TRANSACTIONS

OF

THE ZOOLOGICAL SOCIETY OF LONDON.

VOLUME XIV.

LONDON:

PRINTED FOR THE SOCIETY:

SOLD AT THEIR HOUSE IN HANOVER-SQUARE;

AND BY MESSRS. LONGMANS, GREEN, AND CO., PATERNOSTER-ROW.

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TRANSACTIONS

OF

THE ZOOLOGICAL SOCIETY OF LONDON.

I. *On a Nothosaurian Reptile from the Trias of Lombardy, apparently referable to* Lariosaurus. *By* G. A. Boulenger, *F.R.S.*

Received October 14th, 1893, read November 7th, 1893.

[Plate I.]

The Directors of the Senckenberg Museum, Frankfort-on-Main, have, at the suggestion of my friend Prof. O. Boettger, entrusted to me for description a very valuable palæontological specimen, a slab from the Upper Trias of Perledo, near Varenna, on the Lake of Como, Lombardy, with the nearly complete skeleton of a small Nothosaurian; the counter-slab is also preserved, showing the impression of the skeleton. The fossil was presented to the Senckenberg Museum by the late Dr. Rüppell in 1850, under the name of *Macromerosaurus plinii*, Curioni. It appears from Curioni's paper (8, p. 166) that, prior to 1847, Rüppell had examined some of the Reptilian remains from those beds, then regarded as Liassic; one of these specimens he acquired, together with Fish-remains[1], and subsequently placed in the Museum at Frankfort, where it has remained ever since, apparently ignored of all who have written on this interesting group of early Plesiosaurians.

Some confusion has arisen with regard to the specimen for which the name *Macromerosaurus plinii* was proposed by Curioni. On referring to his first paper (8) published in 1847, it appears as if the name (p. 161) was intended for the Perledo Saurian, of which he gives a detailed description and figure; whilst the name *Lariosaurus balsami* applies to the much larger specimen previously noticed by Balsamo-

[1] Described by Deecke, Palæontogr. lv. 1889, p. 110.

Crivelli (7) as *Palæosaurus.* But in 1863 Curioni explains (12, p. 266 [1]) that *Macromerosaurus* (originally misspelt *Macromirosaurus*) was the name intended for another Saurian, from Perledo and Viggiù, with longer humerus, to which he merely alludes in his first paper, and which is, in fact, the *Pachypleura edwardsii* of Cornalia (9). If we could accept this interpretation, the name *Macromerosaurus* might be used in preference to that of *Pachypleura*, which is preoccupied in zoology, as pointed out by Lydekker (21); but I do not find any justification for such a transposition, and, following tradition, consider *Macromerosaurus* as a synonym of *Lariosaurus*, the former name applying to the young, the latter to the adult.

The Reptile lies on its back, the neck and tail twisted to the right, the hind limbs spread out nearly at right angles to the body. The head is intact, with the palate and mandible completely exposed. The 15 anterior cervical vertebræ are in natural juxtaposition, whilst the remainder are dislocated. The pectoral arch is likewise dislocated, and does not show all the elements. The fore limb is represented by the right humerus, and the perfect left propodials and manus. The dorsal vertebræ are partly imbedded in the matrix, partly hidden under the plastron, most of the bones of which are very well preserved. The pelvis is crushed, but the tail is complete and exposed to its very tip. The Plate (Trans. Zool. Soc. XIV. Pl. I.) represents the fossil natural size; the matrix is represented lighter than it really is, in order to render the outlines of the bones more distinct.

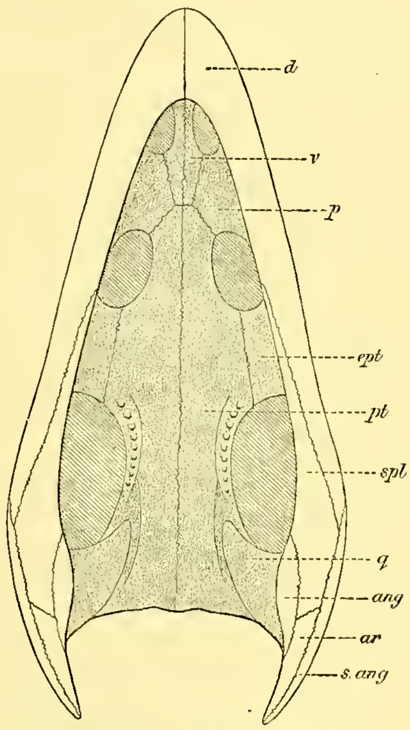
The specimen is now in a very different condition from what it was when sent to me. The manus was a complete fraud, imaginary phalanges having been sculptured out of the matrix in order, evidently, to give the Reptile a more Plesiosaurian appearance; and, deceived at first, I considered the fossil as representing a new type. I must add that in all probability the specimens figured by Curioni were developed by the same "artist"; and that, consequently, some of the conclusions which have been derived from an examination of those specimens, especially as regards the digital formula, the shape of the "claws" or "hoofs," and the aspect of the palate are, to say the least, very doubtful. The specimen figured by Zittel (20) as *Lariosaurus balsami*, and of which a cast is preserved in the British Museum, is imperfect as regards the digits, and the exact number of phalanges is difficult to make out. This explains the contradiction between text and figure in Zittel's Manual, the number of phalanges in

[1] This passage of his second paper is here reproduced:—"Da una nota che il Cornalia aggiunse alla sua Memoria pare che egli ritenga che i rettili di Besano e quelli di Perledo, uno dei quali venne da me descritto e figurato col nome di *Lariosaurus balsami*, Cur. (vedi Memoria citata, Milano, 1847), spettino ad una sola specie di saurii, e debbano riferirsi tutti al suo *Pachypleura*. Nel 1847 io pensava che due fossero le specie di Perledo; una il Lariosauro, affato speciale a Perledo, e un' altra di cui trovavansi esemplari anche a Viggiù, meglio conservati di quelli di Perledo, che io credeva non dover riferire alla medesima specie. Applicai a questa seconda specie il nome di *Macromerosauro*, giudicando che il carattere più sagliente di questa specie fosse la lunghezza degli omeri rettilinei, eccedente di una terza parte quella dei femori: il che non è nel Lariosauro (vedi fig. 2, tav. vii.)." The figure refers to the Reptile with straight and longer humerus, the *Pachypleura* of Cornalia.

the manus being given as 2, 4, 4, 4, 2, which appears wrong *à priori*, whilst the figure shows 2, 3, 4, 4, 2, which is likewise probably erroneous as regards the outer finger. Curioni, on the other hand, describes and figures the number of phalanges as 2, 3, 4, 5, 3, in both manus and pes. In the face of such contradictions, I think it safest to refer the specimen provisionally to *Lariosaurus balsami*, and, contenting myself with describing and figuring the specimen entrusted to me, leave it to those who have access to the typical specimens to decide whether the determination is correct or not. I beg to thank Dr. H. Woodward, F.R.S., for kindly allowing the specimen to be further developed in the British Museum, and Mr. Barlow for the painstaking and skilful manner in which he has acquitted himself of the task entrusted to him.

The skull, which displays the palatal aspect with the mandible *in situ*, and the tips

Fig. 1.



Lower view of skull and mandible.

ang. Angular.
ar. Articular.
d. Dentary.
ept. Ectopterygoid.
p. Palatine.
pt. Pterygoid.
q. Quadrate.
s.ang. Supra-angular.
spl. Splenial.
v. Vomer.

of a few anterior teeth, is elongate-acuminate, its length once and two thirds its greatest width at the mandibular articulation. The structure of the palate is better shown than in any of the small Nothosaurians with which we are at present acquainted, yet some of the sutures are not to be traced as distinctly as might be desired. I trust the annexed diagrammatic restoration (fig. 1) will ultimately prove tolerably correct.

Among the points on which there can be no doubt may be mentioned the very anterior opening of the choanæ, separated by a narrow septum formed by the vomers; the presence of large oval suborbital vacuities, such as are known to exist in *Neusticosaurus*, and as are shown on Curioni's figure; and the backward extension and union on the median line of the pterygoids, as far back as the basioccipital, which they cover over, as well as the basisphenoid, in this respect agreeing with most Nothosaurians. These pterygoids are produced and narrowed anteriorly, where they join the vomers, whilst posteriorly they form two raised ridges on each side, between which the quadrate is wedged in. Before the skull had been thoroughly cleared from the matrix, the outer of these ridges conveyed to my mind the remains of ossified hyoid cornua (ceratobranchials). But, in the course of development, these ridges were found to bear a series of minute subconical teeth. This discovery is a very startling one, for, unless the Placodonts belong to the Plesiosauria, no member of this order was yet known to have possessed teeth on any of the bones of the palate. It is true that the following remark is made by Prof. Seeley (25, p. 591) respecting *Mesosaurus tenuidens*:—"Two elevated ridges, nearly parallel to each other and close together, extend along its [the palate's] length, and converge backward. There is a possibility that these ridges carried single rows of teeth like the teeth on the ridges on the palate of *Pareiasaurus*, as the impression from the cast shows at regular intervals a few white dots along each ridge."

The bone between the suborbital and subtemporal fossæ I take to be the ectopterygoid, known to be largely developed in *Simosaurus*, but absent from the restorations of *Nothosaurus*. Hence, the palatines would be small, and relegated to between the choanæ and the suborbital fossæ.

The mandible has a short symphysis, with median suture, and projects posteriorly considerably beyond its articulation with the cranium; on this process the angular, supra-angular, and articular bones are perfectly distinguishable.

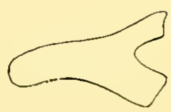
The neck consists of 21 vertebræ. Its length is once and a half that of the skull, and nearly equals that of the body. The vertebræ are short, the centra being a little broader than long; they bear short ribs, which are fork-headed, as is clearly shown on the counter-plate which bears the right rib of the second vertebra, and further by a detached rib lying on the right side of the eighteenth vertebra (fig. 2). The dislocated seventeenth vertebra shows the posterior articular surface moderately cupped. The atlas shows the proatlanto-atlantic hypapophysis separating the neuroids, and followed by the centrum, behind which there is no hypapophysis.

Little is to be seen of the dorsal vertebral column and ribs, obscured as they are by the overlying pectoral arch and plastron; the number of vertebræ may be computed at about 20.

The tail is long and slender, tapering to a fine point; its length is nearly three times that of the skull; it comprises 42 or 43 vertebræ.

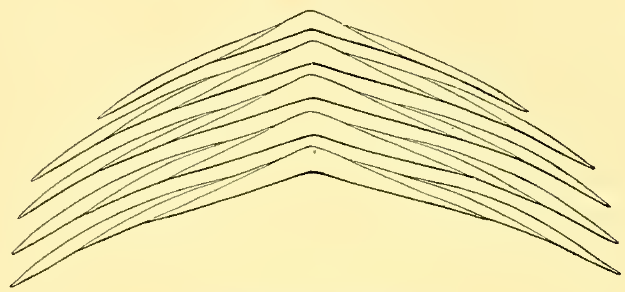
Immediately behind the pectoral arch begins the series of small bones which form the plastron; this does not differ from that of the other Nothosaurians the plastron of which is known. 34 transverse series of bones can be counted between the pectoral and pelvic arches, each series consisting of a median angulate piece and two straight ones on each side (fig. 3), as in Plesiosaurs [1], which reptiles lack, however, the angular bend of the median piece.

Fig. 2.



Posterior cervical rib.

Fig. 3.



Anterior plastral bones.

It is to be regretted that the dislocation of the pectoral arch renders the recognition of its elements somewhat difficult. There is one bone as to the nature of which no doubt can be entertained: that is, the right coracoid, lying on the inner side of the right humerus, which agrees essentially with the same element in *Neusticosaurus.* It is nearly equally expanded at both extremities, its width somewhat exceeding half its length, which nearly equals that of the humerus; its inner border is shorter and more concave than the outer. Two large, flattened, curved bones anterior to the coracoid I take to be clavicles, the left of which appears to cover the left coracoid, and is separated from the other coracoid by a small bone with concave surface, which is probably the proximal (acromial) portion of the scapula. Two displaced anterior dorsal vertebræ and a rib are exposed between the coracoids.

Only the right humerus is completely exposed, having slipped out of the glenoid cavity. It is a short, stout, curved bone with strong preaxial crest; it is provided with a small, elliptic, entepicondylar (ulnar) foramen; its length is exactly half that of the skull. The distal extremity of the left humerus projects from below the left clavicle, showing distinctly the epicondylar foramen. For the other bones of the fore limb we must turn to the left side of the specimen, where the whole forearm and manus are exposed in natural juxtaposition, the radius overlapping the proximal extremity of the ulna. The radius is large and much flattened, with concave inner border, its length twice its distal width and half the length of the humerus; the ulna is much more slender. The carpal bones are seven in number: a large intermedium, a radiale, and

[1] Mr. C. W. Andrews has recently pointed out (Geol. Mag. 1895, p. 243) that some Plesiosaurs have three paired bones to each row. [*June*, 1895.]

a small bone to each digit. The digits are five, increasing in length to the third, which equals the fourth, the fifth intermediate in length between the first and second. The first metacarpal is as long as the fifth but more slender; the second, third, and fourth are equal, half as long as the radius; the first finger has two phalanges, the second three, the third and fourth have four, the fifth three; the distal phalanx is obtusely pointed, flattened, and did not support a claw. The phalangeal bones are devoid of condyles.

The pelvic bones are somewhat crushed and displaced. The left pubis is probably hidden under the ischium, but the right is exposed, and does not show a notch in its posterior border. The ischia form large plates with radiating striæ.

The femur is straight, subcylindrical, but feebly expanded at the extremities; its length exceeds by one fourth that of the humerus. The tibia is a little longer and considerably broader than the fibula, and not quite half as long as the femur. In the tarsus, a large intermedium and a smaller fibulare are present; only two very small bones, at the base of the third and fourth metatarsals, are distinguishable in the second row. The metatarsals are more elongate than the metacarpals, and the third and fourth the longest and equal. The phalanges of the pes are stronger than those of the manus, and their formula is different, viz. 2, 3, 4, 5, 4; the toes increase gradually in length from the first to the fourth; the fifth is nearly as long as the third. The pes exceeds the manus by the length of the two distal phalanges of the fourth toe.

It seems probable, from the structure of the extremities, that this Saurian was better adapted for locomotion in the water than on land, and the digits must have been connected by a broad web.

On comparing the hand and foot of this Reptile with those of *Mesosaurus*, one cannot fail being struck by the concordance in the number of phalanges, and the great similarity in shape of the epipodials and phalangeals. The number of carpal bones is the same in both, but in *Mesosaurus* the tarsus comprises five elements in the distal row, and the fifth toe, instead of being shorter than the fourth, is a little longer. This agreement, together with other characters, such as the structure of the humerus and the form of the ribs, points to special affinity between the *Mesosauria* and *Nothosauria*, as first recognized by Prof. Seeley. This author, in his recent paper on *Mesosaurus* (25), places *Neusticosaurus*, a close ally of the Reptile here described, in a division, *Neusticosauria*, of the Suborder Mesosauria, characterized by flat articular surfaces of the centrum, coracoid separated from scapula, a notch in the pubis, a long neck and a short tail. As regards the latter character, which, even if founded on a well ascertained fact, would be at most a generic character, Prof. Seeley overlooks his former account of *Neusticosaurus*, in which he expresses the opinion that the tails of the specimens described by him are imperfect, and also the fine photograph, exhibited in the Geological Gallery of the British Museum, of a slab from the Lettenkohl of Hoheneck, Würtemberg, representing a group of *Neusticosaurus pusillus*, which have the tail nearly as long as the neck and body, thus proportionately quite as long as in *Mesosaurus* or *Macromerosaurus*. So far as I am able to make out from the photograph, the tail of *N. pusillus* comprises at least 40 vertebræ. The notch in the pubis, to which Prof. Seeley alludes, is not distinctly shown on the lithographed figure published in 1882, but is well marked both on the woodcut, p. 364 of the description, and on the specimen No. R. 53 in the British Museum, and agrees in every respect with the figure of the Reptile referred by Deecke (16) to *Lariosaurus*. Dames (22) has already pointed out that Deecke's *Lariosaurus* could hardly be the same as the *Lariosaurus* of Crivelli and Curioni, from which it differs in the shape of the clavicle, the feebly curved and distally expanded humerus, the longer propodials, and the notched pubis. Apart from the supposed absence of an ectepicondylar foramen in the humerus, which may after all be due to its having been overlooked, I can see no ground for regarding Deecke's specimen as generically distinct from *Neusticosaurus pusillus*. Of course, so long as the skull remains unknown, no certain conclusion can be arrived at, but I am much struck by the agreement of Deecke's and Fraas's specimens in the following points:—

1. The cervical vertebræ are less massive than in *Lariosaurus*.
2. The dorsal ribs are much thicker in their proximal than in their distal portion; the head is expanded and slightly notched.
3. The number of dorsal vertebræ, 23 to 25, which is higher than in *Lariosaurus*.
4. The distally flattened and strongly expanded humerus.
5. The slender, proximally expanded radius, which exceeds half the length of the humerus.
6. The shape of the coracoid.
7. The shape of the pubis.

With regard to *Neusticosaurus pusillus* I must observe that there are certainly 21, and perhaps 22 cervical vertebræ; and that therefore the generic identity of this Reptile with *Pachypleura*, suggested by Lydekker (21) and accepted by Zittel (20), is out of question, as well as its identification with *Lariosaurus* proposed by Bassani (18)[1].

Pachypleura edwardsii, as known from the descriptions and figures of Cornalia (9) and Curioni (12), agrees in many respects with *Lariosaurus* and *Neusticosaurus*; but the neck contains only 16 vertebræ, and the humerus is longer than the femur; the radius and ulna are slender, and two thirds the length of the humerus; the exact number of phalanges is still unknown.

Dactylosaurus, Gürich (15), from the Muschelkalk of Silesia, agrees in the number of cervical vertebræ and the shape and proportion of the radius and ulna with *Pachypleura*; the phalanges number 2, 3, 3, 4, 3, and the fourth finger is longer than the third.

[1] The specimen from Viggiù, figured on plate ii. of Cornalia's memoir, must be taken as the type of *Pachypleura edwardsii*. The specimen from Besano, figured on plate i., is possibly a *Neusticosaurus*.

Assuming the specimen described in this paper to be the young of the larger *Lariosaurus balsami*, the genus *Lariosaurus* is to be distinguished from *Neusticosaurus* by the larger and more elongate skull, the shorter and broader radius, the shape of the humerus, and the absence of notch in the pubis; from *Pachypleura* and *Dactylosaurus* in the greater number of cervical vertebræ, the shorter and broader radius, and the shape of the humerus; and from the latter more particularly in the relative proportions of the third and fourth fingers and the number of phalanges in the third finger. These four genera may be conveniently grouped, for the present, under one family, Lariosauridæ, in many respects intermediate between the Mesosauridæ and the Nothosauridæ, although nearer the latter, as shown in the following attempt at a classification of the Order Plesiosauria:—

Order PLESIOSAURIA.

Skull with a single temporal arch. Dentition thecodont. Plastron present, not connected with the clavicles. No ossified præcoracoid. Sternum absent. Dorsal ribs single-headed.

Divided into three Suborders.

Before passing on to the diagnosis of the minor groups, I must observe that I reckon the so-called "pectoral" vertebræ as cervicals, and that I accept Seeley's interpretation of the shoulder-girdle. There is no evidence to show that the bar termed "precoracoid" in Chelonians constitutes an element distinct from the scapula; therefore, I revert to the nomenclature of Cuvier and Rathke, and term this bar acromial process of the scapula in both Chelonians and Plesiosaurians.

I. Mesosauria.

Clavicles present; scapulæ fused with coracoids, the axes of which are transverse. Humerus with entepicondylar foramen; propodial bones elongate; digits with not more than 5 phalanges. Vertebræ conically cupped, with persistent notochordal canal, without transverse processes; cervical vertebræ 10 or 11; sacral vertebræ 4.

A single family:—

1. Mesosauridæ.

II. Nothosauria.

Clavicles strongly developed, forming a bar across the pectoral region, embracing a small interclavicle; scapulæ with rudimentary acromial process; coracoids elongate, forming an angle, in contact by their extremities. Humerus with entepicondylar foramen; propodial bones elongate; digits with not more than 5 phalanges. Vertebræ biplane or feebly biconcave; transverse processes short or absent; cervical vertebræ 16 to 21; sacral vertebræ 3 to 5[1].

1. Lariosauridæ.—Palate with infraorbital foramen. Dorsal vertebræ without transverse processes.

2. Nothosauridæ.—Palate without infraorbital foramen. Dorsal vertebræ with transverse processes.

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[1] Their number is still unknown in the Nothosauridæ. However, *Anarosaurus*, Dames, which I would refer to this family, is stated to have three sacrals.

III. Sauropterygia.

Clavicles small, if present, applied to the dorsal surface of the scapulæ; scapulæ with much-developed acromial process; coracoids enormously developed, with their long axes parallel, their inner borders in contact. Limbs paddle-shaped, with the propodials more or less abbreviated, and an increased number of phalanges. Vertebræ biplane or feebly biconcave; dorsals with long transverse processes; cervical vertebræ 20 to 72; sacral vertebræ 1 or 2 [1].

Three families:—

1. Pliosauridæ.—No median prolongation of the scapulæ and coracoids, which are widely separated from each other on the median line, thus enclosing a single large foramen; scapulæ not meeting in the middle. About 20 cervical vertebræ, with forked ribs.

2. Plesiosauridæ.—Scapulæ separated on the middle line; coracoids with median anterior prolongation, meeting the interclavicle and clavicles; the pectoral arch thus enclosing two foramina. Cervical vertebræ 28 to 40, with forked ribs.

3. Elasmosauridæ.—Scapulæ extensively in contact with each other on the middle line, where they join corresponding median processes of the coracoids; the pectoral arch thus enclosing two foramina. Cervical vertebræ 35 to 72, with single-headed ribs. Propodial bones much modified, simulating mesopodials.

References to the Literature on Nothosaurians.

1. Meyer, H. von. *Conchiosaurus clavatus,* ein Saurus aus dem Muschelkalke von Bayreuth. Mus. Senckenb. i. 1834, pp. 8–14, pl. i.
2. Münster, G. zu. Vorläufige Nachricht über einige neue Reptilien im Muschelkalk von Baiern. N. Jahrb. Min. 1834, pp. 521–527.
3. Balsamo-Crivelli, G. Descrizione di un nuovo rettile fossile, della famiglia dei Palæosauri. Il Politecnico (Milano), May No., 1839, p. 421.—Abstract in N. Jahrb. Min. 1843, p. 246.
4. Braun, F. Verzeichniss der in der Kreis-Naturalien-Sammlung zu Bayreuth befindlichen Petrefakten. *Leipzig,* 1840, 4to.
5. Meyer, H. von. *Simosaurus,* die Stumpfschnautze, ein Saurier aus dem Muschelkalke von Luneville. N. Jahrb. Min. 1842, pp. 184–197.
6. Meyer, H. von, and Plieninger, J. Beiträge zur Palæontologie Württembergs, enthaltend die fossile Wirbelthierreste aus den Triasgebilden. *Stuttgart,* 1844, 4to.
7. Meyer, H. von. Zur Fauna der Vorwelt. Die Saurier des Muschelkalkes. *Frankfort/M.,* 1847–1855, fol.
8. Curioni, G. Cenni sopra un nuovo Saurio fossile dei monti di Perledo sul Lario. Giorn. Ist. Lomb. xvi. 1847, pp. 157–170, pl. —.
9. Cornalia, E. Notizie zoologiche sul *Pachypleura edwardsii,* nuovo sauro acrodonte degli strati triasici di Lombardia. Giorn. Ist. Lomb. (2) vi. 1854, pp. 45–58, pls. i. & ii.
10. Blainville, H. M. D. de. Ostéographie. Publication posthume. Reptiles. *Paris,* 1855, fol.

[1] This character should probably be erased from the diagnosis. Mr. Andrews (Ann. & Mag. Nat. Hist. 6, xv. 1895, p. 334) states that there appear to be three or four sacral vertebræ in *Cryptoclidus.* [June, 1895.]

11. Gervais, P. Zoologie et Paléontologie françaises. 2e édition. *Paris*, 1859, 4to.
12. Curioni, G. Sui giacimenti metalliferi e bituminosi triasici di Besano. Mem. Ist. Lomb. ix. 1864, pp. 241–268, pls. v. & vi.
13. Fraas, O. Ueber *Simosaurus pusillus*. Württ. Jahresh. xxxvii. 1881, pp. 319–324, pl. i.
14. Seeley, H. G. On *Neusticosaurus pusillus*. Q. Journ. Geol. Soc. xxxviii. 1882, pp. 350–366, pl. xiii.
15. Gürich, G. Ueber einige Saurier des Oberschlesischen Muschelkalks. Zeitschr. Deutsch. Geol. Ges. xxxvi. 1884, pp. 125–144, pl. ii.
16. Deecke, W. Ueber *Lariosaurus* und einige andere Saurier der Lombardischen Trias. Zeitschr. Deutsch. Geol. Ges. xxxviii. 1886, pp. 170–197, pls. iii. & iv.
17. Baur, G. Bemerkungen über Sauropterygia und Ichthyopterygia. Zool. Anz. 1886, pp. 245–252, & p. 323.
18. Bassani, F. Sui fossili e sull' età degli schisti bituminosi triasici di Besano in Lombardia. Atti Soc. Ital. xxix. 1886, pp. 15–72.
19. Kunisch, H. Ueber eine Saurierplatte aus dem Oberschlesischen Muschelkalke. Zeitschr. Deutsch. Geol. Ges. xl. 1888, pp. 671–693, pls. xxix. & xxx.
20. Zittel, K. A. Handbuch der Palæontologie. Palæozoologie. III. *Munich & Leipzig*, 1888, 8vo.
21. Lydekker, R. Catalogue of the Fossil Reptilia and Amphibia in the British Museum. II. *London*, 1889, 8vo.
22. Dames, W. *Anarosaurus pumilio*. Zeitschr. Deutsch. Geol. Ges. xlii. 1890, pp. 74–85, pl. i.
23. Koken, E. Ueber die Bildung des Schädels, der Gehirnhöhle und des Gehörorgans bei der Gattung *Nothosaurus*. Sitzb. Ges. Naturf. Fr. 1890, pp. 108–111.
24. Gürich, G. Ueber einen neuen *Nothosaurus* von Gogolin in Oberschlesien. Zeitschr. Deutsch. Geol. Ges. xliii. 1891, pp. 967–970.
25. Seeley, H. G. The Mesosauria of South Africa. Q. Journ. Geol. Soc. xlviii. 1892, pp. 586–604, pl. xviii.
26. Skuphos, T. G. Vorläufige Mittheilung über *Parthanosaurus zitteli*, einen neuen Saurier aus der Trias. Zool. Anz. 1893, pp. 67–69.
27. Koken, E. Beiträge zur Kenntniss der Gattung *Nothosaurus*. Zeitschr. Deutsch. Geol. Ges. xlv. 1893, pp. 337–377, pls. vii.–xi.

EXPLANATION OF PLATE I.

Lariosaurus balsami, of the natural size. The matrix is represented lighter than it really is, in order to render the outlines of the bones more distinct (see p. 2).

A. M. Woodward del. et lith.

Mintern Bros. imp.

LARIOSAURUS BALSAMI.

II. *On the* Lepidosiren *of Paraguay, and on the external characters of* Lepidosiren *and* Protopterus. *By* E. Ray Lankester, *M.A., F.R.S., F.Z.S., Linacre Professor of Comparative Anatomy in the University of Oxford.*

Received and read June 19th, 1894.

[Plate II.]

THE object of the present communication is to place in the hands of zoologists a carefully-executed drawing of a South-American *Lepidosiren* (Pl. II. fig. 1), which, as will be seen below, there is reason to consider as identical with Natterer's *Lepidosiren paradoxa* (Fitzinger), side by side with a drawing of the African *Protopterus annectens*, Owen, from the Gambia (Pl. II. fig. 2). Measurements are also given of the two species, and illustrations of the proportionate size and of the structure of the scales of the three species—*Ceratodus forsteri*, Krefft, *Protopterus annectens*, Owen, and *Lepidosiren*, from Paraguay (Pl. II. figs. 4–9). The remarkable villi of the posterior limbs of the male specimens of the Paraguay *Lepidosiren* are also carefully represented (Pl. II. fig. 3).

From these data zoologists will be able to form a more correct conception of the appearance of *Lepidosiren* than is possible from Natterer's figure, whilst the differences between it and *Protopterus* become obvious.

I do not propose to attempt to decide critically whether the specimens of *Lepidosiren* from Paraguay, which I have examined, are the *Lepidosiren paradoxa* of Fitzinger or not[1]. The specimens described by Natterer, and named by Fitzinger, were obtained from ponds in the neighbourhood of Borba (not Bahia, *fide* Castelnau), on the Madeira River, a tributary of the Amazon system. One specimen is recorded by Castelnau as captured since Natterer's discovery—having been taken by himself in the Lake Ucayale, which is in Eastern Peru, also connected with a tributary of the Amazons,—and two specimens (one only a skeleton) are in the possession of Prof. Giglioli, of Florence, one from Manaos, the other from Madeira, both localities in the Amazon basin.

The Paraguay specimens, which were brought to Europe in the beginning of 1894 by a German traveller, Dr. Bohls[2], were obtained from the neighbourhood of the Upper

[1] See, however, the postscript to this paper, p. 20.

[2] Dr. Bohls has communicated to the Royal Society of Sciences of Göttingen ('Nachrichten,' 1894, p. 80) an account of his capture of these specimens and of the various points relating to the natural history of *Lepidosiren* observed by him. The account is so interesting that I shall give here some extracts from it. Dr. Bohls states that he discovered these *Lepidosiren* in the interior of the swamps of the Chaco (on the right bank of the Paraguay River). The *Lepidosiren* does not occur in the river itself, but only in the pools of the swampy

Paraguay River, in "the swamps of the Chaco." Six of these specimens I have had the opportunity of examining: two more closely, which I purchased for the Oxford University Museum; three purchased by the British Museum, Natural History (by kind permission of the Keeper of the Zoological Collections); and one in the possession of Mr. E. Gerrard, Jun.

Since these specimens, from one of which (now in the Oxford Museum) the drawing in the accompanying Plate has been prepared, were from the more southern river-system of the La Plata, and *not* from the great Amazon basin, there is, *primâ facie*, a question possible as to whether we have here to deal with Natterer's species or a distinct and new species. Castelnau did not hesitate to assign his specimen from Lake Ucayali, in the Amazonian area, to a new species; but probably, in view of the

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district near it. It appears that Natterer's and Castelnau's specimens were also from pools and not from rivers. Dr. Bohls believes that, whilst there is a southern limit to the distribution of *Lepidosiren*, it will be be found everywhere in the northern parts of South America in stagnant pools which are of fair depth (5 to 6 feet). The particular swamp in which Dr. Bohls captured his specimens was four days' journey west of the Paraguay River, and its borders were inhabited by a primitive tribe of Lengua Indians. They make the *Lepidosiren* and other fish captured in the pools their chief article of diet. The *Lepidosiren* cannot be caught with nets (on account of the weeds), nor by hook and line; they are caught with a spear or harpoon of about eight feet in length. The Indians plunge into the water in parties, prodding the bottom of the pools with these instruments. Dr. Bohls himself went out with a party of ten Indians. The ovaries of the *Lepidosiren* are preferred as an article of food to the salmon-like flesh, and are pressed into a kind of cake. The Lenguas Indians call the *Lepidosiren* "Loalach." The *Lepidosiren* feeds chiefly on a marsh-snail (*Ampullaria*) which grows as large as a man's fist, and has a dense shell which the powerful teeth of the *Lepidosiren* are well fitted to crush. The bite of the animal is much feared by the Indians. Vegetable matter is found in the alimentary canal of the *Lepidosiren* together with the remains of the snails, but Dr. Bohls thinks it probable that this may have been swallowed accidentally, and not as food. Few examples of the fish are taken in a complete condition; one of the limbs may be missing, or the tail injured (as often noted also with *Protopterus*). The Jacare (*Alligator sclerops*) feeds on the *Lepidosiren* in these pools, and specimens were found with the whole region of the body posterior to the anus in a state of regeneration—the amputation having been probably due to the bite of an Alligator.

Dr. Bohls is unable to say from actual observation that *Lepidosiren* can live in the dry mud of the pools, but as the swamps do dry up when the weather is hot and little rain falls, they must either die or pass through a period of non-aquatic life. Natterer relates that his *Lepidosiren* could give a cry like that of a cat. Those observed by Dr. Bohls gave out a sound when removed from the water, caused by expelling air through the narrow aperture of the branchial chamber.

The alcohol in which the *Lepidosiren* were preserved acquired a green colour, and this colouring matter was given out even after months, when the alcohol had been replaced several times (*cf.* green colour of the bones of *Protopterus*). When Dr. Bohls left the Chaco the females were quite ripe with distended ovaries, but no eggs apparently had been laid. The specimens brought home by him therefore are, many of them, in a state approaching that of the spawning period, but not actually arrived at that condition (see above as to my observations on the villi of the pelvic limbs of the males). Dr. Bohls tried to keep specimens alive in tanks, but, as all were necessarily injured by the spear in capture, they invariably died on the second or third day after they were obtained.

absence from his description of any distinctive characters, no one will be found to agree with him.

The view taken as to the Paraguayan *Lepidosiren* being distinct from that of the Amazons will no doubt depend, to some extent, on the conclusion which is accepted as to the existence of a single species of *Protopterus* in the African continent. If we agree with Dr. Günther that Peters's *Protopterus amphibius* from the Zambesi (Quillemane) is not really distinct from the *Protopterus annectens*, Owen, of the western water-shed of Africa (Gambia), then it will seem not unlikely that a single species of *Lepidosiren* may similarly inhabit two distinct river-systems in South America[1].

From an examination which I have made of specimens of *Protopterus* in the British Museum and elsewhere, I cannot regard the question of the species of African *Protopteri* as finally settled, and would venture to point out that it is very desirable that large and well-preserved specimens should be secured, by those who may have the opportunity, from each of the different river-systems of Africa and deposited in European collections for study. It seems that we must either admit that a very marked range of variation is exhibited (as is *à priori* likely enough) in specimens of one species of both *Protopterus* and *Lepidosiren*, or that more than one species has to be recognized in each genus.

On the whole, I think it will be best to assume for the present that Bohls's Paraguay *Lepidosiren*[2] is identical with the *L. paradoxa* of Fitzinger and Natterer, and I now

[1] It appears that Professor Peters refers some of the specimens from the Zambesi and also those from the Nile and from the Tanganyika district to the species *P. annectens* of Owen, and that his *P. amphibius* is represented *only* by certain specimens brought by him from the district of the delta of the Zambesi (Quillimane), and preserved in the Berlin Museum. *P. amphibius* is stated to possess only thirty pairs of ribs instead of thirty-five (*P. annectens*), and as its specially distinctive character is given not merely that a fin-membrane ('Flossensaum') is present on one border of both pectoral and pelvic limbs (instead of on the pectorals only, as in *P. annectens*), but that the membrane in both limbs is supported by minute cartilaginous rods, which are wanting in *P. annectens*. (See Schneider, 'Zoologische Beiträge,' vol. ii. 1890, p. 97).

The determination of the presence or absence of the minute fringing cartilages of the fins requires the use of the microscope. I have examined specimens from the Zambesi (in the British Museum) with a fin-membrane well developed on the hinder limbs, but was not able to apply the microscope. As to how far these characters are really indicative of specific separation is still doubtful, and can be cleared up only by minute examination of large series of specimens, which it is to be hoped will soon be forthcoming now that our communication with Equatorial Africa is so greatly improved and extended.

[2] Prof. Ehlers, in an interesting communication to the Royal Society of Sciences of Göttingen ('Nachrichten,' 1894, p. 84), gives reasons for considering that Dr. Bohls's collection of *Lepidosiren* from Paraguay consists of two species—one which he considers identical with Natterer's *L. paradoxa*, and a second which he distinguishes as *L. articulata*, n. sp. Prof. Ehlers had the opportunity of looking over thirty-two specimens from Paraguay, of which he considers that twenty-seven belong to his new species, whilst five are to be referred to *L. paradoxa* of Fitzinger.

The characters adduced by Prof. Ehlers for separating these two species appear to me to be insufficient propose to point out what are the chief differences of form and proportion between *Lepidosiren* and *Protopterus* as represented on the one hand by the Paraguay specimens of *Lepidosiren*, and on the other hand by specimens of *Protopterus* from both the Gambia and the Zambesi.

Sir Richard Owen, in his original description of *Protopterus annectens* (Trans. Linn. Soc. xviii. 1841, p. 327), pointed out important differences in his new form from Africa

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depending as they do on the general form of the head and snout, which is liable to distortion owing to the specimen resting on the head when placed in a jar containing the alcohol in which it is preserved. The males, both of the series assigned to the old species, *L. paradoxa*, Fitz., and of the series assigned by Ehlers to his new species, presented equally the remarkable villi on the pelvic limbs hitherto unknown in *Lepidosiren*. In the females of both the villi are absent—the specimens brought home formerly by Natterer were females.

The only character which Ehlers adduces for separating the Paraguay specimens into two distinct species, which seems to me likely to be of value, is that upon which he bases the specific name '*articulata*.'

One (or more? Prof. Ehlers does not state) of the specimens belonging to the series of twenty-seven, which on account of shape of head and colour he had set apart as a new species distinct from the remaining five, was found to exhibit a segmentation of the cartilaginous skeletal axis of the limbs, both pectoral and pelvic. Now it is well known that according to Bischoff's description and figure the skeletal axis of the limb (of each girdle) of *L. paradoxa*, Fitz., is an unsegmented continuous tapering rod of cartilage. In the African *Protopterus* the corresponding skeletal element consists of successive segments.

As Prof. Ehlers justly observes, the character which he has thus put forward requires testing on a large number of specimens. It does not appear from his statement that he has so tested it. It would not even follow that two species of *Lepidosiren* exist side by side in Paraguay, because some specimens are found to have segmented skeletal axes to the limbs, and a certain proportion are found to have an unsegmented axis.

The fact is that the specific determination of the Paraguay *Lepidosiren* has yet to be made by comparison, *either* with the five specimens from the Amazons now in European Museums (one in Paris, two in Vienna, two in Florence), *or* with new specimens to be obtained from the Amazon system. (See postscript, p. 20.)

Prof. Ehlers's identification of five specimens, out of thirty-two brought by Dr. Bohls, with *L. paradoxa*, Fitz., cannot be regarded as resting on satisfactory grounds, any more than the separation of the other twenty-seven specimens as a distinct species. That *one* of the latter had a jointed axis to the limb cannot be held to go very far; we do not really know at present whether such jointing is common, or occasional, or never present in *Lepidosiren annectens*, and until we do it will be best to consider Dr. Bohls's specimens from Paraguay *provisionally* as identical with the Amazonian *L. annectens*, Fitz. (See, however, the postscript to this paper, p. 20.)

Bischoff's figure and description of the cartilaginous axis of the limb of *L. annectens*, Fitz., in the 'Annales des Sciences Naturelles,' 1840, does not justify a final conclusion as to the absence of segmentation in that axis. *Protopterus* with its corresponding segmented axis was not known at the time, and in an insufficiently cleaned preparation it is *possible* that segmentation may have escaped Bischoff's notice. He makes no emphatic statement on the subject.

I am unable to gather from Prof. Ehlers's statement whether he he has actually seen a *Lepidosiren* with an unsegmented cartilaginous axis to the limb, or whether he is merely quoting and assuming the finality of Bischoff's statement. He says: "Bei dem von mir so gedeuteten Thiere (*L. annectens*) ist auch das Skelet der Gliedmassen ein einfacher ungegliederter Knorpelstab." Among Dr. Bohls's specimens there were five "so gedeutet" by Prof. Ehlers. It would be satisfactory to know whether all five, or how many, were ascertained to have the simple unsegmented cartilage-axis, or *whether any specimen at all was really ascertained by Prof. Ehlers* to exhibit "ein einfacher ungegliederter Knorpelstab" as the fin-skeleton.

and the description given by Natterer of the South-American *Lepidosiren.* He especially drew attention to the relative distance (and number of vertebræ) intervening in the two species between the anterior and posterior limbs. The difference thus indicated is very striking, and is expressed in general terms by saying that *Lepidosiren* is long and eel-like, whilst *Protopterus* is comparatively short and thick-set.

In order to place the distinction on a definite numerical footing, it is found convenient to take the following points of measurement:—A. Total length from the extremity of the snout to the extremity of the caudal fin; B. From the extremity of the snout to the anterior margin of the pectoral fin where it springs from the body; C. From the anterior margin of the pectoral fin to the anterior margin of the pelvic fin; D. From the anterior margin of the pelvic fin to the extremity of the tail; E. From the anterior margin of the pectoral fin to the vertical drawn from the anterior limit of the dorsal fin.

In the following lists I give these measurements, A, B, C, D, E, for five specimens of the Paraguay *Lepidosiren*, and for six specimens of *Protopterus.* It is no doubt true that the ratio of these lengths one to another differs in larger specimens as compared with quite small specimens; also that the distortion caused by stuffing may entirely obscure the natural proportions. With the exception of two large stuffed specimens of *Protopterus* in the British Museum, all the specimens, the measurements of which are here recorded, were preserved in alcohol.

If we take the length of B (from tip of snout to anterior margin of pectoral fin) as a unit, these measurements may be expressed in a form facilitating a direct comparison of all the specimens examined.

It will facilitate the statement of these results if we call A the total length, B the head-length, C the inter-membral length, D the post-pelvic length, and E the cervico-dorsal length. If we give the total length in centimeters it will be unnecessary to burden the reader with the other measurements in centimeters; it will be sufficient to give them in terms of the unit of comparison adopted, viz. the head-length.

TABLE A.—*Measurements of* Lepidosiren *from Paraguay.*

No.	Specimen.	Total length in centimeters.	Ratio of total length.	Head-length (unit).	Ratio of inter-membral length.	Ratio of post-pelvic length.	Ratio of cervico-dorsal length.
1.	Smaller male *Lepidosiren* from Paraguay (Oxford Museum) .	57	8·77	1	4·7	3·15	3
2.	Larger male *Lepidosiren* from Paraguay (Oxford Museum) .	73·3	10·47	1	5·85	3·57	2·92
3.	Large male *Lepidosiren* from Paraguay (British Museum) .	72	9·27	1	5	3·38	2·58
4.	Small male *Lepidosiren* from Paraguay (British Museum) .	40·5	10·12	1	5	4·1	3·06
5.	Female *Lepidosiren* from Paraguay (British Museum)	67	10·3	1	5·53	3·77	3·54
	Average	......	9·75	1	5·21	3·59	3·2

TABLE B.—*Measurements of specimens of* Protopterus annectens, *Owen.*

No.	Specimen.	Total length in centimeters.	Ratio of total length to head-length.	Head-length (unit).	Ratio of inter-membral length.	Ratio of post-pelvic length.	Ratio of cervico-dorsal length.
1.	Specimen in Oxford Museum, killed, and measured three hours after death (see Pl. II., and explanation where this specimen is figured), from the Gambia	50	6·25	1	2·5	2·63	1·3
2.	Quite small specimen in the Oxford Museum	23	7·66	1	3·3	3·3	1·4
3.	From the Zambesi (British Museum)	39	7	1	3	3	1·2
4.	A second from the Zambesi (British Museum)	32	8	1	3·25	3·75	1·5
5.	Stuffed specimen in British Museum, formerly living in the Crystal Palace, Sydenham.	79	9·3	1	3·53	4·17	1·64
6.	Very large stuffed specimen in British Museum (purchased of M. Parzudaki): Nile	90	7	1	3·46	2·46	2

The facts indicated by these two sets of measurements (excluding any close following of the figures derived from the stuffed specimens of *Protopterus*) are, firstly, that the proportional value of the measurements differs greatly in different specimens; and secondly, that if we take a fair well-grown specimen of *Protopterus* on the one hand and of *Lepidosiren* on the other, the former from 40–50 centimeters, and the latter 60–70 centimeters in length, they contrast most strongly in the following points—namely, that in *Protopterus* the whole animal is about 6½ times as long as its head, whereas in *Lepidosiren* the whole animal is about 10 times as long as its head. Next, that whereas in *Protopterus* the inter-membral length is about 2½ times the length of the head, it is about 5 times the length of the head in *Lepidosiren*; and, lastly, that whereas in *Protopterus* it is about once and a half the length of the head from the pectoral to the commencement of the dorsal fin, it takes as much as three head-lengths to cover the same line in *Lepidosiren.* The post-pelvic ratio of length is nearly the same in the two genera.

These external differences are, of course, accompanied by corresponding numerical differences in the number of myocommata and vertebræ, which have already been noted by Owen, and there are corresponding differences in the number of scales between the points taken. It is not my purpose on the present occasion to deal with points of anatomy, and with regard to the enumeration of scales I will record that it is by no means an easy task in *Lepidosiren* on account of the delicacy of the scales, their small size and deep implantation, as well as the abundant coagulated and strongly pigmented tissue which covers them in specimens recently preserved in spirit and therefore not macerated.

The form and ornamentation of the scales have been more or less fully described by Natterer and Bischoff in *Lepidosiren*, by Owen in *Protopterus*, and by Günther in *Ceratodus*. From Wiedersheim we have a more minute account of the denticles which are set on the polygonal areæ marking the scales of *Protopterus*. In Pl. II. figs. 4–9, I have reproduced drawings prepared for me by Mr. E. S. Goodrich, F.L.S., of Merton College, my assistant in the Oxford Museum, showing the relative size of the scales in the three genera *Ceratodus*, *Protopterus*, and *Lepidosiren*, and also showing the denticulate ornament of the scales, equally magnified in each case for comparison. The scale chosen in each case is taken from a point near the middle of the inter-membral area, and about halfway between the dorsal and ventral mid-line; the object has been to select in each case a similarly-conditioned scale. It will be seen that the scale of *Ceratodus* is enormous compared with those of the other two genera, and that that of *Protopterus* is larger than that of *Lepidosiren*. (See further, as to the scales, in the note to the Explanation of the Plates.)

The denticulations of the scales do not vary in size proportionately to the size of the scales, but are only somewhat coarser in *Ceratodus* than in *Protopterus* and *Lepidosiren* (Pl. II. figs. 7–9).

The last point, in reference to the Paraguayan *Lepidosiren*, to which I desire to draw attention in the present communication is the remarkable development of the villi on the hind limbs. These were described and figured by me in outline in a letter to 'Nature' in April 1894. They have also been described, but not figured, by Prof. Ehlers in a communication to the Göttingen 'Nachrichten,' 1894, p. 87, which was not published until June, and was unknown to me when my letter in 'Nature' was published, although some author's reprints had been distributed before that date. It appears that these villi occur only on male specimens. They are present on all the male specimens I have examined, and are absent from the females. They occur on the postero-medial surface of the elongated pelvic fins, and are seen both in Pl. II. fig. 1 and in the enlarged drawing of the limb (Pl. II. fig. 3), which is represented as turned forward so as to expose them fully to view. The villi are small, pale-coloured, blunt processes, from three to four times as long as broad; they are either simple or joined, to the number of two, three, or four, on a common base. I have examined the microscopic structure of these villi by means of transverse sections. They are covered with epidermic cells, which are two or three deep, and show evidence, in the condition of their nuclei, of being in course of active multiplication. But I did not observe any special characters of interest in these cells; they were block-like, solid, and not flattened. Below the epithelial cells is a finely fibrous connective tissue, which in transverse section of the villi is seen to occupy the axis, and to take the form of trabeculæ enclosing oblong cavities with rounded contours. Numerous nuclei belonging to the connective tissue—some in karyokinetic activity—are apparent in such sections, and here and there a minute blood-vessel. The cavernous structure of the connective tissue and the vascularity of the villi are in favour of the supposition that the cavernous tissue may be erectile under certain conditions, probably at the time of sexual congress [1].

External Gills of Protopterus.

The presence of external gills was given in the Brit. Mus. Cat. Fishes, viii. p. 322 (1870), by Dr. Günther, as diagnostic of the genus *Protopterus* in contrast to *Lepidosiren*. The diagnostic is adopted also by Schneider (*loc. cit.*). I believe that the distinguished zoologist of the British Museum would not at the present moment put forward that character as one to be insisted upon. There is no doubt that moderate-sized specimens of *Protopterus*, such as that figured in Pl. II. fig. 2, do not possess external gills. While small specimens of *Protopterus* possess remarkable *pigmented* (yellow and black) external gills, it is impossible at present to use this character as distinguishing *Protopterus* from *Lepidosiren*, since small specimens of *Lepidosiren* have not been examined, and may therefore, for all we know, possess such gills also.

The Specimen of Protopterus annectens, *figured in* Plate II. fig. 2.

The *Protopterus* figured in the Plate accompanying this paper, for the purpose of comparison with *Lepidosiren*, was living in the tank of the Reptile House in Regent's Park three hours before it was sketched. The drawing has a special value, therefore, as being made from a perfectly fresh and undistorted specimen. It was kindly placed in my hands for the purpose of study by Dr. P. L. Sclater, Secretary to the Zoological Society of London. It proved to be a female, and is one of six from the Gambia River presented to the Society by Mr. H. H. Lee.

It is remarkable that both the limbs and the tail of well-grown specimens of *Protopterus* seem to be specially liable to injury during life. I believe this injury arises not only from bites inflicted by the *Protopteri* on one another, but also from the attacks of a parasite which is allied to, if not identical with, the *Saprolegnia ferox* of salmon disease. In captivity they are, as a fact, attacked by *Saprolegnia*, and the consequent ulceration leads to loss of parts of the caudal and lateral fins.

The female specimen which is drawn in Pl. II. fig. 2 is remarkable for the completeness of the caudal fin and for the fact that a minute median filament is present, extending beyond the main outline of the fin posteriorly.

I am not able at present to give any further detail as to the nature of this process, the specimen being retained in a complete condition for exhibition in the University Museum, Oxford.

The lateral fins are of more than average length as compared with specimens of this size. In young *Protopteri* the pectorals and pelvics are very long; in specimens

[1] A demonstration that such is the nature of the villi would, however, require specimens in which the condition of turgescence was actually retained in preservation, or fresh specimens upon which injection could be practised.

5 inches long the pectoral fins may have a length of $3\frac{1}{2}$ inches. Apparently the fins are continually being shortened by violence or disease, and continually grow again, not to the relative length seen in the young, but so as to repair to a great extent the loss. Hence it seems that little importance can be attached, in the diagnosis of *Protopterus* and *Lepidosiren*, to the relative length of the fins, unless a very large series of each is studied.

I am also unwilling to attach much importance to the general form of the head and the relative position of the eye in relation to the angle of the mouth as specific or generic characters, since we have no drawing or record of freshly killed or living specimens of *Lepidosiren*, while preservation in spirit is liable to be attended by considerable distortion of the head.

But it is fairly apparent, as shown in the Plate, that the head of *Protopterus* is less blunt anteriorly than that of *Lepidosiren*, and that the eye of *Lepidosiren* is placed much further forward than that of *Protopterus*, so as to be in front of the angle of the mouth.

EXPLANATION OF PLATE II.

Fig. 1. *Lepidosiren* from the swamps of the Chaco (Upper Paraguay River), natural size: male. Drawn from a spirit-preserved specimen in the Oxford University Museum by J. Bayzand *.

Fig. 2. *Protopterus annectens*, Owen. Drawn by J. Bayzand * from a specimen recently killed and untouched by alcohol. The specimen is a female, was brought

* *Note*, Dec. 20, 1895.—It is only fair to the artist, Mr. Bayzand, to point out that a curious inaccuracy has crept into the lithographic reproduction of his drawing which is not present in the original as made by him. It will be observed, in the two large figures of *Lepidosiren* and *Protopterus* respectively, that there is a marking on the surfaee of the body, especially strongly rendered in the drawing of *Protopterus*, which appears to indicate "scales," and was interpreted as such by the lithographer. As a matter of fact, *no scales at all or parts of scales* are visible on the surface of the body of a fresh or well-preserved specimen of *Protopterus*. The scales are entirely overlaid, in both *Protopterus* and *Lepidosiren*, by soft vascular connective tissue in addition to a well-developed epithelium. The areæ which are marked out on the surface of the body and have been wrongly rendered in the lithograph as scales are in reality lozenge-shaped areæ outlined by the greater abundance along their margins of the large branching pigment-cells of the connective tissue which overlies as a uniform and continuously flat layer the subjacent scales. The lithographer, thinking he was called upon to represent protruding imbricated scales, such as appear on the surface in many common Teleostean fishes, has changed the outline of the pigment-areæ and represented the posterior border as a portion of a circular curve, a form which it does uot present either in *Protopterus* or *Lepidosiren*, and which was not given to it in Mr. Bayzand's origiual drawing. The true form of these areæ delimited by pigment-cells is seen in the woodeut, fig. 1. The areæ are seen to have a pointed angular posterior border, and not a curved one. The anterior border, on the contrary, shows a rounding-off of the angle, so that the form of the markings given in the lithograph should be reversed. The areæ are less elongated near the head and uear the origin of the mediau fins than in other regions.

Though these areæ are in no way to be regarded as scales, they yet correspond in position and number with the subjacent imbricated scales. Each scale in *Protopterus* and *Lepidosiren* has a large sculptured area carrying the denticulations figured in the Plate, and, extending posteriorly beyond this, a softer unsculptured portion from the Gambia district, West Africa, and had been living two years in the Society's Gardens.

Fig. 3. Left hind limb of the specimen of *Lepidosiren* drawn in fig. 1, reflected forward

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which is as it were cut off above and below so as to form a strong median angle (Plate II. figs. 5 & 6). The line separating the stronger sculptured part of the scale from the smooth softer piece presents a fine curvature (*a a* in figs. 5 & 6 of the Plate). In old spirit-specimens of *Protopterus* (woodcut, fig. 2) and also in similar

Fig. 1.

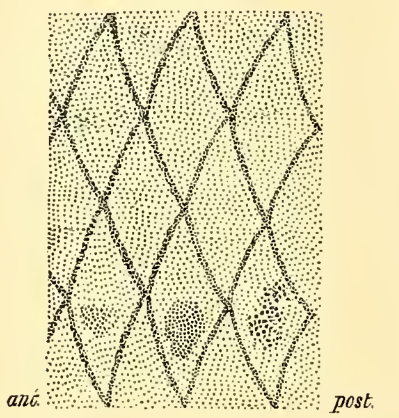

Diagram of the lozenge-shaped areæ outlined by pigment-cells (which are also seen scattered and in some places aggregated on the general surface), from the mid-body region of *Protopterus annectens*, as seen in a freshly-preserved specimen (six months in spirit).

Fig. 2.

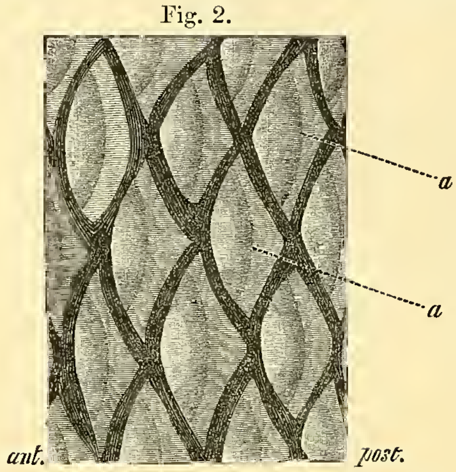

Diagram of the same areæ as those drawn in fig. 1, as seen in a specimen which has been long preserved in weak spirit. The pigment has become altered in colour (from blue-black to a warm brown) and has diffused into and stained adjacent tissue. The subepidermic connective tissue is wrinkled and semitransparent, and permits one to see the outline of the semicircular curve (*a, a*) which separates the sculptured from the unsculptured portion of the subjacent scale.

specimens of *Lepidosiren*, this curved line shows through the softened and wrinkled dermis (woodcut, fig. 2, *a a*) owing to the greater thickness and differentiated texture of the sculptured portion of the buried scale.

Fig. 3.

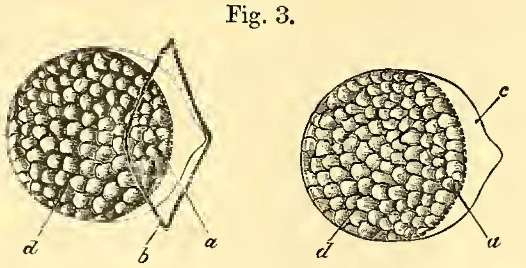

Diagram to show the relation of the scale of *Protopterus* to the superjacent lozenge-shaped area outlined by pigment-cells. *a*, the line separating the thicker sculptured portion of the scale from the softer and smooth, pointed portion, *c*; *b*, the position of the pigment-cells disposed in the form of a lozenge.

The relation of an entire scale to the lozenge-shaped pigment-area of the surface-tissues is shown in woodcut fig. 3, where the scale is drawn so as to show its sculptured and unsculptured portions, and the superjacent lozenge-area of pigment-cells is dotted in.

In the figures 5 and 6 of Plate II. the dotted line indicates similarly the anterior border of a superjacent pigment-lozenge.

If we now compare the figure of the scale of *Ceratodus forsteri* (Pl. II. fig. 4) with the diagrams and drawings of the scales of *Protopterus* and *Lepidosiren*, it becomes apparent that there is here also a smooth unsculptured posterior portion of the scale. In *Ceratodus*, however, this part of the scale is firm and thick, and is freely exposed, covered neither by dermis nor epidermic epithelium.

The most probable interpretation of these facts, from the point of view of the ancestral history of the scale so as to expose the anus on the left side of the animal's body, and showing the villi (found only in the male) on the dorso-mediad face of the limb. Drawn by J. Bayzand: twice the natural size, linear.

Fig. 4. Scale from middle of the side of the body of *Ceratodus forsteri*, Krefft. × 3 diam. *b*, dotted line marking off the exposed portion of the scale (to the right) from that which is sunk beneath the surface.

Fig. 5. Scale from a similar position from *Protopterus annectens*. × 3 diam.

Fig. 6. Scale from a similar position from the Paraguayan *Lepidosiren*. × 3 diam. For explanation of reference-letters *a* and *b* see footnote.

Fig. 7. Denticulation of the scale of *Ceratodus*. × 180 diam.

Fig. 8. Denticulation of the scale of *Protopterus*. × 180 diam.

Fig. 9. Denticulation of the scale of *Lepidosiren*. × 180 diam.

POSTSCRIPT.—*July 8th*, 1895.

SINCE the foregoing paper was written and the figures of the Plate drawn, I have made it my business to examine as far as possible the specimens of *Lepidosiren* from the Amazons which exist in European Museums.

I visited Paris in April, and by the courtesy of the Director of the Jardin des Plantes, M. Milne-Edwards, and of Prof. Le Vaillant was permitted to examine carefully and to measure Castelnau's specimen, as also a fragmentary skin from an old Portuguese collection, which is probably referable to the Amazonian *Lepidosiren*.

I proceeded to Florence, where my old friend Prof. Giglioli placed at my service—for the purpose of determining the justification of Ehlers's proposal to form the new species, *Lepidosiren articulata*—his *two* specimens from the Amazons.

Lastly, I wrote to Dr. Steindachner, of Vienna, to ask him to examine Natterer's two original specimens in order to determine whether the skeletal axis of the limb is "articulated," or a simple continuous rod of cartilage. Dr. Steindachner wrote to inform me that the hinder limbs of the specimen anatomized by Bischoff appear to be lost: they cannot be found. At the same time he had the great kindness to send to me Natterer's untouched second specimen in order that I might examine it myself. I have examined it, and returned it to Dr. Steindachner a month ago.

Thus I have myself examined every specimen of Brazilian *Lepidosiren* known to

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and of the Dipnoï as a natural group, appears to be that the scales of *Protopterus* and *Lepidosiren* are in a state of retrogressive modification or degeneration as compared with those of *Ceratodus*. It would seem that, whereas the ancestral form presents a freely exposed posterior margin to the scale, the whole scale has shrunk and withdrawn, so to speak, within and beneath the outermost layers of the dermis in *Protopterus* and *Lepidosiren*, whilst *Ceratodus* retains the ancestral character. Of course, behind and beyond that (in historical sequence) there is a hypothetical series of more primitive ancestral phases which lead to the multitudinous dermic denticles of primitive fishes.

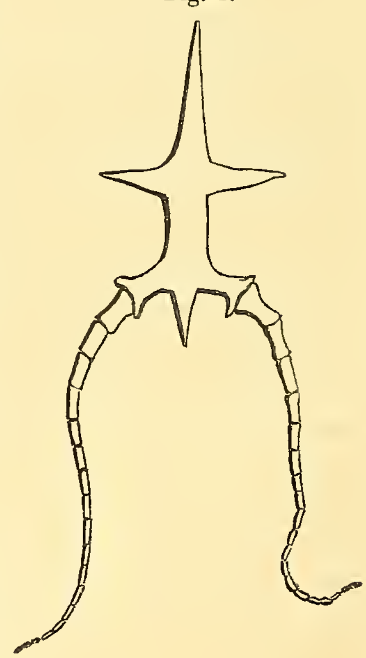
exist in European Museums, excepting the one of Natterer's two which has lost the hinder limbs.

The main point to which my observation was directed was the existence or non-existence of a segmented structure in the cartilaginous skeletal axis of the pectoral and pelvic fins.

The Paris Specimens.—I did not ask permission to cut into the limb of Castelnau's specimen in Paris; hence it remains intact, and may be appealed to should any doubt remain after what I have to relate of the other specimens. The small second specimen in Paris is very incomplete, and of no value for the present enquiry.

Castelnau's specimen measures 85 cm. in length. The head-length (as defined in the preceding memoir) is 9 cm., the inter-membral length is 48·5 cm., the post-membral length is 27·5 cm., and the cervico-dorsal length is 26 cm. The greatest depth of the body is 10 cm. The specimen is very soft, and somewhat flattened and collapsed, hence deeper than natural. The colour is very pale—greyish brown. The anus is on the left side; there are no villi on the pelvic fin. The lower jaw was damaged in capture. The eye is far in front of the angle of the mouth (halfway between it and the border of the snout). The eye is flat, without raised cornea, as in all examples of *Lepidosiren* I have seen, whether from Brazil or Paraguay.

Fig. 4.



The Florence Specimens.—One of these had been macerated and more or less cleaned. The pelvic limbs were attached to the girdle, and presented the appearance shown in the woodcut (fig. 4.). The segmentation of the axis of the limb was most obvious! The fore limbs were very small, and still covered by integument. I dissected this away and found the axis "segmented" or "articulated" as in the hind limbs. This specimen was not a large one (about 40 cm. in length). It was sent to Prof. Giglioli by Senhor J. Barbosa Rodriguez, of Rio de Janeiro, and was procured by him at Antaz, Madeira, Amazons. The sex was not determined. The local native name is "*Trayraboia.*"

Prof. Giglioli's second specimen is larger, and is complete, except that the viscera have been removed (the existence of ova had been noted by Prof. Giglioli). It is 82·25 cm. long. The head-length is 8·25 cm., the inter-membral length 47 cm., the post-membral length 27 cm., the cervico-dorsal 30 cm. There are no villi on the pelvic fin, and the anus is on the left side.

With Prof. Giglioli's permission, I made a partial section of the right fore limb and of the right hind limb. In both the cartilaginous skeletal axis was seen to be made up of successive segments—the separate cartilages being divided by connective tissue. The fore limb in this specimen was very small and flattened.

This specimen was also sent by Senhor Barbosa Rodriguez to Prof. Giglioli. He obtained it from Igarape do Aterro, Manaos, Amazons, where its native name is "*Piramboia*."

Senhor Rodriguez recorded the capture of this specimen in the 'Jornal do Commercio,' of Rio de Janeiro, 15th November, 1886, and while furnishing the reader with a rough but characteristic figure (which would enable an up-country naturalist to recognize specimens should they come to hand), spoke of it as *Lepidosiren gigliolana*, n. sp.

This specimen is a female, and is (as compared with Bohls's Paraguayan specimens) singularly light-coloured. It is of a clear brown. I have, however, little doubt that the paleness of colour is due to the prolonged action of sunlight and of the spirit used as preservative.

The Vienna Specimen (Natterer's original).—It was a rare pleasure to be able to handle one of the two specimens which fifty years ago were brought to Europe by the celebrated traveller Natterer, and were the first indication to zoologists of the existence of the group of Dipnoï, since expanded by the discovery of *Protopterus* and *Ceratodus* and of many Palæozoic allies.

The specimen kindly sent to me by Dr. Steindachner was in beautiful condition, in spite of its fifty years' sojourn in spirit. Like Castelnau's and Giglioli's specimens, it is a clear brown and not greenish black, as are Bohls's specimens from Paraguay. Probably this is due to long soaking in spirit (see Bohls's remarks, cited above, as to the pigment of his specimens). The length of this specimen was 58 cm., its head-length 5·5 cm., the inter-membral length 31 cm., the post-membral length 22 cm., and the cervico-dorsal length 16 cm. There were no villi on the pelvic fin. I did not determine the sex. I opened the integument of both a pectoral and a pelvic fin, and found that the skeletal axis was built up of separate articulated segments as in Prof. Giglioli's two specimens and as in the three Paraguayan specimens which I have examined for the determination of this point. This specimen came from Madeira, Amazons.

Summary of Results of Examination of the Amazonian Lepidosiren.—Of the five specimens of Amazonian *Lepidosiren* which exist in Europe (for we may exclude the small Lisbon skin in the Jardin des Plantes) I have examined three in regard to the articulation of the skeletal axis of the limbs, and have found that that axis is in all segmented. Of the two remaining specimens, one (Natterer's dissected by Bischoff) has now lost the hinder limbs, the other (Castelnau's) remains for reference; for although I examined it and took measurements, I did not cut into the integument of the limbs.

I have not seen a Paraguayan *Lepidosiren* with non-segmented or non-articulated skeletal limb-axis, and it is desirable that Prof. Ehlers should clearly say whether he has or has not. The words which he uses do not amount to a statement to the effect that he has. He says that five specimens out of thirty-two submitted to him by Dr. Bohls from Paraguay differed in certain features of the head from the other twenty-seven; further, that one (or more?) of the twenty-seven had segmented limb-axes, and *therefore* (it seems) he concludes (but does not state as the result of observation) that the remaining five *must* be referred to Fitzinger's *L. paradoxa*, and *must* have an unsegmented limb-axis, since Bischoff figured such an axis in one of the original specimens of *L. paradoxa*. The probability, from my observations, is that Bischoff erroneously omitted the segmentation of the limb-axis in his figure, and did not look into the matter carefully. It seems highly probable that all Brazilian specimens of *Lepidosiren*, and all Paraguayan specimens of *Lepidosiren*, have, like the African *Protopterus*, a segmented limb-axis. The chief ground put forward by Ehlers for erecting a new species, "*Lepidosiren articulata*" from Paraguay, would, if my surmise be correct, fall to the ground.

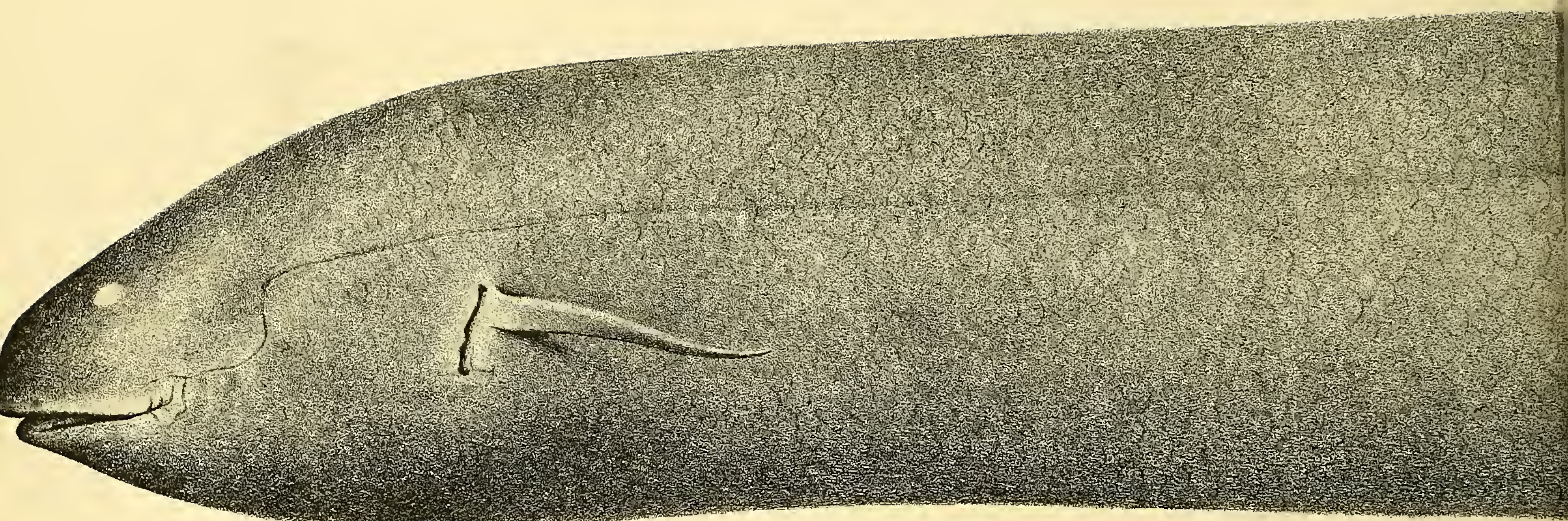
Whether any specific distinction between Paraguayan and Amazonian specimens of *Lepidosiren* can be based upon other grounds remains to be seen. The characters derived from small differences in the shape of the head, relied upon by Ehlers, cannot, in my opinion, be considered as of any value in specimens preserved in spirit, and pressed down in jars or travelling-cases. The most striking and uniform difference which I have observed is in colour: the Paraguayan specimens are black, the Brazilian specimens are clear brown. There is, however, little doubt that this is largely, if not altogether, due to the longer action of alcohol and sunlight upon the Brazilian specimens.

Lastly, we may compare the measurements of the Brazilian and Paraguayan specimens.

If we write down, for the three Brazilian specimens, the measurements already given in terms of head-length, it appears that Castelnau's specimen has a total length of 9·54 units, an inter-membral length of 5·5, a post-membral of 3, and a cervico-dorsal of 3; for Giglioli's large specimen the corresponding figures are—10, 5·7, 3·4, and 3·63; for the Vienna specimen they are—10·06, 5·64, 4, and 3. If we now take the average of these three Brazilian specimens, and compare it with the average of the five Paraguayan specimens given on p. 15, we obtain the following striking result:—

	Total length.	Inter-membral.	Post-membral.	Cervico-dorsal.
Brazilian average in head-length units	9·87	5·25	3·5	3·21
Paraguayan average in head-length units	9·75	5·21	3·59	3·2

The specimens in both series were taken altogether by hazard, yet there is the closest agreement. No doubt such a result does not *exclude* the possibility of a specific difference being discovered separating the Paraguayan from the Brazilian *Lepidosiren*. But it renders the existence of such a difference very unlikely, and I have already shown that it is extremely probable that the character relied on by Prof. Ehlers in order to separate some Paraguayan specimens from the Brazilian species has no existence in fact.



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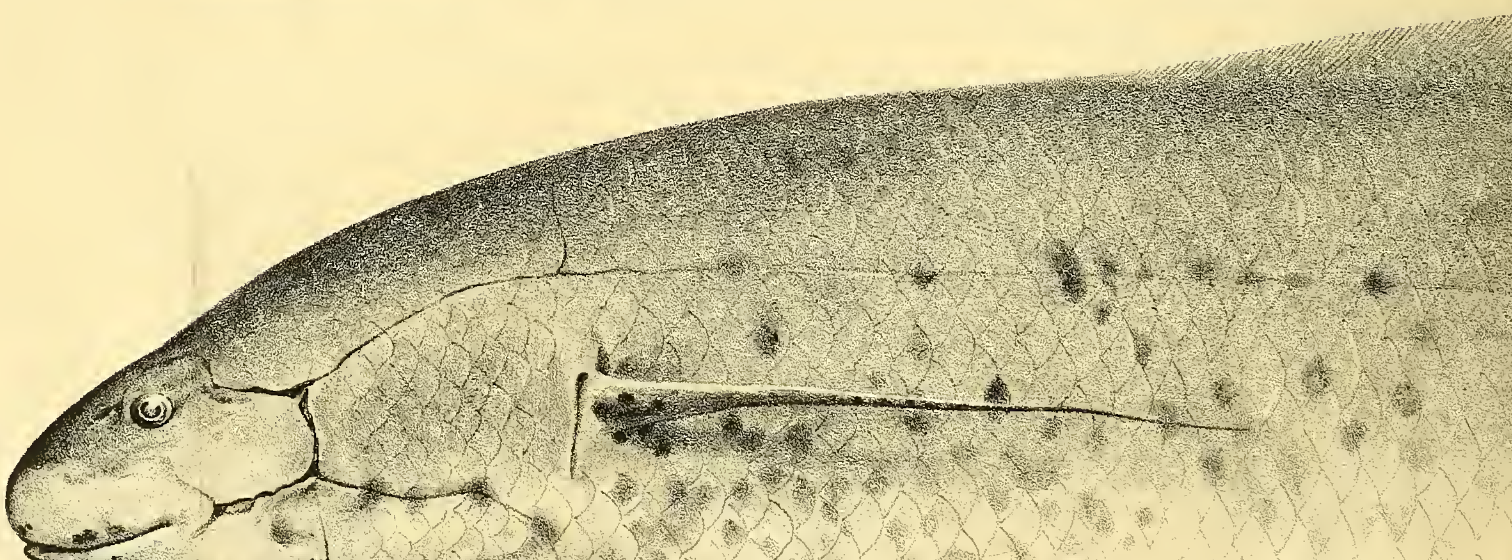
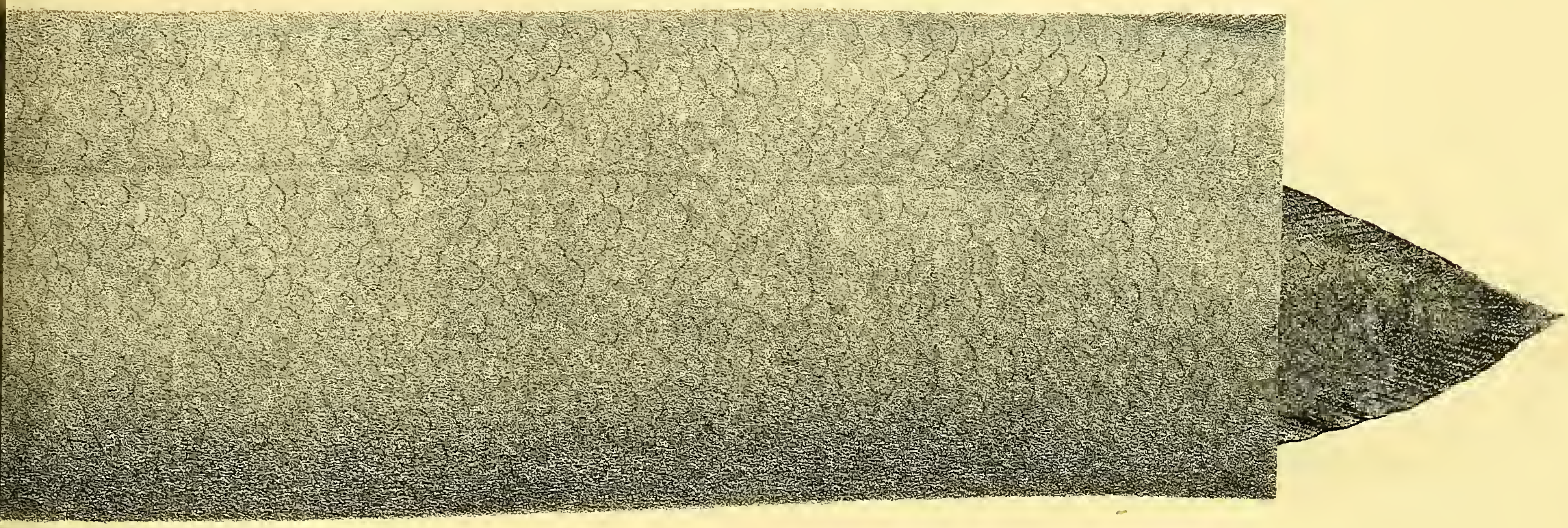


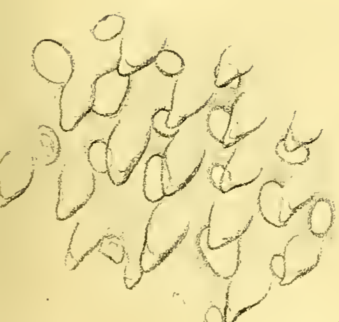
Bayzand del ad nat. J. Smit lith.

Pl. II.

Fig. 1.



LEPIDOSIREN PARADOXA.



9 Lep

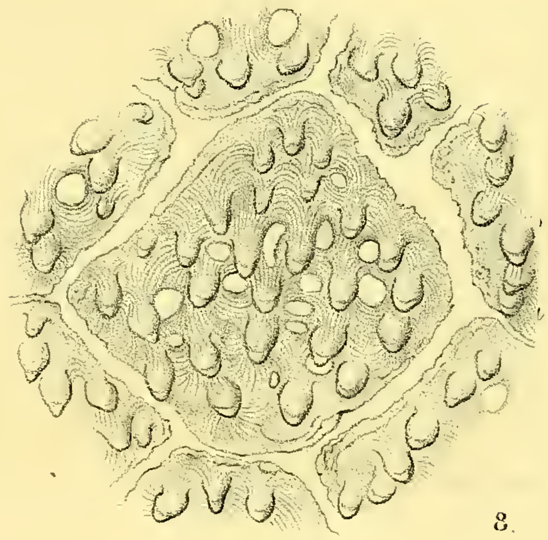


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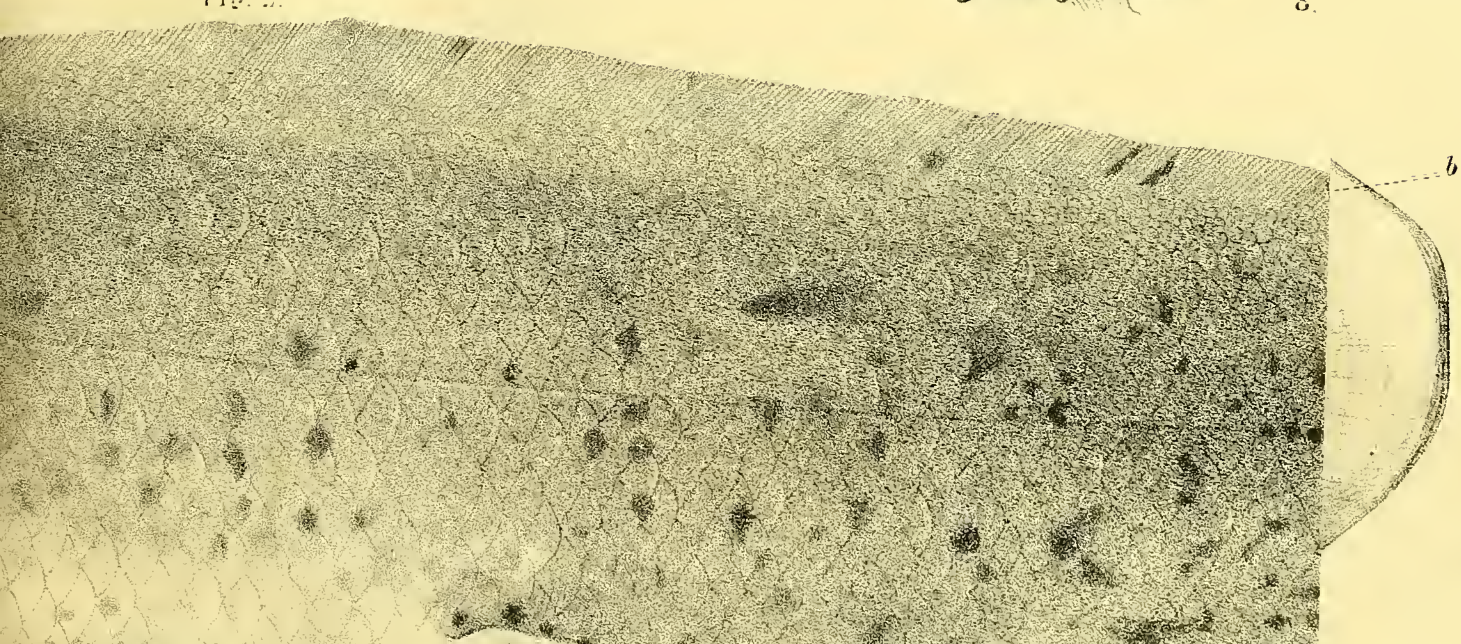
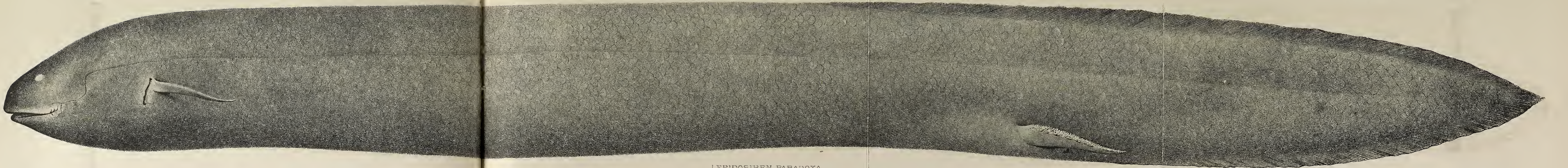
Fig. 2.



PROTOPTERUS ANNECTENS.

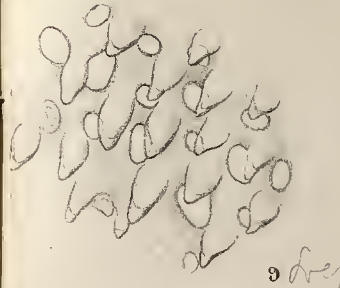
n Bros. imp.

Fig. 1.



LEPIDOSIREN PARADOXA.

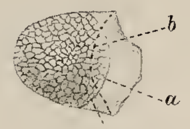
3.



9 Lep

8. Prot

7. Cerat.



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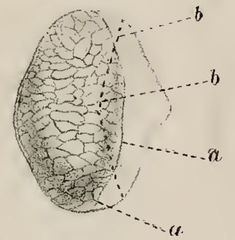
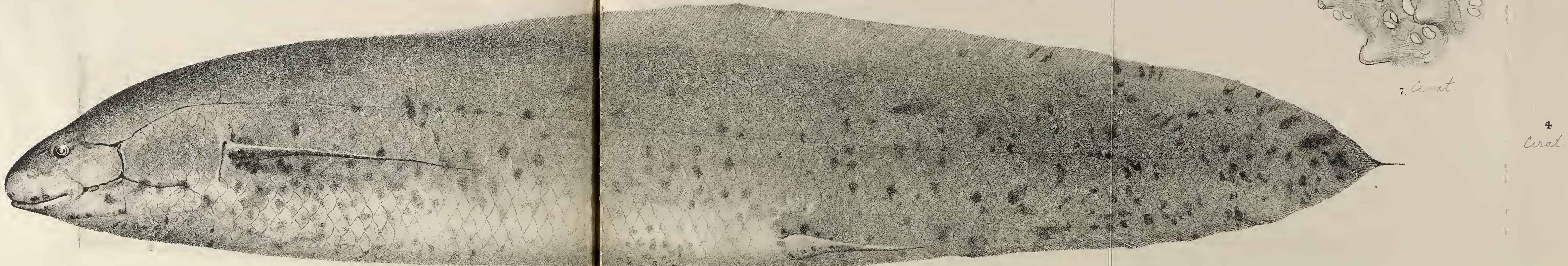


5. Prot.

Fig. 2.



4. Cerat.

PROTOPTERUS ANNECTENS.

Bayzand del ad nat. J. Smit lith.

Mintern Bros. imp.

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390.

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Continued on page 3 of Wrapper.

III. *On a Collection of Fishes from the Rio Paraguay.*
By G. A. Boulenger, *F.R.S.*

Received May 20th, 1895, read June 18th, 1895.

[Plates III.–VIII.]

The Trustees of the British Museum have lately acquired a large collection of Fishes formed by Dr. C. Ternetz at various localities in Matto Grosso and Paraguay. So few fishes have been collected in the Paraguay System since the time of Natterer that it seemed to me desirable to draw up an account of the collection, and to give a full list of all the species represented, several of which are new to science [1].

SCIÆNIDÆ.

1. Plagioscion ternetzi. (Plate III.)

Plagioscion ternetzi, Boulenger, P. Z. S. 1895, p. 523.

Outer upper and inner lower teeth considerably enlarged. Depth of body 3 times in total length, length of head 3 to $3\frac{1}{4}$ times; snout a little longer than diameter of eye, which is 5 to $5\frac{1}{2}$ times in length of head; interorbital width equal to length of snout, 4 times in length of head; maxillary extending to below posterior border of eye; præopercular border rounded, finely denticulated behind, with wide-apart small serræ at the angle and below. 15 gill-rakers on lower part of anterior arch, the longest as long as or a little shorter than longest gill-filaments. Lower pharyngeal teeth villiform. Dorsal X, I 33–35; third and fourth or fourth and fifth spines longest, $\frac{1}{3}$ to $\frac{2}{5}$ length of head. Pectoral nearly $\frac{3}{4}$ length of head. Anal II 6; second spine very strong, $\frac{1}{3}$ length of head. Caudal pointed, densely scaled. The distance between base of anal and base of caudal $2\frac{1}{3}$ depth of caudal peduncle. Scales nearly all ctenoid, 95–100 $\frac{13\text{–}14}{23\text{–}24}$; lat. l. 48–50. Uniform silvery.

