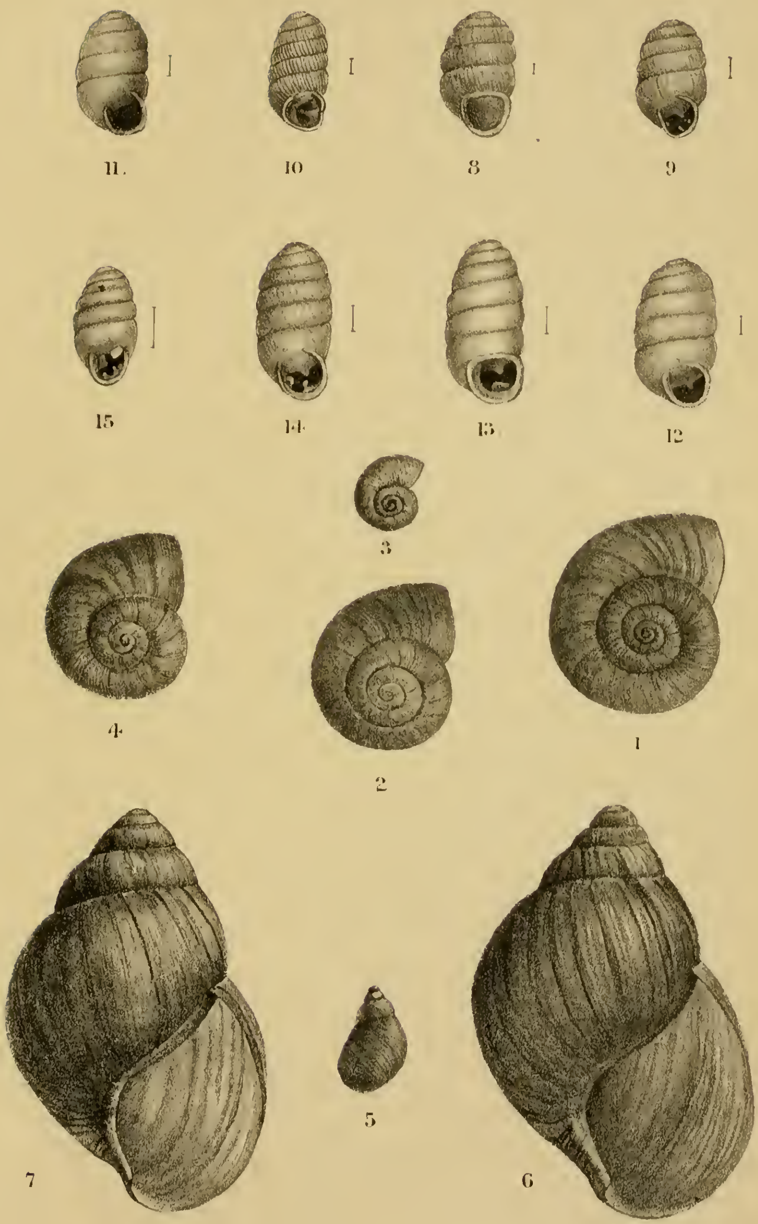

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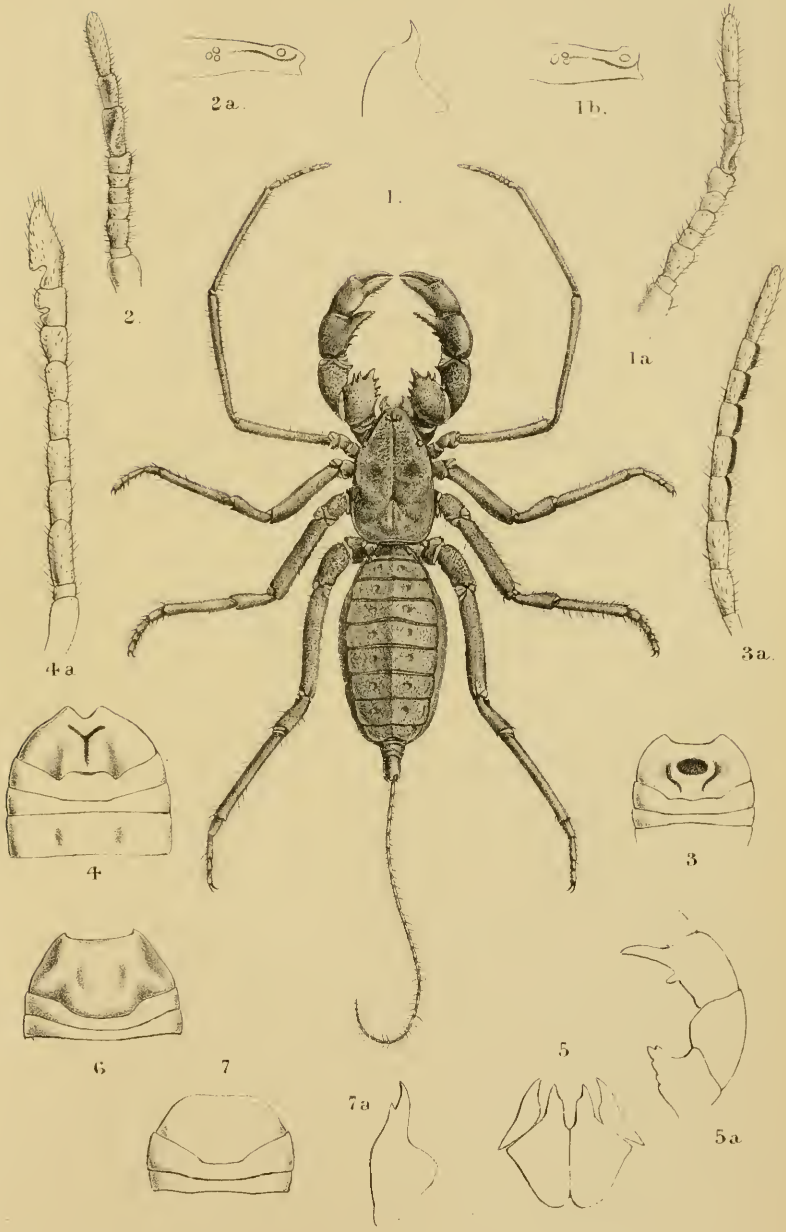