Total length 450 millim.

Two specimens from Remanso, Rio Grande, Paraguay.

This species is allied to *Sciæna surinamensis*, Blkr.

2. Pachyurus schomburgki, Gthr.

Paraguay.

[1] Diagnoses of the new species have appeared in P. Z. S. 1895, p. 523.

CICHLIDÆ.

3. Acara bimaculata, L.
Descalvados, Matto Grosso; Paraguayan Chaco.

4. Acara tetramerus, Heck.
Descalvados, Matto Grosso; Paraguayan Chaco.

5. Mesonauta insignis, Heck.
Descalvados, Matto Grosso.

6. Crenicichla johanna, Heck.
Paraguay.

7. Crenicichla saxatilis, L.
Paraguay.

8. Geophagus duodecimspinosus. (Plate IV. fig. 1.)
Geophagus duodecimspinosus, Boulenger, P. Z. S. 1895, p. 524.

Depth of body $1\frac{4}{5}$ in total length, length of head 3 times. Eye nearer gill-opening than end of snout, its diameter $3\frac{1}{3}$ times in length of head and a little less than interorbital width; præorbital $1\frac{1}{3}$ diameter of eye; scales on cheek small, in 7 series. Dorsal XII 14; spines increasing in length to the fourth, which is $\frac{3}{5}$ length of head; soft portion scaly at the base, longest rays nearly as long as head. Pectoral one fourth longer than head. Ventrals shorter, reaching anal. Anal III 9; third spine longest, as long as third dorsal. Caudal truncate. Scales 30 $\frac{4}{10}$; lat. l. $\frac{18}{9}$. Yellowish, with a dark vertical streak below the eye, and a dark round spot on the side below the lateral line; vertical fins brownish, with some small, round, white spots on the soft dorsal and anal; pectorals white, ventrals blackish.

Total length 90 millim.

A single specimen from Paraguay.

PLEURONECTIDÆ.

9. Solea jenynsii, Gthr.
Paraguay.

SILURIDÆ.

10. Sorubim lima, Schn.
Paraguay.

11. Platystoma orbignianum, Val.
Paraguay.

12. Hemisorubim platyrhynchus, C. & V.
Paraguay.

13. Sciades pictus, Müll. & Trosch.
Matto Grosso.

14. Pimelodus cottoides, Blgr.
Descalvados, Matto Grosso.

15. Pimelodus albicans, C. & V.
Paraguay.

16. Pimelodus maculatus, Lacép.
Paraguay.

17. Pimelodus lateristriga, M. & T.
Descalvados, Matto Grosso.

18. Pimelodus gracilis, C. & V.
Descalvados.

19. Pimelodus labrosus, Lütk.
Descalvados.

20. Pimelodus platanus, Gthr.
Paraguay.

21. Pimelodus pati, Val.
Paraguay.

22. Pimelodus pirinampus, Ag.
Paraguay.

23. Ageniosus brevifilis, C. & V.
Paraguay.

24. Euanemus nigripinnis. (Plate IV. fig. 2.)

Euanemus nigripinnis, Boulenger, P. Z. S. 1895, p. 524.

Depth of body equal to length of head, $4\frac{1}{2}$ to 5 times in total length; width of head equal to length without snout; groove extending from end of snout to occipital bone; eye as long as snout, $3\frac{2}{3}$ times in length of head, half interorbital width; maxillary barbel extending nearly to end of pectoral spine, mandibular barbels to a little beyond base of pectoral spine. Humeral process covered with skin, $\frac{1}{4}$ length of pectoral spine. Dorsal I 6; spine serrated behind, as long as head. Pectoral spine a little shorter than head. Ventral as long as pectoral, reaching a little beyond origin of anal. Anal 36–37. Caudal deeply notched. Upper surface of head, back, and a lateral stripe dark grey, rest white; pectorals and ventrals deep black, white at the base; caudal black at the base.

Total length 190 millim.

Four specimens from Paraguay.

25. Auchenipterus galeatus, L.

Matto Grosso.

26. Trachelyopterus coriaceus, C. & V.

Descalvados, Matto Grosso.

27. Doras costatus, L.

Descalvados, Matto Grosso.

28. Doras maculatus, Val.

Paraguay.

29. Doras weddelii, Cast.

Paraguay.

30. Oxydoras eigenmanni. (Plate IV. fig. 3.)

Oxydoras eigenmanni, Boulenger, P. Z. S. 1895, p. 524.

Both jaws with small teeth. Depth of body equal to length of head, 4 times in total length. Posterior nostril nearer the eye than to the anterior nostril. Diameter of eye 4 times in length of head, $1\frac{1}{4}$ in interorbital width, $1\frac{3}{4}$ in length of snout; bases of the six barbels united by the fold of the lower jaw; maxillary barbels branched, extending a little beyond base of pectoral spine, twice as long as mandibulars. Gill-cleft extending to below posterior border of eye. Humeral process striated, half as long as pectoral spine. Pectoral spine a little longer than the head. Dorsal I 6; spine a little shorter than the head, very strongly serrated in front, very feebly behind. Adipose fin a little shorter than base of anal. No shields between the dorsal fins. Lateral shields moderate, their vertical diameter equal to the eye, serrated behind, 26 or 27. Caudal bifurcate. Brown above, whitish beneath; fins uniform or with small blackish spots.

Total length 80 millim.

Several specimens from Descalvados, Matto Grosso.

This species is named after Prof. C. Eigenmann, the author of the excellent synopsis of South American Siluroid Fishes. It connects the sections *Oxydoras* and *Rhinodoras* as defined by that author, agreeing with the former in the serrature of the dorsal spine, with the latter in all other respects.

31. Rhinodoras kneri, Blkr.

Paraguay.

32. Callichthys asper, Q. & G.

Paraguay.

33. Callichthys pectoralis. (Plate IV. fig. 4.)

Callichthys pectoralis, Boulenger, P. Z. S. 1895, p. 525.

Depth of body $3\frac{1}{3}$ to $3\frac{1}{2}$ times in total length. Head depressed, broader than deep, $3\frac{1}{2}$ times in total length, without bristles on the sides; diameter of eye 6 times in length of head, 4 times in interorbital width; suborbital bone narrow; occipital bone pointed in front, not reaching frontal fontanelle; outer barbels half total length. Pectoral spine $\frac{2}{3}$ length of head, covered with fine bristles, serrated on the inner side. Dorsal I 7; spine nearly $\frac{1}{2}$ length of head. Anal I 5. A pair of large pectoral plates, in contact anteriorly or narrowly separated, their inner borders diverging behind. Shields on body reaching to base of dorsal fins, 23 above and 22 below lateral line; 3 or 4 pairs and 5 to 7 azygos shields between the two dorsal fins. Caudal rounded. Dark brown, with small blackish spots.

Total length 85 millim.

Several specimens from Monte Sociedad, Paraguayan Chaco.

This species is most nearly allied to *C. thoracatus*, C. & V., and *C. longifilis*, C. & V., but differs in the larger pectoral plates, in the wide separation between the frontal fontanelle and the occipital bone, and in the smaller number of anal rays.

34. Callichthys paleatus, Jen.

Descalvados, Matto Grosso.

35. Plecostomus ternetzi. (Plate V.)

Plecostomus ternetzi, Boulenger, P. Z. S. 1895, p. 525.

Head as long as broad, 3 times in total length, with three very obtuse keels; snout rounded, entirely granulated; diameter of eye 7 times in length of head, 4 times in length of snout, $2\frac{1}{2}$ times in interorbital width; barbel as long as diameter of eye; 44 teeth on each side in the upper jaw, and about as many in the lower jaw; interoperculum with very small spines. Sides of throat, thorax, and middle of belly covered with small shields. Dorsal I 7; first ray as long as head, reaching adipose fin. Pectoral spine as long as head, strong, with small curved spines. Ventral I 5, first ray a little shorter than head. Anal I 4. Lower caudal ray very long, a little longer than head, twice as long as upper. Depth of caudal peduncle $2\frac{1}{3}$ in distance between anal and caudal fins. Posthumeral keel very obtuse and short, not extending beyond base of ventral. Scutes on body rough and spinulose, but not keeled; lat. l. 25; 14 scutes between anal and caudal fins. Uniform olive above, white beneath.

Total length 240 millim.

A single specimen from Paraguay.

This species appears to be nearest allied to *P. francisci*, Lütk., which is only known to me from the description.

36. Plecostomus vermicularis, Eigenm.

Paraguay.

37. Plecostomus cochliodon, Kner.

Paraguay.

38. Chætostomus gigas. (Plate VI.).

Chætostomus gigas, Boulenger, P. Z. S. 1895, p. 526.

15 upper and 19 lower teeth on each side. Depth of body $4\frac{1}{2}$ times in total length, length of head $2\frac{3}{5}$ times. Head a little longer than broad, entirely rough with small spines; snout broadly rounded; diameter of eye 11 times in length of head, $4\frac{2}{3}$ times in interorbital width, 6 times in length of snout; anterior border of orbit with enlarged spinules; no postorbital groove; erectile præopercular spines very strong, the longest $2\frac{1}{2}$ diameter of orbit; barbel a little longer than diameter of orbit. Throat and belly studded with small rough shields. Dorsal I 10; all the rays rough with spinules, the first measuring $\frac{2}{3}$ length of head. Pectoral spine as long as head, covered with small spines, the longest of which are hooked and nearly equal diameter of orbit. Ventral I 5, as long as first dorsal ray. Anal I 5. Caudal obliquely truncate, lower ray longest. Shields on body rough with ridges of strong spinules, 25 in a longitudinal series. Brown, densely covered all over with round black spots.

Total length 530 millim.

A single specimen from Paraguay.

This fish, the largest known of the genus, is possibly the adult of *C. aculeatus*, Perugia, in which, however, the ventral region is entirely naked.

39. Chætostomus cirrhosus, Val.

Paraguay; Descalvados, Matto Grosso.

40. Chætostomus leucostictus, Gthr.

Descalvados, Matto Grosso.

41. Hypoptopoma guentheri.

Hypoptopoma guentheri, Boulenger, P. Z. S. 1895, p. 526.

Head not narrowed behind the eyes, its width equal to length to posterior border of orbit, its length $2\frac{3}{4}$ to 3 times in total; diameter of orbit 5 to $5\frac{1}{2}$ times in length of head, $2\frac{1}{2}$ to $2\frac{3}{4}$ times in length of snout, 3 to $3\frac{1}{2}$ times in interorbital width; barbel very small; head-shields as in *H. thoracatum*. Dorsal I 6, first ray as long as head to upper angle of gill-cleft. Pectoral as long as first dorsal ray, extending as far as ventrals, not reaching anal. Caudal deeply notched, middle rays half as long as outer. Two pairs of large transverse pectoral shields, preceded by a transverse series of four small shields, the outer of which are in contact with the suborbital shields; three or four large ventral shields on each side, the anterior of which are usually separated by an azygos shield. Shields on body spinulose, but not keeled, 20 to 22 on each side; 3 shields between the occipital and the dorsal, 12 between the dorsal and the caudal. Olive; dorsal and caudal fins with black spots, which may form two curved bands on the lower lobe of the caudal.

Total length 65 millim.

Numerous specimens from Descalvados, Matto Grosso.

The fish described and figured by Steindachner as *H. thoracatum*, Gthr., belongs to a distinct species, for which I have proposed the name *H. steindachneri*. His *H. bilobatum* is distinct from Cope's, which I regard as identical with *H. thoracatum*, and is the same as that named by me *H. guentheri*. In fact, 3 species are confounded under *H. thoracatum* in Dr. and Mrs. Eigenmann's Synopsis; they are distinguishable as follows:—

I. Throat entirely naked in front of the two pairs of pectoral shields; 6 to 8 pairs of ventral shields separated by a series of azygos shields; spine of adipose fin present; caudal deeply emarginate, middle rays half as long as outer. . . . . *H. thoracatum*, Gthr.

II. A transverse series of four shields in front of the pectoral shields; 3 to 7 pairs of ventral shields and a single azygos shield in front; posterior dorsal spine usually absent.

Pectoral spine not reaching origin of anal; caudal deeply emarginate, middle rays half as long as outer . . . . *H. guentheri*, Blgr.

Pectoral spine reaching origin of anal; caudal less deeply emarginate, middle rays much more than half as long as outer . . . . *H. steindachneri*, Blgr.

42. Otocinclus affinis, Stdr.

Descalvados, Matto Grosso.

43. Loricaria rostrata, Spix.

Paraguay.

44. Loricaria parva. (Plate VIII. fig. 1.)

Loricaria parva, Boulenger, P. Z. S. 1895, p. 527.

Teeth small, well developed in both jaws. Head $1\frac{1}{2}$ as long as broad, $4\frac{2}{3}$ to 5 times in total length; snout obtusely pointed, feebly projecting beyond the lip; head-shields with longitudinal, spinulose striæ, without keels; diameter of orbit $5\frac{1}{2}$ to 6 times in length of head, $2\frac{1}{2}$ to $2\frac{2}{3}$ times in length of snout, $1\frac{1}{2}$ to $1\frac{2}{3}$ in interorbital width; a broad postorbital notch; lower labial fold moderately large, papillose, feebly notched, with a fringe of obtuse papillæ. Dorsal I 7; first ray $1\frac{1}{4}$ to $1\frac{1}{3}$ as long as head, just above base of ventral. Pectoral I 6, as long as head or a little shorter, reaching beyond base of ventral. Ventral I 5, as long as pectoral, reaching beyond origin of ventral. Anal I 5. Outer caudal rays much produced, filiform, upper longest. Lateral scutes 26–28, with two spinose ridges approximating on the 13th or 14th; nuchal shields without keels; 16 or 17 scutes between dorsal and caudal, 14 or 15 between anal and caudal. Breast and belly shielded; pectoral shields numerous, polygonal, irregular; ventrals 7 to 9 transversely enlarged ones on each side and 3 series of small ones in the middle. All the shields spinulose and striated. Olive above, with ill-defined dark cross-bars; a dark streak on each side of the snout, from the tip to the eye; fins with dark spots.

Total length 110 millim.

Numerous specimens from Descalvados, Matto Grosso.

This species is nearest related to *L. filamentosa*, Stdr.

45. Loricaria labialis. (Plate VII. fig. 1.)

Loricaria labialis, Boulenger, P. Z. S. 1895, p. 527.

Teeth minute, rudimentary, in both jaws. Head $1\frac{2}{5}$ as long as broad, $4\frac{1}{2}$ to $4\frac{3}{4}$ times in total length; snout obtusely pointed, feebly projecting beyond the lip; head-shields rough with villose spinules, except on the edge of the end of the snout, without keels; diameter of orbit 6 to $6\frac{1}{2}$ times in length of head, 3 times in length of snout, $1\frac{1}{2}$ in interorbital width; a broad postorbital notch; lower labial fold moderately large in females, very large and extending to the pectoral shields in males, without notch and without fringe. Dorsal I 7; first ray nearly as long as head, just above base of ventral. Pectoral I 6, as long as head to posterior border of orbit, not reaching base of ventral. Ventral I 5, as long as pectoral, reaching origin of anal. Anal I 5. Upper caudal ray produced in a short filament. Lateral shields 30, with two spinose ridges approximating on the 21st or 22nd; nuchal shields without keels; 18 shields between dorsal and caudal, 16 between anal and caudal. Breast and belly shielded; pectoral shields numerous, polygonal, irregular; ventrals 4 to 6 transversely enlarged ones on each side, and one or two series of smaller ones in the middle. All the shields finely granulate and spinulose. Olive above; dorsal and caudal with small dark spots along the rays; pectorals and ventrals blackish.

Total length 220 millim.

Three specimens from Paraguay.

Allied to *L. nudirostris*, Kner, and *L. spixi*, Stdr.

46. Loricaria anus, Val.

Paraguay.

47. Loricaria maculata, Bl.

Paraguay.

48. Loricaria apeltogaster. (Plate VII. fig. 2.)

Loricaria apeltogaster, Boulenger, P. Z. S. 1895, p. 528.

A few slender teeth in both jaws. Head slightly longer than broad, 5 times in total length; snout acutely pointed, feebly projecting beyond the lip; head-shields strongly spinulose; occipital shield with two closely approximated, parallel keels; diameter of orbit $7\frac{1}{2}$ to 8 times in length of head, 4 times in length of snout, $1\frac{1}{3}$ to $1\frac{1}{2}$ in interorbital width; no postorbital notch; lower labial fold rather larger with long fringes; barbel long. Dorsal I 7; first ray a little longer than the head, just above base of ventral. Pectoral I 6; first ray more or less produced, at least as long as the head, reaching much beyond base of ventral. Ventral I 5; first ray produced, but shorter than pectoral, reaching much beyond origin of anal. Anal I 5. Upper caudal ray produced in a very long filament. Lateral shields 31 or 2, with two spinose ridges uniting on the 17th to 20th; nuchal shields bicarinate; 21 or 22 shields between dorsal and caudal, 19 or 20 between anal and caudal. Breast and belly naked, or with small stellate shields; a series of 6 to 8 small transverse shields may be present on each side of the belly. All the shields finely granulate and spinulose. Pale brown above, with three or four darker cross-bars on the body and two on the head; fins partially blackish.

Total length 210 millim.

Four specimens from Paraguay.

Allied to *L. nudiventris*, C. & V., *L. evansi*, Blgr., and especially to *L. macrodon*, Kner.

49. Loricaria lata, Eigenm.

Paraguay.

50. Loricaria lamina, Gthr.

Paraguay.

51. Acestra oxyrhynchus, Kner.

Descalvados, Matto Grosso.

52. Bunocephalus iheringii, Blgr.

Descalvados, Matto Grosso, and Monte Sociedad, Paraguayan Chaco.

53. Trichomycterus brasiliensis, Lütk.

Descalvados, Matto Grosso, and North Paraguay.

CHARACINIDÆ.

54. Pyrrhulina semifasciata, Stdr.

Descalvados, Matto Grosso, Monte Sociedad, Paraguayan Chaco.

55. Nanostomus lateralis, Blgr.

Descalvados and Monte Sociedad.

56. Curimatus alburnus, M & T.

Descalvados.

57. Curimatus rutiloides, Kner.

Paraguay.

58. Curimatus latior, Spix.

Paraguay.

59. Hemiodus semitæniatus, Kner.

San Luis, Matto Grosso.

60. Hemiodus microlepis, Kner.

San Luis.

61. Parodon affinis, Stdr.

North Paraguay.

62. Leporinus striatus, Kner.

Descalvados, Matto Grosso.

63. Leporinus eques, Stdr.

Descalvados and San Luis, Matto Grosso.

64. Tetragonopterus multiradiatus, Stdr.

Descalvados and San Luis.

65. Tetragonopterus ternetzi. (Plate VIII. fig. 2.)

Tetragonopterus ternetzi, Boulenger, P. Z. S. 1895, p. 528.

Depth of body $1\frac{3}{4}$ to $1\frac{4}{5}$ in total length, length of head $3\frac{1}{2}$ to $2\frac{2}{3}$ times. Diameter of eye $2\frac{1}{3}$ to $2\frac{1}{2}$ times in length of head, twice length of snout, equal to interorbital width; maxillary toothless, extending to below anterior border of eye. Dorsal 11, originating behind vertical of ventrals, longest rays as long as head. Anal 40–42, deepest anteriorly, longest rays a little shorter than head. Caudal bifurcate. Scales 30–33 $\frac{7-8}{8-9}$; lateral line complete. Pale brownish, upper surface of head, dorsal, anal, and lower part of caudal region of body blackish; two blackish vertical bands on upper half of body, the first behind the head, the second below the origin of the dorsal fin.

Total length 45 millim.

Several specimens from Descalvados, Matto Grosso.

66. Tetragonopterus argenteus, Cuv.

Descalvados, Matto Grosso; North Paraguay.

67. Tetragonopterus lacustris, Lütk.

Descalvados and North Paraguay.

68. Tetragonopterus abramis, Jen.

Descalvados.

69. Tetragonopterus dichrourus, Kner.

San Luis and Descalvados.

70. Tetragonopterus agassizii, Stdr.

Descalvados and Monte Sociedad.

71. Tetragonopterus lineatus, Perugia.

San Luis.

72. Tetragonopterus ulreyi. (Plate VIII. fig. 3.)

Tetragonopterus ulreyi, Boulenger, P. Z. S. 1895, p. 529.

Depth of body $2\frac{1}{2}$ to $2\frac{3}{4}$ in total length, length of head $3\frac{1}{3}$ to $3\frac{1}{2}$ times. Diameter of eye half length of head, twice length of snout, equal to interorbital width; maxillary toothless, extending to below anterior third of eye. Dorsal 10, originating behind base of ventrals, longest rays as long as head. Anal 23–25, anterior rays elongate, a little shorter than the head. Caudal bifurcate. Scales 32–33 $\frac{6}{4}$; lateral line reduced to 8 or 9 scales. Yellowish, with a small black humeral spot, a black line along the middle of the side, and a black line along the base of the anal fin; dorsal blackish at the end.

Total length 35 millim.

Several specimens from Descalvados, Matto Grosso.

Named after Prof. A. B. Ulrey, the author of a very useful key to the determination of the species of this genus.

73. Brachychalcinus retrospina, Blgr.

Descalvados and San Luis, Matto Grosso.

74. Chalcinus nematurus, Kner.

Asuncion, Paraguay.

75. Chalcinus paranensis, Gthr.

Descalvados and Paraguay.

76. Gastropelecus stellatus, Kner.

Descalvados.

77. Anacyrtus macrolepis, Kner.

Descalvados.

78. Anacyrtus microlepis, Reinh.

Descalvados and Paraguay.

79. Anacyrtus prognathus. (Plate VIII. fig. 4.)

Anacyrtus prognathus, Boulenger, P. Z. S. 1895, p. 529.

Depth of body $2\frac{4}{5}$ in total length, length of head 4 times. Snout strongly projecting beyond the mouth, squarely truncate, with two strong tooth-like spines pointing outwards and forwards, several smaller teeth on each side of the upper jaw and two on each side of the lower; diameter of eye $\frac{1}{4}$ length of head, $1\frac{1}{2}$ in length of snout, $1\frac{1}{4}$ in interorbital width; maxillary extending to below anterior third of eye; upper profile of head very concave. Dorsal 11, equally distant from eye and base of caudal, longest rays a little shorter than head. Anal 52. Caudal deeply forked. Yellowish, with a silvery lateral stripe; end of snout and a small spot at base of caudal blackish.

Total length 125 millim.

A single specimen from Paraguay.

80. Salminus maxillosus, C. & V.
Paraguay.

81. Xiphorhamphus ferox, Gthr.
Paraguay.

82. Serrasalmo serrulatus, C. & V.
Paraguay.

83. Serrasalmo spilopleura, Kner.
Descalvados and Paraguay.

84. Serrasalmo humeralis, C. & V.
Descalvados and Paraguay.

85. Myletes asterias, M. & T.
Descalvados.

86. Myletes brachypomus, Cuv.
Paraguay.

87. Myletes duriventris, Cuv.
Paraguay.

88. Myletes hypsauchen, M. & T.
Descalvados.

SCOMBRESOCIDÆ.

89. Belone tæniata, Gthr.
Descalvados.

CLUPEIDÆ.

90. Engraulis olidus, Gthr.
Paraguay.

GYMNOTIDÆ.

91. Sternarchus albifrons, L.
Descalvados, Matto Grosso.

92. Rhamphichthys blochii, Kaup.
Paraguay.

93. Rhamphichthys brevirostris, Stdr.
Descalvados, Matto Grosso.

94. Sternopygus carapus, L.

95. Sternopygus virescens, Val.
Descalvados.

SYMBRANCHIDÆ.

96. Symbranchus marmoratus, Bl.
Descalvados, Matto Grosso.

TRYGONIDÆ.

97. Tæniura dumerilii, Casteln.
Paraguay.

EXPLANATION OF THE PLATES.

PLATE III.

Plagioscion ternetzi, $\frac{1}{2}$ nat. size, with upper view of head: p. 25.

PLATE IV.

Fig. 1. *Geophagus duodecimspinosus*: p. 26.
Fig. 2. *Euanemus nigripinnis*: p. 28.
2 *a*. Upper view of head.
Fig. 3. *Oxydoras eigenmanni*: p. 28.
Fig. 4. *Callichthys pectoralis*: p. 29.
4 *a*. Lower view of head and pectoral region.

PLATE V.

Plecostomus ternetzi, $\frac{5}{6}$ nat. size, with upper and lower views of head: p. 30.

PLATE VI.

Chætostomus gigas, $\frac{4}{5}$ nat. size, with upper and lower views of head ($\frac{1}{2}$): p. 30.

PLATE VII.

Fig. 1. *Loricaria labialis*: p. 32.

1 *a*, upper, 1 *b*, lower view of head and anterior part of body.

Fig. 2. *Loricaria apeltogaster*: p. 33.

2 *a* upper, 2 *b*, lower view of head and anterior part of body.

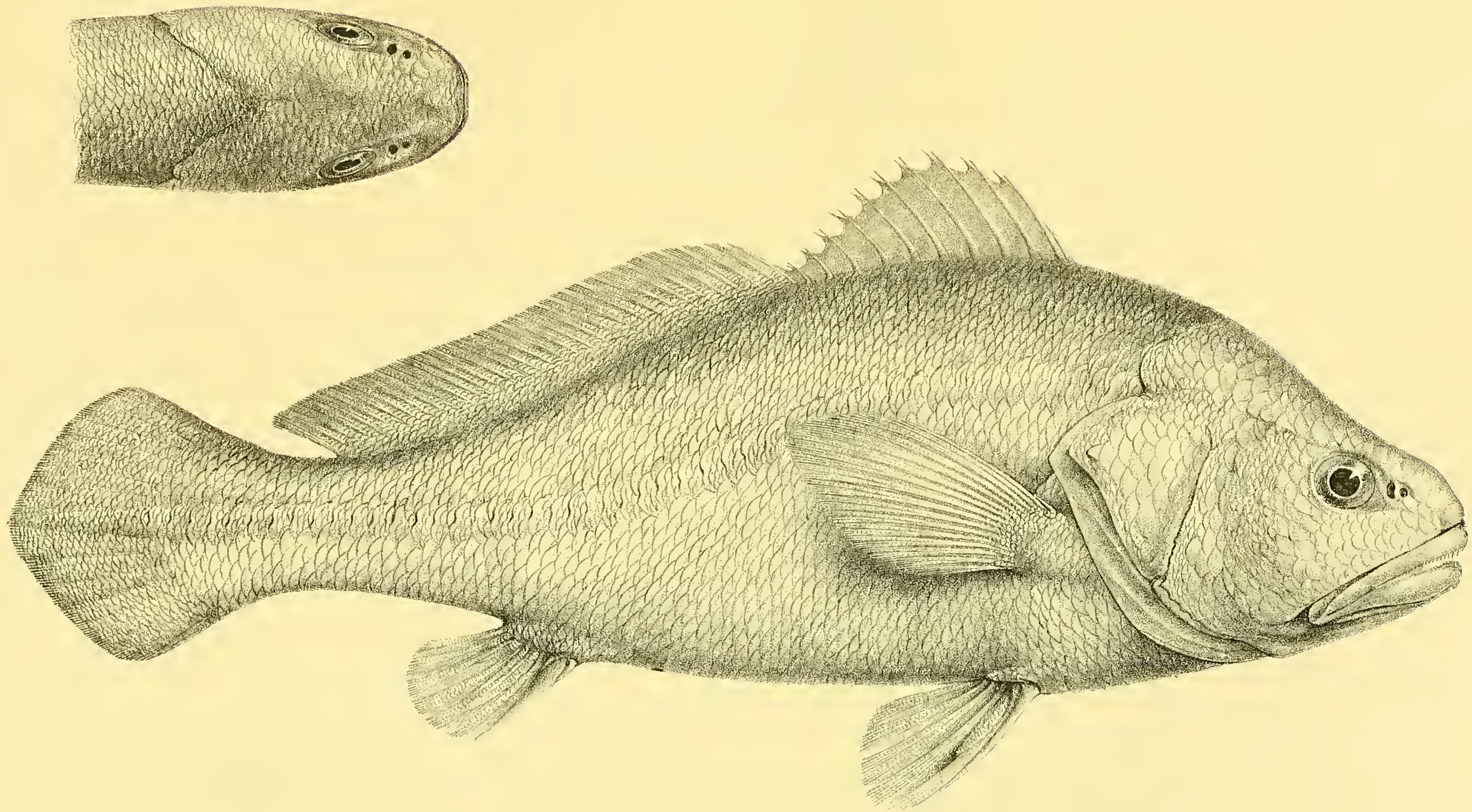
PLATE VIII.

Fig. 1. *Loricaria parva*, with enlarged upper (*a*) and lower (*b*) views of head: p. 32.

Fig. 2. *Tetragonopterus ternetzi*: p. 35.

Fig. 3. *Tetragonopterus ulreyi*: p. 35.

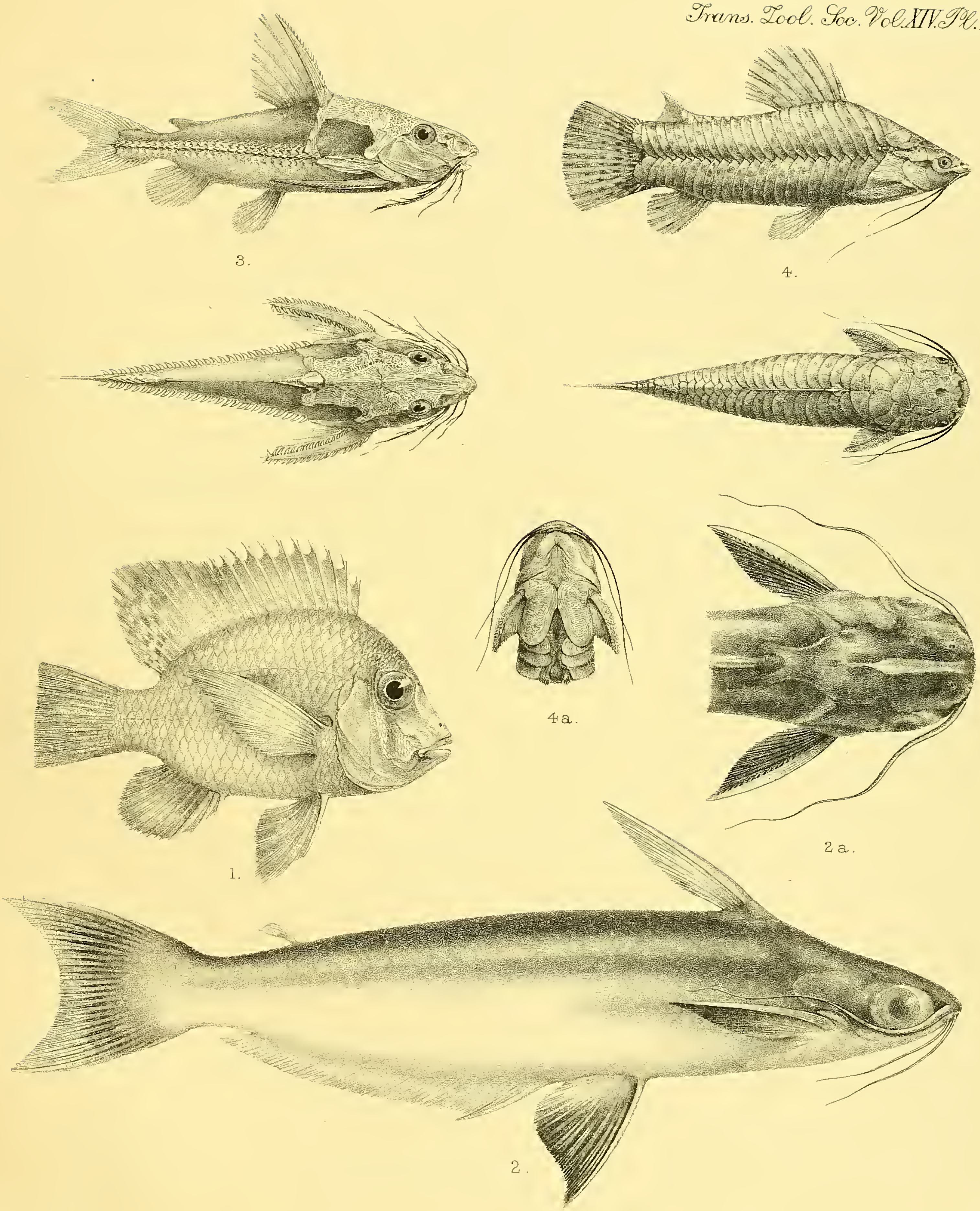
Fig. 4. *Anacyrtus prognathus*: p. 36.



J. Green del. et lith.

PLAGIOSCION TERNETZI.

Mintern Bros. imp.

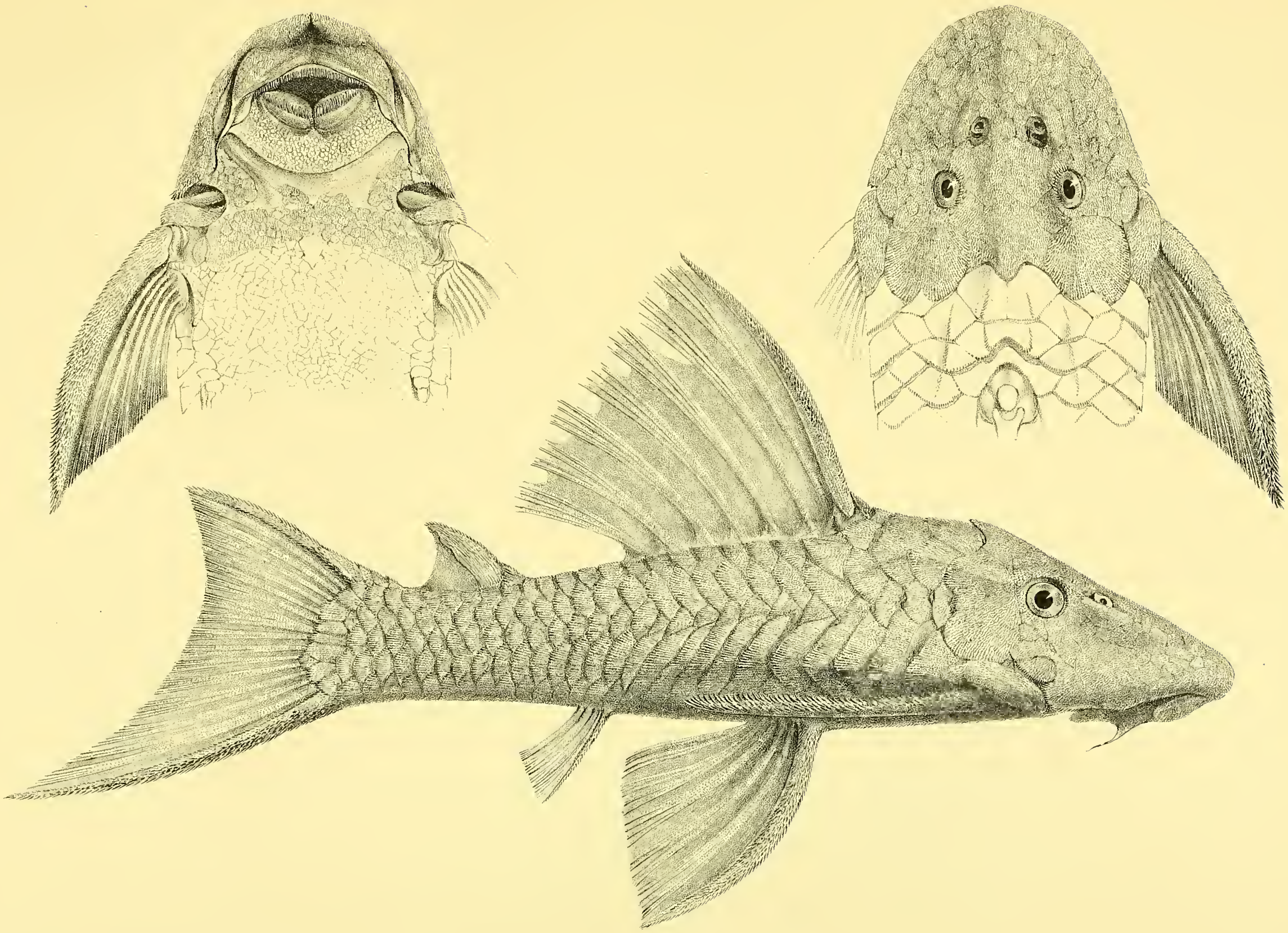


J. Green del. et lith.

Mintern Bros. imp.

1. GEOPHAGUS DUODECIMSPINOSUS. 2. EUANEMUS NIGRIPINNIS.
3. OXYDORAS EIGENMANNI. 4. CALLICHTHYS PECTORALIS.

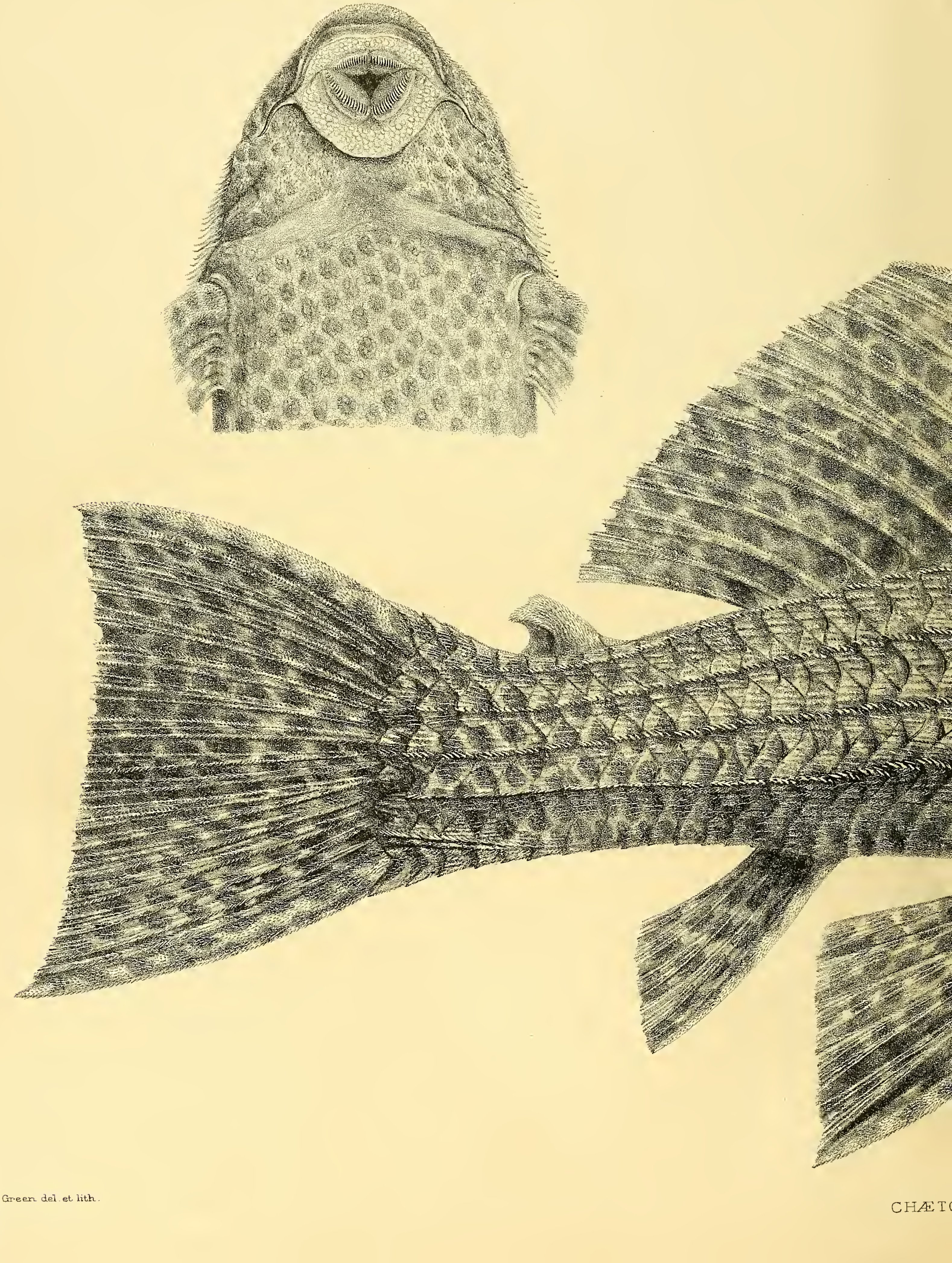
Trans. Zool. Soc. Vol. XIV. Pl. V.



J. Green del. et lith.

PLECOSTOMUS TERNETZI.

Mintern Bros. imp.



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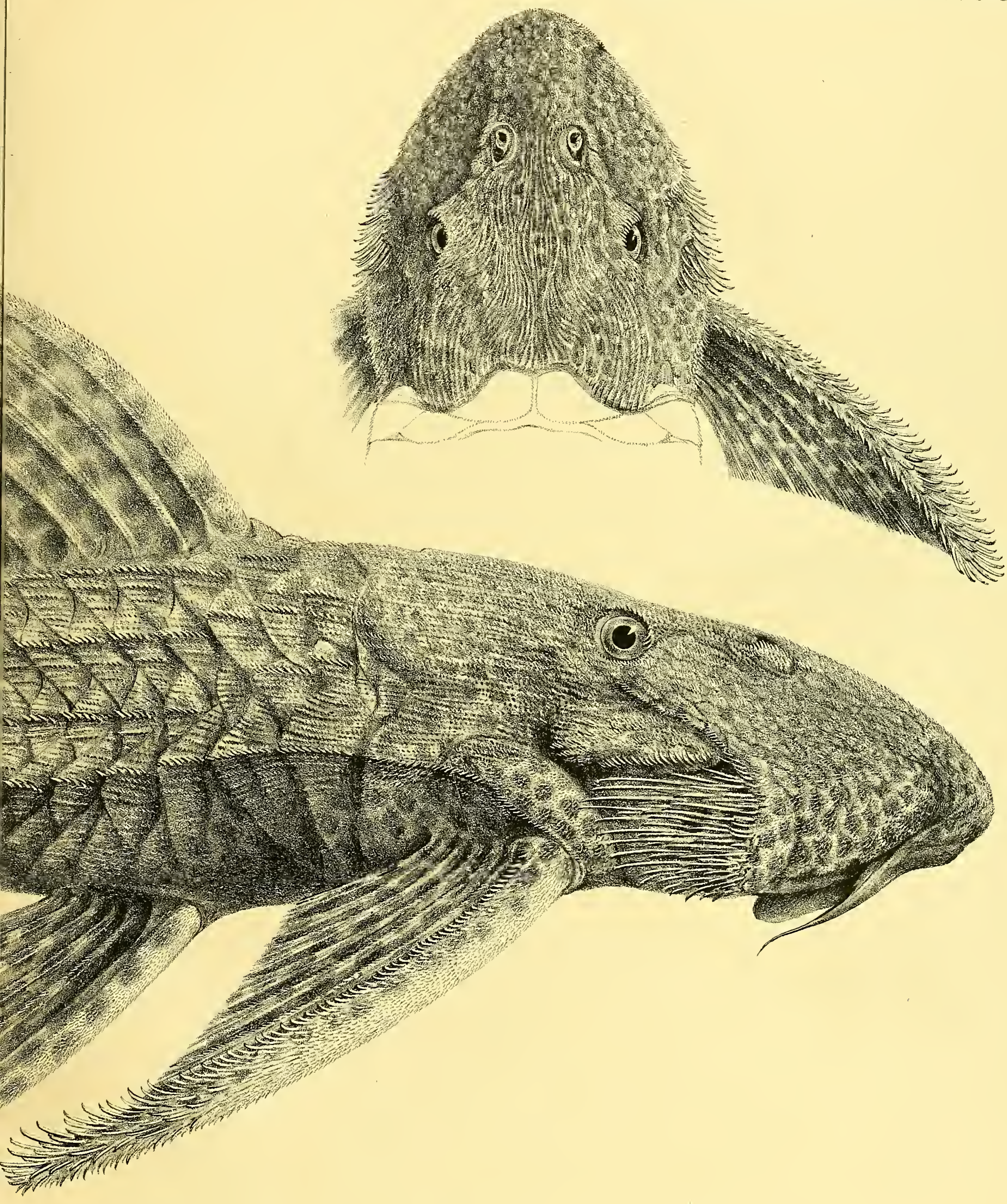
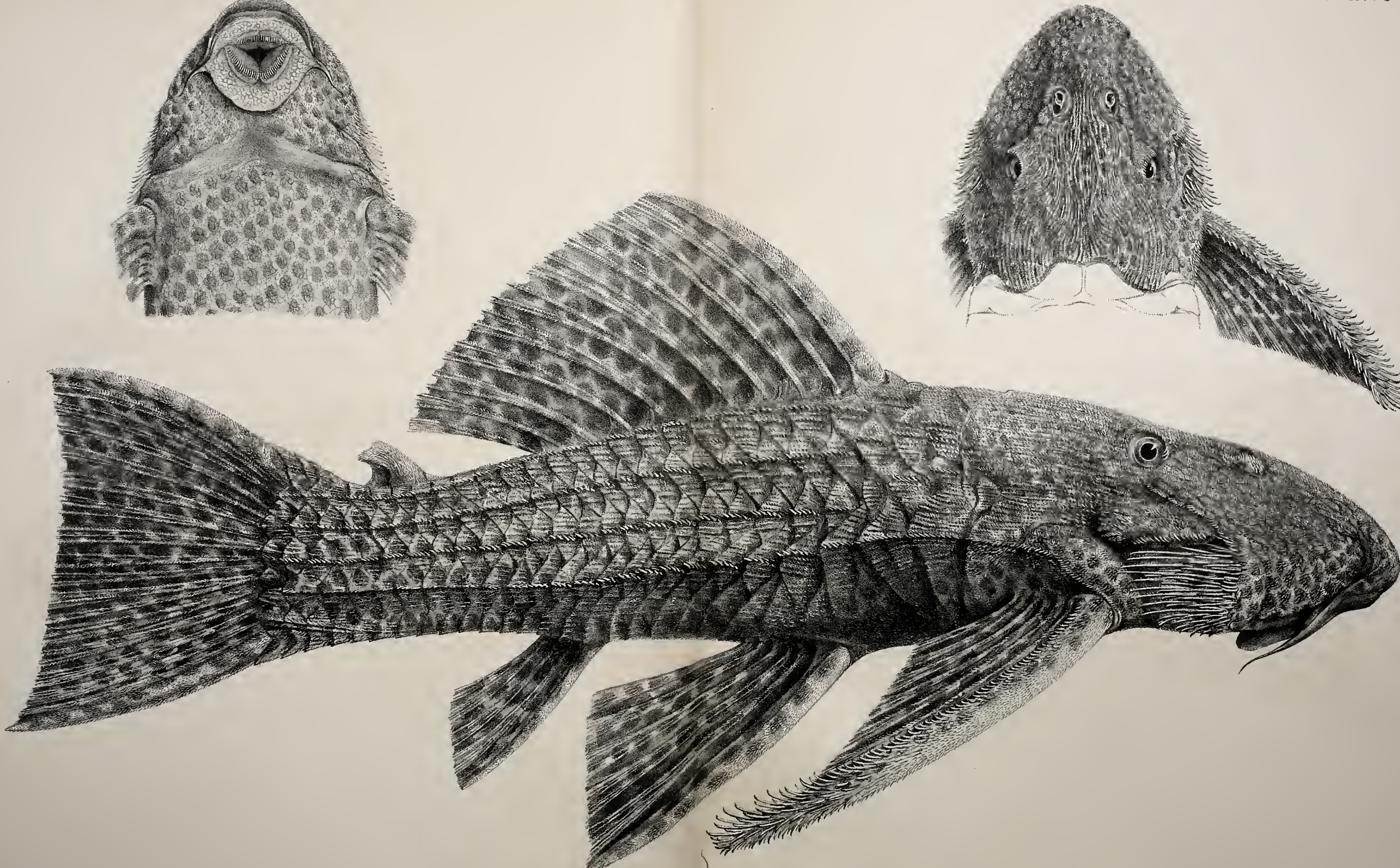
CHÆTO



OMUS GIGAS.

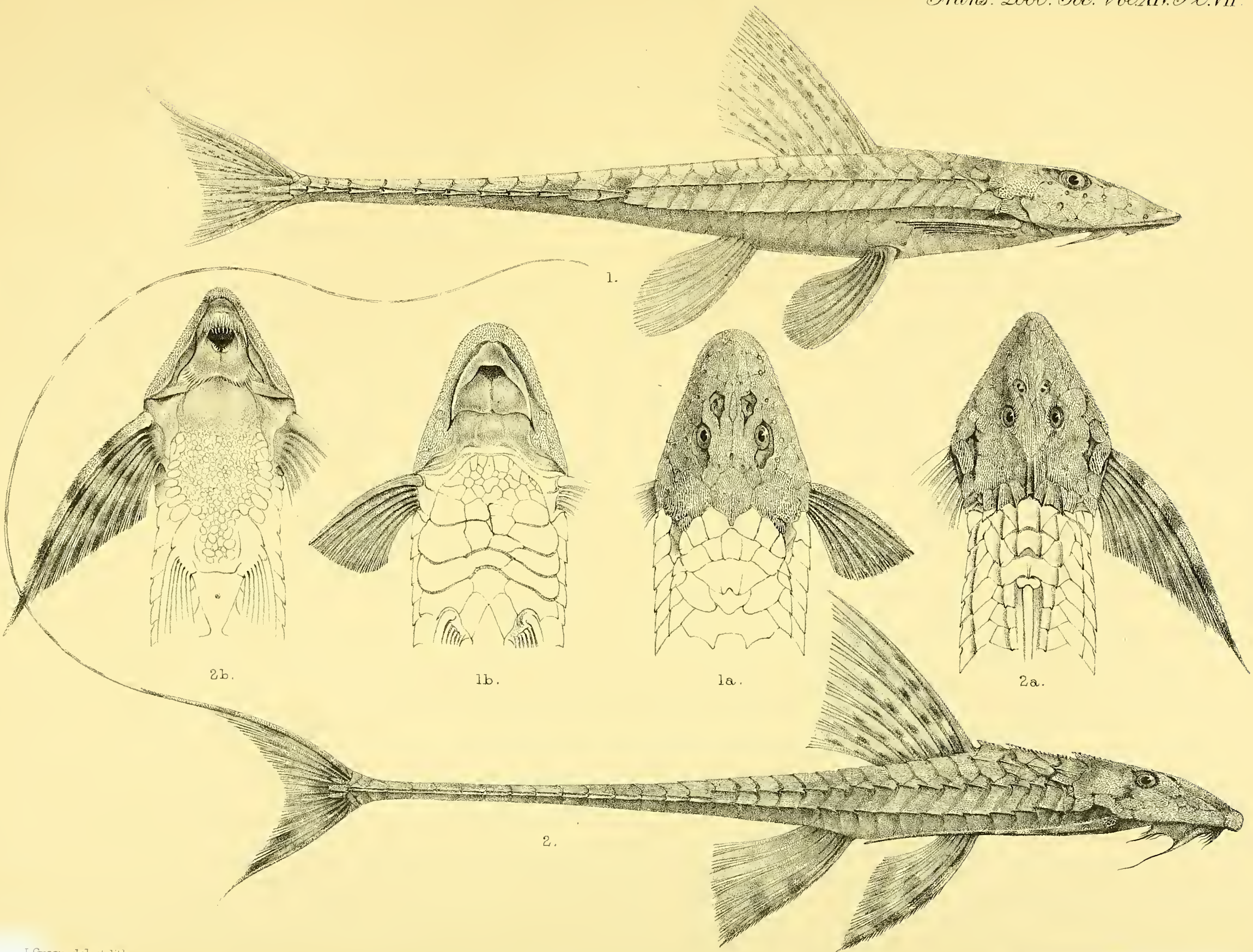
Mintern Bros. imp.



J. Green del et lith.

Mintern Bros imp.

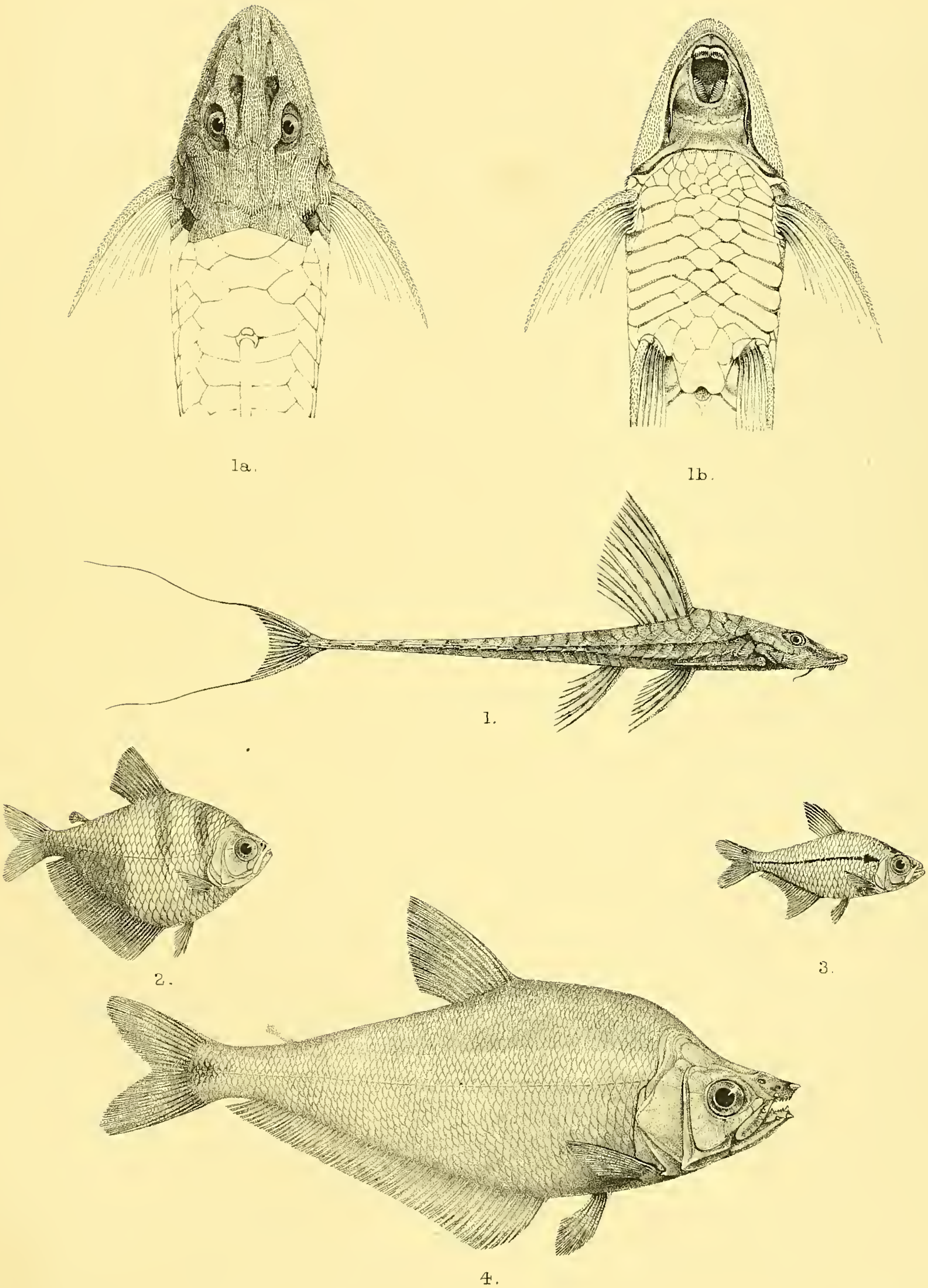
CHÆTOSTOMUS GIGAS.



J. Green del. et lith.

Mintern Bros. imp.

1. LORICARIA LABIALIS. 2. LORICARIA APELTOGASTER.



J. Green del. et lith.

Mintern Bros. imp.

1. LORICARIA PARVA. 2. TETRAGONOPTERUS TERNETZI.
3. TETRAGONOPTERUS ULREYI. 4. ANACYRTUS PROGNATHUS.

TRANSACTIONS

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Continued on page 3 of Wrapper.

IV. *Contributions to the Comparative Anatomy and Histology of the Suprarenal Capsules.—The Suprarenal Bodies in Fishes, and their Relation to the so-called Head-Kidney.* *By* SWALE VINCENT, *M.B.Lond., Demonstrator of Physiology and Assistant Lecturer on Histology, Mason College, Birmingham* [1].

Received September 28th, 1895, read November 19th, 1895.

[PLATES IX.–XIV.]

CONTENTS.

I. INTRODUCTORY.

I HAVE been led to investigate the suprarenal capsules in Fishes because their importance in Man and Mammals generally is no longer a matter of doubt. Their function is not yet completely known, but we shall, I imagine, not go far wrong if we state that in Mammals the suprarenal bodies are secreting-glands, and that they pour some material into the blood which is essential for the maintenance of the normal tone of the muscles throughout the body. But this function appears to be confined to the medullary portion of the gland, and, since the two portions are so strikingly different

[1] Towards the expenses of this research a grant has been made by the British Medical Association, at the recommendation of the Scientific Grants Committee of the Association.

in structure and origin, and being inclined to the opinion that these bodies are homologous throughout Vertebrates, I considered that a careful enquiry into their anatomy and histology in the lowest class of Vertebrates could not fail to be of some value as a contribution to our knowledge of their exact distribution and relationships.

Moreover, I felt that there was definite need for such an enquiry and clear statements of its results. Although some good work has been done upon the subject, it is embodied only in scattered, often antiquated and inaccessible memoirs; the text-books scarcely refer to the subject, and various writers who mention the suprarenals make serious errors as to points of fact.

Some authors have attempted to establish the view that (in Teleosts), where suprarenals are present, there is no lymphatic head-kidney, and *vice versâ*; in other words, that the suprarenals are interchangeable with the head-kidney, that where one exists the other does not. I shall be able to show that this idea is quite groundless.

Again, certain writers appear to think that suprarenals are comparatively rare objects among the Teleosts. It will be seen that, so far as my observations have gone, *they are universally present* in this order. I will not enlarge further on these points here, as they will be dealt with in detail in the body of the paper.

As for methods of work, these have been very various. I have examined fifty-five species in all, and many individuals of several species. *Most of these have been perfectly fresh*, indeed all but nine, which were preserved specimens.

In each case I have observed *in situ* the position and relations of the suprarenals and the head-kidney. After careful removal, both these have been examined microscopically. Numerous sections of various parts of different kidneys have also been made and examined.

Some preparations were made quite fresh, *i. e.* sections cut with Swift's "Ether Freezing Microtome." Others have been hardened in alcohol or Müller's fluid, stained in bulk, imbedded in paraffin, and cut with the "Rocking Microtome." The precise method I have used to the greatest extent is the following:—

The material is hardened in Müller's fluid in the usual way for about six weeks. [In some cases the process has been hastened by keeping the tissue at a temperature of about 36° C.] It is then double-stained in bulk with Ehrlich's hæmatoxylin and eosin, and imbedded in paraffin.

In working at the naked-eye anatomy in the Elasmobranchii, I have made use of both the chromic-acid method of Semper and the osmic-acid method of Chevrel.

I have made a special point of obtaining, in all cases where this was possible, perfectly fresh specimens, and no results, with one or two exceptions, have been considered worth recording, especially in a histological direction, unless the tissues were practically living at the time of dissection.

I was convinced that what was particularly needed was a series of accurate drawings of the suprarenal bodies and their relation to the kidney. Consequently I have given an outline sketch of the kidney from the ventral surface in nearly every species examined, putting in the suprarenals in plain lines when on the ventral surface, in dotted lines when on the spinal surface. Such a series of drawings I cannot find and do not believe to exist. In the Elasmobranchii the only drawing I am acquainted with is that in Semper's paper, and this, I was sure, might easily be improved upon.

Many parts of the paper are not nearly so complete as I should have wished. Indeed, in many respects I wish the paper to be considered as merely preliminary to future work on the same subject. This applies particularly to the histological part. The head-kidney I hope to make the subject of an exhaustive research at some future time.

I have not touched upon the subject in the Cyclostomata, having so far only been able to get specimens of the small river-lamprey, but I hope to deal with their blood-vascular glands in a separate contribution [1]. Further, I have not made any investigation of the development of the suprarenal bodies.

I am deeply indebted to Prof. T. W. Bridge, M.A., D.Sc., of Mason College, Birmingham, for his kindly and repeated advice on many subjects connected with this research, and for the generous manner in which he has placed specimens at my disposal; to Prof. F. J. Allen, M.A., M.D., for much important assistance; to Mr. Walter E. Collinge, F.Z.S., for help on many points; and to Prof. W. N. Parker for specimens of Protopterus and the use of some of his slides. I must also express my thanks to Prof. G. B. Howes for many suggestions, bibliographical and otherwise.

I take this opportunity of expressing my thanks to the Research Committee of the British Medical Association for a grant in aid of these investigations.

II. Historical.

The literature of this subject is so very scattered and often so inaccessible, and I have become acquainted with some papers touching upon it in such accidental ways, that I fear my account may not be complete. However, I trust that most of the important papers dealing with the general subject have fallen into my hands; at the same time it is possible that accounts of the suprarenals and discussions of their morphology in monographs may have escaped me. Then, too, some text-books may have accounts which I have overlooked; but, from the exceedingly unsatisfactory account given by Eberth in Stricker, I did not consider it would be profitable to explore these very thoroughly.

[1] Since the above was written I have, in conjunction with Mr. Walter E. Collinge, F.Z.S., investigated the subject in the Cyclostomata, with the result that nothing in the way of suprarenals can be made out. (Anat. Anz. Bd. xii. Nr. 9 & 10, 1896.)

[More recently Pettit (Thèse, Paris, 1896) has been unable (p. 86) to ascertain definitely whether suprarenals are present in the Cyclostomata or not.—S. V., 10. 1. 97.]

The earliest account of the suprarenal bodies in fishes appears to be that of Retzius. His description, written in 1819, has reference only to cartilaginous fishes.

Retzius (18) pointed out as suprarenals certain structures in *Squalus glaucus*, *S. acanthias*, *Raja clavata*, *R. fullonica*, and *R. batis*. From his description it is evident that he refers to what is now usually termed the "interrenal body." He considered this organ to be the suprarenal on account of its resemblance in texture to the suprarenals of birds [1].

The suprarenals in Teleostei appear to have been discovered by Stannius (20) in 1839.

In 1843 J. Müller (16) described in Myxinoids a clustered gland without a duct on each side of the cardia, which he at first considered to be a suprarenal, but afterwards thought to be thymus. In *Petromyzon* he found instead of this gland "certain white plugs with which the trunks of the posterior veins of the body are beset." These structures had been previously described by Rathke [2].

Three years later, in 1846, Stannius and Ecker threw considerable light on the subject. Stannius (21) describes the suprarenals as existing both in the higher cartilaginous and in the bony fishes. His account of the suprarenals in Elasmobranchs obviously applies only to the interrenal. The segmentally-arranged bodies were not yet discovered. He gives also in this first edition a fairly good account of the general position of the suprarenals in several Teleosts and in the Sturgeon. In addition this observer questions the right of Müller's "clustered gland" to rank as a suprarenal.

Ecker (6), in addition to verifying the results of the above observer in regard to the gross anatomy of the suprarenals, gives an account of their minute anatomy, which was for many years the common store of information on this subject.

In 1851 Hyrtl (10) mentions some facts about the suprarenals in several Teleosts. He examined 222 species. He gives first a short and very imperfect account of their general position and appearances, and then mentions them very briefly under the special heading of the species. But, although he states in his introductory general description that suprarenals were found in almost all the fish he examined, yet I find, on looking through the paper, that they are only specifically noted in 28 species. In some two or three cases he states that he could not find them. In all the rest he never mentions them. He definitely found them in :—

Uranoscopus scaber.	*Silurus glanis.*
Cottus quadricornis.	*Schilbe mystus.*
Diagramma punctatum.	*Pimelodus bayard.*
Lophius piscatorius.	*Salmo fario.*
Chironectes punctatus.	*Saurus lacerta.*
Normyrus oxyrhynchus.	*Clupea nilotica.*

[1] See also Nagel, Müller's Archiv, 1836.

[2] See Collinge and Vincent (*loc. cit.*), also Pottit (*loc. cit.*).—S. V., 10. 1. 97.

Elops salmoneus.	*Lota vulgaris.*
Gadus barbatus.	*Phycis blennoides.*
Cobitis fossilis.	*Platessa passer.*
Acanthopsis tænia.	*Rhombus nuchus.*
Esox lucius.	*Echeneis remora.*
Esococtus exiliens.	*Ammodytes tobianus.*
Belone vulgaris.	*Symbranchus marmoratus.*
Motella mustela.	*Diodon novemmaculatum.*

No doubt a large proportion of Hyrtl's specimens were not fresh but preserved, and this would often prevent the discovery of the suprarenal bodies.

In the same year Leydig (13) described the suprarenals of *Chimæra monstrosa* thus: "Each suprarenal forms a narrow streak $\frac{3}{4}'''$ long, of an ochre-yellow colour. The posterior end is somewhat thicker and more rounded. They lie on the inner border of the kidney." This, of course, is the "interrenal." In Elasmobranchs we find no mention yet of the paired segmental bodies on the branches of the aorta, but only a body "in Form eines schmales ockergelben Streifens an der Rückseite der Nieren" (*Stannius*).

After this period we come to researches of much more importance, in reference at any rate to the subject in Elasmobranchs, and it will be necessary to review it in some detail.

In 1852 Leydig published his famous 'Rochen und Haie' (11). In this work he insists that the "so-called axillary hearts and their continuations on the sympathetic ganglia are to be considered as the real suprarenals of Cartilaginous Fishes, and not, as heretofore reckoned, the yellow stripes and bodies behind the kidneys." He bases this view on the fact that the paired bodies resemble the suprarenals in Mammalia in "consisting of closed bladders filled with cells," also in their abundant vascular and nervous supply. On the other hand, he says "the yellow stripes" consist simply of "masses of fat-globules and bright nuclei." He emphasizes the close connection between the suprarenals and the sympathetic nervous system. "As the pituitary body is an integral part of the brain, so the suprarenals are part of the sympathetic." In the same work Leydig expresses his opinion that the organs previously considered as suprarenals are "fat-glands" analogous to those known in the Amphibia. Referring to the Cyclostomes this author definitely states his belief that the "clustered gland" of Müller and the "white plugs" of Rathke and Müller are analogous to the suprarenals.

About this time too (1852) appeared Frey's article on the Suprarenals in Todd's 'Cyclopædia' (7). It was obviously written before the above researches of Leydig, so that the only suprarenals mentioned in Elasmobranchs are the bodies now termed "interrenal." This writer gives a very good account of the anatomy and histology, mostly after Ecker, and in the part relating to fishes, at any rate, there seems little that may be considered original.

In the next year (1853) Leydig published his 'Fische und Reptilien' (12). In this work he gives a description of the suprarenals in the Sturgeon, and finds them to be composed of "an aggregation of fat-globules." He states that they are always placed on the walls of the blood-vessels. But he changes his view entirely on the subject of the suprarenals in cartilaginous fishes. He now considers that both the paired bodies in connection with the sympathetic ganglia and the "ochre-yellow stripes" behind the kidney belong to the same system and constitute the suprarenal capsules in this order of fishes.

Stannius, in a later edition (22), seems to have recognized both kinds of bodies. Balfour says his description is "not quite intelligible." This I consider to be quite a euphemism. I have found the description totally incomprehensible as applied to the Elasmobranchs. On the other hand he gives a very excellent account of the suprarenals in Teleosts. He states that in the Pike these bodies have been found studded in the kidney from the middle to the tail-end, and believes them to be absent in *Clupea harengus* and *Ammodytes tobianus*.

The next important step in advance was made by Semper (19) in 1875, who emphasizes the segmental arrangement of the suprarenals, and believes them to be the same kind of structure as the interrenal. In fact he appears to believe that there exists a direct anatomical continuity between them. "Hier freilich gehen sie bei manchen Formen (*Rochen*, *Chimæra*, *Scymnus*, *Acanthias*, *Mustelus*, etc.), also wahrscheinlich wohl bei den meisten Plagiostomen in einen bald weissen, bald hell- oder dunkel-gelben Körper über, welcher, zwischen den Enden der beiden Nieren liegend, dicht an der einfachen Caudalvene sitzt."

F. M. Balfour (1) in 1878 has also dealt with this subject with considerable care in his monograph on Elasmobranch Fishes. He gives an account of the history up to date, and it is to him we owe the term "interrenal" as applied to the unpaired body in *Scyllium*. He expresses his opinion that there is very probably "a third kind of body in connection with the kidney," and regrets he could not settle the point with fresh specimens. He refers to Stannius's description as possibly indicating a third structure; but, so far as I could understand this author, he seems to allude to broken-off or scattered portions of the interrenal, which, as we shall see later on, are frequently found. The "lymphoid masses" which Balfour mentions in connection with the larger vessels of the kidney do not appear to me to be of any importance in connection with this subject, as lymphoid tissue is very common in all fishes both in and surrounding the renal organs.

Balfour's researches were both anatomical and developmental. With the latter I shall not concern myself, but the former must be dealt with in some detail. He describes the general anatomical relations of both "supra-" and "inter-"renals, and then gives an account of their histology, which suffers from the fact that he had only been able to obtain specimens preserved in chromic acid. He lays great stress on the relations between the paired suprarenals and the sympathetic nervous system, but states that there is a "much smaller ganglionic development" in connection with the posterior bodies than with the anterior. The typical suprarenal structure, he says, is best exhibited in a posterior one. "Externally there is present a fibrous capsule which sends in the septa, imperfectly dividing up the body into a series of alveoli or lobes. Penetrating and following the septa there is a rich capillary network. The parenchyma of the body itself exhibits a well-marked distinction, in the majority of instances, into a cortical and medullary substance. The cortical substance is formed of rather irregular columnar cells, for the most part one row deep, arranged round the periphery of the body. The cells measure on an average ·03 mm. in their longest diameter. The medullary substance is more or less distinctly divided into alveoli, and is formed of irregularly polygonal cells . . . . &c."

Balfour mentions also that the protoplasm of both sorts of cells has a yellowish tinge, and that the suprarenals are more or less surrounded by lymphoid tissue. He gives a drawing of these appearances in pl. xviii. fig. 6. As for the connection between the sympathetic ganglia and the suprarenal bodies, he says:—"In the case of one of the posterior bodies, a small ganglion is generally found attached to both ends of the body, and invested in the same sheath; in addition to this a certain number of ganglion-cells (very conspicuous by their size and other characters) are to be found scattered through the body. In the anterior suprarenal bodies the development of ganglion-cells is very much greater. If a section is taken through the region where the large sympathetic ganglion is attached to the body, one half of the section is composed mainly of sympathetic ganglion-cells and nerve-fibres, and the other of suprarenal tissue, but the former spread in considerable numbers into the latter." At one point (*n* in pl. xviii. fig. 7) a nerve is shown entering. He states that the ganglion and nerves are so intimately united with the suprarenal body as not to be separable from it.

Balfour leaves it an open question whether there are cells of an intermediate character between the ganglion cells and the cells of the suprarenal body. Then follow the developmental researches, the general conclusion of which is that the paired "suprarenal" bodies develop as parts of the sympathetic nervous system.

Passing on to the interrenal body, this author gives a sketch of its general anatomy, and differs from Semper as to the continuity of the two kinds of structure. It will be seen that my own observations agree on this point with Balfour. With regard to the histology of the interrenal, he gives a drawing (pl. xvii. fig. 8), and describes it thus: "It is invested by a fairly thick tunica propria, which sends in septa, dividing it into rather well-marked lobules or alveoli. These are filled with polygonal cells, which form the true parenchyma of the body. These cells are in my hardened specimens not conspicuous by the number of oil-globules. . . . They are rather granular in appearance, and are mainly peculiar from the somewhat large size of the nucleus. . . ."

Balfour notes as differences between the "supra-" and "inter-"renals the distinction into cortex and medulla in the former, and the large size of the nuclei in the cells of the latter. From the developmental standpoint he concludes that the interrenal does not belong to the same system as the suprarenals, and he proceeds to enquire with which (if with either) of these two bodies the suprarenal bodies of the higher vertebrates are homologous. He does not decide the question definitely, but inclines to the view that the *paired* bodies of *Scyllium* are homologous with the suprarenals of Mammalia [1].

The only recent account of the suprarenals in a Teleost which I have found is that of M'Kenzie (15), written in 1884, who gives a description of the suprarenals of *Amiurus catus*, with drawings of their histological appearances. They are, according to M'Kenzie, sometimes entirely concealed by the kidney-substance. This is noteworthy as being decidedly rare in this order. He describes alveoli containing large and small granular cells, the longest of them reaching from wall to wall of an alveolus. These two kinds of cells bear no constant relation to each other. This author does not believe that the bodies have anything to do with the elaboration of the blood, and is opposed to Weldon's view that the suprarenals are metamorphosed parts of the kidney just as the head-kidney is. This fish, he states, has a well-developed (lymphatic?) head-kidney in addition to the undoubted suprarenals. The interest and importance of this will be seen later on.

Chevrel (3) appears to be the last author who has written upon this subject [2]. He, like Leydig, Semper, and Balfour, has discussed the subject in Elasmobranchs, and chiefly from the standpoint of the sympathetic nervous system. He has picked out the nerve-fibrils and suprarenal bodies with osmic acid. In this excellent memoir he gives a very good historical account, and carefully reviews Balfour's work on the subject. Chevrel states that the interrenal body is situated between the inferior surface of the dorsal aorta and the superior surface of what he calls the "interrenal vein." He describes also small detached parts of the interrenal on the superior and posterior parts of the kidneys.

In the case of the paired bodies, Chevrel denies Balfour's division into cortex and medulla, and explains the appearance obtained by the latter observer as due to the action of reagents. As will be seen below, this view is entirely corroborated by my own researches. Chevrel got no appearances anything like Balfour described. He says, "On ne voit ni cellules columnaires à la périphérie, ni cellules polygonales au centre; il n'y a que des apparences. Et ces apparences sont dues vraisemblablement

[1] [R. Fusari ("Contribuzione allo Studio dello Sviluppo delle Capsule surrenali e del Simpatico nel Pollo e nei Mammiferi," Arch. per le Scienze med., Torino, 1892, vol. xvi. no. 14, pp. 249–301, tav. iv.–vii.), from investigations on mammals, maintains that the interrenal body is not homologous with any part of the suprarenal capsule, but with a certain adipose tissue found round the suprarenals in some mammals.

On the other hand, M. Braun ("Bau und Entwickelung der Nebennieren bei Reptilien," Arbeit. a. d. zool.-zoot. Inst. Würz., Band v. pp. 1–30, Taf. i., ii., 1882), R. Semon ("Studien über den Bauplan des Urogenitalsystems der Wirbelthiere (*Ichthyophis*), Jena. Zeitschr., 1891, Band xxvi. pp. 89–203), and F. van Wyhe ("Ueber Mesodermsegmente des Rumpfes und die Entwickelung des Excretionsystems bei Selachiern," Arch. f. mikr. Anat. Band xxxiii. 1889, pp. 461–516, Taf. xxx.–xxxii.) favour Balfour's views.

Valenti (Atti della Soc. Toscana di Scienze nat. 1889, Pisa, vol. x. tav. x) believed the suprarenal capsule to be a rudimentary organ.—S. V., 10. 1. 97.]

[2] See footnote to p. 49.

aux contours des mailles de la trame conjonctive des corps. Les dissociations nous ont également donné des résultats négatifs." He doubts their analogy to the suprarenal bodies of Mammalia, and describes their structure thus :—" De la fine membrane qui les enveloppe partent des filets qui vont former dans son intérieur, de concert avec ceux qui naissent de l'anneau conjonctif entourant l'artériole, une sorte de réticulum très compliqué, à mailles inégales, dans lesquelles se trouvent un nombre considérable de noyaux ovales. Chacun de ces noyaux, pourvu de plusieurs petits corps très réfringents, paraît simplement plongé dans le protoplasme granuleux; on pourrait peut-être supposer qu'il appartient à une cellule sans membrane d'enveloppe dont le protoplasme granuleux se fusionne avec celui des cellules voisines. De cette fusion résulterait une masse protoplasmique unique contenant tous les noyaux et remplissant les mailles du réticulum. Enfin des ganglions et des cellules sympathiques se trouvent assez souvent plongés dans le parenchyme du corps, et, à sa surface, circulent sans pénetrer, du moins en apparence, dans sa substance, et sans émettre de rameaux, des filets nerveux appartenant également au système sympathique."

Passing on to the interrenal, Chevrel says, "À l'état frais, les éléments propres de ce corps disparaissent sous une couche de globules clairs, légèrement teintés, qui lui donnent une couleur jaunâtre particulière." Leydig thought these globules to be fat. Balfour, on the contrary, thought they were not fat. Chevrel is of the latter opinion, since ether does not dissolve them, nor osmic acid blacken them to any extent. He proceeds to describe their microscopical structure as being much the same as that of the suprarenals. The chief differences, according to him, are—(1) Inequality in size of nuclei (10 μ in "inter," 9 μ in "supra"). (2) Absence in the suprarenal of the clear globules which the interrenal contains in abundance. (3) A distinct division sometimes, in the case of the interrenal, into "capsules ou vésicules nettement marquée." (4) A less abundant vascular supply in the interrenal.

Chevrel does not think there is any very direct connection between the interrenal and the suprarenals, and notes that the "interrenal" has no relations with the sympathetic. He does not decide whether the interrenal body is of a different order of structure from the suprarenals. As to the connection between the suprarenals and the small sympathetic ganglia, he states, "This connection in the case of the smaller bodies is not so frequent as Leydig, Semper, and Balfour imagined."

Chevrel has also more recently (4) given an account of the sympathetic system in the Sturgeon. He gives a drawing of the relations of the suprarenal bodies to the sympathetic nervous system, and also a very unsatisfactory representation of the microscopical structure of the ganoid suprarenal [1].

[1] [Since this was written, the papers of V. Diamare (" Ricerche intorno all' Organo interrenale degli Elasmobranchi col ai Corpuscoli di Stannius dei Teleostei" etc., Mem. matem.-fis. ser. 3, t. x. 3 tav., 1896) and Pettit (Thèse, ' Recherches sur les capsules surrénales,' Paris, 1896) have appeared.

These will be briefly referred to again, as occasion requires, in later footnotes.—S. V., 10. 1. 97.]

III. Classified List of Species examined.

i. ELASMOBRANCHII.

A. Selachoidei.

Scyllidæ : *Scyllium canicula.*
,, *catulus.*
Spinacidæ : *Acanthias vulgaris.*
Rhinidæ : *Rhina squatina.*

B. Batoidei.

Rajidæ : *Raja batis.*
,, *clavata.*
,, *maculata.*

ii. HOLOCEPHALA.

Chimæridæ : *Chimæra monstrosa.*

iii. GANOIDEI.

A. Chondrostei.

Spatularidæ : *Polyodon folium.*
Acipenseridæ : *Acipenser sturio.*

iv. TELEOSTEI.

A. Plectognathi.

a. Sclerodermi.

Balistidæ : *Balistes maculatus.*

b. Gymnodontes.

Molidæ : *Orthagoriscus mola.*
Tetrodontidæ : *Tetrodon nigropunctatus.*

B. Physostomi.

Murænidæ : *Anguilla anguilla.*
Conger conger.
Clupeidæ : *Clupea harengus.*
Esocidæ : *Esox lucius.*
Salmonidæ : *Salmo salar.*
,, *trutta.*
Cyprinidæ : *Leuciscus rutilis.*
,, *cephalus.*
,, *vulgaris.*

C. Anacanthini.

Gadidæ : *Gadus morrhua.*
,, *æglefinus.*
,, *merlangus.*
,, *virens.*

Merluccias valgaris.
Motella tricirrhata.
Molva vulgaris.
Pleuronectidæ : *Hippoglossas vulgaris.*
Pleuronectes flesus.
" *limanda.*
" *platessa.*
Solea vulgaris.
Hippoglossoides limandoides.
Zeugopterus.
Rhombas lævis.

D. Acanthopteri.

a. Pharyngognathi.

Coris pulcherrima.

b. Acanthopterygii.

Percidæ : *Gastrosteus spinachia.*
Perca flaviatilis.
Labrax lupus.
Mullidæ : *Mallus barbatus.*
Sparidæ : *Pagellus centrodontus.*
Cantharus griseas.
Triglidæ : *Cottus gobio.*
Trigla pini.
" *lyra.*
Scomberidæ : *Scomber scomber.*
Zeus faber.
Blennidæ : *Anarrhichas lupus.*
Pediculati : *Lophias piscatorius.*

c. Acanthopterygii mugiliformes.

Mugilidæ : *Mugil capito.*

d. Acanthopterygii gobiiformes.

Discoboli : *Cyclopterus lumpas.*

v. DIPNOI.

Lepidosiren paradoxa (*L. appendiculata*, Ehlers [1]).
Protopterus annectens.

IV. Gross Anatomy.

1. ELASMOBRANCHII.

In this order there are two distinct sets of bodies which have borne the name of "suprarenals." One of these is a more or less rod-shaped structure, unpaired in some

[1] [See, however, Lankester, "On *Lepidosiren* and *Protopterus*," Trans. Zool. Soc. vol. xiv. part i., April 1896. —S. V., 10. 1. 97.]

genera, as *Scyllium*, paired in others, as *Raja*, which lies in the region of the hinder end of the kidney—in the middle line, as a rule, in the first case; on the inner and hinder border of the kidney in the second (Pl. IX. figs. 1, 2, 3, & 4, Pl. X. figs. 5, 6, & 7, *i.r.*). This structure was called by Balfour the "interrenal" body, and has since usually borne this name. The other set of structures is a segmentally arranged series of paired bodies, placed on the intercostal or parietal branches of the aorta, and extending in many cases throughout the whole length of the abdominal cavity (Pl. IX. figs. 1–4; Pl. X. figs. 5, 6, & 7, *ax.h.*, & *s.r.*).

a. Selachoidei and Batoidei.

I have examined the following seven species, and in some cases several individuals of the same species:—

Scyllium canicula.	*Raja batis.*
,, *catulus.*	,, *clavata.*
Acanthias vulgaris.	,, *maculata.*
Rhina squatina.	

The Segmentally arranged Bodies.—These are disposed in much the same manner in all Plagiostomes. Their general arrangement has been already well described by Leydig, Semper, and Balfour; and Chevrel has given a description of their anatomical connections with the sympathetic. It is therefore only necessary for me to give a brief account of their usual anatomy, emphasizing such points as may seem to need it.

These bodies are placed for the most part in a very definitely segmental manner (Pl. IX. fig. 2). The anterior pair are always elongated and equal in size to several of the following bodies (Pls. IX. & X. figs. 1–7, *ax.h.*); as a matter of fact they seem to correspond usually to three or four segments. They are arranged on branches of the aorta, the intercostal arterioles (Pl. IX. figs. 1 & 4; Pl. X. figs. 5 & 6), and extend on each side of the vertebral column from the front part of the sinus of Monro to a variable distance posterior to the origin of the posterior cardinal veins. The anterior pair and some of those bodies which immediately follow these on either side are placed in the cavity of the sinus, and therefore during life are bathed in its blood (Pls. IX. & X. figs. 1–7, *ax.h.*, *s.r.*). They usually more or less completely surround the artery with their substance, and with the aid of a lens one can nearly always see the artery, vein, and a fine nerve distributed to each segmental body. The first pair are placed on or near the axillary arteries, hence their old name "Axillary Hearts." An arteriole usually communicates between the axillary and the succeeding branch of the aorta, and runs through the whole length of the body (Pl. IX. figs. 2 *a* & 4).

In the anterior part of the abdominal cavity these bodies have no relation to the kidney-substance, but in the region of this organ they become more or less imbedded in it. Where the renal substance is distinctly segmented they are often placed deep down in the grooves which separate the segmental portions, and are often in this way almost completely hidden. They usually overlap the region of the interrenal, and often extend nearly to the hinder end of the kidney in company with the interrenal (Pl. IX. figs. 2 & 4; Pl. X. figs. 5 & 7, *s.r.*). In other cases (Pl. IX. figs. 1 & 3; Pl. X. fig. 6, *s.r.*) they cannot be traced very far behind the anterior extremity of the interrenal. When the segmentally arranged bodies extend very far back they have a great tendency to get less and less distinct and more fragmentary in appearance.

Their relation to the sympathetic is made evident in a general way by ordinary care in dissection, but the precise details of this relationship are not at all easy to make out. Chevrel has, however, described this part of the subject with such care that little need be said; but as very little besides his work has ever been done upon this subject, it may be as well to call attention to some points. It is a great mistake to suppose that the sympathetic ganglia are all, or indeed mostly, wrapped up in the same sheath as the segmental suprarenal bodies. This is undoubtedly true in many cases, perhaps in all, of the first pair, but it is not nearly so common with the posterior ones. Indeed, without in any way questioning the value of Balfour's developmental researches, I am inclined to think that the connection between the sympathetic nervous system and these bodies has been overstated. They are intimately involved in the sympathetic plexuses, and often have tiny ganglia very close to them; but in the adult, at any rate, whatever their developmental relations may be, *it can, in my opinion, not be truly said that they are an integral part of the sympathetic nervous system.*

The Interrenal Body.—This body, as we have seen, was the structure to which the name "suprarenal" was first applied. After the discovery of the "paired suprarenals" of Leydig, a new name was required for the old body. This was supplied by Balfour, who called it "interrenal."

The interrenal body is an "ochre-yellow" rod-shaped structure, paired in the Rays, unpaired in the Sharks, lying usually in the region of the posterior part of the kidney, but sometimes extending as far forward as its anterior extremity (Pls. IX. & X. figs. 1–7, *i.r.*). It bears a striking resemblance in its colour, general appearance, and relations to the kidney, to the suprarenals of Amphibia and Reptilia.

The unpaired interrenal of the Dog-fishes (Pl. IX. figs. 2, 3, & 4; Pl. X. fig. 5, *i.r.*) lies between the inferior surface of the dorsal aorta and the superior surface of the unpaired caudal vein, or, as Chevrel prefers to call it, the "interrenal" vein.

The paired interrenal of the Skates (Pl. X. figs. 6 & 7, *i.r.*) lies on the median side of the ureter and on a superior level, so that it often lies on the dorso-internal edge of each kidney adjoining the middle line.

In addition to this one often finds slight streaks or dots of the same characteristic yellow colour in other parts of the kidney [1].

[1] This may be compared on the one hand with the multiple suprarenals of the Sturgeon, and on the other with the frequency of "accessory" suprarenals in Teleosts and in Mammals. The accessory bodies in Mammals are said to consist of cortex only, and it may be as well to note here that my investigations lead me to conclude that interrenal, suprarenals in Teleosts and Ganoids, and cortex in Mammals are all strictly homologous with one another.

The interrenal is generally much thicker behind than in front (Pl. IX. figs. 1, 3, & 4); in fact, while it is posteriorly often markedly bulbous, it usually tapers off anteriorly into a broken line of extreme tenuity. It diminishes in diameter, however, not regularly, but is often more or less moniliform; the constrictions may be complete here and there, and at the anterior extremity one often finds several small pieces of interrenal separated by a considerable interval from the rest of the body (Pl. IX. figs. 1, 3, & 4; Pl. X. figs. 5 & 7, *a.i.r.*).

In the Batoidei the interrenal is never quite symmetrical; nearly always the body of one side extends further forward than that of the other, and in one case, in *Raja batis* (Pl. X. fig. 6, *i.r.*), I found a complete and comparatively thick bridge connecting the interrenal of one side with that of the other. This might perhaps be looked upon as a single body behind, which became divided in front; in this instance the organ extended further forward on the right side, and further backward on the left.

In some cases (e. g., *Acanthias*) the unpaired interrenal body appears to be placed not quite mesially, but is laid on the median surface of one or other kidney (Pl. X. fig. 5, *i.r.*).

Occasionally (*Raja maculata*) the anterior piece of the interrenal of each side, which is cut off by more or less of an interval from the rest of the body, shows curious claw-like processes on its outer side running in the kidney-substance towards the ureter (Pl. X. fig. 7, *a.i.r.*).

Balfour quotes Semper as describing an anatomical connection between the interrenal and the paired bodies. Balfour questions this, and I am convinced from the examination of several fresh specimens, both of *Scyllium* and *Raja*, that there is never any such connection or continuity. *The two kinds of structure are always totally independent and unconnected.* I have mentioned in the historical section Balfour's surmises with regard to the existence of a third kind of body in relation to the kidney in *Scyllium*, and I have intimated that masses of adenoid tissue were to be expected, and were frequently found in various situations in and about the kidney. I have, nevertheless, carefully searched for anything which might rank as a "third kind of body." I have been able to examine a number of fair-sized perfectly fresh specimens, and I have failed entirely to find anything of the kind. So that we may consider that we have to limit the morphological and physiological problem, difficult as it is, to the relationships and significance of the paired segmental bodies and the "ochre-yellow strips" or interrenal bodies. The problem which naturally presents itself is:—Which of these two structures (if not both) corresponds to the suprarenal capsules of Teleosts and higher Vertebrates? For an account of the discussion see the historical section above. My own view will be stated after I have given a description of the histology.

In the above account I have treated the Sharks and Rays together, because there is not sufficient difference between the general arrangement in the two cases to make a separate description necessary.

b. Holocephala.

In *Chimæra monstrosa* (Pl. IX. fig. 1) from the examination of four well-preserved specimens, I find the suprarenals arranged almost exactly after the type of the Plagiostomes. There is the same interrenal, unpaired as in the Dog-fishes [1], enlarged and rounded posteriorly and broken up at its anterior end. There is also the same arrangement of the segmental bodies, the only noticeable difference being that the anterior pair, instead of being elongated and irregular, are smooth and regular oval in shape (Pl.IX. fig. 1, *ax.h.*)[2]. They are, nevertheless, many times larger than any of the other bodies of the same series.

2. GANOIDEI.

Among Ganoids I have only been able to obtain representatives of two families of the Chondrostei, viz., *Acipenser sturio* and *Polyodon folium*. The *Polyodon* was a spirit-specimen in a bad state of preservation, and I could find nothing in the way of suprarenals, so that I am limited to the Sturgeon for information about this order. The Sturgeon is practically the only Ganoid it is possible to examine in anything like a fresh state in this country. I have been able to obtain and have carefully examined two specimens whose tissues were, to all intents and purposes, in a living condition. The first specimen was 1·65 metre in length, with a kidney 63 centim. long; the second was 2·14 metres, with a kidney of 1 metre.

The suprarenals in the Sturgeon are "ochre-yellow" bodies of precisely the same tint as the interrenal in Elasmobranchs. They vary extremely in size and shape, and are scattered in a more or less irregular manner throughout the substance of the kidney (Pl. X. fig. 8, *s.r.*). They are for the most part finely lobulated, almost coarsely granular to the naked eye, and many of the larger ones have processes or claws extending out in various directions into the kidney-substance. A certain number of the larger bodies are visible on the surface of the kidney, or revealed with very little dissection. A still larger number come into view on slitting up the posterior cardinal sinus, since they lie in abundance in its walls and in the immediate neighbourhood. A large residue, including the majority of the smaller bodies, are only revealed by digging away the kidney-substance in various parts.

I find the larger bodies placed anteriorly (Pl. X. fig. 8); and in this respect my observations differ from those of Leydig, who says that the larger ones are posterior. It is quite possible that the arrangement differs in different specimens. I found none whatever in the hinder fifth of the kidney, and by far the larger number, at least of bodies of any size, were in both my specimens in the anterior seventh, *i. e.*, just behind the lymphatic head-kidney (Pl. X. fig. 8, *h.k.*). Thus the most striking feature about their arrangement is their extreme anterior position as compared with Teleosts.

[1] Leydig describes a paired "suprarenal," but although my specimens were old, yet I am convinced that there was a single median interrenal in each case.

[2] [This appearance may possibly be due in part to the effect of long preservation.]

Many of the suprarenals are of exceeding minuteness, even less than 1 mm. in diameter, and these are seen in large numbers from the interior of the posterior cardinal sinus, whence they appear like "tubercles" in the wall of this vessel; indeed the appearance of these tiny bodies as seen through the lining epithelium of the vein is almost identical with the caseous nodules of pathology. In the two specimens I have examined the large suprarenals were arranged in two very irregularly symmetrical groups just behind each "head-kidney."[1] Each group consisted of about a dozen, and all of them were in close proximity to the venous sinus (Pl. X. fig. 8).

Some of the suprarenals lying on the posterior surface of the kidney were flattened, almost wafer-like.

The bodies I have seen varied in size from about 1 mm. in diameter to something under 1 cm., but measurements are difficult as their shape is often so irregular. They have a decidedly fatty appearance to the naked eye, and on being placed for a few hours in a 5 per cent. solution of osmic acid they become quite black, so that the presumption is that they contain some material of a fatty nature.

I have not been able to make out any very intimate relations between the suprarenals and the sympathetic nervous system in the Sturgeon, but I find that in many cases the bodies are placed on blood-vessels which are running in the kidney-substance.

3. TELEOSTEI.

a. PLECTOGNATHI.

In the tribe Sclerodermi I have only been able to obtain a small spirit-specimen of *Balistes maculatus*. It was not in a good state of preservation, and the results were negative.

In the Gymnodontes I have examined the Sun-fish (*Orthagoriscus mola*) as a representative of the Molidæ and *Tetrogon nigropunctatus* among the Tetrodontidæ. The last was an ill-preserved specimen and nothing was found. The following is the arrangement in the Sun-fish:—

MOLIDÆ.—In a specimen of *Orthagoriscus mola* (Pl. X. fig. 9, *s.r.*), 70 cm. in length, with kidneys of 20 cm. in length, I found one suprarenal only, which appeared to belong to the right side (Pl. X. fig. 9, *s.r.*). It was kidney-shaped, whitish, and fatty-looking, but of firm texture, and was about 1 cm. long by about 5 mm. broad.

b. PHYSOSTOMI.

MURÆNIDÆ.—In this family I have investigated both the Conger and the Silver Eel. There are two suprarenals in both species; these are in *Conger conger* (Pl. X. fig. 10, *s.r.*) triangular with rounded corners, in *Anguilla anguilla* round or oval in shape. Their position is peculiar in that they lie very anteriorly, being not far behind the point where the two crura of the kidney unite (Pl. X. fig. 10, *s.r.*). They are situated

[1] [In some cases they extend into the lymphatic tissue.—S. V., 10. 1. 97.]

on the ventral surface of the kidney, and are usually closely approximated to the middle line. They are only slightly imbedded in the substance of the kidney. The following may be taken as the typical arrangement in the Murænidæ:—

The suprarenals are about 1·5 mm. in diameter (of course they may be much larger in *Conger*). They are triangular with rounded corners; there is one on each side of the middle line and they are nearly in contact. They are on the ventral surface of the kidney, just behind the junction of the crura, and both are on the same level. The bodies are smooth, pale pink, and only slightly imbedded in the kidney.

CLUPEIDÆ.—In *Clupea harengus* (Pl. X. fig. 11) I have found two unequal suprarenals placed on the spinal surface of the kidney at about the mid-point of its length.

ESOCIDÆ.—I have examined two examples of *Esox lucius* (Pl. XI. fig. 12). The first specimen was 50 cm. in length, the second 57, both being young specimens.

In the first (Pl. XI. fig. 12) the suprarenals were two in number, one on each side. They were imbedded in the substance of the kidney, nearer the spinal than the ventral surface, and placed distinctly in advance of the mid-point of the kidney length, so as to be about in the middle point of the length of the body. The bodies are thus even more anterior than in the eels. They were each about 3·25 mm. long by 2 mm. broad. Their surface was distinctly lobulated (Pl. XI. fig. 12, *s.r.*).

In the second their arrangement appeared at first sight to be identical with that of the first, but, on closer examination, the left was seen to be represented by two bodies, and these were placed slightly in advance of the right one. They were, like those above described, imbedded in the kidney-substance. But in this specimen there were tiny "accessory" bodies, some two or three in number, in different parts of the kidney. I have not found, however, anything approaching the condition described by Stannius, in which the posterior half of the kidney is studded with suprarenal bodies. Very possibly this appearance was pathological.

SALMONIDÆ.—In a specimen of *Salmo salar*, 83 cm. long, I found five suprarenals (Pl. XI. fig. 13, *s.r.*). There were three on the left side and two on the right. None of them were visible on the ventral surface of the kidney, as they were placed on the lateral or spinal surfaces. The bodies belonging to the right side were situated respectively 20·5 and 20 cm. from the hinder end of the kidney, being placed almost in the middle point of its length. Those of the left side were placed at unequal intervals opposite them. The right suprarenals are respectively 5 mm. and 3 mm. in diameter. The larger is anterior and slightly kidney-shaped. The largest on the left side is directly opposite the larger on the right; it is 7 mm. by 3·5 mm. and distinctly kidney-shaped. At a short distance in front of this is a body about half its size and likewise kidney-shaped. At a further interval behind it lies an elongated oval one. The suprarenals are very pale pink in colour, almost white, and have a fatty appearance. They do not project appreciably from the surface of the kidney. They are distinctly lobulated and marbled with blood-vessels.

In another Salmon, a young fish only 47 cm. in length, I found three suprarenals, placed, as in the former specimen, at about the middle point of the length of the kidney and on the spinal surface. There were two chief ones, right and left respectively, situated each about 1 mm. from the middle line, the left one being about 3 mm. by 1·5, the right about 5 by 1·5, but irregular in shape. About 1 cm. anterior to these two is another about 1 mm. by ·5 mm. on the left side.

In a specimen of *Salmo trutta*, 58 cm. long, with a kidney of 26 cm., I found the suprarenals seven in number. There were six on the spinal and one on the ventral surface, all small. They were pale pink, roundish or oval bodies, and were partly imbedded in the substance of the kidney. This fact, coupled with the presence of one on the ventral surface, suggested to me that some might be completely buried in the substance of the kidney. This, however, I found not to be the case. The most anterior one was very small, and was situated 10 cm. from the anterior end of the kidney; the rest were scattered throughout the succeeding 4·25 cm. The one on the ventral surface was 12·5 cm. from the anterior extremity of the kidney. None of the bodies were more than 3 mm. in diameter.

In *Osmerus eperlanus* (Pl. XI. fig. 14) the suprarenals were represented by two miliary bodies about the size of a pin's head, projecting from the hinder end of the kidney, placed one behind the other (*s.r.*).

Among the Cyprinidæ I have examined:—

Leuciscus rutilis. (Pl. XI. fig. 15.)
„ *cephalus*. (Pl. XI. fig. 16.)
Leuciscus vulgaris. (Pl. XI. fig. 17.)

The suprarenals are usually two; but in a specimen of *L. vulgaris* there were four (Pl. XI. fig. 17, *s.r.*). They are usually rounded in this family.

As to position, they are usually in the posterior fourth of the kidney, but they may reach as far forward as the junction of the posterior with the middle third. They are usually placed one on each side of the middle line, but are often very close to it. They are on the spinal surface or the edge of the kidney.

In the fishes of this family I have examined the bodies have never been more than about 2 mm. in diameter, and they are often buried to some extent in the kidney-substance.

c. Anacanthini.

Gadidæ.—In this family I have investigated:—

Gadus morrhua. (Pl. XI. fig. 18.)
„ *æglefinus*. (Pl. XI. fig. 19.)
„ *merlangus*.
„ *virens*.
Merluccius vulgaris. (Pl. XI. fig. 20.)
Molva vulgaris. (Pl. XI. fig. 21.)
Motella tricirrhata.

In the Gadidæ there is considerable variation in number and size of the suprarenals, although their shape is nearly always rounded.

As for number, two must be regarded as the rule, but there is even more variation in this respect than in the Pleuronectidæ (*q. v.*). Thus, in a specimen of *Gadus morrhua* I have found as many as five; in *G. merlangus* I found only one. I have occasionally found one also in *Molva vulgaris*. In *Merluccius vulgaris* I have found in one case as many as five; in this case the suprarenal of the left side was represented by four small bodies instead of one larger one (Pl. XI. fig. 20, *s.r.*).

Their position is usually one on each side, but, as in other families, the right and left are rarely quite on the same level, one being usually anterior or posterior to the other. They also vary as to their relation to the middle line, some being more lateral, others more central.

The suprarenals in this family are almost always visible on the ventral surface of the kidney, though they may (either one or both) be lateralized, or even exceptionally may be partially on the spinal surface. They are usually more or less imbedded in the kidney-substance.

The bodies appear to be situated always in the region of the posterior third of the length of the kidney, though they sometimes approach very near the anterior limit of this distance.

The size varies from 1 mm. to 1 cm. in longest diameter in the fishes I have examined.

In one specimen of *Gadus morrhua* the arrangement was peculiar. The suprarenals were five in number. The tail of the kidney projected 3 cm. under the hæmal arch. Four of the bodies were under the arch on the ventral surface of the kidney; they were compressed into angular form owing to their position. There were two large ones, the anterior being 1 cm. by ·5 cm. (irregular oblong), the posterior being rhomboidal and having about the same greatest dimensions. There were in addition two quite small bodies placed between the two larger ones. The fifth one was on the spinal surface of the kidney, just anterior to the hæmal arch. It is about 1 cm. by ·5 cm., oval, and appears divided into two parts on the surface by a median longitudinal depression.

The typical arrangement of the suprarenals in the Gadidæ may be stated thus:—

The organs are rounded and about 5 mm. in diameter. There is one on each side of the middle line on the ventral surface of the kidney, but one is more lateral than the other. They are placed at about one quarter the length of the kidney from its hinder end, and one is slightly anterior to the other. They are smooth and partly imbedded in the kidney-substance, and are pale pink in colour.

Pleuronectidæ.—I have been able to obtain and examine:—

Pleuronectes flesus. (Pl. XI. fig. 22.)
" *limanda*. (Pl. XI. fig. 23.)
" *platessa*. (Pl. XI. fig. 24.)
Hippoglossus vulgaris. (Pl. XII. fig. 25.)
Hippoglossoides limandoides. (Pl. XII. fig. 26.)
Solea vulgaris. (Pl. XII. fig. 27.)
Rhombus lævis. (Pl. XII. fig. 28.)
Zeugopterus.

In Pleuronectidæ there is considerable variation in the number, form, size, and position of the suprarenal bodies; the variation in each of these respects affects not only the different species, but even different individuals of the same species.

With regard to their number this may be stated as usually two. Thus there are most often two in *Hippoglossus vulgaris*, *Pleuronectes flesus*, *P. limanda*, and *Solea vulgaris*. But I have found one only in some specimens of *P. limanda* and *Hippoglossoides limandoides*, while I have found three in one specimen of *P. flesus*. [In this case, however, the two of one side were close together, and were, taken together, not larger than the one of the opposite side.]

Their shape is nearly always rounded, but in *P. flesus* one was oval.

As to their position, the bodies appear to be affected to some extent by the characteristic asymmetry of the family, though sometimes they may be arranged symmetrically. There is usually one belonging to each side, but sometimes one is placed behind the other in the middle line (Pl. XII. fig. 26, *s.r.*). This was found, *e. g.*, in *P. flesus* and *Solea vulgaris*. Occasionally they are placed abreast, but both on one side of the median line; this occurred in *P. limanda*. Often the body of one side is decidedly more anterior or posterior than that of the other. Again, sometimes they are close together in the middle line (Pl. XI. fig. 24); at other times separated by the whole breadth of the kidney.

The suprarenals are always enclosed in the capsule of the kidney; but appear never to be imbedded in the kidney-substance in this family. They are always near the posterior end of the kidney, and never further forward than the junction of the posterior with the middle third of the kidney.

The size of the capsules in the Pleuronectidæ varies in specimens I have seen from ·5 mm. to 1·75 cm. in diameter. They do not appear to vary very directly in proportion to the size of the individual fish, but they are larger in the larger species.

The typical arrangement of the suprarenals in the Pleuronectidæ may be described as follows:—

The organs are about ·75 cm. in diameter and rounded. There is one on each side of the median line on the spinal surface of the kidney, but one is nearer to the middle line than the other. They are situated about one-quarter the length of the kidney from its posterior extremity, and one is placed rather in front of the other. They are smooth and free on the kidney-surface, and are pale pink or glistening white in aspect.

d. Acanthopteri.

In the Pharyngognathi I have only been able to obtain a spirit-specimen of *Coris pulcherrima*. It was not in a good state of preservation and no suprarenals were found.

In the Acanthopterygii I have been enabled to investigate representatives of several families.

Percidæ.—In two specimens of Perch (*Perca fluviatilis*, Pl. XII. fig. 29) I have found only one suprarenal body to be present in each case. In both it was about

8 mm. from the hinder end of the kidney on its spinal surface, and was about 1 mm. in diameter.

Gastrosteus spinachia was too small for anything to be seen with certainty.

In a specimen of *Labrax lupus* 70 cm. in length, with a kidney of 30 cm., I found two suprarenals placed one immediately behind the other on the spinal surface. The anterior one is 5 mm. by $2\frac{1}{2}$ mm.; the posterior one is about half the size of the anterior.

MULLIDÆ.—Two specimens of *Mullus barbatus* (Pl. XII. figs. 30 & 30 A) have been examined. In one, 24 cm. long, there were three suprarenals present; in the other, 42 cm. long, there were five.

In the first specimen these were crowded together in the middle line on the spinal surface about 3·25 cm. from the hinder end of the kidney (Pl. XII. fig. 30, *s.r.*).

In the second one (Pl. XII. fig. 30 A) there were two "chief" bodies, right and left, situated a few mm. behind the hinder end of the kidney, attached to the kidney and to the intestine and body-wall by fibrous strands. The left one has an "accessory" body just behind it, and there are two small ones on the ventral surface of the left tail of the kidney (Pl. XII. fig. 30 A, *s.r.*). The right chief body is 4 mm. by 3 in diameter, the left 3 by 2.

It is interesting to note, in relation with the abundance of suprarenal tissue, that this fish is of a red colour, and has an intensely pigmented, almost black, peritoneum.

SPARIDÆ.—In the common Sea-Bream (*Pagellus centrodontus*) I have found two suprarenals, 2 mm. in diameter, and very pale pink in colour, situated 1 cm. from the hinder end of the kidney on its spinal surface (Pl. XII. fig. 31). In *Cantharus griseus* almost exactly the same arrangement was found.

TRIGLIDÆ.—In this family I have examined *Cottus gobio* (Pl. XII. fig. 32), *Trigla pini* (Pl. XII. fig. 33), and *T. lyra* (Pl. XII. fig. 34). The rule as to number is the same as in Teleosts generally, *i. e.*, that there are two; but in one specimen of *Trigla pini* I have found one only, in the middle line, on the spinal surface, about 8 mm. from the hinder end of the kidney.

Their shape is rounded, and their position as a rule bi-lateral; but in *Trigla lyra* I have found two, placed one behind the other, both to the left of the left edge of the kidney near its hinder extremity (Pl. XII. fig. 34, *s.r.*).

Except in this one example of *T. lyra* I have always found them on the spinal surface of the kidney in this family.

They are of a very pale pink colour, and are free on the surface of the kidney, sometimes attached to the body-wall by bands of fibrous tissue. In size they vary between 1 and 2 mm.

SCOMBRIDÆ.—In this family I have been able to examine *Scomber scomber* and *Zeus faber* (Pl. XII. figs. 35 & 36).

In the Mackerel (Pl. XII. fig. 35) I have found the suprarenal bodies on the ventral aspect of the kidney, about 4·5 cm. from its posterior extremity, almost completely concealed, however, by kidney-substance. The body of the right side was rounded and about 2 mm. in diameter, the left was about 3 mm. by 1·5 mm. In another specimen, however, I found them placed on the *dorsal* aspect of the kidney at about the middle of its length, the right being slightly smaller than, and somewhat anterior to, the left one.

Frey says that in this fish the suprarenals are placed one behind the other. This is certainly not the rule, but it may be so in some cases.

I have examined several specimens of John Dory (Pl. XII. fig. 36). There were usually two suprarenals, one on each side of the middle line, but occasionally the body of one or other side has been represented by two smaller bodies. Sometimes they are placed side by side, sometimes one behind the other. They are always near the junction of the posterior crura of the kidney. They are mostly white or slightly iridescent and smooth, being enclosed in a firm fibrous capsule. They are rounded and situated on the spinal surface of the kidney. This is noteworthy, as I have always found them on the ventral surface in *Scomber*. Another point of distinction between the two genera is that in the John Dory they are not imbedded in the kidney-substance; they always lie within the posterior quarter of the kidney.

Blennidæ.—In a specimen of *Annarhichas lupus* (Pl. XII. fig. 37), 115·5 cm. in length, I found two suprarenals, situate 5 cm. from the hinder end of the kidney. The left was on the ventral surface of the kidney, nearly round, and 5 mm. in diameter. The right was on the dorsal or spinal surface, and, being the larger, its central point was posterior to that of the left, as their anterior ends were on the same level. This right body was oval in shape and 1 cm. by ·5 cm. The organs were partly imbedded in the kidney-substance.

Pediculati.—In the Angler (*Lophius piscatorius*, Pl. XII. fig. 38), in a fish of 54 cm. in length, I found five suprarenals. The chief pair were situated on the ventral surface of the kidney, about 1 cm. from its hinder end. The right was 3 mm. in diameter, the left 3·5 mm. They were of a pale flesh-colour and marbled with very fine blood-vessels.

In addition to these two, there was on the right side a body about 1·25 mm. in diameter, just at the hinder extremity of the kidney, where the ureter springs from its substance; again, just anterior to it is another, about one-third its size. On the left side there is also a second body, about 1·5 mm. by ·75 mm., situated midway between the "chief" body and the end of the kidney.

The larger suprarenals were more or less imbedded in the substance of the kidney.

Mugilidæ.—In *Mugil capito* (Pl. XIII. fig. 39), 55 cm. long, I found one suprarenal capsule of large size (6 mm. by 3). It was placed about 4 mm. from the posterior extremity of the kidney, and, being imbedded in the kidney-substance, its large size enabled it to be seen either from the spinal or the ventral surface (Pl. XIII. fig. 39).

In another example, 35 cm. long, there were two suprarenal bodies, on the spinal surface, at the extreme hinder end of the kidney. They were packed close together in the middle line, the right one being about 2·5 mm. by 2, and the left being about 2 by 1.

Here, as well as in *Mullus barbatus*, we have a proportionately large amount of suprarenal tissue associated with a deeply pigmented peritoneum.

DISCOBOLI.—I have only so far been able to examine one specimen of *Cyclopterus lumpus* (Pl. XIII. fig. 40). This fish was 46·25 cm. in length. The suprarenals were situated on the spinal surface of the kidney. The central point of the left was 3 cm. from the hinder end of the kidney, that of the right was 3·75 cm. distant. The right body was rounded and about 4·5 mm. in diameter, the left was oval (5 mm. by 2·5 mm.).

It will have been seen from the above account that in the Teleosts *I find suprarenal bodies in all fresh specimens examined.* There are usually paired, round or oval, pale pink bodies, placed on the spinal or ventral surface of the kidney. They are near the posterior extremity of the renal mass and are either free on its surface or more or less imbedded in its substance.

4. DIPNOI.

Nothing is known of the suprarenal capsules in this order of fishes. At any rate they are not described in *Lepidosiren* (9)[1]; in *Ceratodus* (8) and in *Protopterus* their presence is exceedingly doubtful[2]. However, what has to be said on this head will be stated below in the histological section (V.).

Having thus reviewed the gross anatomy of the suprarenal bodies in the orders I have examined, a few general remarks must be here interpolated. Being unable to obtain fresh specimens of any of the Dipnoi, I will leave this order quite out of the question[2]. In Elasmobranchs, Ganoids, and Teleosts, suprarenals have long been described, but never very systematically or connectedly. This I have endeavoured to do as far as possible in the above account. That there was need of this is clear from the fact that some zoologists of standing still seem largely to ignore their existence. Thus Beard (2), in his very interesting paper, says :—"Not one of the least brilliant of Mihálkovics' discoveries is that of the relationship between the reproductive gland and the suprarenal bodies[3]. Mihálkovics showed that the non-nervous part of these organs is the most anterior portion of the reproductive gland, and that in those animals in which suprarenals occur the germinal cells which give rise to them have undergone degeneration and have got separated off from the rest of the germinal epithelium as a mass of cells remaining in a so-called embryonic state."[4] This may be true enough,

[1] See also Ehlers, E., "Zur Kenntnis der Eingenweide von Lepidosiren," Vorläufige Mittheilung, Nachrichten der k. Gesellschaft der Wissenschaften zu Göttingen, Math.-physik. Klasse, 1895, Nr. 1.

[2] See footnote 2, page 73.

[3] It is noteworthy in this relation that in the Reptilia the suprarenal body is most often in very close relationship with the reproductive gland. The same applies to birds.

[4] [It may be observed, by the way, that the medulla is probably *not* "nervous," and that the cortex is certainly *not* "embryonic."—S. V., 10. 1. 97.]

but Beard goes on: "It is a significant fact, hitherto, I believe, unnoticed, that *suprarenals are found only in those forms in which a reduction in number of ripe sexual elements required has taken place*"[1]. In regard to this I can only state that suprarenals (one or both parts) are probably universally present throughout Elasmobranchs, Ganoids, and Teleosts. Further, this writer observes: "In the present state of our knowledge of these bodies, I do not wish to lay too much stress on the point of existence or non-existence of suprarenals in any order of Vertebrates." But he adds: "If Rabl's 'tree' be correct in respect of the ancestry of Ganoids from Sharks . . . . . I can conceive that *the non-existence of suprarenals in the former group*[1] would be a fact which our author might find difficulty in accounting for—unless he ignored it entirely!"

Suprarenals non-existent in Ganoids! Either Beard has quite overlooked their presence in the Sturgeon, or he has some view of his own as to the significance of those yellow bodies which are scattered throughout the kidney. If the latter were the case one would have surely expected him, in dealing with the subject, to note the fact.

Further on in the same paper our author gives a "tree," in which it is stated that *suprarenals are totally absent not only in Ganoids and Marsipobranchs, but also in Teleosts*[2]. It would be interesting to know what he calls those little bodies I have represented in my plates. Later on he says: "It would doubtless be interesting to find some traces of suprarenal bodies in the Dipnoi." It will be seen from what I say on this subject under the head of histology, that I am decidedly of the opinion that in all probability there are suprarenals of some sort in the Dipnoi[3].

With regard to the occurrence of suprarenals in Teleosts, in addition to the species in which I have described them above, there are mentioned many other species in which other writers have found them. Thus Stannius and Ecker, also Hyrtl, state that they are present in several species I have not been able to obtain. M'Kenzie, too (15), describes them in *Amiurus catus*. So that, although of course I cannot affirm from my own observations that these bodies are universally present in this order, I should, from a joint consideration of my own and previous researches, consider this to be more than probable. *If suprarenals are not present in all Teleosts, in which species are they absent?*

V. Histology.

1. ELASMOBRANCHII.

My results in this department appear to differ in many respects from those of Leydig, Semper, and Balfour. They agree fairly well in some respects with those of Chevrel, but there are important points of difference, and, besides, Chevrel's histological drawings are so imperfect that little can be learnt from them.

[1] The *italics* are mine.—S. V.

[2] This is not stated in so many words, but the "tree" has inscribed upon it, "Suprarenals totally absent on this side"; and "this side" includes the orders named above.

[3] [These have since been discovered by Petitt (*loc. cit.*).—S. V., 10. 1. 97.]

PAIRED "SUPRARENAL" BODIES.—With regard to the segmentally-arranged bodies, there is not a great deal new to be said. But it is certain that in all cases the structure is very different from that which Balfour described and depicted. Chevrel explains Balfour's appearances as due to the action of reagents, and I am satisfied, from the examination of many individuals and many species with various modes of preparation, that there is never any such arrangement of a cortex of columnar and a medulla of polyhedral cells (Pl. XIII. figs. 41 & 42).

The structure of these bodies is far from easy to describe, and this I find, notwithstanding that my material was perfectly fresh and my preparations mostly very satisfactory. The organs are surrounded with a tolerably firm fibrous capsule of a thickness about 4–7 μ (Pl. XIII. fig. 41, *c.*), which sends in septa (*s.*), which in some parts are distributed almost as regularly as in a Mammalian lymphatic gland. These septa rapidly break up into an irregular fibrous meshwork which is distributed throughout the body (Pl. XIII. fig. 41, *str.*).

The parenchyma of these bodies is not arranged in any definite acini or alveoli, thus *marking them off distinctly from the suprarenals in Teleosts, Ganoids, and the interrenal body in Elasmobranchs* (*q. v.*) and indeed from suprarenal capsules in other Vertebrata.

There are, as a rule, no definite cell-outlines to be made out, and the main part of the parenchyma appears to consist of an irregular or wavy fibrous stroma (Pl. XIII. fig. 41, *str.*), with protoplasm (*pr.*) and scattered nuclei of round or oval shape (*n.*). The protoplasm is often granular, sometimes finely, sometimes coarsely. The nuclei are of different characters, sometimes showing nuclear figures, at other times devoid of them, sometimes large and faintly stained, sometimes small and darkly stained. They vary in diameter from 5 to 9 μ. However unsatisfactory this may seem, it is all that can be ascertained, and it is difficult to imagine how former observers such as Leydig and Balfour could have described them as having definite lobules and cell-outlines.

But there are definite cells in some parts (Pl. XIII. fig. 42, *p.c.*) quite apart from the easily recognizable nerve-ganglion cells. They have, so far as I know, not been previously described. They are mostly triangular or multipolar in shape (Pl. XIII. fig. 42, *p.c.*) and of a uniform sepia-brown tint, and they contain large, very darkly stained, round nuclei. It is difficult to state their size, as their shape is so irregular; they vary, however, in their greatest lengths from 10–30 μ; the nucleus is usually about 6–8 μ in diameter. These cells are found particularly in the more central parts of the anterior paired bodies, but their distribution is irregular. The brown coloration of these cells is possibly due to the Müller's fluid in which the material was hardened. But, even if this be the case, the appearances indicate a difference in chemical reaction, and therefore in physiological import. These cells appear in some places to communicate together by their processes, but whether this communication is real or apparent I cannot be absolutely certain. Is it possible that these cells have anything to do with nerve-cells?

There is no essential difference in structure between the more anterior and the more posterior paired bodies. But, as Balfour has pointed out, the ganglionic development is more abundant in the case of the anterior ones. The presence of nerve-cells in the substance of the body itself is also more frequent in the case of the anterior suprarenals; in fact, nerve-cells are almost absent from the interior of the most posterior bodies, which consist entirely of suprarenal tissue proper.

The anterior pair or "axillary hearts," however, from their size and extensive nervous connections, require a separate description.

A longitudinal section of the "axillary heart" of *Scyllium canicula*, taken somewhere near its median part, shows that the body consists of an external and an internal portion. The internal part is characterized by the above-described brown pigmented cells [1]. The external part on one side is composed to a great extent of large nerve-cells with nerve-fibres running longitudinally. The nerve-cells are on an average 55 μ in diameter, but some of the oval ones may have a length of more than twice this number. This formation extends for about two-thirds of the length of the gland. On the opposite side and at the ends their external part is composed of the tissue which makes up the bulk of the segmental bodies, viz. a very fine but irregular fibrous matrix enclosing protoplasm with oval nuclei without definite cell-outlines [2].

At about a third of the length of the gland from the anterior end, a large group of nerve-cells occupies the central part of the structure, and scattered nerve-cells are distributed in other parts of the organ.

In some instances (*e. g.* axillary hearts of *Acanthias vulgaris*) there are to be seen some very large nuclei, twice or thrice the usual dimensions, and in addition one sees nuclei of varying sizes down to the very smallest.

This is not intended to be an exhaustive account of the histology of these bodies, and with one more remark I will conclude for the present what I have to say about them. I believe that many of the fibrils in the paired suprarenals (with the exception, perhaps, of the axillary hearts), which Balfour took for nerve-fibres, are in reality nothing more than connective tissue, which, as we have seen, runs in an irregular manner throughout the parenchyma.

Interrenal Body.—I may as well state at the outset that I agree with the view that this body corresponds with the cortical part of the suprarenal in Amphibians, Reptiles, Birds, and Mammals. I am further of opinion that it is essentially a secreting-gland. These conclusions have been forced upon me by its very close resemblance in structure to the cortex of the suprarenal capsules of higher Vertebrates, and by its strikingly

[1] The appearance of these pigment-cells is quite different from those which are found in various organs and tissues in fishes. There are in most cases no irregular masses or granules, but the whole cell, which has clear and definite outlines, is of a uniform brown tint. In some few cases, however, the cells appear to be of the ordinary coarsely granular type.

[2] Since the above was written, by careful examination of a good preparation with oblique light, I have succeeded in making out the cell-outlines in the "axillary hearts" of *Scyllium canicula*.

glandular arrangement into alveoli and its markedly granular protoplasm. The cell-outlines, too, are clearly seen in the majority of instances (Pl. XIII. fig. 43, *al.w.*, *e.c.*). The alveoli appear to be arranged, in some parts at any rate, in a more or less radiating manner round large veins or venous sinuses (Pl. XIII. fig. 43, *v.s.*).

A very striking feature in most of my sections is the presence of structures which remind one of the "demilunes" in mammalian mucous glands (Pl. XIII. fig. 43, *d.c.*). Their presence is quite clear and unmistakable, but I cannot guess at their significance [1].

The general appearance under the microscope reminds one very forcibly of cortical suprarenal tissue in the Mammalia. The interior of the organ is made up of lobules or alveoli, each enclosed in a delicate but distinct fibrous capsule about 2 μ in thickness. These alveoli are of various sizes, more or less oblong in form, about 50 μ thick and reaching 140–150 μ in length, so far as I can judge by my sections; in many cases fibrous tissue appears to divide the individual cells one from another. The cells vary much in shape and size, the majority being elongated; some of the longest of these are 30–50 μ in length and reach quite across the thickness of an alveolus. The nuclei of the cells have an average diameter of 10 μ. The above description of the interrenal is taken from a specimen of *Raja clavata*. The interrenal of *Scyllium* has much the same structure, but the alveoli are not perhaps quite so clearly marked out. This applies to the Sharks generally.

In *Chimæra* the anterior pair of the suprarenal bodies ("axillary hearts"), although long preserved in spirit, presented appearances which are worth recording. It is somewhat easier to imagine definite cells in the case of *Chimæra* than in the Elasmobranchs, for although there are no distinct cell-walls to be seen, yet the protoplasm appears to be gathered in separate portions of varying shape round the nuclei. These are of very different sizes and shapes. It is noticeable that there seems to be no ganglion of any great size in immediate connection with the body, and undoubted nerve-cells in its substance are almost totally absent.

The interrenal of *Chimæra* shows on microscopic examination a distinct alveolar arrangement as contrasted with the absence of such an arrangement in the paired suprarenals. This corresponds with what is found in the Sharks and Rays.

With regard to the true nature of these two kinds of body in Elasmobranchs, and the question as to their relations to the suprarenal bodies in the higher Vertebrates, there are one or two points to be noticed.

1. The interrenal of the Cartilaginous Fishes bears a very striking external resemblance to the structure which, in Amphibians and Reptiles, is always admitted to be a suprarenal. Its colour, its position, and its proneness to become broken up at its anterior end are all points of resemblance.

[1] The drawing (Pl. XIII. fig. 43) represents the appearances after hardening, double-staining in bulk, and saturating with paraffin. When examined fresh, the structure is largely concealed by the abundance of fatty-looking globules.

2. The interrenal, in its histological features, very closely resembles the suprarenals of Teleosts, and in some cases its structure is almost identical with that of the cortex of certain Mammalian capsules.

3. The paired bodies, as we have seen, have not such a definitely glandular appearance. They consist simply of a fibrous stroma, protoplasm, nuclei of various characters [1], and nervous elements.

Although the question is still very doubtful, and though I have not attempted any investigation of the development, I am decidedly inclined to the view that if one and not both of these bodies corresponds to the suprarenals of the higher Vertebrata, this one is the interrenal and not the paired suprarenal. And I am led to this view from consideration of its general appearance and position as well as its minute structure [2].

I think there can no longer be any doubt, at all events, that the paired suprarenals and the interrenals are totally distinct structures and almost certainly have quite different functions.

On the other hand, one is much more tempted to believe that the interrenal corresponds to the cortex and the paired suprarenals to the medulla of the Mammalian capsules, and this hypothesis would, so far as I can see, accord fairly well with known facts. But I should hesitate to give myself over entirely to this view until the development of the suprarenals in Mammals has been put upon a more satisfactory basis. Besides, even if this hypothesis were correct, it would not be by any means a final solution of the difficulty. For the questions naturally arise, What is the significance of this dual origin in Elasmobranchs? What is the essential nature of the interrenal and the segmental bodies? Balfour and others have proved conclusively a very intimate structural and developmental connection between the sympathetic chain and the segmental bodies. But, in effect, what does this mean? The segmental bodies are not in their essence nervous structures, and we know of nothing elsewhere which illustrates or throws any light on this curious development of glandular material in connection with the nervous system.

Again, I am not sure that the paired segmental bodies are not more intimately related to the blood-vascular than to the nervous system. We have seen that each one is placed around an arteriole, and many of them are immersed in the blood of the cardinal sinus. Further, it occurs to me that, after all, their connection with the sympathetic system may be in a certain sense accidental: *i. e.* they are abundantly supplied by the sympathetic as are other abdominal organs; but that, owing to their position, close to

[1] See footnote 2, page 66.

[2] Since the above was written, and as the result of further investigations throughout Vertebrates, I have elsewhere emphasized the view that the suprarenals of Mammals are to be regarded as compound glands derived from these two organs in Elasmobranch Fishes, and have suggested that each portion probably has a distinct function. The function of the medulla is becoming tolerably well understood. The function of the cortex is still unknown (Oliver and Schäfer, Proc. Physiological Society, 1895; Swale Vincent, Proc. Birm. Nat. Hist. & Phil. Soc. 1896, vol. x. pt. i.; Birm. Med. Review, Aug. 1896; also Anat. Anz. xiii. Bd. Nr. 1 & 2, 1897).

the main chain of the sympathetic, they have become connected with it in a remarkably intimate manner [1].

2. GANOIDEI.

Structure of the Suprarenal Bodies of the Sturgeon.—I have examined some of these bodies after putting them quite fresh into 1 % osmic acid for twenty-four hours, and then cutting in gum. They were stained quite black to the naked eye, and on cutting and examining microscopically their alveolar structure was obvious.

If examined immediately in Farrant's fluid, the alveoli appeared to be filled with mulberry-masses of material most probably of a fatty nature, as they had taken a deep brown stain with osmic acid, so that the cell-outlines were not to be made out.

If, however, the sections were passed through turpentine or Canada balsam, the structure was beautifully shown (Pl. XIV. fig. 44). The rounded or elongated oval alveoli (50–60 μ in diameter, or even 100 μ long by about 60 μ broad) are bounded by bold thick walls, averaging 3 μ in thickness (*al.w.*), and the cell-outlines were admirably preserved (*x*). The preponderating shape of the cells was round or oval, and in some parts they are seen to overlap, as the section was thick enough to contain several layers (*x*). In other parts the cells are more polyhedral or irregular. Like the alveoli, they vary somewhat in size; their average diameter is about 20 μ. The nuclei (*n.*) are deeply stained and somewhat irregular in shape, having a diameter of 3–6 μ. The protoplasm is very finely granular as a rule, occasionally more coarsely granular [2]. There are small nerve-ganglia in connection with some of the bodies.

[1] As for the meaning of the two kinds of body present in the Elasmobranchs and of one only in Teleostei and Ganoids there are two alternative theories.

One is that the two kinds of structure are both represented in the higher Vertebrates, but that the paired bodies have disappeared in Teleosts.

The other view is that the paired bodies in Elasmobranchs are the remains of former more important bodies, while in higher forms they disappear altogether. In favour of this it may be urged that their nerve-supply is quite disproportionate to their sizo and apparent importance, and possibly represents the persistenco of a nerve-supply suited to a former larger structure.

As to which of these is the correct view I cannot at present bo certain, but on the whole perhaps the usual view is the most probable, viz., that in Elasmobranchs the paired suprarenals and the interrenal correspond respectively to the medulla and the cortex of Amphibians, Reptiles, Birds, and Mammals.

There is not much difficulty in recognizing that the interrenal of the Cartilaginous Fishes corresponds to the cortex of higher Vertebrates, but it is far from easy to imagine that the masses of protoplasm with scattered nuclei which constitute the paired bodies in Elasmobranchs are really homologous with the branched granular cells of the medulla of higher Vertebrates.

[2] When the suprarenals of the Sturgeon are hardened, double-stained in bulk, and cut in paraffin, they do not show nearly such a distinct alveolar arrangement as do those treated fresh with osmic acid. The larger oval nuclei show a very distinct nuclear network and a large darkly-stained nucleolus centrally placed. In other cases only dark nuclear granules of various sizes are to be made out. The cells appear for tho most part made up of a variable number (5–6) of vesicles, from which evidently the fat has been dissolved by this mode of preparation. The cells of the body have shrunk to some extent, so as to leave spaces of variable extent between them.

I have no doubt, from the above structure, that these bodies are representatives of the suprarenals in Ganoids, and in my opinion they correspond to the cortical portion in higher Vertebrates.

3. TELEOSTEI.

The minute structure of the suprarenal bodies does not exhibit any wide variation throughout the different families of Teleosts. Between the individual members of the families the differences are of course still less. There are, however, such differences, and these appear to consist chiefly of variation in amount of fibrous tissue, variation in blood-vascular supply, and in the shape of the alveolar compartments into which they are all divided.

The organs are surrounded by a capsule of very varying thickness (in the species I examined from 4 to 70 μ), in close connection with which are sometimes found sympathetic nerve-fibres and small ganglia, and blood-vessels. Outside the capsule there is usually more or less adenoid tissue. In the majority of instances this is nothing more than a local increase, in the neighbourhood of the suprarenals, of the ordinary renal intertubular adenoid tissue.

The capsule is always thicker throughout the area which is in contact with the kidney. This is probably to be explained by the fact that we have a double layer, consisting of the capsule of the suprarenal and the capsule of the kidney, fused together at this part. There is never any direct anatomical connection between the parenchyma of the suprarenals and kidneys, and, so far as I have been able to discern, nothing to suggest that the suprarenals are parts of the kidney.

The fibrous capsule sends in trabeculæ, which divide and subdivide at first in a rather irregular manner; but ultimately they form in all cases very regular alveoli, having about the same average dimensions as those of the interrenal of the Elasmobranchs (*q. v.*), *strikingly suggestive of those of secreting-glands*, and these alveoli are, as a rule, completely filled with the suprarenal cells, which are much smaller than those of the interrenal of Elasmobranchs. But in some species (*Conger conger*, *Anguilla anguilla*, and *Salmo trutta*) there is a more or less empty space in the centre of each alveolus (Pl. XIV. figs. 45 & 46, *c.sp.*). These spaces are, however, never complete; one finds scattered cells, nuclei, and shreds of protoplasm, which suggest that this space does not exist in life. Most probably the central cells of each alveolus are more loosely connected together than the rest, or possibly they suffer a very rapid *post-mortem* change[1]. In by far the majority of Teleosts a very regular row of nuclei can be traced round the circumference of each alveolus, and in many cases their cell-

[1] [Pettit (*loc. cit.*) has laid great stress on this peculiar structure of the alveoli in the Eel, looking upon it as the fundamental type of a suprarenal gland. He finds a true physiological compensatory hypertrophy of one gland after removal of the other, and urges that the body is a true secreting-gland. But he seems to be totally unaware that the known suprarenals of the Eel and other Teleosts correspond to the cortex only of the Mammalian gland, and that all we know about the function of the suprarenals so far is confined to the medulla.—S. V., 10. 1. 97.]

outlines can also be perceived. In some cases, as in the Trout, the alveoli are very distinctly marked, and have every appearance of being not closed vesicles, but in communication one with another.

The essential suprarenal cells I find to be of two kinds. The first are irregular branched cells, most often tending towards a spindle-shape, about $7\,\mu$–$8\,\mu$ in length, with very large prominent nuclei (Pl. XIV. figs. 48 & 49). These nuclei are often as large in diameter as the widest part of the cell (*i. e.*, about $3{\cdot}5\,\mu$) (Pl. XIV. fig. 48), and appear to bulge it out at that point. In the nucleus can be seen a number of small dark nucleoli, and often a distinct nuclear network. The protoplasm of these cells is distinctly granular.

The second kind of cell is usually irregularly triangular, having generally a greatest length of about $6{\cdot}5$ or 7μ, with a small dark nucleus not more than $2{\cdot}5\,\mu$ in diameter (Pl. XIV. fig. 49).

These two kinds of cells are readily distinguished, and both are usually present in any given specimen, but in very varying proportions.

I have doubted whether these appearances might be simply due to treatment or to accidental modes of staining, but I believe they depend in some way on the functional activity (for the suprarenals are *not* mere embryonic remains), stage of development, or the age of the fish, as their relative occurrence is found to differ very widely even among closely allied species. Thus in *Gadus æglefinus* I found nearly all the cells had large round clear nuclei and nuclear figures, while in *Merluccius vulgaris* the cells appeared almost all to have small dark nuclei [1]. This point I hope to have the opportunity of investigating by taking series of specimens of different ages, and after different modes of feeding, starvation, poisoning, &c. At present I must leave their true nature quite an open question.

There is no distinction to be made out between cortex and medulla in this order of fishes, or, rather (as appears probable by comparison with other groups of Vertebrates), *the suprarenal consists entirely of cortex* [2].

I have made careful preparations of the suprarenals of all the species whose gross anatomy is given above, but, as I have said, these do not offer any great variety among themselves. It may, however, be useful to indicate briefly the kind of variation one finds in the different families by a few illustrative extracts from my laboratory note-book. Perhaps one of the most characteristic appearances is found in the Murænidæ. In this family (Pl. XIV. figs. 45 & 46) the alveoli are rounded, and contain cells polyhedral or angular in shape. These are arranged for the most part in a single tier around the circumference of each alveolus, leaving an irregularly-shaped cavity in the

[1] I have even found that in one specimen of *Mullus barbatus* there was a vast majority of one kind of cell, and in another specimen of the same fish a corresponding preponderance of the other kind.

[2] [Diamare (*loc. cit.*) has arrived at the same conclusions as myself as regards the homology of the interrenal body in Elasmobranchs with the suprarenal bodies of Teleostei. It follows that *the representative of the suprarenal medulla is absent in Teleostean fishes.*—S. V., 10. 1. 97.]

centre (Pl. XIV. fig. 46, *c.sp.*). This appearance is described above, and some explanation of it has been offered. The alveolar walls are permeated by capillary blood-vessels (Pl. XIV. fig. 46, *cap.*).

In the Pleuronectidæ the appearance under a low power is very like that of a lymphatic gland, but under a high power an alveolar arrangement can always be seen, and the nuclei are seen to belong to more or less closely-packed cells of the two varieties described above. In *Pleuronectes limanda* distinct acini are often seen almost like those of the mammalian pancreas, filled with cells of spindle-shape, with large round nuclei and very distinct nuclear figures. There is a tendency towards a clear space in the central part of each. In *Rhombus lævis* the acini are quite filled with cells, which are more rounded than in other members of this family, and there is generally more cell-protoplasm.

In the Gadidæ the individual members do not differ very widely from each other. In *Gadus morrhua* the cells are pear-shaped, oval, rounded or irregular, and in the specimens I have examined nearly all have large round figured nuclei. In *Gadus æglefinus* the appearance is peculiar: the acini appear to be occupied by scarcely anything more than free nuclei with nuclear figures, the cell-protoplasm being scanty and irregularly branched. *Molva vulgaris* shows the acinar arrangement very well, with a very regular ring of nuclei round the outside of each alveolus.

Pl. XIV. fig. 47 represents the appearances in the suprarenal of the Wolf-fish (*Anarrhichas lupus*). The alveoli are elongated, and there is an incomplete central space (Pl. XIV. fig. 47, *c.sp.*). Thus it is possible to consider that there are two chief types in the alveolar arrangements of teleostean suprarenals: one, as in the Murænidæ, is not unremindful of the testis in some animals (*cf.* Mihálkovics, 14), while the other is more suggestive of the mammalian pancreas.

The suprarenals of the Sunfish (*Orthagoriscus mola*) have a very peculiar structure, in that the acini are very long and tubular.

4. DIPNOI.

In *Protopterus annectens*, Parker (17) describes "around the kidney, but more particularly along its dorsal and outer sides, masses of brown cells, which in appearance remind one of the adrenal bodies of Amphibia," and he suggests the enquiry "whether they or the lymphoid cells which give rise to them have anything to do with the adrenals."

I have examined this point with some care, and I have been able to verify in every detail Parker's account of this lymphoid tissue, both round the kidneys and along the alimentary canal, and forming the substance of the spleen. This I was enabled to do by means of two specimens of *Protopterus* which Prof. Parker was kind enough to send me.

By the kindness of Prof. Bridge, I have also been able to examine the kidneys and surrounding tissue of *Lepidosiren.* The specimen was a long-preserved one, and I could make out nothing with the naked eye. On cutting sections, however, the same pigment-patches were obvious in the perirenal tissue as in *Protopterus*; if anything, these were more abundant in *Lepidosiren.* Here, too, the resemblance to suprarenals was greater than in *Protopterus*, for I found not only small patches or individual pigment-cells, but large rounded accumulations, which represent not continuous columns, but spherical masses, thus approximating anatomically to adrenals.

This tissue is of such great interest from many standpoints that I hope before long to be able to give a fuller description of it in another place. I am persuaded that it is really a "large-celled adenoid tissue," and some of the chief varieties of leucocytes can be recognized in some of my sections. But the appearance in places is so very glandular that Prof. Schäfer, who has been kind enough to look at some of my slides, said he should be very much inclined to think it might be suprarenal tissue, if a material so very like it were not found in other places. In fact, the intestinal walls show abundance of the same structure, and the spleen is very little different [1].

I have carefully compared both these with the pigment-patches in other parts, and find that they are quite comparable to these, so that, on the whole, I am inclined to the view that they have nothing to do with the adrenals.

Nevertheless, from *à priori* considerations, I believe that adrenals of some sort are almost certainly present in the Dipnoi. These fishes closely approach the Amphibians in many respects, and I am persuaded that could one obtain perfectly fresh specimens of large size, suprarenals of a type resembling that of the Amphibians would be found [2].

My investigations upon the structure of the suprarenal capsules in Fishes all point to their being *blood-vascular secreting-glands* of two distinct kinds, and this coincides entirely with the most recent views as to the function of the Mammalian organs.

VI. The Relation of the Suprarenal Bodies to the Head-Kidney.

1. *Historical.*

Balfour (23 and 24) first clearly made out that in *Acipenser* and *Lepidosteus* the anterior dilatations of each kidney consist not of kidney-substance, but of lymphatic tissue. He says, "*Thus the whole of that part of the apparent kidney in front of the*

[1] But, after all, it may be that there is no "great gulf" fixed between the leucocytes of adenoid tissue and the cells of a secreting-gland. I have recently seen a preparation from a case of Paget's disease of the nipple in the human subject which appeared to show a transition between the epithelial cells of the ducts and ordinary leucocytes. See also Beard (Anat. Anz. ix. Band, Nr. 15, p. 481, and his references to Kölliker and A. Prenant).

[2] [Since the above has been in type, Petitt (*loc. cit.* pp. 67–68) has claimed to have found the suprarenals in *Protopterus*. He says that in general form and relations they resemble those of the Teleostei, while in minute anatomy they are rather like those of Batrachians. But he gives no histological details, and says nothing about cortex and medulla.—S. V., 10. 1. 97.]

ureter, including the whole of the so-called head-kidney, is simply a great mass of lymphatic tissue, and does not contain a single uriniferous tubule or Malpighian body." He next proceeded to examine *Esox lucius*, *Osmerus eperlanus*, *Anguilla anguilla*, and *Lophius piscatorius* among Teleosts, and found pretty much the same condition as in Ganoids. He does not speak very positively about the Angler, but believes that tubules were present in all parts of the kidney. He sums up "*that the pronephros, though found in the larvæ or embryos of almost all the Ichthyopsida, except the Elasmobranchii, is always a purely larval organ, which never constitutes an active part of the excretory system in the adult state.*" Balfour describes the lymphatic tissue of the so-called head-kidney as formed of trabecular work and cells resembling a lymphatic gland. This tissue is very vascular, with a regular plexus of very large capillaries, which appear to have distinct walls, and which pour their blood into the posterior cardinal vein as it passes through the organ. With regard to the function of this tissue Balfour suggests that this is either the formation of lymph-corpuscles or of blood-corpuscles, and he was inclined provisionally to regard it as a lymphatic gland.

Parker (Brit. Assoc. Reports, 1882) stated that in many instances the mesonephros has grown forward in front of the air-bladder, and taken the place of the pronephros.

In studying *Dactylopterus volitans*, Calderwood (25) found the pronephros entirely separated from the body-kidney, and situated anterior to the abdominal cavity in the same transverse plane as the heart. On section this head-kidney appeared to be a functional kidney, only it did not contain so many tubules as the body-kidney. In *Cyclopterus lumpus* he finds that not till the fish has become sexually mature does its head-kidney commence to degenerate. Calderwood concludes that in adult Teleosteans the renal function is performed in some instances by the body-kidney only, in others by the head-kidney only, and in others, probably a very limited number, by both the body- and head-kidneys. Besides *Dactylopterus* he is aware of only one instance where the head-kidney is described as possessing tubules and Malpighian bodies, viz. *Fierasfer* (Emery 26 and 27)[1].

Weldon (35 and 36), in a paper on the head-kidney of *Bdellostoma*, describes a lobulated glandular body lying in front of the secreting part of the kidney, which he suggests is "a part of the embryonic kidney, modified in connection with the needs of the animal to perform some unknown function in the elaboration or purification of the blood." Then he instances Balfour's description of the lymphatic head-kidney in Teleosts and Ganoids as being a further illustration of a modification of a part of the embryonic kidney into an organ like a lymphatic gland. Next he suggests that in higher Vertebrates the suprarenal capsules are similarly modified portions of the primitive kidney. He continues, "*In Teleostei suprarenals are, at all events, frequently absent*[2]; or, as I would suggest, they are represented by the greatly-metamorphosed

[1] In a later paper (Scientif. Trans. Roy. Dublin Society, vol. v. (ser. ii.) ix. 1895, Survey of Fishing-grounds, &c.) Holt and Calderwood add to this list *Mora mediterranea* and all the species of Macruridæ.

[2] The *italics* are mine.—S. V.

head-kidney described by Balfour. In other cases *where suprarenals have been detected* [1], they have always been attached to the surface of the kidney." Later on he talks about "*the very general absence of suprarenals as separate structures in Teleosteans*" [1], as if their lying upon the surface of the kidney abolished them as "separate structures"! More recently, Miss Kirkaldy (33) has expressed much the same views as Weldon. She remarks, "It may therefore be concluded that the pronephros in *Myxine* represents the mesoblastic part of the suprarenal bodies, which have been shown by Prof. Weldon to be derived from the anterior part of the mesonephros in the higher Vertebrata."

I have already shown conclusively that suprarenals are not frequently absent, but are probably always present. It only remains to deal with their supposed relation to the head-kidney. Weldon's teaching seems to have found pretty general acceptance. Thus Auld [2] says, referring to the lymphatic tissue of the head-kidney, "Now *in Teleosteans and Teleosteoid Ganoids which possess this tissue no suprarenal organs are found* [1], and hence it is to be concluded with Balfour (!) that they are represented by this tissue." Balfour, at any rate in the paper quoted, says nothing of the kind; but the comparative portion of Auld's paper is of no importance, except as illustrating the injurious influence of Weldon's inaccuracy.

It will have been noticed that although many writers have declared suprarenals to be often absent in Teleosts, none of them have stated definitely in what species we may look for them in vain. The above quotations imply a very general belief something to this effect: that suprarenal bodies are rare phenomena in Teleosts and Ganoids, and that when present there is no lymphatic head-kidney, while when they are absent their place is taken by this structure.

The following quotation from Wiedersheim (Lehrbuch der vergl. Anat. der Wirbelthiere, 2te Aufl., Jena, 1886) shows the need for clearing up this point:—

"Bei Teleostiern sind die Nebennieren nicht überall in klarer und überzeugender Weise nachgewiesen, wo dies aber der Fall ist, handelt es sich, wie früher schon angedeutet wurde, um Beziehungen zu der in lymphoides (adenoides) Gewebe umgewandelten Kopfniere. (Dies gilt nach W. Weldon auch für die *Cyclostomen* [*Bdellostoma Forsteri*].) In andern Fällen, aber, sind sie enge mit der Niere verbunden."

The plain facts of the case are quite the contrary, and are these:—

Suprarenal capsules are present in certainly the majority of Teleosts and Ganoids, and I believe in all. Further, as far as I know at present, the purely lymphatic head-kidney is present in all Ganoids and in all Teleosts except Lophius, Dactylopterus, Fierasfer, *and, as will be stated below*, Orthagoriscus mola [3].

[1] The *italics* are mine.—S. V.

[2] Brit. Med. Journ., Oct. 6th. 1894.

[3] And, according to Holt and Calderwood, in *Mora mediterranea* and the Macruridæ.

2. *The Nature of the Intertubular Material in the Kidneys.*

The lymphatic head-kidney is not in any true sense a very specialized portion of the kidney. By "lymphoid" tissue we mean a variety of retiform connective tissue, in which the meshes of the network are filled up to a large extent with lymph-corpuscles. These differ from the white corpuscles of the blood in that their nuclei show a network. Some are as large as white blood-corpuscles, others (the majority) have a minimum of protoplasm, and appear as almost free nuclei. This structure is found typically in a mammalian lymphatic gland.

Now, on examining the kidney of any fish, the tubules appear to be separated by a variable, often a large, amount of intertubular material, which presents all the features given above characteristic of lymphatic or adenoid tissue. This appearance presents a marked contrast to the compact mass of tubules and Malpighian bodies one sees in a mammalian kidney. The kidney of the frog appears to be intermediate between the mammalian and fish's kidney, in respect of the amount of this intertubular adenoid tissue.

This tissue varies in amount in different regions of the kidney, but on the whole forms a fairly even bed for the tubules. In Teleosts, as one approaches nearer and nearer to the anterior end of the organ, the amount of adenoid tissue becomes greater and greater until in most cases the extreme anterior extremity of the apparent kidney consists entirely of adenoid tissue.

3. *Histology of the Head-Kidney.*

Structure of the Head-Kidney of the Ling (*Molva vulgaris*).—The tissue was hardened in spirit, stained in bulk with hæmatoxylin and eosin, and imbedded in paraffin; sections were then cut with the rocking microtome.

On examination with a low power, the organ is seen to be obviously a lymphoid structure. Not a trace of kidney-tubules or Malpighian bodies is to be found in any part of the section. The organ is enclosed in a very definite fibrous capsule. There are large blood-vessels [1] in abundance full of red blood-corpuscles.

With a high power the substance of the head-kidney is seen to be made up of a delicate reticulum enclosing in its meshes closely-packed leucocytes *with many red cells apparently free in the reticular spaces*, as well as in the large capillaries. In addition, there are many hexagonal crystals of a red colour, most probably oxy-hæmoglobin [2], and masses of dark pigment-crystals of acicular form, evidently some derivative of hæmoglobin.

I have found practically the same structure in the head-kidneys of the Pleuronectidæ, Gadidæ, and in fact in all Teleosts I have examined. I have only found this lymphatic

[1] And, in some cases, blood-sinuses (*vide infra*).

[2] The crystals of oxy-hæmoglobin obtained from the blood of the Squirrel and Hamster (Halliburton) are described as of this shape, also those from the Mouse (Bojanowski) and Horse (Hüfner and Bücheler). It is tolerably certain that these crystals are of the same character.

head-kidney absent in *Lophius piscatorius* and *Orthagoriscus mola*. Other authors have added some few more species, see above, also summary below. A few detailed illustrations will suffice.

Cyclopterus lumpus.—I have particularly examined the kidney of this species. It will be seen (Pl. XIII. fig. 40) that it has a peculiar shape.

At its anterior extremity are two dark red spherical masses of tissue, only attached to the rest of the kidney by connective tissue. On microscopical examination these are found to consist of an extremely vascular lymphoid tissue, with no trace of urinary tubules or Malpighian bodies [1].

The divided portion of the kidney on each side is represented by two very thick masses nearly half the total length of the kidney (fig. 40).

I find that almost the anterior third of this part, as well as the dark red bodies in front, is composed entirely of lymphoid tissue. As one approaches the junction of the anterior and middle thirds of this part of the kidney, one or two tubules make their appearance in the central portion of the section. In the middle third tubules are more frequent, while in the posterior third the appearance is almost that of "body-kidney" generally.

So that we have in *Cyclopterus* a well-developed lymphoid head-kidney, with an anterior part completely constricted off. This constriction may possibly throw some light upon other masses of lymphoid tissue which one finds in the neighbourhood of the kidney in Elasmobranchs as well as in Teleosts.

With regard to *Lophius piscatorius*, which was supposed by Hyrtl to have only a head-kidney, I find with Balfour tubules and Malpighian bodies in all parts of the kidney-mass except the extreme anterior end, where Malpighian bodies are absent. Here, too, there is more adenoid tissue than elsewhere, and it appears more probable that the whole kidney is contracted longitudinally, and that the lymphoid remains of the pronephros have been encroached upon by the mesonephros than that the whole of the ordinary excretory organ has been lost, and the pronephros has remained as the functional kidney.

In *Anguilla anguilla* I found in a specimen 68 cm. long, with a total length of kidney of 25 cm., that exactly the anterior three-quarters of the ununited portion of kidney on each side was entirely lymphoid, *i.e.*, half the total length of the kidney. At the mid-point of the kidney-length tubules begin to appear and rapidly increase in number till the normal secreting structure is reached.

In the *Sturgeon* the whole of the part *h.k.* (Pl. X. fig. 8) as far as the dotted line is purely lymphoid. There is also a small area of lymphatic tissue at the extreme hinder end of the kidney.

In the *Sunfish* all parts of the kidney contain urinary tubules, even the extreme

[1] [This structure corresponds to that of a "hæmo-lymph gland" (see Vincent and Harrison, Journ. of Anat. and Phys., Jan. 1897).—S. V., 10. 1. 97.]

anterior end which reaches far into the head. So that this species must be added to the list of those which have no purely lymphatic head-kidney.

4. *Function of the Lymphatic Head-Kidney.*

I am convinced that the appearances above described (blood-corpuscles free in the tissue spaces, crystals of oxy-hæmoglobin and other derivatives of hæmoglobin) point to a blood-destroying function of the lymphoid anterior end of the kidney, and very possibly also of the rest of the intertubular material, and this appears not unreasonable since lymphatic glands in Man can probably carry on this function. They appear to do so, at all events after removal of the spleen, and it is not conceivable that an organ should be able to take on in an emergency duties which it had never performed to the slightest extent previously [1].

5. *Relation of the Suprarenals to the Head-Kidney.*

I have already sufficiently disproved the idea that where one of these is present the other is absent. I have further, by careful measurements, attempted to make out if there were any inverse ratio between them as to respective bulk, but in this I have failed entirely. So that I am forced to conclude that there is no anatomical relationship whatever between them.

Physiologically one cannot be so certain, but it seems very likely that the head-kidney functionates as a lymphatic gland, while the suprarenals, in all probability, are secreting-glands, which minister to the needs of the blood, just as in the higher Vertebrates. Functional relationship is, then, equally improbable.

Grosglik (29) considers that the head-kidney of adult Teleosts consists of two parts, the degenerated pronephros and the cortical part of the suprarenals, and that the known suprarenals of Teleosts correspond to the medullary substance in the Amniota [2].

It is certainly curious that we find the lymphatic head-kidney just in those cases where only one portion of the suprarenal appears to be represented. But, in my opinion, the part which is not represented in Teleosts and Ganoids is the *medulla* and not the cortex, so that, if the head-kidney has anything to do with the suprarenals at all, I should expect that it would represent the medulla. But, satisfactory as such a conclusion would be, I cannot find any grounds for it whatever. *There is nothing in the structure of the degenerated pronephros which suggests any connection with supra renal structure of either kind.*

The question as to the physiological correspondence of the suprarenal in Fishes to the organs in higher Vertebrates, I hope to have the opportunity of settling at an early date by means of direct experiment [2].

[1] [It has been mentioned above that Balfour considered the function to be that of formation of red corpuscles. This view has also been held by Emery (26), and Bizzozero and Torre, Mem. Accad. Lincei Roma, vol. xviii. 1883–84.—S. V., 10. 1. 97.]

[2] An t. Anz. xiii. Bd. Nr. 1 & 2 (1897).

VII. Summary and Conclusions.

A. *Gross Anatomy.*

My investigations in this department have led me to conclude that:—

1. *Suprarenals are almost certainly present in all Elasmobranchii, Holocephala, Ganoidei, and Teleostei*, and very probably in Dipnoi also [1].

2. In Elasmobranchs *the interrenal body is totally distinct and separate from the segmental bodies, and there is no kind of connection between them.*

3. *There is no* "*third kind of body*" in relation to the kidneys, as Balfour surmised there might be.

4. *The yellow bodies scattered in the Sturgeon's kidney are the true suprarenals* in Ganoids, and correspond to the interrenal of Elasmobranchs and the suprarenals of Teleosts.

B. *Histology.*

The following points in histology are either new or have not been sufficiently emphasized by previous observers:—

1. In Elasmobranchs *the interrenal body consists of definite alveoli, containing cells with large nuclei, and curious structures resembling* "*demilune*" *cells of mucus-glands.* This structure indicates its "*secretory*" nature and its analogy to the suprarenals of Teleosts and the cortical part of the suprarenals of the higher Vertebrates.

2. *The segmentally arranged bodies in Elasmobranchs have no cortex and medulla, no definite alveoli, and cell-outlines seen only with difficulty.* There are, however, in some places *branched pigment-cells* which appear to communicate together by their processes. The nuclei are of very varying size.

3. *These segmental bodies, having such a different structure from the interrenal, are probably different also both morphologically and physiologically* [2].

4. *That the fibrils which Balfour observed in the substance of the paired bodies were probably many of them only connective tissue, that the significance of the relations of the paired suprarenals to the sympathetic has been much overstated, and that their relation to the vascular system is probably much more important.*

5. *The suprarenals in the Sturgeon have a structure which is definitely alveolar and cellular—analogous to the interrenal of Elasmobranchs and the suprarenals of Teleosts.*

6. *The interrenal of Elasmobranchs and the suprarenals of Ganoids and Teleosts are in their essence* "*secreting-glands,*" *as the Mammalian organ is now believed to be.*

7. *The segmental suprarenals of Elasmobranchs are also secreting-glands, though probably of a different nature* [2].

C. *Head-Kidney.*

1. That *all Teleosts and Ganoids, as far as is known at present* (*except* Lophius, Dactylopterus, *and* Fierasfer, Orthagoriscus mola, Mora mediterranea, *and all the species of Macruridæ*), *have a* "*lymphatic head-kidney.*"

[1] See footnote 2, page 73.

[2] See Anat. Anz. xiii. Bd. Nr. 1 & 2 (1897).

2. That *this head-kidney is a lymphoid organ with a probable blood-destroying function.*

3. That *the kidney of fishes consists of two totally distinct parts—(1) The secreting-tubules and Malpighian bodies, and (2) an adenoid intertubular material.*

4. That *the head-kidney in adult Teleosts is not a "specialised" portion of the primitive kidney, but simply an increase, at the anterior end, of the lymphatic tissue which exists between the tubules throughout the kidney.*

5. That *there is no anatomical or physiological relationship of any kind between the suprarenals and the head-kidney.*

VIII. Bibliography.

A. *On the Suprarenal Bodies.*

1. Balfour, F. M. A Monograph on the Development of the Elasmobranch Fishes. London, 1878.
2. Beard, J. The Inter-relationships of the Ichthyopsida. Anat. Anz., V. Jahrgang, 1890.
3. Chevrel, R. Sur l'Anatomie du Système nerveux grand sympathique des Elasmobranches et des Poissons Osseaux. Archives de Zoologie expér. et gén. 2e série, tome v. bis (1887), Supplémentaire.
4. Chevrel, R. Recherches anatomiques sur le système nerveux grand sympathique de l'Esturgeon. Arch. de Zool. Expér. et gén. 3e série, tome ii. 1894.
   Also a paper bearing the same title in the C. R. de l'Acad. des Sciences, tome cxvii. no. 13, 2e semestre, p. 441.
5. Eberth, —. Article "Suprarenal Capsules" in Stricker's 'Handbuch,' 1871.
6. Ecker, —. Der feinere Bau der Nebennieren, etc. Braunschweig, 1846.
7. Frey, H. Article "Suprarenal Capsules" in Todd's 'Cyclopædia,' vol. iv. (1852).
8. Günther, A. Description of *Ceratodus*. Phil. Trans. vol. clxi. 1871.
9. Hyrtl, J. *Lepidosiren paradoxa.* Abhandl. d. Böhm. Gesellsch. Prag, 1845.
10. Hyrtl, J. Das uropoetische System der Knockenfische. Sitz. Wiener Akad. 1851.
11. Leydig, F. Beiträge zur mikros. Anat. etc. der Rochen und Haie. Leip. 1852.
12. Leydig, F. Anatomisch-histologisch. Untersuchungen über Fische u. Reptilien. Berlin, 1853.
13. Leydig, F. Zur Anatomie und Histologie der *Chimæra monstrosa.* Müller's Archiv, 1851.
14. Mihálkovics, —. Entwick. d. Harn. u. Geschlechtsapp. der Amniota. iii. Die Geschlechtsdrüsen. Internat. Monatschr. f. Anat. etc. Bd. ii. 1885, pp. 389–402.
15. M'Kenzie, —. Contributions to the Anatomy of *Amiurus.* Proc. Canad. Inst. of Toronto, n. s. vol. ii. no. 3, 1884.
16. Müller, J. Vergleichende Anatomie der Myxinoiden. Schluss. Abhandl. d. Akad. der Wissenschaften zu Berlin, 1843, S. 113.
17. Parker, W. N. On the Anatomy and Physiology of *Protopterus annectens.* Trans. Roy. I. Acad. vol. xxx. part iii. 1892.
18. Retzius, —. Observationes in Anatomiam Chondropterygiorum. Lund, 1819. 4to.
19. Semper, C. Urogenitalsystem d. Plagiostomen. Arb. zool.-zoot. Inst. z. Würzburg, vol. ii. 1875.
20. Stannius, H., in Müller's Archiv, 1839, S. 97 ff.
21. Stannius, H. Vergleichende Anatomie. Berlin, 1846.
22. Stannius, H., u. v. Siebold. Handbuch der Zootomie. 2te Aufl. 1854.

B. *Head-Kidney.*

23. Balfour, F. M. The Pronephros of Teleosteans and Ganoids. Brit. Assoc. Reports, 1881, p. 721.
24. Balfour, F. M. On the Nature of the Organ in adult Teleosteans and Ganoids which is usually regarded as the Head-Kidney or Pronephros. Q. J. M. S. vol. xxii. p. 12 (Jan. 1882).
25. Calderwood, W. L. The Head-Kidney of Teleostean Fishes. Journ. of the Mar. Biol. Assoc. of United Kingdom, N. S., vol. ii. no. 1 (May 1891).
26. Emery, C. Zur Morphologie der Kopfniere der Teleostei. Zool. Anz. viii. pp. 742–744. (Atti dell' Accademia dei Lincei, 1882.)
27. Emery, C. Le specie del genere *Fierasfer* nel Golfo di Napoli. Leip. 1881.
28. Field, H. H. Development of Pronephros and Segmental Duct in Amphibia. Bull. Mus. Comp. Zool. xxi. (1891) pp. 201–340 (8 pls.).
29. Grosglik, —. Zur Morphologie der Kopfniere der Fische. Zool. Anz. 1885.
30. Janosik, —. Bemerkungen über die Entwickelung der Nebennieren. Arch. f. mikr. Anat. Band xxii. pp. 738–746, Taf. xxvii. (1883).
31. Jungersen, H. F. E. Development of Kidneys in Sturgeon. Zool. Anz. xvi. (1893), pp. 464–467, 469–472 (1 fig.).
32. Jungersen, H. F. E. Development of Kidneys in *Amia calva.* Zool. Anz. xvii. (1894), pp. 246–252 (5 figs.).
33. Kirkaldy, J. W. On the Head-Kidney of *Myxine.* Q. J. M. S. vol. xxxv. (Jan. 1894), p. 353.
34. Semon, R. Relation of Mesonephros to Pronephros and Suprarenal Bodies. Anat. Anz. v. (1890), pp. 455–482 (8 figs.).
35. Weldon, W. F. R. On the Head-Kidney of *Bdellostoma,* &c. Q. J. M. S. xxiv. p. 171 (April 1884).
36. Weldon, W. F. R. Suprarenal Bodies of Vertebrata. Q. J. M. S. vol. xxv. p. 127.

EXPLANATION OF THE PLATES.

Reference-letters to figs. 1–40 (Plates IX.–XIII.).

a.a., axillary artery; *a.i.r.*, anterior broken-off portions of the interrenal body; *ao.*, aorta; *ax.h.*, anterior pair of suprarenal bodies; *f.t.*, bands of fibrous tissue; *h.a.*, anterior limit of hæmal arch; *h.k.*, head-kidney; *i.a.*, intercostal arteries; *i.r.*, interrenal body; *k.*, kidney; *l.k.*, lobe of kidney-substance; *n.*, nerves running through deep fissures in head-kidney; *œ.*, œsophagus cut across; *s.r.*, suprarenal bodies; *sy.*, main chain of the sympathetic; *sy.g.*, sympathetic ganglion; *sy.pl.*, sympathetic plexus; *ur.*, ureter.

Figs. 1–40 represent the outlines of the kidneys in the several species examined, with the suprarenals and interrenals shaded in. In the Teleosts (figs. 9–40) the suprarenals when on the ventral surface are drawn in plain lines, when on the spinal surface in dotted lines.

PLATE IX.

Fig. 1. Ventral view of the kidney, suprarenals, and interrenal of *Chimæra monstrosa*, showing the smooth, oval, anterior pair of suprarenal bodies. $\times$ 1.

Fig. 2. Dissection of *Scyllium canicula* (young female specimen) giving a ventral view of suprarenals and interrenal. The parovarium has been dissected away. This drawing may be taken as a typical representation of these bodies in Elasmobranchs. The connections with the sympathetic are indicated to some extent in the anterior part of the figure. The suprarenals were displayed by Semper's chromic acid method. $\times \frac{1}{2}$.

Fig. 2 A. From the same preparation as the last. First three suprarenals of each side. $\times$ 2.

Fig. 3. Suprarenals of *Scyllium canicula* brought out by Chevrel's osmic acid method. Their irregular outline is well shown, and many of the sympathetic fibrils are stained black. $\times$ 1.

Fig. 4. Ventral view of kidneys, suprarenals, and interrenal of *Scyllium catulus*. This drawing shows fairly well the relations to the sympathetic. There is a large plexus anterior to and outside the axillary hearts, with occasional ganglia. $\times \frac{1}{2}$.

PLATE X.

Fig. 5. Suprarenals, &c., of *Acanthias vulgaris*, shows sympathetic relations in anterior part. The interrenal is not quite in the middle line, but is laid on the surface of the left kidney. $\times$ 1.

Fig. 6. Ventral view of kidneys, &c., of *Raja batis*. This drawing represents a not unusual condition in the Rays, in which there is a bridge-like communication between the interrenals of the two sides. The sympathetic is shown to some extent about the middle of the left kidney. $\times$ 1.

Fig. 7. Same view in *Raja maculata*. The anterior separated portions of the interrenals show processes or claws on their outer sides. $\times$ 1.

Fig. 8. Ventral view of kidney and suprarenals of *Acipenser sturio*. Part of the kidney-substance has been dissected away so as to display the suprarenal bodies distributed throughout the organ. $\times \frac{1}{10}$.

Fig. 9. Ventral view of kidneys and suprarenal of *Orthagoriscus mola*. The kidneys are a very peculiar shape. There is one suprarenal attached by fibrous bands behind the right kidney. $\times \frac{1}{4}$.

Fig. 10. Kidney and suprarenals of *Conger conger*, suprarenals on ventral surface of kidney. $\times \frac{1}{2}$.

Fig. 11. *Clupea harengus*, suprarenals on spinal surface of kidney. $\times$ 1.

PLATE XI.

Fig. 12. *Esox lucius.* Suprarenals in kidney-substance. × $\frac{1}{2}$.
Fig. 13. *Salmo salar.* Five suprarenals on spinal surface of kidney. × $\frac{1}{4}$.
Fig. 14. *Osmerus eperlanus.* Suprarenals projecting behind hinder end of kidney. × 1.
Fig. 15. *Leuciscus rutilis.* Suprarenals on ventral surface. × 1.
Fig. 16. *Leuciscus cephalus.* Suprarenals on ventral surface. × 1.
Fig. 17. *Leuciscus vulgaris.* Suprarenals on spinal surface. × 1.
Fig. 18. *Gadus morrhua.* Suprarenals on ventral surface. × $\frac{1}{3}$.
Fig. 19. *Gadus æglefinus.* Suprarenals on ventral surface. × 1.
Fig. 20. *Merluccius vulgaris.* Suprarenals on ventral surface. × $\frac{1}{2}$.
Fig. 21. *Molva vulgaris.* Suprarenals on ventral surface. × $\frac{1}{2}$.
Fig. 22. *Pleuronectes flesus.* Suprarenals on ventral surface. × 1.
Fig. 23. *Pleuronectes limanda.* Suprarenals on spinal surface. × 1.
Fig. 24. *Pleuronectes platessa.* Suprarenals on spinal surface. × 1.

PLATE XII.

Fig. 25. *Hippoglossus vulgaris.* Suprarenals on spinal surface. × $\frac{1}{3}$.
Fig. 26. *Hippoglossoides limandoides.* Suprarenals projecting from hinder end of kidney. × 1.
Fig. 27. *Solea vulgaris.* Suprarenals on spinal surface. × 1.
Fig. 28. *Rhombus lævis.* Suprarenals on spinal surface. × 1.
Fig. 29. *Perca fluviatilis.* One suprarenal on spinal surface. × 1.
Fig. 30. *Mullus barbatus.* Suprarenals on spinal surface. × 1.
Fig. 30 A. Another specimen, showing hinder end of kidney and five suprarenals. × 1.
Fig. 31. *Pagellus centrodontus.* Suprarenals on spinal surface. × 1.
Fig. 32. *Cottus gobio.* Suprarenals on spinal surface. × 1.
Fig. 33. *Trigla pini.* One suprarenal on spinal surface. × 1.
Fig. 34. *Trigla lyra.* Two suprarenals off left side of tail of kidney, attached by bands of fibrous tissue. × 1.
Fig. 35. *Scomber scomber.* Suprarenals on the ventral surface of the kidney. × $\frac{1}{2}$.
Fig. 36. *Zeus faber.* Suprarenals on spinal surface of the kidney. × 1.
Fig. 37. *Anarrhichas lupus.* Left suprarenal on ventral surface of kidney, right one on spinal surface. × $\frac{1}{4}$.
Fig. 38. *Lophius piscatorius.* Five suprarenals on ventral surface of the kidneys. Notice peculiar shape of the kidney-masses. × 1.

PLATE XIII.

Fig. 39. *Mugil capito.* One large suprarenal in substance of tail of kidney; could be seen from either surface. × $\frac{1}{2}$.
Fig. 40. *Cyclopterus lumpus.* Suprarenals on spinal surface of kidney. × $\frac{1}{2}$

Reference-letters to figs. 41–49 (Plates XIII., XIV.).

ad., adenoid tissue of kidney between the tubules; *al.w.*, walls of alveoli; *bld.c.*, blood-corpuscles; *c.*, capsule; *cap.*, capillary blood-vessels; *c.sp.*, central space in alveoli; *d.c.*, cells resembling "demilune" cells; *e.c.*, elongated cells; *n.*, nuclei; *n.c.*, nerve-cell; *n.net.*, nuclear network; *nl.*, nucleoli; *p.c.*, branched pigment-cells; *pr.*, granular protoplasm; *s.*, septa; *str.*, fibrous stroma; *t.*, tubules of kidney; *v.s.*, venous sinuses; *x*, cells seen to be overlapping.

Fig. 41. Section of a suprarenal body of *Acanthias vulgaris*, showing the capsule, trabeculæ, stroma, protoplasm, and various-sized nuclei. Zeiss H. immers. E. P. 2. Drawn with Zeiss's camera lucida.

Fig. 42. Section of a suprarenal body of *Scyllium canicula*, from about the middle region of the abdominal cavity. In this section are seen a large nerve-cell and several branched pigment-cells. Zeiss H. immers. E. P. 2. Camera lucida.

Fig. 43. Section of the interrenal body of *Raja clavata*, showing alveoli of various shapes and sizes, filled with cells, many of them elongated. Zeiss apochrom. $\frac{1}{12}''$ water immers. Camera lucida.

PLATE XIV.

Fig. 44. Section of a suprarenal body of *Acipenser sturio*. The body was put into osmic acid about 12 hours after death, and sections were cut with the freezing microtome on the following day. The alveolar arrangement is well seen and the cell-outlines are admirably preserved. Zeiss H. immers. E. P. 2. Camera lucida.