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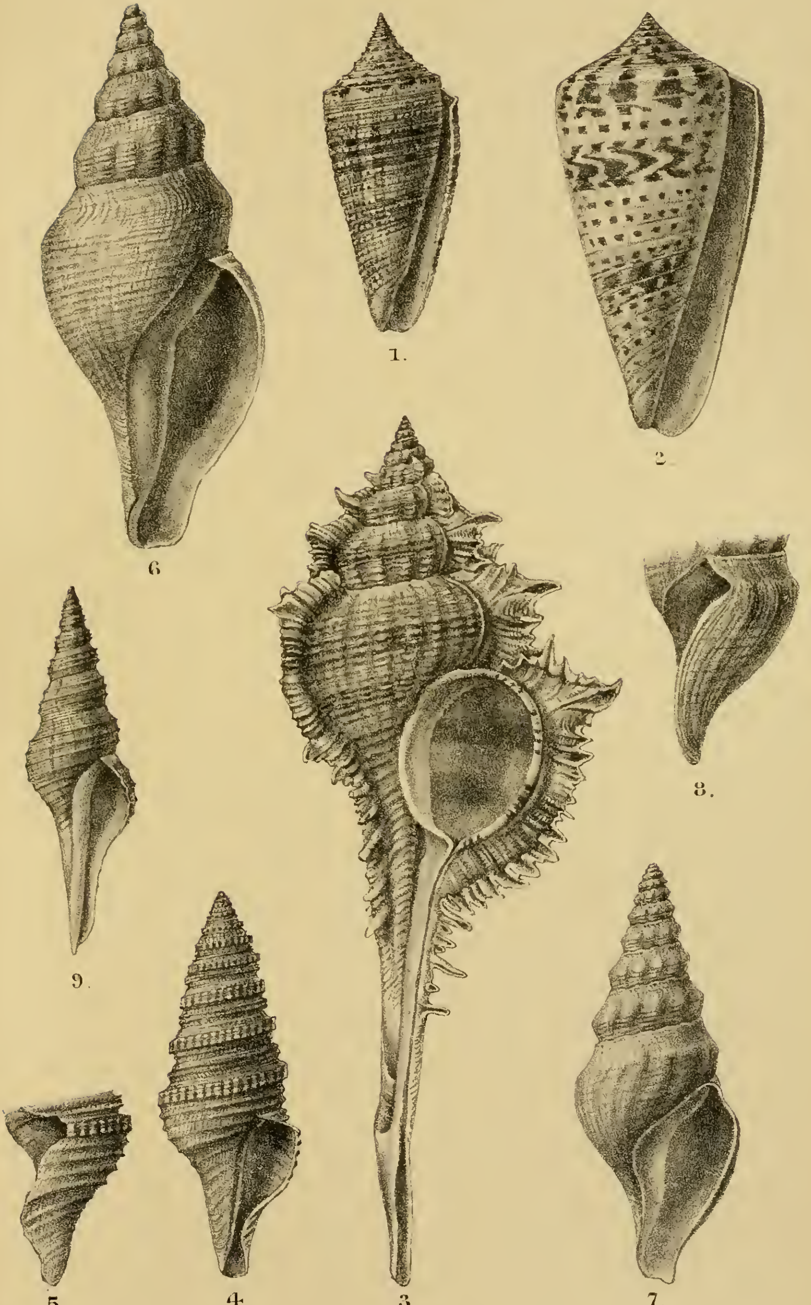

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