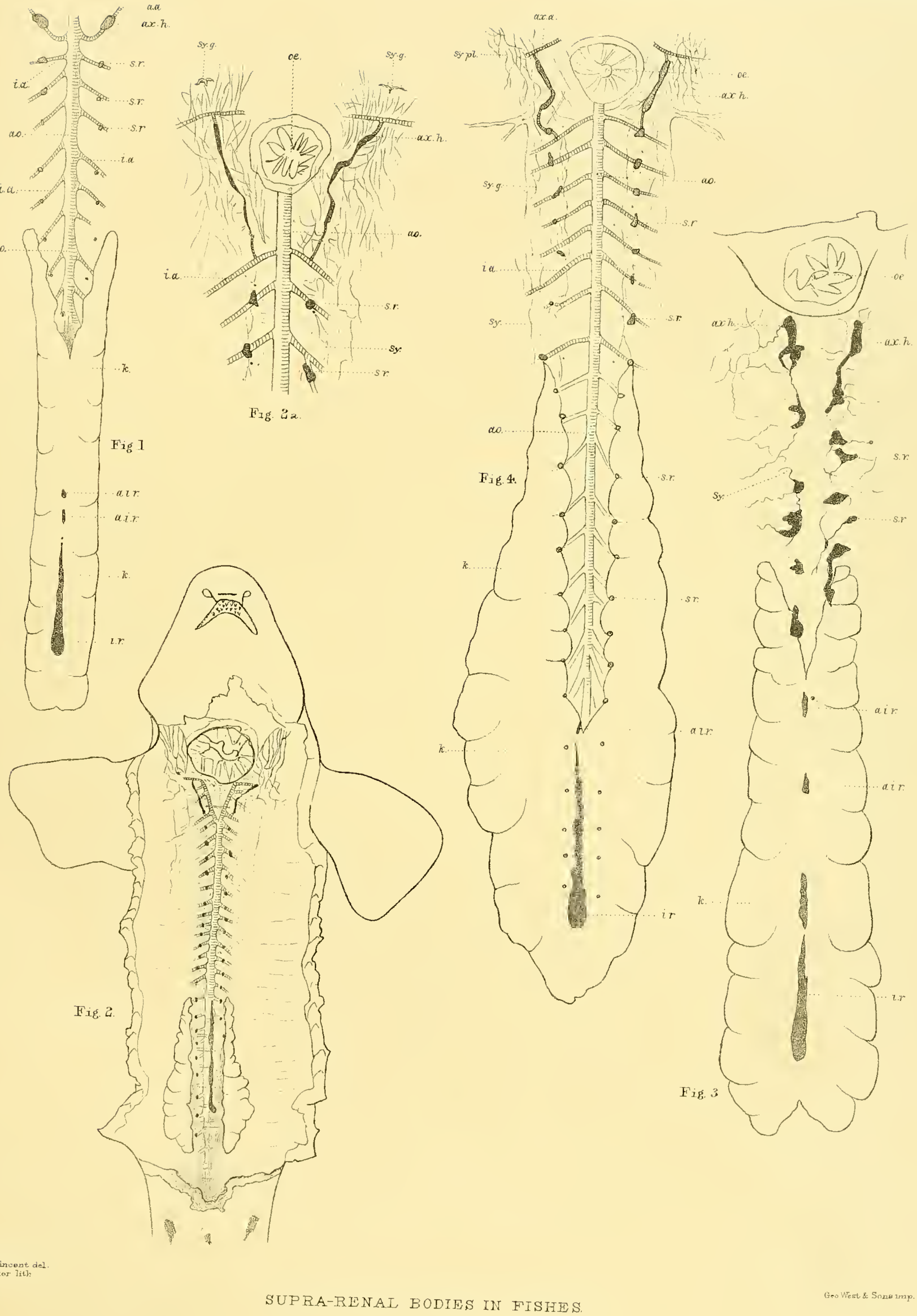
Fig. 45. Section through a portion of the kidney and the two suprarenals of *Conger conger*, showing the renal intertubular material, the low power appearance of the suprarenals, and their connexions with the kidney. $\times$ 70.

Fig. 46. Portion of suprarenal of *Conger* from same slide as preceding, showing the alveoli containing a regular tier of irregular cubical cells, and central spaces containing nuclei and shreds of cells. Zeiss apochrom. $\frac{1}{12}''$ water immers. Camera lucida.

Fig. 47. Section of suprarenal of *Anarrhichas lupus*, showing a curious serpentine arrangement of the alveoli. Zeiss $\frac{1}{12}''$ apochrom. water immers. Camera lucida.

Fig. 48. Separate cells of suprarenal of *Pleuronectes limanda*. Zeiss apochrom. $\frac{1}{12}''$ water immers. Compens. 0·18.

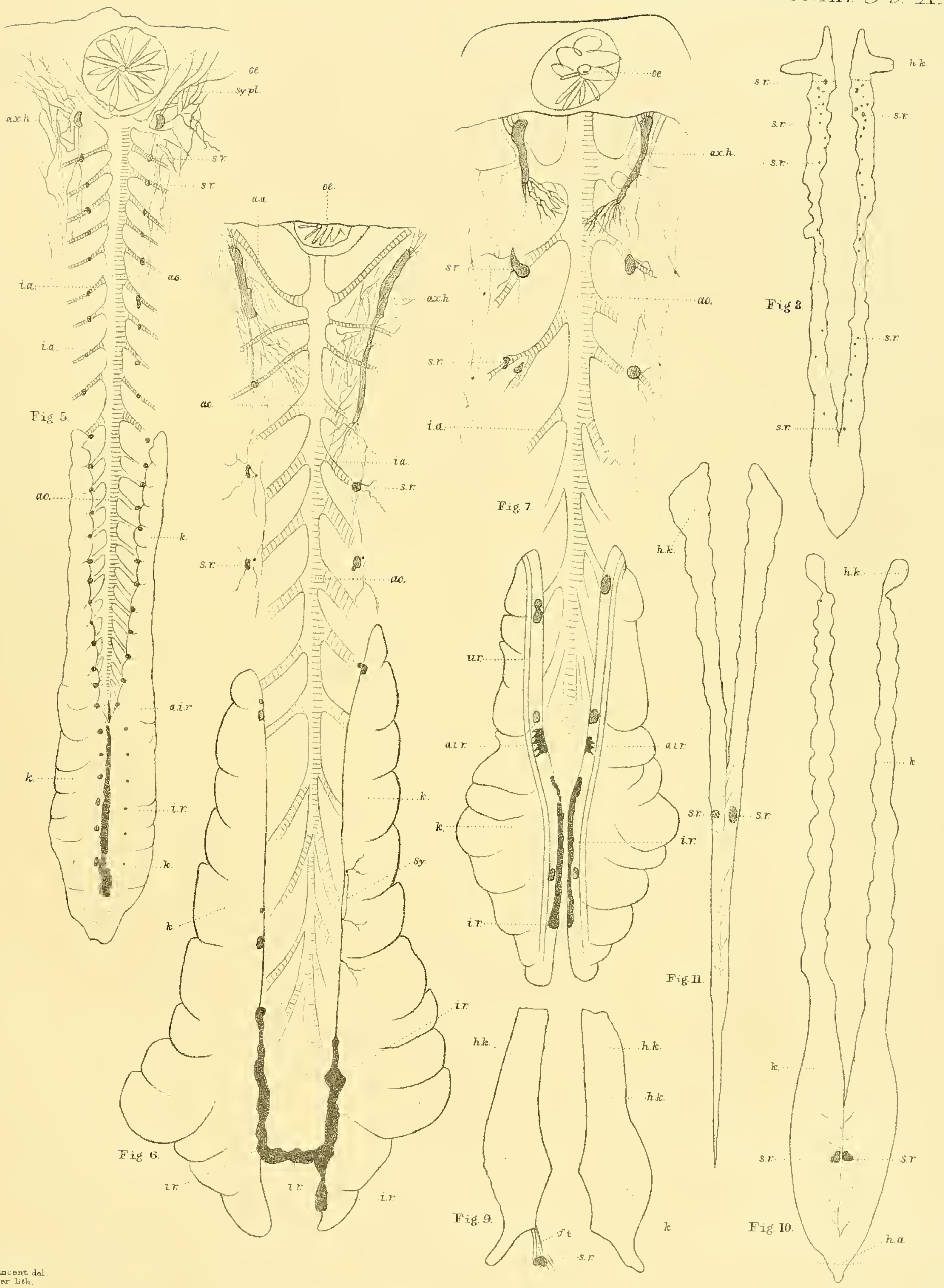
Fig. 49. Separate cells of suprarenal of *Mullus barbatus*. Shows the two kinds of cells. Same power as fig. 48.



Swale Vincent del.
M. P. Parker lith.

SUPRA-RENAL BODIES IN FISHES.

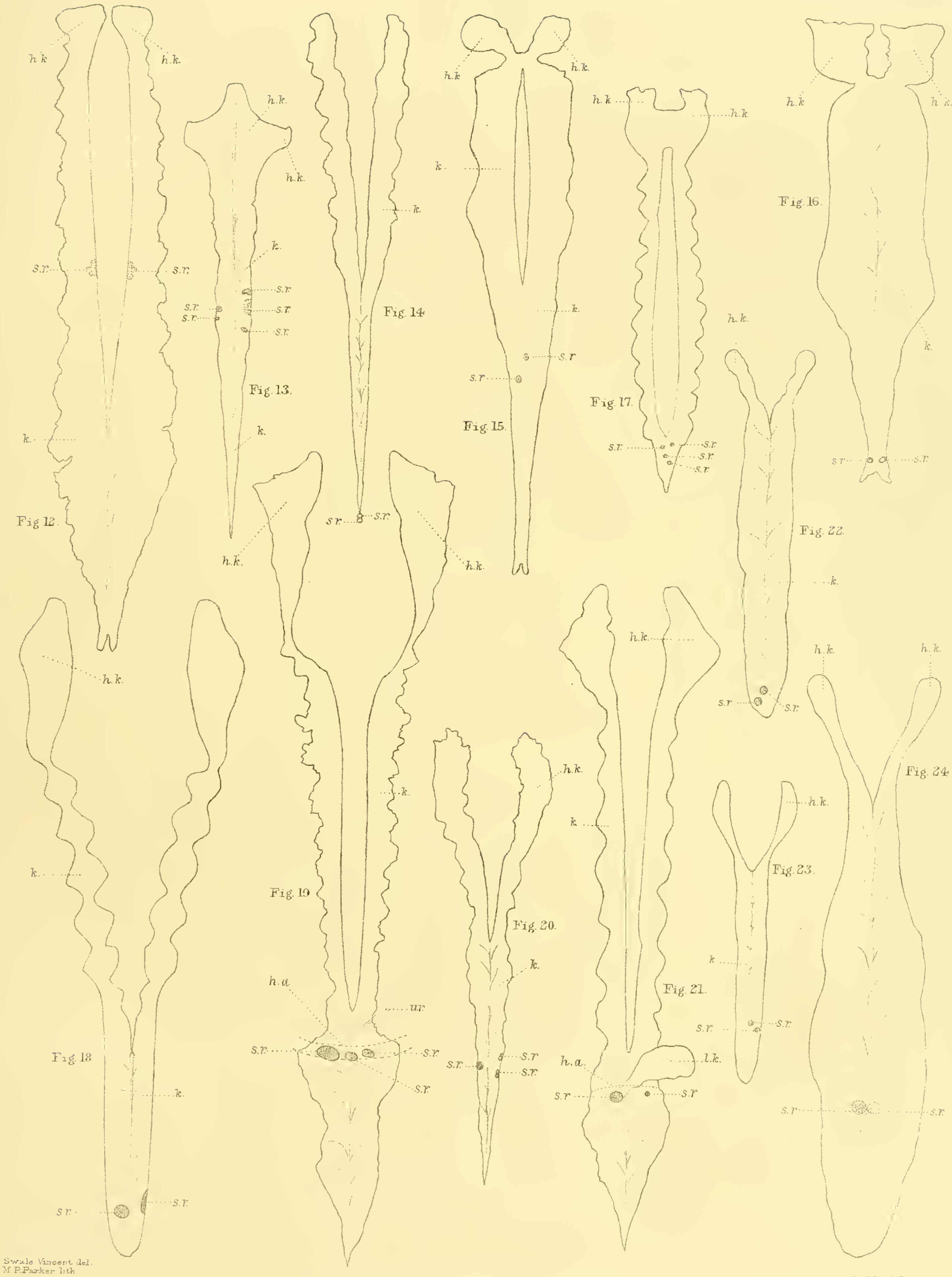
Geo West & Sons imp.



Swale Vincent del.
M P Parker lith.

SUPRA-RENAL BODIES IN FISHES.

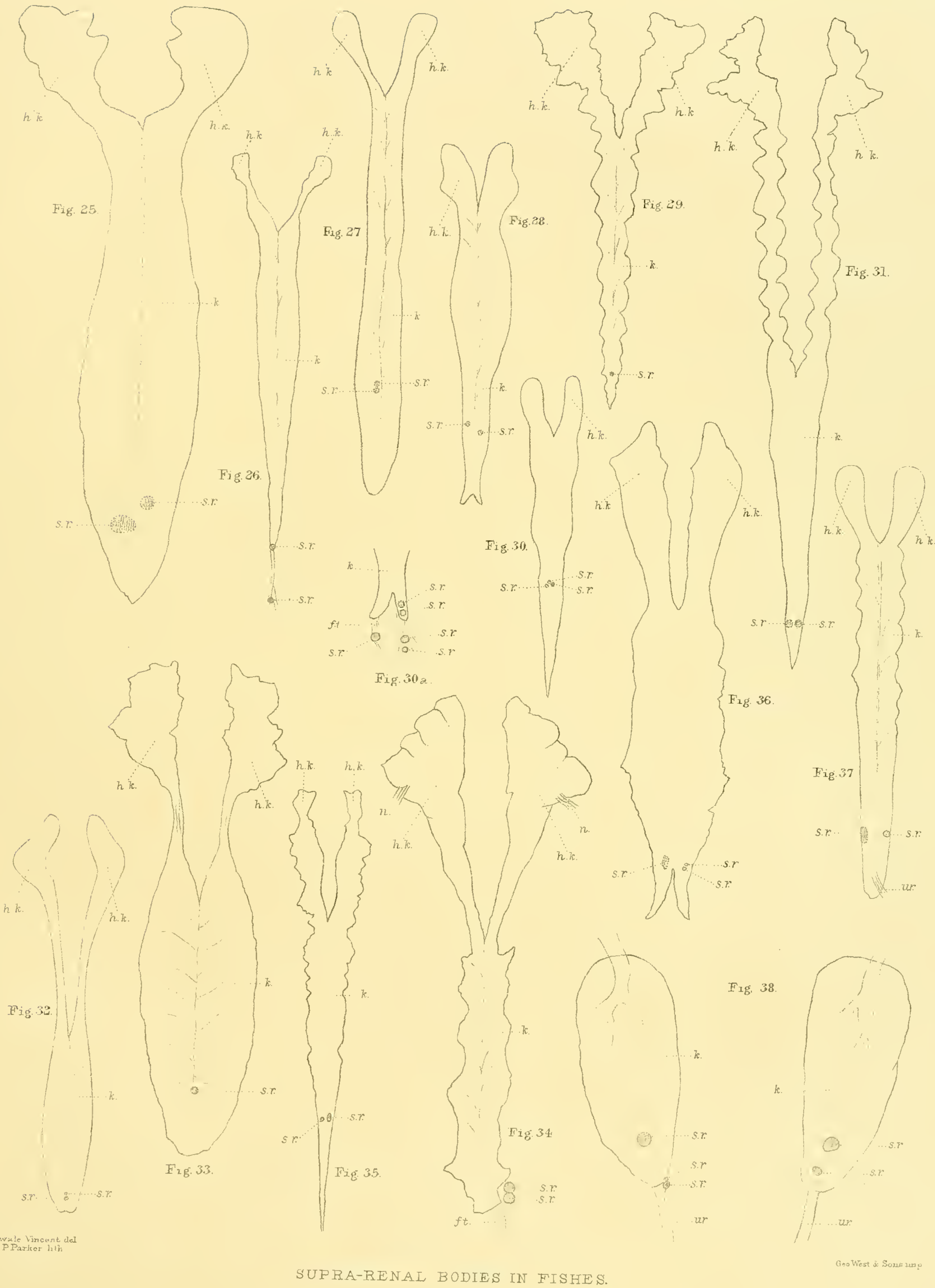
Geo. West & Sons imp.



Swale Vincent del.
M. P. Parker lith.

Geo West & Sons imp.

SUPRA-RENAL BODIES IN FISHES.



Swale Vincent del.
M. P. Parker lith.

Geo. West & Sons imp.

SUPRA-RENAL BODIES IN FISHES.

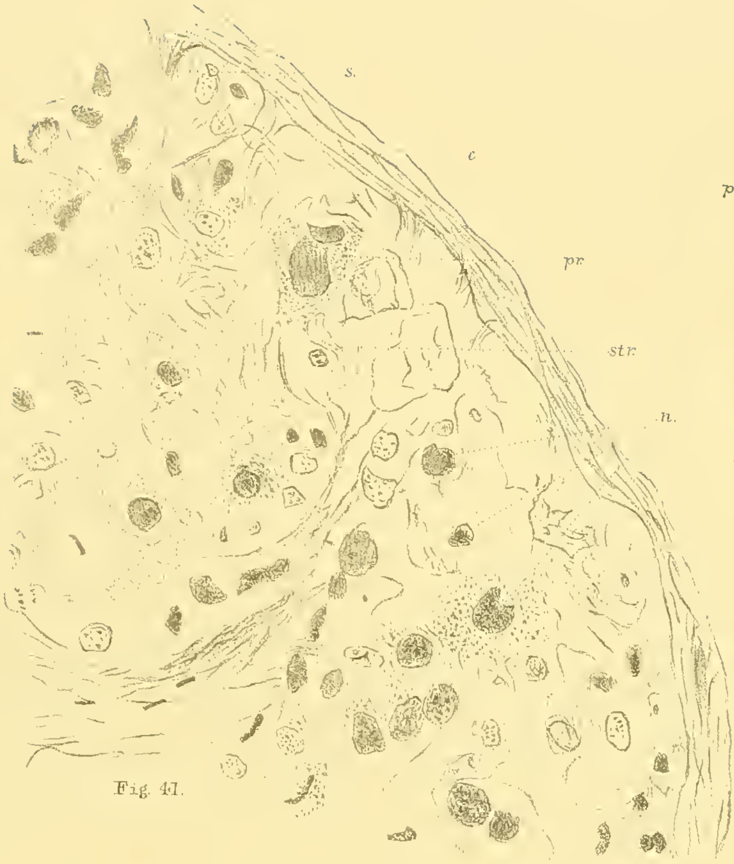


Fig. 41.

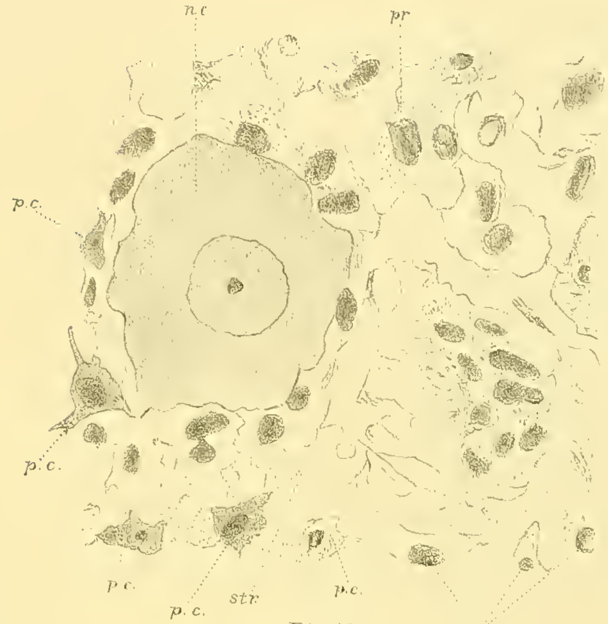


Fig. 42.

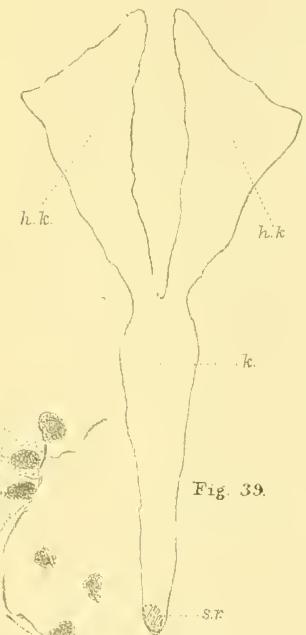


Fig. 39.

Fig. 40.

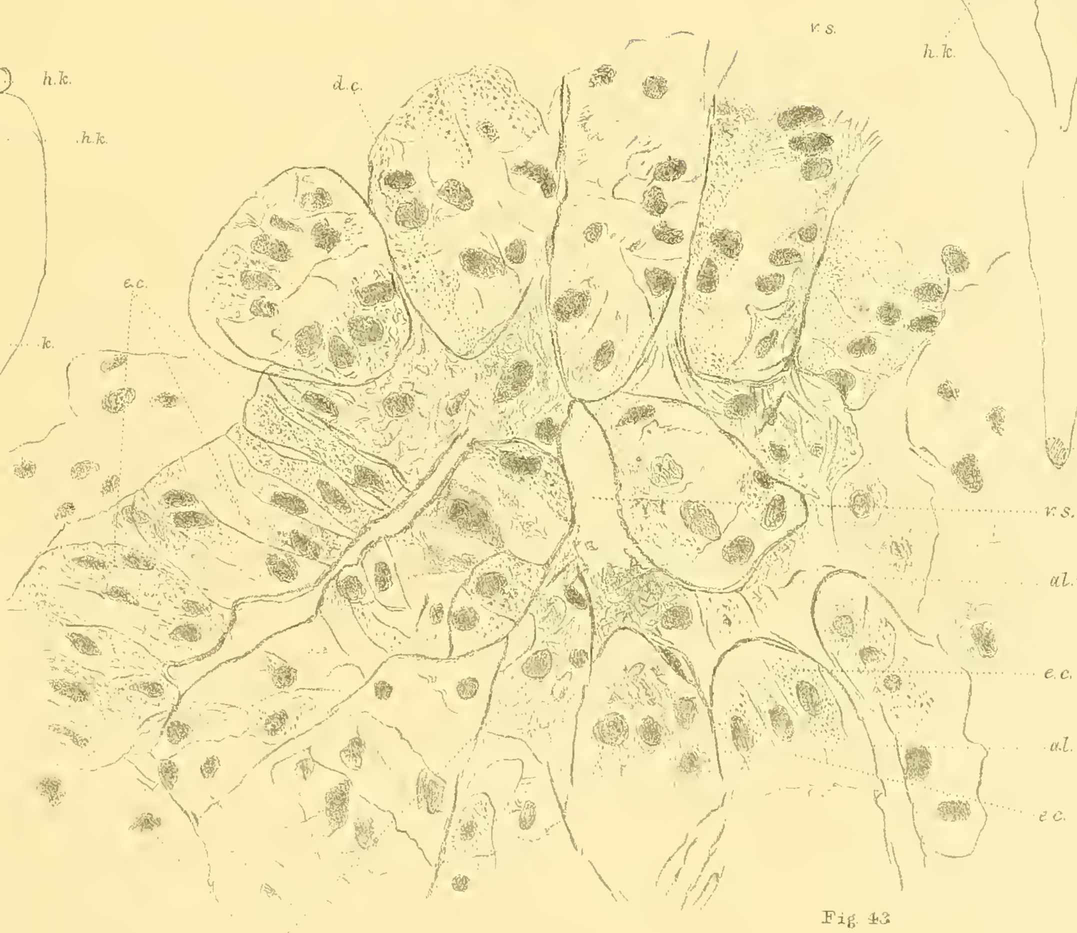


Fig. 43

Swale Vincent del.
M.P. Parker lith.

Geo West & Sons imp.

SUPRA-RENAL BODIES IN FISHES.

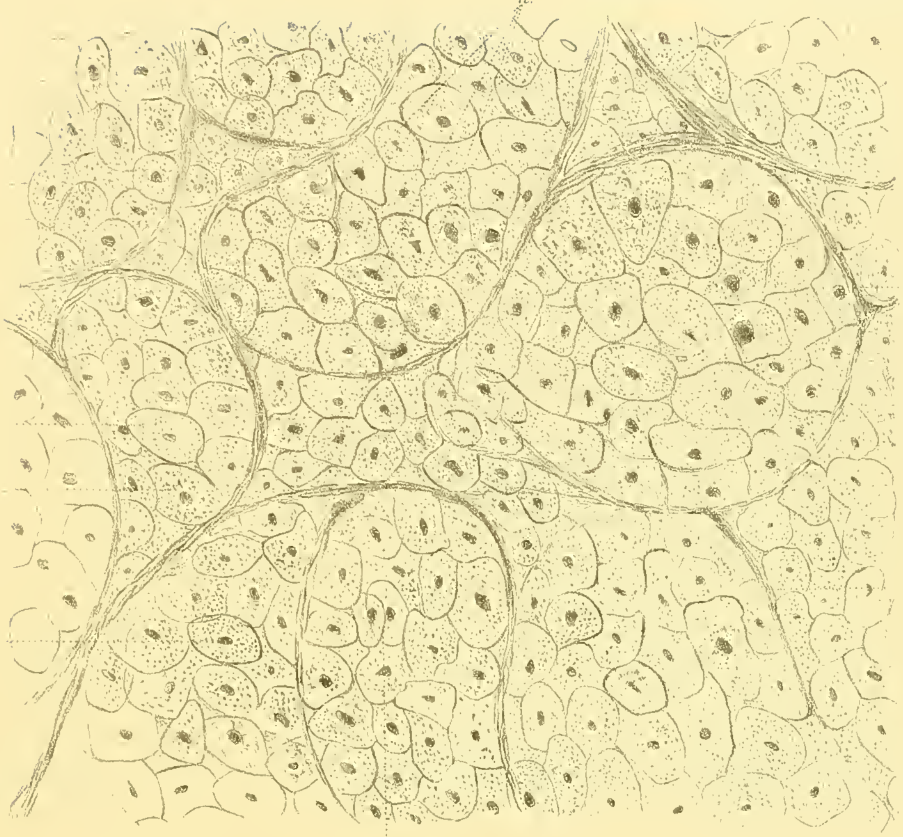


Fig. 44.

Fig. 46

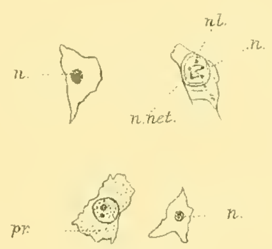


Fig. 49.

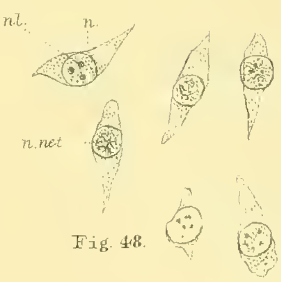


Fig. 48.

Fig. 47.

Fig. 45

Swale Vincent del.
M. P. Parker lith.
Geo West & Sons imp.

SUPRA-RENAL BODIES IN FISHES.

V. *A Supplementary Report on the Crustaceans of the Group* Myodocopa *obtained during the 'Challenger' Expedition, with Notes on other new or imperfectly known Species.* *By* G. STEWARDSON BRADY, *M.D., LL.D., F.R.S.*

Received August 28, 1895, read December 3, 1895.

[PLATES XV.-XVII.]

SINCE the publication of my Report on the Ostracoda of the 'Challenger' Expedition I have received from Dr. John Murray and Professor G. O. Sars further specimens which were met with during the examination of other groups of Crustacea. All of them are pelagic species belonging to the group *Myodocopa*, and it is with Dr. Murray's approval that I record them here. In addition to the specimens so obtained, I am in possession of other undescribed or imperfectly known forms which have come into my hands at various times and which are of sufficient interest to make their further description desirable. Among these are some collected by my brother, the late Dr. H. B. Brady, F.R.S., among the South Sea Islands, and which were described by me a few years ago [1] in the 'Transactions' of the Royal Society of Edinburgh. At that time, however, I was unacquainted with the soft parts of many of the species, and was able to describe the shells only. Some of these descriptions I am now able to improve by the addition of anatomical details derived from the examination of macerated specimens.

OSTRACODA.

Section *MYODOCOPA.*

Family CYPRIDINIDÆ.

Genus CYCLASTEROPE, nov. gen.

The shell is more nearly spherical than is usual in *Asterope*. Frontal tentacle stout, 3-(or 2?)jointed. The first joint of the mandibular foot has a falcate masticatory process as in *Asterope*, but much more elaborately spinous; the second joint, instead of being produced backwards in an angular process, bears on its distal margin a large tongue-like appendage which extends as far as the extremity of the following joint. The last limb (vermiform foot) is very profusely armed with setæ, many of the segments bearing two or three on each lateral margin. In other respects the anatomy is that of *Asterope*.

[1] "On Ostracoda collected by H. B. Brady, Esq., LL.D., F.R.S., in the South Sea Islands," Transactions of the Royal Society of Edinburgh, vol. xxxv. part 11 (1888).

Cyclasterope hendersoni, n. sp. (Plate XV. figs. 1–12.)

Shell of the female (figs. 1, 2) very tumid, subspherical: seen from the side broadly ovate; greatest height situated near the middle and equal to two-thirds of the length; anterior extremity somewhat narrowed in comparison with the posterior, which is broad and well rounded; the beak narrow, curved, and sharply pointed, notch very narrow; dorsal margin boldly arched, but towards the front flattened and rather steeply sloping; ventral margin evenly and gently convex. Seen from above the outline is subovate, wide in the middle and but slightly tapered towards the extremities, width nearly equal to the height; lateral margins strongly convex, anterior extremity rather abruptly narrowed, obtuse and slightly produced, posterior rounded. Surface of the shell smooth or but very slightly punctated; the anterior margin clothed with very small fine hairs; colour yellowish. Length 7 millim. Male unknown.

Frontal tentacle (fig. 3) stout, two-jointed, the basal joint short; apical joint twice as long, subclavate, constricted at the base, and slightly also in the middle, whence it tapers gradually to the extremity. Secondary branch of the antenna (fig. 4) two-jointed, geniculated, basal joint bearing several marginal setæ, distal joint one long ringed seta. The basal joint of the mandibular foot bears a falciform masticatory process the convex side of which is, towards the apex, divided into numerous very irregular processes (figs. 6–8), those at the apex being slender and falcate, the others broader, tooth-like, and marginally denticulated: below this series of processes the margin of the organ forms a flattened laminar flange which bears several transverse rows of spinules. The last pair of limbs ("vermiform feet") take the form, usual in Cypridinidæ, of flexuous hollow cylinders containing in the interior a spirally coiled chitinous thread: the free extremity (fig. 9) has four sets—two on each side—of spine-like teeth, and bears a vast number (about two hundred and fifty) of fine barbed setæ (fig. 10), which spring irregularly from the margins of the segments and are of various lengths, a single segment frequently having on each side three setæ of different sizes, others only one or two.

Each caudal lamina bears eight slender curved ungues, which increase progressively in length from the first to the last, the first four, however, being distinctly smaller and less robust than the rest (fig. 11); the concave margins of the ungues finely pectinated with lancet-shaped spinules (fig. 12). In the intervals between the third, fourth, fifth, and sixth ungues are attached small marginal setæ about one-third as long as the ungues themselves: the abdominal margin in front of the ungues is densely hispid.

The eyes consist of subreniform black pigment-masses about which numerous simple convex lenses are clustered in regular rows; a delicate capsule invests the whole structure, and is continued over a peduncle in which are contained muscles for the movement of the eye as well as numerous nucleated (nerve ?) cells. The whole organ lies loosely within the shell and has no attachment to the body of the animal except by its peduncle. There are seven pairs of laminar branchiæ, and in all essential particulars the anatomy is that of *Asterope*.

I have pleasure in naming this fine species after Mr. Henderson of the Christian College, Madras, to whom I am indebted for numerous specimens.

The species was dredged by Mr. Henderson in Madras Harbour in a depth of 4–5 fathoms.

CYCLASTEROPE ORBICULARIS, n. sp. (Plate XV. figs. 13–19.)

Female.—Shell rather thin, subspherical (figs. 13, 14): seen from the side almost circular, height equal to five-sixths of the length; beak short and sharp; rostral notch narrow and moderately deep, situated quite in the middle of the anterior margin; seen from above the outline is regularly ovate, tapering a little towards the posterior extremity, which is evenly rounded off, and more considerably to the front, which is somewhat obtuse. Anterior margins of the shell fringed with short fine hairs; surface smooth; colour light brown. Frontal tentacle (fig. 15) three-jointed; the second joint short, last joint elongated, conical. Secondary branch of the antenna three-jointed (fig. 16); first joint broad and fringed below with numerous fine hairs, second much more slender and bearing a single short marginal seta, third very small and ending in a single long ringed seta. The mandibular foot (fig. 17) is very similar to that of *C. hendersoni*, except that the falciform process (which having been broken was only partially seen) seems to be much smaller and less elaborately armed. Caudal laminæ (fig. 19) broad and short, bearing eleven marginal ungues, the first eight of which are merely slender closely-set curved setæ, nearly equal in length and slightly spinulose; the remaining three are very stout, strongly curved, and bear numerous marginal teeth, the first of them about as long as the preceding setæ, the second twice, and the third fully three times as long; abdominal margin in front of the lamina densely hairy. Length of the shell 2·7 millim.

I have seen only one specimen of this species. It bears the inscription "Valparaiso," without any further particulars; and I am not sure whether I had it from the Challenger' or from some other source.

Genus CYPRIDINA, Milne-Edwards.

CYPRIDINA ALBOMACULATA, Baird.

1880. *Cypridina albomaculata*, Baird, "Note upon the Genus *Cypridina*, Milne-Edwards," Proc. Zool. Soc. Lond., Annulosa, p. 201, pl. lxxi. figs. 1, 1*a*, 1*b*, 1*c*, 1*d*.

The type of this species is in the British Museum, and is stated in Dr. Baird's description to be from "Swan River,—from the collection of Mr. Cuming." The single specimen which I possess was taken many years ago by Dr. Coppinger, of H.M.S. 'Alert,' in Dundas Strait, N.W. Australia.

CYPRIDINA CASTANEA, n. sp. (Plate XVI. figs. 1–4.)

Male.—Shell corneous, flexible, dark brown, as are also the limbs of the animal. The rostrum is bordered by a thin scale-like flange, which is strengthened below by several stout spines; the convexity of the sub-rostral cleft has a fringe of numerous slender spines, which are long in the middle of the series and gradually smaller towards the ends; the shell-surface near the rostral angle has also an elevated hump to which are attached a number (about fifteen) of long, rigid setæ (fig. 1). Masticatory process of the mandibular foot bifid and bearing a long lateral seta (fig. 2). The antennules have two long apical setæ and several small sensory ones, and to two of the smaller of these are attached circular, saucer-shaped disks. The distal extremity of the first maxilla (fig. 3) bears numerous ciliated setæ, and four very stout spine-like teeth which have spinulose margins. Caudal laminæ (fig. 4) provided with nine equidistant, slender, curved, and denticulated ungues, the last two of which are very long, the rest gradually decreasing in length to the first. Length of the shell about 7 millim.

One example only of this species was taken by the 'Challenger' Expedition in a "deep haul" from the Atlantic, lat. 32° 41′ N., long. 36° 6′ W., depth 1675 fathoms, 6th May, 1876. The specimen was much damaged, and neither the shell nor the soft parts were in a condition to be accurately examined. Provisionally, however, it may be referred to the genus *Cypridina*, though some of the characters show an approach to *Philomedes*.

CYPRIDINA BAIRDI, G. S. Brady. (Plate XVI. figs. 22, 23.)

1865. *Cypridina bairdii*, G. S. Brady, "On new or imperfectly known species of Marine Ostracoda," Trans. Zool. Soc. vol. v. p. 387, pl. lxii. figs. 7 *a–m*.

Of this species I have seen no specimens other than those on which the original description was founded. The squamous outgrowths of the shell in the neighbourhood of the beak (figs. 22, 23) are, however, somewhat similar to those of *C. castanea*, with which the soft parts also agree so far as they have been examined. It is probable that a fuller knowledge of the two forms may show other points of resemblance.

C. bairdii was taken in the tow-net, off Pescadores, China, by the late Mr. A. Adams.

CYPRIDINA JAPONICA, G. S. Brady.

1865. *Cypridina japonica*, G. S. Brady, *loc. cit.* p. 386, pl. lxii. figs. 8 *a–d*.

This would appear, from the imperfectly preserved specimen in my collection, to be rightly referred to the genus *Cypridina*.

Collected in Japan by Mr. A. Adams.

CYPRIDINA (?) ELONGATA, G. S. Brady.

1865. *Cypridina elongata*, G. S. Brady, *loc. cit.* p. 386, pl. lxii. figs. 9 *a–d*.

Respecting this species I am able to add nothing to the short description already published.

(?) CYPRIDINA PUNCTATA, Dana. (Plate XVI. figs. 5–9.)

1852. *Cypridina punctata*, Dana, Crustacea of U.S. Exploring Exped. p. 1293, pl. ix. figs. 2 *a, b*.

Three specimens only of a species closely similar to, if not identical with, Dana's *C. punctata* were taken by the 'Challenger' Expedition at some point, not accurately noted, in the Eastern Archipelago. All the three were in very bad condition—many of the limbs broken or absent. In no case have I been able to find the slightest trace of the vermiform limb.

Shell extremely thin and membranaceous: seen from the side (fig. 5) subovate, greatest height in the middle and equal to somewhat more than half the length, dorsal and ventral margins evenly arched, the dorsal having the larger curve; anterior extremity obliquely subtruncate, with a short wide beak, above which is a shallow sinuation, subrostral sinus narrow; posterior extremity produced below the middle into a rather wide, obtusely angular process, which is continuous with the ventral margin below, but is separated from the dorsal margin by an abrupt sinuation; seen from above the outline is ovate, with produced subacute extremities. The mandibular foot terminates in three short, equal ungues (fig. 7), which are slightly swollen at their bases; there is also a single slender curved seta, considerably shorter than the ungues; the masticatory process (fig. 8) is slightly bifid at the apex. Caudal laminæ (fig. 9) having eight marginal ungues, the first three extremely small and weak, the rest successively increasing in length to the last; the fifth, sixth, and seventh ungues are not articulated to the limb but are simply processes of it. Length of the shell 1·5 millim.

CYPRIDINA DANÆ, G. S. Brady. (Plate XVI. fig. 24.)

1880. *Cypridina danæ*, Brady, Report on the Ostracoda of the 'Challenger' Expedition, p. 156, pl. xxxvi. figs. 2 *a–d*.

The head of the vermiform appendage, here figured, is peculiar, the upper portion being massive, strongly curved, and armed with a series of marginal teeth; the lower portion much smaller, and consisting of a simple, almost rectangularly curved process, wide at the base but slender beyond the middle.

CYPRIDINA (?) ARMATA, n. sp. (Plate XV. figs. 20, 21.)

Shell thin and membranaceous: seen from the side oblong, subovate, greatest height situated in the middle and equal to two-thirds of the length; dorsal and ventral margins evenly arched; beak wide, obtusely pointed, notch deeply excavated; posterior extremity wide, produced in the middle into a broad, bifid prominence. Seen from above the outline is subpentagonal, with parallel and almost straight lateral margins, which in front of the middle converge sharply towards the subacute anterior extremity; posterior extremity very wide, scarcely narrower than the widest part of the shell, truncated, the outer angles forming two backward-pointing spines, obtusely mucronate in the middle. Surface of the shell smooth; behind the middle, on the lateral aspect of each valve, there is a very large, acutely lancet-shaped spine which points directly backwards, its point reaching almost as far as the hinder border of the shell; just within the dorsal margin, above the base of the larger spine, is a much smaller one of similar form, but pointing upwards. Colour brown, the spines almost black at their apices. Length 1·4 millim.

Animal unknown.

One specimen from a depth of 7 fathoms, Flinders Passage, Sept. 8th, 1874—'Challenger' Expedition.

Cypridina (?) squamosa, n. sp. (Plate XVI. figs. 10–12.)

Shell very thin and membranaceous: seen from the side almost circular (fig. 10), the height equal to about three-fourths of the length; anterior extremity broadly rounded, the beak wide and almost rectangular, notch deep and narrow; posterior extremity rounded above the middle, below the middle forming a wide truncate prominence; dorsal and ventral margins boldly convex. Shell marked throughout with a reticulated pattern as of imbricated scales (fig. 11). Caudal laminæ (fig. 12) bearing only three ungues, which are strongly curved, the first being very small, the second about thrice as long, and the third twice as long as the second. Length 0·9 millim.

One specimen only of this species has been noticed; it occurred in a gathering from the Eastern Archipelago the precise locality of which was not stated. Only fragments of the soft parts were recognizable, and its position as a *Cypridina* must be looked upon as provisional only.

Genus Philomedes, Lilljeborg.

Philomedes agilis, Thomson. (Plate XVI. figs. 13–16.)

1878. *Philomedes agilis,* Thomson, "On the New Zealand Entomostraca," Trans. New Zealand Institute, vol. xi. p. 257, pl. xi. fig. C. 8 *a–e*, D. 1 *a–g*.

Male.—Shell, seen from the side (fig. 13), oblong, ovate, greatest height in the middle and equal to about two-thirds of the length, beak obtuse and only slightly produced, notch very shallow, anterior extremity narrow and somewhat angular, posterior broad and well rounded; dorsal and ventral margins equally arched; the dorsal margin, especially in its posterior half, irregularly emarginate and presenting an abruptly undulated outline. Seen from above, the outline is compressed, subclavate, sides nearly parallel but slightly converging towards the obtusely-pointed front; posterior extremity wide and subtruncate, greatest width considerably less than half the length. Surface of the shell covered with numerous subrotund pits and sparingly setose. Colour light brown. Eyes large and black. Length 1·9 millim.

Secondary branch of the antenna (fig. 14) three-jointed and strongly prehensile; basal joint short and bearing several setæ, one of which is long and plumose; second joint much elongated, and having two long setæ in the middle of the external margin; third joint also long, curved, with a denticulated external margin, a single long seta at the base, its apex rounded, crenulated, and slightly split up in a multifid fashion.

Apex of the vermiform appendage (fig. 15) having its upper process armed with five slender curved spines; lower portion rounded, obtuse, and toothless. Caudal laminæ (fig. 16) bearing three principal ungues and six very small spine-like setæ: the first five setæ are quite minute, then follows a strong curved unguis of moderate size; a sixth small seta intervening between it and the following unguis, which is twice as long as the preceding; the last unguis is still longer and, like its neighbour, has a spinulose margin.

Female.—"Valves somewhat larger and much more circular in outline, with the beak small and very slightly produced; oral notch nearly rectangular; height about three-fourths of the length; easily distinguished externally from the male by the small size of the eye-spot. Eyes reddish."

I am indebted to Professor G. M. Thomson, of Otago, for specimens of this interesting species, which was taken by him "swimming actively in the rock-pools on the Taieri Beach." The specimens sent to me were all males. I have therefore quoted Prof. Thomson's description of the female shell.

PHILOMEDES CORRUGATA, n. sp. (Plate XVI. figs. 17–21.)

Shell very tumid: seen from the side (fig. 17) subrhomboidal, highest about the middle, height equal to two-thirds of the length; the dorsal and ventral margins markedly convex; anterior extremity narrowed and rather oblique, beak blunt and not very prominent, notch very shallow; posterior extremity evenly rounded. Seen from above (fig. 18), the outline is subpentagonal, greatest width situated behind the middle and equal to four-fifths of the length; the anterior margin is rounded off but extremely broad and almost subtruncate, the posterior margin slopes very abruptly and with an irregularly sinuous curve from the widest point, and terminates in a very broad obtusely rounded median process; the lateral margins converge very slightly and in sinuous fashion towards the wide anterior extremity. The surface of the shell is much wrinkled and pitted, and slightly hispid with short distant hairs. Colour reddish brown. Length 1·4 millim.

The sculpturing and general outline of the shell as shown in the lateral view (fig. 17) are possibly to some extent incorrect owing to shrivelling of the specimen when taken out of the spirit. The soft parts of the animal, so far as they can be made out, do not differ materially from those generally belonging to the genus.

The first three natatory setæ of the female antenna are marginally spinous as in *Pleoschisma* (see figs. 3, 4, Pl. XVII.); so also is the first seta of the male antenna. The prehensile branch of the male antenna (fig. 19) is irregularly dentated on both margins. Caudal laminæ (fig. 20) armed with seven marginal setæ, four of which are unguiform and much stouter than the others; of these ungues the first is very short, the second about twice as long, the third twice as long as the second, and the fourth slightly longer than the third; three very short, slender, and nearly equal setæ are placed in front of the first unguis and in the spaces behind the first and second and second and third ungues.

Hab. One specimen (a male) of this species was found in a tow-net gathering from a depth of 2–10 fathoms, off Port Jackson, Australia; another (female) from a depth of 7 fathoms in Flinders Passage, Australia.

Genus Pleoschisma, G. S. Brady.

Pleoschisma moroides, G. S. Brady. (Plate XVII. figs. 1–11.)

1888. *Pleoschisma moroides,* G. S. Brady, "On Ostracoda collected by H. B. Brady, Esq., LL.D., F.R.S., in the South Sea Islands," Trans. Roy. Soc. Edinb. vol. xxxv. p. 514, pl. i. figs. 23, 24.

"Shell, seen from the side, subcircular, height equal to three-fourths of the length. Anterior extremity wide, feebly rounded, almost flat, notch obsolete; posterior narrower, rounded, slightly sinuated above and below; dorsal and ventral margins moderately convex. Seen from above, broadly ovate, nearly equal in width throughout; extremities broad and rounded, the anterior rather the narrower of the two; lateral margins moderately arcuate; width equal to four-sevenths of the length. Surface of the shell minutely punctated, and in old specimens raised into circular bosses; colour dark brown. Length 1·2 mm."

Antennules, in both sexes, very similar to those of *Philomedes*: the sensory setiferous seta attached to the antepenultimate joint in the male is dilated at the base, and is setiferous on the outer side only (fig. 1). The antenna of the male is larger than that of the female, and the dilated basal joint is closely and delicately striated (fig. 2); the first and third joints of the natatory branch are very long, the relative lengths of the nine joints being approximately as follows: $\frac{1\,.\,2\,.\,3\,.\,4\,.\,5\,.\,6\,.\,7\,.\,8\,.\,9}{18\;\;4\;\;14\;\;3\;\;2\;\;2\;\;2\;\;2\;\;1}$; the secondary branch is strongly prehensile, its terminal joint curved, its concave margin deeply and irregularly indented, and its apex minutely crenulated (fig. 5); each of these two joints bears a single seta; the much smaller basal joint has four or five small cilia. In the female (fig. 3) the basal joint is not at all striated, and the relative lengths of joints of the natatory branch (fig. 3) are as follows: $\frac{1\ .\ 2\ .\ 3\ .\ 4\ .\ 5\ .\ 6\ .\ 7\ .\ 8\ .\ 9}{20\ \ 3\ \ 3\ \ 1\frac{1}{2}\ \ 1\frac{1}{2}\ \ 1\frac{1}{2}\ \ 1\frac{1}{2}\ \ 1\frac{1}{2}\ \ 1\frac{1}{2}}$; the setæ attached to the second, third, fourth, and fifth joints are extremely short, equal in length, and are armed with short stout spines along their outer margins (figs. 3, 4); the setæ of the last four joints are from three to four times as long as the preceding and are not spinous; secondary branch simple, curved, one-jointed. The mandibular foot is four-jointed, and is in the male (fig. 7) devoid of any masticatory process, but bears nnmerous simple setæ; in the female the first joint bears a bifid process, and the second has, in addition to several simple setæ, a small bisetose finger-like process at its distal end (fig. 8). The first maxilla (fig. 6) consists of one stout principal lobe with four smaller lobes, all of which are setiferous, most of the stouter setæ having one of the margins strongly denticulated: the principal lobe is two-jointed, the last joint small and giving attachment to about six apical setæ, which are graduated in size from the first to the last and bear strong marginal teeth. The vermiform limb has a single claw-like process at its apex. Caudal laminæ (fig. 10) short; the first three marginal appendages consisting of very short slender setæ, the fourth an unguiform spine about twice as long as the preceding setæ and very much stouter; then follows another small seta, then a second stout unguis about twice as long as the first, and lastly a third unguis which is more than twice as long as the second. Eyes small, deep red, the lenses irregularly placed and of very unequal size; in the male subreniform (fig. 11), in the female smaller and globose.

My first description of this genus was deficient in any account of the soft parts of the animal, but I have recently by careful maceration of some of the dried shells been able to obtain preparations which show, though imperfectly, some of the more important structures. These are certainly sufficiently characteristic, and even apart from the shell would constitute a valid generic distinction.

The specimens were obtained from various localities among the South Sea Islands.

Genus Sarsiella, Norman.

Sarsiella sculpta, G. S. Brady. (Plate XVII. figs. 12, 13.)

1888. *Sarsiella sculpta*, G. S. Brady, "Ostracoda collected in the South Sea Islands," Trans. Roy. Soc. Edinb. vol. xxxv. p. 517, pl. i. figs. 17–20.

The original description of this species was taken from the shell only, but I have recently succeeded in finding remains of the soft parts in a specimen taken by the 'Challenger,' and from it I have here figured the end of the vermiform foot and one of the caudal laminæ. These, it will be seen, exactly agree with *Sarsiella*.

The 'Challenger' specimen was taken at a depth of 7 fathoms in Flinders Passage.

Sarsiella simplex, G. S. Brady. (Plate XVII. figs. 16–19

1888. *Sarsiella simplex*, G. S. Brady, "Ostracoda collected in the South Sea Islands," Trans. Roy. Soc. Edinb. vol. xxxv. p. 516, pl. iv. figs. 15, 16.

One specimen was taken by the 'Challenger' Expedition in the tow-net off Cape Howe, Australia, at night.

Sarsiella robusta (G. S. Brady). (Plate XVII. figs. 14, 15.)

1888. *Pleoschisma robusta* ♂, G. S. Brady, "Ostracoda collected in the South Sea Islands," Trans. Roy. Soc. Edinb. vol. xxxv. p. 513, pl. iv. figs. 13, 14.

Further examination of the dried shells of this species has revealed portions of the limbs, which show that it must be referred to the genus *Sarsiella*. The antennules (fig. 14) are provided with the dense fascicle of hairs which has been described by Dr. G. W. Müller as characteristic of the male *Sarsiella*, and also by Dr. Norman and myself under the genus *Nematohamma*.

Genus Eurypylus, G. S. Brady.

Eurypylus petrosus, G. S. Brady. (Plate XVI. figs. 25, 26.)

1870. *Eurypylus petrosus*, G. S. Brady, Les Fonds de la Mer, tome i. p. 141, pl. xviii. figs. 1, 2.

The type specimen of this species remains as yet the only one which has been seen. It was described from the shell only, and inasmuch as other very nearly allied forms belonging to the genera *Sarsiella* and *Pleoschisma* have since been published, I thought it well to sacrifice the shell for the sake of examining the contained animal, of which, unfortunately, I succeeded in obtaining fragments only. The mandibular foot (fig. 25) and caudal lamina (fig. 26) are here figured. The former, it will be seen, is very similar to that of *Sarsiella*; the latter to that of *Pleoschisma*. The differences are in fact quite sufficient to indicate three distinct genera.

The type of *Eurypylus* was taken off St. Vincent (Cape Verd).

Family HALOCYPRIDÆ.

Of many of the species belonging to this group I have seen only imperfect examples, and cannot, therefore, figure or describe them satisfactorily. They have, however, been fully illustrated by Dr. Claus in his works on the Atlantic and Mediterranean Halocypridæ. Some of the new genera proposed by Dr. Claus seem to me to be based on trivial and insufficient characters, and are adopted here only as a temporary expedient.

The most interesting point in connexion with the specimens here noted is the confirmation which they afford to the generally accepted idea of the almost cosmopolitan distribution of many pelagic animals. With one exception they are referable to species already described by Dr. Claus from the North Atlantic and Mediterranean, whereas the 'Challenger' specimens are mostly from the Pacific and Australasian areas.

Genus Conchœcia, Dana (in part).

Conchœcia bispinosa, Claus.

1890. *Conchœcia bispinosa*, Claus, Die Gattungen und Arten der mediterranen und atlantischen Halocypriden, p. 10.
1891. „ „ Claus, Die Halocypriden des atlantischen Oceans und Mittelmeeres, p. 59, pl. v., pl. vi. fig. 1, pl. viii. figs. 7, 8.

Taken in the tow-net during the 'Challenger' Expedition: lat. 32° 41′ N., long. 36° 6′ W.; and in lat. 36° 32′ S., long. 132° 52′ W.

Genus Paraconchœcia, Claus.

Paraconchœcia oblonga, Claus. (Plate XVII. figs. 20, 21.)

1890. *Paraconchœcia oblonga*, Claus, Die Gattung. und Arten der medit. und atlant. Halocypr. p. 13.
1891. „ „ Claus, Die Halocypr. des atlant. Oceans und Mittelmeeres, p. 63, pl. viii. figs. 10, 11, pl. ix.

Hab. Off Kandabu, Fiji; and in lat. 46° 46′ S., long. 45° 31′ E. (St. 146, 'Challenger'). The specimens described by Dr. Claus were from lat. 37° 45′ N., long. 13° 38′ W., depth 1500 metres; and from lat. 34° 18′ N., long. 15° 34′ W., depth 1000 metres. I have no record of the depth at which the 'Challenger' specimens were taken.

Genus Conchœcetta, Claus.

Conchœcetta acuminata (?), Claus.

1890. *Conchœcetta acuminata*, Claus, Die Gattung. und Arten der medit. und atlant. Halocypr. p. 16.
1891. „ „ Claus, Die Halocypr. des atlant. Oceans und Mittelmeeres, p. 67 pl. xiii., xiv.

A single specimen, apparently belonging to the young of this species, was found in a 'Challenger' gathering from the neighbourhood of the Philippine Islands.

Genus Conchœcilla, Claus.

Conchœcilla daphnoides, Claus.

1890. *Conchœcilla daphnoides*, Claus, Die Gattungen und Arten der mediterranen und atlantischen Halocypriden, p. 18.
1891. „ „ Claus, Die Halocypriden des atlantischen Oceans und Mittelmeeres, p. 68, pl. xv.

One specimen from a gathering made by the 'Challenger' Expedition off Kandabu, Fiji.

Genus Conchœcissa, Claus.

Conchœcissa imbricata, G. S. Brady.

1880. *Halocypris imbricata,* G. S. Brady, Report on the Ostracoda of the 'Challenger' Expedition, p. 167.

1890. *Conchœcissa armata,* Claus, Die Gattungen und Arten der mediterranen und atlantischen Halocypriden, pp. 19, 20.

1891. „ „ Claus, Die Halocypriden des atlantischen Oceans und Mittelmeeres, p. 70, pl. xvi., xvii., xviii.

This is referred doubtfully by Dr. Claus to his more recently described species, *Conchœcissa armata*, and, notwithstanding the slight discrepancies referred to by that author, I can scarcely doubt that the two are identical.

Genus Pseudoconchœcia, Claus.

Pseudoconchœcia serrulata, Claus. (Plate XVII. figs. 22–24.)

1874. *Conchœcia serrulata,* Claus, Die Familie der Halocypriden, p. 61, pl. i. figs. 2–7, 9–11, pl. ii. figs. 12, 13, 17, 19.

1880. *Halocypris atlantica,* Brady, Report on the Ostracoda of the 'Challenger' Expedition, p. 164, pl. xi. figs. 1–15, pl. xli. figs. 11, 12.

1890. *Pseudoconchœcia serrulata,* Claus, Die Gattungen und Arten der mediterranen und atlantischen Halocypriden, p. 20.

1891. „ „ Claus, Die Halocypriden des atlantischen Oceans und Mittelmeeres, p. 72, pl. xix. figs. 1–14, pl. xxiii. figs. 1–13.

The reference of this species in the Report of the 'Challenger Expedition' to *Halocypris atlantica*, Lubbock, can scarcely be maintained, though the figures and description there given are, I think, correct so far as they go. The descriptions, both of Dana and Sir John Lubbock, are so concise and vague that it is impossible to say certainly to what they refer. There can, however, be no doubt that *Pseudoconchœcia serrulata*, Claus, is identical with *Halocypris atlantica* of the 'Challenger' Report. Some characters which were passed without notice in that Report I figure here—the hooked appendage of the right and left male antenna (figs. 23, 24) and the swimming-setæ of the same limb (fig. 22). These setæ are figured in order to show their narrowly lanceolated or spathulate extremities. All the setæ seem to end in this way, but the two springing from the apical joint much more distinctly so than the rest: in fact, it is not easy to see the slightly dilated apices of the lateral setæ except by rotating them so as to get a front view. But although it was in *P. serrulata* that I first noticed the dilated apices, I now find on closer investigation that the antennal setæ of other species (perhaps, indeed, of all the Halocypridæ) have a similar structure. This point is noted (though not figured) by Prof. Claus in his definition of the subfamily Conchœcinæ. There seems to be no such structure in the setæ of the Cypridinidæ.

P. serrulata occurred in many of the 'Challenger' gatherings. Those which I have been able to verify since recognizing the identity of the specimens are as follows:—Surface-net between Api and Cape York and off Port Jackson; in tow-net at 30 fathoms, South Atlantic, lat 42° 32′ S., long. 56° 27′ W.; and in lat. 35° 41′ N., long. 159° 41′ E.

Genus Microconchœcia, Claus.

Microconchœcia clausii (G. O. Sars).

1887. *Halocypris clausii,* G. O. Sars, Nye Bidrag til Kundskaben om Middelhavets Invertebrat-fauna, iv. Ostracoda Mediterranea, p. 87, pl. xi. figs. 7–10, pl. xiv. figs. 6–18.

1890. „ „ Claus, Die Gattungen und Arten der mediterranen und atlantischen Halocypriden, p. 22.

1891. *Mikroconchœcia clausii,* Claus, Die Halocypriden des atlantischen Oceans und Mittelmeeres, p. 73, pl. xx.

The only 'Challenger' gathering in which this species had been detected was from the surface-net off Kandabu, Fiji, where it occurred in considerable abundance.

Genus Halocypris, Dana.

Halocypris concha, Claus.

1874. *Halocypris concha,* Claus, Die Familie der Halocypriden, pl. ii. figs. 20–25, pl. iii. figs. 26–35.

1891. „ „ Claus, Die Halocypriden des atlantischen Oceans und Mittelmeeres, p. 77, pl. viii. fig. 12, pl. xi. figs. 6, 7, pl. xxii. figs. 1–12, pl. xxvi. fig. 11.

In a 'Challenger' surface-net gathering from the North Atlantic: lat. 26° 21′ N., long. 33° 37′ W.

Halocypris pelagica, Claus.

1890. *Halocypris pelagica,* Claus, Die Gattungen und Arten der Halocypriden, p. 25.

1891. „ „ Claus, Die Halocypriden des atlantischen Oceans und Mittelmeeres, p. 78, pl. xxi. figs. 1–11.

In two surface-net gatherings from the 'Challenger': lat. 35° 18′ N., long. 144° 8′ E.; and lat. 35° 41′ N., long. 157° 41′ E.

Genus Halocypria, Claus.

Halocypria globosa, Claus.

1890. *Halocypria globosa,* Claus, Die Gattungen und Arten der mediterranen und atlantischen Halocypriden, p. 25.

1891. „ „ Claus, Die Halocypriden des atlantischen Oceans und Mittelmeeres, p. 79, pl. xxii. figs. 13–18.

In the surface-net between Api and Cape York, and in lat. 36° 32′ S., long. 132° 52′ W. ('Challenger').

EXPLANATION OF THE PLATES.

PLATE XV.

Cyclasterope hendersoni, ♀ (p. 86).

Fig. 1. Shell seen from right side, } ×8.
Fig. 2. " above, }
Fig. 3. Frontal tentacle.
Fig. 4. Secondary branch of antenna.
Fig. 5. Mandibular foot.
Fig. 6. Falciform process of mandible.
Figs. 7, 8. End and side of falciform process, more highly magnified.
Fig. 9. End of vermiform limb.
Fig. 10. Segments of the same with setæ.
Fig. 11. Caudal lamina.
Fig. 12. " spines of unguis.

Cyclasterope orbicularis, ♀ (p. 87).

Fig. 13. Outline of shell seen from left side, } ×20.
Fig. 14. " above, }
Fig. 15. Frontal tentacle.
Fig. 16. Secondary branch of antenna.
Fig. 17. Mandibular foot.
Fig. 18. Maxilla of first pair: (*a*) terminal process of same.
Fig. 19. Caudal lamina.

Cypridina (?) *armata* (p. 89).

Fig. 20. Shell seen from left side, } ×40.
Fig. 21. " above, }

PLATE XVI.

Cypridina castanea, ♀ (p. 88).

Fig. 1. Supero-anteal margin of left valve.
Fig. 2. Mandibular foot.
Fig. 3. Masticatory lobe of first maxilla.
Fig. 4. Caudal lamina.

Cypridina punctata (p. 89).

Fig. 5. Outline of shell, $\times 40$.
Fig. 6. ,, rostrum of right valve.
Fig. 7. End of mandibular foot.
Fig. 8. Masticatory process of the same.
Fig. 9. Caudal lamina.

Cypridina (?) *squamosa* (p. 90).

Fig. 10. Shell seen from right side, $\times 50$.
Fig. 11. Portion of shell with sculpture.
Fig. 12. Caudal lamina.

Philomedes agilis, ♀ (p. 90).

Fig. 13. Shell seen from left side, $\times 40$.
Fig. 14. Secondary branch of antenna.
Fig. 15. Apex of vermiform foot.
Fig. 16. Caudal lamina.

Philomedes corrugata (p. 91).

Fig. 17. Shell of female seen from right side, }
Fig. 18. ,, above (Flinders Passage), } $\times 40$.
Fig. 19. Secondary branch of antenna, ♂.
Fig. 20. Caudal lamina.
Fig. 21. Outline of shell (Port Jackson).

Cypridina bairdi (p. 88).

Fig. 22. Outline of right valve in region of notch.
Fig. 23. Outline of left valve.

Cypridina danæ (p. 89).

Fig. 24. End of vermiform foot.

Eurypylus petrosus (p. 94).

Fig. 25. Mandibular foot.
Fig. 26. Caudal lamina.

PLATE XVII.

Pleoschisma moroides (p. 92).

Fig. 1. Apical joints of antennule, ♂.
Fig. 2. Antenna, ♂ (imperfect).
Fig. 3. „ ♀.
Fig. 4. „ one of the short setæ more highly magnified.
Fig. 5. „ secondary branch, ♂.
Fig. 6. First maxilla.
Fig. 7. Mandible, ♂.
Fig. 8. Mandible, ♀.
Fig. 9. End of vermiform foot.
Fig. 10. Caudal lamina.
Fig. 11. Eye, ♂.

Sarsiella sculpta (p. 93).

Fig. 12. End of vermiform foot.
Fig. 13. Caudal lamina.

Sarsiella robusta, ♂ (p. 94).

Fig. 14. Antennule.
Fig. 15. Secondary branch of antenna.

Sarsiella simplex, ♀ (p. 94).

Fig. 16. Shell seen from right side, } ×80.
Fig. 17. „ above, }
Fig. 18. First maxilla.
Fig. 19. Caudal lamina.

Paraconchœcia oblonga, ♂ (p. 95).

Fig. 20. Shell seen from left side, ×40.
Fig. 21. Anterior margin of shell.

Pseudoconchœcia serrulata, ♂ (p. 96).

Fig. 22. Natatory branch of antenna.
Fig. 23. Secondary branch of right antenna.
Fig. 24. „ left „

G. S. Brady del.
M. P. Parker lith.

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Continued on page 3 of Wrapper.

VI. *A Revision of the Oriental* Hesperiidæ. *By* H. J. Elwes, *F.R.S.*, *F.L.S.*, *F.Z.S.*, *and* James Edwards, *F.E.S.*[1]

Received April 14, 1896, read June 2, 1896.

[Plates XVIII.–XXVII.]

Although Mr. F. Moore had previously described many genera and species of Hesperiidæ, the majority of which are sound and well characterized, yet this large and difficult group of Butterflies was, perhaps, less known than any other in the Old World before Mr. de Nicéville and Captain Watson began to pay attention to it; and until Captain Watson's paper on the classification of the family in the Proceedings of this Society for 1893 laid down a fair basis for its arrangement, Elwes had not attempted to arrange his own collection, which contains a far greater number of species and specimens from the Oriental region than that of the British Museum, on which Watson based his work.

On proceeding to do so, Elwes found numerous species which Watson had not seen, and which required a detailed examination in order to decide their specific and generic position. This he would not have been able to undertake without the able assistance of Mr. Edwards, who has given all his spare time for nearly three years to the task of working out the large mass of material which has passed through their hands during that period, including much necessary dissection of the genitalia and the comparison of their generic characters with those given by Watson. How far the characters drawn from a careful examination of the male genitalia can be properly used in deciding questions of specific identity or distinction is a point which by some entomologists has been questioned; and a very considerable practice in making this examination, and great experience in estimating the value of the characters observed, are necessary in order to form an opinion on the subject. But those who have most experience and who have devoted most time to this study are, we think, practically agreed that these characters are of great importance and assistance, and the question has been so well stated by Messrs. Godman and Salvin in the 'Biologia Centrali-Americana,' Rhopalocera, vol. ii. p. 245, that we cannot do better than quote their remarks, in which we fully concur.

They say :—" As in the foregoing families, we have examined the male secondary sexual organs and find an almost endless variety of structure. We have not ventured

[1] The Editor of the Society's Publications wishes it to be understood that he is not responsible for the nomenclature used in the present memoir, which deviates in several points from that habitually employed by the Society.—P. L. S.

to use these characters for building up any system of classification, as we consider the time is hardly come for their adoption for any such purpose. But we have found them invaluable in deciding points of specific distinction where the external characters are not clearly defined. In some cases a slight external feature distinguishes wo forms, which is sometimes greatly strengthened by a marked divergence in the male genitalia, and sometimes no difference can be traced in these organs. In the former case a specific difference between two similar forms can safely be conceded, while in the latter the opposite course should be followed."

As regards the arrangement of genera, we have adopted that proposed by Watson in his last paper, "A Key to the Asiatic Genera of the Hesperiidæ," published in the Journal of the Bombay Natural History Society for 1895, which in some respects is an improvement on his earlier paper before referred to. We have been compelled to propose a few new genera and some seventy species; and though probably there are still many additions and corrections to be made to the list, especially in the Malay islands and Indo-Chinese countries, yet we have spared no efforts to procure for examination all the material which Elwes's collection did not previously contain. In doing so we have to acknowledge the very great assistance which has been afforded us by Mr. L. de Nicéville and Captain Watson in India, who have sent us advance copies of all their papers and descriptions. In Europe Dr. Georg Semper, of Altona, has been good enough to lend us authentic specimens of all the species included in his great work 'Die Schmetterlinge der Philippinischen Inseln.' Dr. O. Staudinger has sent us a large number of specimens from Borneo and other Malayan islands, the novelties amongst which he has kindly permitted us to describe. Herr P. C. T. Snellen, of Rotterdam, has been equally liberal with specimens from Java and Sumatra. M. Charles Oberthür has enabled us to examine some of the new and rare forms in his magnificent collection from China, and Mr. Leech has also been most obliging in lending types described in his 'Butterflies of China &c.' and other specimens for examination. The Hon. Walter Rothschild kindly allowed us to select from and describe several species of interest in his collection; and we are indebted to Mr. O. Salvin and Sir G. F. Hampson for advice and assistance in many points of difficulty and for the loan of specimens. Col. Swinhoe has also lent us many of his types and allowed us to describe new species in his collection; and so far as we know there is no collection containing many types to which we have not had access, except that of M. Mabille, which we have not visited [1]. Some species which have been described by the latter and by Plötz we have, in common with Captain Watson, failed to identify, and we have possibly overlooked a few others; yet we think that the material at our disposal has been hitherto unrivalled, and the localities given for

[1] Since the above was written M. Mabille has been kind enough to lend us a number of his types, which we have been able to identify with certainty and put in their proper order; so we do not think that there can exist in Europe, at present, any important sources of information in this family of which we have not availed ourselves.

each species may be relied upon as those of specimens actually in coll. Elwes or examined personally by us. We have not, as a rule, quoted localities given by other authors, because in some cases it is doubtful to what species they refer.

As regards the respective share which the authors have had in this paper, we think it best to say that Edwards alone is responsible for the whole of the drawings and dissections of genitalia and for the conclusions derived from them; he has arranged in the form of analytical tables such of the differential characters of the several species as he found to be diagnostic in the greatest degree, and he has had the principal share in the descriptions of genera and species. Elwes alone is responsible for all the localities, geographical distribution, and questions of specific distinction arising from their consideration.

With regard to the geographical area covered by the paper, though it relates specially to Asia, we have thought it best to take in the Hesperiidæ of Europe, because their male genitalia had not previously been extensively studied, and in some cases this study has led to striking results, but we have not included those of North America because they belong for the most part to the Neotropical region. We have not attempted to deal with the species occurring in the Malayan islands east of Wallace's line, because, although a good many Indian forms occur in them, the Austro-Malayan element is probably predominant, and our knowledge of the Hesperiidæ of the New Guinea Region is too small to enable them to be profitably classified at present.

In the descriptive portion of the paper we have used the Continental system of numbering the veins in preference to that adopted by many English authors, because it seems to us shorter and more convenient. We have adopted a few terms from Mr. Meyrick's recent 'Handbook of British Lepidoptera': thus the *dorsum* is the edge of the wing opposite to the costa, the *termen* the edge of the wing opposite to the base, and the *tornus* is the angle in which the dorsum joins the termen. The *transverse vein*, sometimes called the upper, middle, and lower discocellular nervules, is that which forms the apical boundary of the discal cell. The subcostal and median *segments* are the pieces of the subcostal and median veins which lie between the bases of veins 7–11 and 2–4 respectively; they are numbered from the base: thus the *second median segment* forms the base of cell 2 and so on. The simple vein nearest to the dorsum in both fore and hind wings is called vein 1*a*, and the second vein from the dorsum of the hind wing is called vein 1*b*. With the exception of the discal cell in each wing, which is referred to simply as *the* cell, the name of each cell is taken from that of the vein forming its lower boundary.

With a few unimportant exceptions, this paper will be found to contain a concise statement of the diagnostic characters of all the species of Hesperiidæ hitherto described from the region treated of; although we have not given or quoted descriptions in full, except in the case of newly-described species and a few obscure ones which we have not seen.

Although the Hesperiidæ as a group are very well-marked and easy of recognition, their classification *inter se* is a matter of great difficulty, owing, mainly, to the paucity of index characters. Venation is probably of less assistance here than in any other group of Rhopalocera. The fore wing has a free vein near the costa, another near the dorsum, and a discal cell from which arise ten simple veins; the hind wing has a discal cell giving off six simple veins, a free vein near the costa, and two near the dorsum. The modifications of this type are few in number and slight in character.

Taking the group as a whole, we may divide off—First, *Pyrrhopyge* and its allies, a group characterized by the large blunt recurved club to the antennæ and the cell of the fore wing more than two-thirds as long as the costa; and secondly, *Ismene* and its allies, a group characterized by the porrect and filiform third joint of the palpi. There then remains a vast number of species for the grouping of which no such satisfactory characters are available. They may, however, be divided into two series according to the position and direction of vein 5 in the fore wing, in which particular they may be regarded as conforming to one of two types: the first, exemplified by *Thanaos tages*, in which vein 5 of the fore wing is straight and therefore practically parallel to vein 6; and the second, exemplified by *Augiades sylvanus*, in which the basal third of vein 5 is decurved towards the origin of vein 4, and consequently recedes to that extent from vein 6. This basis of subdivision is not invariably well-marked, but that circumstance does not give rise to any real difficulty, because in doubtful cases the correct position of a given species is determinable from other considerations.

All the specimens, dissections, and drawings of genitalia, including a great number not figured, are open to the examination of any naturalist who may be interested in the subject.

We have not considered it necessary to give a full synonymy of the species dealt with, but only those references which are original or important.

Orthophœtus.

Pteroxys, Watson, P. Z. S. 1893, p. 29, nom. præocc. Type *phanæus,* Hew.
Orthophœtus, Watson, Jour. As. Soc. Beng. 1895.

In defining this genus Watson says "fore wing: ♂ with a costal fold"; this is true of *lidderdali*, Elwes, and *lalita*, Dohy., but not of *phanæus*, Hew., which, however, he gives as the type. In the latter species as well as *lidderdali*, Elwes, and *lalita*, Dohy., the third joint of the palpi is concealed; but it would be better to extend the definition of the genus so as to include the *Celænorrhinus omeia* of Leech, a species which is very closely allied to the three former, but has the third joint of the palpi distinct; there is no costal fold in the male of *omeia*, Leech.

The species might be thus distinguished:—

1 (6). Third joint of palpi concealed. Hind wing below with a dark discal spot.
2 (3). No costal fold in the male. Upperside fusco-fulvous. Postmedian series of spots on hind wing above small, black . . . . *phanæus*, Hew.
3 (2). Male with a costal fold.
4 (5). No pale spots in cells 4 and 5 of fore wing above. Upperside bright fulvous. Postmedian series of spots on hind wing above black, with or without white centres . . . . *lalita*, Dohy.
5 (4). Fore wing above with pale spots in cells 1–8. Postmedian series of spots on hind wing above black, with yellow edges . . . . *lidderdali*, Elwes.
6 (1). Third joint of palpi distinct. Hind wing below plain brown. No costal fold in the male . . . . *omeia*, Leech.

! [1] ORTHOPHŒTUS PHANÆUS.

Eudamus phanæus, Hewitson, Descr. Hesp. p. 14 (1867).
Casyapa phanæus, Distant, Rhop. Mal. p. 386, pl. xxxv. fig. 18 (1886); Watson, Hesp. Ind. p. 109 (1891).

In point of colour Distant's figure represents *O. lalita* rather than *O. phanæus*, but the Perak specimens in my coll. agree with the Bornean type.

Hab. Perak, Pulo Laut (*Doherty*); Labuan (*coll. Stgr.*); Selesseh, Sumatra (*Martin in coll. Rothschild*).

! ORTHOPHŒTUS LALITA.

Erionota? lalita, Doherty, Jour. As. Soc. Beng. 1886, p. 263.
Casyapa phanæus, Elwes, P. Z. S. 1892, p. 657.

Until Mr. Edwards separated this from the Bornean species by the costal fold, Elwes had confused it with *O. phanæus*. It is, as he pointed out, much yellower in colour, but has similar markings. It has only been taken, so far as we know, by Doherty in the Chittagong and Karen hills.

Hab. Chittagong (*Doherty*); E. Pegu (*Doherty*).

ORTHOPHŒTUS LIDDERDALI. (Plate XX. fig. 18, ♂.)

Chæticnema? lidderdali, Elwes, Trans. Ent. Soc. Lond. 1888, p. 459.
Casyapa lidderdali, Watson, Hesp. Ind. p. 109 (1891).

The type in the British Museum remains unique; but as Dr. Lidderdale's collection was made at Buxa in Bhutan and Darjeeling it is almost certainly from one of those localities, probably the former. We append further particulars of this specimen, supplementary to the original description cited above.

♂ with a costal fold. Upperside: fore wing warm brown, with ten ochreous hyaline patches placed as follows:—one across the end of the cell, one each in cells 2–8, and

[1] This sign is prefixed to the names of the species which are in Mr. Elwes's collection.

two, one above the other, near the middle of cell 1 *a*; an ochreous line along vein 12 and also along the upper and lower margins of the cell, an ochreous line bordering cell 2 within from the base as far as the hyaline spot, and an ochreous streak in the base of cells 9 and 10; hind wing warm brown, basal two-thirds clothed with long brownish-yellow hairs, a postmedian series of eight elongate oval, velvety black, yellow-edged spots, placed as follows:—two in cell 1*b* and one in each of cells 2–7. Fringe of the fore wing brownish grey, of the hind wing yellowish grey. Thorax concolorous; abdomen brown, hind margin of the segments narrowly pale Underside as above, save that there is on the hind wing a dusky oblong spot next the transverse vein.

Hab. Bhutan? (*Lidderdale*).

! ORTHOPHŒTUS OMEIA.

Celænorrhinus omeia, Leech, Butt. China &c. p. 572, pl. xxxviii. fig. 5, ♂ (1894).

Leech suggests that a new genus is necessary for this species; but, as it differs from *Orthophœtus* chiefly by the form of the palpi, we do not agree with him.

Hab. Omei-shan, W. China.

CALLIANA.

Calliana, Moore, P. Z. S. 1878, p. 686; Watson, P. Z. S. 1893, p. 31. Type *pieridoides*, Moore.

The single species in this genus is well distinguished by its facies. The antennæ in the male are about half as long as the costa, the club slender, the apiculus gradual, about half as long as the club.

CALLIANA PIERIDOIDES.

Calliana pieridoides, Moore, P. Z. S. 1878, p. 687, pl. xlv. fig. 2, ♂; de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1891, p. 377, pl. G. fig. 25, ♀.

Hab. Khasia Hills (*Hamilton*); Margherita, Upper Assam (*Doherty*).

CAPILA.

Capila, Moore, P. Z. S. 1865, p. 785; Watson, P. Z. S. 1893, p. 30. Type *jayadeva*, Moore.

Moore founded this genus for his *Ismene jayadeva*, but the insect which he described as the female of *jayadeva* is really the male of another species for which we adopt the name *C. zennara*, Moore, in accordance with a suggestion of Captain Watson. The females of these two species were the originals of the two sexes of Moore's genus *Pisola*.

We include here *Rhopalocampta translucida*, Leech, which, however, may be not congeneric with the other species.

The distinctive characters of the species under consideration may be thus expressed:—

1 (6). With a pencil of long hairs at the base of hind tibiæ (*i. e.* males).
2 (5). Dark brown above, with white rays in the cells of both wings.
3 (4). Crown, thorax, and base of wings sordid orange . . . . *jayadeva*, Moore.
4 (3). Crown, thorax, and base of wings sordid brown . . . . *zennara*, Moore.
5 (2). Dark brown above; disc of both wings transparent sordid white, crossed by dark veins . . . . *translucida*, Leech.
6 (1). No pencil of long hairs at base of hind tibiæ (*i. e.* females).
7 (8). Hind wing above brown, with two grey lines in the outer half of each cell. *jayadeva*, Moore.
8 (7). Hind wing above plain brown . . . . *zennara*, Moore.

The female of *C. translucida*, Leech, is unknown.

! CAPILA JAYADEVA.

Ismene jayadeva, Moore, Cat. Lep. E.I. C. i. p. 248 (1857).
Capila jayadeva, Moore, P. Z. S. 1865, p. 785, pl. xlii. fig. 3 ♂, 4 ♀; Watson, Hesp. Ind. p. 25 (1891).

Hab. Sikkim (*Möller*); Naga Hills, E. Pegu (*Doherty*).

It will be impossible to work out the distribution of this species and the next correctly without an examination of the actual specimens referred to by various writers in their local lists, because the authors of such lists, in recording *Capila jayadeva* and *Pisola zennara*, have but rarely mentioned the sex of their specimens.

! CAPILA ZENNARA.

♂ = *Capila jayadeva*, Moore, ♀, P. Z. S. 1865, p. 785.
♀ = *Pisola zennara*, Moore, ♀, t. c. p. 786.

Hab. Sikkim (*Möller*, *Elwes*); E. Pegu (*Doherty*).

CAPILA TRANSLUCIDA.

Rhopalocampta translucida, Leech, Butt. China &c. p. 642, pl. xxxix. fig. 11, ♂ (1894).

Hab. Omei-shan, W. China (*Leech*).

We are indebted to Mr. Leech for the opportunity of examining his unique example of this species.

CROSSIURA.

Crossiura, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1892, p. 350. Type *pennicillatum*, de Nicév.

This genus, in our opinion, might well be merged in *Orthophœtus*, where the single species would follow *omeia*, Leech. The fore wing in both sexes is banded as in the female of *Capila*, and there is in addition a series of small white spots, one in each of cells 4 to 8 or 5 to 8, independent of sex; the male has no costal fold, but the dorsum of the hind wing is folded under, and the tornus bears, near the end of vein 1*b*, a tuft of long hairs, and there is also a fringe of long hairs to that part of the wing which lies below vein 1*b*. Mr. de Nicéville (Jour. Bomb. Nat. Hist. Soc. 1892, p. 351) speaks of the anal angle (tornus) being fringed with long stout setæ; this is misleading, as the hairs forming the tuft and fringe are not more bristle-like than those which form the tibial pencil in many species of Hesperiidæ. These observations are, in part, based on an examination of a male specimen of *C. pennicillatum*, de Nicév., ex coll. E. Swinhoe.

CROSSIURA PENNICILLATUM.

Crossiura pennicillatum, de Nicéville, t. e. p. 351, pl. J. fig. 1 ♂, 2 ♀.

Hab. Khasia Hills, where it seems rare or very local.

ACHALARUS.

Achalarus, Scudder, Syst. Rev. Am. Butt. p. 50 (1872); Watson, P. Z. S. 1893, p. 33. Type *lycidas,* Sm. Abb.

Lobocla, Moore, Jour. As. Soc. Beng. 1884, p. 51. Type *liliana,* Atkinson.

Vein 5 in the hind wing is obsolete in *lycidas* and most of the American species, but well-developed in *liliana* and all the Eastern species, as well as some of the American.

The species known to us we distinguish as follows:—

1 (2). Fore wing above: white discal band reaching vein 1 *a*, white spot in cell 3 filling up the base of that cell . . . . . *liliana,* Atkinson.

2 (1). Fore wing above: white discal band not reaching vein 1 *a*, white spot in cell 3 usually not filling up the base of that cell.

3 (6). Fore wing above: white spot in cell 3 contiguous to that in cell 2.

4 (5). Clothing of second joint of palpi grey. Hind wing below: terminal grey band irregular, not wide enough to reach the narrow subterminal pale band . . . . *bifasciatus,* Brem. & Grey.

5 (4). Clothing of second joint of palpi blackish. Terminal grey band on hind wing below suffused, broad, regular, reaching about half the length of cell 3 . . . . *simplex,* Leech.

6 (3). Fore wing above: white spot in cell 3 not touching that in cell 2.

7 (12). Dark spots on the hind wing below very prominent, much darker than the ground-colour.

8 (11). Fore wing below: hyaline spot in cell 5 not touching that in cell 6.

9 (10). Hind wing below: subterminal dark spot across cells 1*b* and 2 as wide where it is cut short by vein 3 as where it is crossed by vein 2, the pale border of its inner edge straight, that of its outer edge sinuate, receding from the termen as it approaches vein 3. . . . . *proximus,* Leech.

10 (9). Hind wing below: subterminal dark spot across cells 1 *b* and 2 ending in a point near the middle of vein 3, the pale border of its inner edge evenly convex, that of its outer edge nearly parallel with the termen and continuous with the pale outer border of the spots in cells 3 and 4–5 . . [1]*frater*, Ob.

11 (8). Hyaline spots in cells 4–8 of fore wing forming a continuous series . . . . *germanus*, Ob.

12 (7). Dark spots on hind wing below not very prominent, but little darker than the ground-colour. Otherwise very similar to *A. germanus* . . . . *nepos*, Ob.

! Achalarus liliana.

Plesioneura liliana, Atkinson, P. Z. S. 1871, p. 216, pl. xii. fig. 2.
Lobocla liliana, Watson, Hesp. Ind. p. 157 (1891).
Lobocla casyapa, Moore, Jour. As. Soc. Beng. 1884, p. 52; Watson, t. c. p. 158.

Hab. Khasia (*Hamilton*); E. Pegu (*Doherty*); N.W. Himalaya (*Lang*).

A specimen of *A. casyapa* from Moore is marked with the locality Mynpoorie, but as this is on the plains of the N.W. Provinces, while Lang and Reed have both taken it in the Himalaya, I doubt its correctness. This specimen, notwithstanding its widely separated habitat, is inseparable from *liliana.*

! Achalarus bifasciatus.

Eudamus bifasciatus, Bremer & Grey, Schmett. N. China's, p. 10, pl. iii. fig. 1 (1853); Oberthür, Étud. d'Ent. xi. pl. vi. fig. 47 (1886).
Goniloba bifasciatus, Ménétriés, Mus. Petr., Lep. i. pl. v. fig. 3 (1855).
Achalarus bifasciatus, Leech, Butt. China &c. p. 560 (1894).
Achalarus bifasciatus, var. *contractus*, Leech, l. c. pl. xxxviii. fig. 9, ♂.

Hab. Central and Western China (*Pratt*); Korea (*Leech*); Amurland (*Jankowsky*).

! Achalarus simplex.

Eudamus simplex, Leech, Entom. xxiv. Suppl. p. 58 (June 1891).
Eudamus gener, Oberthür, Étud. d'Ent. xv. p. 18, pl. i. fig. 2 (July *nec* June 1891).
Achalarus simplex, Leech, Butt. China &c. p. 561, pl. xxxviii. fig. 12, ♂ (1894).

Hab. Western China (*Pratt*).

! Achalarus proximus.

Eudamus proximus, Leech, Entom. xxiv. Suppl. p. 59 (June 1891).
Achalarus proximus, Leech, Butt. China &c. p. 560, pl. xxxviii. fig. 7, ♂ (1894).

Hab. Ta-tsien-lo, Moupin, W. China (*coll. Oberthür*).

[1] In *A. proximus* the extreme base of cell 7 on the hind wing below is whitish; this point is not indicated in the figure of *A. frater*, but it is not certain that it had not disappeared from the specimen figured as the result of rough handling.

Achalarus frater.

Eudamus frater, Oberthür, Étud. d'Ent. xv. p. 18, pl. i. fig. 3 (July *nec* June 1891).

Hab. Yunnan (*Delavay, fide Oberthür*).

! Achalarus germanus.

Eudamus germanus, Oberthür, Étud. d'Ent. xi. p. 26, pl. vi. fig. 48 (1886).
Achalarus germanus, Leech, Butt. China &c. p. 561 (1894).

Hab. Ta-tsien-lo (*Biet*); Pu-tsu-fong, Wa-ssu-kow, 5000–8000 feet, June and July (*fide Leech*).

! Achalarus nepos.

Eudamus nepos, Oberthür, l. c. pl. vi. fig. 49.
Achalarus nepos, Leech, l. c.

Hab. Ta-tsien-lo (*Biet*); Pu-tsu-fong, 8000 feet, July (*Leech*).

Hantana.

Hantana, Moore, Lep. Cey. i. p. 179 (1881); Watson, Hesp. Ind. p. 144 (1891); id. P. Z. S. 1893, p. 37. Type *infernus,* Felder.

The type of this monotypic genus is well distinguished among its allies by the dark purple-brown colour of the upperside and the absence of hyaline spots except four on the fore wing, namely, one in the cell next the apical fourth of its upper edge, and one each (small and roundish) in cells 6, 7, and 8. The hyaline spot in the cell of the fore wing has a tendency to disappear, and the base of cell 4 is twice as long as the base of cell 5.

! Hantana infernus.

Eudamus infernus, Felder, Verh. zool.-bot. Gesellsch. Wien, 1868, p. 283.
Hantana infernus, Moore, Lep. Cey. i. p. 179, pl. lxviii. fig. 6 (1881); Watson, Hesp. Ind. p. 145 (1891).

Hab. Ceylon (*Mackwood*).

Charmion.

Charmion, de Nicéville, Jour. As. Soc. Beng. 1894, p. 48. Type *ficulnea,* Hew.

Antennæ more than half as long as costa, somewhat shorter in the female, club slender, apiculus robust, about half as long as the club. Palpi appressed, densely scaled, third joint concealed. Fore wing: vein 5 straight, nearer 6 than 4, vein 2 from the basal fourth of the lower margin of the cell. No alar sex-mark in the male. Tibial epiphysis present. Species fuliginous brown, with an oblique white median band on fore wing, abbreviated at each end.

In *C. ficulnea* the hind tibiæ of the male are thickly fringed on their basal half, and have at the base a thick tuft of long ochreous hairs nearly as long as the joint itself.

! CHARMION FICULNEA.

Hesperia ficulnea, Hewitson, Descr. Hesp. p. 37 (1868).
Plesioneura signata, Druce, P. Z. S. 1873, p. 360, pl. xxxiii. fig. 8.
Plesioneura leucographa, Plötz, Berl. ent. Zeits. xxvi. p. 262 (1882).
Charmion ficulnea, de Nicéville, Jour. As. Soc. Beng. 1894, p. 49.

Hab. Perak (*Doherty*); Kina Balu, Borneo (*Waterstradt*); Sumatra (*Martin in coll. Rothschild*).

CHARMION TOLA.

Plesioneura tola, Hewitson, Ann. & Mag. Nat. Hist. ser. 5, vol. i. p. 340 (1878).
Plesioneura zawi, Plötz, Berl. ent. Zeits. 1885, p. 225.
Plastingia? plesioneuræ, Staudinger, Ex. Schmett. p. 299, pl. C, ♀ (1888).

This species is distinguished from the preceding by having a small roundish projection of the white band on the fore wing reaching about halfway across cell 1 *a*. Hewitson's type is a male. The type of *P. zawi*, Plötz, lent to me by Dr. Staudinger is a female.

Dr. Staudinger concurs in our opinion that his *P. plesioneuræ* is synonymous with *C. tola*.

Hab. Tondano (*fide Hewitson*); Minahassa, Celebes (*fide Staudinger*).

CELÆNORRHINUS.

Celænorrhinus, Hübn. Verz. p. 106 (1816); Watson, P. Z. S. 1893, p. 49. Type *eligius*, Cr.
Gehlota, Doherty, Jour. As. Soc. Beng. 1889, p. 131. Type *sumitra*, Moore.

Species large and robust; dorsum of the fore wing usually longer than the termen. Fore wing with several white spots of which some form an oblique discal band, or with yellow spots forming an oblique discal band, or with a continuous yellow oblique discal band. Hind wing rounded, its termen as a rule not evidently excavated before the tornus, in several species much spotted with yellow. Antennæ half as long as the costa or longer, club slender, apiculus gradual, the shaft sometimes pure white in front. Palpi appressed, third joint suberect. Vein 5 of the fore wing straight, arising as a rule distinctly nearer to vein 6 than to vein 4, but in *flavocincta*, de Nicév., intermediate between the two. Hind tibiæ with two pairs of spurs, and bearing a hair-pencil in the male.

The different phases of this large genus are well exemplified by *sumitra*, Moore, *leucocera*, Koll., and *aurivittata*, Moore, respectively.

Though de Nicéville so recently as 1889 gave an elaborate revision of this genus [1],

[1] Jour. Bomb. Nat. Hist. Soc. 1889, p. 177.

yet we have in many cases been obliged to dissent from the opinions he arrived at, probably because the material at our disposal is much more complete than his at the time he wrote.

The following is a list of the species known to us; the value of the characters relied on for their discrimination has been carefully considered and supplemented by an examination of the male genitalia of numerous specimens:—

1 (58) Hind wing below, not brown with a narrow yellow spot on the transverse vein, its fringes not pale unspotted yellow.

2 (55). Fore wing with a pale spot in each of cells 6, 7, and 8.

3 (14). Fore wing with a small pale spot near the base of cell 1 *a*[1].

4 (13). Macular band on fore wing pure white.

5 (8). Basal spot in cell 1*a* of fore wing yellow.

6 (7). Male: shaft of antennæ white in front throughout; hind wing distinctly produced on vein 1 *b*. Expanse 62 mm. *pero*, de Nicév.

7 (6). Male: shaft of antennæ white in front only near the base of the club; hind wing rounded, not produced on vein 1 *b*. Expanse 49 mm. . . . . *pulomaya*, Moore.

8 (5). Basal spot in cell 1 *a* of fore wing white.

9 (10). Hind wing below with two well-defined yellow spots in the middle of the cell, the lower one joined to the base by a yellow streak . . . . *maculosa*, Feld.

10 (9). Hind wing below with only one pale spot in the middle of the cell.

11 (12). Hind wing below with the pale spots orange-yellow; fringe orange-yellow, scarcely interrupted with darker . . . *aspersa*, Leech.

12 (11). Hind wing below with the pale spots cream-coloured; fringe chequered . . . . *consanguinea*, Leech.

13 (4). Macular band on fore wing above dirty white. Upperside grey-brown, fringes chequered . . . . *ambareesa*, Moore.

14 (3). Fore wing with no pale spot near the base of cell 1 *a*.

15 (16). Hind wing below (except a brown terminal band) orange-yellow, with several (about 9) black spots . . . . . [2]*flavocincta*, de Nicév.

16 (15). Hind wing not as in 15.

17 (34). Fore wing above with the pale macular band pure white.

18 (27). Fore wing above; extreme base of cell 3 not filled up with white.

19 (26). Hind wing above not conspicuously clothed with brownish-yellow scales and hairs almost to the termen.

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[1] Very rarely this spot is traceable in the female of *leucocera*, Koll.

[2] This species will probably be found to belong to the group (par. 3 *supra*) which has a small pale spot near the base of cell 1 *a* of the fore wing, as such a spot is indicated in a male specimen from the Möller collection; the point, however, is of no consequence, as the species is distinguished from all its congeners by the pattern and coloration of the hind wing below.

20 (21). Pale spots on hind wing below large, numerous, and orange-yellow; shaft of antennæ in the male not entirely white in front . . . . *sumitra,* Moore.

21 (20). Pale spots on hind wing below neither large, numerous, nor orange-yellow.

22 (25). Pale spots on hind wing below small, stramineous, sharply defined, variable in number, sometimes reduced to one only next the transverse vein.

22a (22b). Shaft of antennæ in the male spotted with white in front . *maculicornis,* n. sp.

22b (22a). Shaft of antennæ in the male entirely white in front.

23 (24). Pale spot in cell 2 of fore wing as wide as or wider than high. Fore wing broader and less pointed . . . . . *leucocera,* Koll.

24 (23). Pale spot in cell 2 of fore wing at least one and a half times as high as wide, its inner and outer edges both straight. Fore wing narrower and more pointed, termen straight and forming an angle of about 110° with the dorsum . *leucocera* var. *angustipennis.*

25 (22). Pale spots on hind wing below suffused and indistinct, or entirely wanting. Shaft of antennæ in the male not entirely white in front . . . . *spilothyrus,* Feld.

26 (19). Hind wing above clothed throughout with brownish-yellow scales and hairs except a narrow terminal space . . . *chamunda,* Moore.

27 (18). Fore wing above: extreme base of cell 3 filled up with white.

28 (33). Fore wing above with one or two white spots in cell 1 *a*.

29 (30). Upperside blackish brown; fringe of the hind wing brown, not chequered . . . . *balukinus,* n. sp.

30 (29). Fringe of the hind wing chequered.

31 (32). Upperside grey-brown, white spot in cell 2 of fore wing subrhomboidal or irregular, always straight on the inner edge . . . . *nigricans,* de Nicév.

32 (31). Upperside blackish brown, white spot in cell 2 of fore wing irregularly roundish . . . . *orbiferus,* n. sp.

33 (28). Fore wing above without any white spot in cell 1 *a* nor in cells 4 and 5 . . . . *asmara,* Butl.

34 (17). Fore wing above with the pale band yellowish white, yellow, or orange-yellow.

35 (48). Pale spot in cell 1 *a* of fore wing hyaline.

36 (37). Pale spot in cell 1 *a* of fore wing reaching to vein 1 *a* . *tibetana,* Mab.

37 (36). Pale spot in cell 1 *a* of fore wing not reaching to vein 1 *a*.

38 (47). Pale spot in cell 3 of fore wing filling up the extreme base of that cell.

39 (46). Pale spot in cell 1 *a* of fore wing subquadrate or irregular, joining that in cell 2 near its lower outer angle.

40 (45). Pale spot in cell 1 *a* of fore wing not produced into a tooth at its inner lower angle.

41 (44). Pale spot in cell 2 of fore wing reaching inwardly much beyond the base of vein 3.

42 (43). Expanse 38 mm. Tegumen and clasp as in figures 1, 1 *a*, 1 *b*, Plate XXII. . . . . *dhanada,* Moore.

43 (42). Expanse 32 mm. Tegumen and clasp as in figures 2, 2 *a*, Plate XXII. . . . . *andamanica,* W.-M. & de Nicév.

44 (41). Pale spot in cell 2 of fore wing not reaching inwardly beyond the base of vein 3. . . . . *inæqualis,* n. sp.

45 (40). Pale spot in cell 1 *a* of fore wing produced into a large tooth at its lower inner angle . . . . *dentatus,* n. sp.

46 (39). Pale spot in cell 1 *a* of fore wing small, punctiform, joining that in cell 2 near its half length . . . . *fulvescens,* n. sp.

47 (38). Pale spot in cell 3 of fore wing not filling up the extreme base of that cell . . . . *saturatus,* n. sp.

48 (35). Pale spot in cell 1 *a* of fore wing opaque.

49 (52). Fore wing with the pale band deep orange-yellow, practically unicolorous throughout, *i. e.* the part in cells 2 and 3 and that across the cell are semitransparent, but do not differ appreciably in tint from the other parts.

50 (51). Fore wing: breadth of the pale band where it crosses the cell equal to about one seventh of the length of the costa, its outer edge regular, not broken by the projection of the pale spot in cell 3 . . . . *cameroni,* Dist.

51 (50). Fore wing: breadth of the pale band where it crosses the cell equal to about one fifth of the length of the costa, its outer edge broken by the projection of the pale spot in cell 3 . . . . *lativittus,* n. sp.

52 (49). Fore wing with the pale band pale yellow in cells 2 and 3 and across the cell, distinctly stronger in colour in cell 1 *a* and next the costa.

53 (54). Fringe of hind wing chequered . . . . *affinis,* n. sp.

54 (53). Fringe of hind wing brown . . . . *aurivittata,* Moore.

55 (2). Fore wing above with a yellow oblique postmedian band, but no pale spot in cells 6, 7, or 8. Hind wing above brown.

56 (57). Hind wing below brown, basal half yellow-brown by reason of a thick clothing of yellow scales, a feeble suffused pale spot next the transverse vein, and a suffused yellow spot at the apex of cell 1 *b* . . . . *ladana,* Butl.

57 (56). Hind wing below plain brown . . . . *batchianus,* n. sp.

58 (1). Hind wing below brown, with a narrow yellow spot on the transverse vein; fringe pale yellow, unspotted . . . *badia,* Hew.

! CELÆNORRHINUS PERO.

Celænorrhinus pero, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1889, p. 183, pl. B. fig. 12, ♂; Elwes, P. Z. S. 1892, p. 660.

Hab. Naga Hills (*Doherty*).

! CELÆNORRHINUS PULOMAYA.

Plesioneura pulomaya, Moore, P. Z. S. 1865, p. 787.
Celænorrhinus lucifera, Leech, Butt. China &c. p. 571, pl. xxxix. fig. 5, ♀ (1893–4).

Hab. Himalayas from Kangra to Sikkim, Naga Hills (*Doherty*); Moupin (*fide Leech*).

! CELÆNORRHINUS MACULOSA.

Pterygospidea maculosa, Felder, Reise 'Novara,' Lep. iii. p. 528, pl. lxxiii. fig. 7, ♂ (1867).
Celænorrhinus maculosa, Leech, Butt. China &c. p. 569, pl. xxxix. fig. 2, ♂.

Hab. Central and Western China (*Pratt*).

! CELÆNORRHINUS ASPERSA.

Celænorrhinus aspersa, Leech, Entomologist, xxiv. Suppl. p. 61 (1891); id. Butt. China &c. p. 571, pl. xxxix. fig. 4, ♂ (1893–4).
Celænorrhinus clitus, de Nicév. Jour. Bomb. Nat. Hist. Soc. 1891 (published 2 Feb. 1892), p. 378, pl. G. fig. 26, ♂; Elwes, P. Z. S. 1892, p. 660.

Hab. Naga Hills, Bernardmyo (*Doherty*); Western China (*fide Leech.*) The type of *clitus* is in coll. Elwes.

! CELÆNORRHINUS CONSANGUINEA.

Celænorrhinus consanguinea, Leech, Entomologist, xxiv. Suppl. p. 61, 1891; id. Butt. China &c. p. 570, pl. xxxix. fig. 3, ♂.

Hab. Central and Western China; Eastern Tibet (*Pratt*, *Kricheldorf*).

! CELÆNORRHINUS AMBAREESA.

Plesioneura ambareesa, Moore, P. Z. S. 1865, p. 788; de Nicéville, Jour. As. Soc. Beng. vol. li. p. 87, pl. x. fig. 9, ♀ (1883).

Hab. Western Ghats from Mahableshwar to Goa; Nilgiris (*Swinhoe*, *Hampson*).

! CELÆNORRHINUS FLAVOCINCTA.

Plesioneura flavocincta, de Nicéville, P. Z. S. 1887, p. 464, pl. xl. fig. 9, ♀.

Hab. Sikkim (*Knyvett*).

! CELÆNORRHINUS SUMITRA.

Plesioneura sumitra, Moore, P. Z. S. 1865, p. 787.

Celænorrhinus pyrrha, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1889, p. 181, pl. B. fig. 11, ♀.
Celænorrhinus patula, de Nicéville, t. c. p. 182, pl. B. fig. 4, ♀.
Celænorrhinus plagifera, de Nicéville, t. c. p. 182, pl. B. fig. 13, ♀.
Celænorrhinus pluscula, Leech, Butt. China &c. p. 571, pl. xxxix. fig. 6, ♀ (1893–4).

Hab. Sikkim (*Elwes*); Naga Hills, Bernardmyo (*Doherty*); China (*fide Leech*).

! CELÆNORRHINUS MACULICORNIS, n. sp. (Plate XVIII. fig. 8, ♂.)

♂. This species may be distinguished from *C. leucocera* by reason that the upperside or front of the shaft of the antennæ in the male is minutely and regularly spotted with black and white. This might be considered a trivial and insufficient character, were it not for the fact that the male of *C. leucocera*, whatever may be the state of the spotting of the wings, always has the upperside or front of the shaft of the antennæ continuously pure white from the base to the apex.

There are in coll. Elwes more than twenty males of *C. leucocera* from various localities, and we have examined at least as many more in other collections without finding any trace of a tendency to spotting on the front of the shaft of the antennæ. The relationship of *C. maculicornis* to *C. leucocera* is quite different from that of *C. leucocera* var. *angustipennis*; the latter being separated from *C. leucocera* by differences in the spotting and shape of the wings, which are distinctly variable in *C. leucocera*; whilst the character by which we separate *C. maculicornis* is one which proves to be constant in *C. leucocera*. The male genitalia do not afford material for its separation from *C. leucocera* or *C. sumitra*.

Hab. Shillong, Khasias, 6400 feet (*Elwes*); ? Kumaon? (*fide Doncaster* ? Khasias).

Described from two males in coll. Elwes. It seems probable that this species is passed over in collections as the female of *C. leucocera*, which has brown antennæ with a broad white band on the club. We do not know the female of *C. maculicornis*.

! CELÆNORRHINUS LEUCOCERA.

Hesperia leucocera, Kollar, in Hügel's 'Kaschmir,' vol. iv. p. 454, pl. xviii. figs. 3, 4, ♀ (1848).
Plesioneura putra, Moore, P. Z. S. 1865, p. 788.
P. leucocera, Wood-Mason & de Nicéville, Jour. As. Soc. Beng. 1881, p. 257.
P. munda, Moore, Jour. As. Soc. Beng. 1884, p. 48.
P. leucocirca, Elwes, Trans. Ent. Soc. Lond. 1888, p. 462.
Celænorrhinus putra, Watson, Hesp. Ind. p. 139 (1891).
C. munda, Watson, l. c.

Hab. N.W. Himalaya (*Young*, *Hocking*); Sikkim, Khasias (*Elwes*); Nagas, Burmah, Bali (*Doherty*); Andamans (*de Roepstorff*); Nilgiris (*Hampson*); C. China (*Pratt*); Java (*Fruhstorfer*).

A common and variable species. The type of *putra*, which is in the British Museum, is from Java.

Var. ANGUSTIPENNIS, nov.

This form, which is apparently confined to W. Java, is readily distinguished by the characters given in the table above, and particularly by the greater length of the costa of the fore wing in proportion to the dorsum.

Hab. Preanger, West Java, *circa* 5000 feet (*Piepers*); Sukabumi, 2000 feet (*Fruhstorfer*).

Var. BRAHMAPUTRA, Stgr. MS.

This also is a long-winged form, from Kina Balu, Borneo (*Waterstradt*), and wants the white spots in cells 4 and 5 on the fore wing above. The hind wing above is very slightly spotted (in the male) or without spots (in the female).

All the insular forms of *leucocera* appear to be of a darker colour and less spotted on the hind wing above than those from Continental India.

! CELÆNORRHINUS SPILOTHYRUS.

Eudamus spilothyrus, Felder, Verh. zool.-bot. Gesellsch. Wien, 1868, p. 283, ♂.
Plesioneura ruficornis, Mabille, Ann. Soc. Ent. Belg. xxi. p. 32 (1878).
Plesioneura spilothyrus, Moore, Lep. Cey. vol. i. p. 179, pl. 67. figs. 4, 4 *a* (1880–81).
? (? *var. dist.*) *Plesioneura fusca,* Hampson, Jour. As. Soc. Beng. 1888, p. 367.

Hab. Java (*Staudinger*); N. Canara (*Aitken*); Malabar (*Vidal*); Nilgiris (*Hampson*); Ceylon (*Green*).

We have received three specimens from Bali and one from Arjuno, Java, collected by Mr. Doherty, which may constitute a distinct local race; they are, however, only distinguishable from *spilothyrus* by the almost complete disappearance of the spots on the hind wing below, and agree exactly with a specimen of his *P. ruficornis* sent by M. Mabille; they have the costal spot of the fore wing white instead of yellow, thus resembling South Indian specimens (*P. fusca,* Hampson) in which this spot is usually but not always white, and not Ceylon specimens in which it seems to be always yellow.

! CELÆNORRHINUS CHAMUNDA.

Plesioneura chamunda, Moore, P. Z. S. 1865, p. 788.

Hab. Sikkim (*Möller*); Khasias (*Hamilton*); Nagas (*Doherty*); Shan Hills (*Manders*).

! CELÆNORRHINUS BALUKINUS, n. sp. (Plate XVIII. fig. 1, ♂.)

Plesioneura balukina, Staudinger, *in litt.*

In addition to the characters laid down in the table above, this species differs from *C. nigricans*, de Nicév., as follows:—The white spot in cell 1 *a* of the fore wing is irregularly roundish, not reaching halfway across the cell, and placed next the apex of the lower edge of the white spot in cell 2. On the underside the hyaline spot in cell 1 *a* of the fore wing is attended on the outer side by two suffused whitish blotches divided by the intra-neural fold. The hind wing below is dark brown with somewhat of a purple shade, and there is a feeble suffused yellow spot next the transverse vein and a subterminal series of suffused indistinct yellow spots, of which the strongest are the two in cell 1 *b*.

Expanse $32\frac{1}{2}$–$36\frac{1}{2}$ mm.

Hab. Kina Balu, Borneo (*Waterstradt*).

Described from three males and two females ex coll. Staudinger. Males only are in coll. Elwes.

! CELÆNORRHINUS NIGRICANS.

Plesioneura nigricans, de Nicéville, Jour. As. Soc. Beng. 1885, p. 123, pl. ii. fig. 6, ♀.

Hab. Mandi, N.W. Himalaya (*Young*); Sikkim (*Möller*); E. Pegu (*Doherty*).

CELÆNORRHINUS ORBIFERUS, n. sp. (Plate XVIII. fig. 2, ♂.)

♂. Very near to *C. nigricans*, de Nicév., from which it differs in the following particulars:—Upperside darker brown, the white spot in cell 2 of the fore wing suborbicular, occupying the whole width of the cell; the white spot in cell 1 *a* of the fore wing minute, punctiform, and placed near the apical fifth of vein 2. On the underside of the fore wing the white spot in cell 1 *a* is larger than on the upperside, and accompanied by a suffused subquadrate whitish spot.

Hab. Kina Balu, Borneo (*Waterstradt*).

Described from one example ex coll. Staudinger.

! CELÆNORRHINUS ASMARA.

Plesioneura asmara, Butler, Trans. Linn. Soc. Lond., Zoology, ser. 2, vol. i. p. 556 (1877); Distant, Rhop. Mal. p. 400, pl. xxxv. fig. 28 (1886).

Celænorrhinus consertus, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1890, p. 222, pl. E. fig. 12, ♂.

Celænorrhinus cacus, de Nicéville, t. c. p. 223, pl. E. fig. 11, ♂; Elwes, P. Z. S. 1892, p. 661.

Plesioneura goto, Mabille, Ann. Soc. Ent. Belg. xxvii. p. lvi (1883).

Notocrypta goto, Leech, Butt. China &c. p. 628, pl. xxxviii. fig. 4, ♂ (1894).

Plesioneura palajava, Staudinger, Isis, ii. p. 156, pl. ii. fig. 10 (1889).

Celænorrhinus palajava, Semper, Schmett. Philipp. p. 360 (1892), *sec. spec. comm.*

Hab. E. Pegu, Pulo Laut, Borneo (*Doherty*); Khasia Hills, Rangoon (*fide de Nicéville*); Malacca (*Pinwill* in B. M.); Japan? (*fide Mabille*); Palawan (*Platen*); E. Java (*Piepers*).

We have examined Staudinger's type of *palajava*, which agrees with what Elwes followed de Nicéville in calling *C. cacus*, but which agrees with an example from Malacca figured by Distant as *asmara*, Butl. We have seen Mabille's type of *P. goto*, but strongly doubt the habitat given by him.

! CELÆNORRHINUS TIBETANA.

Pterygospidea tibetana, Mabille, Ann. Soc. Ent. Fr. ser. 5, vol. vi. p. liv (1876).
Notocrypta tibetana, Leech, Butt. China &c. p. 628, pl. xxxviii. fig. 6, ♂ (1894).

Hab. West China (*Pratt*); Siau-lou (? Yunnan, *fide Oberthür*).

! CELÆNORRHINUS DHANADA. (Plate XXII. figs. 1, 1 *a*, 1 *b*.)

Plesioneura dhanada, Moore, P. Z. S. 1865, p. 789.
Kerana dhanada, Watson, Hesp. Ind. p. 150 (1891); Elwes, P. Z. S. 1892, p. 663.

Hab. Sikkim (*Möller*).

We have seen no specimen of this species except from Sikkim. It is therefore probable that so-called *dhanada* from the Khasias and Burmah in collections are really *C. affinis* (*vide* p. 121 *post*).

! CELÆNORRHINUS ANDAMANICA. (Plate XXII. figs. 2, 2 *a*.)

Plesioneura dan, var. *andamanica*, Wood-Mason & de Nicéville, Jour. As. Soc. Beng. 1881, p. 257; iid. op. cit. 1887, p. 391.
Coladenia dan, var. *andamanica*, Watson, Hesp. Ind. p. 120.

In the male of this species the lower lobe of the clasp is acute with a strong tooth near the middle of its upper edge, and the tegumen is bifid in its apical third.

Hab. Andamans (*de Roepstorff*); Cherra Punji (*fide Swinhoe*).

CELÆNORRHINUS INÆQUALIS, n. sp. (Plate XVIII. fig. 3, ♂.)

♂. Allied to *C. saturatus*, from which it differs as follows:—The band on the fore wing is narrower and paler, somewhat resembling that of *C. tibetana*, Mab., and the spots which connect the band with the costa are quite hyaline. The pale spot in cell 3 fills up the base of that cell, the inner edge of the pale spot in cell 2 does not reach further inwards than the base of vein 3, and the pale spot in cell 1 *a*, which joins the apical third of the lower edge of that in cell 2, is oblique, about one-half higher than wide, and has its outer edge almost continuous with that of the spot in cell 2. On the hind wing below there is a feeble suffused yellow spot next the transverse vein and the faint indication of a postmedian series of similar spots running parallel to the termen. The fringe of the hind wing is greyish yellow, slightly interrupted with brown next veins 2–4, and the short scales are brown.

Expanse 36 mm.

Hab. Gedeh, Java.

Described from one example ex coll. Staudinger.

CELÆNORRHINUS DENTATUS, n. sp. (Plate XVIII. fig. 4, ♂.)

Differs from *C. saturatus* as follows:—

♂. Upperside browner, the hind wing therefore not exhibiting brown spots; the pale spot in cell 3 of the fore wing filling up the extreme base of that cell; the pale spot in cell 1 *a* of the fore wing oblong, with a large tooth continuous with its inner edge jutting out at its inner lower angle.

♀. Similar to the male, but the hyaline spot in cell 1 *a* of the fore wing below is attended on its outer side by a subquadrate yellow opaque spot.

Expanse 38–39 mm.

Hab. Kina Balu, Borneo (*Waterstradt*).

Described from one pair ex coll. Staudinger.

CELÆNORRHINUS FULVESCENS, n. sp. (Plate XVIII. fig. 5, ♂.)

♂. Differs from *C. saturatus* in the following particulars:—Rather smaller and decidedly brighter and more reddish yellow-brown in colour; the pale spot in cell 3 of the fore wing fills up the entire base of that cell, and the pale spot in cell 1 *a* of the fore wing is a mere point situate next the middle of the lower edge of the pale spot in cell 2; the latter character will serve to distinguish it from the variety of *C. saturatus* in which the pale spot in cell 3 of the fore wing fills up the base of that cell.

Expanse 33 mm.

Hab. Kina Balu, Borneo (*Waterstradt*).

Described from one example ex coll. Staudinger.

! CELÆNORRHINUS SATURATUS, n. sp. (Plate XVIII. fig. 6, ♂; Plate XXII. figs. 5, 5*a*.)

♂. Upperside warm brown, passing into yellow-brown on the hind wing by reason of the rather heavy clothing of dull yellow scales: fore wing with an oblique sordid yellow median macular band composed of the following elements:—an opaque spot next the costa, a large oblong hyaline spot across the cell having its outer edge notched, a hyaline spot ocupying the basal third of cell 3 except the extreme base, a large hyaline spot occupying the middle third of cell 2 and usually in the form of a parallelogram, and a small roundish or subquadrate hyaline spot in cell 1 *a*, standing next to the apical third of the lower edge of the spot in cell 2; three small subequal yellowish hyaline spots in cells 6, 7, and 8, and sometimes a pale point near the middle of one or both of cells 4 and 5: hind wing with a suffused brown discal spot and a postmedian macular band of suffused brown spots running parallel with the termen. Underside: fore wing brown, a little paler along the dorsum; pale spots as on the upperside, but that next the costa stronger; sometimes there is a suffused pale subtornal spot: hind wing brown, with a feeble pattern of suffused dull yellow spots, of which one lies across the middle of the cell, one before the middle of cell 7, and the remainder form median and postmedian curved series running parallel with the termen. Fringe of the fore wing brown, sometimes paler next cell 1 *a*; of the hind wing brown, more or less chequered with yellowish grey. Antennæ brown, more or less spotted with yellowish white and with a feeble yellowish ring next the base of the club. Body and legs concolorous with the wings. Second joint of palpi clothed with greyish-yellow hairs, with a few black ones intermixed. Lower lobe of clasp subtruncate, its upper edge simple; tegumen bifid to the middle.

♀. Similar to the male.

Expanse 37 mm.

Hab. Megamendong, Tjampea, Java (*Piepers*); Java (*Fruhstorfer*); Arjuno, Java, Bali (*Doherty*).

Described from six males and one female in coll. Elwes. One of the six males has the base of cell 3 entirely filled up with yellow. This species might be confused with large specimens of *Coladenia dan*, Fab., but the latter may be at once distinguished by the porrect third joint of its palpi.

Specimens of this species were sent by Herr Snellen as *dhanada*, Moore, and it is probable that the *dhanada* of the British Museum and some other collections is the same thing.

! CELÆNORRHINUS CAMERONI.

Plesioneura cameroni, Distant, Ann. & Mag. Nat. Hist. ser. 5, vol. x. p. 248 (1882).
Kerana aurivittata, var. *cameroni,* ibid. Rhop. Mal. p. 403, pl. xxxiv. fig. 19 (1886).

Hab. Perak (*Doherty*); Malacca (*ex coll. Stgr.*).

! CELÆNORRHINUS LATIVITTUS, n. sp. (Plate XVIII. fig. 7, ♂.)

Plesioneura lativitta, Staudinger, *in litt.*

♂. Resembles *C. dentatus*, but is rather smaller and darker and also differs from it in the following particulars:—Band on the fore wing deep golden yellow, practically of the same tint throughout, its inner edge straight and continuous from the costa to vein 2, its width where it crosses the cell equal to or exceeding one-fifth of the length of the costa; the pale spot in cell 1 *a* of the fore wing triangular, adjoining the apical half of the lower edge of that in cell 2, its apex nearly touching vein 1 *a*, its outer edge irregular and attended by a more or less distinct suffused yellow spot; on the underside of the fore wing the triangular yellow spot in cell 1 *a* and a subquadrate spot between it and the termen are plain and confluent, forming a large subtornal spot. On the upperside the surface of the triangular spot in cell 1*a* of the fore wing is similar to that of the spot in cell 2, but on the underside its surface is scaled as heavily as the rest of cell 1 *a*, but with yellow scales.

♀. Similar to the male, but a little larger and paler.

Expanse 35–37 mm.

Hab. Kina Balu, Borneo (*Waterstradt*).

Described from one pair in coll. Elwes. Others are in Dr. Staudinger's collection.

! CELÆNORRHINUS AFFINIS, n. sp. (Plate XVIII. fig. 9, ♀; Plate XXII. fig. 4.)

Differs from *dhanada*, Moore, in the particulars set forth in the table of species. Having regard to the male genitalia, it is much more nearly allied to *C. dhanada* than to *C. aurivittata*, and it is, probably, the species upon which Watson bases his assertion (Hesp. Ind. p. 149) that the fringe of the hind wing in *aurivittata* is not invariably brown.

Hab. Khasias (*Hamilton*); E. Pegu (*Doherty*); Tenasserim (*Bingham*).

! CELÆNORRHINUS AURIVITTATA. (Plate XXII. figs. 3, 3 *a.*)

Plesioneura aurivittata, Moore, P. Z. S. 1878, p. 843, pl. liii. fig. 2.
Kerana aurivittata, Watson, Hesp. Ind. p. 149 (1891).

The best points for distinguishing this species from *dhanada*, Moore, lie in the deep yellow spot near the tornus of the fore wing, which forms the end of the pale band, and the unchequered brown fringe of the hind wing; in these respects it resembles the *aurivittata* var. *cameroni* of Distant, which, however, is easily distinguished by the difference in the pale band on the fore wing set forth in the foregoing table. Watson's statement that the fringe of *aurivittata* is not invariably brown on the hind wing leaves one in doubt whether the localities which he gives for that insect really refer to the *aurivittata* of Moore and of this paper or to *C. affinis*.

Dr. Staudinger sends from Kina Balu, Borneo, a single female specimen, which differs from *aurivittata* as follows:—The pale spots in cells 6, 7, and 8 of the fore wing are unequal, that in cell 7 being at least twice as large as the minute punctiform ones in cells 6 and 8; the pale spot in the cell of the fore wing reaches two millimetres further inward than that in cell 2, and the hind wing below has a narrow yellow spot next the transverse vein and a subterminal series of suffused indistinct yellow spots, of which the strongest are two near the apex of cell 1 *b*.

Hab. Nagas, Upper Burmah (*Doherty*); Tavoy (*Pitman*); Andamans (*fide Swinhoe*).

! CELÆNORRHINUS LADANA.

Carystus ladana, Butler, Trans. Ent. Soc. Lond. 1870, p. 502; id. Lep. Exot. p. 170, pl. lix. fig. 1 (1874).

Hab. Perak (*Doherty*).

CELÆNORRHINUS BATCHIANUS, n. sp. (Plate XVIII. fig. 10, ♂).

♂. Upperside dark brown: fore wing with a somewhat narrow pale yellow oblique band from the upper edge of the cell to vein 2, of which latter it adjoins the preapical fourth; the inner edge of this band is practically regular. Underside similar to the upperside, but somewhat paler. Fringes brown. Antennæ brown above, grey-brown beneath, the apiculus whitish or yellowish on the underside. Body and legs concolorous with the wings.

♀. Similar to the male, but a little larger and paler, and having in cell 1 *a* of the fore wing a triangular yellow spot adjoining the lower edge of the yellow spot in cell 2 beyond its middle and reaching less than halfway across the cell. On the underside of the fore wing there is a little yellow suffusion from the upper edge of the cell towards the costa.

Expanse 40–43 mm.

Hab. Batchian (*fide Stgr.*).

Described from one pair ex coll. Staudinger.

! CELÆNORRHINUS BADIA.

Pterygospidea badia, Hewitson, Ann. & Mag. Nat. Hist. ser. 4, vol. xx. p. 322 (1877); id. Desc. Lep. Coll. Atk. p. 4 (1879).

Plesioneura badia, de Nicéville, Jour. As. Soc. Beng. 1883, p. 88, pl. x. fig. 10, ♂.

Hab. Sikkim (*Möller*).

This seems an extremely rare and local species.

ABRAXIMORPHA, gen. nov.

This generic name is proposed for *Pterygospidea davidii*, Mab., a species which is totally different in facies from any of the species properly referred to either of the genera in which it has hitherto been placed, namely, *Pterygospidea* and *Celænorrhinus*.

Antennæ, wing-shape, venation, and tibial spurs of *Celænorrhinus*. Palpi: second joint ascending, third well-developed, porrect. Fore wing above greyish black, with many irregular pure white spots; hind wing below pure white, with four irregular transverse series of greyish-black spots—basal, antemedian, postmedian, and terminal. Front coxæ of the male with a long hair-pencil on the inner lower side; no hair-pencil on the hind tibiæ.

! ABRAXIMORPHA DAVIDII.

Pterygospidea davidii, Mabille, Ann. Soc. Ent. Fr. 1876, p. liv.

Celænorrhinus davidi, Leech, Butt. China &c. p. 572, pl. xxxix. fig. 9, ♂.

Hab. Central China (*Pratt*).

SARANGESA.

Sarangesa, Moore, Lep. Cey. i. p. 176 (1881); Watson, Hesp. Ind. p. 53 (1891); id. P. Z. S. 1893, p. 48. Type *purendra,* Moore.

Hyda, Mabille, Bull. Soc. Ent. Fr. (6) ix. p. clxxxiii (1889). Type *micacea,* Mab.

Sape, Mabille, Bull. Soc. Ent. Belge, p. lxvii (1891). Type *lucidella,* Mab.

The slight arching of the lower margin of the cell of the fore wing between veins 2 and 3 in *Sarangesa*, upon which Watson in his table relies for the separation of the former from *Coladenia*, Moore, is so slight as not to be readily appreciable.

The following is a table of the species known to us:—

1 (4). Hind wing below with small pale spots.
2 (3). A large transparent pale spot in cell 2 of fore wing . . . . . *purendra,* Moore.
3 (2). No such spot in cell 2 of fore wing . . . . *sati,* de Nicév.

4 (1). No pale spots on hind wing below.
5 (6). Hind wing below grey-brown, with three transverse series of darker spots . . . . *dasahara*, Moore.
6 (5). Hind wing below for the most part pale bluish white . . . . . *albicilia*, Moore.

! SARANGESA PURENDRA. (Plate XXII. figs. 6, 6 *a*.)

Sarangesa purendra, Moore, P. Z. S. 1882, p. 262; Watson, Hesp. Ind. p. 54 (1891).

Hab. Mandi, N.W. Himalaya (*Young*); ? Nilgiris (*Roberts*).

As defined by the characters in the foregoing table this form seems a good species. We only know it certainly from the N.W. Himalaya, but I have a specimen believed to be from the Nilgiri Hills, whence *dasahara* is recorded by Sir G. F. Hampson.

! SARANGESA SATI. (Plate XXII. fig. 8.)

Sarangesa sati, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1891, p. 391, pl. G. fig. 37, ♂.

Hab. Kutch; Rajputana.

! SARANGESA DASAHARA. (Plate XXII. fig. 7.)

Nisioniades dasahara, Moore, P. Z. S. 1865, p. 787.
Sarangesa dasahara, Watson, Hesp. Ind. p. 54 (1891).

Hab. Kangra (*Hocking*); Mandi (*Young*); Sikkim (*Möller*); Nagas, E. Pegu (*Doherty*); Ganjam (*Minchin*); Bombay (*Swinhoe*); Canara (*Aitken*); Tenasserim (*Bingham*); Akyab (*Adamson*).

This species and *albicilia* are remarkable for the possession, in the male, of a slightly curved horn on each side of the base of the terminal part of the tegumen; in *purendra* and *sati* this part is simple, not subtended by a horn on each side.

! SARANGESA ALBICILIA.

Sarangesa albicilia, Moore, Lep. Cey. i. p. 176, pl. lxviii. figs. 5, 5 *a* (1881); Watson, Hesp. Ind. p. 55 (1891).

Hab. Ceylon (*Wade, Mackwood*).

This insect, in its typical state, is evidently a Ceylonese local form of *S. dasahara*, Moore; the male genitalia in each absolutely agree, and the only point of distinction is the development in *albicilia* of the bluish-white shade (with the co-extensive white fringe) on the hind wing below, which proceeds from the tornal region and spreads over the whole surface, except about the costal third. The two specimens on which Mr. Hampson includes *albicilia* in his Nilgiri list (Jour. As. Soc. Beng. 1888, p. 368), and of which he remarks that they differed from Ceylon specimens in being dusky instead of white on the underside of the hind wing, seem to have been intermediate between the two forms. The tendency to the development of the pale suffusion of the hind wing below is evident in an otherwise normal specimen from Akyab; and Moore seems to have had in mind specimens similar to this when he wrote that *albicilia* "differs from *S. dasahara* in the hind wing being *more prominently* white."

Coladenia.

Coladenia, Moore, Lep. Cey. vol. i. p. 180 (1881); Watson, P. Z. S. 1893, p. 49. Type *indrani,* Moore.

A genus of few species, placed together on account of their resemblance to "*Plesioneura*" *indrani,* Moore. The third joint of the palpi is porrect.

The species known to us may be distinguished as follows:—

Fore wing above with a black or denuded and therefore dark spot or spots near the basal third of cell 1 *a,* visible on one or both surfaces.
- Hind wing below with three or more black spots.
  - Fore wing below with a more or less distinct yellow spot in the apex of cell 1 *a.*
    - Pale spots in cells 6, 7, and 8 of fore wing subequal in size, their bases practically in line . . . . *indrani,* Moore.
    - Pale spots in cells 6 and 8 of fore wing larger than that in cell 7, their bases nearly in line with the apex of the spot in cell 7 . . . . *tissa,* Moore.
  - No such spot on the fore wing below.
    - Termen of hind wing bluntly angulated between veins 2 and 4. Hyaline spot in cell 7 of fore wing well developed. Dark spots in cell 7 of hind wing below subequal in size . . . . . *laxmi,* de Nicév.
    - Termen of hind wing rounded or scarcely perceptibly produced between veins 2 and 4. Hyaline spot proper to cell 7 of the fore wing obsolete or wanting. Distal dark spot in cell 7 of the hind wing below subquadrate, twice as large as the proximal one . . . . *sobrina,* n. sp.
- Hind wing below brown, with three transverse curved series of suffused ochreous spots . . . . *dan,* Fab.

Fore wing above with no dark spot near the basal third of cell 1 *a.*
- Hyaline spots on the fore wing pure white.
  - Outermost row of dark spots on the hind wing passing through cells 4–5 just before the middle.
    - Upperside pale brown. Back of tegumen simple . . . . *agni,* de Nicév.
    - Upperside dark umber-brown. Tegumen with a large dorsal crest . . *agnioides,* n. sp.
  - Outermost row of dark spots on the hind wing passing through cells 4–5 evidently beyond the middle . . . . *igna,* Semper.
- Hyaline spots on the fore wing sordid yellowish white. Outermost row of dark spots on the hind wing passing through cells 4–5 just before the middle. Upper edge of clasp with one small sharp triangular tooth near the middle . . . . *semperi,* n. sp.

! Coladenia indrani.

Plesioneura indrani, Moore, P. Z. S. 1865, p. 789.
Coladenia indrani, Watson, Hesp. Ind. p. 118.

Two specimens from North Canara (Aitken, 11.7.90 and 14.8.90) differ from the ordinary form in the umber-brown colour of the upperside, and in the absence of the subterminal series of pale markings, except the spot in cell 1 *a* on the fore wing below. A specimen from the Nilgiris (Hampson, 8.9.84), which is probably of the same species as the specimens recorded by Hampson from the Nilgiris as *C. tissa*, is intermediate in appearance between the Canara specimens and the ordinary form. The male genitalia afford no means of distinction between the three forms.

Hab. Sikkim (*Möller*); Burmah (*Doherty*); Tenasserim (*Bingham*); N. Canara (*Aitken*); Nilgiris (*Hampson*).

Coladenia tissa.

Coladenia tissa, Moore, Lep. Cey. i. p. 180, pl. lxvii. fig. 6 (1881).

This species, though otherwise closely resembling the preceding, and probably just as variable in colour, may be known in both sexes by the distinct displacement inwards of the middle one of the three pale spots which form the subapical series. The differences in the male genitalia of the two species are merely those of degree.

Hab. Ceylon (*Wade, Mackwood*).

! Coladenia laxmi. (Plate XXII. fig. 10.)

Plesioneura laxmi, de Nicéville, Jour. As. Soc. Beng. 1888, p. 290, pl. xiii. fig. 5, ♀.
? *Netrocoryne atilia,* Mabille, Le Naturaliste, 1888, p. 88.
Plesioneura atilia, var. *palawana,* Staudinger, Iris, ii. pp. 156, 165, pl. ii. fig. 11 (1889).
Tapena laxmi, de Nicéville, op. cit. 1891, p. 382, pl. G. fig. 28, ♂; Watson, Hesp. Ind. p. 123 (1891); Semper, Schmett. Philipp. p. 316 (1892).

Hab. Perak (*Doherty*; ♂ type in coll. Elwes); Burmah (*Bingham, fide de Nicéville*); Luzon, S.E. Mindanao (*Semper*); Palawan (*Platen*); Kina Balu (*Waterstradt*); Namoe Oekor, Sumatra (*Martin*).

Coladenia sobrina, n. sp. (Plate XVIII. fig. 12, ♂.)

♂. Upperside: fore wing fuscous or mouse-grey, with a suffused dark terminal band and an oblique white macular median band from vein 2 to the costa, composed of the following hyaline spots:—one large and oblong near the middle of cell 2, one small and subquadrate near the base of cell 3, not filling up the base of that cell, one large and oblong across the cell, and one also oblong between the subcostal and the costa, two hyaline points placed obliquely, the lower innermost, beyond the middle of cell 1 *a*, and a small hyaline spot in each of cells 6 and 8, that usually found in cell 7 obsolete or wanting; near the basal third of cell 1 *a* a somewhat indistinct geminate dark spot or pair of spots: hind wing fuscous, with antemedian and postmedian irregular curved series of blackish spots, and a feeble indication of a narrow suffused subterminal dark band from the costa as far as the middle. Underside: fore wing similar to the upperside, but somewhat paler and having the dark spots near the basal third of cell 1 *a* distinct: hind wing with a postmedian series of black spots corresponding with that on the upperside; a black spot in the upper distal angle of the cell, and two in cell 7, one near the base and the other, which is subquadrate and reaches across the cell, near the middle. Fringes dark fuscous, on the underside with a pale anteciliary line. Second joint of palpi clothed with black and pale grey scales intermixed. Antennæ above dark brown, the apiculus and the underside of the shaft pale grey. Body and legs concolorous with the wings.

Expanse 35 mm.

Hab. Namoe Oekor, Sumatra (*Martin*).

Described from a specimen ex coll. Rothschild. This species most nearly resembles *C. laxmi* in colour and markings, but is easily to be distinguished by its larger size and the rounded termen of the hind wing.

! COLADENIA DAN. (Plate XXII. figs. 9, 9 *a*.)

Papilio dan, Fabricius, Mant. Ins. ii. p. 88 (1787).
? *Hesperia eacus*, Latreille, Enc. Méth. ix. p. 738 (1823).
Coladenia dan, Distant, Rhop. Mal. p. 398, pl. xxxv. fig. 27 (1886); Watson, Hesp. Ind. p. 120 (1891).
? *Coladenia dan*, var. *dea*, Leech, Butt. China &c. p. 568, pl. xxxviii. fig. 10, ♂ (1894).
Hesperia fatih, Kollar, Hügel's Kaschmir, iv. p. 454, pl. xviii. figs. 5, 6 (1848).
Coladenia fatih, Watson, t. c. p. 119.

Watson (*t. c.* p. 120) records Mr. de Nicéville's opinion, contrary to that generally prevalent, that this species is distinct from *C. fatih*, Koll.; but he proceeds, "I am unable to say by what characteristic they are to be separated, though *C. fatih* seems to be constantly larger." The latter view is carried out in Watson's arrangement of the specimens in the British Museum, where the larger specimens are called *fatih*, Koll., and the smaller ones *dan*, Fab.

Hab. Kangra (*Hocking*); Kulu (*Young*); Sikkim (*Möller*); Margherita (*Doherty*); Khasias (*Elwes*); Bernardmyo, E. Pegu (*Doherty*); Akyab, Moulmein (*Adamson*); Perak (*Doherty*); Java (*Fruhstorfer*); Sambawa (*Doherty*); Bali, low country (*Doherty*).

! COLADENIA AGNI. (Plate XXII. figs. 11, 11 *a*.)

Plesioneura agni, de Nicéville, Jour. As. Soc. Beng. 1883, p. 87, pl. x. fig. 4, ♀.
Tapena agni, Watson, Hesp. Ind. p. 122 (1891).

Hab. Sikkim (*Möller*); E. Pegu (*Doherty*); Kina Balu, Borneo (*Waterstradt*).

! COLADENIA AGNIOIDES, n. sp. (Plate XVIII. fig. 11; Plate XXII. figs. 12, 12 *a*.)

This species is distinguished from *agni* in the first place by its dark umber-brown colour and the dark umber-brown fringe to cells 6 and 7 on the hind wings below; the pale fringe to these cells is not absolutely constant in *agni*, but is well marked in 4 out of the 5 male specimens examined. The male genitalia also differ considerably: in *agnioides* there is a large dorsal crest on the tegumen and the upper lobe of the clasp is merely a very small pointed strap-shaped piece; in *agni* the back of the tegumen is simple and the upper lobe of the clasp is at least as wide as the lower lobe, rounded on the upper edge and triangularly pointed.

The type in coll. Elwes was taken in the Naga Hills by Mr. Doherty.

COLADENIA IGNA.

Tapena igna, Semper, Schmett. Philipp. p. 316 (1892).

Hab. Luzon, E. Mindanao (*Semper*).

COLADENIA SEMPERI, n. sp.

Tapena laxmi, Semper, Schmett. Philipp. p. 316 (1892), in part.

This species is founded on the male specimen from Camiguin de Mindanao referred to by Semper (*l. c.*) as differing from his other specimens of *laxmi* in having the hyaline spots smaller and yellower, and the hind wing above browner, with the outer row of dark spots more distinct. Fortunately we have been able to examine the clasp-form of this specimen without dissection, and find that it differs from that of *laxmi* in the particulars given in the table above. The angulation of the hind wing also is less evident than in *laxmi*.

Hab. Philippines (*Semper*).

COLADENIA HAMILTONII.

Coladenia hamiltonii, de Nicéville, Jour. As. Soc. Beng. 1888, p. 291, pl. xiii. fig. 8, ♂; Watson, Hesp. Ind. p. 121 (1891).

We transcribe the original description of this species, taken from a single specimen from Sylhet:—

"*Male.* Upperside: fore wing olive-greenish fuscous, with two very irregular broad discal black fasciæ joined in the middle; three most minute transparent subapical dots, the uppermost the largest, placed at the outer edge of the anterior portion of the outer black fascia; a very minute similar spot in the second median interspace; a very attenuated spot across the middle of the first median interspace, both placed on the outer black fascia; the inner margin somewhat broadly irrorated with greyish scales; a submarginal indistinct broad blackish fascia. Hind wing: ground-colour much as in the fore wing, but the outer third of the wing irrorated with grey scales; a recurved black macular decreasing band from the costa near the apex of the wing to the second median nervule; the discocellular nervules defined by a pale line. Underside: both wings vinous fuscous. Fore wing with the transparent spots as above. Hind wing with the disc irrorated with whitish; the macular black band much as above; an anteciliary whitish line. Cilia fuscous.

Expanse, ♂, 1·6 inches."

The figure gives one the idea of a much-worn and possibly abnormal specimen, and it is remarkable that the species, if species it is, has never since turned up among the numerous collections recently sent from the Khasias.

COLADENIA BUCHANANII.

Celænorrhinus buchananii, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1889, p. 187, pl. B. fig. 2, ♀.

We transcribe the original description of this species, which was described from a single specimen from the Ruby Mine District, Upper Burmah, as we have not seen a specimen:—

"*Female.* Very closely allied to *C. laxmi,* mihi, from which it differs in its considerably larger size. Upperside: fore wing with the white discal band fully twice as wide, not divided into spots, extending uninterruptedly from the costa to the submedian nervure, its edges very irregular, its lower portion posterior to the first median nervule much narrower than the rest of the band: this species lacks the two obliquely placed black dots found near the base of the submedian interspace in *C. laxmi.* Hind wing, instead of possessing two parallel discal macular black bands, has a rounded black spot towards the end of the discoidal cell and a discal series of 6 black spots, of which the anterior one is round and well separated from the spot which follows it, the second spot is round, the next pair are the largest and elongated, and the last pair smaller but also elongated; cilia of hind wing anteriorly white, posteriorly dark brown. Underside: both wings with the same differences as above, but all the spots of the hind wing more prominent."

Although this species is compared with *C. laxmi* it agrees better with *C. agni* in the shape of the hind wing.

COLADENIA VITREA.

Coladenia vitrea, Leech, Butt. China &c. p. 569, pl. xli. fig. 15, ♂ (1894).

This species, which was described from a single specimen in the collection of Mr. H. Grose Smith, taken at Ta-tsien-lo, may be distinguished by the hyaline spots on the hind wing below: these, with the exception of one near the base of cell 7, form two irregular transverse series, and are placed as follows:—a subquadrate one near the middle of cell 7, one filling the basal third of cell 6, a large subquadrate one occupying the distal half of the cell, a narrow one across cell 1 *b* before the middle, one in cells 4–5 just beyond the transverse vein, about half as large as that in the cell, one filling the basal third of cell 3, an oblong one near the middle of cell 2, and a narrow one across cell 1 *b* just beyond the middle.

! Coladenia mæniata.

Coladenia mœniata, Oberthür, Études d'Ent. xx. p. 42, pl. ix. fig. 164, ♂ (1896).

Closely allied to *C. vitrea*, Leech, but differs in the number and position of the hyaline spots in the hind wing below as follows:—the spot in cell 6 does not fill the apex of that cell, there is no spot in cells 4–5, nor across cell 1 *b* before the middle. The termen of the hind wing also is more evidently produced near vein 4 than in *C. vitrea*.

Hab. E. Tibet (*fide Oberthür*).

M. Oberthür was good enough to give Elwes a specimen of the species taken at a place called Mænia, which he says is near Ta-tsien-lo; but, notwithstanding the points of difference above noted, we think it may prove to be only a variety of *C. vitrea*, which came from the same district.

Satarupa.

Satarupa, Moore, P. Z. S. 1865, p. 780; Watson, Hesp. Ind. p. 87 (1891); id. P. Z. S. 1893, p. 46. Type *gopala*, Moore.

Daimio, Murray, Ent. Mo. Mag. xi. p. 171 (1875); Watson, P. Z. S. 1893, p. 47. Type *tethys*, Mén.

It would be better to place in this genus all the species which Watson puts into the genus *Daimio*. Murray used the latter name for *tethys*, Mén., but if such insects as *sinica*, Feld., *phisara*, Moore, and *sambara*, Moore, are associated with *gopala*, Moore, and *nymphalis*, Speyer, in one genus, as they well may be, then *tethys*, Mén., which is evidently congeneric, should be with them and the name *Daimio* becomes unnecessary.

Watson says of *Satarupa*: "Closely allied to *Daimio*, from which it may be separated by the shape of the wings, especially of the hind wing, by the much greater length and more decided hook in the terminal portion of the antennal club, and by the scaling of the hind tibiæ of the male." Of the points on which he relies to separate the genera, the greater length of the hind wing is only found in *gopala*, Moore; the more decided hook in the terminal portion of the antennal club is merely a matter of degree, and the scaling of the hind tibiæ of the male is not sufficiently uniform in the species to form a generic distinction. Of *Satarupa* he says: "In the male the hind tibiæ are fringed along their upper edge, and the inner side of the tibiæ is clothed with long, coarse, recumbent hairs,"—thus omitting all mention of the tuft of long hairs which springs from the upperside of the base of the hind tibiæ in *gopala*, Moore, which he makes the type of the genus (*nymphalis*, Speyer, in which a similar structure occurs was, apparently, not before him). In *sambara*, Moore, which he also places in *Satarupa*, there is no trace of the tibial pencil in the male. It appears, therefore, that whilst the tibial pencil is always present in the males of *Daimio*, it is also found in two species of *Satarupa* (*gopala*, Moore, and *nymphalis*, Speyer) and absent from one (*sambara*, Moore).

The genus *Satarupa* was used by Moore, its founder, in the extended sense in which it is here treated.

The following is an analytical table of the species known to us:—

1 (20). Clothing of lower side of second joint of palpi yellow.
2 (17). Pale band on hind wing above similar in colour in both sexes.
3 (14). Pale band on hind wing above pure white or smoke-grey.
4 (13). Pale band on hind wing above pure white.
5 (8). Pale spot in cell of fore wing adjoining its upper edge or reaching across the cell. Species large; expanse 62–73 mm.
6 (7). Pale spot in cell of fore wing subtriangular, adjoining its upper edge but not reaching the lower . . . . *gopala*, Moore.
7 (6). Pale spot in cell of fore wing subreniform, reaching quite across the cell . . . . *nymphalis*, Speyer.
8 (5). Pale spot in cell of fore wing small, next the base of cell 3. Species small, not exceeding 48 mm.
9 (12). White band on hind wing below complete, reaching the costa.
10 (11). Pale spot in cell 1 *a* of fore wing nearly twice as wide as that in cell 2. White band on hind wing much wider than the marginal dark band . . . . *narada*, Moore.
11 (10). Pale spot in cell 1 *a* of fore wing subequal in width to that in cell 2. White band on hind wing not wider (sometimes narrower) than the marginal dark band . . . . *diversa*, Leech.
12 (9). White band on hind wing below cut short by vein 8, not reaching the costa . . . . *diræ*, de Nicév.
13 (4). Pale band on hind wing above smoke-grey. Pale spot in cell 2 small, not reaching vein 2, in shape like the lower half of a crescent. *fumosa*, n. sp.
14 (3). Pale band on hind wing above cream-coloured or sordid white.
15 (16). Pale spot in cell of fore wing large, reaching from side to side . . *bhagava*, Moore.
16 (15). Pale spot in cell of fore wing small, next the base of cell 3, or absent. *phisara*, Moore.
17 (2). Pale band on hind wing above bright yellow in the male, white in the female; pale band on hind wing below white or yellowish white in both sexes.
18 (19). Hind wing above with an indistinct suffused pale subterminal line, the space between it and the pale discal band somewhat darker than the space between it and the termen, and broken up by slightly paler lines along the veins into a series of dark spots . . *celebica*, Feld.

19 (18). Hind wing above with a subterminal series of suffused spots (on the upperside brownish grey in the male and whitish in the female, on the underside white in both sexes), the space between it and the diseal baud not broken into spots by pale lines	*corona,* Stgr.
20 (1). Clothing of lower side of second joint of palpi pure white.	
21 (26). No white spot in cell of fore wing.	
22 (25). Abdomen above wholly or in part white.	
23 (24). Abdomen above entirely white. Base of hind wing below bluish white.	*dohertyi,* Watson.
24 (23). Abdomen above dark at base and apex, white in the middle. Base of hind wing below brown	*sambara,* Moore.
25 (22). Abdomen above entirely brown	*affinis,* Druce.
26 (21). A large white spot reaching quite across cell of fore wing. Abdomen dark with narrow pale rings or entirely dark.	
27 (28). White band on hind wing above very distinct	*sinica,* Feld.
28 (27). White band on hind wing above absent or but faintly indicated . .	*tethys,* Mén.

! Satarupa gopala.

Goniloba gopala, Moore, Cat. Lep. Mus. E.I. C. i. p. 246.
Satarupa gopala, Moore, P. Z. S. 1865, p. 780, pl. xlii. fig. 1; Watson, Hesp. Ind. p. 90 (1891).

Hab. Sikkim (*Möller*); Khasia (*Hamilton*).

! Satarupa nymphalis.

Tagiades nymphalis, Speyer, Stett. ent. Zeit. xl. p. 348 (1879); Staudinger, Mém. sur Lép. iii. p. 153, pl. viii. fig. 4 (1887).
Satarupa nymphalis, Leech, Butt. China &c. p. 562 (1894).

Hab. Amurland (*fide Speyer*); Chefoo, North China (*in B. M.*); Central and Western China (*Pratt*).

! Satarupa narada.

Satarupa narada, Moore, Jour. As. Soc. Beng. 1884, p. 51; Watson, Hesp. Ind. p. 89 (1891).

Hab. Sikkim (*Möller*); E. Pegu (*Doherty*).

! Satarupa diversa.

Pterygospidea diversa, Leech, Entomologist, xxiii. p. 46 (1890).
Daimio narada, var. *diversa,* Leech, Butt. China &c. p. 566, pl. xxxviii. fig. 14, ♂ (1894).

This insect is quite as distinct from *S. narada,* Moore, as are some of the admitted species *inter se,* and there seems to be no advantage in treating it as a variety of *narada.*

Specimens from the Khasia Hills agree with those from Central China. We have not seen it from any intermediate locality.

! SATARUPA DIRÆ.

Daimio diræ, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1895, p. 369, pl. Q. fig. 49, ♂.
Tagiades graya, Staudinger, MS.

Hab. Pulo Laut; Arjuno; Java; Bali (*Doherty*); N.E. Sumatra (*fide de Nicéville*).

Abdomen black, hind-margin of the segments narrowly white.

A single female from Pulo Laut, which otherwise much resembles *diræ*, has the abdomen white with the apical third black.

SATARUPA FUMOSA, n. sp. (Plate XVIII. fig. 13, ♂.)

♂. Upperside fuliginous brown: fore wing with seven white hyaline spots—one, the largest, in shape like the lower half of a crescent, in cell 2 next the base of vein 3 and not quite reaching vein 2, one in cell 3 outwardly oblique from the base of vein 4, four small and punctiform (one near the middle of cells 5 and 8 and one near the basal third of cells 6 and 7), and one small and roundish near the apical fourth of the upper edge of the cell: hind wing with a broad discal band and a narrow subterminal macular band smoke-grey. Underside: fore wing as on the upperside and having two suffused subquadrate white spots divided by the intraneural fold near the apex of cell 1 *a*: hind wing fuliginous brown, with bluish-white hairs near the base, a broad pure white discal band from the dorsum as far as vein 7 and continued into cell 7 by a suffused whitish spot near the middle of the lower edge of that cell, and a subterminal series of seven suffused sordid whitish spots, two in cell 1 *b* and one in each of cells 2–6. Fringes and body above concolorous with the wings. Antennæ blackish, apiculus grey beneath. Clothing of the second joint of the palpi and the breast yellow, of the legs sordid white. Abdomen beneath white.

Expanse 35 mm.

Hab. Sumatra (*Martin*).

Described from one specimen in coll. Rothschild.

! SATARUPA BHAGAVA.

Satarupa bhagava, Moore, P. Z. S. 1865, p. 781; Watson, Hesp. Ind. p. 88 (1891).
Satarupa phisara, var.?, Elwes, P. Z. S. 1892, p. 655.
Tagiades bhagava, var. *andamanica*, Wood-Mason & de Nicéville, Jour. As. Soc. Beng. 1881, p. 256, pl. iv. fig. 5, ♂; Watson, l. c.

Hab. Bernardmyo, Burmah (*Doherty*); Tavoy (*Tucker*); ? Sikkim.

We identify this species by Moore's description alone. He gives N.E. Bengal as the habitat. It may occur in Sikkim, but we have no specimens from there.

The var. *andamanica*, according to the figure, differs from the type in wanting the cream-coloured subquadrate spot near the middle of cell 1 *a* on the fore wing above and the cream-coloured streak below vein 1 *a* by which the spot is continued to the dorsum; it agrees with the type on the underside. Judging from the description, however, it is a mere trifling variety with no constant character and not worthy of a name.

! SATARUPA PHISARA.

Satarupa phisara, Moore, Jour. As. Soc. Beng. 1884, p. 50; Wood-Mason & de Nicéville, op. cit. 1886, p. 390, pl. xvii. fig. 4, ♂; Watson, Hesp. Ind. p. 89 (1891).
Satarupa bhagava ?, de Nicéville, Jour. As. Soc. Beng. 1883, p. 90, pl. x. fig. 14, ♀.

Hab. Sikkim (*Möller*); Khasia (*Hamilton*).

! SATARUPA CELEBICA.

Pterygospidea celebica, Felder, Reise Nov., Lep. iii. p. 528, pl. lxxiii. fig. 8, ♂ (1867).
Pterygospidea permena, Hewitson, Descr. Hesp. p. 51 (1868).

Hab. Sula Island (*coll. Stgr.*); Celebes (*fide Felder*).

! SATARUPA CORONA.

Tagiades corona, Staudinger, MS.
Satarupa corona, Semper, Schmett. Philipp. p. 306, pl. xlix. fig. 2, ♀ (1892).

Hab. Davao, Mindanao (*coll. Staudinger*); Philippines (*Semper*).

SATARUPA DOHERTYI.

Satarupa dohertyi, Watson, P. Z. S. 1893, p. 46.

Rather larger than *S. sambara*, with the postmedian row of black spots on the hind wing below more regular and freer from the dark terminal band.

Hab. Kumaon (*fide Watson*).

SATARUPA SAMBARA.

Goniloba sambara, Moore, Cat. Lep. Mus. E.I. C. i. p. 246 (1857).
Satarupa sambara, Moore, P. Z. S. 1865, p. 781; Watson, Hesp. Ind. p. 89 (1891).

Hab. Sikkim (*Möller*); Khasia (*Hamilton*).

! SATARUPA AFFINIS.

Satarupa affinis, Druce, P. Z. S. 1873, p. 360, pl. xxxiii. fig. 9.
Satarupa affinis, var. *cognata*, Distant, Rhop. Mal. p. 385, pl. xxxv. fig. 17 (1886).
Tagiades niphates, Weymer, Stett. ent. Zeit. vol. xlviii. p. 15, pl. i. fig. 5 (1887).

This species is nearest to *S. sambara*.

Hab. Kina Balu (*Waterstradt*); Sumatra (*fide de Nicéville*); Perak (*fide Distant*); Preanger, W. Java (*Piepers*).

! SATARUPA SINICA.

Pterygospidea sinica, Felder, Wien. ent. Mon. vi. p. 30 (1862).
Pterygospidea moori, Mabille, Ann. Soc. Ent. Fr. 1876, p. clii; Alphéraky, Rom. Mém. sur Lép. v. p. 122, pl. v. figs. 9 *a, b* (1889).
Daimio felderi, Butler, Ann. & Mag. Nat. Hist. (5) vii. p. 140 (1881).
Daimio sinica, Leech, Butt. China &c. p. 565 (1894).

Hab. Central and Western China (*Pratt, Leech*).

The insect here dealt with is the same as that figured by Alphéraky as cited above, but we have no means of deciding if it is really the true *sinica* of Felder.

The *sinica*, Feld., of the British Museum collection, from North China, is a species with the clothing of the second joint of the palpi below yellow, the white band on the hind wing below reaching from the costa to the dorsum, and bearing a subquadrate brown spot near the apical third of cell 7; the fore wing above has a white band from the middle of the dorsum to the hyaline spot in cell 2 three-fourths as wide as that spot; and the abdomen above is white with the apical fourth brown.

SATARUPA TETHYS.

Pyrgus tethys, Ménétriés, Cat. Mus. Petr. p. 126, pl. x. fig. 8 (1857).
Daimio tethys, Pryer, Rhop. Nihon. p. 33, pl. x. fig. 6 (1889); Leech, Butt. China &c. p. 564 (1894).

Hab. Japan (*Pryer, Leech*); Amurland; China (*Pryer*).

ODINA.

Odina, Mabille, Comptes Rend. Ent. Soc. Belg. p. cxiii (1891); Watson, P. Z. S. 1893, p. 50. Type *chrysomelæna,* Mab., = *hieroglyphica,* Butl.

Species orange-yellow, with blackish-brown markings, the dark pattern practically the same on both surfaces. Antennæ more than half as long as costa, club gradual, apiculus acute, scarcely half as long as the club. Palpi ascending, third joint porrect, pointed in *cuneiformis*, Semper, cylindrical and subtruncate in *decoratus*, Hew. Fore wing: vein 5 a little nearer 6 than 4, vein 2 from the basal third of the lower edge of the cell.

Table of Species.

1 (4). Dark markings forming an irregular network on the hind wing above.
2 (3). Hind wing above with the large discal yellow spot triangular . . . *hieroglyphica,* Butl.
3 (2). Hind wing above with the large discal yellow spot irregularly 4-sided . . . . *cuneiformis,* Semper.
4 (1). Dark markings on the hind wing above an antemedian, postmedian, and marginal row of distinct black spots . . . . *decoratus,* Hew.

Odina hieroglyphica.

Plastingia hieroglyphica, Butler, Trans. Ent. Soc. Lond. 1870, p. 511; id. Lep. Exot. p. 171, pl. lix. fig. 12 (1874); Dist. Rhop. Mal. p. 470, pl. xliv. fig. 25.

Odina chrysomelæna, Mabille, Comptes Rendus Soc. Ent. Belg. p. cxiii (1891), *fide* Watson.

Hind wing above orange-yellow, with a brown band from the middle of the costa to the tornus; this band gives off in cell 6 a Y-shaped branch to join the brown terminal band, and in cell 2 a simple branch to the same band, the large discal yellow spot is therefore triangular; the space between the lower edge of the cell and the dorsum brown, with two yellow spots, one near the middle of cell 1 *b*, and one near the apical third of cell 1 *a*. Fore wing: yellow spots in cells 2 and 3 forming, when taken together, an oblique suboval spot divided by vein 3; that in cell 3 triangular, that in cell 2 not or scarcely reaching vein 2. These particulars are taken from the type specimen from Borneo in the collection of Messrs. Godman and Salvin.

The *O. hieroglyphica* of the British Museum collection has the hind wing above brown, with a large bright yellow spot near the middle of cell 6: this may be an extreme variation of the true *O. hieroglyphica*, Butl., but we have had no opportunity to compare the two insects with the view of deciding this point.

Hab. Labuan (*coll. Staudinger*); Perak (*fide Distant*); Borneo (*Low in coll. Godman*).

Odina cuneiformis.

Plastingia cuneiformis, Semper, Schmett. Philipp. p. 314, pl. xlix. fig. 11, ♂ (1892).

Hind wing above orange-yellow; the space between the lower edge of the cell and vein 2 and the dorsum brown, except in the apical fourth, and bearing a yellow streak in cell 1 *a*, and a roundish yellow spot near the middle of cell 1 *b*; from the middle of the costa to the base of vein 2 a straight brown band, which gives off in cell 6 an irregularly Y-shaped branch to join the brown terminal band, from the apex of vein 5 to the apical third of vein 2 an irregular widening brown band, the large yellow discal spot is therefore irregularly four-sided. Fore wing: hyaline spots in cells 2 and 3 forming a short regular yellow band from the middle of vein 2 to the base of vein 4.

These particulars are taken from Herr Semper's type specimen from Mindoro.

Hab. Philippines (*Semper*).

! Odina decoratus.

Eudamus decoratus, Hewitson, Descr. Hesp. p. 17 (1867).

Pterygospidea decoratus, id. Ex. Butt. vol. v. pl. *Pterygospidea*, fig. 2 (1873).

Entheus bicolor, Oberthür, Études d'Ent. xvii. p. 14, pl. iv. fig. 36, ♂ (1893).

Hab. Sylhet, Java (*fide Hewitson*); Garo hills (*fide de Nicéville*); East Pegu (*Doherty*); Tonquin (*coll. Oberthür*).

We have not seen the female of this species, which seems to be unknown.

ODINA ORTYGIA.

Odina ortygia, de Nicéville, Jour. As. Soc. Beng. 1895, p. 531.

Closely allied to *hieroglyphica*, Butl., from which it differs "on both surfaces in having all the black markings reduced by half, all the orange markings therefore greatly enlarged."

Expanse $36\frac{1}{4}$ mm.

Hab. Daunat Range, Tenasserim, Burmah (*fide de Nicéville*).

Described from one male specimen.

DARPA.

Darpa, Moore, P. Z. S. 1865, p. 781; Watson, op. cit. 1893, p. 58. Type *hanria*, Moore.

A genus of one species, distinguished as well by its facies as by its much dentate hind wing, which is produced into a strong tooth at the apex of each of veins 2, 3, 5, and 6.

DARPA HANRIA.

Darpa hanria, Moore, P. Z. S. 1865, p. 781, pl. xlii. fig. 2.

Hab. Sikkim (*Möller*).

TAGIADES.

Tagiades, Hübner, Verz. p. 108 (1816); Watson, P. Z. S. 1893, p. 53. Type *japetus*, Cr.
Pterygospidea, Wallgr. Rhop. Caffr. p. 53 (1857). Type *flesus*, Fab.

A genus of soberly coloured species, brought together on account of more or less resemblance to *Papilio japetus*, Cr. In the more typical species the palpi are porrect, densely scaled, with the usual lateral rows of hairs rudimentary or absent, the last joint small and bluntly conical, and the lower edge of the cell of the fore wing is more or less arcuate between the bases of veins 2 and 3; but this latter is a very variable feature. Watson gives the hind tibiæ as "fringed" only, but the males of several species have penicillate hind tibiæ, and in some the intermediate tibiæ are penicillate also.

The following is a table of the species known to us:—

1 (48). Transverse vein of hind wing erect, *i. e.* forming practically a right angle with vein 4.

2 (39). Second joint of palpi densely scaled, when viewed from the side subovate, nearly as wide as long, the lateral row of hairs rudimentary or absent.

3 (26). No hyaline spot in cell 11 of fore wing.

4 (9). Hind wing above brown, no bluish-white pubescence near the termen.
5 (6). Hind wing beneath brown or grey-brown . . . . *ravi*, Moore.
6 (5). Hind wing beneath in greater part bluish white.
7 (8). Expanse 40–47 mm. Fore wing beneath without a bluish-white suffused patch near the tornus . . . . *helferi*, Feld.
8 (7). Expanse 49–55 mm. Fore wing beneath with a bluish-white suffused patch near the tornus . . . . *khasiana*, Moore.
9 (4). Hind wing above with a white or bluish-white patch on the lower half of the termen, or at least with bluish-white pubescence in the same region.
10 (23). Hyaline spots in cell of fore wing very small or absent in the male.
11 (22). Hind wing below with distinct black spots.
12 (17). Pale portion of hind wing above suffused with bluish white, or, if the tornal region of the termen is narrowly white, then the white passes into bluish white towards the base.
13 (14). Hind wing below with the dark costal portion suffused with the bluish white of the disc. Hyaline spots in cells 6, 7, and 8 of fore wing only in either sex . . . . *alica*, Moore.
14 (13). Hind wing below with the dark costal portion sharply separated from the white discal portion, at least near the termen.
15 (16). Hind wing below: dark costal portion continued along the termen towards the tornus as an irregular line which is interrupted in cells 3 and 4. Hyaline spots in cell of fore wing wanting in both sexes . . . . *obscurus*, Mab.
16 (15). Hind wing below: dark costal portion continued along the termen towards the tornus as an uninterrupted row of spots. Hyaline spots in cell of fore wing visible in the male, well developed in the female . . . . *japetus*, Cr.
17 (12). Hind wing above: tornal region of the termen more or less broadly snow-white.
18 (21). Hind wing below: tornal region of the termen with an irregular row of 2 or more, more or less confluent, black spots, which is interrupted in cells 3 and 4.
19 (20). Hind wing below: no dark spot in the end of the cell . . . . *gana*, Moore.
20 (19). Hind wing below: a dark spot in the end of the cell and one in each of cells 3–7, that in cell 7 feeble; in the female the dark spots in cells 3–6 are subequal in size and form a regular row . *karea*, Mab.
21 (18). Hind wing below: termen with a black border from veins 1*b* to 6 interrupted by the intra-neural folds, which appear as white lines parallel with the veins; a feeble dark spot in the end of the cell and another near the middle of cell 7; a well-defined black spot in each of cells 4–5 and 6, the former geminate . . *elegans*, Mab.
22 (11). No well-defined black spots on hind wing below . . . . . . *lavata*, Butl.

23 (10). Hyaline spots in cell of fore wing large and well defined in the male.

24 (25). Termen of hind wing below with a black or brown border from the tornus as far as vein 5 . . . . *titus,* Plötz.

25 (24). Termen of hind wing below entirely white from the tornus as far as vein 5 . . . . *pteria,* Hew.

26 (3). Fore wing with a hyaline spot in cell 11.

27 (38). Hind wing below with distinct black spots.

28 (29). Hind wing above with a dark postmedian spot in cell 1 *b* . . . *menaka,* Moore.

29 (28). No dark postmedian spot in cell 1 *b* on hind wing above.

30 (37). Hind wing above with the dorsum white for at least half its length.

31 (36). Fore wing below without distinct short white streaks in cell 1 *a*.

32 (35). Hind wing above: black terminal spots on veins 1 *b* to 4 subequal in size, sometimes confluent.

33 (34). Tibial pencil in the male yellowish white; clasp simple. A hyaline spot at least indicated in each of cells 2 and 3 of fore wing below, and generally two in the cell . . . . *atticus,* Fab.

34 (33). Tibial pencil in the male brown; upper edge of the clasp near the apex with a long, curved, pointed horn, half as long as the clasp. Fore wing above sometimes with two white points placed one above the other near the apical third of cell 1 *a*, after the manner of *T. pralaya* and *T. trichoneura* . . . . *sambavana,* n. sp.

35 (32). Hind wing above: terminal black spot on vein 1 *b* at least twice as large as those on veins 2, 3, and 4. No hyaline spot in cells 2 and 3 of the fore wing and only one (the upper) in the cell . . *waterstradti,* n. sp.

36 (31). Fore wing below with two distinct short white streaks placed one above the other near the apical third of cell 1 *a* . . . . . . *martinus,* Plötz.

37 (30). Hind wing above with the dorsum white for about one-fourth of its length . . . . *nana,* n. sp.

38 (27). Hind wing below fuliginous brown without black spots: in the male with a suffused white streak in cell 1 *b* and a feeble indication of a suffused terminal macular whitish band arising near the tornus and becoming obsolescent before vein 4; in the female the whitish markings are more extensive, occupying about half of the wing and passing into bluish white at the base, and there is a suffused white spot on the transverse vein . . *nestus,* Feld.

39 (2). Second joint of palpi laxly scaled.

40 (43). No hyaline spot in cell 10 of the fore wing.

41 (42). Termen of hind wing distinctly excavate in cells 4–5 and distinctly produced on vein 1 *b*. No yellow on the hind wing above . . *dealbata,* Dist.

42 (41). Hind wing above with rather more than the terminal third bright yellow. Fore wing above with the apical fifth of cell 1 *a* yellow, and with hyaline spots in each of cells 4–8, those in cells 6–8 large and oblong . . . . *princeps,* Stgr.

43 (40). Fore wing with hyaline spots in cells 10 and 11, those in cells 2 and 3 linear and oblique.
44 (45). Pale portion of hind wing below yellow . . . . *pralaya*, Moore.
45 (44). Pale portion of hind wing below white.
46 (47). Pale portion of hind wing above yellow . . . . *trichoneura*, Feld.
47 (46). Pale portion of hind wing above yellowish white, pale yellow only at the tornus . . . . *trichoneuroides*, Stgr.
48 (1). Transverse vein of hind wing oblique, *i. e.* forming an obtuse angle with vein 4. Second joint of palpi, seen from the side, twice as long as wide, the lateral row of hairs well developed.
49 (50). Fore wing with no hyaline spots in cells 4–8. Hind wing with the subterminal series of dark spots in part merging in the dark terminal band . . . . *pinwilli* Butl.
50 (49). Fore wing with hyaline spots in cells 4–8 and a hyaline streak in the base of cell 4 next vein 4. Hind wing with the postmedian series of dark spots free from the dark terminal band . . . . *tabrica*, Hew.

! TAGIADES RAVI

Pterygospidea ravi, Moore, P. Z. S. 1865, p. 779.
Tagiades ravi, Distant, Rhop. Mal. p. 388, pl. xxxiv. fig. 1, ♂ (1886).

Distant's figure (*l. c.*) is rather poor and represents *T. helferi* rather than *T. ravi*.

Hab. Tavoy (*Pitman*); Nicobar, Perak, Pulo Laut (*Doherty*); Nias (*Modigliani*).

! TAGIADES HELFERI.

Pterygospidea helferi, Felder, Verh. zool.-bot. Gesellsch. Wien, vol. xii. p. 483 (1862).
Tagiades noctis, Stgr. *in litt.*

Hab. Nicobar (*de Roepstorff*); Camorta (*Doherty*); Borneo (*coll. Stgr.*).

! TAGIADES KHASIANA.

Tagiades khasiana, Moore, Jour. As. Soc. Beng. 1884, p. 51.

Hab. Khasias (*Hamilton*); Nagas (*Doherty*); Akyab (*Adamson*); Tavoy (*Pitman*); East Pegu (*Doherty*); Andamans (*de Roepstorff*).

! TAGIADES ALICA.

Tagiades alica, Moore, P. Z. S. 1877, p. 593, pl. lviii. fig. 2, ♂.
Tagiades meetana, id. t. c. 1878, p. 842, pl. liii. fig. 1.

Specimens with both series of fringe-scales white in the tornal region are *alica*, and those with the long fringe-scales brown and the short ones white are *meetana*; these differences, however, depend on the amount of bluish-white scaling on the hind wing above.

Hab. N. Canara (*Aitken*); E. Pegu (*Doherty*); Tavoy (*Pitman*); Andamans (*de Roepstorff*); Perak, Pulo Laut (*Doherty*).

! TAGIADES OBSCURUS.

Tagiades obscurus, Mabille, Ann. Soc. Ent. Fr. ser. 5, vol. vi. p. 274 (1876); Wood-Mason & de Nicéville, Jour. As. Soc. Beng. 1886, p. 389, pl. xvii. fig. 9, ♀.
Tagiades distans, Moore, Lep. Cey. vol. i. p. 175, pl. lxviii. figs. 1, 1 *a* (1880–81).

Hab. Nilgiri hills (*Hampson*); Ceylon (*Mackwood*); Java? (*fide Mabille*).

Though I have not been able to compare Malayan with Ceylon specimens, yet the absence of the discal spots relied on by Moore for distinguishing his species is a character of no value, the two spots being sometimes absent in Ceylon specimens.

It is possible that *obscurus*, Mab., has not been correctly identified and may be a synonym of *japetus*, in which case the name *distans* will stand.

TAGIADES JAPETUS.

Papilio japetus, Cramer, Pap. Exot. iv. pl. ccclxv. E, F (1782).
Tagiades brasidas, Doherty, Jour. As. Soc. Beng. 1891, p. 195.

Hab. Java (*Piepers*); Sambawa, Bali, Lombok (*Doherty*); Amboina (*coll. Snellen*); Philippines?

Though the characters given in the table to separate this from the last species are fairly constant, yet I have two females from the Philippines which have the hind wing below rather as in *obscurus*. Neither of these species is recorded by Semper from the Philippines.

TAGIADES GANA.

Pterygospidea gana, Moore, P. Z. S. 1865, p. 180.
Tagiades gana, Distant, Rhop. Mal. p. 388, pl. xxxiv. fig. 2, ♂ (1886).

Specimens from Java, Nias, Perak, and Pulo Laut are constantly smaller than those from Sikkim.

Hab. Sikkim (*Möller*); Perak, Pulo Laut (*Doherty*); Java (*Fruhstorfer*); Andamans (*de Roepstorff*); Palawan (*Platen in coll. Staudinger*).

! TAGIADES KAREA.

Tagiades karea, Mabille, Comptes Rendus Soc. Ent. Belg. iv. no. 16, p. lxxiii (1891); Semper, Schmett. Philipp. p. 308 (1892).

Hab. Philippines, generally distributed (*Semper*).

! TAGIADES ELEGANS.

Tagiades elegans, Mabille, Bull. Soc. Ent. Fr. 1877, p. xl; Semper, Schmett. Philipp. p. 309, pl. xlix. fig. 4, ♂ (1892).

Hab. Luzon, E. Mindanao (*Semper*).

! Tagiades lavata.

Tagiades lavata, Butler, Trans. Linn. Soc. Lond. Zoology, ser. 2, vol. i. p. 557, pl. lxix. fig 8 (1877); Distant, Rhop. Mal. p. 389, pl. xxxiv. fig. 5.

Hab. N. Borneo (*Pryer*); Kina Balu, Borneo (*Waterstradt*); Tavoy (*Pitman*); Bunguran, Natuna Island (*Everett*).

! Tagiades titus. (Plate XX. fig. 15, ♂.)

Tagiades titus, Plötz, Jahrb. Nass. Ver. xxxvii. p. 46 (1884); Semper, Schmett. Philipp. p. 310 (1892).
Tagiades latreillei, Mabille, *fide* Semper.
Tagiades japetus, var. *latreillei*, Staudinger, Iris, ii. p. 160 (1889) (*fide* Semper).

Male. Hind wing below white, with a blackish border round the costa and termen, its inner edge suffused; a feebly indicated dark spot near the middle of cell 3, a geminate spot in cells 4–5 and a larger one in cell 6 blackish. In the female the hind wing below is paler and the pale discal portion is bluish white.

Hab. Philippines (*Semper*); Palawan (*Staudinger*).

Tagiades pteria.

Pterygospidea pteria, Hewitson, Descr. Hesp. p. 51 (1868); id. Exot. Butt. v., *Pterygospidea*, pl. i. fig. 1 (1873).
Tagiades pteria, Semper, Schmett. Philipp. p. 308 (1892).

In this species the hind wing above resembles that of *T. pralaya* or *T. trichoneura*, save that the pale part is white or yellowish white instead of yellow; it is distinguished from these species by the small and roundish hyaline spots in cells 2 and 3 and the want of hyaline spots in cells 10 and 11 of the fore wing.

Hab. E. Mindanao (*Semper*).

! Tagiades menaka.

Pterygospidea menaka, Moore, P. Z. S. 1865, p. 778.
Tagiades atticus, Leech, Butt. China &c. pl. xxxviii. fig. 13, (1892–94), *nec* Fabr.

The dark spot near the apical third of cell 1 *b* in the hind wing is absolutely diagnostic of this species. It does not appear that this species ever has more than one pale spot in the cell of the fore wing, but this character *alone* will not separate it from those specimens of *T. atticus* which want the lowermost pale spot in the cell of the fore wing.

Hab. N.W. Himalaya (*Young*); Nipal; Sikkim (*Möller*); Khasias; Nagas, E. Pegu (*Doherty*).

! TAGIADES ATTICUS. (Plate XXII. fig. 13.)

Hesperia atticus, Fabricius, Ent. Syst. iii., i. p. 339 (1793).

Tagiades atticus, Moore, Lep. Cey. vol. i. p. 175, pl. lxviii. fig. 2 (1880–81); Wood-Mason & de Nicéville, Jour. As. Soc. Beng. 1886, p. 389, pl. xvii. fig. 10, ♀.

Tagiades calligana, Butler, Trans. Linn. Soc. Lond. Zoology, ser. 2, vol. i. p. 556, pl. lxix. fig. 11.