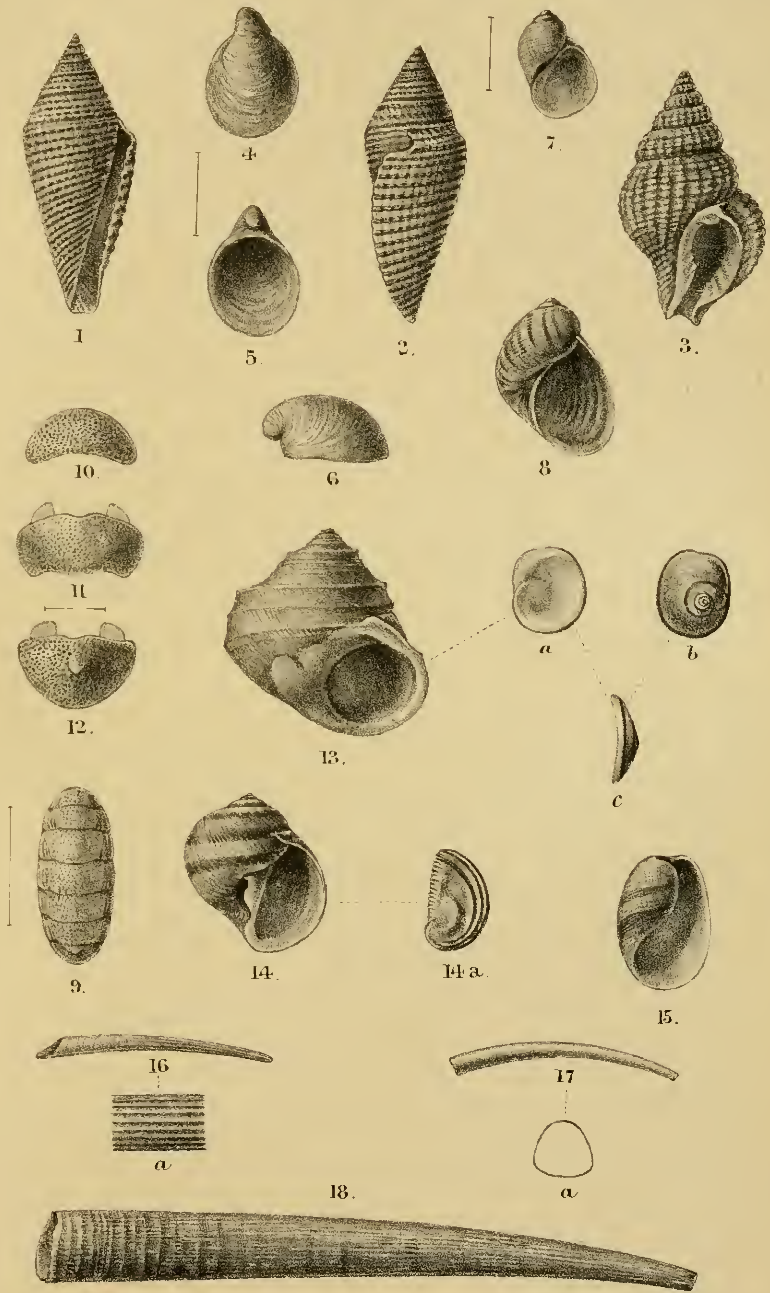

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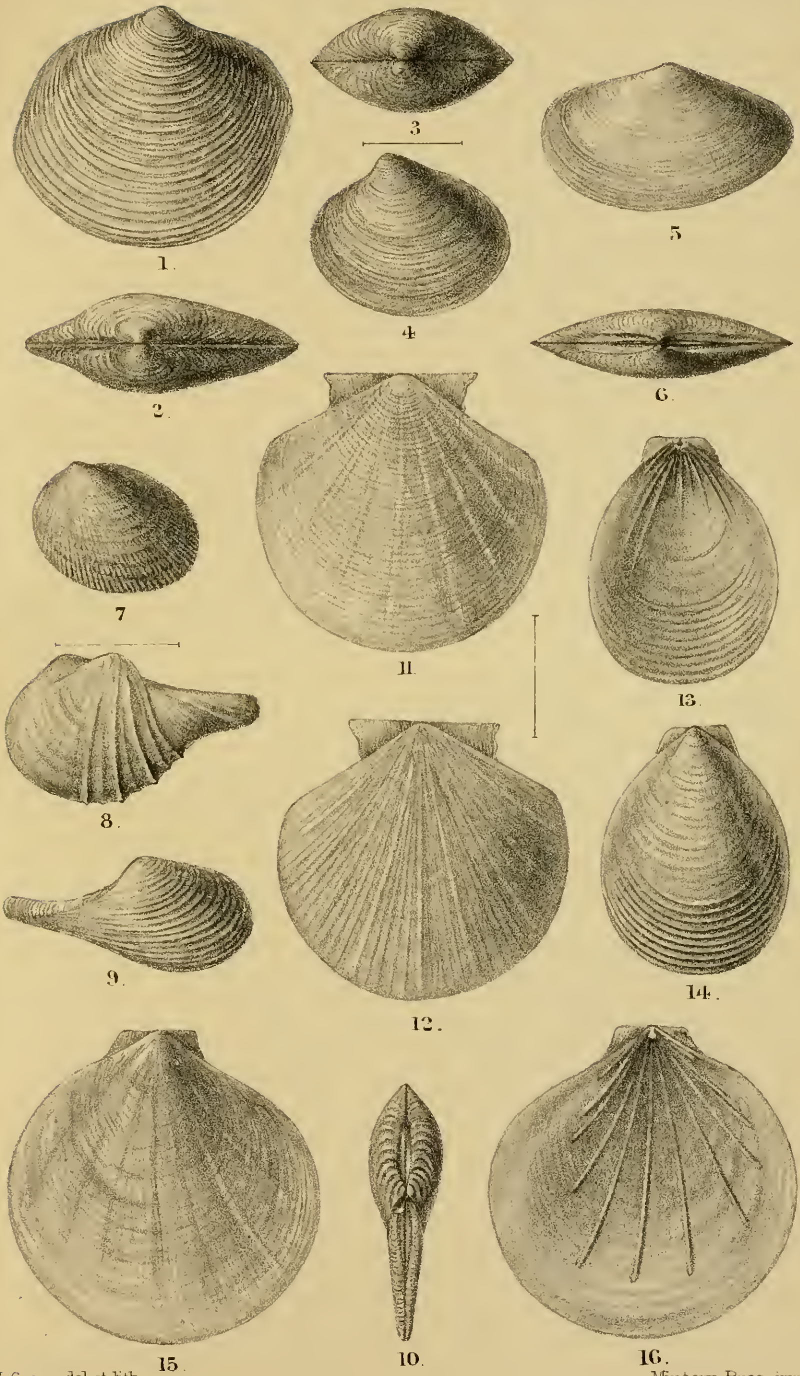