Tagiades atticus, var. *calligana*, Distant, Rhop. Mal. p. 387, pl. xxxiv. fig. 6.

Tagiades menaka, Staudinger, Iris, ii. p. 159 (1889).

Tagiades litigiosa, Möschler, Verh. zool.-bot. Wien, xlviii. p. 230 (1878).

Hab. Sikkim (*Möller*); Nagas, E. Pegu, Pulo Laut (*Doherty*); Palawan (*Platen*); Java (*coll. Stgr.*).

We are indebted to Dr. Staudinger for the opportunity of examining the type of *litigiosa*, Möschl., from "India ? Silhet."

! TAGIADES WATERSTRADTI, n. sp. (Plate XX. fig. 7, ♂.)

♂ ♀. Nearest to *T. atticus*, Fab., from which it differs in the following points:—On the fore wing there is no hyaline spot in cells 2 and 3, and only one (the uppermost) in the cell, and on the hind wing above the black basal portion is more extensive, the dorsum being black for at least half its length, and the black terminal spot on vein 1 *b* is at least twice as large as those on veins 2, 3, and 4.

Expanse $36\frac{1}{2}$–$38\frac{1}{2}$ mm.

Hab. Kina Balu, Borneo (*Waterstradt*).

Described from three specimens ex coll. Staudinger, one of which is now in coll. Elwes.

! TAGIADES MARTINUS.

Tagiades martinus, Plötz, Jahrb. Nass. Ver. xxxvii. p. 47 (1884); Semper, Schmett. Philipp. p. 309, pl. xlix. fig. 3, ♂ (1892).

Hab. Amboina, Philippines, Aru Islands, Mysol (*Semper*); Celebes (*coll. Stgr.*).

! TAGIADES SAMBAVANA, n. sp. (Plate XX. fig. 10, ♂; Plate XXII. fig. 14.)

Very similar to *T. atticus*, but on the hind wing below the black spot in the cell is wanting or very small, and on the upperside there are sometimes two white points near the apical third of cell 1 *a* in the fore wing (as seen in *T. trichoneura* and *T. pralaya*). The species is however well distinguished by the clasp-form of the male. In *T. atticus* the apical part of the clasp is triangular and its apex, instead of being deflexed and serrate as in *T. menaka*, is simple; in *T. sambavana* the clasp has a short spiniform tooth near the middle of its upper edge, and beyond this, at a distance about equal to the distance of the short tooth from the base of the clasp, there arises a long curved acuminate horn, which is about equal in length to the greatest width of the clasp.

Hab. Sambawa, Bali (*Doherty*). Described from eight males and one female in coll. Elwes.

! Tagiades nana, n. sp. (Plate XX. fig. 13, ♂.)

♂. Upperside dark olive-brown, with a pure white patch next the tornus of the hind wing bearing two black spots. Fore wing with nine transparent white points placed as follows, namely, two near the apex of the cell, one near the basal third of cell 3, one near the middle of each of cells 4, 5, and 6, one near the basal third of cell 7, one near the middle of cell 8, and one near the apex of cell 11; fringe concolorous. Hind wing with a pure white patch reaching from the dorsum as far as vein 3, and one-fourth or one-fifth the length of the wing, its inner edge rather sharply defined; a large spot at the apex of vein 1 *b* and a smaller one at the apex of vein 2, black; fringe white from the tornus to vein 4, thence dark brown. Underside: fore wing a little paler than above: hind wing bluish white, costal region as far as vein 6 brown, the colours suffused; a large black spot near the middle of cells 4–5, a smaller one in cell 6, and the indication of one or more dark spots nearer the base of the wing; on the pale part of the wing there is a fine black terminal line, which expands into triangular spots at the apices of veins 1 *b*, 2, and 3. Body above dark olive-brown, abdomen beneath bluish white.

Expanse 32 mm.

This, the smallest of the genus known to us, appears quite distinct; the type specimen is in my collection.

Hab. Khasia hills (native collectors, *fide Doncaster*); island of Nias (*in coll. Rothschild*).

Tagiades toba.

Tagiades toba, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1896, p. 19, pl. T. fig. 47, ♂.

"*Male.* Upperside: both wings deep black. Fore wing with the following transparent white dots:—Two placed outwardly obliquely towards the outer end of the discoidal cell, the lower one sometimes missing; a costal one placed between the costal nervure and first subcostal nervule; one in the second median interspace; and five subapical forming a perfect S-shaped figure. Cilia fuscous. Hind wing with the anal angle broadly, as far as the second median nervule pure white, bearing a large round black spot on the margin in the submedian interspace, and a small one in the first median interspace; a fine black anteciliary line in the white area. Cilia anteriorly fuscous, posteriorly and along the abdominal margin pure white; very long at the anal angle. Underside: both wings dull black. Fore wing with the dots as on the upperside, a pale suffused twinned spot towards the outer angle in the submedian interspace. Hind wing almost entirely white, the costa and apex broadly, a narrow anteciliary line alone being of the dull black ground-colour; the posterior edge of the blackish area bearing four rounded deep black spots; the two black spots on the outer margin as on the upperside. Thorax and abdomen above black, but the latter tipped with white. Palpi beneath, thorax, legs, and abdomen beneath pure white."

Expanse 34–35 mm.

Hab. Battak Mountains, N.E. Sumatra (*fide de Nicéville*).

After our description and figure of *T. nana* were printed we received Mr. de Nicéville's description and figure of his *T. toba*, which, judging from the figure, appears to be the same as *T. nana*, although the spots on the termen of the hind wing, which he describes as lying in the submedian and first median interspaces respectively, are represented as originating on the apices of the veins, and the figure of the hind wing below shows *three* simple veins between the median vein and the dorsum.

! TAGIADES NESTUS. (Plate XX. fig. 12, ♂.)

Pterygospidea nestus, Felder, Sitz. Ak. Wiss., math.-nat. Cl. xl. p. 461 (1860).

Hab. Amboina (*Felder*); Batchian (*fide Staudinger*).

! TAGIADES DEALBATA.

Tagiades dealbata, Distant, Rhop. Mal. p. 388, pl. xxxv. fig. 25 (1886).

Hab. Upper Assam, Perak, Pulo Laut (*Doherty*); Burmah (*Adamson*).

! TAGIADES PRINCEPS.

Tagiades princeps, Staudinger, *in litt.*; Semper, Schmett. Philipp. p. 307, pl. xlix. fig. 5, ♂ (1892).

Hab. Mindanao (*Semper*).

! TAGIADES PRALAYA.

Pterygospidea pralaya, Moore, P. Z. S. 1865, p. 779.

In this species and the next the intermediate tibiæ of the males are penicillate.

Hab. Sikkim (*Möller*); Khasias (*Hamilton*).

! TAGIADES TRICHONEURA.

Pterygospidea trichoneura, Felder, Wien. ent. Mon. vol. iv. p. 402 (1860); id. Reise Nov., Lep. vol. iii. pl. lxxiii. figs. 14, 15 (1867).

Tagiades trichoneura, var., Distant, Rhop. Mal. p. 389, pl. xxxiv. fig. 20 (1886).

Hab. E. Pegu, Perak, Arjuno, Java (*Doherty*). The specimens from the last-named locality have the hind wing below of a deeper yellow.

! Var. TRICHONEUROIDES, Stgr. MS.

Only differs in the particulars set forth in the table above.

Hab. Kina Balu, Borneo (*Waterstradt*).

! TAGIADES PINWILLI.

Plesioneura pinwilli, Butler, Trans. Linn. Soc. Lond., Zoology, ser. 2, vol. i. p. 556, pl. lxviii. fig. 4 (1877); Distant, Rhop. Mal. p. 400, pl. xxxv. fig. 29, ♂.

Celænorrhinus pinwilli, Watson, Hesp. Ind. p. 144 (1891).

Hab. Margherita, Assam, E. Pegu (*Doherty*); Malacca (*Pinwill*); Tameang Lajang, S.E. Borneo (*in coll. Rothschild*).

TAGIADES TABRICA.

Pterygospidea tabrica, Hewitson, Exot. Butt. v. pl. lix. fig. 8 (1873).
Celænorrhinus tabrica, Watson, Hesp. Ind. p. 143 (1891).

Hab. Darjeeling (*Roberts, fide Hewitson*).

Hewitson's type in the British Museum is a male, and it is very remarkable that if it really came from Darjeeling no other example has since been obtained.

TAPENA.

Tapena, Moore, Lep. Cey. i. p. 181 (1881); Watson, P. Z. S. 1893, p. 60. Type *thwaitesi,* Moore.

A genus of few species closely allied to the next, but distinguished by the single angulation of the termen of the hind wing, which occurs at the apex of vein 3. The hyaline spots in the fore wing of the male in all the species known to us are present only in cells 6, 7, and 8, but there is sometimes an indication of two others in cells 10 and 11; in the hind wing there is sometimes one in the cell near the transverse vein.

In the males the clasp is wider than usual, and the upper lobe is developed into one or more processes which, when *in situ,* lie upon the back of the tegumen and evidently effect the depression of that organ in proportion as the inner faces of the clasps approach each other. This structure is also found in the males of *Ctenoptilum.*

The following is a table of the species at present known to us:—

Males.

1 (2). Upper lobe of clasp bifid at the apex . . . . *thwaitesi,* Moore.
2 (1). Upper lobe of clasp not bifid at the apex.
3 (4). Upper lobe of clasp with three limbs, all of which are serrate. Similar to *thwaitesi,* but smaller and paler above . . . . *minuscula,* n. sp.
4 (3). Upper lobe of clasp with two limbs, of which the lower is serrate and the upper simple. Size of *thwaitesi,* but upperside in the male nearly uniform dark umber-brown . . . . *hampsoni,* n. sp.

! TAPENA THWAITESI. (Plate XXII. fig. 15.)

? *Tapena thwaitesi,* Moore, Lep. Cey. i. p. 181, pl. lxvii. figs. 2, 2 *a,* ♂ (1881); Watson, Hesp. Ind. p. 122 (1891).

Hab. Perak (*Doherty*); Selessch, Sumatra (*in coll. Rothschild*); Kina Balu, Borneo (*Waterstradt*); Chindwin District, Burmah (*Adamson*).

As we have not been able to examine the clasp-form of a Ceylon specimen of *T. thwaitesi,* it is possible that we have not correctly identified it.

! Tapena minuscula, n. sp. (Plate XVIII. fig. 18, ♂; Plate XXII. fig. 17.)

Tapena thwaitesi, Elwes, P. Z. S. 1892, p. 659, in part.

Similar to *T. thwaitesi*, but smaller and paler. This species is best characterized by the peculiar clasp-form, which is figured.

Two males from Bernardmyo (*Doherty*) in Elwes's collection are the only ones we have seen of this species.

! Tapena hampsoni, n. sp. (Plate XVIII. fig. 19, ♂; Plate XXII. fig. 16.)

This species also is best characterized by the clasp-form of the male. It resembles *T. thwaitesi* in size, but the upperside in the male is darker and consequently the dark markings are less evident than in that species.

Female. Upperside grey-brown; fore wing with hyaline white spots as follows:—An L-shaped one in the cell, an irregular one before the middle of cell 2, a punctiform one in the base of cell 3, one in each of cells 6, 7, and 8, one in cell 11, and the indication of one (on the underside) in the base of cell 10; hind wing with a subquadrate hyaline white spot next the upper outer angle of the cell. Fringes brown in both sexes.

The hyaline spot in the cell of the hind wing is of no importance as a differential character, as it is present in some specimens and absent from others, both of this species and *T. minuscula*.

Hab. Nilgiris (*Hampson*), recorded as *T. thwaitesi*; N. Canara (*Aitken*).

Ctenoptilum.

Ctenoptilum, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1890, p. 220; Watson, P. Z. S. 1893, p. 60. Type *vasava*, Moore.

Club of antennæ finely pointed. Hind wing biangulated, produced into a tooth at the apex of veins 4 and 7, bearing on the basal half a cluster of irregular hyaline spots. Male with a tibial pencil of the ordinary form. Watson says of this genus: "Vein 8 (of fore wing) usually given out beyond the end of cell—that is, veins 7 and 8 anastomose for a portion of their basal length (this is not an invariable character; the length of the anastomosis varies in different specimens, and occasionally, though very rarely, veins 7 and 8 are free for their entire length)." In ten specimens in coll. Elwes from Sikkim, East Pegu, Akyab, and Tenasserim respectively, and in eight specimens in coll. Leech from Kiukiang and Ningpo, vein 8 is quite free from vein 7; but in two specimens in coll. Elwes from Kiukiang, Central China, veins 7 and 8 anastomose through their basal half.

The species occurring in our region may be separated as follows:—

White spot in cell 7 of fore wing reaching beyond that in cell 6.
- Expanse about 34 mm. Fore wing above without any short subterminal dark band near the apex of the costa. Lower lobe of clasp broadly triangular . . . . *vasava*, Moore.

Expanse about 38 mm. Fore wing above with a straight dark band from the costa just before the apex as far as vein 4. Lower lobe of clasp long and narrow, rounded at the apex . . . . *chinensis*, n. sp.
White spot in cell 7 of fore wing not reaching beyond that in cell 6 . . *multiguttata*, de Nicév.

! CTENOPTILUM VASAVA. (Plate XXII. figs. 18, 18 *a*.)

Achlyodes vasava, Moore, P. Z. S. 1865, p. 786.
Ctenoptilum vasava, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1890, p. 221.

Hab. Sikkim (*Möller*); Khasias (*Hamilton*); E. Pegu (*Doherty*).

! CTENOPTILUM CHINENSIS, n. sp. (Plate XXIII. figs. 19, 19 *a*.)

Ctenoptilum vasava, Leech, Butt. China &c. p. 575, pl. xli. fig. 13, ♂ (1893–94).

Hab. Ningpo, April (*Leech*); Kiukiang, May (*Pratt*).

Differs from *C. vasava*, Moore, in its larger size and in having a dark subterminal band on the fore wing above from the costa just before the apex as far as vein 4, and also in the clasp-form, as may be seen from the figures.

! CTENOPTILUM MULTIGUTTATA.

Ctenoptilum multiguttata, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1890, p. 221, pl. E. fig. 10, ♂.

Hab. Akyab (*Adamson*); Tenasserim (*Bingham*).

ODONTOPTILUM.

Odontoptilum, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1890, p. 217; Watson, P. Z. S. 1893, p. 61. Type *sura*, Moore.

Tip of antennæ blunt. Male with the fore coxæ heavily scaled and having on the inner side a thick tuft of long straight hairs, somewhat exceeding the joint in length and springing, for the most part, from the base of the joint. In the male genitalia both the clasps and the tegumen are unsymmetrical, the excess of development in both cases being on the right side. The angulation of the hind wing presents three forms: one represented by *sura*, Moore, and *helias*, Feld., a second represented by *pygela*, Hew., and a third represented by *leptogramma*, Hew.

The species known to us we separate as follows:—

1 (4). Termen of hind wing once angulated, at vein 7.
2 (3). Male: long hairs clothing the apex of the scapulæ of varying lengths and somewhat spreading, not collected into a pencil . . . . . . *sura*, Moore.
3 (2). Male: long hairs clothing the apex of the scapulæ subequal in length and collected into a distinct pencil lying on each side of the thorax . *helias*, Feld.
4 (1). Termen of hind wing more than once angulated.
5 (6). Termen of hind wing twice angulated, at veins 4 and 7 . . . . . *pygela*, Hew.
6 (5). Termen of hind wing thrice angulated, at veins 3, 6, and 7 . . . . *leptogramma*, Hew.

! ODONTOPTILUM SURA.

Achlyodes sura, Moore, P. Z. S. 1865, p. 786.

Abaratha sura, Distant, Rhop. Mal. p. 390, pl. xxxiv. fig. 16, ♂ (1886).

Odontoptilum sura, Watson, Hesp. Ind. p. 105 (1891).

? *Pterygospidea angulata*, Felder, Verh. zool.-bot. Gesellsch. Wien, vol. xii. p. 488 (1862); id. Reise Nov., Lep. iii. p. 529, pl. lxxiii. figs. 10, 11, ♂ (1867).

We use the name of *sura* in preference to that of *angulata*, Feld., adopted by Watson, which has three years' priority, because we cannot identify Felder's species with any certainty. He gives the habitat of *angulata* as China and Luzon, and his figure represents a species with a strongly angled band on the fore wing above, such as we have never seen in *sura*.

Hab. Mandi (*Young*); Sikkim (*Möller*); Nagas, Burmah, Bali, Sambawa (*Doherty*); Java (*Fruhstorfer*).

! ODONTOPTILUM HELIAS.

Pterygospidea helias, Felder, Reise Nov., Lep. iii. p. 529, pl. lxxiii. figs. 12, 13 (1867).

Odontoptilum helias, var. *helisa*, Semper, Schmett. Philipp. p. 311 (1892).

Hab. Celebes (*Felder*); Luzon, Samar, Bohol, E. Mindanao (*Semper*).

A male and female of the variety *helisa*, Stgr. *in litt.*, from Luzon differ from typical *helias* in their smaller size and in having the pale preapical fourth of cell 1 *a* on the fore wing below and a spot near the base of that cell clothed with bluish-white scales. The hair-pencil on the scapulæ of the male is brown, very pale in the basal half and dark in its apical half, whereas in *helias* the entire pencil is blackish brown.

ODONTOPTILUM HYPERIDES.

Abaratha hyperides, Doherty, Jour. As. Soc. Beng. 1891, p. 195.

"Very near *Pterygospidea helias*, Feld., from the Celebes, but the bands and the discal hyaline spots of the fore wing are absent, and the apex of the hind wing is broadly dark. From *A. sura* it differs in the fore wing, which is almost uniform dark brown above and below. The hind wing is also less variegated above and below, the white area is larger and more uniform, the inner line of spots is obsolete, the outer united, and dark apically, nearly obliterated by white scales in the median spaces.

"*Hab.* Sambawa.

"Another species, more like *A. angulatus*, was found in Sumba, but no specimens have survived." (*Doherty, l. c.*)

We have not seen this species and do not know where the type is.

! ODONTOPTILUM PYGELA.

Pterygospidea pygela, Hewitson, Desc. Hesp. p. 53 (1868); id. Exot. Butt. vol. v., *Pterygospidea*, pl. i. fig. 3 (1873).

Abaratha pygela, Distant, Rhop. Mal. p. 390, pl. xxxiv. fig. 18 (1886)

Hab. Perak, E. Pegu (*Doherty*); Palawan (*Platen*).

! ODONTOPTILUM LEPTOGRAMMA.

Pterygospidea leptogramma, Hewitson, Descr. Hesp. p. 53 (1868); id. Exot. Butt. vol. v., *Pterygospidea,* pl. i. fig. 4 (1873).
Odontoptilum leptogramma, Semper, Schmett. Philipp. p. 311 (1892).

Hab. Bohol, Camiguin de Mindanao, Panaon, Mindanao (*Semper*).

CAPRONA.

Caprona, Wallengren, Rhop. Caffr. p. 51 (1857); Watson, P. Z. S. 1893, p. 62. Type *pillaana,* Wallgr.
Abaratha, Moore, Lep. Cey. i. p. 181 (1881). Type *ransonnettii,* Feld.

This genus is given by Watson as closely allied to the last; and, apparently, separated for the most part on account of the secondary male character, which he describes as a radiating tuft of hairs attached to the fore coxæ. This radiating tuft of hairs we have not been able to see, but in *ransonnettii,* Feld., and *syrichthus,* Feld., the fore coxæ in the male are heavily scaled, as in *Odontoptilum,* and bear on the inner side a tuft of long straight hairs, which only differs from that found in *Odontoptilum* in that the hairs are black and more than twice as long as the coxa. The genus is further distinguished from its allies by the possession of two small hyaline spots near the middle of cell 1 *a* in the fore wing in addition to the usual discal and subapical series, and the termen of the hind wing is more or less produced at the apex of veins 2, 3, and 6, besides the main angulations at veins 4 and 7.

The diagnostic characters of the species here dealt with are expressed in the following table:—

No terminal row of pale spots on the fore wing above.	
No hyaline spot in the cell of the fore wing near the middle. Right clasp elongate, bifid at the apex; left one simple	*ransonnettii,* Feld.
With a hyaline spot in the cell of the fore wing near the middle.	
Hind wing below with a little white scaling near the base, and three series of short dark brown transverse lines—two in the basal series, two in the median, and five in the postmedian. Right clasp simple, left one dissimilar, suddenly narrowed at the apex	*saraya,* Doh y.
Underside "frosted with white throughout, except very narrowly along the outer margins of both wings"	*alida,* de Nicév.
A complete terminal row of pale spots on the fore wing above	*syrichthus,* Feld.

! CAPRONA RANSONNETTII. (Plate XXIII. figs. 20, 20 *a*.)

Pterygospidea ransonnettii, Felder, Verh. zool.-bot. Gesellsch. Wien, 1868, p. 284.
Pterygospidea potiphera, Hewitson, Exot. Butt. vol. v., *Pterygospidea,* pl. i. fig. 7 (1873).
Abaratha ransonnettii, Moore, Lep. Cey. vol. i. p. 182, pl. xcvii. fig. 1 (1881).
Abaratha taylorii, de Nicéville, Jour. As. Soc. Beng. 1883, p. 88, pl. x. fig. 13, ♂.

We have no hesitation in treating *taylorii* as a synonym, as we have Nilgiri specimens which agree with it precisely.

Hab. Ceylon; Nilgiri hills (*Hampson*); N. Canara (*Aitken*); Travancore, Orissa (*fide de Nieéville*); Khasia hills (*Hamilton*).

! CAPRONA SARAYA. (Plate XVIII. fig. 20, ♂; Plate XXIII. figs. 21, 21 *a*.)

? *Abaratha saraya*, Doherty, Jour. As. Soc. Beng. 1886, p. 138.

The *C. saraya* of this paper is the same as that of the British Museum collection, where there are three specimens thus named, which had been originally labelled on the pin *taylorii*, de Nicév. These specimens all come from "Futeh Khan's Bungalow, Kootur, Chittarpahar: probably 3000 feet."

It is, however, doubtful if they are correctly identified; because, according to the original description, the hind wing below in *C. saraya* has "a black transverse streak at the end of the cell, a fainter one near the base of the cell, and a circle of large and conspicuous black spots, nine in all, round the disc, whereof two are between the costal and the subcostal, and two between the median and submedian veins." *C. saraya* was described from a single male.

Hab. Kumaon, 3500 feet (*Doherty*).

! CAPRONA ALIDA.

Abaratha alida, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1891, p. 394, pl. G. fig. 40, ♂.

Fore wing with a small round white transparent spot about the middle of the discoidal cell. "Underside: both wings thickly overlaid with large pure white scales, so that the dark ground-colour is entirely hidden except narrowly along the outer margins, the whole wing surface having the appearance of being thickly strewn with hoar-frost."

Very similar in appearance to *C. ransonnettii*, but the latter wants the hyaline spot near the middle of the cell of the fore wing.

Hab. Tilin Yaw, Upper Burmah (*Watson*); Upper Chindwin River (*Adamson*).

! CAPRONA SYRICHTHUS.

Pterygospidea syrichthus, Felder, Reise Nov., Lep. vol. iii. p. 530, pl. lxxii. figs. 22, 23 (1867).
Abaratha syrichthus, Elwes, P. Z. S. 1892, p. 656, pl. xliii. fig. 2, var.?
Pyrgus agama, Moore, Cat. Lep. Mus. E.I. C. vol. i. p. 249, pl. vii. figs. 1 (larva), 1 *a* (pupa) (1857).
Caprona elwesi, Wats. *in litt.*

The specimens from Bernardmyo, which Elwes figured as a variety of *C. syrichthus*, are remarkable for their small size; the smallest expands only 28 mm. As, however, there is no difference in the genitalia, we consider that the name of *C. elwesi* given by Watson to this form cannot stand.

Hab. Bhamo, Burmah (*Adamson*); Shan hills (*Manders*); Burmah, Bali (*Doherty*); West Java.

CARCHARODUS.

Carcharodus, Hübner, Verz. p. 110 (1816); Watson, P. Z. S. 1893, p. 67. Type *lavateræ,* Esp.
Spilothyrus, Dup. Pap. Fr. Diurn., Suppl. p. 415 (1832). Type *alceæ,* Esp.

A genus well distinguished by its facies. Fore wing with a dark basal shade and hyaline spots. Termen of the hind wing crenulate.

The following table includes all the known species:—

Fore wing below with no tuft of hair in the male.
 Fore wing with the hyaline spot in cell 2 wider than high . . . . *lavateræ,* Esp.
 Fore wing with the hyaline spot in cell 2 higher than wide . . . . *alceæ,* Esp.
Fore wing below with a tuft of hair in the male . . . . *altheæ,* Hübn.

! CARCHARODUS LAVATERÆ.

Papilio lavateræ, Esper, Schmett. i. 2, pl. lxxxii. fig. 4 (1783); Hübner, Eur. Schmett. i. figs. 454, 455 (1798–1803).

Hab. Central Europe to Asia Minor.

! CARCHARODUS ALCEÆ.

Papilio alceæ, Esper, Schmett. i. 2, pl. li. fig. 3 (1780).
Pyrgus dravira, Moore, P. Z. S. 1874, p. 576, pl. lxvii. fig. 5; de Nicéville, Jour. As. Soc. Beng. 1883, p. 88, pl. x. fig. 5, ♀.
Carcharodus swinhoei, Watson, P. Z. S. 1893, p. 68.

There is no difference in the genitalia of the Western and Eastern forms, and we see no reason for separating them. It is true that the desert form *swinhoei*, Watson, found in Beluchistan, is much paler than the Himalayan form *dravira*, Moore's figure of which is very bad, but we find similar variations in colour almost as striking amongst European specimens.

Hab. Central and Southern Europe to Central Asia and N.W. Himalayas up to 9000 feet.

CARCHARODUS ALTHEÆ.

Papilio altheæ, Hübner, Eur. Schmett. i. figs. 452, 453 (1798–1803).

This species also varies from dark to light grey-brown.

The eggs, larva, and pupa are described by Heinrich Gross (Stett. ent. Zeit. 1894, p. 77); the eggs were laid and the larva fed on *Betonica officinalis.*

Hab. Central and Southern Europe to Central Asia.

Gomalia.

Gomalia, Moore, P. Z. S. 1879, p. 114; Watson, P. Z. S. 1893, p. 67. Type *albofasciata,* Moore.

A genus of one or two small species differing from *Hesperia* in facies and the slender and straight club of the antennæ. Male with a costal fold but no tibial hair-pencil.

! Gomalia albofasciata.

Gomalia albofasciata, Moore, P. Z. S. 1879, p. 144; id. Lep. Cey. vol. i. p. 183, pl. lxxi. fig. 7 (1881).

? *Gomalia littoralis,* Swinhoe, P. Z. S. 1884, p. 513, pl. xlvii. fig. 4.

Hab. S. India (*Hampson*); Hambantota, Ceylon (*Green*); Karachi (*fide Swinhoe*); Quetta, Beluchistan (*Murray in coll. Swinhoe*).

We have not seen the type of *littoralis*, but, judging from the description and figure, it is indistinguishable from *albofasciata*, like specimens from Quetta which we have examined.

Hesperia.

Hesperia, Fab. Ent. Syst. iii. vol. i. p. 258 (1793); Watson, P. Z. S. 1893, p. 64. Type *malvæ,* Linn.

Pyrgus, Hübn. Verz. p. 109 (1816). Type *syrichtus,* Fab.

Syrichthus, Boisd. Icones, p. 230 (1832–33). Type *proto,* Esp

Scelothrix, Rambur, Cat. Lép. And. i. p. 63 (1858). Type *carthami,* Hübn.

A numerous group of closely allied species, which are associated together on account of their resemblance to the *Papilio malvæ* of Linnæus. According to Watson, it is separable from *Carcharodus*, Hübn., by the even termen of the hind wing, from *Gomalia*, Moore, by the curved club to the antennæ, and from *Thanaos*, Bdv., which has a comparatively slender antennal club, by the robust club of its antennæ. The following pale spots on a darker ground constitute what may be considered as the normal pattern of the hind wing below, namely:—one occupying the whole or part only of cell 1 *a*; three in cell 7, basal, medial, and apical; two in cell 6, basal and medial; one near the base of the cell; a large geminate one next the transverse vein and occupying the base of cells 4 and 5, and another geminate one near the apex of the same cells; one near the apex of cell 3; two in cell 2, basal and apical; and three, basal, medial, and apical, in cell 1 *b*. These pale spots fall into three irregular transverse series. The modifications of this wing-pattern are for the most part trifling, but they sometimes afford useful distinguishing characters.

The following table will serve to show what characters have been found most useful in the arrangement of the species of this difficult group in coll. Elwes; this arrangement is doubtless far from perfect, but it certainly gives a better result than any other with which we are acquainted. The species of the *orbifer* group are exceedingly closely allied; the male genitalia and the essential wing-pattern are practically identical, but the characters given below will separate the majority of specimens. *Therapne*, Rbr., put by Staudinger as a variety of *sao*, is just as distinct from the latter as are *orbifer* and *ali*.

1 (66). Hind wing below dark, with a pale median band.
2 (57). Such band macular, generally much broken.
3 (32). Fore wing with a subterminal series of small pale spots.
4 (5). Fore wing below with a distinct white spot (not merely a pale dash) near the base of the cell. Median pale band on hind wing below continuous from veins 2–7 . . . . *galba*, Fab.
5 (4). Fore wing below with the basal pale marking in the cell (when present) a dash, not a distinct spot.
6 (21). Hind wing below with the pale spot near the middle of cell 7 continued in cell 8.
7 (16). Hind wing below: middle spot in cell 7 not joined to that on the transverse vein, or at most only touching it in a point.
8 (15). Hind wing below with the apical third of cell 8 dark.
9 (10). Hind wing below sordid yellowish green, pale spot on the transverse vein with sharp projecting angles . . . . . . *orbifer*, Hübn.
10 (9). Hind wing below tile-red (more or less bright) or pale red-brown.
11 (12). Hind wing below with the pale spot on the transverse vein not produced inwardly; wings strongly tinged with sordid yellow . . . . *therapne*, Rbr.
12 (11). The pale spot on the transverse vein of hind wing below produced both outwardly and inwardly.
13 (14). Such spot and that in cell 1 *b* but little intensified; hind wing below tile-red . . . . *sao*, Bergstr.
14 (13). Such spots much intensified, silver-white; hind wing below pale red-brown . . . . *ali*, Ob.
15 (8). Hind wing below with the apical third of cell 8 pale . . . . *geron*, Wats.
16 (7). Hind wing below with the middle spot in cell 7 broadly connected with that on the transverse vein by a triangular spot in the base of cell 6.
17 (18). Hind wing above with no pale spot in the middle of cell 7. No costal fold in the male . . . . *phlomidis*, H.-S.
18 (17). Hind wing above with a pale spot in the middle of cell 7. Male with a costal fold.
19 (20). No tibial hair-pencil in the male, but several short spines on the outer side of hind tibiæ . . . . *cribrellum*, Evers.
20 (19). Male with a tibial hair-pencil[1] . . . . *cynaræ*, Rbr.

[1] *Fide* Watson. There is no male of this species in coll. Elwes, and only one female. The latter can only be separated from *cribrellum* by its name-label.

21 (6). Hind wing below with the pale spot in the middle of cell 7 not continued in cell 8.

22 (27). Hind wing below with the outermost pale spot in cell 7 adjoining or near the termen.

23 (26). Hind wing below with the pale median band conspicuously broken inwardly at cell 7.

24 (25). Species smaller (exp. 30–38 mm.) and paler. Pale spots on upperside relatively larger . . . . *tessellum,* Hübn.

25 (24). Species larger (exp. 40–45 mm.) and darker. Pale spots on upperside relatively smaller . . . . *gigas,* Brem.

26 (23). Hind wing below with the pale median band continuous and equally wide in cells 3 to 7 inclusive . . . . *nobilis,* Stgr.

27 (22). Hind wing below with the outermost pale spot in cell 7 remote from the termen.

28 (29). Costal fold inconspicuous, apparently absent; no tibial hair-pencil . . . . *poggei,* Led.

29 (28). Costal fold conspicuous; no tibial hair-pencil.

30 (31). Hind wing below: inner edge of the outermost spot in cell 7 in line with the transverse vein. Size generally smaller. Subapical notch of clasp with an erect tooth . . . . . *proto,* Esper.

31 (30). Hind wing below: inner edge of the outermost spot in cell 7 not in line with the transverse vein. Size larger. Subapical notch of clasp without a tooth. . . . . *staudingeri,* Speyer.

32 (3). No subterminal series of small pale spots on fore wing.

33 (36). With a tibial hair-pencil but no costal fold in the male. Hind wing below with the pale macular band ending in a spot at the apex of cell 1 *b*.

34 (35). Hind wing above usually without pale markings . . . . . [1]*cashmirensis,* Moore.

35 (34). Hind wing above with conspicuous pale markings . . . . . [1]*alpina,* Ersch.

36 (33). Tibial hair-pencil and costal fold both present in the male. Hind wing below with the macular band ending in a spot in the middle of cell 1 *b*.

37 (50). Hind wing below with the spot on the transverse vein straight-sided within.[2]

38 (49). Hind wing below with the markings sharply defined.

39 (40). Hind wing below with an irregular continuous pale terminal band[3] . . . . *carthami,* Hübn.

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[1] These two species are exceedingly closely allied. It seems doubtful whether *alpina* is not a geographical race of *cashmirensis.*

[2] This character is not absolute. Exceptions occur in *H. malvæ* and some others; but *malvæ* is a well-known species, and the other exceptions occur so sparingly that the practical utility of the character is not affected.

[3] This character is not absolutely diagnostic of *carthami,* but in practice it is found that its occurrence in other species is rare and obviously abnormal.

40 (39). Hind wing below without an irregular continuous pale terminal band.

41 (48). Apex of tegumen undivided.

42 (47). Tegumen without lateral horns.

43 (46). Apical lobe of clasp much expanded, broadly and evenly rounded in a semicircle.

44 (45). Fore wing below greenish grey-brown; hind wing below with a pale dot normally present in cell 6 . . . . [1]*serratulæ,* Rbr.

45 (44). Fore wing below blackish brown; hind wing below normally without a pale dot in cell 6 . . . . [2]*speyeri,* Stgr.

46 (43). Apical lobe of clasp not expanded in a semicircle . . . . . . [1]*alveus,* Hübn.

47 (42). Tegumen with a horn on each side, tip compressed. Clasp of the same type as *zona* . . . . *malvoides,* n. sp.

48 (41). Apex of tegumen bipartite . . . . *malvæ,* Linn.

49 (38). Markings of hind wing below obsolescent by reason of general paleness. Tegumen with a branched horn on each side . *melotis,* Dup.

50 (37). Hind wing below with the pale spot on the transverse vein produced inwardly towards the origin of vein 7.[3]

51 (54). Hind wing below with a pale dash in cell 1 *b* near the base.

52 (53). Fore wing above with a straight oblique pale macular band from the costa beyond the middle to the dorsum before the middle . . . . *andromedæ,* Wlgrn.

53 (52). No such band on fore wing above . . . . [4]*cacaliæ,* Rbr.

54 (51). Hind wing below with the pale basal marking in cell 1 *b* a spot, not a dash.

55 (56). Hind wing below pale sordid yellowish- or russet-green . . . *onopordi,* Rbr.

56 (55). Hind wing below dark (usually blackish) green . . . . . *centaureæ,* Rbr.

57 (2). Hind wing below with the pale median band sharply defined, narrow, non-macular, and preceded by a broad irregular brown band, which bears a small pale spot near the basal third of cell 7; or if macular, then not interrupted, and preceded by a dark Y-shaped marking reaching quite across the wing and followed by a dark subterminal band.

58 (61). Hind wing below with the pale median band preceded by a large dark Y-shaped marking reaching quite across the wing and followed by a dark subterminal band.

59 (60). No dark terminal band on hind wing below . . . . . . *bieti,* Ob.

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[1] We cannot distinguish with certainty between *serratulæ* and *alveus*, except by the male genitalia. If we make the presence or absence of pale markings on the hind wing above the basis of separation, we find that this character varies too much to be reliable; if, on the other hand, we use the male genitalia, we get two forms which do not intergrade. The male genitalia can always be referred with certainty to their respective types, although both kinds are known to occur in the same locality, as at Vernet and Mont Cenis.

[2] Very near the preceding, and probably not distinct.

[3] *Vide* note to paragraph 37.

[4] This insect has the same type of clasp form as *andromedæ*.

60 (59). Hind wing below with a dark terminal band separated from the dark subterminal band by a zigzag white line or row of irregular spots . . . . *oberthüri,* Leech.

61 (58). Hind wing below with the pale median band preceded by a broad irregular brown band, which bears a small pale spot near the basal third of cell 7.

62 (63). Hind wing above with a median row of pale spots. Fore wing below with the apex yellow-brown; pale spot near the apex of cell 5 oblique, distinct from that in cell 4. No subterminal pale band on hind wing below . . . . *zona,* Mab.

63 (62). Hind wing above with two rows of pale spots.

64 (65). Fore wing below with the apex yellow-brown; the pale spot near the apex of cell 5 oblique, distinct from that in cell 4 . *maculatus,* Brem. & [Grey.

65 (64). Fore wing below with the apex white, with a short oblique yellow-brown dash; pale spots near the apex of cells 4 and 5 coalescent, their inner edges erect . . . . *thibetanus,* Ob.

66 (1). Hind wing below white, with two irregular orange-yellow bands narrowly margined with black.

67 (68). Fore wing above with the pale spot in the cell higher than wide, generally constricted in the middle. Male with costal fold and tibial hair-pencil . . . . *sidæ,* Esper.

68 (67). Fore wing above with the pale spot in the cell wider than high, subrhomboidal. Neither costal fold nor tibial hair-pencil in the male . . . . *antonia,* Speyer.

In the matter of synonymy we have restricted the references to those which appear to be necessary for the identification of the species under consideration.

! HESPERIA GALBA.

Hesperia galba, Fabricius, Ent. Syst. vol. iii. p. 352 (1793); Moore, Lep. Cey. vol. i. p. 183, pl. lxxi. fig. 6 (1881).
Pyrgus superna, Moore, P. Z. S. 1865, p. 792.
Pyrgus evanidus, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. v. p. 223 (1880).
Hesperia evanidus, Watson, Hesp. Ind. p. 156 (1891).
Pyrgus zebra, Butler, op. cit. ser. 6, vol. i. p. 207 (1888).
Hesperia zebra, Watson, Hesp. Ind. p. 156 (1891).
Hesperia hellas, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1889, p. 177, pl. B. fig. 9, ♂.

I cannot see any good grounds for separating *P. zebra*=*hellas* (fide Watson) from *galba.* Though I have no Campbellpur specimens for comparison, yet the characters relied on by de Nicéville seem very variable. The species has a very wide range throughout the drier parts of India and extends from Burmah (*Manders*) to Aden, being apparently common in the foot-hills of the N.W. Himalaya.

! Hesperia orbifer.

Papilio orbifer, Hübner, Eur. Schmett. i. figs. 803–806 (1818–27).

Hab. S. Europe to Turkestan and Amurland.

! Hesperia therapne.

Hesperia therapne, Rambur, Ann. Soc. Ent. Fr. 1832, pl. vii. fig. 4.

Hab. Corsica, Sardinia.

! Hesperia sao.

Papilio sao, Bergstrasser, Nomencl. vol. ii. pl. xl. figs. 8, 9 (1779); Hübner, Eur. Schmett. vol. i. figs. 471, 472 (1798–1803).

Hab. Mont Cenis, Valais, 2000 ft., Kreusnach, Briançon (*Elwes*); S. Spain (*Elwes*).

! Hesperia ali.

Syrichthus ali, Oberthür, Études d'Ent. vi. p. 61, pl. ii. fig. 3.

Hab. Batua, Constantine, Algeria (*Elwes*).

! Hesperia geron. (Plate XXIII. fig. 31.)

Hesperia geron, Watson, P. Z. S. 1893, p. 66.

Though we have only one male of this species from Quetta, we think it is a distinct species.

Hab. Beluchistan (*Watson*); Shahrud, Persia (*Zeller, fide Watson*).

! Hesperia phlomidis. (Plate XXIII. fig. 30.)

Hesperia phlomidis, Herrich-Schäffer, Schmett. Eur. vol. i., *Hesp.* figs. 8, 9 (1845).

Hab. Asia Minor, Greece, Caucasus.

! Hesperia cribrellum.

Hesperia cribrellum, Eversman, Bull. Mosc. 1841, p. 25; Freyer, Neuere Beitr. vol. iv. pl. cccxlix. fig. 1 (1840?); Herrich-Schäffer, Schmett. Eur. vol. i., *Hesp.* figs. 12, 13 (1845).

Hab. S. Russia, West Asia, Turkestan, Upper Amur (*fide Graeser*).

! Hesperia cynaræ.

Hesperia cynaræ, Rambur, Faun. And. pl. viii. figs. 4, 5 (1839); Herrich-Schäffer, Schmett. Eur. vol. i., *Hesp.* figs. 4–7 (1845).

Hab. S. Russia to Turkestan.

! HESPERIA TESSELLUM.

Papilio tessellum, Hübner, Eur. Schmett. vol. i. figs. 469, 470 (1798–1803).
Hesperia tessellum, Rambur, Faun. And. pl. viii. figs. 1, 2 (1839).
Hesperia noma, Lederer, Verh. zool.-bot. Gesellsch. Wien, 1855, p. 193, pl. i. fig. 7.

Hab. S. Russia, Armenia to Central Asia.

! HESPERIA GIGAS.

Pyrgus gigas, Bremer, Lep. Ost-Sib. p. 96, pl. viii. fig. 3 (1864).

Hab. Amurland.

! HESPERIA NOBILIS.

Pyrgus nobilis, Staudinger. Stett. ent. Zeit. 1886, p. 255.

Hab. Turkestan.

! HESPERIA POGGEI.

Hesperia poggei, Lederer, Wien. ent. Mon. 1858, p. 141.

Hab. Syria, Armenia to Turkestan.

! HESPERIA PROTO. (Plate XXIII. fig. 22.)

Papilio proto, Esper, Schmett. vol. i. p. 2, pl. exxiii. figs. 5, 6 (1806 ?); Hübner, Eur. Sehmett. vol. i. figs. 918–921 (1827–41).
Syrichthus mohammed, Oberthür, Bull. Ent. Soe. Fr. 1887, p. xlviii; id. Études d'Ent. xii. p. 23, pl. v. figs. 23 *a* ♂, 23 *b* ♀ (1888).

Hab. S. Spain, Portugal to Syria and Armenia; Lambessa, Algeria (*Bleuse*).

HESPERIA LEUZEÆ.

Syrichthus leuzeæ, Oberthür, Études d'Ent. vi. p. 60, pl. iii. fig. 10 (1881).

This species, which was described from a single specimen from Boisduval's collection, appears to be nearest to *H. proto*. It may be distinguished from that species, however, by reason that the pale subterminal band on the hind wing below, which in *H. proto* is at the most only represented by a row of small indistinct pale spots, is developed into a well-defined band about two-thirds as broad as the median band.

Hab. Mascara, Algeria (*fide Oberthür*).

! HESPERIA STAUDINGERI. (Plate XXIII. fig. 23.)

Syrichthus staudingeri, Speyer, Stett. ent. Zeit. 1879, p. 344.
Pyrgus (*Syrichthus*) *proteus*, Staudinger, t. c. 1886, p. 253.

Hab. Turkestan.

! HESPERIA CASHMIRENSIS.

Pyrgus cashmirensis, Moore, P. Z. S. 1874, p. 274, pl. xliii. fig. 7.

Hab. Kulu, N.W. Himalaya 12,000 ft. (*Young*), to Kashmir (*Leech*).

! HESPERIA ALPINA.

Hesperia alveus, var. *alpina,* Erschoff, Lep. Turk. p. 24, pl. ii. fig. 18 (1874).

Hab. Turkestan (*Haberhauer, &c.*).

! HESPERIA CARTHAMI.

Papilio carthami, Hübner, Eur. Schmett. vol. i. figs. 720, 723 (1803–18).
Hesperia carthami, Râmbur, Faun. And. pl. viii. fig. 8 (1839).

Hab. Central and South Europe, Alps and Pyrenees to 5000 ft. (*Elwes*).

! HESPERIA SERRATULÆ. (Plate XXIII. fig. 24.)

Hesperia serratulæ, Rambur, Faun. And. pl. viii. fig. 9 (1839); Herrich-Schäffer, Schmett. Eur. vol. i., *Hesp.* figs. 18–20 (1846).

Hab. Alps to 6000 feet, Central and South Europe to Caucasus, Amasia (*Fuchs*).

! HESPERIA SPEYERI. (Plate XXIII. fig. 26.)

Scelothrix speyeri, Staudinger, Rom. Mém. sur Lép. iii. p. 153, pl. viii. figs. 5 *a, b.*

Hab. Amurland (*Dörries*).

! HESPERIA ALVEUS. (Plate XXIII. figs. 25, 25 *a.*)

Papilio alveus, Hübner, Eur. Schmett. i. figs. 461–463 (1798-1803).

Hab. Alps to 6000 feet, Central Europe to Amurland, Syria (*Delagrange*).

! HESPERIA MALVOIDES, n. sp. (Plate XXIII. figs. 27, 27 *a.*)

We propose this name for an insect, of which we have three specimens from Biarritz, taken by Elwes on July 25, 1887, and a single male from Granada (*Ribbe*), which has all the facies of *H. malvæ* but very distinct male genitalia. The differences in this respect will be apparent from the figures. The proportion of black hair-scales in the clothing of the second joint of the palpi appears to be considerably greater in *H. malvæ* than in *H. malvoides.*

We should not have ventured to separate this on genitalic characters alone but for the fact that the genitalia in six specimens of *H. malvæ* from Denmark, Kreusnach, Rennes, Brittany, Stettin, and Brussa are all absolutely similar *inter se,* as are the three specimens above mentioned. Probably it will be found that *H. malvoides* has a wider range and other distinctive characters.

! HESPERIA MALVÆ. (Plate XXIII. figs. 28, 28 *a*.)

Papilio malvæ, Linnæus, Faun. Suec. p. 285. n. 1081 (1761); id. Syst. Nat. i. 2, p. 795. n. 267 (1767); Esper, Schmett. i. 1, pl. xxxvi. fig. 5 (1778).
Papilio taras, Bergstrasser, Nomencl. vol. iv. pl. xci. figs. 5, 6 (1780).
Hesperia taras, Meigen, Eur. Schmett. ii. p. 61, pl. lv. figs. 3 *a*, *b* (1830).

Hab. Europe to Amurland.

! HESPERIA MELOTIS. (Plate XXIII. fig. 29.)

Hesperia melotis, Duponchel, Lép. Fr., Suppl. i. pl. xlii. figs. 1, 2 (1832).
Pyrgus hypoleucos, Lederer, Verh. zool.-bot. Gesellsch. Wien, 1855, p. 193, pl. i. fig. 8.

Hab. Beirut, Syria (*Zach*).

! HESPERIA ANDROMEDÆ.

Syrichthus andromedæ, Wallengren, Vet.-Ak. Forh. 1853, p. 25; id. Lep. Scand., Rhop. p. 272 (1857).

Hab. Alps, 6000 ft. (*Elwes*); Norway (*Schoyen*).

! HESPERIA CACALIÆ.

Herperia cacaliæ, Rambur, Faun. And. pl. viii. figs. 6, 7 (1839); Herrich-Schäffer, Schmett. Eur. i., *Hesp.* figs. 23–25 (1846).

Hab. Alps, 6000 feet (*Elwes*).

! HESPERIA ONOPORDI. (Plate XXIII. fig. 25 *b*.)

Hesperia onopordi, Rambur, Faun. And. pl. viii. fig. 13 (1839).
Scelothrix onopordi, Rambur, Cat. Lép. And. vol. i. p. 72 (1858).

Hab. S. Spain (*Staudinger*); Batna, Algeria (*Elwes*).

This difficult species may be distinguished from *H. alveus*, of which it has been doubtfully treated as a synonym, by the pattern of the hind wing below, which in *H. onopordi* has the white spot in cells 4–5 projecting into the discoidal cell next the subcostal, whilst in *H. alveus* the spot in question has no such projection, and also by the difference in the form of the male genitalia.

! HESPERIA CENTAUREÆ.

Hesperia centaureæ, Rambur, Faun. And. pl. viii. fig. 10 (1839); Herrich-Schäffer, Schmett. Eur. i., *Hesp.* figs. 1–3 (1845).

Hab. Norway, 2000–6000 ft. (*Elwes, Schoyen*); Finland (*Schilde*); Labrador (*Moeschler*); Laggan, Alberta Terr., British N. America, 5000 ft. (*Elwes*).

! Hesperia bieti.

Syrichthus bieti, Oberthür, Étud. d'Ent. xi. p. 26, pl. vi. fig. 50 (1886).
Hesperia bieti, Leech, Butt. China &c. p. 578 (1894).

Hab. Western China (*fide Leech*); N.E. Tibet (*fide Alphéraky*).

Hesperia oberthüri.

Syrichthus oberthüri, Leech, Entomologist, xxiv. Suppl. p. 59 (June 1891).
Syrichthus delavayi, Oberthür, Étud. d'Ent. xv. p. 20, pl. iii. fig. 31, ♂ (July 1891).
Hesperia oberthüri, Leech, Butt. China &c. p. 579, pl. xli. fig. 5, ♂.

Hab. Western China (*fide Leech*); Yunnan (*fide Oberthür*).

We rely on Mr. Leech's identification of *H. delavayi* with *H. oberthüri*, not having seen the former.

! Hesperia zona.

Scelothrix zona, Mabille, Ann. Soc. Ent. Fr. 1875, p. ccxiv.
Scelothrix (*Pyrgus*) *albistriga,* Mabille, t. c. 1876, p. xxvii.
Pyrgus sinicus, Butler, Ann. & Mag. Nat. Hist. ser. 4, vol. xix. p. 96 (1877).
Syrichthus sinicus, Pryer, Rhop. Nihon. p. 35, pl. x. fig. 22 (1889).
Hesperia zona, Leech, Butt. China &c. p. 577, pl. xli. figs. 1, 3 (1893–4).

Hab. Japan, Shanghai (*Pryer*); Central China (*Pratt*); Korea (*Leech*).

We rely on Mr. Leech's identification of *H. sinicus* with *H. zona*, which is, we believe, correct. We do not feel equal confidence in the constancy of the characters by which he separates it from *H. maculatus*, especially as the differences in their genitalia are of degree only.

! Hesperia maculatus.

Syrichthus maculatus, Bremer & Grey, Schmett. N. China's, p. 11, pl. iii. fig. 6 (1853); Pryer, Rhop. Nihon. p. 35, pl. x. fig. 21 (1889).
Pyrgus maculatus, Ménétriés, Cat. Mus. Petr. pl. v. fig. 5 (1855).
Hesperia maculata, Leech, Butt. China, &c. p. 576, pl. xli. fig. 2, ♂ (1893–4).

Hab. Amurland (*Graeser*); Askold, Shanghai (*Pryer*).

! Hesperia thibetanus.

Syrichthus maculatus, var. *thibetanus,* Oberthür, Étud. d'Ent. xv. p. 20, pl. iii. fig. 27 (1891).
Hesperia thibetana, Leech, Butt. China &c. p. 578 (1894).

Hab. Western China (*fide Leech*).

We follow Mr. Leech in treating this as a distinct species, as our material is insufficient to decide the question; the differences noted are not, however, very striking.

! Hesperia sidæ.

Papilio sidæ, Esper, Schmett. i. 2, pl. xc. fig. 3 (1784); Hübner, Eur. Schmett. i. fig. 468 (1798–1803).

Hab. Alassio, N. Italy (*Mrs. Nicholl*); S.E. Europe; Asia Minor to Turkestan.

! HESPERIA ANTONIA.

Syrichthus antonia, Speyer, Stett. ent. Zeit. 1879, p. 342.

Hab. Turkestan, Amurland.

THANAOS.

Thanaos, Boisd. Icones, 240 (1832–33); Watson, P. Z. S. 1893, p. 69. Type *tages,* Linn.

This name is applied generically to certain species more or less resembling the *Papilio tages* of Linnæus.

We separate the species in coll. Elwes as follows:—

Male with a costal fold.
- Hind wing above without yellow spots . . . . *tages,* Linn.
- Hind wing above with yellow spots.
  - Expanse about 35 mm. Fore wing below with the first row of pale spots beyond the end of the cell suffused and irregular. Fore wing above with the postmedian band broader, at least as broad as the width of cell 2. Tegumen with two pairs of lateral dorsal lobes, of which the pair nearest the apex are smaller, triangular, and simple, and the pair nearest the base are larger, ear-shaped, and rough with short spines . . . . *montanus,* Brem.
  - Expanse about 30 mm. Fore wing below with the first row of pale spots beyond the end of the cell regular and well-defined. Fore wing above with the postmedian band narrower, in cell 2 about half as broad as the width of that cell. Tegumen wanting the pair of ear-shaped spinose lateral dorsal lobes . . . . *leechii,* n. s.

Male without a costal fold.
- Fore wing above with the pale spots in cells 7 and 8 well marked. Basal angle of the lower lobe of left clasp not produced into a horn . . . . *marloyi,* Bdv.
- Fore wing above with the pale spots in cells 7 and 8 obsolete. Basal angle of the lower lobe of left clasp produced into a long curved horn . . . *pelias,* Leech.

! THANAOS TAGES.

Papilio tages, Linnæus, Faun. Suec. p. 286. n. 1082 (1761); id. Syst. Nat. i. 2, p. 795. n. 268 (1767); Esper, Schmett. i. 1, pl. xxiii. fig. 3 (1777); Hübner, Eur. Schmett. i. figs. 456, 457 (1798–1803).

Thanaos cervantes, Grasl. Ann. Soc. Ent. Fr. 1836, p. 558, pl. 17 B. figs. 1, 2.

Nisoniades tages, var. *sinina,* Groum-Grshimaïlo, Horæ Soc. Ent. Ross. xxv. p. 461 (1891); Leech, Butt. China &c. p. 661 (1894).

? *Thanaos popoviana,* Nordm. Bull. Mosc. 1851, ii. p. 443, pl. xii. figs. 3, 4.

Hab. Europe to Amurland.

Judging from a specimen from Koko-nor, Tibet, ex coll. Rothschild, the variety *sinina* has the ground-colour paler and greyer than is usual in *T. tages* proper, the terminal row of spots on both wings are white, the hind wing below has a well-marked postmedian band of small white spots and a narrow white spot on the transverse vein, and on the fore wing below there are two small suffused white spots near the apical third of cell 1 *a*, separated by the intraneural fold. Having regard to the relationship of *T. montanus* and *T. nigrescens*, it is possible that *sinina* is really a distinct species from *T. tages*, but we have had no opportunity of comparing their male genitalia.

T. cervantes, Grasl., is a larger and darker form, which prevails in Andalusia, but the male genitalia are identical with those of typical *T. tages*, L.

! THANAOS MONTANUS. (Plate XXIII. fig. 34.)

Pyrgus montanus, Bremer, Bull. Acad. Petr. iii. p. 473 (1861); id. Lep. Ost-Sib. p. 31, pl. ii. fig. 4 (1864).
Thanaos rusticanus, Butler, Jour. Linn. Soc., Zool. ix. p. 58 (1866).
Nisoniades montanus, Pryer, Rhop. Nihon. p. 35, pl. x. fig. 23 (1889).
Thanaos montanus, Leech, Butt. China &c. p. 580.

Hab. Amurland, Japan, China.

! THANAOS LEECHII, n. sp. (Plate XXIII. fig. 35.)

Thanaos montanus, var. *nigrescens*, Leech, Butt. China &c. p. 581, pl. xlii. fig. 2, ♂ (1894).

Distinguished from *T. montanus* by the characters given in the table above, of which the most constant are its smaller size and different male genitalia. The tegumen expands near the middle into two small, triangular, smooth, lateral dorsal lobes, as in *T. montanus*, but these are not subtended, as in that species, by a pair of much larger spinose lobes.

Hab. Wa-ssu-Kow, Ta-tsien-lu, W. China (*fide Leech*); Tchang-Kou, Tibet (*fide Oberthür*).

! THANAOS MARLOYI. (Plate XXIII. figs. 32, 32 *a*.)

Thanaos marloyi, Boisduval, Icones, pl. xlvii. figs. 6, 7 (1832).
Hesperia sericea, Freyer, Neuere Beitr. iii. pl. ccxlv. fig. 4 (1838); Herrich-Schäffer, Schmett. Eur. i., *Hesp.* figs. 29, 30 (1846).

Hab. S.E. Europe, Asia Minor, N. Persia, Syria.

! THANAOS PELIAS. (Plate XXIII. figs. 33, 33 *a*.)

Nisoniades pelias, Leech, Entomologist, xxiv. Suppl. p. 60 (June 1891).
Nisoniades erebus, Groum-Grshimaïlo, Horæ Soc. Ent. Ross. xxv. p. 461 (1891).
Thanaos pelias, Leech, Butt. China &c. p. 581, pl. xlii. fig. 3, ♂ (1893–94).

The male genitalia of *T. pelias*, Leech, and *T. erebus*, Gr.-Gr., are identical in form, as we find on examination of authentic specimens of each.

Hab. W. China, E. Tibet (*Pratt*); N.E. Tibet (*Groum-Grshimaïlo*).

Pamphila.

Pamphila, Fabricius, Ill. Mag. vi. p. 287 (1807); Watson, P. Z. S. 1893, p. 89. Type *palæmon*, Pall.
Steropes, Boisduval, Voy. Astrol. p. 167 (1832), *nom. præocc.*
Carterocephalus, Lederer, Verh. zool.-bot. Gesellsch. Wien, ii. p. 26 (1853). Type, *palæmon*, Pall.

A group of small species associated on account of their general resemblance to the *Papilio palæmon* of Pallas. Palpi porrect. Antennæ short, simply clavate. Fore wing: vein 2 arising about the middle of the lower edge of the cell; hind wing: cell 6 a little longer than cell 3. Hind tibiæ more or less fringed (at least in the male), generally with but one pair of spurs, but with two pairs in *P. abax*, Ob.

The species with which we are acquainted may be distinguished as follows :—

1 (10). Hind wing below with no pale spot near the middle of cell 8.
2 (9). Pale markings on the hind wing below non-metallic.
3 (6). Fore wing above blackish brown with yellow spots.
4 (5). Hind wing below with a subterminal series of pale spots. Hind tibiæ with one pair of spurs . . . . *palæmon*, Pall.
5 (4). No subterminal series of pale spots on hind wing below. Hind tibiæ with two pairs of spurs . . . . *abax*, Ob.
6 (3). Fore wing above yellow with black spots.
7 (8). Hind wing below with the pale spot on the transverse vein irregularly roundish, enclosing that vein . . . . *silvius*, Knoch.
8 (7). Hind wing below with the pale spot on the transverse vein straight-sided within, bounded inwardly by that vein . . . . . . *houangty*, Ob.
9 (2). Pale markings on the hind wing below metallic silvery white, and consisting of the following :—A streak along the upper edge of the cell from the base as far as the middle of cell 5, constricted or narrowly interrupted at its half-length, the lower edge of its outer half coalescing with a somewhat semi-circular spot in cell 4, a spot occupying the apical third of cell 6, a roundish spot near the base of cell 2, a clavate streak from the base to the middle of cell 1 *b*, and a submarginal series of oblong spots, placed one in each of cells 1 *c*, 2, and 3, sometimes feebly continued in cells 4 and 5 . . . . *pulchra*, Leech.
10 (1). Hind wing below with a pale spot near the middle of cell 8.
11 (16). Pale markings of the upperside yellow or yellowish white.[1]
12 (13). Hind wing below with no pale spot near the apex of cells 2 and 3; the disc of the wing occupied by a large subpyriform silvery spot, which arises near the middle of cell 7, and spreads outwards and downwards by way of the transverse vein; a small pale spot near the basal third of the cell, and the indication of another near the middle of cell 6 . . . . *avanti*, de Nicév.
13 (12). Hind wing below with a pale spot near the apex of each of cells 2 and 3.

[1] See note to paragraph 16 *post*.

14 (15). Fore wing below with a pale spot occupying the extreme base of cell 2, and another, at least twice as wide as high, near the middle of that cell . . . . *argyrostigma*, Eversm.

15 (14). Fore wing below with no pale spot in the base of cell 2, but a subquadrate one before the middle of that cell . . . . . . *flavomaculatus*, Ob.

16 (11). Pale markings on upperside pure white.[1]

17 (18). Hind wing below with the pale spots near the apex of cells 6 and 7 not connected with those near the apex of cells 2 and 3 by a pale band traversing cells 4 and 5.

17 *a* (17 *b*). Fore wing above without white spots near the base; hind wing above with two distinct unequal white discal spots . . . . *niveomaculatus*, Ob.

17 *b* (17 *a*). Fore wing above with two white spots near the base—one hyaline near the base of the cell, and the other opaque next the costa; hind wing above with a large white discal spot formed by the confluence of two unequal spots . . . . *christophi*, Gr.-Gr.

18 (17). Hind wing below with the pale spots near the apex of cells 6 and 7 connected with those near the apex of cells 2 and 3 by a pale band traversing cells 4 and 5, and thus forming an irregular subterminal pale band.

19 (20). Fore wing below with the pale spots in cells 1 *a* and 2 remote from that near the apical third of the cell . . . . *dieckmanni*, Graeser.

20 (19). Fore wing below with the pale spots in cells 1 *a* and 2 joined to that near the apical third of the cell to form a continuous median band . . . . *micio*, Ob.

! PAMPHILA PALÆMON.

Papilio palæmon, Pallas, Reise, vol. i. p. 471 (1771).

Papilio paniscus, Fabricius, Syst. Ent. p. 531 (1775); Esper, Schmett. i. 1, pl. xxviii. fig. 2 (1778?); i. 2, pl. xcv. fig. 5 (1788).

Papilio brontes, Wien. Verz. p. 160 (1776); Hübner, Eur. Schmett. i. figs. 475, 476 (1798–1803).

Hesperia mandan, Edwards, Proc. Ent. Soc. Philad. vol. ii. p. 20 (1863).

Carterocephalus palæmon, Bean, Can. Ent. xxv. p. 145 (1893).

Hab. Europe to Amurland, N. America; Laggan, Alberta Terr., Brit. N. Amer., 5000 ft. (*Elwes*); Nepigon, Lake Superior (*Fletcher*).

There is no doubt in our mind that the American form described as *mandan* is identical with the European.

! PAMPHILA ABAX.

Carterocephalus abax, Oberthür, Étud. d'Ent. xi. p. 27, pl. v. fig. 27 (1886).

Pamphila abax, Leech, Butt. China &c. p. 587 (1893–4).

Hab Ta-tsien-lo (*Pratt*); Moupin, E. Tibet (*Kricheldorf*).

[1] What we identify as the female of *niveomaculatus* has the spots on the upperside yellowish instead of pure white.

! PAMPHILA SILVIUS.

Papilio silvius, Knoch, Beitr. Ins. i. pl. v. figs. 1, 2 (1781); Esper, Schmett. i. 2, pl. lxxx. figs. 5, 6 (1782); Hübner, Eur. Schmett. i. figs. 477, 478 (1798–1803).

Hab. N. Europe to Amurland (*Graeser*).

! PAMPHILA HOUANGTY.

Carterocephalus houangty, Oberthür, Étud. d'Ent. xi. p. 27, pl. v. fig. 5 (1886).
Pamphila houangty, Leech, Butt. China &c. p. 586 (1893–4).

Hab. West China, Ta-tsien-lo (*Pratt*).

! PAMPHILA PULCHRA.

Pamphila pulchra, Leech, Entomologist, xxiv. Suppl. p. 59 (June 1891); id. Butt. China &c. p. 586, pl. xl. fig. 20, ♂ (1894).
Carterocephalus ops, Groum-Grshimaïlo, Horæ Ent. Soc. Ross. xxv. p. 460 (1891).

Hab. Ta-tsien-lo, Wa-su-Kow, West China (*Pratt*); N.E. Tibet (*Groum-Grshimaïlo, fide Leech*).

We rely on Mr. Leech's identification of *C. ops,* which we have not seen.

! PAMPHILA AVANTI.

Pamphila avanti, de Nicéville, Jour. As. Soc. Beng. 1886, p. 255, pl. xi. fig. 10, ♂; Watson, Hesp. Ind. p. 159.

Type in coll. Elwes.

Hab. Interior of Sikhim, circa 12,000 feet (*White*).

! PAMPHILA ARGYROSTIGMA.

Steropes argyrostigma, Eversmann, Bull. Mosc. 1851, i. p. 624; Nordmann, l. c. ii. p. 442, pl. xii. figs. 1, 2 (1851).
Carterocephalus argyrostigma, Alphéraky, Mém. sur Lép. v. p. 123 (1889).
Pamphila argyrostigma, Leech, Butt. China &c. p. 585 (1893–4).

Hab. Amurland (*Eversmann*); Mongolia (*Potanine, fide Alphéraky*).

! PAMPHILA FLAVOMACULATUS.

Carterocephalus flavomaculatus, Oberthür, Étud. d'Ent. xi. p. 27, pl. ii. fig. 9 (1886).
Pamphila flavomaculata, Leech, Butt. China &c. p. 587 (1893–4).

Hab. West China (*Pratt*); E. Tibet (*Biet*).

! PAMPHILA NIVEOMACULATUS. (Plate XIX. fig. 23, ♀.)

Carterocephalus niveomaculatus, Oberthür, Étud. d'Ent. xi. p. 27, pl. ii. fig. 8 (1886).
Pamphila niveomaculata, Leech, Butt. China &c. p. 588 (1893–4).

Hab. Ta-tsien-lo and E. Tibet (*Biet*); Koko-nor, Tibet (*in coll. Rothschild*).

The female is not described or figured by M. Oberthür, though he says that he has both sexes. Two females from Koko-nor in coll. Rothschild differ in having the spots of the upperside yellowish instead of pure white, but we have little doubt that they are really females of this species.

! Pamphila christophi.

Carterocephalus christophi, Groum-Grshimaïlo, Horæ Ent. Soc. Ross. xxv. p. 460 (1891).

Pamphila niveomaculata, var. *christophi*, Leech, Butt. China &c. p. 588 (1893–4).

Aubertia dulcis, Oberthür, Étud. d'Ent. xx. p. 40, pl. ix. fig. 162 (1896).

Hab. Sinin-Shan mountains (*Groum-Grshimaïlo*); Tibet (*fide Oberthür*)

! Pamphila dieckmanni.

Carterocephalus dieckmanni, Graeser, Berl. ent. Zeits. 1888, p. 102.

Carterocephalus gemmatus, Leech, Entomologist, xxiv. Suppl. p. 59 (June 1891).

Carterocephalus demea, Oberthür, Etud. d'Ént. xv. p. 19, pl. iii. fig. 24 (July 1891).

Pamphila gemmata, Leech, Butt. China &c. p. 588 (1893–4).

Hab. Wladiwostock, Amurland (*Graeser*); Ta-tsien-lo (*Pratt*); Lutschau (*Dörries*), Blagowetshensk (*Dieckmann*), Koslofska (*Bükow in coll. Dieckmann*); Koko-nor, Tibet (*in coll. Rothschild*).

We have no hesitation in restoring Graeser's name for this species, as we have examined three typical specimens kindly lent to us by Mr. Dieckmann. As a result of the reduction of the silvery markings on the hind wing below, a specimen from Koslofska, in coll. Dieckmann, has the roundish spot proper to the cell barely indicated.

Pamphila micio.

Carterocephalus micio, Oberthür, Etud. d'Ént. xv. p. 19, pl. iii. fig. 29 (1891).

Pamphila micio, Leech, Butt. China &c. p. 589 (1894).

Hab. Tse-kou, E. Tibet (*fide Oberthür*).

Heteropterus.

Heteropterus, Duméril, Zool. Anal. p. 271 (1806); Watson, P. Z. S. 1893, p. 89. Type *morpheus*, Pall.

No hyaline spots on the wings. Antennæ less than half as long as costa, simply clavate. Palpi porrect. Fore wings long and narrow. Body long and slender. Vein 2 of fore wing arising nearer to the base of the wing than to the end of the cell. No sex-mark on the wings of the male.

1 (2). Hind wing below yellow, with twelve suboval black-margined white spots. Front tibiæ with a short spur on the inner side near the middle, hind tibiæ with two pairs of spurs. Tornus of hind wing evident . . . *morpheus*, Pall.

2 (1). Hind wing below dull greenish yellow, without suboval white spots. Front tibiæ simple, hind tibiæ with only one pair of spurs. Tornus of hind wing completely rounded off.

3 (4). Hind wing below without silvery markings . . . . *unicolor*, Brem.

4 (3). Hind wing below with a silvery middle stripe from the base to the termen, and frequently another in cell 1 *b* . . . . *ornatus*, Brem.

! Heteropterus morpheus.

Papilio morpheus, Pallas, Reise, vol. i. p. 471 (1771).

Papilio steropes, Wien. Verz. p. 160 (1776); Esper, Schmett. i. 1, pl. xli. fig. 1 (1778?); Hübner, Eur. Schmett. i. figs. 473, 474 (1798–1803).

In the male the hind wing below has the outer half of the fringe brown, but in the female the same fringe is brown only in spots opposite the veins.

Hab. Biarritz (*Elwes*); Europe; Korea (*Leech*); Amurland (*Graeser*).

! HETEROPTERUS UNICOLOR.

Steropes unicolor, Bremer & Grey, Schmett. N. China's, p. 10, pl. iii. fig. 3 (1853).

Cyclopides ornatus, Bremer, Bull. Acad. Petr. iii. p. 473 (1861); id. Lep. Ost-Sib. p. 33, pl. ii. fig. 5 (1864).

Cyclopides unicolor, var. *ornatus*, Stgr. Rom. Mém. vi. p. 209.

Hab. Japan (*Pryer*); Central China (*Pratt*); Amurland (*fide Staudinger*).

Though *ornatus* and *unicolor* have hitherto been treated as distinct species, I agree with Staudinger and Leech that they cannot be separated, on account of the intermediate forms. The genitalia offer no differences.

DEJEANIA.

Dejeania, Oberthür, Étud. d'Ent. xx. p. 40 (1896). Type *bicolor*, Oberthür.

Antennæ bluntly pointed, non-apiculate, half as long as the costa. Palpi porrect, second joint laxly scaled, third joint of moderate length. Fore wing: dorsum a little longer than the termen, the latter evenly curved; vein 11 free, transverse vein erect, vein 5 straight, equidistant from veins 4 and 6, vein 2 from near the half-length of the cell, vein 3 arising twice as near to vein 4 as to vein 2. Hind wing about one-fourth longer than broad, termen evenly rounded, cell a little longer than half the wing, vein 2 from beyond the half-length of the cell, vein 3 arising much before the cell-end opposite to the origin of 7, vein 5 strong, transverse vein feeble but practically erect. Tibial epiphysis present, but very small. Hind tibiæ in the male fringed, and bearing two pairs of spurs.

Allied to *Heteropterus*, Dum., in venation, palpi, and antennæ, but has the hind wing rounded at the apex instead of produced.

The above particulars are taken from authentic specimens of *Dejeania bicolor*, Ob., a brown species with a broad oblique postmedian yellow band on the fore wing, bearing a narrow dark spot on the transverse vein, and a straight narrow yellow band on the hind wing below from the apex of vein 1 *b* to the apex of vein 7.

DEJEANIA BICOLOR.

Dejeania bicolor, Oberthür, t. c. p. 40, pl. ix. fig. 163, ♂.

Hab. Tse-kou, Tibet (*Dubernard*); Siáo-Lóu (*fide Oberthür*).

BARACUS.

Baracus, Moore, Lep. Cey. i. p. 162 (1881); Watson, P. Z. S. 1893, p. 114. Type *vittatus*, Feld.

Antennæ about half as long as the costa, apiculus about as long as the diameter of the eye. Palpi ascending; third joint porrect, prominent, about one-half as long as the diameter of the eye. Fore wing: vein 11 running closer to 12 than to 10, vein 2 arising from the distal third of the lower edge of the cell; 3, 4, 5, and 6 almost equidistant at the base, 6 and 7 from the same point. Hind tibiæ fringed and bearing two pairs of spurs.

What may be regarded as the typical wing-pattern in this genus is peculiar: the pale markings on the fore wing above consist of four oblong spots placed in two pairs, one near the base of each of cells 2 and 3, and one near the base of each of cells 6 and 7, and there is sometimes a pale spot or spots in cell 1 *a*; in the latter case the pale markings almost assume the form of a postmedian curved macular band, interrupted in cells 4 and 5. The normal pattern is found in both sexes of *B. subditus*, Moore, and *B. septentrionum*, de Nicév., but only in the female of *B. vittatus*, Felder.

The species known to us are distinguished as follows:—

Males.

1. Upperside brown; interno-basal half of the fore wing and the entire hind wing, except the costa and the termen, pale . .	2.
Upperside brown; fore wing with two pairs of pale spots, one in each of cells 2 and 3, 6 and 7, and sometimes one in cell 1 *a*.	3.
2. Pale portion of upperside sordid creamy white	*vittatus*, Feld.
Pale portion of upperside pale whitish blue	*plumbeolus*, Feld.
3. Hind wing below ochreous brown, with a pale stripe from the base of the wing as far as the half-length of cell 5, and a terminal series of pale streaks, one in each of cells 2, 3, 4, and 6.	4.
Hind wing below at first sight appearing yellow, with many brown streaks, but really brown sprinkled with yellow scales, and having the veins, a spot occupying the basal half of cells 4–5, and sometimes continued to the base of the wing, and a subterminal series of spots consisting of one in each of cells 2–7, of which those in cells 2, 3, and 6 are about twice as long as the others, yellow	*hampsoni*, n. sp.
4. Expanse about 32 mm. Pale markings on the hind wing below but little paler than the ground-colour	*septentrionum*, Wood-Mason & [de Nicéville.
Expanse about 27 mm. Pale markings on the hind wing below much paler than the ground-colour, the stripe from the base of the wing to the middle of cell 5, and another in cell 1 *b*, whitish	*subditus*, Moore.

! BARACUS VITTATUS.

Isoteinon vittatus, Felder, Verh. zool.-bot. Gesellsch. Wien, xii. p. 480 (1862).

Baracus vittatus, Moore, Lep. Cey. i. p. 162, pl. lxix. figs. 1, 1 *a* (1881); Watson, Hesp. Ind. p. 151 (1891).

Hab. Nuwara Eliya, Ceylon, 7000 feet (*Elwes*).

! BARACUS PLUMBEOLUS.

Hesperia plumbeola, Felder, Reise Nov., Lep. iii. p. 519, pl. lxxi. fig. 20, ♂ (1867).

In the female of this species the blue colour of the upperside is on the hind wing less extensive than in the male, and on the fore wing is almost confined to the dorsum below vein 1 *a*, leaving the remainder of the wing brown, save for a few pale bluish scales near the base.

Hab. Luzon, Philippines (*Semper*).

! BARACUS SUBDITUS.

Baracus subditus, Moore, P. Z. S. 1883, p. 534; Watson, Hesp. Ind. p. 151 (1891).

Hab. Nilgiri hills (*Hampson*); Palnai hills (*Castets*).

A specimen from the Nilgiris (*Hampson*), taken on the 14th October, has the pale markings on the hind wing below as feeble as they are in *B. septentrionum*.

! BARACUS SEPTENTRIONUM.

Baracus septentrionum, Wood-Mason & de Nicéville, Jour. As. Soc. Beng. 1886, p. 379, pl. xviii. figs. 4, 4 *a*, ♂ ; Watson, Hesp. Ind. p. 151 (1891).

Hab. Sikkim (*Knyvett*) ; Shan hills (*Manders*).

! BARACUS HAMPSONI, n. sp. (Plate XVIII. fig. 21, ♂.)

♂. Upperside brown; fore wing with four yellow spots, one in each of cells 2, 3, 6, and 7. Underside: fore wing dark brown from the dorsum as far as the upper edge of the cell, the outline of the dark space concave from the apex of vein 3 to a point near the middle of cell 6, the remainder of the wing yellow, the yellow spots in cells 6 and 7 as on the upperside: hind wing at first sight appearing yellow, with many brown streaks, but really brown closely sprinkled with yellow scales, and having the veins, a spot occupying the basal half of cells 4–5 and sometimes continued to the base of the wing, and a subterminal series of spots consisting of a spot in each of cells 2–7, of which those in cells 2, 3, and 6 are about twice as long as the others, yellow ; a pale anteciliary line on both wings. Fringes grey, chequered with darker, the short scales dark brown.

♀. Similar to the male, but slightly larger.

Expanse 24–26 mm.

Hab. N. Canara (*Aitken*).

Described from five males and two females in coll. Elwes.

ASTICTOPTERUS.

Astictopterus, Felder, Wien. ent. Monatsb. iv. p. 401 (1860) ; Watson, P. Z. S. 1893, p. 114. Type *jama*, Feld.

In structure of the antennæ, palpi, and veins this genus does not differ essentially from *Baracus*, although vein 2 of the fore wing arises near the middle of the lower edge of the cell, and the last joint of the palpi is comparatively shorter. The facies of its members, however, is different, and the hind tibiæ are not fringed with long hairs as in *Baracus*. The species are dark brown above, with or without a few small white spots, which, when present, are placed near the base of cells 6 and 7 or 6, 7 and 8, and more rarely there is another near the basal third of cell 3.

The species known to us may be distinguished as follows :—

1 (2). Fore wing below umber-brown, the costal and apical regions but little paler: male without hyaline spots; female usually with hyaline spots in cells 6, 7, and 8. Hind wing below umber-brown, with very ill-defined antemedian and postmedian macular dark bands . . . . . *olivascens*, Moore.

2 (1). Fore wing below fuliginous brown, the costal and apical regions pale reddish brown, the latter with some grey scaling next the termen from vein 3 to the apex: both sexes usually with hyaline spots in cells 6, 7, and 8, and in the female there is frequently a short hyaline spot near the basal third of cell 3. Hind wing below pale reddish brown, with antemedian and postmedian darker bands, of which the latter sometimes bears some spots of whitish scales . . . . . . *henrici*, Holland.

! ASTICTOPTERUS OLIVASCENS. (Plate XVIII. fig. 16, ♂.)

Astictopterus olivascens, Moore, P. Z. S. 1878, p. 692; Watson, Hesp. Ind. p. 146 (1891).

Hab. Khasia hills (*Hamilton*); Naga hills (*Doherty*); Shan hills (*Manders*); Sikkim (*Möller*); Buxar, Bhutan (*in coll. Elwes*); Perak (*Doherty*); W. Java (*Piepers*); Cherrapunji (*in coll. Swinhoe*).

! ASTICTOPTERUS HENRICI. (Plate XVIII. fig. 17, ♂.)

Cyclopides henrici, Holland, Trans. Amer. Ent. Soc. xiv. p. 124, pl. ii. fig. 5 (1887).
Astictopterus kada, Swinhoe, Trans. Ent. Soc. Lond. 1893, p. 328.
Astictopterus olivascens, Leech, Butt. China &c. p. 629, pl. xlii. fig. 1 (1894).

Hab. Khasia hills (*Hamilton*); Burmah (*Adamson*); E. Pegu (*Doherty*); Nilawa (*Manders*); W. China (*Leech*); Chia-ting-fu (*Pratt*).

Chinese specimens are darker on the underside than Indian ones. Leech's figure (*l. c.*) is not quite characteristic.

Dr. Holland, to whom we had sent a transcript of our statement of the diagnostic characters of *olivascens* and *henrici*, as given in the preceding table (using the name *kada* for the latter) writes as follows :—"I have complied with your request, and carefully examined my type of *Astictopterus*! (false *Cyclopides*) *henrici*. It agrees best and quite certainly with the description of *kada*, Swinhoe. I have not a particle of doubt that it is the latter."

ASTICTOPTERUS JAMA.

Astictopterus jama, Felder, Wien. ent. Mon. iv. p. 401 (1860); Distant, Rhop. Mal. p. 401 (1886).

Not having seen this species, we transcribe the original description :—"Alis utrinque saturate fuscis, cervino atomatis. ♂. Coll. Felder. *A. pygmæo*, Fabr., species hæc in

India continenti etiam occurrens, similis, sed alæ breviores et latiores palporumque articulus tertius minutus."

Hab. Malay Peninsula.

Felder's collection is now in the Museum of the Hon. Walter Rothschild at Tring, and Dr. Jordan, to whom we applied for an account of Felder's type of this species, writes that the specimen which stands as *Astictopterus jama* in Felder's collection is not that species, as it has a broad yellow band across the fore wing somewhat like *sindu*, and that there are a number of specimens from Malacca in the same drawer without names, of which one may be the type of *jama*. We do not know what insect was identified by Distant as *jama*, Feld., nor how Watson identified as *jama*, Feld., the insect from which his description (P. Z. S. 1893, p. 114) of the genus *Astictopterus* was taken.

APOSTICTOPTERUS.

Apostictopterus, Leech, Butt. China &c. p. 630 (1894). Type *fuliginosus*, Leech.

Antennæ about half as long as costa, club gradual; apiculus robust. Palpi ascending; third joint porrect, cylindrical, at least as long as half the diameter of the eye. Wings comparatively long and narrow: tip of fore wing truncate, *i. e.* the termen is nearly vertical from vein 5 to the costa, and inwardly oblique from vein 5 to vein 1*a*, with an obtuse but distinct angle at the end of vein 5; vein 2 from the basal third of the lower edge of the cell; vein 5 a trifle nearer 4 than 6; vein 11 normal, *i. e.* not in any way approaching vein 12. Tibial epiphysis present, hind tibiæ with two pairs of spurs.

The foregoing characters are present in Mr. Leech's unique type of *Apostictopterus fuliginosus*, which he has been so good as to entrust to us for examination. The genus should stand next to *Astictopterus*.

APOSTICTOPTERUS FULIGINOSUS.

Apostictopterus fuliginosus, Leech, Butt. China &c. p. 631, pl. xxxviii. fig. 8, ♂ (1894).

Hab. Omei Shan, Western China (*fide Leech*).

SANCUS.

Sancus, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1891, p. 395; Watson, P. Z. S. 1893, p. 87. Type *subfasciatus*, Moore = *pulligo*, Mab.

Body and wings above entirely dark brown. Palpi appressed, 2nd joint densely scaled, 3rd joint almost concealed. Fore wing with vein 12 shortly touching vein 11 near its base. Sex-mark of the male, when present, an oblong-oval patch of modified scales in the basal third of cell 1 *a* on the fore wing below and touching the median and the base of vein 2; its presence is not always well indicated on the upper surface of the wing. The fore wing is rather narrow and feebly subtruncate at the apex, the termen between veins 5 and 6 reaching a little beyond the actual tip; hind wing rounded, its greatest length not exceeding that of the dorsum of the fore wing. Abdomen comparatively long and slender. On the hind wing below the common pattern consists of the following spots of pale scales, namely:—one in cell 7 erect from the base of vein 7, one near the middle of the upper margin of the cell, one in the basal third of cell 6, and four in a straight line almost parallel with the termen, one each in cells 2, 3, 4, 5; some of these spots are sometimes suppressed, and in some specimens the whole are scarcely discernible.

Two species are mentioned by Watson (P. Z. S. 1893, p. 87), which may be distinguished as follows:—

Sex-mark present in the male. Hind wing below with pale spots or bands, or both . . . . *pulligo*, Mab.
Sex-mark wanting in the male. Hind wing below unmarked . . . . *fuscula*, Snell.

Watson says of *S. fuscula* that the male mark is present, but inconspicuous, and he separates the species from *S. pulligo* by having the underside of the hind wing entirely unmarked, and by the beautiful plum-like bloom of the upperside, though this last character is only apparent in fresh specimens.

! SANCUS PULLIGO.

Tagiades pulligo, Mabille, Bull. Soc. Ent. Fr. 1876, p. xxvi; id. Ann. Soc. Ent. Fr. 1876, p. 272.
Astictopterus subfasciatus, Moore, P. Z. S. 1878, p. 842; Wood-Mason & de Nicéville, Jour. As. Soc. Beng. 1886, p. 380, pl. xviii. figs. 1, 1 *a*, ♂; Watson, Hesp. Ind. p. 148 (1891).
Astictopterus ulunda, Staudinger, Iris, ii. p. 146 (1889).
Sancus subfasciatus, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1891, p. 396.
? *Antigonus kethra*, Plötz, Jahrb. Nass. Ver. 1884, p. 24.
? *Astictopterus kethra*, Plötz, Stett. ent. Zeit. xlvii. p. 110 (1886).
Sancus pulligo, Semper, Schmett. Philipp. p. 319, pl. xlix. fig. 1, ♂ (1892).

Hab. Nilghiri hills (*Hampson*); Akyab, Moulmein (*Adamson*); Perak, Pulo Laut, Bali (*Doherty*); Java (*Piepers*); Borneo, Philippines (*Semper*); Palawan (*Platen*).

SANCUS FUSCULA.

Tagiades? fuscula, Snellen, Tijd. voor Ent. vol. xxi. p. 42, pl. ii. fig. 3 (1878); de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1891, p. 397.

Hab. S.W. Celebes (*fide de Nicéville*).

KORUTHAIALOS.

Koruthaialos, Watson, P. Z. S. 1893, p. 76, pl. ii. fig. 8. Type *hector*, Wats.

A genus of few species, well exemplified by the *Astictopterus xanites* of Butler. Apart from facies, it differs from *Suastus* and *Iambrix* in the fact that vein 11 of the fore wing touches or anastomoses with vein 12 for a portion of its length. Perhaps the most remarkable feature of the genus is the frenulum-like tuft of bristly hairs found at the base of the costa of the hind wing in the male.