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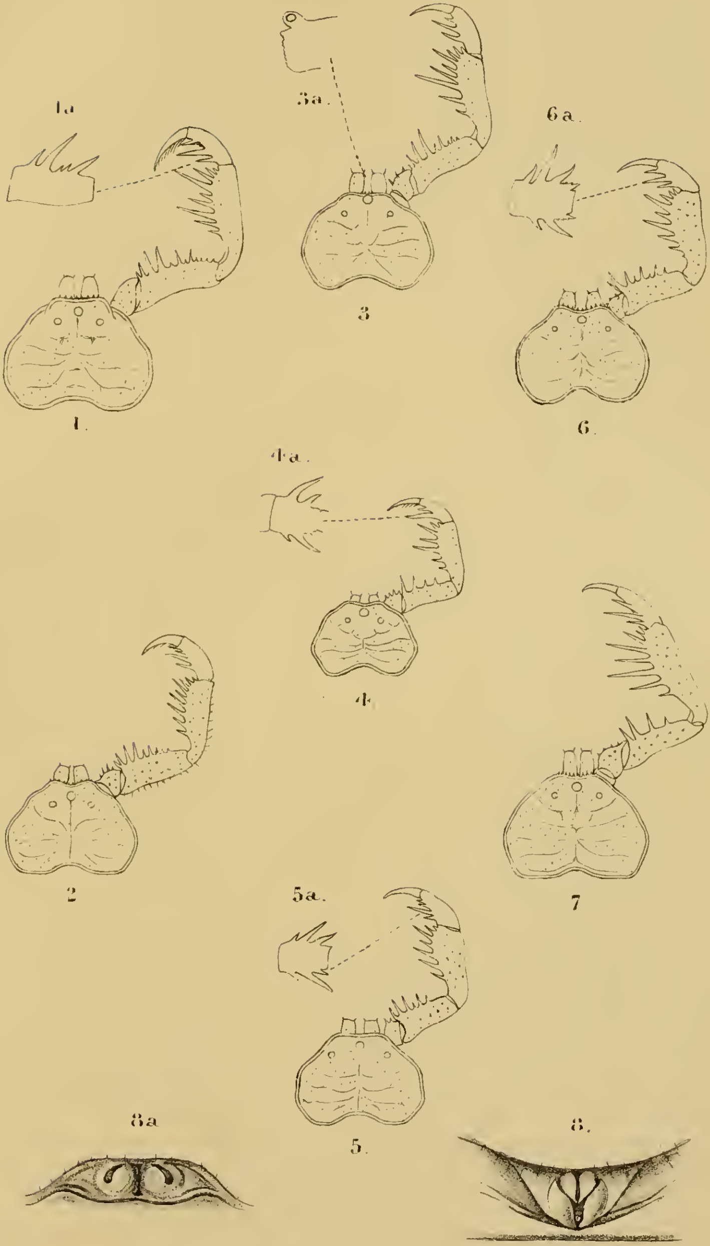

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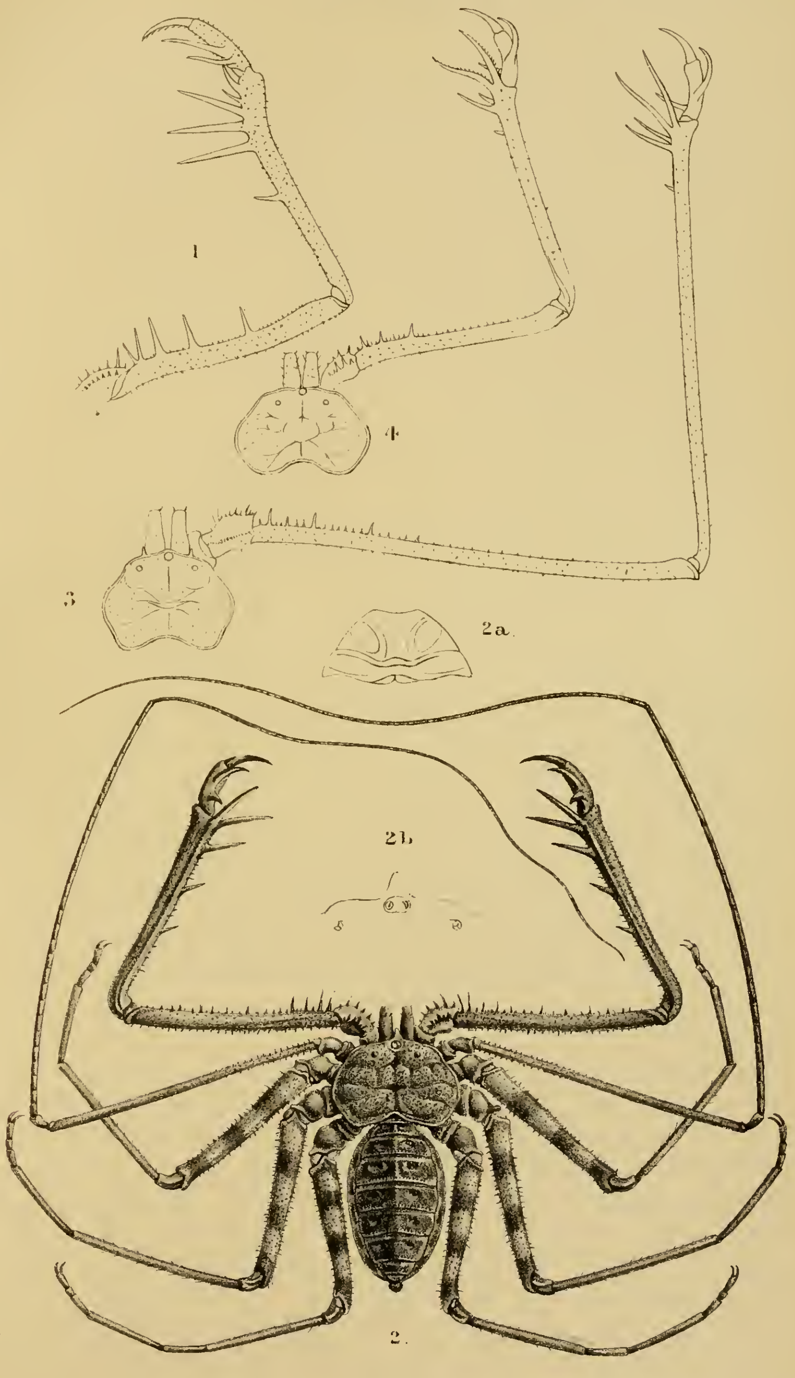

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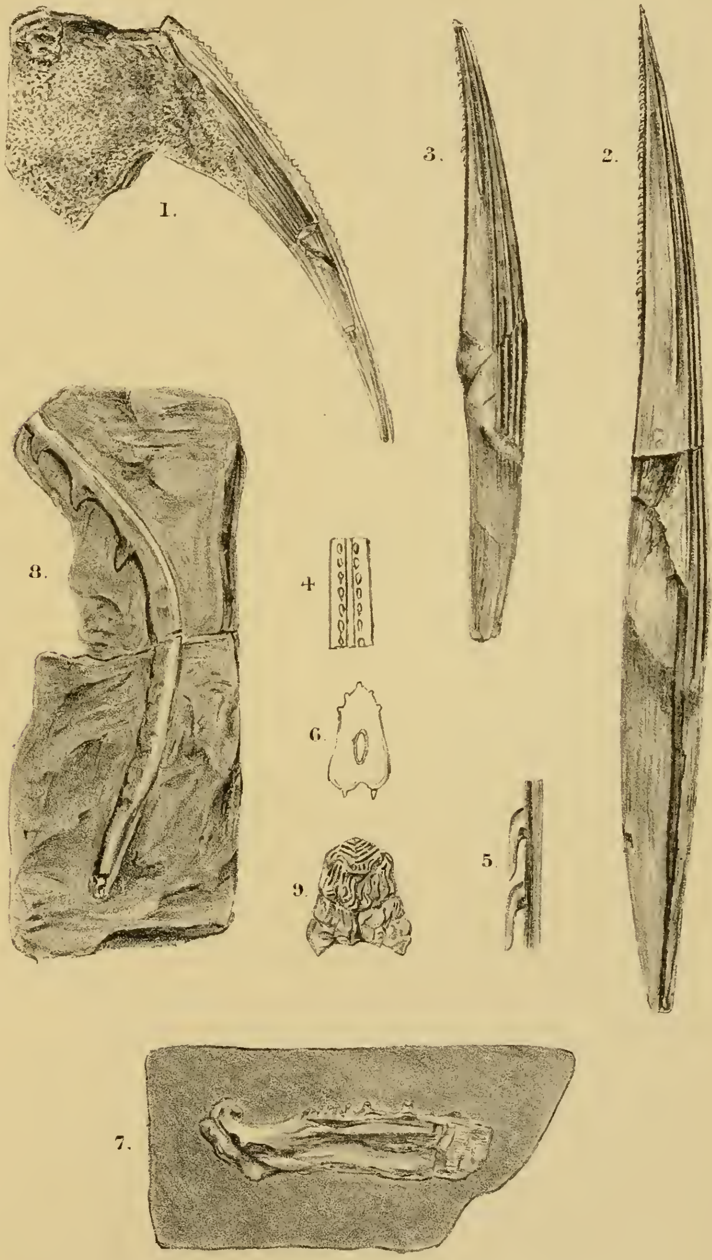