The following table deals only with the three species in coll. Elwes :—

Males.

1 (4).	Fore wing with a red band, at least on the underside.	
2 (3).	Red band on fore wing below broader, its breadth near the middle about equal to one-third of the length of the costa .	*xanites*, Butl.
3 (2).	Red band on fore wing below narrower, its breadth near the middle about equal to one-fourth of the length of the costa.	*hector*, Wats.
4 (1).	Fore wing without any red band	*butleri*, W.-M. & de Nicév.

With regard to *K. xanites* and *K. hector*, it is difficult to lay down any satisfactory character for the separation of these two species, if species they are. In their typical state they offer no difficulty, *K. xanites* being the larger insect, expanding about 41 mm., with the red band on the fore wing above broad, and reaching from the middle of the costa to the tornus; whilst *K. hector* is smaller, expanding about 35 mm., with the red band on the fore wing above comparatively narrower and rarely reaching quite to the tornus, frequently abbreviated at each end, and sometimes entirely wanting. Pending the comparison of the male genitalia of typical specimens when opportunity offers, we find that the most constant character by which to separate the two forms lies in the relative breadth of the red band of the fore wing, as exhibited on the underside.

! KORUTHAIALOS XANITES.

Astictopterus xanites, Butler, Trans. Ent. Soc. Lond. 1870, p. 510; id. Trans. Linn. Zool. Soc. ser. 2, vol. i. p. 555, pl. lxix. fig. 7 (1877).
Koruthaialos xanites, Watson, P. Z. S. 1893, p. 77.

Hab. Borneo (*fide Butler*); Malacca (*fide Watson*); Kina Balu, Borneo (*Waterstradt*); Perak, Bali (*Doherty*).

! KORUTHAIALOS HECTOR.

Koruthaialos hector, Watson, P. Z. S. 1893, p. 77.
Astictopterus xanites, Distant, Rhop. Mal. p. 402, pl. xxxiv. fig. 28 (1886); Watson, Hesp. Ind. p. 145 (1891).
Astictopterus xanites, var. *palawites*, Staudinger, Iris, ii. p. 148 (1889).
Kerana gemmifer, Semper, Schmett. Phillipp. p. 318 (1892), *sec. spec. comm.*

Hab. Luzon (*fide Semper*); Palawan (*fide Staudinger*); Burmah (*Adamson, Doherty*); Tenasserim (*Bingham*); Perak, Pulo Laut, Bali, Arjuno, Java (*Doherty*); Java (*Piepers*); Bunguran, Natuna Is. (*Everett*); Palawan (*in coll. Rothschild*).

! KORUTHAIALOS BUTLERI.

Astictopterus butleri, Wood-Mason & de Nicéville, Jour. As. Soc. Beng. 1883, p. 98, pl. x. fig. 3, ♂; iid. op. cit. 1886, p. 380.

Dark fuliginous brown with somewhat of a purple tinge, the latter most evident on hind wing below. Male with no trace of a pale band on either side of the fore wing; in the female[1] (*fide* de Nicéville) the fore wing has an obsolete oblique discal red band, which is sometimes quite absent from the upperside, but always distinctly traceable on the underside. This species, though distinct enough to admit of its definition, is evidently but little removed from the preceding; being, in fact, more remote from it in the matter of facies than it is in the form of the male genitalia.

Hab. Sikkim (*Möller*); Upper Assam (*Doherty*); Khasias (*Hamilton*).

Koruthaialos verones.

Astictopterus verones, Hewitson, Ann. & Mag. Nat. Hist. (5) i. p. 341 (1878).
Koruthaialos verones, de Nicéville & Martin, Jour. As. Soc. Beng. 1895, p. 534.

"Both sides rufous brown. Underside of the anterior wing marked by a subapical rufous spot." (*Hewitson, l. c.*)

Hab. Sumatra (*fide Hewitson*).

Koruthaialos kerala.

Koruthaialos kerala, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1896, p. 20, pl. T. fig. 48, ♂.

"*Male.* Upperside, both wings shining fuscous. Fore wing with a broad oblique discal orange fascia exactly as in *Kerana armatus,* Druce, that is to say, the band is about twice as long as it is broad, and it does not quite reach the costa, the outer margin at the anal angle, or the inner margin; but it differs slightly in form from the band in that species, as its inner edge anteriorly is obliquely cut off instead of being continued straight to the margin. Hind wing unmarked. Underside: both wings paler than on the upperside, of a more sooty brown. Fore wing has the discal band rather broader than on the upperside, reaching the inner margin; it is paler, moreover, throughout, especially so posteriorly. Hind wing immaculate. Antennæ black, the apex of the club paler beneath. Palpi blunt, the third joint hidden beneath the second.—*Female* exactly like the male."

Expanse, ♂, 44–45 mm.; ♀, 44–54 mm.

Hab. Perak, Malay Peninsula; Battak Mountain, N.E. Sumatra (*fide de Nicéville*).

We have not seen this species.

Koruthaialos kophene.

Koruthaialos kophene, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1896, p. 21, pl. T. figs. 49 ♂, 50 ♀.

"*Female.* Upperside, both wings sooty-brown. Fore wing with a broad oblique discal orange fascia (not as broad as in *Celænorrhinus ladana,* Butler, *Kerana armatus,* Druce, and *Koruthaialos kerala,* de Nicéville) commencing near the costa, ending near the submedian nervure, its edges irregular, crossed by the dark brown veins,

[1] We have never seen the female of this species.

bearing a dark brown line which defines the discocellular nervules. Hind wing unmarked. Underside, both wings rather paler than above. Fore wing with the discal band broader and paler, especially posteriorly, than on the upperside, the discocellular dark line narrower and more prominent. Hind wing unmarked. Antennæ black, the apex of the club beneath paler. Palpi blunt, the third joint hidden beneath the second.—*Male* similar to the female but smaller, the orange fascia on both sides of the fore wing rather more obscure and narrower."

Expanse, ♂, 40; ♀, 45–52½ mm.

Hab. N.E. Sumatra, Central Java (*fide de Nicéville*).

We have not seen this species. It will be observed that both this species and the preceding are remarkable for the position of the third joint of the palpi; in all the Hesperiidæ known to us the third joint of the palpi proceeds from the distal end of the second joint and is not hidden beneath it.

SUADA.

Suada, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1895, p. 370. Type *swerga,* de Nicéville.

This genus is distinguished from *Suastus* by having vein 11 of the fore wing touching or approaching vein 12.

The species known to us may be distinguished as follows:—

1 (2). Hind wing above not marked with white . . . . *swerga,* de Nicév.
2 (1). Subtornal region of hind wing above in greater or less part pure white.
3 (4). Fore wing fuliginous brown, without hyaline spots or, at most, with one or more of the subapical series. Hind wing below pure white, unspotted, narrowly brown along the costa . . . . *cataleucos,* Stgr.
4 (3). Fore wing above fuliginous brown, with three small hyaline white spots on the disc, one each, subequal in size, in the cell and cell 2 next the base of vein 3, and one, smaller and triangular, in the base of cell 3.
5 (6). Hind wing below white as far as vein 7, thence to the costa brown; termen suffused with brown in the apex of cells 1 and 2 . . . . . *albinus,* Semper.
6 (5). Hind wing below white as far as vein 7, thence to the costa brown, the white portion with some black spots, namely, one in the apex of the cell, one near the apical third and one at the apex of cell 1 *b*, both large (the former subquadrate), and followed by some smaller ones in cells 2, 3, and 4, 5, the whole indicating a postmedian and terminal macular band respectively . . . . *scopas,* Stgr.

! SUADA SWERGA.

Hesperia swerga, de Nicéville, Jour. As. Soc. Beng. 1883, p. 89, pl. x. fig. 12, ♂.
Suastus mölleri, Moore, Jour. As. Soc. Beng. 1884, p. 49.
Suada swerga, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1895, p. 372.

Hab. Sikkim (*Möller*); Arjuno, Java (*Doherty*).

! SUADA CATALEUCOS.

Heteropterus? cataleucos, Staudinger, Iris, ii. p. 162, pl. ii. fig. 13, ♂ (1889).

Hab. Pulo Laut, Borneo (*Doherty*); Palawan (*Platen*).

SUADA ALBINUS.

Suastus albinus, Semper, Schmett. Philipp. p. 299, pl. xlix. fig. 8, ♀ (*nec* ♂) (1892).

Hab. S.W. Mindanao (*Semper*); Davao, Mindoro (*Staudinger*).

Herr Semper is mistaken as to the sex of his single example of this species; it is undoubtedly a female.

SUADA SCOPAS.

Heteropterus? (Steropes) scopas, Staudinger, Iris, ii. p. 161, pl. ii. fig. 12, ♂ (1889).

Hab. Palawan (*Platen*).

Distinguished from *albinus* by the smaller amount of white on the hind wing above and the black spots on the white portion of the hind wing below.

SUASTUS.

Suastus, Moore, Lep. Cey. vol. i. p. 168 (1881); Watson, P. Z. S. 1893, p. 75. Type *gremius*, Fab.

No hyaline spot in cell 4 of fore wing. Third joint of palpi acicular, erect, one-third to one-half as long as the diameter of the eye. Fore wing: vein 11 not touching 12; vein 2 nearer the base of the wing than the end of the cell.

We are acquainted with five species of this genus, distinguished as follows:—

1 (8). Hind wing above not marked with white.
2 (7). Hind wing below not sprinkled with purple scales.
3 (6). Pale spot in cell 1 *a* of fore wing below not reaching the termen.
4 (5). Dark spots on hind wing below black. Expanse about 38 mm. . . . *gremius*, Fab.
5 (4). Dark spots on hind wing below but little darker than the ground-colour. Expanse about 30 mm. . . . . *sala*, Hew.
6 (3). Pale spot in cell 1 *a* of fore wing below pure white, and, with the exception of a small piece in the upper outer angle of that cell, occupying the entire space between the dorsum and vein 2 from the termen to the middle of the wing. Hind wing below brown, closely sprinkled with whitish-grey scales and bearing a few brown spots, of which two in cell 1 *b*, one near the base of vein 2, and the other near the apical third of the cell, one each in cells 2 and 3, and one in the apex of the cell are the most evident; an anteciliary brown line; fringe white . . . . *migreus*, Semper.
7 (2). Hind wing below rather thickly sprinkled with purple scales on the basal two-thirds . . . . *bipunctus*, Swinh.

8 (1). Subtornal region of hind wing above in greater or less part pure white. Hind wing below white; costa brown as far as vein 7; a large subquadrate black spot beyond the middle of cell 1 *b*, a small one next the transverse vein, and one or two others . . . . *tripura*, de Nicév.

The *Carystus telesinus* of Mabille, which Semper includes in this genus, we place tentatively in *Plastingia*: it has not the facies of *Suastus* nor the long acicular third joint of the palpi characteristic of that genus.

! SUASTUS GREMIUS.

Hesperia gremius, Fabricius, Ent. Syst. Suppl. p. 433 (1798).
Hesperia divodasa, Moore, P. Z. S. 1865, p. 791.
Hesperia subgrisea, Moore, P. Z. S. 1878, p. 689.
Suastus gremius, Moore, Lep. Cey. vol. i. p. 168 (1881).
Suastus subgrisea, Moore, l. c.

Hab. N.W. Himalayas (*Young*); Bangalore, Ganjam (*Minchin*); Sikkim (*Möller*); Khasia (*Elwes*); Bombay (*Swinhoe*); Burmah (*Adamson*).

SUASTUS CHILON.

Suastus chilon, Doherty, Jour. As. Soc. Beng. 1891, p. 198.

"Above, male all dark brown, no hyaline markings nor patches of lighter brown scales. Below, fore wing with a minute white dot discally in the lower median space, the subapical hyaline spots represented by two slight dark streaks, the lower (in one specimen) containing a lighter dot. Hind wing nearly white (not grey as in *S. gremius*), the borders dark; a conspicuous black cell-spot, and a row of black discal spots, six in one specimen, four in the other. The absence of hyaline spots distinguishes it from all others. Two males, Sumba coast." (*Doherty, l. c.*)

We have not seen this species and do not know whether the types still exist.

! SUASTUS SALA. (Plate XVIII. fig. 15, ♂.)

Hesperia sala, Hewitson, Trans. Ent. Soc. Lond. 1866, p. 500; Wood-Mason & de Nicéville, Jour. As. Soc. Beng. 1881, p. 259.
Suastus aditus, Moore, Jour. As. Soc. Beng. 1884, p. 49.

Hab. Sikkim (*Möller*); E. Pegu, Andamans (*Doherty*); Java (*Piepers*).

! SUASTUS MIGREUS.

Suastus migreus, Semper, Schmett. Philipp. p. 300, pl. xlix. fig. 9, ♂ (*nec* ♀) (1892).

Hab. Luzon, Mindanao (*Semper*); Mindoro (*coll. Staudinger*).

Herr Semper has been good enough to lend us the specimen figured in his work, which is certainly a male. The species is well characterized by the large white patch in the tornus of the fore wing below.

! Suastus bipunctus. (Plate XVIII. fig. 14, ♂.)

Suastus bipunctus, Swinhoe, Ann. & Mag. Nat. Hist. (6) v. p. 364 (1890).
Suastus aditus, Hampson, Jour. As. Soc. Beng. 1888, p. 365.

Hab. Nilgiri hills (*Hampson*).

! Suastus tripura.

Tagiades tripura, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1891, p. 392, pl. G. fig. 39, ♀.
Carystus albescens, Mabille, Ann. Soc. Ent. Belg. xxxvii. p. 51 (1893).

Hab. Perak, Pulo Laut, Bali (*Doherty*); Java (*Fruhstorfer*).

Suastus minuta.

Tagiades minuta, Moore, Ann. & Mag. Nat. Hist. (4) xx. p. 343 (1877); id. Lep. Cey. i. p. 176, pl. lxviii. figs. 4, 4 *a* (1881); Watson, Hesp. Ind. p. 96 (1891).

Resembles *S. tripura* in general appearance, but has the hind wing above entirely brown. Hind wing below white, brown along the costa; an ill-defined brown spot near the apical third of cell 1 *b*, an indication of a smaller one in cell 2, and another next the transverse vein.

Hab. Ceylon.

Suastus robsonii.

Suastus robsonii, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1895, p. 372, pl. Q. fig. 50, ♂.

Nearest to *S. minuta.* Hind wing below "(as seen under a strong magnifying-glass) overlaid throughout with dull ochreous scales; an elongated minute black spot at the end of the cell." Described from a single example taken at Masuri, W. Himalayas, 12th July, 1892.

Suastus phiditia.

Hesperia phiditia, Hewitson, Trans. Ent. Soc. Lond. ser. 3, vol. ii. p. 501 (1866).
Suastus phiditia, de Nicéville & Martin, Jour. As. Soc. Beng. 1895, p. 535.

This species, which we have not seen, has one large vitreous spot on the hind wing above, and the hind wing below "ochreous, crossed at the middle by a band of four brown spots" (*rufo-ochraceis, fasciâ fuscâ*).

Hab. Sumatra (*fide Hewitson*).

Iambrix.

Iambrix, Watson, P. Z. S. 1893, p. 76, pl. iii. fig. 25. Type *salsala,* Moore.

A genus established by Watson for the *Nisoniades salsala* of Moore and its immediate allies. It differs from *Suastus* in facies and in the fact that vein 3 of the fore wing arises immediately before the end of the cell. The males of the three species placed in this genus by its author, together with one other, may be distinguished by the characters given below. In *salsala* and *stellifer* the white spots on the hind wing below are very inconstant in size and number, and so, in a lesser degree, are the white spots on the fore wing of the females of those species.

Males.

Fore wing above not banded with yellow-red. Hind wing below with 2–4 small snow-white spots (sometimes absent). No patch of androconia on the hind wing above.

- Fore wing above with a sordid yellow macular band running obliquely outwards from the middle of the dorsum (sometimes indistinct, but always indicated by more or less distinct patches of golden-yellow scales). *salsala,* Moore.
- Fore wing above without any trace of a pale discal macular oblique band . . *stellifer,* Butl.

Fore wing above with a broad yellow-red postmedian band, which is sometimes more or less abbreviated at each end. A large patch of androconia at the base of the hind wing above near the costa.

- Fore wing below: red band narrower, lying at a right angle to the dorsum and reaching about halfway across cell 3, its inner edge nearly straight, not indented at the end of the cell . . . . *sindu,* Feld.
- Fore wing below: red band broader, reaching to about the apical sixth of cell 3, its inner edge deeply indented at the end of the cell, its outer edge forming an almost regular curve from the apical fifth of the costa to the tornus . . . . *latifascia,* n. sp.

! IAMBRIX SALSALA.

Nisoniades salsala, Moore, P. Z. S. 1865, p. 786.
Astictopterus salsala, Distant, Rhop. Mal. p. 401, pl. xxxiv. fig. 21 (1886).

In typical females of this species there is on the underside of the fore wing a round white spot at the end of the cell and a curved postmedian series of roundish white spots, placed one each in cells 2–8 inclusive, and decreasing in size towards the costa.

Hab. Sikkim (*Möller*); Assam, Naga hills, East Pegu, Perak (*Doherty*); Burmah (*Adamson*); Ceylon; Ganjam (*Minchin*); West Java (*Piepers*); Kina Balu (*Waterstradt*).

! IAMBRIX STELLIFER.

Astictopteryx stellifer, Butler, Trans. Linn. Soc. Lond., Zool. ser. 2, vol. i. p. 555 (1877); Moore, Lep. Cey. vol. i. p. 163 (1881).

This is a good and distinct species, notwithstanding all that has been written to the contrary. In typical females there is on the underside of the fore wing a round white spot in the cell and three other roundish white spots placed as follows, namely: one near the basal third of cell 2, one near the basal third of cell 3, and one near the middle of cell 5, thus forming an oblique series running outwardly towards the apex of the wing.

Hab. East Pegu, Pulo Laut, Sumatra (*Doherty*); Nias (*Modigliani*); Java (*Fruhstorfer*).

! Iambrix sindu.

Astictopterus sindu, Felder, Wien. ent. Mon. iv. p. 401 (1860); Distant, Rhop. Mal. p. 402, pl. xxxv. fig. 30 (1886).

Astictopterus obliquans, Mabille, Ann. Soc. Ent. Belg. xxxvii. p. 51 (1893).

Hab. Perak, Pulo Laut (*Doherty*); Labuan, Kina Balu, Borneo (*Waterstradt*); Padang, Sumatra (*Sachs*, *Martin*).

! Iambrix latifascia, n. sp. (Plate XXI. fig. 9, ♂.)

♂ ♀. Slightly larger than *I. sindu*, from which it is distinguished by the different shape and much greater breadth of the red band on the fore wing. These differences are detailed in the table above. The male genitalia are similar to those of *I. sindu.*

Expanse, ♂ 26, ♀ 29 mm.

Hab. Kinu Balu, Borneo (*Waterstradt*); Liwa, S.E. Sumatra (*Doherty*).

Described from specimens ex coll. Staudinger, one of which is now in my collection.

Ge.

Ge, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1895, p. 373. Type *geta,* de Nicév.

A genus, for the present, containing one species only, allied to *Matapa*, from which it is best distinguished by the sex-marks of the male. The latter are as follows:—On the fore wing above, near the base of cell 2, an oval depression fringed on its inner edge by a series of erecto-patent hair-scales; the latter are blackish, becoming pale at the base, and when viewed from above appear to entirely cover the oval depression, the long axis of which reaches quite across the cell; on the hind wing above a fringe of long hair-scales along the basal half of vein 7, directed obliquely outward and downward, and covering wholly or in part a pale patch of modified scales.

! Ge geta.

Ge geta, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1895, p. 374, pl. Q. fig. 51, ♂.

The female is undescribed.

Hab. Pulo Laut (*Doherty*); East Java (*Piepers*); Selesseh, Sumatra (*Martin*).

Taractrocera.

Taractrocera, Butler, Cat. Lep. Fabr. p. 279 (1869): Watson, P. Z. S. 1893, p. 94, pl. iii. fig. 20. Type *mævius,* Fab.

A genus of small species, associated on account of their general resemblance to the *Hesperia mævius* of Fabricius, as figured by Butler (Cat. Lep. Fabr. pl. iii. fig. 13).

They may be readily distinguished by the blunt club of the antennæ, which is excavated on the upperside.

We know nine species, which we distinguish as follows :—

1 (6). Pale markings of the upperside white or whitish.
2 (3). Hind wing below with the veins conspicuously pale . . . . . [1]*mævius*, Fab.
3 (2). Hind wing below with the veins not conspicuously pale.
4 (5). Hind wing below with a whitish stripe from the base to the termen in cell 1 *b* . . . . *danna*, Moore.
5 (4). No whitish stripe in cell 1 *b* of hind wing below . . . . . . *ardonia*, Hew.
6 (1). Pale markings of the upperside deep tawny- or golden-yellow.
7 (14). Hind wing below with a pale spot near the middle of cell 7.
8 (11). Fore wing below: cell brown, with a yellow spot near the apex.
9 (10). Size generally larger. Pale spots of upperside smaller, those of the hind wing above remote . . . . *ceramas*, Hew.
10 (9). Size smaller. Pale spots of upperside larger, those of the hind wing above contiguous, forming an irregular macular extra-discal band . . . . *nicevillei*, Wats.
11 (8). Fore wing below : cell brown, with at least the distal half yellow.
12 (13). Hind wing below : cell 7 black, with an oblong yellow spot in the middle . . . . *ziclea*, Plötz.
13 (12). Hind wing below : basal third of cell 7 and a subquadrate spot beyond the middle of that cell yellow . . . . *flavoides*, Leech.
14 (7). Hind wing below with no pale spot in cell 7.
15 (16). Yellow band on hind wing above not recurved towards the costa, ending at vein 6; fore wing below with the cell brown nearly to the middle, thence yellow . . . . *archias*, Feld.
16 (15). Yellow band on hind wing above recurved towards the costa, ending at vein 7; fore wing below with the cell brown, with a yellow spot near the apex . . . . *oberthüri*, n. sp.

! TARACTROCERA MÆVIUS.

Hesperia mævius, Fabricius, Ent. Syst. iii. p. 352 (1793).
Taractrocera mævius, Butler, Cat. Lep. Fabr. p. 279, pl. iii. fig. 13 ; Moore, Lep. Cey. vol. i. p. 172, pl. lxx. fig. 5 (1880–81) ; Watson, Hesp. Ind. p. 62.
Pamphila sagara, Moore, P. Z. S. 1865, p. 792.

Hab. N.W. Himalayas (*Young, Hocking*); Ganjam, Calcutta (*Minchin*); Ceylon (*Mackwood*); Burmah (*Watson*).

[1] Specimens from Ceylon have the hind wing below sordid green and the veins less conspicuously pale.

! Taractrocera danna.

Pyrgus danna, Moore, Cat. Lep. E. I. C. i. p. 249.
Pamphila danna, Moore, P. Z. S. 1865, p. 508, pl. xxx. fig. 8.
Taractrocera danna, Watson, Hesp. Ind. p. 63.

Hab. N.W. Himalaya, 5000–9000 feet (*Young*); Sikkim (*Elwes*).

! Taractrocera ardonia.

Ancyloxypha ardonia, Hewitson, Descr. Hesp. p. 45 (1868).

Hab. Kina Balu, Borneo (*Waterstradt*), Pulo Laut (*Doherty*).

! Taractrocera ceramas. (Plate XXI. fig. 24, ♂.)

Cyclopides ceramas, Hewitson, Descr. Hesp. p. 44 (1868).
Taractrocera ceramas, Watson, Hesp. Ind. p. 63.

Hab. N. Canara (*Aitken*); Travancore, Malabar; Nilgiris (*Minchin*).

! Taractrocera nicevillei. (Plate XXI. fig. 12, ♂.)

Taractrocera nicevillei, Watson, P. Z. S. 1893, p. 95.

The form of the male genitalia is similar in this species and the preceding, and the essential wing-pattern of the two is also similar, the difference in facies being caused by the greater development of the yellow spots in *T. nicevillei.* We have not, however, seen any intermediate specimens.

Hab. Bombay (*Swinhoe*).

! Taractrocera ziclea.

Thymelicus ziclea, Plötz, Stett. ent. Zeit. xlv. p. 289 (1884).
Pamphila mæsoides (*luzonensis,* Mab.), Staudinger, Iris, ii. pp. 145, 165 (1889).
Ampittia ziclea, Semper, Schmett. Philipp. p. 304.
Ampittia mæsoides, id. t. c. p. 358.
Pamphila luzonensis, Mabille, *sec. spec. comm.*

This species and the next are interesting as combining the facies of *Telicota dara,* Koll., with the generic characters of *Taractrocera.* After examining a male and female of *ziclea* and a male of *mæsoides* from Semper, we are satisfied that they represent but one species. There are some small differences of degree in wing-pattern, but having regard to the latitude of similar variation which obtains in insects having a similar facies (e. g. *Telicota dara,* Koll.) these differences cannot be taken as satisfactorily characterizing a species.

Hab. Luzon, Mindoro, Samar, Bohol, Cebu, Mindanao (*Semper*).

! Taractrocera flavoides.

Taractrocera flavoides, Leech, Butt. China, &c. p. 590, pl. xl. fig. 10 ♀, 11 ♂ (1893–94).

Hab. Omei-shan, Central China (*Pratt*); Moupin (*ex coll. Oberthür*).

! TARACTROCERA ARCHIAS.

Pamphila archias, Felder, Sitzb. Ak. Wiss. Math. Nat. Cl. xl. p. 462, *sep.* p. 15 (1860).
Thymelicus nigrolimbatus, Snellen, Tijd. Ent. xix. p. 165, pl. vii. fig. 5 (1876).
Telicota nigrolimbata, Distant, Rhop. Mal. p. 384, pl. xxxv. fig. 16 (1886).

According to a specimen received from M. Mabille, this is the same as *Pamphila dschalia,* Plötz.

In the Felder collection, under the name "*Pamphila archias,*" are four specimens; two of these are without locality-labels and may be disregarded, but the remaining two which are labelled in contemporary handwriting "*Amboina,* Dolesch," are without doubt the same as *Thymelicus nigrolimbatus,* Snellen.

Hab. Java (*Piepers*); Sambawa, Bali, Arjuno, Java (*Doherty*).

! TARACTROCERA OBERTHÜRI, n. sp.

♀. Upperside similar to that of *T. ziclea,* but having the yellow markings less extensive. Hind wing below sordid yellow, by reason of a dense clothing of sulphureous scales on a dark brown ground; a large oblong pale spot occupying about the middle third of cells 4–5, a roundish one in the cell near the base of vein 7, another near the basal third of cell 2, and a feeble one in the base of cell 6; cell 1 *b* pale.

Hab. Trichinopoly, S. India (*Castets*).

Described from one female lent to us by M. Charles Oberthür.

OCHUS.

Ochus, de Nicéville, Jour. As. Soc. Beng. 1894, p. 51. Type *subvittatus,* Moore.

This is a genus established by Mr. de Nicéville for the *Cyclopides subvittatus* of Moore. It is mainly distinguished from *Baracus* (e. g. *B. septentrionum* and *B. subditus*) by having the base of cell 6 in the fore wing nearly as long as that of cell 5, and vein 11 not approaching vein 12.

OCHUS SUBVITTATUS.

Cyclopides subvittatus, Moore, P. Z. S. 1878, p. 692; Wood-Mason & de Nicéville, Jour. As. Soc. Beng. 1886, p. 392, pl. xvii. figs. 6, 6 *a* ♂, × 2; Watson, Hesp. Ind. p. 69 (1891).
Cyclopides subradiatus, Moore, l. c. p. 693.

Hab. Sikkim, Khasia (*Elwes*), Nagas (*Doherty*).

AMPITTIA.

Ampittia, Moore, Lep. Cey. i. p. 171 (1881); Watson, P. Z. S. 1893, p. 95. Type *maro,* Fab.

A group comprising a few small species, dark brown with yellow spots, associated on account of their general resemblance to the *Hesperia maro* of Fabricius. In the latter there is no evident apiculus to the club of the antennæ, although a small one is present in the other species. The males of those species possessing a sex-mark on the fore wing above have the "tuning-fork" arrangement of the subcostal veins in the hind wing. We distinguish the species known to us as follows:—

1 (4). Fore wing above with a sex-mark in the male.
2 (3). Exp. 25 mm. Male: fore wing below—cell yellow except at the base. *maro*, Fab.
3 (2). Exp. 30–32 mm. Male: fore wing below—cell yellow, with a black streak in the middle . . . . *virgata*, Leech.
4 (1). No sex-mark on fore wing above in the male.
5 (6). Fore wing more pointed; termen straight, oblique. Dark markings on hind wing below consisting of small, scattered, black spots . *maga*, Leech.
6 (5). Fore wing less pointed, termen evenly rounded.
7 (8). Hind wing below yellow, with irregular pale brown markings forming three more or less distinct transverse series; a large, oblong, pale spot occupying the basal half of cells 4–5 . . . . *trimacula*, Leech.
8 (7). Hind wing below yellow-brown by reason of a close sprinkling of yellow scales on a brown ground, with three yellow spots near the base and an irregular subterminal and postmedian series of yellow spots, the largest member of the latter being a spot near the middle of cells 4–5 and occupying the entire width of those cells . *delai-lama*, Mab.

! AMPITTIA MARO.

Hesperia maro, Fabricius, Ent. Syst., Suppl. p. 432 (1798), ♂.
Cyclopides camertes, Hewitson, Descr. Hesp. p. 43 (1868), ♂.
Ampittia maro, Moore, Lep. Cey. i. p. 172, pl. lxxi. figs. 1, 1 *a* (1880–81); Watson, Hesp. Ind. p. 61 (1891).
Telicota maro, Distant, Rhop. Mal. p. 383, pl. xxxv. fig. 14 ♂, 15 ♀ (1886).

Hab. N. Canara (*Aitken*); Ceylon (*Mackwood*); Nilgiris (*Roberts*); Calcutta (*de Nicéville*); Burmah, Tenasserim (*Watson*); Shanghai (*Pryer*); Bali (*Doherty*).

AMPITTIA MAROIDES.

Ampittia maroides, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1896, p. 190, pl. T. fig. 51, ♂.

Differs from *A. maro* "on both sides of the fore wing in lacking the chrome-yellow spot in the middle of the submedian interspace."

Expanse 25 mm.

Hab. Daunat Range, Tenasserim (*fide de Nicéville*).

We have not seen this species.

! AMPITTIA VIRGATA.

Pamphila virgata, Leech, Entomologist, xxiii. p. 47 (1890).
Padraona virgata, Leech, Butt. China, &c. p. 598, pl. xl. fig. 15, ♂ (1886).

Hab. Changyang, Central China (*Pratt*).

! AMPITTIA MAGA.

Pamphila maga, Leech, Entomologist, xxiii. p. 48 (1890).
Padraona maga, Leech, Butt. China, &c. p. 599, pl. xl. fig 18, ♂ (1894).

Hab. Ichang, Ningpo (*Leech*).

AMPITTIA TRIMACULA.

Taractrocera trimacula, Leech, Entomologist, xxiv. Suppl. p. 60 (1891).
Padraona trimacula, Leech, Butt. China, &c. p. 599, pl. xl. fig. 17, ♂ (1894).

Hab. Wa-su-kow, West China (*fide Leech*).

! AMPITTIA DELAI-LAMA.

Cyclopides delai-lama, Mabille, Ann. Soc. Ent. Fr. 1876, p. lvi.
Taractrocera lyde, Leech, Entomologist, xxiv. Suppl. p. 60 (1891).
Aeromachus delai-lama, Leech, Butt. China, &c. p. 620, pl. xl. fig. 16, ♂ (1894).

Hab. West China, E. Tibet (*Pratt, Kricheldorf*).

AEROMACHUS.

Aeromachus, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1890, p. 214. Type *stigmata,* Moore.

This is a group of small dull-coloured species associated together on account of their resemblance to the *Thanaos stigmata* of Moore. The distinctive wing-pattern is generally well marked, and consists of a postmedian and subterminal curved series of small pale spots running almost parallel to the termen of both fore and hind wings: it is best displayed on the underside, and the postmedian series on the fore wing is usually the most sharply defined. In *kali*, de Nicév., the most aberrant species known to us, the essential pattern is traceable, although the pale spots are purple instead of whitish, and the sex-mark of the male is of the same kind as that found in *inachus.*

We separate the species known to us as follows:—

1 (22). Hind wing below without purple markings.
2 (9). Sex-mark on the fore wing above in the male a seam passing obliquely outwards from the middle of vein 1 *a* to the base of vein 3.
3 (8). Fore wing below with two rows of pale spots—one postmedian, the other subterminal.
4 (7). Hind wing below: space between the postmedian and subterminal pale macular bands darkened and divided into a series of spots by the pale veins.
5 (6). Hind wing below with the subterminal row of dark spots greenish brown; markings in cell 7 scarcely developed . . . . . . *stigmata,* Moore.
6 (5). Hind wing below with the subterminal row of dark spots velvety greenish-black; markings in cell 7 strongly developed. Fore wing longer in proportion to its width, its termen more distinctly curved . . . . *chinensis,* n. sp.
7 (4). Hind wing below uniform pale greenish grey, the veins not evidently paler than the disc, the space between the postmedian

and subterminal pale macular bands not darker than the remainder . . . . *piceus,* Leech.

8 (3). Fore wing below with only one row of pale spots—the postmedian one—and that but feebly developed. Hind wing below grey-brown, closely sprinkled with yellow scales, with a feeble irregular postmedian band of pale spots . . . . *musca,* Mab.

9 (2). Sex-mark on the fore wing above in the male a small longitudinal fold of pale scales on vein 1 *a* a little beyond the middle, or none.

10 (11). Hind wing below with the veins pale. Tegumen (viewed from above) slightly angularly widened on each side just below its rounded apex; lower lobe of clasp broadly rounded, its margin serrate and continuous with the outline of the upper lobe . . *inachus,* Mén.

11 (10). Hind wing below with the veins concolorous.

12 (19). Fore wing broader and more triangular, the termen straighter and longer in proportion to the dorsum.

13 (16). Fore wing below: postmedian and subterminal pale macular bands both well developed, usually complete from the dorsum to the costa. Tegumen (seen from above) with a small notch at each distal angle, its apex truncate or but slightly rounded between the notches.

14 (15). Hind wing below grey-brown; the postmedian series of pale spots not stronger and more evident than the subterminal series . . *discreta,* Plötz.

15 (14). Hind wing below greenish ochreous; the postmedian series of pale spots stronger and more evident than the subterminal series . *jhora,* de Nicév.

16 (13). Fore wing below: pale macular bands imperfect or absent, not in any case reaching the dorsum.

17 (18). Fore wing below with a spot of pale scales in the cell near its upper distal angle. Tegumen (seen from above) with a small rounded projection on each side near the apex, beyond which it is produced in a bluntly-rounded triangle . . . . *dubius,* n. sp.

18 (17). No such pale spot on the fore wing below. Tegumen as in *discreta* and *jhora* . . . . *javanicus,* n. sp.

19 (12). Fore wing narrower and more oblong; termen more strongly curved, almost evenly curved from the dorsum to the costa.

20 (21). Fore wing below with the pale postmedian macular band continuous from cell 2 to cell 7 or 8, and running almost parallel with the termen; no pale spot in the cell near its upper distal angle. Tegumen parallel-sided in its apical half, evenly rounded at the apex; lower lobe of clasp not produced, broadly rounded, serrate and continuous with the outline of the upper lobe . . *indistincta,* Moore.

21 (20). Fore wing below with the pale spots in two outwardly oblique series—one series in cells 5, 6, and 7 or 8, or 6, 7, and 8, the other series in cells 2 and 3; no pale spot in cell 4; a pale spot in the cell near its upper distal angle. Tegumen a little constricted on each side just below the apex, which is bluntly

triangular; lower lobe of clasp acuminate, produced much above the level of the upper edge of the clasp . . . . . . *nanus*, Leech.

22 (1). Hind wing below with pale purple spots.

23 (24). Upperside fuliginous brown. Sex-mark on the fore wing of the male a small longitudinal fold of pale scales on vein 1 *a* about the middle. Purple markings on the disc of hind wing below forming a large irregular macular patch having its outer edge parallel with the termen . . . . *kali*, de Nicév.

24 (23). Upperside pale brown. Sex-mark on fore wing of the male a seam passing obliquely outwards from the middle of vein 1 *a* to the base of vein 3. Purple markings on disc of hind wing below forming a continuous curved macular band from the costa as far as vein 1 *b* . . . . *catocyanea*, Mab.

! AEROMACHUS STIGMATA. (Plate XIX. fig. 3, ♂.)

Thanaos stigmata, Moore, P. Z. S. 1878, p. 694.
Aeromachus stigmata, Watson, Hesp. Ind. p. 68 (1891).

Specimens from the N.W. Himalayas and some from Sikkim show a band of whitish spots across the fore wing and a discal spot, which are faint or absent on the upperside of Khasia and Naga hill specimens; the undersides also vary to some extent, but the genitalia seem to be identical in both forms.

Hab. N.W. Himalayas (*Young*); Sikkim (*Möller*); Khasias (*Elwes*); Naga hills (*Doherty*).

! AEROMACHUS CHINENSIS, n. sp.

Aeromachus inachus, Leech, Butt. China, &c. p. 619, pl. xl. fig. 19, ♂ (1893–94), in part. (*nec* Ménétriés).

This insect, which in some parts of Western China appears to represent *A. stigmata*, may be readily distinguished from that species by the characters given in the table above. The genitalia do not differ materially. The sex-mark in the two male specimens which we have seems less conspicuous, but their condition is not perfect

Hab. Wa-shan, Ta-tsien-lu, West China (*Pratt*).

! AEROMACHUS PICEUS.

Aeromachus piceus, Leech, Butt. China, &c. p. 618, pl. xli. fig. 16, ♂ (1893–94).

Hab. Moupin, E. Tibet (*fide Leech*).

! AEROMACHUS MUSCA.

Pamphila? musca, Mabille, Bull. Soc. Ent. Fr. 1876, p. xxvi.
Aeromachus musca, Semper, Schmett. Philipp. p. 305 (1892).

A very distinct little species, of the size of *nanus*, Leech, or *indistincta*, Moore.

Hab. Luzon, Siargao (*Semper*).

! Aeromachus inachus. (Plate XIX. fig. 7; Plate XXIII. figs. 36, 36 *a*.)

Pyrgus inachus, Ménétriés, Bull. Acad. Petr. xvii. p. 217 (1859); Schrenk's Reisen, p. 46, pl. iv. fig. 2 (1859).

Closely allied to *stigmata*, but separable by its somewhat paler colour and the different form of the sex-mark.

It has the wing-shape of *chinensis*.

We have not been able to identify this with Ménétriés's type except by the locality; but Amur specimens agree well with those from Japan. Mr. Leech has included under this name what we call *chinensis*, and we have specimens from his collection which were mixed with others from Western China but which may be from Japan.

Hab. Yokohama (*Manley*); Oiwake, Japan (*Pryer*); Amurland, West China (*coll. Leech*).

! Aeromachus discreta. (Plate XIX. fig. 6, ♂.)

? *Apaustus discreta*, Plötz, Berl. ent. Zeit. 1885, p. 232.

Hab. Khasia, 5000 feet (*Elwes*); Bernardmyo, Burmah (*Doherty*); Battak Mountains, Sumatra (*Martin*). Cf. *javanicus*, post.

! Aeromachus jhora. (Plate XXIII. figs. 37, 37 *a*.)

Thanaos jhora, de Nicéville, Jour. As. Soc. Beng. 1885, p. 122, pl. ii. fig. 12, ♂.

Hab. Sikkim (*Möller*).

! Aeromachus dubius, n. sp. (Plate XIX. fig. 10, ♂; Plate XXIII. fig. 39 *a*.)

♂. Upperside dark olive-brown, the postmedian series of spots on the fore wing very indistinct or wanting; sex-mark on the fore wing a small inconspicuous fold of raised scales in cell 1 *a* next vein 1 *a* near the middle. Underside: fore wing umber-brown, the apical and costal regions similar to the hind wing; a small pale spot near the upper distal angle of the cell; the postmedian series of pale spots represented by about six spots, which become gradually fainter in their course from cells 8–3; a pale anteciliary line: hind wing ochreous brown by reason of a close sprinkling of yellow scales on the umber-brown ground; the postmedian and subterminal series of pale spots very indistinct or wanting; a pale anteciliary line. Fringes greyish white, the short scales grey-brown. Antennæ above blackish, minutely spotted with yellowish; beneath greyish yellow, the shaft spotted with black. Second joint of palpi clothed with yellow and black hairs intermixed. Body above concolorous with the wings, beneath with greyish-yellow pubescence. Legs with greyish-yellow scaling.

Tegumen (seen from above) with a small rounded projection near the apex on each side, beyond which it is produced in a bluntly rounded triangle.

♀. Differs from the male in wanting the sex-mark and in having the pale spots proper to the underside more strongly developed, and consequently the postmedian series appears faintly on the costal portion of the upperside of the fore wing.

Expanse 21–21½ mm.

Hab. Palnai hills (*Castets*); Peermaad, Travancore.

Described from four males and one female. Of the species known to us this comes nearest to *A. jhora*, de Nicév., from which, however, it differs in the form of the tegumen as well as in the spotting of the wings.

! AEROMACHUS JAVANICUS, n. sp. (Plate XIX. fig. 24, ♂.)

♂. Upperside pale umber-brown without markings, a few greyish-yellow scales near the base of the fore wing towards the costa; on the hind wing a line of long grey hairs along the basal two-thirds of vein 1 *b*; sex-mark on the fore wing a small inconspicuous fold of raised scales in cell 1 *a* next vein 1 *a* near the middle. Underside: fore wing pale umber-brown; the apical region similar to the hind wing, and having the usual postmedian series of pale spots indicated by very indistinct pale spots in cells 5–7 or 5–8; a pale anteciliary line: hind wing grey-brown, with a very faint greenish tinge by reason of the close sprinkling of yellowish-grey scales on the pale brown ground; a pale anteciliary line; the usual postmedian and subterminal series of pale spots are only indicated by a few very indistinct pale spots. Fringes pale grey, the shorter scales grey-brown. Antennæ above black, minutely spotted with yellowish; beneath greyish yellow, the shaft spotted with black. Second joint of palpi clothed with whitish-grey and black hairs intermixed. Body above concolorous with the wings, beneath with yellowish-grey pubescence. Legs with yellowish-grey scaling.

Tegumen as in *A. discreta* and *A. jhora*.

Expanse 21 mm.

Hab. West Java.

Described from a single male kindly sent to us by Herr P. C. T. Snellen with the name *Apaustus discreta*, Plötz. In general appearance it comes nearest to the insect from the Khasia hills and Burmah, which we identify as *discreta*, Plötz, originally described from India; but the latter species, in all the specimens which we have seen, has the pale pattern on the underside well marked and constant.

! AEROMACHUS INDISTINCTA. (Plate XIX. fig. 11, ♂; Plate XXIII. fig. 39.)

Thanaos indistincta, Moore, P. Z. S. 1878, p. 694.
Aeromachus indistincta, Watson, Hesp. Ind. p. 66 (1891).

Hab. Nilgiri hills (*Hampson*); Tavoy (*Tucker*); Tounghoo, Burmah (*Adamson*); Bernardmyo (*Doherty*); ? Khasias.

! Aeromachus nanus. (Plate XXIII. figs. 38, 38 *a.*)

Aeromachus nanus, Leech, Butt. China, &c. p. 620, pl. xl. fig. 21, ♂ (1893–94).

Hab. Shanghai (*Pryer*); Ichang (*Pratt*).

! Aeromachus kali.

Thanaos kali, de Nicéville, Jour. As. Soc. Beng. 1885, p. 123, pl. ii. fig. 3, ♂.

The largest of the genus and a very distinct species.

Hab. Sikkim (*Möller*); Naga hills, Bernardmyo (*Doherty*).

Aeromachus catocyanea.

Pamphila catocyanea, Mabille, Ann. Soc. Ent. Fr. 1876, p. lv.
Aeromachus catocyaneus, Leech, Butt. China, &c. p. 618 (1894).

We have relied on the drawing of Mabille's type of this species referred to by Leech in separating this species, which we have not seen, but which seems nearest to *A. kali.*

Hab. "Thibet" (*David*). Type in Mus. Paris.

Sebastonyma.

Sebastonyma, Watson, P. Z. S. 1893, p. 81. Type *dolopia,* Hew.

A monotypic genus closely allied to *Halpe.* Vein 5 of the fore wing is straight and arises very little nearer to vein 4 than to vein 6, and the sex-marks in the male consist of an infra-alar tuft on the fore wing and a large suboval patch of androconia near the base of the hind wing above, situate in the cell next its lower edge and occupying about one-half of its area. The sex-mark on the hind wing is not noticed in the original diagnosis of the genus.

Sebastonyma dolopia.

Hesperia dolopia, Hewitson, Descr. Hesp. p. 27 (1868); id. Ex. Butt. v. pl. lv. figs. 60, 61 (1873).
Halpe dolopia, Watson, Hesp. Ind. p. 74 (1891).

Hab. Sikkim (*Möller*); Nagas, E. Pegu (*Doherty*); Khasias (*Hamilton*).

Pedestes.

Pedestes, Watson, P. Z. S. 1893, p. 81. Type *masuriensis,* Moore.

Watson made *Isoteinon masuriensis,* Moore, the type of this genus, and he also included in it *I. pandita,* de Nicév.

The male genitalia in these two species are remarkable for a certain amount of asymmetry and the possession of separate *œdeagus-guards*, not part of the tegumen, of which the right is larger than the left. The tegumen is symmetrical in both species, and the clasps are so in *pandita*; but in the clasps of *masuriensis* the asymmetry is extreme.

The species here included in the genus may be distinguished as follows:—

1 (4). Fore wing with hyaline spots in cells 6, 7, 8. Hind wing below not marked with about ten black spots.

2 (3). Upperside dark brown with a purple shade, pale spots on the fore wing pure white. Hind wing below grey-brown, generally with a minute pale spot in each of cells 2 and 3; fringe white . . *masuriensis*, Moore.

3 (2). Upperside brown, pale spots on the fore wing sordid yellowish white. Hind wing below yellow-brown; fringe brownish grey . *pandita*, de Nicév.

4 (1). Fore wing without hyaline spots in cells 6, 7, and 8, or with one in cell 6 only. Hind wing below marked with about ten black spots.

5 (6). Fore wing with no pale spot in cell 6. Fringes of hind wing below pale, with dark spots next the veins. Male with the long hairs near the base of the hind wing above normal, not forming a tuft. Apex of tegumen (viewed from above) elongate-triangular, with a short horn on each side of the base . . . . *maculicornis*, n. sp.

6 (5). Fore wing with a pale spot in cell 6. Fringes of hind wing below pale with the basal half dark. Male with a distinct tuft of subequal long hairs near the base of hind wing above. Apex of tegumen (viewed from above) elongate-triangular, with an ear-like lobe on each side of the base . . . . *fuscicornis*, n. sp.

PEDESTES MASURIENSIS. (Plate XXIV. figs. 40, *a*, *b*, *c*.)

Isoteinon masuriensis, Moore, P. Z. S. 1878, p. 693; Watson, Hesp. Ind. p. 79; Staudinger, Exot. Tagf. i. p. 301, ii. pl. c.

Hab. N.W. Himalaya (*Young*); Sikkim (*Möller*).

PEDESTES PANDITA. (Plate XXIV. figs. 41, *a*, *b*.)

Isoteinon pandita, de Nicéville, Jour. As. Soc. Beng. 1885, p. 181, pl. ii. fig. 14, ♀; Watson, Hesp. Ind. p. 81.

Hab. Sikkim (*Möller*); Naga hills (*Doherty*).

PEDESTES MACULICORNIS, n. sp. (Plate XVIII. fig. 23, ♂; Plate XXIV. fig. 42.)

♂. Upperside dark umber-brown: fore wing with four yellowish-white hyaline spots—one large, occupying the prebasal fifth of cell 2, one occupying the prebasal fifth of cell 3, and two in the cell, one on the lower edge and next the base of cell 3 and one on the upper edge near the base of cell 9; a streak of golden-yellow scales along the costa from the base to near the middle and another along the upperside of vein 1 *a* from the base to beyond the middle. Underside: fore wing with the discal area brown, apical area brownish grey; hyaline spots as on the upperside; a large oblong suffused pale spot in cell 1 *a*, and a small brown spot in each of cells 4–7: hind wing brownish grey, with nine roundish black spots placed as follows—one in the basal fourth of cell 7, one in the cell next the base of cell 6, one near the basal third of cell 1 *b*, one near the middle of cell 7, one in cell 6, one in cells 4–5, one each in cells 2 and 3, and one near the apical third of cell 1 *b*, the six last named forming a subterminal curved series; fringe pale, with dark spots next the veins.

Body above concolorous with the wings. Palpi clothed with yellowish-grey scales intermixed with black ones. Antennæ brown, spotted with white on the underside from the base to the club, which bears a white ring.

♀. Similar to the male.

Expanse 37–38 mm.

Described from three males and one female in coll. Elwes.

Hab. Pulo Laut (*Doherty*).

PEDESTES FUSCICORNIS, n. sp. (Plate XVIII. fig. 25, ♂; Plate XXIV. fig. 43.)

♂. Upperside dark umber-brown: fore wing with five yellowish-white hyaline spots—one, the largest, in cell 2 and reaching from the basal fifth to about the middle of that cell, one occupying the prebasal fourth of cell 3, one, punctiform, near the basal third of cell 6, and two in the cell, one on the lower edge and next the base of cell 3 and one on the upper edge near the base of cell 9; the wing-membrane on each side of vein 1 *a* from the base to the middle paler in colour and having a somewhat inflated appearance: hind wing with a tuft of subequal long brown hairs near the base and reaching nearly to the middle. Underside: fore wing brown, the hyaline spots as on the upperside; a large oblong suffused pale spot in cell 1 *a*, and traces of small dark spots one each in cells 4–8, most distinct in cells 4 and 5: hind wing brown, with a distinct purple shade and nine black spots placed as follows:—one in the basal fourth of cell 7, one in the cell next the base of cell 6, one near the basal third of cell 1 *b*, one near the middle of cell 7, one in cell 6, one in cells 4–5, one each in cells 2 and 3, and one near the apical third of cell 1 *b*, the six last named forming a submarginal curved series; fringe pale, the basal half (that is, the short scales) dark.

Body above concolorous with the wings. Clothing of palpi above dark brown, beneath of yellowish-grey and brown scales intermixed in nearly equal numbers. Antennæ brown, underside spotted with white near the base; club with a white ring.

Expanse 30–34 mm.

Described from three male specimens in coll. Elwes, in one of which the purple shade is absent from the underside of the hind wing.

Hab. Pulo Laut (*Doherty*).

Lophoides.

Lophoides, Watson, P. Z. S. 1893, p. 84. Type *iapis,* de Nieé.

Antennæ two-thirds as long as the costa; club moderate, gradual; apiculus gradual. Palpi suberect, third joint short, almost concealed. Fore wing pointed, dorsum subequal in length to the termen; vein 5 straight, practically intermediate between veins 4 and 6; vein 2 from the basal third of the lower edge of the cell (further from the base of the wing in the female); base of cell 3 subequal in length to that of cell 4; hyaline spot in cell 4 reduced to a point or wanting. Hind wing with the termen evenly rounded, cell about half as long as the wing; vein 3 arising immediately before the end of the cell, vein 2 just beyond the middle of the lower edge of the cell.

In the male the dorsum of the fore wing has in its middle third a scanty fringe of long hairs pointing obliquely downward and outward; on the underside of the fore wing the middle third of the dorsum bears a thick fringe of long hairs pointing obliquely upward and outward; on the upperside of the hind wing there is a patch of long recumbent hairs attached to the basal portion of vein 8; and the fringe of the hind wing next the tornus is much elongated.

The first described species belonging to this genus was *obscura,* Distant, a species for which that author made the genus *Isma*; but as his account of that genus is both imperfect and inaccurate (he ascribes to the type a pyriform antennal club, which it certainly does not possess), his name must sink in favour of *Lophoides,* Watson, of which *iapis,* de Nicév., is the type, and of which the diagnosis does include a statement of the differential characters of the type species.

1 (8). With at least one cell-spot on the fore wing, that next the lower edge of the cell.

2 (7). Fore wing with the pale spot in cell 2 small, higher than wide (at least in the male).

3 (6). Hind wing below without any purplish suffusion on the basal half.

4 (5). Hind wing with a sprinkling of yellowish-grey scales, sometimes by their absence in parts giving rise to the appearance of a very obscure dark spot next the transverse vein, and a postmedian series of four or five similar spots. Fore wing broader, termen subequal in length to the dorsum. Upper edge of lower lobe of clasp not serrate; œdeagus-guards toothed on the edges. . . . . . . *iapis,* de Nicév.

5 (4). Hind wing below with a feeble brown spot next the transverse vein and a postmedian series of four similar spots, one each in cells 2, 3, 4–5, and 6 respectively. These spots are of purplish-brown scales and not merely bare patches of the ground-colour of the wing. Fore wing longer and narrower, termen longer than the dorsum . . . . *obscura,* Distant.

6 (3). Hind wing below with a feeble purple suffusion on its basal half. Upper edge of lower lobe of clasp serrate ; œdeagus-guards smooth on the edges . . . . *purpurascens*, n. sp.
7 (2). Fore wing with the pale spot in cell 2 large, wider than high. Male genitalia as in *iapis* . . . . *vulso*, Mab.
8 (1). No cell-spot on the fore wing. Hind wing below with two minute white points on the disc, one each in cells 2 and 3 . . . . . *binotatus*, n. sp.

! LOPHOIDES IAPIS. (Plate XXIV. figs. 44, 44 *a*.)

Isoteinon iapis, de Nicéville, Jour. Bom. Nat. Hist. Soc. 1890, p. 213, pl. E. fig. 9, ♂; Watson, Hesp. Ind. p. 86.

Hab. Johore, Malay Peninsula ; Mergui Archipelago (*fide de Nicéville*) ; Pulo Laut, Borneo ; Perak (*Doherty*) ; Banguey (*coll. Staudinger*).

LOPHOIDES OBSCURA.

Isma obscura, Distant, Rhop. Mal. p. 386, pl. xxxv. fig. 19 (1886).

We are indebted to Messrs. Godman and Salvin for the opportunity to critically examine the type of this species, which is from Singapore (*Wallace*).

! LOPHOIDES PURPURASCENS, n. sp. (Plate XVIII. figs. 26 ♂, 27 ♀ ; Plate XXIV. figs. 45, 45 *a*.)

Distinguished from *L. iapis* by the purple suffusion of the basal half of the hind wing below.

Expanse 31 mm.

Hab. Pulo Laut, Borneo (*Doherty*).

Described from three males and one female in coll. Elwes.

! LOPHOIDES VULSO, Mab.

Pamphila vulso, Mabille, Ann. Soc. Ent. Belg. xxxvii. p. 55 (1893).

Hab. West Java (*Piepers*) ; Java (*Fruhstorfer*) ; Bali (*Doherty*) ; Selesseh, Sumatra (*Martin*).

LOPHOIDES BINOTATUS, n. sp. (Plate XVIII. fig. 28, ♀ .)

♀ . Upperside dark brown : fore wing with five hyaline white spots, one about one and a half times as high as wide in cell 2, one less than half the size of the former in cell 3, one very small in cell 4, and two small and punctiform, one each in cells 6 and 7, and a small white spot next the upper edge of vein 1 *a* near the middle ; hind wing with an indistinct pale point on the disc, coinciding with that in cell 3 on the underside. Underside brown : fore wing darker on the disc, with a suffused whitish spot near the middle of cell 1 *a*, and the hyaline spots as on the upperside ; hind wing with two minute white points on the disc, one each in cells 2 and 3. Fringe of the fore wing grey-brown, a little paler next cell 1 *a*; of the hind wing dark grey, with the short scales dark brown and a feeble indication of chequering. Antennæ blackish, finely spotted with white on the underside; club white beneath, apiculus dark. Body above concolorous with the wings. Second joint of palpi clothed with yellowish and black hairs intermixed. Clothing of breast and legs brown. Abdomen beneath yellowish grey.

Expanse 30 mm.

Hab. Kina Balu, Borneo (*Waterstradt*).

Described from one example ex coll. Staudinger.

HYAROTIS.

Hyarotis, Moore, Lep. Cey. i. p. 174 (1881). Type *adrastus,* Cr.

This is a monotypic genus established by Moore for *Hesperia adrastus*, Cr., an insect sufficiently distinguished by its facies. Vein 5 of the fore wing is straight throughout.

HYAROTIS ADRASTUS.

Hesperia adrastus, Cramer, Pap. Ex. vol. iv. pl. ccexix. figs. F, G (1780).
Plesioneura praba, Moore, P. Z. S. 1865, p. 790.
Hesperia phœnicis, Hewitson, Ex. Butt., Hesp. pl. iv. figs. 36, 37 (1869).
Hyarotis adrastus, Moore, Lep. Cey. vol. i. p. 174, pl. lxvii. figs. 5, 5 *a* (1881); Distant, Rhop. Mal. p. 397, pl. xxxiv. fig. 4 (1886); Watson, Hesp. Ind. p. 117.

Hab. Kangra (*Hocking*); Sikkim (*Möller*); E. Pegu (*Doherty*); Ceylon; Java (*Fruhstorfer*); Philippines (*Semper*); Palawan (*Platen*).

ISOTEINON.

Isoteinon, Felder, Wien. ent. Monats. vi. p. 30 (1862); Watson, P. Z. S. 1893, p. 83. Type *lamprospilus,* Feld.

Watson restricts the name *Isoteinon* to the *lamprospilus* of Felder and diagnoses the genus by the direction of the third joint of the palpi, which is "erect, reaching well above the vertex of the head, slender, obtusely conical." We have not seen any specimens of *lamprospilus*, Feld., with palpi of this kind; for us, the third joint of the palpus is short, about equal in length to one-fourth of the diameter of the eye, erecto-patent, and not reaching to the level of the vertex; and this condition does not appear to be due to deflexion of the head in setting. The basal portion of vein 5 of the fore wing recedes from vein 6.

ISOTEINON LAMPROSPILUS.

Isoteinon lamprospilus, Felder, Wien. ent. Mon. vi. p. 30 (1862); id. Reise Nov., Lep. iii. pl. lxxiv. fig. 20 (1867); Leech, Butt. China, &c. p. 582 (1893–94).

Pamphila vitrea, Murray, Ent. Mo. Mag. xi. p. 171 (1875).
Pamphila lamprospilus, Pryer, Rhop. Nihon. p. 33, pl. x. fig. (1889).

Hab. Japan (*Pryer*, *Leech*); Changyang, C. China (*Pratt*).

Idmon.

Idmon, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1895, p. 375. Type "*unicolor,*" de Nicév. (nec Dist.)

This is a genus made by Mr. de Nicéville for a species from Perak, of which the female, according to him, agrees very closely with Distant's figure of *Baoris unicolor*. The latter is an entirely brown insect with an expanse of about 30 mm., and, as we have satisfied ourselves by an examination of the type kindly lent to us by Dr. Staudinger, is a true *Parnara*, and a male, not a female as supposed by Mr. de Nicéville. In the genus *Idmon*, according to his description, "the middle and lower discocellulars of the fore wing are very upright, slightly inwardly oblique only, both slightly concave, the middle a very little longer than the lower, the second median nervule arises close to the lower end of the cell, and the first median arises a little nearer to the base of the wing than to the lower end of the cell." There is on the fore wing of the male a sex-mark, which is described by him first as "a sexual brand placed anterior to, but against the submedian nervure towards its base, this brand is narrow and raised," and afterwards as "a narrow raised brand of modified scales lying alongside a portion of the submedian nervure towards its base on the upperside of the fore wing."

The hind tibia has "a tuft of hairs attached to its proximal and two pairs of spines on its distal end." This latter character is not found in any species of Hesperiidæ known to us; and as Mr. de Nicéville says that the female of his *Idmon* differs from the male only in the wings being broader and lacking the sexual brand on the fore wing, it would appear that there are two pairs of spines on the distal end of the hind tibia in both sexes.

Mr. de Nicéville gives as the type of this genus an insect which he was unable to identify correctly without seeing, and his generic diagnosis relates to the species mentioned below, which we have never seen, and not to *Baoris unicolor*, Dist.

Idmon unicolor.

Idmon unicolor, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1895, p. 377, pl. Q. fig. 53, ♂.

Hab. Perak (*fide de Nicéville*).

Arnetta.

Arnetta, Watson, P. Z. S. 1893, p. 81. Type *atkinsoni,* Moore.

Watson includes in this genus *Isoteinon atkinsoni*, Moore, and *I. vindhiana*, Moore; the former has vein 5 in the fore wing straight and very little nearer to vein 4 than to vein 6, and in the latter the basal portion of vein 5 in the fore wing recedes from vein 6, so that vein 5 arises much nearer to vein 4 to vein 6. The palpi are porrect in both species.

The two species may be distinguished as follows:—

1 (2). Male with a tuft of hair near the middle of the dorsum of the fore wing below. Vein 1 *a* of fore wing deflexed to the dorsum near the middle. Hind wing below with small pale spots . . . *atkinsoni*, Moore.

2 (1). No such tuft in the male, vein 1 *a* of fore wing straight. Hind wing below divided into a pale basal and a dark apical area, the boundary between these being in a line from the apical third of vein 8 to the apical fourth of vein 1 *b* and somewhat angulated in or near cell 7 . . . . *vindhiana*, Moore.

! ARNETTA ATKINSONI.

Isoteinon atkinsoni, Moore, P. Z. S. 1878, p. 693, pl. xlv. fig. 10; Elwes, Trans. Ent. Soc. Lond. 1888, p. 455, pl. xi. fig. 9, ♂; Watson, Hesp. Ind. p. 77.
Isoteinon subtestaceus, Moore, t. c. p. 844; Watson, t. c. p. 78.
Isoteinon khasianus, Moore, t. c. p. 693; Watson, t. c. p. 78.

Hab. Sikkim (*Elwes*); Khasias (*Hamilton*); Nagas, Burmah (*Doherty*).

Atkinsoni varies in the ground-colour of the hind wing below and the development of the pale spots thereon; in typical examples the latter are well marked, but they are sometimes entirely absent, and many intermediate states occur: the unspotted or faintly marked examples (*subtestaceus*, M.) were regarded by Möller as the spring brood, and Watson got *atkinsoni* only in August and *subtestaceus* only in April. Watson says (P. Z. S. 1893, p. 82) that in the males of *atkinsoni* and *subtestaceus* there is attached along the basal half of the inner margin of the fore wing a tuft of longish hairs, which are turned up and spread out fanwise over the underside of the hind wing. In the male specimens of *atkinsoni* before us there is on the dorsum of the fore wing, from a point distant about one-fourth from the base of the wing to a point about the middle of the dorsum, a fringe of long black hairs, which form a tuft pointing in the direction of the tornus and covering the middle portion of vein 1 *a*, which is deflexed so as to touch the dorsum, and is there thickened and channelled.

! ARNETTA VINDHIANA. (Plate XVIII. fig. 24, ♂.)

Isoteinon vindhiana, Moore, P. Z. S. 1883, p. 533; Watson, Hesp. Ind. p. 84.
Isoteinon nilgiriana, Moore, l. c.; Watson, l. c.
Isoteinon modesta, Moore, t. c. p. 534; Watson, l. c.

Hab. Jubbulpore (*fide Moore*); Nilgiris (*Hampson*); Mhow, Matheran (*fide Swinhoe*); Travancore (*in coll. Rothschild*).

Itys.

Itys, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1895, p. 377. Type *iadera,* de Nicé.

The following are the chief characters given by Mr. de Nicéville for this genus and are taken from the male:—Antennæ more than half as long as costa, club elongate slender, apiculus short. Palpi porrect, densely hairy, third joint almost concealed. Fore wing: dorsum considerably longer than the termen, vein 5 rather nearer 4 than 6, vein 2 a little nearer to the end of the cell than to the base of the wing; dorsum on the underside with a long tuft of hair-scales directed upwards and outwards. Hind wing much longer than broad. Abdomen slender, reaching to the tarsus of hind wing. Tibial epiphysis present. Hind "tibia with a single pair of long spines at its distal end."

Table of Species.

1 (2). Entire insect shining brownish fuscous . . . . *iadera,* de Nicév.

2 (1). Upperside dark vandyke-brown suffused with purple. Fore wing below with four whitish hyaline spots, one each in cells 2, 3, 6, and 7, and a geminate cell-spot which is twice as high as wide. Hind wing below vandyke-brown, suffused with purple, with indistinct traces of three dark bands, one sub-basal and two postmedian, and not more than four small ochreous-white spots, of which latter, according to the figure, there are two in cell 7, and one in the cell near its upper outer angle . . . . *microstictum,* Wood-Mason [& de Nicéville.

Itys iadera.

Itys iadera, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1895, p. 379, pl. Q. fig. 52, ♂.

Hab. Penang, N.E. Sumatra (*de Nicéville*).

Itys microstictum.

Isoteinon microstictum, Wood-Mason & de Nicéville, Jour. As. Soc. Beng. 1886, p. 385, pl. xvii. figs. 3 ♂, 3 *a* ♀; Watson, Hesp. Ind. p. 82.

Hab. Silcuri, Cachar (*Wood-Mason & de Nicéville*).

Zographetus.

Zographetus, Watson, P. Z. S. 1893, p. 84. Type *satwa,* de Nicév.

Species of small size, without markings on the hind wing above; no hyaline spot in cell 4 of the fore wing; alar sex-mark when present not of the kind found in *Halpe.* Basal portion of vein 5 of the fore wing decurved. The latter point is less evident in *satwa* than in *ogygia* and the other species here included in the genus. Antennæ about half as long as the costa (somewhat exceeding that length in the male of *ogygia*), the club and apiculus moderate and gradual. Palpi ascending, third joint short. Hind tibiæ with two pairs of spurs.

The species known to us may be distinguished as follows:—

1 (10). The largest or only pale spot in the cell of the fore wing placed next the lower edge of the cell.

2 (5). Hind wing below yellow or greenish yellow in the basal half, purple or brownish purple in the terminal half.

3 (4). Ground-colour of the fore wing above plain brown. Fore wing in the male with a distinct ridge or fold on each side of the prebasal fourth of vein 1 *a* and on each side of the basal third of vein 2. Hind wing below bright yellow, the termen broadly brownish purple . . . *satwa*, de Nicév.

4 (3). Ground-colour of the fore wing above brown with a dark purple shade. No sex-mark on the fore wing of the male. Hind wing below greenish yellow, the termen broadly purple-brown . . . . *durga*, Plötz.

5 (2). Hind wing below not as in paragraph 2.

6 (7). Male: fore wing above[1] with a tuft of long hair-like scales near the middle of the dorsum. Hind wing below yellow; termen narrowly brown from the tornus as far as vein 7; a brown spot next the transverse vein, a smaller one in cell 5, and three small subcontiguous brown rings, one each in cells 1 *b*, 2, and 3 . . . . . *flavalum*, de Nicév.

7 (6). No tuft of long hair-scales on the dorsum of the fore wing in the male.

8 (9). Hind wing below brown, with several suffused patches of yellow forming two series, a median and subterminal, the latter being the more distinct; about six more or less indistinct suffused dusky spots, one near the middle of cell 7, one near the middle of the upper edge of the cell, and a postmedian series of about four commencing in cell 2 and running parallel to the termen . . . . *ogygia*, Hew.

9 (8). Hind wing below red-brown, with about seven suffused dark purple-brown spots, one near the middle of cell 7, one near the middle of the upper edge of the cell, and a postmedian series of five others placed one each in cells 1 *b*, 2, 3, 4–5, and 6, and running parallel to the termen . . . . *ogygioides*, n. sp.

10 (1). The largest or only pale spot in the cell of the fore wing placed next the upper edge of the cell. Hind wing below yellow, with a nearly straight postmedian series of five oblong brown spots passing from just beyond the middle of vein 1 *b* to just beyond the middle of vein 6, and a more or less distinct suffused dusky terminal band . *auriferus*, n. sp.

ZOGRAPHETUS SATWA.

Isoteinon satwa, de Nicéville, Jour. As. Soc. Beng. 1883, p. 86; Watson, Hesp. Ind. p. 79.

Hab. Sikkim (*Elwes*); E. Pegu, Perak (*Doherty*).

! ZOGRAPHETUS DURGA.

Apaustus durga, Plötz, Stett. ent. Zeit. xlv. p. 153 (1884).
Isoteinon durga, Semper, Schmett. Philipp. p. 306, pl. xlix. fig. 10, ♂ (1892).

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[1] See next page, under *flavalum*.

Resembles *I. satwa*, de Nicév., so closely that the differences only need be noticed. Fore wing with a dark purple shade throughout; no pale spot in cell 7, no modification of veins 1 and 2 by way of sex-mark; the yellow colour on the hind wing below more extensive but much less bright; club of antennæ pure white beneath.

Hab. Camaguin de Mindanao (*Semper*); Sambawa (*Doherty*).

ZOGRAPHETUS FLAVIPENNIS.

Isoteinon flavipennis, de Nicéville, Jour. As. Soc. Beng. 1885, p. 122, pl. ii. fig. 4, ♀; Watson, Hesp. Ind. p. 81.

Zographetus flavipennis, Watson, P. Z. S. 1893, p. 85.

The hind wing below is described as "ferruginous-ochreous, glossed and marbled with purple," and as having "a dark brown spot in the cell and a series of five or six similar spots placed around the cell." The figure shows the termen of the hind wing below rather broadly and suffusedly brown.

Col. Swinhoe has kindly lent us an insect from Sikkim (*Monro*), labelled by Mr. de Nicéville "*Isoteinon flavipennis*, de Nicéville, ♀," which agrees fairly well with the figure above cited. The underside of the hind wing of this specimen is dull red-yellow, darker next the termen, with seven dark purple-brown spots, one near the middle of cell 7, one near the middle of the upper edge of the cell, and a postmedian series of five others placed one each in cells 1 *b*, 2, 3, 4–5, and 6, and running parallel to the termen. The fore wing is remarkable for the large size of the hyaline spot in cell 6, which is oblong and nearly as large as that in cell 3; the one in cell 7 is punctiform. In cell 1 *a* on the fore wing above there is a yellowish-white spot next vein 1 *a* beyond the middle.

Hab. Buxa, Bhutan (*Moti Ram*); Sikkim (*Möller*); South Andaman Island (*de Roepstorff*). All *fide* de Nicéville.

ZOGRAPHETUS FLAVALUM.

Isoteinon flavalum, de Nicéville, P. Z. S. 1887, p. 463, pl. xl. fig. 10, ♂; Watson, Hesp. Ind. p. 83 (1891).

Hab. Sikkim.

Having regard to the statement in the original description of this species that there are "no secondary male sexual characters," it is well to note that in the type specimen (kindly lent to me by Mr. Rothschild) there is a tuft of long pale hair-scales occupying the middle third of the dorsum of the fore wing *above* directed very obliquely outward and upward and reaching as far as vein 1 *a*. It is, however, just possible that this tuft may have been misplaced in setting the insect, and that its normal position is on the *underside* of the fore wing, as in some other species.

! ZOGRAPHETUS OGYGIA.

Hesperia ogygia, Hew. Trans. Ent. Soc. Lond. ser. 3, vol. ii. p. 500 (1866).

Hab. Pulo Laut (*Doherty*); Labuan (*coll. Staudinger*).

ZOGRAPHETUS OGYGIOIDES, n. sp. (Plate XIX. fig. 9, ♂.)

♂. Upperside dark brown: fore wing with five yellowish-white spots placed as follows—one large and subquadrate in cell 2, one much smaller but also subquadrate in cell 3, an oblong one of moderate size near the apex of the lower edge of the cell, a punctiform one just above the one last named, and a small roundish one in cell 6; no evident sexual modification of veins 1 and 2. Underside: fore wing dark brown on the disc, paler along the dorsum, the extra-discal region concolorous with the hind wing, the pale spots as on the upperside; hind wing red-brown, with about seven suffused dark purple-brown spots, one near the middle of cell 7, one near the middle of the upper edge of the cell, and a postmedian series of five others placed one each in cells 1 *b*, 2, 3, 4–5, and 6, and running parallel to the termen. Fringes whitish grey, the short scales grey-brown. Antennæ dark brown, spotted with whitish beneath; club white on the upperside, apiculus pale red beneath. Body and legs brown. Second joint of palpi clothed with greyish-yellow and black hairs intermixed.

Expanse 27–28 mm.

Hab. Kina Balu (*Waterstradt*); Banguey (*coll. Stgr.*).

Described from three specimens, one from Gunong Ijan ex coll. Rothschild and two ex coll. Staudinger; one of the latter, that from Banguey, is a little smaller and paler than the other and wants the dark spot in cell 6 on the hind wing below.

! ZOGRAPHETUS AURIFERUS, n. sp. (Plate XIX. fig. 13, ♂.)

♂. Upperside brown: fore wing with five white spots placed as follows—two oblong, one each near the base of cells 2 and 3, two very much smaller but also oblong, one each near the base of cells 6 and 7, and one, small and indistinct, near the apical third of the upper edge of the cell; no evident sexual modification of veins 1 and 2. Underside: fore wing brown, the extra-discal region more or less thickly clothed with yellow scales; the pale spots as on the upperside, a suffused and rather indistinct subterminal yellow macular band from the costa to vein 3: hind wing yellow, with a nearly straight postmedian series of five oblong brown spots passing from just beyond the middle of vein 1 *b* to just beyond the middle of vein 6, and a more or less distinct suffused dusky terminal band. Fringes grey, the short scales brown. Antennæ dark brown, finely spotted with yellowish white beneath and becoming entirely pale on the underside of the basal part of the club; apiculus pale red beneath. Body above brown. Second joint of palpi, breast, and legs clothed with yellow and black hairs intermixed. Abdomen beneath sordid yellowish white.

Expanse 25–26 mm.

Hab. Island of Nias (*Modigliani*).

Described from three specimens, one in coll. Elwes, one ex coll. Rothschild, and one ex coll. Staudinger; in the fore wing of the two latter the pale spots proper to cells 6 and 7 are wanting, and the pale cell-spot is only visible on the underside.

Scobura, nom. nov.

Isma, Watson, P. Z. S. 1893, p. 83, *nec* Distant, Rhop. Mal. p. 386 (1886).

The species here dealt with under this genus are associated on account of their general resemblance to *Hesperia cephala* and *H. bononia* of Hewitson, and the main distinguishing feature common to them all is the presence of pale spots in both fore and hind wings; the palpi are ascending, with an inconspicuous third joint, and there is no sex-mark on the wings of the male. Antennæ more than one-half, in some species two-thirds, as long as the costa; club slender, apiculus moderate and gradual. It comprises two natural sections, one consisting of *cephala* and *cephaloides*, and the other of *feralia* and its allies.

Watson, in his Revision of the genera of Hesperiidæ, characterizes a genus which he calls *Isma*, Distant, and gives *obscura*, Distant, as the type of it; but it appears from a statement of Mr. de Nicéville (Jour. Bomb. Nat. Hist. Soc. 1895, p. 378) that Watson's diagnosis of the genus *Isma* was drawn up from "*Hesperia*" *cephala*, Hew., and we find that it does not agree with the type specimen of *Isma obscura*, Dist. Under all the circumstances, it appears that the genus *Isma* of Watson requires another name, and that of *Scobura* has accordingly been applied to it.

The following is a table of the species known to us:—

1 (4). Fore wing: hyaline spots in cells 2 and 3, 2 and 4, or in cell 2 only, not in cells 2, 3, and 4. Hind wing below with the pale spots pure white and dark-edged.

2 (3). Fore wing: no hyaline spot in cell 3. Hind wing below yellowish green or greyish green, with a large white spot near the base of cells 4–5, touching veins 4 and 6.

2 *a* (2 *b*). Cell-spot of the fore wing not reaching the subcostal. Hind wing below yellowish green . . . . *cephala*, Hew.

2 *b* (2 *a*). Cell-spot of the fore wing passing from the median to the subcostal. Hind wing below greyish green . . . . *martini*, n. sp.

3 (2). Fore wing: no hyaline spot in cell 4. Hind wing below with the basal half yellow, the apical half reddish brown; a white spot about the middle of cell 1 *b*, and one each near the bases of cells 2, 3, and 5 . . . . *cephaloides*, de Nicév.

4 (1). Fore wing with hyaline spots in cells 2, 3, and 4.

5 (14). Pale spots on hind wing oblong or cuneate or both.

6 (7). Hind wing below with two pale spots, one in cell 2 near the middle and the other in cell 3 near the base . . . . *bononia*, Hew.

7 (6). Hind wing below with three contiguous pale spots, one in each of cells 2 and 3, and one in cells 4–5, and sometimes one or two others.

8 (13). Fore wing with two long unequal cell-spots.

9 (12). Hind wing below: pale spot in cell 2 subequal in length to or shorter than that in cell 3.

10 (11). Pale spot in cell 1*a* of the fore wing above as wide or wider than high, not reaching vein 2. No pale spot in cell of hind wing below . . . . *feralia*, Hew.

11 (10). Pale spot in cell 1*a* of fore wing above nearly twice as high as wide, reaching quite across the cell. Hind wing below with a pale spot in the cell next the base of cell 3. Lower lobe of clasp produced into a sharp triangle . . . . *fenestrata*, n. sp.

12 (9). Hind wing below: pale spot in cell 2 about twice as long as that in cell 3, the cell generally with a pale spot next the base of cell 3. Pale spot in cell 1*a* of fore wing above as wide or wider than high, not reaching vein 2. Lower lobe of clasp not produced into a triangle . . . . *inarime*, de Nicév.

13 (8). Fore wing without any cell-spot . . . . *concinna*, n. sp.

14 (5). Pale spots on the hind wing small and roundish.

15 (16). Hind wing: vein 2 arising near the half-length of the cell . . . *bipunctata*, n. sp.

16 (15). Hind wing: vein 2 arising near the apical third of the cell . . *umbrosa*, n. sp.

! SCOBURA CEPHALA.

Hesperia cephala, Hewitson, Ent. Mo. Mag. 1876, p. 152; id. Descr. Lep. Coll. Atk. p. 4 (1879).
Isoteinon cephala, Elwes, Trans. Ent. Soc. Lond. 1888, p. 456, pl. xi. fig. 10 ♂; Watson, Hesp. Ind. p. 80.
Isma isota, Swinhoe, Trans. Ent. Soc. Lond. 1893, p. 320.

Hab. Sikkim (*Möller*); Burmah (*Watson*); E. Pegu (*Doherty*); Tavoy (*Tucker*); Shillong (*fide Swinhoe*).

Specimens in which the pale spot is absent from cell 4 of the fore wing are not uncommon; the type of *I. isota*, Swinh., is one of these.

SCOBURA MARTINI, n. sp. (Plate XVIII. fig. 22, ♀.)

♀. Differs from *S. cephala*, Hew., in the following points:—The cell-spot of the fore wing reaches right across the cell and is rather more than half as long next the subcostal as it is next the median, and there is no white spot in cell 4; the hind wing below and the apical region of the fore wing pale greyish green, the former with a large hyaline spot across cells 4–5, and three small more or less distinct brown spots, one before the middle of cell 6, one before the middle of cell 2, and one beyond the middle of cell 1 *b*.

Expanse 30 mm.

Hab. Battak Mountains, Sumatra (*Martin*).

Described from a single specimen in coll. Rothschild.

! SCOBURA CEPHALOIDES.

Hesperia? cephaloides, de Nicéville, Jour. As. Soc. Beng. 1888, p. 288, pl. xiii. fig. 4 ♂.
Isoteinon cephaloides, Watson, Hesp. Ind. p. 80 (1891).

Hab. Naga hills; Bernardmyo, Burmah (*Doherty*).

! SCOBURA BONONIA.

Hesperia bononia, Hewitson, Desc. Hesp. p. 29 (1868); id. Exot. Butt. v., *Hesp.* pl. vii. figs. 75, 76 (1876).
Isma bononia, Distant, Rhop. Mal. p. 386, pl. xxxv. fig. 20 (1886).

Hab. Pulo Laut (*Doherty*).

! SCOBURA FERALIA.

Hesperia feralia, Hewitson, Descr. Hesp. p. 31 (1868); id. Exot. Butt. iv., *Hesp.* pl. iv. fig. 32 (1869).

Hab. Kina Balu, Borneo (*Waterstradt*); Pulo Laut (*Doherty*); West Java (*Piepers*).

! SCOBURA FENESTRATA, n. sp. (Plate XIX. fig. 16, ♂; Plate XXIV. fig. 46.)

♂. Closely allied to *S. inarime*, de Nicév., which it resembles in the possession of a hyaline spot in the cell of hind wing below, next the base of cell 3. It is distinguished, however, by the shape of the white spot which stands on vein 1 *a* of the fore wing above, which is oblong, nearly twice as high as wide, reaching from vein 1 *a* to vein 2, and having its inner edge continuous with the inner edge of the white spot in cell 2.

Hab. Pulo Laut (*Doherty*). Type in coll. Elwes.

! SCOBURA INARIME. (Plate XXIV. fig. 47.)

Isma inarime, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1891, p. 391, pl. vi. fig. 38 ♂.
Pamphila zetus, Mabille, Ann. Soc. Ent. Belg. xxxvii. p. 55 (1893).

Hab. Perak; Pulo Laut (*Doherty*); Java (*fide Mabille*). Type in coll. Elwes.

! SCOBURA CONCINNA, n. sp. (Plate XIX. fig. 12, ♀.)

♀. Upperside deep warm brown: fore wing with six irregular white spots, of which four placed one in each of cells 1 *a* to 4 form an oblique series from just beyond the middle of vein 1 *a* to cell 4, and two small oblong ones are placed one in each of cells 6 and 7: hind wing with three white spots on the disc, that in cell 2 oblong, that in cell 3 cuneate, and that in cell 4 roundish. Underside: fore wing blackish-brown on the disc, closely sprinkled with greenish-yellow scales in the costal and apical regions; pale spots as on the upperside save that the one in cell 1 *a* is represented by a suffused white patch and a pale point is feebly indicated in cell 8: hind wing dull greyish green by reason of a close sprinkling of greenish-yellow scales on a brown ground, pale spots as on the upperside but feebly and irregularly dark-edged. Fringes pale grey, the short scales brown. Antennæ above blackish, spotted with white beneath; club white on the underside. Second joint of the palpi clothed with greyish-yellow and black hairs intermixed. Body above and legs brown; abdomen beneath and the tarsi yellowish grey.

Expanse 31 mm.

Hab. Pulo Laut, Borneo (*Doherty*).

This species, which is described from a single example in coll. Elwes, is well distinguished from its allies by the want of pale spots in the cell of the fore wing.

Scobura bipunctata, n. sp. (Plate XIX. fig. 2, ♀.)

♀. Upperside ochreous brown: fore wing with a yellow spot near the middle of cell 1 *a* and seven hyaline spots—two small and remote in the cell, one in each of cells 2, 3, and 4 forming a rapidly decreasing series, and one in each of cells 6 and 7; hind wing with two small irregularly roundish hyaline spots on the disc, and one in each of cells 2 and 3. Underside: fore wing brown on the disc, the dorsal region pale yellowish grey nearly to the base, the costal and apical regions thickly clothed with greenish-yellow scales, the hyaline spots as on the upperside: hind wing dull greenish-yellow by reason of the thick clothing of greenish-yellow scales on a brown ground, a median band of small irregular, bare, and therefore brown, spots running parallel to the termen, the hyaline spots in cells 2 and 3 not so well defined as on the upperside. Fringe of the fore wing yellowish grey indistinctly chequered; of the hind wing greyish yellow on the upperside, on the underside with the short scales and a few long ones next veins 2 and 3, brown. Second joint of palpi clothed with greyish-yellow and black hairs intermixed. Antennæ above brown, spotted beneath with yellowish white; club white on the underside. Body above concolorous with the wings, abdomen beneath and legs paler.

Expanse 28 mm.

Hab. Palawan (*Platen*).

Described from a single specimen ex coll. Staudinger.

Scobura umbrosa, n. sp. (Plate XIX. fig. 1, ♀.)

♀. Upperside deep warm brown, dorsal region of the hind wing paler: fore wing with seven sordid white spots placed as follows:—one, roundish, near the middle of cell 1 *a* next vein 1 *a*, one, subquadrate, near the basal third of cell 2, one much smaller near the basal third of cell 3, one, small and roundish, near the middle of cell 4, one in each of cells 6 and 7, and one, small and somewhat roundish, near the upper edge of the cell: hind wing with two small hyaline spots on the disc, one in each of cells 2 and 3, and sometimes with a third pale spot indicated by a feeble pale point in cell 5. Underside grey-brown, the disc of the fore wing darker towards the base; fore wing with the pale spots as on the upperside save that the one in cell 1 *a* is larger and suffused; hind wing with the pale spots in cells 2 and 3 as on the upperside and the pale point in cell 5 distinct. Fringe of the fore wing brown, becoming a little paler towards the tornus, of the hind wing dark grey feebly chequered. Antennæ above blackish, finely spotted with white on the underside, club yellowish white beneath. Second joint of palpi clothed with yellowish-grey and black hairs intermixed. Body and legs concolorous with the wings.

Expanse 33 mm.

Hab. Kina Balu, Borneo (*Waterstradt*).

Described from two specimens ex coll. Staudinger.

MATAPA.

Matapa, Moore, Lep. Cey. i. p. 163 (1881); Watson, P. Z. S. 1893, p. 85. Type *aria*, Moore.