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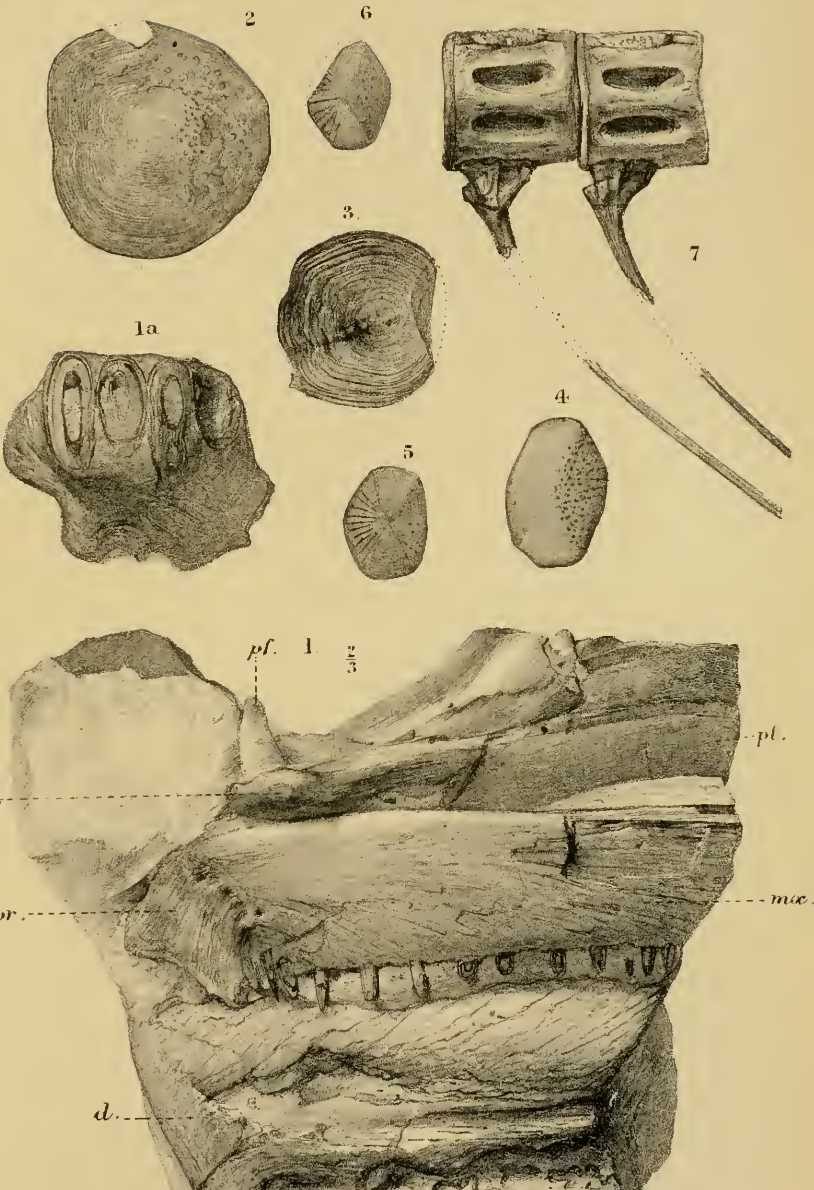

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CRETACEOUS FISHES FROM QUEENSLAND.

CONTENTS OF NUMBER 84.—*Sixth Series.*

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