A natural and easily recognized group of species, associated on account of their resemblance to the *Ismene aria* of Moore, for which he subsequently established the present genus. Wings above and below brown unspotted; fore wing pointed, termen nearly straight, on the upperside in the male bearing a narrow curved impressed marking from the middle of vein 1 *a* to the base of vein 3. Body stout; antennæ rather more than half as long as costa. Palpi appressed, very densely scaled, 3rd joint concealed.

The males of the species in coll. Elwes may be distinguished by the characters given below:—

1 (2). Fringe of hind wing below whitish grey, the basal half (*i. e.* the short scales) brown . . . . *aria*, Moore.
2 (1). Fringe of hind wing below in greater part bright yellow.
3 (6). Fore wing above with the sex-mark black.
4 (5). Fore wing above with a purple shade in certain lights. Upper edge of lower lobe of clasp excavated . . . . *purpurascens*, n. sp.
5 (4). No purple shade on fore wing above. Upper edge of lower lobe of clasp convex, even . . . . *druna*, Moore.
6 (3). Fore wing above with the sex-mark whitish grey.
7 (8). Hind wing below with all the scales in the fringe to cells 1–3 bright yellow . . . . *sasivarna*, Moore.
8 (7). Hind wing below with the short scales in the fringe to cells 1–3 dark, the long ones yellow . . . . *shalgrama*, de Nicev.

! MATAPA ARIA.

Ismene aria, Moore, P. Z. S. 1865, p. 784.

Matapa aria, Moore, Lep. Cey. vol. i. p. 164, pl. lxvi. figs. 1, 1 *a* (1881); Distant, Rhop. Mal. p. 378, pl. xxxv. fig. 8 (1886); Watson, Hesp. Ind. p. 22.

Hab. E. Pegu, Bali (*Doherty*); Andamans (*de Roepstorff*); Ganjam (*Minchin*); N. Canara (*Aitken*); Java (*Piepers*); Philippines (*Semper*); Palawan (*Platen*).

! MATAPA PURPURASCENS, n. sp. (Plate XX. fig. 1, ♂; Plate XXIV. fig. 48.)

♂. Upperside brown, with a purple shade which is strongest on the apical half of the fore wing, sex-mark blackish. Underside brown, fore wing with the dorsum and apex suffusedly paler. Fringe of the fore wing whitish grey, of the hind wing deep yellow from the tornus about as far as vein 6, thence to the apex brown. Antennæ brown, spotted with yellowish beneath, club yellowish on the underside. Clothing of palpi, body, and legs concolorous with the wings.

Expanse 40 mm.

Hab. Khasias (*Hamilton*); E. Pegu (*Doherty*).

Described from two males in coll. Elwes, where, however, there is no female which can be certainly identified as the female of this species, although there are two purpurascent females, one from Sikkim with the underside entirely pale grey-brown, and the other from Tavoy with the underside as in *M. druna*; both these females have the clothing of the apex of the abdomen yellow.

This species is nearest to *M. druna*, Moore, from which it differs in having a purple shade on the fore wing above, and also in the clasp-form of the male.

Doherty has sent from East Pegu no less than three species of this genus—*purpurascens*, *sasivarna*, and *shalgrama*, and also a single female which does not agree with any of those species; it has not the purple shade on the upperside proper to *purpurascens*, the underside is too pale and the yellow clothing of the apex of the abdomen too extensive for *sasivarna* (of which, moreover, I have typical females from East Pegu), and it has not the pale red-brown underside nor the brown clothing to the apex of the abdomen proper to *shalgrama*; its underside is pale grey-brown, and the clothing of the abdomen beneath is orange-yellow through rather more than its apical third; the fringe of the hind wing is orange-yellow, passing into pale grey-brown next cells 4–8; the colour of the hind wing below is uniform and not paler in the basal third as usual in *druna* ♀, and the pubescence of the hind part of the thorax and of the basal part of the hind wing above shows in certain lights a brilliant greenish-blue colour.

! MATAPA DRUNA. (Plate XXIV. fig. 49.)

Ismene druna, Moore, P. Z. S. 1865, p. 784, ♂ ; Wood-Mason and de Nicéville, Jour. As. Soc. Beng. 1881, p. 255 ♀.
Matapa druna, Watson, Hesp. Ind. p. 23.

Hab. Sikkim (*Möller*); Andamans (*de Roepstorff*); Kina Balu (*Waterstradt*).

! MATAPA SASIVARNA.

Ismene sasivarna, Moore, P. Z. S. 1865, p. 784.
Matapa sasivarna, Watson, Hesp. Ind. p. 23.

Hab. Sikkim (*Möller*) ; Khasias (*Hamilton*); E. Pegu, Perak, Pulo Laut (*Doherty*); Tavoy (*Tucker*).

! MATAPA SHALGRAMA.

Hesperia aria, Hewitson (*nec* Moore), Exot. Butt. vol. iv., *Hesp.* pl. iii. figs. 24, 25, ♀ (1868) ; *fide* de Nicéville *l. c. post.*
Matapa shalgrama, de Nicéville, Jour. As. Soc. Beng. 1883, p. 85 ; Watson, Hesp. Ind. p. 24.

Hab. Sikkim (*Möller*) ; E. Pegu, Pulo Laut, Bali (*Doherty*) ; Java (*Fruhstorfer*).

SEPA.

Sepa, de Nicéville, Jour. As. Soc. Beng. 1894, p. 50. Type *cronus,* De Nicév.

This genus will include certain species distinguished from *Parnara* by having vein 5 of the fore wing straight and practically intermediate between vein 4 and vein 6.

Antennæ more than half as long as costa, reaching nearly to the end of the cell, club gradual, apiculus about one fourth as long as the club. Palpi with the second joint densely scaled, third joint short, nearly or quite concealed. Fore wing moderately pointed, costa about one-fourth longer than the dorsum, termen moderately curved, a trifle shorter than the dorsum ; vein 5 straight, practically intermediate between vein 4 and vein 6, base of cell 3 a little shorter than that of cell 4. Hind tibiæ with two pairs of spurs.

The linear sex-mark on the fore wing in the first three species is most easily observed whilst the wing is wet with benzole.

Males.

1 (10). Fore wing with distinct hyaline spots.
2 (7). Sex-mark on fore wing above linear, being merely a ridge forming the inner boundary of the hyaline spot in cell 2, and sometimes continued across cel 1*a*.
3 (6). Sex-mark reaching from vein 1 *a* to vein 3.

4 (5). Sex-mark angulated near the middle, erect from near the middle of vein 1 *a* as far as vein 2, thence oblique to the base of vein 3. Hyaline spot in cell 2 of fore wing above linear, no white spot near the middle of cell 1*a*. Hind wing below with a pale dot in each of cells 2 and 4 and the indication of another next the transverse vein. Fringe of the hind wing gradually increasing in length from vein 2 to the tornus, where it is about three times as long as at vein 2 . . . . *cronus*, de Nicév.

5 (4). Sex-mark continuous, slightly oblique throughout. Hyaline spot in cell 2 of the fore wing above oblong, rather more than twice as high as wide, a small white spot near the middle of cell 1*a*. Hind wing below with a small pale spot near the basal third of each of cells 2 and 3. Fringe of the hind wing normal or nearly so . . *cicatrosa*, n. sp.

6 (3). Sex-mark between veins 2 and 3 only, not extended across cell 1*a*. A long-oval slightly raised space near the base of cell 1*a* and lying next to vein 1 *a*, which is there slightly sinuate . . . . *miosticta*, de Nicév.

7 (2). Sex-mark a long-oval raised space near the base of cell 1*a* and lying next to vein 1 *a*, which is there sinuate.

8 (9). Fore wing with two unequal cell-spots . . . . *guttulifera*, n. sp.

9 (8). Fore wing without cell-spots . . . . *cinnamomea*, n. sp.

10 (1). Pale spots absent from the fore wing or only sharply defined on the underside.

11 (14). Dorsum of the fore wing feebly sinuate and bearing on its middle third a thin fringe of long hairs directed obliquely outward and downward.

12 (13). Fore wing with pale spots, feebly indicated on the upperside, sharply defined on the underside. Hind wing below with a pale point in each of cells 2 and 3 and sometimes the indication of another in cell 6 . . . . *biseriata*, n. sp.

13 (12). Wings brown, entirely unspotted . . . . *ciliata*, n. sp.

14 (11). Dorsum of the fore wing normal. Wings brown, entirely unspotted. *noctis*, Stgr.

SEPA CRONUS.

Sepa cronus, de Nicéville, Jour. As. Soc. Beng. 1894, p. 50, pl. v. fig. 4 ♂.

Hab. Battak Mountains, N.E. Sumatra (*in coll. Martin*); Kina Balu, Borneo (*Waterstradt*); Gunong Ijan (*in coll. Rothschild*).

The following is the description of a female *Sepa* from Gunong Ijan ex coll. Rothschild, which may or may not be the female of *S. cronus*, the male of which from the same locality is in the same collection.

♀. Upperside brown; fore wing with seven sordid white hyaline spots placed as follows:—one, quadrate, across the basal third of cell 2, one, also quadrate, across the basal third of cell 3, one, small and narrow, before the middle of cell 4, one, small and roundish, in each of cells 6 and 7, and two in the cell, the upper one punctiform, the lower one larger and suboval. Underside brown ; dorsal region of the fore wing as far as vein 2, except at the base and apex, suffusedly pale grey. Fringes concolorous with the wings. Antennæ blackish, minutely spotted with white in front; club broadly white on the underside next the apiculus. Body above concolorous with the wings. Clothing of the second joint of palpi of whitish and black hairs intermixed, of the breast of yellowish and black hairs intermixed, of the legs brown. Abdomen beneath grey.

Expanse 34 mm.

SEPA CICATROSA, n. sp. (Plate XIX. fig. 4, ♂.)

♂. Upperside rather pale brown: fore wing with two small indistinct white cell-spots, a round white spot in each of cells 6 and 7 and a minute white point in cell 8, an erect oblong white spot standing on vein 1*a* near the middle and reaching halfway across cell 1*a*, an oblong white spot standing on vein 2 before the middle and passing obliquely to the base of vein 3, a white spot near the basal third of cell 3, and a small linear erect white spot near the middle of cell 4, the inner edge of the white spots in cells 1*a* and 2 is bounded by a linear ridge of androconia: hind wing with a white point in each of cells 2 and 3. Underside paler than above ; the pale spots as on the upperside save that the one in cell 1*a* is represented by an oblong patch of white scales reaching quite across cell 1*a* and similar in size and shape to that in cell 2. Fringes brown, that of the hind wing showing a tendency to elongation next the tornus. Antennæ above blackish, spotted with white beneath, club whitish on the underside.

Expanse 33 mm.

Hab. Kina Balu, Borneo (*Waterstradt*).

Described from one male in coll. Staudinger.

! SEPA MIOSTICTA.

Parnara miosticta, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1891, p. 385, pl. G. fig. 31 ♂.

Hab. Perak (*Doherty*). Type in coll. Elwes.

SEPA GUTTULIFERA, n. sp. (Plate XIX. fig. 8, ♂.)

♂. Upperside deep warm brown: fore wing with two unequal suboval yellowish-white cell-spots of which the lower one is much longer than the upper, a small yellowish-white spot in cell 1*a* next to vein 1*a* near the middle, a large subquadrate yellowish-white spot near the middle of cell 2, a small yellowish-white spot near the basal third of cell 3, and a small yellowish-white spot in each of cells 6 and 7; near the base of cell 1*a* and next to vein 1*a*, which is there slightly sinuate, a long-oval raised space: hind wing sometimes with two pale dots, one in each of cells 2 and 3. Underside paler brown than the upperside, the pale spots as on the upperside save that there is a very minute pale dot near the middle of cell 4, and that the pale spot in cell 1 *a* is represented by a whitish blotch near the middle of that cell. Fringe of the fore wing brown, of the hind wing paler, inclining to yellow-brown near the middle; the short scales brown. Antennæ above blackish, spotted with white beneath; club whitish on the underside. Body and legs concolorous with the wings. Second joint of palpi clothed with greyish-yellow and black hairs intermixed.

Expanse 38 mm.

Hab. Kina Balu, Borneo (*Waterstradt*).

Described from two specimens in coll. Staudinger.

SEPA CINNAMOMEA, n. sp. (Plate XIX. fig. 25, ♂.)

♂. Upperside brown, inclining to yellow-brown; fringe of the hind wing yellow except at the apex: fore wing above with four hyaline spots—one large, about one-half higher than wide, across cell 2 near the middle, and one in each of cells 3, 6, and 7, that in cell 7 very minute; a long-oval raised space near the base of cell 1 *a* and lying next to vein 1 *a*, which is there slightly sinuate: hind wing above sometimes with the pale spots proper to the underside faintly showing through. Underside much paler than the upperside: fore wing with the pale spots as on the upperside: hind wing with three small pale discal spots, one near the basal third of each of cells 2 and 3 and one in cells 4–5, the latter sometimes only represented by a pale point near the basal third of cell 5. Fringe of the fore wing grey-brown; of the hind wing grey-brown in cells 6 and 7, the remainder yellow in fresh, yellowish grey in somewhat faded specimens. Antennæ blackish above, spotted with white beneath, club whitish on the underside. Second joint of palpi clothed with yellow hairs, with black ones intermixed. Body beneath and tarsi yellowish.

Expanse 32–34 mm.

Hab. Kina Balu, Borneo (*Waterstradt*).

Described from two specimens in coll. Staudinger.

SEPA BISERIATA, n. sp.

Parnara? species? Semper, Schmett. Philipp. p. 299 (1892).

♂. Upperside warm brown: fore wing with four very indistinct pale spots, one near the upper outer angle of the cell and one in each of cells 2, 3, and 6; dorsum feebly sinuate and bearing on its middle third a fringe of long hairs directed obliquely outward and downward. Fore wing below rather paler than above; middle third of the dorsum thickly fringed with long hairs directed obliquely upward and outward, of which those nearer the base are more obliquely placed than the remainder; the pale spots placed as above, but sordid white in colour, that in cell 2 twice as high as wide and reaching quite across the cell just before the middle, the others small and roundish; the middle of the dorsum, where it is in great part covered by the upper series of the fringe of hair-scales, is pale grey: hind wing with two small, feeble, roundish, sordid white spots, one before the middle of each of cells 2 and 3. Fringe brownish grey, the short scales brown. Antennæ, body, and legs concolorous with the wings, the clothing of the scapulæ appearing metallic green in a strong light.

Expanse 32 mm.

Hab. Philippines (*Semper*).

Described from Herr Semper's single male specimen from Central Luzon and one from Mindoro in coll. Staudinger. The latter differs from the former only in having a small pale spot in each of cells 7 and 8 on the fore wing below.

! SEPA CILIATA, n. sp. (Plate XIX. fig. 22, ♂.)

♂. Upperside dark brown with a faint purple shade. Dorsum of the fore wing sinuate and bearing on its middle third a fringe of long hairs, which are directed obliquely outward and downward. Underside similar in colour; dorsal region of the fore wing pale brown as far as vein 2, the dorsum bearing on its middle third a thick fringe of long hairs directed obliquely upward and outward, of which those nearer the base are more obliquely placed than the remainder. Fringes brown. Antennæ, body, and legs concolorous with the wings.

♀. Similar to the male, but a little larger and paler.

Expanse, ♂ 32 mm., ♀ 35 mm.

Described from a single pair from Pulo Laut (*Doherty*).

Type in coll. Elwes.

! SEPA NOCTIS.

Pamphila noctis, Staudinger, Iris, ii. p. 143 (1889).
Plesioneura dissimilis, Snellen, *in litt.*
Pamphila perfusca, Mabille, Ann. Soc. Ent. Belg. xxxvii. p. 53 (1893).

A little larger than the preceding species, with no purple tinge, and no infra-alar tuft on the fore wing of the male.

Hab. Palawan, Mindanao (*in coll. Staudinger*); Pulo Laut (*Doherty*); W. Java (*Piepers*); Sumatra (*Martin, in coll. Rothschild*).

Herr Snellen has kindly sent us a pair of his *Plesioneura dissimilis.* The male we are unable to distinguish from "*Pamphila*" *noctis*, Stgr., of which we have several specimens, including one from Dr. Staudinger. The female is a brown insect with a broad white discal band on the fore wing between the upper edge of the cell and vein 2, composed of the following hyaline white spots, namely—a large oblong one across the cell near its apical third, a small one filling up the base of cell 3, and a large one, oblong with rounded angles, in cell 2. Save that the white band on the fore wing is cut short by vein 2 and there is no suffused white subtornal patch on the fore wing below.

it agrees well with the description and figure of *Notocrypta monteithi*, Wood-Mason and de Nicéville (Jour. As. Soc. Beng. 1886, p. 391, pl. xviii. figs. 3, 3 *a*, ♀). As, however, Herr Snellen tells us that this female "is certainly the other sex [of his *P. dissimilis*], being bred from the larva by Mr. Piepers," we do not feel justified in placing it in the genus *Notocrypta* as we should have done.

We have seen a female from North Borneo in coll. Rothschild which agrees with the description and figure of *N. monteithi*, and is similar to Herr Snellen's female.

Acerbas.

Acerbas, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1895, p. 381. Type *anthea*, Hew.

This genus was established by Mr. de Nicéville for the *Hesperia anthea* of Hewitson. We associate with the latter species three others which in form, colour, and pattern resemble it more than they do any other species known to us; they differ, however, from *anthea* in wanting an alar sex-mark in the male, and from that species and each other in venation.

We distinguish the species as follows:—

1 (2) Cell-spot normally absent from fore wing. Cell of hind wing at least half as long as the wing. Disc of fore wing below in the male covered with modified scales . . . . *anthea*, Hew.

2 (1) Cell-spot normally present in the fore wing. Cell of hind wing distinctly less than half as long as the wing. No alar sex-mark in the male.

3 (6). Base of cell 4 about one-fourth as long as the base of cell 3. Band on the hind wing below dull white. One pale spot in cell of fore wing near its upper edge.

4 (5). White band on hind wing above evanescent towards the costa. Dark part of underside plain brown. Pale band on the hind wing below white throughout, a little contracted next the costa . . . *martini*, Dist.

5 (4). White band on hind wing above broad, sharply defined, abruptly cut short at vein 6. Dark part of underside brown, with a distinct purple shade, which is strongest in the apical region of the fore wing. Pale band on hind wing below white, becoming yellow in cells 7 and 8, not contracted next the costa . . . . *duris*, Mab.

6 (3). Base of cell 4 about half as long as the base of cell 3. Band on hind wing below glistening white. Two pale spots in cell of fore wing . . . . *nitidifasciata*, n. sp.

! Acerbas anthea.

Hesperia anthea, Hewitson, Descr. Hesp. p. 29 (1868).
Plesioneura? anthea, Distant, Rhop. Mal. p. 404, pl. xxxv. fig. 32 (1886).
? *Carystus tagiadoides*, Mabille, *sec. spec. comm.*

Hab. Pulo Laut (*Doherty*).

! Acerbas martini. (Plate XXIV. fig. 50.)

Zea martini, Distant, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 274 (1887).

Hab. Pulo Laut (*Doherty*).

! Acerbas duris.

Carystus duris, Mabille, Comptes Rendus Soc. Ent. Belg. iii. no. 31, p. lix (1883).
Lotongus duris, Semper, Schmett. Philipp. p. 289, pl. xlix. fig. 7, ♀ (1892).
Carystus mabillei, Staudinger, MSS.

Hab. Philippines (*Semper*); Kina Balu, Borneo (*Waterstradt*).

Though the characters given in the table seem sufficient to separate the few specimens (only six in all) that we have seen of these two species, yet the occurrence of both of them in Borneo throws some doubt on the constancy of the differences, and we have seen no female of *martini* as yet. The female of *duris* is similar to the male. The male genitalia of the two forms do not afford material for their separation.

! Acerbas nitidifasciata, n. sp. (Plate XX. fig. 9, ♂; Plate XXIV. fig. 51.)

Besides the characters given above this species may be distinguished from *A. martini* by its larger size (expanse 47 mm.) and the broader white band on the hind wing below. The latter at its greatest breadth extends from the cell at the level of the base of vein 2 as far as the apical third of cells 4–5; in *A. martini* this band at its greatest breadth extends from the cell at the level of the base of vein 2 only half-way across cells 4–5. In *A. nitidifasciata* the apex of the lower lobe of the clasp is simply rounded and serrate; in *A. martini* the same part is broadly truncate, and its inner angle is produced into a long strap-shaped lobe, rounded at the apex.

Hab. Labuan (*fide Staudinger*); N. Borneo (*Pryer*); Pulo Laut (*Doherty*).

Pudicitia.

Pudicitia, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1895, p. 379. Type *pholus*, de Nicév.

This genus has been established by Mr. de Nicéville for his *Parnara pholus*, an insect of the size and shape of *P. assamensis*, Wood-Mason and de Nicév., and having deep yellow hyaline spots on both wings, those on the hind wing forming a transverse discal series. The course of vein 5 in the fore wing is not stated in the description, but vein 1 *a* in that wing has in the male "a narrow brand formed of modified black scales placed anteriorly against it along its basal second and third fifths."

Pudicitia is compared by its author with *Erionota*, Mab.

Pudicitia pholus.

Parnara pholus, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1889, p. 172, pl. B. fig. 3, ♀.
Pudicitia pholus, id. op. cit. 1895, p. 381.

Hab. Bhutan (*Möller*); Khasias (*fide de Nicéville*).

Erionota.

Erionota, Mabille, Ann. Soc. Ent. Belg. xxi. p. 34 (1878); Watson, P. Z. S. 1893, p. 86. Type *thrax,* Linn.

Large species expanding 60 to 90 mm. Hind wing with vein 7 almost equidistant between 6 and 8, veins 2 and 3 normal in both sexes.

We are acquainted with the three following species:—

1 (4). Pale spots on fore wing above yellow.
2 (3). Fore wing above: pale spot in cell 3 remote from the others, situate near the middle of the cell, variable in shape, but never wider than high . . . . *thrax,* Linn.
3 (2). Fore wing above: pale spot in cell 3 occupying the basal half of the cell with the exception of the extreme base, and therefore only separated from that in cell 2 by vein 3 . . . . *alexandra,* Semper.
4 (1). Pale spots on fore wing above pure white . . . . *grandis,* Leech.

! Erionota thrax.

Papilio thrax, Linnæus, Syst. Nat. i. 2, p. 794 (1767); Donovan, Ins. Ind. pl. xlix. fig. 2 (1800).
Erionota thrax, Mabille, Ann. Soc. Ent. Belg. xxi. p. 35 (1878); Watson, Hesp. Ind. p. 107 (1891).
Telegonus acroleucus, Wood-Mason & de Nicéville, Proc. As. Soc. Beng., August 1881, p. 143.
Hesperia hiraca, Moore, Trans. Ent. Soc. Lond., September 1881, p. 313, ♀.
Hesperia acroleuca, Wood-Mason & de Nicéville, Jour. As. Soc. Beng. 1881, p. 260.
Telegonus lara, Swinhoe, Ann. & Mag. Nat. Hist. 1890, p. 365 (*fide Watson*).
Erionota acroleuca, Watson, Hesp. Ind. p. 107 (1891).

Hab. Sikkim (*Möller*); Khasias (*Hamilton*); Pulo Laut, Sambawa, Bali (*Doherty*); Nias (*Modigliani*); Andamans (*de Roepstorff*); Philippines (*Semper*); Palawan (*Platen*).

Two specimens of *acroleuca*, named by de Nicéville, from the Andamans, seem to us inseparable from *thrax*, though they are conspicuously smaller.

Erionota alexandra.

Erionota alexandra, Semper, Schmett. Philipp. p. 312 (1892).

Hab. N.W. Luzon (*Semper*).

The larva of this species is very differently coloured to that of *E. thrax*

! Erionota grandis.

Plesioneura grandis, Leech, Entomologist, xxiii. p. 47 (1890).
Hidari grandis, Leech, Butt. China &c. p. 633, pl. xxxix. fig. 13, ♂ (1894).

Hab. West China (*Pratt*).

Gangara.

Gangara, Moore, Lep. Cey. i. p. 164 (1881); Watson, P. Z. S. 1893, p. 86. Type *thyrsis,* Fab.

This genus may be distinguished from *Erionota* by having veins 2 and 3 of the hind wing more or less swollen in their basal half in the males, as in *Paduka*; the underside, too, has some bluish-white scales in suffused patches, or a pink shade towards the base.

The three species known to us are distinguished as follows:—

1 (4). Fore wing above with pale spots in cells 6, 7, and 8. No yellowish-white spot in the base of cell 7 of hind wing below.

2 (3). Fore wing above: pale spot in cell 6 remote from that in cell 7, that in cell 8 oblong. Male: fore wing above with a vein-like ridge arising out of the upperside of vein 1 *a* in its apical fourth, and running parallel to it nearly to the base, and a ridge on each side of the basal half of vein 2; fore wing below with an oblong patch of yellow hairs near the dorsum . . . . *thyrsis*, Fab.

3 (2). Fore wing above: pale spot in cell 6 close to that in cell 7, that in cell 8 punctiform. Hind wing below brown, with a pink shade near the base, and a sub-basal and median series of suffused oblong greenish-brown spots . . . . *sybirita*, Hew.

4 (1). Fore wing above without pale spots in cells 6, 7, or 8. Hind wing below with a yellowish-white spot near the base of cell 7. Male without a sex-mark on fore wing above, the tuft of hair near the dorsum of fore wing below much less evident than in *thyrsis* . *sanguinocculus*, Martin.

! Gangara thyrsis.

Papilio thyrsis, Fabricius, Syst. Ent. p. 582 (1775).

Hesperia pandia, Moore (Horsf. & Moore), Cat. Lep. Mus. E.I. C. vol. i. p. 254, pl. vii. figs. 10 larva, 10 *a* pupa (1857); Moore, P. Z. S. 1865, p. 790.

Gangara thyrsis, Moore, Lep. Cey. vol. i. p. 165, pl. lxvi. figs. 3, 3 *a* (1881); Distant, Rhop. Mal. p. 394, pl. xxxv. fig. 13 (1886).

Hab. Babuyanes, Luzon, Mindanao (*Semper*); Palawan (*Staudinger*); Akyab (*Adamson*); E. Pegu, Pulo Laut, Bali (*Doherty*); Java (*Piepers*); Andamans (*de Roepstorff*).

Gangara sybirita.

Hesperia sybirita, Hewitson, Ann. & Mag. Nat. Hist. ser. 4, vol. xviii. p. 451 (1876).

Hidari sybirita, Distant, Rhop. Mal. p. 395, pl. xxxv. fig. 24 (1886).

We have only been able to examine a female of this species, but entertain no doubt as to its being properly placed in this genus.

Hab. Malay Peninsula, Singapore (*fide Distant*); Borneo (*Cator*).

! Gangara sanguinocculus. (Plate XX. fig. 17.)

Erionota sanguinocculus, Martin, Einige neue Tagschmetterlinge von Nordost-Sumatra, p. 5 (München, pub. Gotteswinter 1895).

♂. Upperside brown: fore wing with three aureo-hyaline spots—one occupying the apical third of the cell, one occupying cell 3 from the base to the middle, its outer edge obliquely concave and passing from the basal third of vein 4 to beyond the middle of vein 3, and one irregularly ovate and placed obliquely near the middle of cell 2, of which it occupies the entire width. Underside brown: fore wing with the hyaline spots as on the upper surface, cell 1 pale, except in its apical fifth, a suffused brownish-grey patch near the middle of the costa and a suffused patch of bluish-white scales reaching from the apex of the cell to the costa just before the apex of the wing; hind wing with a small sharply defined cream-coloured spot near the base of cell 7, cell 1 sparsely sprinkled throughout with bluish-white scales, and on the disc some suffused patches of bluish-white scales indicating an irregular median and postmedian band. Fringes concolorous, a little paler near the tornus of each wing. Body, palpi, legs, and antennæ brown, the latter brownish yellow on the underside of the club.

♀. Fore wing above with the hyaline spot in cell 3 completely filling up the base of that cell, and the hyaline spot in cell 2 forming a parallelogram, of which the upperside occupies the basal half of vein 3 and the lower side is separated from the base of vein 2 by two-fifths, and from the apex of vein 2 by one-fifth of the entire length of that vein. Otherwise like the male.

Expanse 52–53 mm.

Hab. Perak (*Doherty*); N.E. Sumatra (*Martin*).

The above description was drawn up from a single pair in coll. Elwes long before Dr. Martin's description appeared; and as the latter did not know the female, it has been allowed to stand.

PADUKA.

Paduka, Distant, Rhop. Mal. p. 375 (1886); Watson, P. Z. S. 1893, p. 85. Type *glandulosa*, Dist., = *lebadea*, Hew.

Allied to *Matapa*; the sex-marks in the male constitute the main differences; there is in that sex a large tomentose patch on the disc of the fore wing above, a tuft of long hairs on the dorsum of the same wing below, and a conspicuous seam on the basal half of veins 2 and 3 of the hind wing above. There is but one described species, *lebadea*, Hew., a large insect expanding 51–65 mm. The male resembles a *Matapa* in the stout body, contour of wings, uniform brown coloration of the latter above, and the yellow fringe to the hind wing; the female (which appears to be hitherto undescribed) exactly resembles the male on the underside, but has three deep yellow spots on the fore wing and otherwise closely resembles *Erionota thrax*.

! PADUKA LEBADEA.

Hesperia lebadea, Hewitson, Exot. Butt. iv., *Hesp.* pl. ii. figs. 22, 23 (1868).
Ismene subfasciata, Moore, P. Z. S. 1878, p. 686.

Matapa subfasciata, Moore, Lep. Cey. i. p. 164, pl. lxiv. figs. 3 *a*, *b* (1881); Watson, Hesp. Ind. p. 24 (1891).

Paduka glandulosa, Distant, Rhop. Mal. p. 376, pl. xxxv. fig. 5, ♂ (1886).

Hab. Perak, Pulo Laut (*Doherty*); Java (*Fruhstorfer*); Sikkim (*Knyvett*).

Watsonia, gen. nov.

Antennæ half as long as the costa; club moderate; apiculus acuminate, bent almost at a right angle, two-thirds as long as the club. Palpi appressed, second joint densely scaled, third almost concealed. Fore wing: distal two-thirds of the costa straight, dorsum two-thirds as long as the costa, about one-sixth longer than the termen; vein 5 straight, a trifle nearer to vein 4 than to vein 6, vein 12 approaching 11 in its apical fourth, base of cell 10 one-third longer than that of cell 9, of cell 8 about half that of cell 9, of cells 6 and 7 mere points, base of cell 3 about half as long as that of cell 4 and giving off a recurrent vein, that of cell 2 nearly or quite as long as the first median segment; transverse vein nearly parallel with the termen. Hind wing suborbicular, a little longer than broad; termen nearly straight between veins 1 *b* and 3; first and second subcostal and median segments subequal; cell less than half as long as the wing; transverse vein concave, slightly angulated at the origin of vein 5. No hyaline spots in either wing. Tibial epiphysis present; hind tibiæ with two pairs of spurs.

Differs from *Kerana* in the shorter antennæ, straighter costa to the fore wing, the position of vein 5, and the shorter base to cell 3 in the same wing.

! Watsonia swinhoei, n. sp. (Plate XX. fig. 6, ♂.)

♂. Upperside deep brown with a dull purple shade, except on the apical region of the fore wing. Underside brown: fore wing with the dorsum broadly pale brown and the apical region ochreous brown; hind wing with a faint purple shade. Fringes brown. Antennæ, palpi, body, and legs concolorous with the wings, antennæ a little paler in front.

♀. Similar to the male, but a little larger and paler.

Expanse, ♂ 47, ♀ 54 mm.

Hab. Khasia hills (*fide Swinhoe*).

Described from one pair given to me by Col. Swinhoe as a new genus and species. There are other specimens in Col. Swinhoe's collection.

Kerana.

Kerana, Distant, Rhop. Mal. p. 402 (1886); Watson, P. Z. S. 1893, p. 115. Type *armatus,* Druce.

No hyaline spots on either wing. Species brown or black above, generally with an oblique yellow or red-yellow band on the fore wing. Antennæ more than half as long as costa; club slender; apiculus acute. Palpi appressed, third joint almost concealed. Fore wing: dorsum longer than the termen, vein 5 nearer 4 than 6; first and second median segments subequal in length, the third about two-thirds as long as the second, vein 12 feebly sinuate towards vein 11. Hind wing: first median segment about three times as long as the second, the third about one-fourth as long as the second.

The species known to us may be distinguished as follows:—

1 (6). Fore wing above with a red-yellow or yellow band.
2 (5). Pale band on fore wing above red-yellow, passing obliquely from the middle of the costa to the tornus.[1]
3 (4). Male with a black patch of androconia near the base of the hind wing above, coinciding with the cell. Expanse 50 mm. . . . . . . *armata*, Druce.
4 (3). No sex-mark on hind wing above in the male. Hind wing above with a small spot of pale purple scales in each of cells 2, 3, 5, and 6. Expanse 32–34 mm. . . . . *gemmifer*, Butl.
5 (2). Pale band on fore wing above yellow, very broad, passing from the dorsum towards the middle of the costa, where it is cut short by the upper edge of the cell, its outer edge convex, its inner edge passing obliquely from the apex towards the base and giving off along the dorsum a triangular tooth to the base of the wing . . *fulgur*, de Nicév.
6 (1). Entirely fuliginous or olive-brown above . . . . *diocles*, Moore.

! KERANA ARMATA.

Astictopterus armatus, Druce, P. Z. S. 1873, p. 359, pl. xxxiii. fig. 7.
Kerana armata, Distant, Rhop. Mal. p. 402, pl. xxxv. fig. 31 (1886).

Hab. Perak, Pulo Laut (*Doherty*); Nias (*Modigliani*).

! KERANA GEMMIFER.

Astictopterus gemmifer, Butl. Trans. Linn. Soc. Lond., Zool. ser. 2, vol. i. p. 555 (1877).
Kerana gemmifer, Distant, Rhop. Mal. p. 403, pl. xxxiv. fig. 29 (1886); Watson, Hesp. Ind. p. 149 (1891).

Hab. Perak, Pulo Laut (*Doherty*); Bunguran, Natuna Is. (*Everett*); Penrisen Mt. (*in coll. Rothschild*).

KERANA FULGUR.

Kerana fulgur, de Nicéville, Jour. As. Soc. Beng. 1894, p. 55, pl. i. fig. 6, ♀; id. Jour. Bomb. Nat. Hist. Soc. 1895, p. 383, pl. Q. fig. 54, ♂.

♂. Upperside rich dark brown; fore wing with a very broad yellow median band passing from the dorsum towards the middle of the costa and cut short by the upper

[1] In a pair of specimens of *armata* from the Island of Nias the red-yellow band of the fore wing above is entirely wanting in the male and faintly indicated in the female.

edge of the cell; the outer edge of this band is nearly regularly convex, and its inner edge, which is straight and passes obliquely inwards and downwards, gives off along the dorsum a large triangular tooth to the base of the wing: hind wing with three divergent stripes of golden-yellow hairs from the base nearly to the middle. Underside paler brown than the upperside: fore wing with the yellow band as above, save that its inner boundary is wanting; an oblong brown spot from the middle of the base as far as vein 2, an oblong suffused red-yellow patch between the apical fourth of the cell and the costa, and a suffused yellow spot in the apex of the wing: hind wing with six pale bluish-purple spots placed as follows—three at equal distances in cell 1 *b*, one near the apical third of cell 2, one next the transverse vein, and one near the middle of the upper edge of the cell, and a few scales of a similar colour near the base of the costa. Antennæ brown; apex of the club and the apiculus beneath yellow. Second joint of palpi clothed with yellow scales, intermixed with black ones. Thorax concolorous with the base of the wings. The abdomen and legs are not in a condition for description.

Expanse 42 mm.

Hab. Borneo (*in coll. Cator*); Battak Mountains, Sumatra (*Martin*).

The above description of the male of this insect had already been written from a specimen from Borneo in the collection of Mr. D. Cator when Mr. de Nicéville's description appeared. The female we have not seen, but from Mr. de Nicéville's description and figure we gather that the band on the fore wing in that sex differs in colour and shape from that of the male, being red-yellow and passing obliquely from the middle of the costa towards the tornus, which it does not quite reach.

! KERANA DIOCLES.

Nisoniades diocles, Moore, P. Z. S. 1865, p. 787.
Kerana diocles, Distant, Rhop. Mal. p. 403, pl. xxxiv. fig. 8 (1886); Watson, Hesp. Ind. p. 148.

Hab. Sikkim (*Möller*); Khasias (*Hamilton*); Tavoy (*Tucker*); Perak, Pulo Laut (*Doherty*); Java (*Piepers*); Nias (*Modigliani*).

ANCISTROIDES.

Ancistroides, Butler, Trans. Ent. Soc. Lond. 1874, p. 436; Watson, P. Z. S. 1893, p. 116. Type *longicornis,* Butler.

Nearest allied to *Kerana*, but differs from it in the relative proportions of the third median segment in both wings; that of the fore wing being one-third as long as the second, that of the hind wing about one-fourth as long as the second.

ANCISTROIDES OTHONIAS. (Plate XXI. fig. 18.)

Astictopterus othonias, Hewitson, Ann. & Mag. Nat. Hist. ser. 5, i. p. 342 (April 1878).

Hab. Labuan, Kina Balu, Borneo (*Waterstradt*); N. Borneo (*Pryer, in coll. Rothschild*).

Pirdana.

Pirdana, Distant, Rhop. Mal. p. 376 (1886); Watson, P. Z. S. 1893, p. 116. Type *hyela,* Hewitson.

Wings unspotted. Species plain brown above or with a blue, green, or purple shade from the base of the wings outwards; tornus of hind wing more or less broadly yellow. Antennæ more than half as long as costa; club slender. Fore wing with the termen as long as or longer than the dorsum, at least in the male, the former straight from the tornus to vein 5; vein 2 from the basal third of the lower edge of the cell, vein 5 nearer 4 than 6. Hind wing: termen distinctly produced at vein 1 *b*; vein 2 from the apical third of cell. Hind tibiæ roughly scaled on the outer side, but not fringed with long hairs.

We distinguish the species known to us as follows:—

1 (6). With a sex-mark on the fore wing above in the male; antennæ above brown.

2 (5). Sex-mark on upperside of fore wing in the male consisting of a raised seam on each side of the basal third of vein 2 and the middle third of vein 1 *a*. Hind wing below purplish brown with green veins, or washed with green.

3 (4). Hind wing below purplish brown, the veins broadly and the dorsum pale green . . . . *hyela,* Hew.

4 (3). Hind wing below purplish brown washed with green; veins concolorous; cells 1 *a* and 1 *b* purple, shot with green . . . . *distanti,* Stgr.

5 (2). Sex-mark on the upperside of the fore wing in the male consisting of three oblong-oval patches of androconia, a large one near the base of cell 2, and two others much smaller, placed one above the other near the middle of cell 1 *a*. Hind wing below plain brown . . . *celsina,* Feld.

6 (1). No sex-mark on fore wing above in the male; antennæ above in greater part white . . . . *albicornis,* n. sp.

! Pirdana hyela.

Hesperia hyela, Hewitson, Descr. Hesp. p. 23 (1867).
Pirdana hyela, Distant, Rhop. Mal. p. 376, pl. xxxv. fig. 6, ♀ (1886).
Pirdana rudolphii, Elwes & de Nicéville, Jour. As. Soc. Beng. 1886, p. 438, pl. xx. fig. 6, ♂.

As the type specimen of *P. rudolphii* is now in the Calcutta Museum, we only know it from the plate above referred to. The only difference between the figures of *rudolphii* and *hyela* from Borneo is the smaller extent of yellow at the anal angle in the former.

Hab. Perak, Pulo Laut (*Doherty*); Tenasserim (*Bingham*); Java (*fide Hew.*); Khasias (*coll. Swinhoe*).

! PIRDANA DISTANTI.

Pirdana distanti, Staudinger, Iris, ii. p. 141 (1889).
Pirdana pavona, de Nicéville, Jour. As. Soc. Beng. 1895, p. 540.

Hab. Malacca (*fide Staudinger*); Labuan (*fide Staudinger, in coll. Elwes*); E. Pegu, Perak (*Doherty*); ? Sikkim (*Lang, fide de Nicéville*); Buitenzorg, Java (*Piepers*).

This species seems constantly distinct from *hyela*, though its geographical range covers that of *hyela*. It is probably the species referred to from Sikkim by de Nicéville in our description of *P. rudolphii*.

PIRDANA CELSINA.

Hesperia celsina, Felder, Reise Nov., Lep. iii. p. 512, pl. lxxi. fig. 12, ♀ (1867).
Pamphila celsina, Staudinger, Exot. Tagf. p. 298, pl. 99, ♂ (1888).
Tanyptera celsina, Semper, Schmett. Philipp. p. 294 (1892).

Hab. Celebes (*fide Felder*); Philippines (*fide Semper*).

PIRDANA ALBICORNIS, n. sp. (Plate XXI. fig. 14, ♂.)

♂. Upperside: fore wing dark brown with a dull purple shade, glossed from the base almost to the middle with metallic greenish blue; hind wing dark brown as far as the apex of vein 4 and the apical fourth of the dorsum, thence bright yellow, the disc from the base glossed with metallic greenish blue. Underside verdigris-green; disc of the fore wing dark purple, the dorsum of that wing broadly pale brown: hind wing with the bright yellow subtornal region as on the upperside; cell 1 *b* black, glossed with metallic greenish blue. Fringe of the fore wing grey-brown, of the hind wing yellow from the tornus as far as vein 4, thence somewhat dusky. Antennæ in greater part white on the upperside, beneath blackish, with a white spot next the apiculus; club black; apiculus white. Clothing of second joint of palpi, breast, legs, and abdomen beneath yellow. Thorax above clothed with greyish-yellow and black hairs intermixed. Abdomen above brown.

Expanse 42 mm.

Hab. Kina Balu, Borneo (*Waterstradt*).

Described from one specimen in coll. Staudinger.

PLASTINGIA.

Plastingia, Butler, Ent. Mo. Mag. 1870, p. 95; Watson, P. Z. S. 1893, p. 118. Type *flavescens*, Felder.

This genus is best distinguished by its facies, which is well exemplified in *P. callineura*, Felder.

Antennæ usually two-thirds as long as the costa; club slender; apiculus acute, recurved. Palpi appressed; third joint short, conical, almost concealed. Fore wing pointed, termen straight, oblique; vein 5 nearer 4 than 6, vein 2 from the basal fourth of lower edge of the cell. Upperside brown, with pale spots in cells 2, 3, 6, and 7, one or two near the apex of the cell on the fore wing, and sometimes one in cells 4 and 5; the disc of the hind wing is more or less extensively yellow. Epiphysis present; hind tibiæ fringed and bearing two pairs of spurs.

There is some difference in the comparative length of the cell of the hind wing in the different species; it is longer in *P. tessellata*, Hew., than in the others. In *P. callineura*, Feld., and its allies, the base of cell 5 in the fore wing is about one and a half times as long as that of cell 4; in *P. tessellata*, *noemi*, &c., the bases of cells 4 and 5 in the fore wing are subequal in length.

The species known to us we distinguish as follows:—

Males.

1 (16). A hyaline spot in cell 4 of the fore wing.
2 (11). Hind wing below with pale purple or bluish-white spots.
2a (*2b*). Termen of the hind wing broadly and decreasingly yellow from the dorsum as far as vein 3 . . . . *vermiculata*, Hew.
2b (*2a*). Termen of the hind wing not as above.
3 (8). Shaft of antennæ entirely pale beneath.
4 (7). Hyaline spots in cell of fore wing remote. Tegumen simple.
5 (6). Hind wing below: veins rather broadly vermilion-red. Lower lobe of clasp produced into two strong teeth at apex . . . . . . *callineura*, Feld.
6 (5). Hind wing below: veins yellow. Lower lobe of clasp produced at the apex into one strong tooth, the apical half of which is spiniform . . . . *latoia*, Hew.
7 (4). Hyaline spots in cell of fore wing confluent. Tegumen with a short tooth on each side at the base . . . . *margherita*, Dohy.
8 (3). Shaft of antennæ entirely blackish, club pale beneath.
9 (10). Fore wing above: basal three-fifths of cell 1 *a* filled up with yellow, the yellow colour spreading to the dorsum at the base. Hind wing above: cell entirely pale, the disc of the wing yellow from the dorsum as far as vein 6, the dorsum broadly yellow as far as the termen . . . . *helena*, Butl.
10 (9). Fore wing above: an elongate triangular yellow spot in the basal half of cell 1 *a*, its apex reaching the base of the wing on vein 1 *a*. Hind wing above: upper half of the cell blackish, the yellow discal patch not reaching the dorsum, the latter dark brown with a yellow streak . . . . *fruhstorferi*, Mab.
11 (2). No purple spots on hind wing below.
12 (13). Fore wing with the basal two-thirds of cell 2 hyaline. Hind wing below red-yellow, with irregular black dashes; a broad black line in the basal two-thirds of cell 7 . . . . *aurantiaca*, n. sp.

13 (12). Hyaline spot in cell 2 of fore wing much less than half as long as the cell.

14 (15). Hind wing below brown, with the following pale yellow markings—a broad oblique postmedian band between veins 2 and 6, a broad stripe in cell 8, the apical third of cell 7 nearly as far as the termen, a stripe next the upper edge of the discoidal cell, a subterminal row of spots, one in each of cells 1 *b* to 6, and three rays, of which the innermost is the shortest, next the dorsum . . . . . . *liburnia,* Hew.

15 (14). Hind wing below yellowish green with feeble pale spots, one near the bases of each of cells 2, 3, and 4, and sometimes a small one near the middle of cell 5, that in cell 4 oblong and occupying about the basal third of the cell . . . . *telesinus,* Mab.

16 (1). No hyaline spot in cell 4 of the fore wing.

17 (20). Hind wing below chequered throughout with pale spots.

18 (19). Hind wing below brown, chequered with greyish-yellow spots . . *tessellata,* Hew.

19 (18). Hind wing below brown with dull silvery-white spots . . . . . *naga,* de Nicév.

20 (17). Hind wing below not chequered.

21 (22). Hind wing below yellow, with the termen narrowly, the tornus broadly, the veins, a short line in the discoidal cell next the outer half of its upper edge, and a line in the basal half of cell 1 *b,* black . . . . *viburnia,* Stgr.

22 (21). Hind wing below: veins not black.

23 (24). Hind wing below unspotted, ochreous, blackish in cell 1 *a* . . . *corissa,* Hew.

24 (23). Hind wing below with a postmedian band of blackish spots (sometimes with pale centres) and one near the base of cell 7, one near the apex of the cell, and one near the base of cell 1 *b.*

25 (26). Expanse 34 mm. Fore wing above with the uppermost of the two pale spots in the cell small and roundish. Tegumen simple . . *similis,* n. sp.

26 (25). Expanse 39–40 mm. Fore wing above with the uppermost of the two pale spots in the cell oblong, as large as that in cell 6. Tegumen with a decurved horn on each side about the middle . *noëmi,* de Nicév.

! PLASTINGIA CALLINEURA. (Plate XXIV. fig. 52.)

Hesperia callineura, Felder, Reise Nov., Lep. iii. p. 513, pl. lxxi. figs. 9, 10 (1866).

? *Plastingia callineura,* Distant, Rhop. Mal. p. 396, pl. xxxv. fig. 26 (1886); Watson, Hesp. Ind. p. 113 (1891).

Distant's description (*l. c.*) applies rather to the next species than to the true *callineura* of Felder, who correctly says of the hind wing below "venis ferrugineo-rufo marginatis." His plate, however, does not admit of identification with any of the species in coll. Elwes.

Hab. Kina Balu, Borneo (*Waterstradt*); E. Pegu, Perak (*Doherty*); Battak Mountains, Sumatra (*Martin*).

! PLASTINGIA LATOIA. (Plate XXIV. fig. 53.)

Hesperia latoia, Hewitson, Descr. Hesp. p. 34 (1868); id. Exot. Butt., v. *Hesp.* pl. vi. figs. 62, 63 (1873).

? *Plastingia callineura* et var. *flavia*, Staudinger, Iris, ii. p. 150 (1889).

Distinguished from the preceding species by its slightly smaller size, the yellow veins on the hind wing below, and the single tooth into which the lower lobe of the clasp is produced.

The variety *flavia* from Palawan is said to be distinguished from *callineura* by its smaller size; it may possibly be a distinct species, but we have had no opportunity of comparing its male genitalia with those of *P. latoia*. A female from Palawan, ex coll. Rothschild, expands 39 mm., and very possibly represents a distinct species; it does not agree with the same sex of either *latoia* or *callineura*.

Hab. Pulo Laut (*Doherty*); East Java (*coll. Piepers*); Singapore (*fide Hewitson*); Selesseh, Sumatra (*in coll. Rothschild*).

! PLASTINGIA MARGHERITA. (Plate XXIV. figs. 54, 54 *a*.)

Plastingia margherita, Doherty, Jour. As. Soc. Beng. 1889, p. 131, pl. x. fig. 5, ♂.

Hab. Margherita, Upper Assam (*Doherty*); Naga hills (*Doherty*).

As I have the type of this species, I am able to say that it seems as distinct a species as any in the genus, though closely allied to *latoia*.—H. J. E.

! PLASTINGIA HELENA.

Plastingia helena, Butler, Lep. Exot. p. 190, pl. lxiv. fig. 3 (1874).

Hab. Sarawak (*Low, fide Butler*); Pulo Laut (*Doherty*); Namoe Ockor, Sumatra (*in coll. Rothschild*).

PLASTINGIA VERMICULATA.

Hesperia vermiculata, Hewitson, Ann. & Mag. Nat. Hist. ser. 5, vol. i. p. 346 (1878).

Plastingia vermiculata, de Nicéville, Jour. As. Soc. Beng. 1894, p. 56, pl. v. fig. 15, ♂.

This species is distinguished by having the termen of the hind wing broadly and decreasingly yellow from the tornus as far as vein 3. The hind wing below has several large bluish-white spots or dashes.

Hab. Battak Mountains, Sumatra (*Martin, fide de Nicéville*).

! PLASTINGIA FRUHSTORFERI. (Plate XIX. fig. 19, ♂; Plate XXIV. figs. 55, 55 *a*.)

Plastingia fruhstorferi, Mabille, Ann. Soc. Ent. Belg. xxxvii. p. 52 (1893).

Hab. Java (*Fruhstorfer*); Pulo Laut (*Doherty*); Labuan (*coll. Staudinger*); Selesseh (*in coll. Rothschild*).

! PLASTINGIA AURANTIACA, n. sp. (Plate XIX. fig. 17, ♂.)

♂. Upperside: fore wing blackish brown with five hyaline spots, one in each of cells 2, 3, 4, 6, and 7, and another indicated by a small pale dash near the apex of the cell next its upper edge; an elongate rhomboidal spot in cell 1 *a* almost coinciding in length with the hyaline spot in cell 2, an acuminate streak next the costa from the base of the wing as far as the apex of cell 10, and a narrow border to the hyaline spots bright orange-yellow: hind wing with the disc irregularly, and a streak along vein 1 *b*, orange-yellow. Underside: fore wing orange-yellow, with the costa and termen narrowly black; a subterminal band of blackish spots arising in a large subquadrate spot in the apex of cell 1 *a*, and decreasing in size towards the apex; a black streak from the end of the discoidal cell in part along the course of vein 5, and another in cell 8 continued towards the base along the upper edge of the discoidal cell; dorsum black as far as vein 1 *a*, and an oblong, black-edged, somewhat metallic pale spot in cell 1 *a* from the base of vein 2 to the base of the wing: hind wing deep orange-yellow, the costa and termen narrowly black; cell 1 *a* and the lower half of cell 1 *b* black, the former with an orange streak in its basal two-thirds; cell 1 orange-yellow; disc of the wing with several irregular black dashes placed as follows, namely—two in cell 7, of which the basal one occupies two-thirds of the length of that cell, two in each of cells 2, 3, 4–5, and 6, one in the discoidal cell, and three in cell 1 *b*. Fringes below orange-yellow, the short scales on the fore wing blackish. Antennæ blackish, the shaft yellow below from the base to the club. Clothing of palpi pale yellow, with a few black hairs intermixed. Clothing of body and legs orange-yellow.

Expanse 34–36 mm.

Hab. Pulo Laut (*Doherty*); Poeh, Sarawak (*in coll. Rothschild*).

Described from two males in coll. Elwes.

! PLASTINGIA LIBURNIA.

Hesperia liburnia, Hewitson, Descr. Hesp. p. 33 (1868); id. Exot. Butt. v., *Hesp.* pl. vi. figs. 58, 59 (1873).

Plastingia liburnia, Semper, Schmett. Philipp. p. 313 (1892).

Hab. Luzon, Mindoro, Camotes, Mindanao (*Semper*).

PLASTINGIA TELESINUS.

Carystus telesinus, Mabille, Pet. Nouv. Ent. ii. p. 205 (1878).

Carystus lænas, Mabille, Comptes Rendus Soc. Ent. Belg. iv. p. cxix (1891).

Suastus telesinus, Semper, Schmett. Philipp. p. 300 (1892).

Hab. Luzon, Bohol (*Semper*).

This species seems to be most nearly allied to *P. corissa*, Hew., to which it bears considerable resemblance in the colour of the underside, but the latter species wants the pale spots on the hind wing below.

! PLASTINGIA TESSELLATA.

Hesperia tessellata, Hewitson, Trans. Ent. Soc. Lond. ser. 3, vol. ii. p. 494 (1866).
Hesperia eulepis, Felder, Reise Nov., Lep. iii. p. 517, pl. lxxii. fig. 12, ♂ (1867).
Plastingia tessellata, var. *palawata*, Staudinger, Iris, ii. p. 149 (1889).

Hab. Celebes (*fide Hewitson*); Palawan (*fide Semper*); Pulo Laut (*Doherty*); Battak Mountains, Sumatra (*Martin*).

! PLASTINGIA NAGA.

Hesperia? naga, de Nicéville, Jour. As. Soc. Beng. (1883) p. 89, pl. x. fig. 2, ♀.
Plastingia naga, Watson, Hesp. Ind. p. 115 (1891); Semper, Schmett. Philipp. p. 314 (1892).

Hab. Sibsagar, Upper Assam (*Peal*, *fide de Nicéville*); E. Pegu (*Doherty*); Jaintia hills (*coll. Swinhoe*); Lawas, N. Borneo (*Everett*); Khasias (*in coll. Rothschild*); Battak Mountains, Sumatra (*Martin*); E. Mindanao (*Semper*).

Watson (P. Z. S. 1893, p. 118) puts this species as a synonym of *tessellata*, Hew., and as it resembles that species in all but the colour of the pale spots on the underside, we were, so long as we had seen female specimens only, inclined to adopt the same view, seeing that the type was a female; but having, through the kindness of Herr Semper, had the opportunity of examining one of his two males from E. Mindanao, which exactly agrees with the original description and figure as well as with female specimens in coll. Elwes, we are satisfied that it is a distinct species. It has been sent to us from Java by Staudinger as *tessellata*, Hew.

PLASTINGIA VIBURNIA.

Plastingia viburnia, Staudinger, *in. litt.*; Semper, Schmett. Philipp. p. 314 (1892).

Of this very distinct species the female resembles the male, save that the pale markings on the upperside are yellowish white instead of deep yellow.

Hab. Mindoro (*Semper*).

! PLASTINGIA CORISSA.

Hesperia corissa, Hewitson, Ann. & Mag. Nat. Hist. ser. 4, xviii. p. 455 (1876).
Plastingia drancus, Plötz, Stett. ent. Zeit. xlv. p. 149 (1884).
Isoteinon indrasana, Elwes & de Nicéville, Jour. As. Soc. Beng. 1886, p. 441, pl. xx. fig. 5, ♀ (*fide* de Nicéville); Watson, Hesp. Ind. p. 86 (1891).
Plastingia latonia, Staudinger, MS.

Hab. Kina Balu, Borneo (*Waterstradt*); Pulo Laut (*Doherty*); Battak Mountains, Sumatra (*Martin*).

Mr. de Nicéville identifies *I. indrasana*, which he described in the joint paper on Tavoy butterflies, cited above, as *I. corissa*. As the type is now in the Calcutta Museum, we take his word for it, but the plate does not represent our specimens correctly. A female of *P. latonia*, Stgr., marked by Dr. Staudinger as "typisch," differs from the same sex of *P. eorissa* in being a little larger, and in having the hyaline spots in cells 6 and 7 of the fore wing above longer, an oblong hyaline spot in cell 8, and a small irregular yellow spot in cell 5 near the lower outer angle of the spot in cell 6.

!PLASTINGIA NOËMI. (Plate XXIV. figs. 57, 57 *a*.)

Plastingia noëmi, de Nicéville, Jour. As. Soc. Beng. 1885, p. 120, pl. ii. fig. 15, ♂.

Hab. Sikkim (*Möller*, *fide de Nicéville*, *Knyvett*); E. Pegu (*Doherty*).

!PLASTINGIA SIMILIS, n. sp. (Plate XIX. fig. 18, ♂; Plate XXIV. figs. 56, 56 *a*.)

Closely allied to *P. noëmi*, de Nicév., from which it differs in its smaller size, the less conspicuous yellow streak along the basal half of the costa of the fore wing above, and in the particulars set forth in the above Table of Species.

Expanse 34 mm.

Hab. Pulo Laut (*Doherty*).

Described from one male and two females in coll. Elwes.

PLASTINGIA SUBMACULATA.

Plastingia submaculata, Staudinger, Iris, ii. p. 149, pl. ii. fig. 8, ♂ (1889).

Fore wing above with two cell-spots, a pale spot in each of cells 2 and 3, and a yellow streak from the base next the upper edge of vein 1 *a*. Hind wing below yellow-green, the dorsum darker, three black spots near the base, and six others forming a postmedian curved series.

Hab. Palawan (*Platen*).

We have not seen this species, which may not be a *Plastingia*; the figure of the fore wing below does not agree with the author's description.

LOTONGUS.

Lotongus, Distant, Rhop. Mal. p. 371 (1886); Watson, P. Z. S. 1893, p. 121. Type *calathus*, Hew.
Zea, Distant, t. c. pp. 369 & 377. Type *mytheca*, Hew.
Zela, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1895, p. 386. Type *zeus*, de Nicév.
Zampa, de Nicéville, t. c. p. 389. Type *zenon*, de Nicév.

Antennæ (in the male) about two-thirds as long as the costa; club slender; apiculus acicular, reflexed, rather less than half as long as the club. Palpi appressed, densely scaled; third joint minute, acicular or obtuse, almost concealed. Fore wing: termen (in the male) longer than the dorsum, vein 5 nearer 4 than 6, vein 2 from the basal third of the lower edge of the cell, no hyaline spot in cell 4; in *calathus*, *zeus*, and *mytheca*, the base of cell 3 is about twice as long as the base of cell 4, and in *zenon*, *avesta*, *sarala*, and *excellens* the base of cell 3 is about one-third longer than the base of cell 4. Hind wing: cell less than half the length of the wing, termen very feebly excavated in cell 1 *b*. Epiphysis present; hind tibiæ fringed and bearing two pairs of spurs.

We find that the following species fall within the above definition :—

1 (10). Hind wing above plain brown.
2 (9). Hind wing below brown, with or without a whitish border round the apex.
3 (6). Cell-spot present on fore wing above.
4 (5). No sex-mark on fore wing above in the male. Fringe of hind wing not yellow in the tornal region. Hind wing below frequently more or less broadly whitish round the apex . . . . *calathus*, Hew.
5 (4). Sex-mark on fore wing above in the male linear, blackish, erect from the middle of vein 1 *a* to the basal third of vein 2, thence oblique to near the base of vein 3. Fringe of hind wing yellow in the tornal region. *zeus*, de Nicév.
6 (3). No cell-spot on fore wing above.
7 (8). Hind wing above in the male with a tuft of long hairs near the base completely covering the cell; the latter very short, about one-third as long as the wing, transverse vein suberect, veins 3, 4, and 6 equidistant at the base and much thickened in their basal half. Hind wing below brown, yellowish next the transverse vein . . . . . *zenon*, de Nicév.
8 (7). Hind wing above in the male normal; below brown, with a sharply defined yellow transverse band from the apical third of the costa to the basal third of the dorsum but interrupted in cell 1 *b*. No cell-spot on the fore wing above . . . . *avesta*, Hew.
9 (2). Hind wing below brown, with a white median band from the costa to vein 1 *b*, the breadth of this band equal to half the length of the wing. *mytheca*, Hew.
10 (1). Hind wing above in part yellow.
11 (12). Fore wing above with a cell-spot, no pale spots in cells 6, 7, or 8. Hind wing below with a yellow band having the same direction as in *avesta*. *sarala*, de Nicév.
12 (11). Fore wing above with a cell-spot and a pale spot in each of cells 6 and 7 or 6, 7, and 8. Hind wing below with a broad yellow band from the middle of the costa to the middle of cell 1 *b*, sometimes continued to the dorsum . . . . *excellens*, Stgr.

! LOTONGUS CALATHUS.

Eudamus calathus, Hewitson, Ann. & Mag. Nat. Hist. ser. 4, vol. xviii. p. 353 (1876).
Lotongus calathus, Distant, Rhop. Mal. p. 371, pl. xxxiv. fig. 14 (1886).
Lotongus maculatus, Distant, t. c. p. 372, pl. xxxv. fig. 1.
Hesperia parthenope, Weymer, Stett. ent. Zeit. xlviii. p. 17, pl. ii. fig. 8, ♀ (1887).
Plesioneura aliena, Staudinger, Iris, ii. p. 155 (1889), *sec. spec. typ.*
Lotongus parthenope, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1892, p. 354, pl. J. figs. 4 ♂, 5 ♀.
Proteides zalates, Mabille, Ann. Soc. Ent. Belg. xxxvii. p. 52 (1893).
Proteides surus, Mabille, Bull. Soc. Ent. Fr. 1895, p. lix.

Hab. Nias (*Modigliani*); Palawan; Kina Balu, Borneo; Java (*fide Staudinger*); Selesseh, Battak Mountains, Sumatra (*Martin*).

We have been obliged to unite the three supposed species of *Lotongus* upon which Mr. de Nicéville has written, we think, without sufficient material. We possess specimens of both sexes from Distant's collection, with the label "Malacca, *Biggs*." The males are marked in his writing *maculatus*, the female *calathus*. A male from Pulo Laut agrees with these males. We have also three males and four females of *parthenope*, Weym., from the typical locality Nias, which vary considerably *inter se* in the very characters by which alone they can be separated from the Malacca and Bornean specimens, namely, the size and number of the spots on the fore wing in the male, and in the female by the amount of white on the apex of the hind wing below, which is present in both sexes of *calathus*, but in some females only of *parthenope*. The Javan form figured by de Nicéville as *parthenope* ♂ has only one spot in the cell, whilst two of our three males have two. The genitalia of the two forms are identical.

! LOTONGUS ZEUS.

Zela zeus, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1895, p. 388, pl. Q. fig. 57, ♂.

We give a description of this species, which had been prepared before Mr. de Nicéville's paper appeared.

♂. Upperside dark brown: fore wing with four hyaline whitish-yellow spots—one, about twice as high as wide, near the middle of cell 2, one, subquadrate, near the basal fourth of cell 3, one, oblong, near the base of cell 6, and one, longer than wide, in the cell, next the base of vein 3; sex-mark linear, blackish, erect from the middle of vein 1 *a* to the basal third of vein 2, thence oblique to near the base of vein 3: hind wing with the basal two-thirds thickly clothed with long fuliginous hairs. Underside brown: hind wing and basal two-thirds of the costal region of fore wing bright yellow-brown, a small feeble yellow spot next the transverse vein of the hind wing. Fringes of the fore wing whitish grey; of the hind wing bright yellow in the tornal region, passing gradually into whitish grey towards the apex; short scales dark on both wings except on the brightest of the yellow part. Antennæ brown; club slender, paler beneath; the apiculus equal in length to one-half of the clavate portion. Vein 2 of fore wing arising near the basal third of the cell. Body and legs concolorous with the upperside.

Expanse 39–47 mm.

Hab. Pulo Laut (*Doherty*); Mindoro (*coll. Semper*); Khasia hills (*fide Swinhoe*).

This species is the type of Mr. de Nicéville's genus *Zela*. A male specimen from the Khasia hills, ex coll. Swinhoe, of which we have compared the genitalia, is larger than specimens from Pulo Laut, expanding 47 mm., and the pale spots on the fore wing are reduced in size, that proper to cell 6 being absent. Type in coll. Elwes.

! LOTONGUS ZENON.

Zampa zenon, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1895, p. 391, pl. Q. fig. 58, ♂.

This species, of which the type is in coll. Elwes, is the type of Mr. de Nicéville's genus *Zampa*.

The curvature of the dorsum of the fore wing in the male is correlated to the supra-alar tuft on the hind wing, and is not peculiar to this species. Cf. *Parnara oceia*, ♂.

Hab. Pulo Laut (*Doherty*).

! LOTONGUS AVESTA.

Hesperia avesta, Hewitson, Descr. Hesp. p. 30 (1868).
Lotongus avesta, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1895, p. 383, pl. Q. fig. 56, ♀.
Pamphila tamiata, Stgr. MSS.

Hab. Kina Balu, Borneo (*Waterstradt*); Pulo Laut (*Doherty*).

! LOTONGUS MYTHECA.

Hesperia mytheca, Hewitson, Ann. & Mag. Nat. Hist. ser. 4, vol. xix. p. 81 (1877).
Zea mytheca, Distant, Rhop. Mal. p. 377, pl. xxxv. fig. 7 (1886).

Hab. Perak (*Doherty*).

! LOTONGUS SARALA.

Parnara sarala, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1889, pl. B. fig. 6, ♀; Watson, Hesp. Ind. p. 48.

Hab. Khasia hills (*Hamilton*).

Both sexes of this species, which do not differ, are in the Elwes collection.

! LOTONGUS EXCELLENS.

Proteides excellens, Staudinger, Iris, ii. p. 141, pl. ii. fig. 6 (1889).

Hab. Pulo Laut (*Doherty*); Palawan (*Platen, fide Stgr.*); Sumatra (*in coll. Rothschild*).

CRETEUS.

Creteus, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1895, p. 385. Type *cyrina*, Hew.

This is a genus erected by Mr. de Nicéville for the *Hesperia cyrina* of Hewitson, a species which is remarkable for the presence of hyaline spots on the hind wing, placed as follows:—one in the cell next the transverse vein, one in the basal third of each of cells 2 and 3, and one near the middle of each of cells 6 and 7. The hyaline spots on both wings are apt to be reduced in size, and in a specimen from Borneo in which this is the case the hyaline spot proper to cell 2 of the hind wing is wanting altogether. The sex-mark on the fore wing above in the male consists of a streak of modified scales occupying about the middle third of vein 2.

! CRETEUS CYRINA.

Hesperia cyrina, Hewitson, Ann. & Mag. Nat. Hist. ser. 4, vol. xviii. p. 450 (1876); Watson, Hesp. Ind. p. 160 (1891).

Parnara parca, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1889, p. 174, pl. B. fig. 10, ♀.
Pamphila meleagrina, Staudinger, MSS.

Hab. Khasia (*Hamilton*); Kina Balu, Borneo (*Waterstradt*).

All the spots on both the Bornean specimens in coll. Elwes are smaller than in the Khasia one, but there is no other difference.

Unkana.

Unkana, Distant, Rhop. Mal. p. 369 (1886); Watson, P. Z. S. 1893, p. 123. Type *batara*, Moore, MS.

A genus established by Distant for *Ismene batara*, Moore, MS.

Sexes dissimilar. Fore wing with the full complement of hyaline spots, *i. e.* a cell-spot and one in each of cells 2 to 8 in both sexes. Antennæ (in the male) more than half as long as costa; club slender; apiculus acicular, about half as long as the club. Palpi appressed, densely scaled; third joint blunt, very short, almost concealed. Fore wing: termen in the male as long as or longer than the dorsum, cell 4 slightly narrowing to the base, vein 2 from the basal third of the lower edge of the cell, transverse vein oblique, base of cell 3 about twice as long as that of cell 4. Hind wing: termen angularly produced at vein 1 *b*, cell less than half the length of the wing. Epiphysis present; hind tibiæ fringed and bearing two pairs of spurs, the submedian pair small and appressed.

Watson, in his 'Revision,' places this genus (presumably after having examined the type species) in his Pamphilinæ, Section B, and *Erionota* in his Pamphilinæ, Section A. In his more recent paper, before referred to, he says that *batara* correctly belongs to the genus *Erionota*, and sinks the genus *Unkana* accordingly; but, since *batara* differs from *thrax*, the type of *Erionota*, much more than *thrax* does from *thyrsis*, the type of *Gangara*, there seems to be, even on his own estimate of genera, no good reason for such a course.

So far as we can judge, the *Erionota* (*Casyapa*) *mabillei*, Stgr., belongs here rather than to *Erionota*, and it is placed in this genus accordingly.

! Unkana attina.

Ismene batara, Moore, MS.; Horsfield & Moore, Cat. Lep. E.I. C. i. p. 249 (1857), ♂.
Hesperia attina, Hewitson, Trans. Ent. Soc. Lond. ser. 3, vol. ii. p. 489 (1866), ♀.
Hesperia latreillei, Felder, Reise Nov., Lep. iii. p. 511, pl. lxxi. fig. 8 (1866), ♀.
Goniloba cruda, Herrich-Schäffer, Prod. Syst. Lep. iii. p. 75 (1869).
Unkana batara, Distant, Rhop. Mal. p. 370, pl. xxxiv. fig. 11, ♂ (1886).
Unkana attina, Distant, t. e. p. 371, pl. xxxiv. fig. 30, ♀; Watson, Hesp. Ind. p. 4 (1891).

Hab. Malacca (*Biggs*); Perak (*Doherty*); Moulmein (*Adamson*); Java (*Fruhstorfer*) Palawan (*Platen*); Mindanao (*Semper*).

UNKANA MABILLEI.

Erionota (Casyapa) mabillei, Staudinger, Iris, vol. ii. p. 135 (1889).

The male differs from that sex of *U. attina*, Hew., on the upperside by the want of pale spots in cells 4 and 5 and the different shape and sordid yellow colour of the remaining spots, that in the cell being one and a half times as wide as high; the hind wing below is brown, with some dull red spots near the lower angle of the cell, a broad irregular dark brown band gradually narrowing from the costa and almost reaching vein 1 *b*, and a large brown subtriangular patch next the base. Fringe of the fore wing whitish grey, the short scales brown; of the hind wing brown from the apex to vein 4, thence pale yellowish grey.

These particulars are taken from an example, ex coll. Staudinger, in which the hind wing below is much rubbed.

Hab. Labuan (*coll. Stgr.*); Palawan (*Platen, fide Stgr.*).

HIDARI.

Hidari, Distant, Rhop. Mal. p. 395 (1886); Watson, P. Z. S. 1893, p. 123. Type *irava*, Moore.

Fore wing with the termen (in the male) as long as or longer than the dorsum; hind wing short, rounded; abdomen about one-fourth longer than hind wing. Antennæ about half as long as costa; club slender; apiculus acute, less than half as long as club. Palpi appressed, second joint densely scaled, third joint very short, blunt, almost concealed. Fore wing: vein 2 from the basal third of the lower edge of the cell, transverse vein oblique, base of cell 4 about half as long as the base of cell 3. Hind wing with the cell about half as long as the wing.

Distant includes in this genus three species, which we distinguish as follows:—

1 (4). Fore wing above with the pale spots free.
2 (3). Fore wing above with a pale spot near the middle of cell 1 *a* next vein 1 *a*, but, normally, no pale spots in cells 7 and 8; hind wing below with a small pale spot in the cell, near the base of vein 6 . . . . *irava*, Moore.
3 (2). Fore wing above with no pale spot in cell 1 *a*, and a pale spot in each of cells 6, 7, and 8; no pale spot in the cell on hind wing below . . . *sybirita*, Hew.
4 (1). Fore wing above with the pale spots confluent and forming a broad irregular deep yellow band from the upper edge of the cell to vein 1 *a*. *staudingeri*, Dist.

! HIDARI IRAVA.

Hesperia irava, Moore; Horsfield & Moore, Cat. Lep. Mus. E.I. C. i. p. 254 (1857); Plötz, Stett. ent. Zeit. xliii. p. 328 (1882).

Hidari irava, Distant, Rhop. Mal. p. 395, pl. xxxiv. fig. 15, ♀ (1886); Watson, Hesp. Ind. p. 112 (1891).

Hab. Perak, Bali (*Doherty*); Java (*Piepers*).

HIDARI DOESOENA.

Hidaria doesoena, Martin, Einige neue Tagschmetterlinge von Nordost-Sumatra, p. 6 (1895).

Differs from *H. irava*, Moore, in having the pale spot in cell 2 of the fore wing only separated from the cell-spot by the lower boundary of the cell, and the small pale spot in the cell of the hind wing below white instead of yellow. We have not seen this species.

Hab. N.E. Sumatra (*Martin*).

HIDARI SYBIRITA.

Hesperia sybirita, Hewitson, Ann. & Mag. Nat. Hist. ser. 4, vol. xviii. p. 451 (1876).
Hidari sybirita, Distant, Rhop. Mal. p. 395, pl. xxxv. fig. 24 (1886).

Hab. Singapore (*coll. Hewitson*).

! HIDARI STAUDINGERI.

Hidari staudingeri, Distant, Rhop. Mal. p. 395, pl. xxxv. fig. 25 (1886).

Hab. Perak (*Doherty*).

HIDARI BHAWANI.

Hidari bhawani, de Nicéville, Jour. As. Soc. Beng. 1888, p. 291, pl. xiii. fig. 6, ♂; Watson, Hesp. Ind. p. 112 (1891).

Resembles *H. irava* in the spotting of the fore wing above, but the hind wing below is pale ochreous, coarsely striated transversely with brown, and there is a brown streak near the costa and another next the dorsum. We have not seen this species.

Hab. Arracan coast, Burma (*Bingham, fide de Nicéville*).

EETION.

Eetion, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1895, p. 395. Type *elia,* Hew.

This is a genus erected by de Nicéville for the *Hesperia elia* of Hewitson, a species which is well distinguished from its immediate allies by the presence of hyaline spots on the disc of the hind wing; these form a transverse row and are placed one in each of cells 1 *b*, 2, 3, and 4–5. There is in the male a tuft of long hairs near the base of the dorsum of the fore wing below, and on the upperside of the fore wing a seam of modified scales passing obliquely inwards and downwards from the base of vein 3, nearly half of its length lying below vein 2.

! EETION ELIA.

Hesperia elia, Hewitson, Trans. Ent. Soc. Lond. ser. 3, vol. ii. p. 489 (1866).
Unkana elia, Distant, Rhop. Mal. p. 370, pl. xxxiv. fig. 25 (1886).

Hab. Singapore (*Godfrey*); Perak (*Doherty*).

Pithauria.

Pithauria, Moore, P. Z. S. 1878, p. 689; Watson, op. cit. 1893, p. 119. Type *murdava*, Moore.
Pithauriopsis, Wood-Mason & de Nicéville, Jour. As. Soc. Beng. 1886, p. 387; Watson, l. c. Type *aitchisoni*, Wood-Mason & de Nicév.

Fore wing rather narrow and pointed; thorax very stout; abdomen conical, not longer than the dorsum of the hind wing. Antennæ about half as long as costa; club slender; apiculus acicular, reflexed, at least one-half as long as the club. Palpi appressed, densely scaled, third joint almost concealed. Fore wing: no hyaline spot in cell 4, vein 2 arising near the half-length of the cell, vein 5 nearer 4 than 6. Hind wing: cell less than half as long as the wing, angulated at the origin of vein 7 and also at the origin of vein 2, vein 5 absent; termen feebly curved, nearly straight between veins 1 *a* and 7; tornus not distinctly produced. Epiphysis present; hind tibiæ with two pairs of spurs. Front coxæ in the male densely clothed with long hair-like scales, and in the same sex the disc of the hind wing above is densely clothed with long hair-like scales.

There are three species separable as follows:—

Males.

1 (4). No sex-mark on the fore wing above.
2 (3). The long clothing of hind wing above not conspicuously pale. *murdava*, Moore.
3 (2). The long clothing of hind wing above whitish grey . . . *stramineipennis*, de Nicév.
4 (1). A double sex-mark near the middle of cell 1 *a* on fore wing above, precisely similar to that found in the genus *Halpe*. *aitchisoni*, W.-M. & de Nicév.

! Pithauria murdava.

Ismene murdava, Moore, P. Z. S. 1865, p. 784.
Pithauria murdava, Moore, P. Z. S. 1878, p. 689, pl. xlv. fig. 13; Distant, Rhop. Mal. p. 378, pl. xxxv. fig. 9, ♂ (1886); Watson, Hesp. Ind. p. 27 (1891).

The female of this species has on the hind wing below a suffused subterminal pale band, and an oblong pale spot in each of cells 6 and 7, being thus distinguished from the female of *P. stramineipennis*, in which the hind wing below is uniform grey by reason of a sprinkling of whitish-grey scales on a pale greenish-brown ground; in one of my two specimens of the latter there is a feeble pale spot near the basal third of cell 6 on the hind wing below.

Hab. Sikkim (*Möller*); Khasia (*Hamilton*).

! Pithauria stramineipennis.

Pithauria stramineipennis, Wood-Mason & de Nicéville, Jour. As. Soc. Beng. 1886, p. 388, pl. xx. fig. 5, ♂; Watson, Hesp. Ind. p. 27 (1891); Leech, Butt. China &c. p 631, pl. xli. fig. 19, ♂ (1894).

Hab. Sikkim (*Möller*); Nagas (*Doherty*); Tavoy (*Tucker*).

! PITHAURIA AITCHISONI.

Pithauriopsis aitchisoni, Wood-Mason & de Nicéville, Jour. As. Soc. Beng. 1886, p. 387, pl. xv. fig. 4, ♂; Watson, Hesp. Ind. p. 28 (1891).
Pamphila glauca, Staudinger, *in litt.*

♀. Hind wing above brown, without the grey clothing found in the male. Hind wing below red-brown, paler along the dorsum, with the following pure white markings, namely:—a streak from the base along cell 7 as far as its middle, a streak in the basal half of cell 6, but not reaching the base of that cell, a series of four small oblong spots, one near the middle of each of cells 2, 3, 4, and 5, and sometimes another beyond the middle of cell 1 *b*. Otherwise like the male.

Described from a specimen from Kina Balu, Borneo, ex coll. Staudinger.

Hab. Kina Balu, Borneo (*Staudinger*); Java (*Piepers*).

NOTOCRYPTA.

Plesioneura, Felder, Wien. ent. Monatsb. vi. p. 29 (1862), *nom. præocc.* Type *curvifascia*, Felder.
Notocrypta, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1889, p. 188; Watson, P. Z. S. 1893, p. 112. Type *curvifascia*, Felder.

Antennæ about two-thirds as long as costa, rather shorter in the female. Palpi ascending; third joint porrect, almost concealed. Fore wing: vein 5 arising much nearer 4 than 6, and having a distinct upward curve, or straight and practically intermediate between veins 4 and 6; vein 2 from the basal third of the lower edge of the cell. Hind tibiæ with two long pairs of spurs.

Species blackish brown above, with white hyaline markings on the fore wing, of which the most prominent is a more or less complete broad band passing from the middle of the costa to the distal third of the dorsum.

In 'Iris,' vol. ii. p. 151, Dr. Staudinger attempts to show that *signata*, Druce (P. Z. S. 1873, p. 360, pl. xxxiii. fig. 8), is an aberration of *alysos*, Moore; but this view is scarcely tenable, because, apart from the differences in the venation in the two insects, the band on the fore wing in *signata*, Druce (recte *Charmion ficulnea*, Hew.), is cut short by vein 2, which is not the case in *alysos*, Moore (recte *feisthamelii*, Bdv.).

The species dealt with in this paper may be distinguished as follows:—

1 (6). Vein 5 in the fore wing curved, its basal portion receding from vein 6; vein 5 therefore arising much nearer to vein 4 than to vein 6.
2 (5). Hind wing below without white spots.
3 (4). General direction of the termen of the fore wing forming a more or less obtuse angle with the dorsum. Fore wing above with or without white spots besides those forming the band . . . . *feisthamelii*, Bdv.

4 (3). General direction of the termen of the fore wing forming a right angle with the dorsum. Fore wing above without white spots except those forming the band . *quadrata*, n. sp.
5 (2). Hind wing below with an angular white spot near the distal third of the cell and another near the basal third of cell 2 . . . . *paralysos*, Wood-Mason & [de Nicév.
6 (1). Vein 5 in the fore wing straight, practically intermediate between veins 4 and 6.
7 (10). Base of cell 3 on the fore wing not filled up with white.
8 (9). Basal fifth or fourth of hind wing below yellow. Subtornal blotch on fore wing below obsolete or wanting . . . . *basiflava*, de Nicév.
9 (8). Hind wing below pale brown. Subtornal blotch on fore wing below sordid white . . . . *inornata*, n. sp.
10 (7). Base of cell 3 on the fore wing filled up by a triangular white spot . . . . *monteithi*, Wood-Mason & [de Nicév.

NOTOCRYPTA FEISTHAMELII.

Thymele feisthamelii, Boisduval, Voy. Astr., Lép. p. 159, pl. ii. fig. 7 (1832).
Plesioneura curvifascia, Felder, Wien. ent. Mon. vi. p. 29 (1862).
Plesioneura alysos, Moore, P. Z. S. 1865, p. 789; id. Lep. Cey. i. p. 178, pl. lxvii. figs. 3 ♂, 3 *a* ♀, 3 *b* larva and pupa (1881); Distant, Rhop. Mal. p. 399, pl. xxxiv. fig. 7, ♂ (1886).
Plesioneura albifascia, Moore, P. Z. S. 1878, p. 843, pl. liii. fig. 3, ♂.
Plesioneura restricta, Moore. Lep. Cey. i. p. 178 (1881); Wood-Mason & de Nicéville, Jour. As. Soc. Beng. 1887, p. 390, pl. xvii. fig. 5, ♂.
Plesioneura volux, Mabille, Ann. Soc. Ent. Belg. 1883, p. lvi.
? *Plesioneura clavata*, Staudinger, Iris, ii. p. 153, pl. ii. fig. 9 (1889).
Notocrypta alysos, Watson, Hesp. Ind. p. 126 (1891).
Notocrypta albifascia, Watson, Hesp. Ind. p. 128 (1891).
Notocrypta feisthameli, var. *rectifascia*, Leech, Butt. China, &c. p. 627, pl. xxxviii. fig. 2, ♂ (1894).
Notocrypta curvifascia, Leech, t. c. p. 626, pl. xxxviii. fig. 1, ♂.
Notocrypta restricta, Leech, t. c. p. 627, pl. xxxviii. fig. 3, ♂; Watson, Hesp. Ind. p. 128 (1891).

Judging from the male genitalia it seems probable that there is but one species of this genus with the fringe of the hind wing grey-brown, the white band on fore wing above not cut short by vein 2, and having a dark sub-basal and median band, but no white spot on the hind wing below. The oldest name given to an insect falling within this definition is that of *feisthamelii*, Bdv. The presence or absence of small white spots on the fore wing, an opaque white patch on the fore wing below continuing the white band to the costa, or a white dash in each of cells 9 and 10 on the fore wing below between the hyaline spot in cell 8 and the costa, are particulars not sufficiently constant to be of any use as specific characters. The form *albifascia*, Moore, which we have from Java and Pulo Laut, a comparatively small insect with no white markings except the rather narrow band on the fore wing above, is very different in appearance from the much larger typical *feisthamelii* (which we have also from Java), with its broad white band on the fore wing and five white spots besides; but there is nothing in the male genitalia of the two forms to prevent us from regarding the former as a depauperate local form of the latter.

The main differences in the several named forms consist in the greater or lesser number of white spots on the fore wing above, exclusive of those forming the discal band, and in a lesser degree the differences in the shape of the band itself and whether or not it is extended to the costa on the underside by a pale patch. Beyond those which form the discal band the largest number of white spots found on the fore wing above appears to be seven, namely, one in each of cells 3–9 inclusive; all or any of these may be absent, and specimens might in this respect be grouped under three heads: (*a*) those with no white spots, except those forming the band; (*b*) those with one spot, that in cell 4; and (*c*) those with more than one spot, *i. e.* with any number from 2 to 7, and of these the specimens with five or six spots are perhaps the most numerous. Such a grouping, however, would be purely artificial and would answer no useful purpose.

Though at first sight it might seem that we have united several forms more distinct *inter se* than others which we have previously treated as good species, yet a careful study of no less than 35 males and 26 females from all parts of India and the Malay Islands, representing all the named forms, together with the fact that the genitalia of all the specimens examined seem to be identical in structure, convinces us that it is impossible to separate them. The principal points which have been relied on by authors are the number of the spots beyond the band on fore wing above, the form of the band, and whether or not it is extended to the costa below.

P. albifascia, Moore, is a small form from Java, Borneo, and Bali, with a narrow band and usually no spots beyond the band.

P. volux, Mab., of which we have seen the type in Dr. Staudinger's collection, is also spotless.

Mr. Leech, who has given much attention to these insects, divides the specimens found in the region treated of in his book as follows:—

Pale band on fore wing below continued to the costa by a pale patch . . . . *feisthameli,* Bdv.
Pale band not so continued.
  Fore wing below with a white dash in each of cells 9 and 10 between the hyaline
    spot in cell 8 and the costa . . . . *curvifascia,* Feld.
  Fore wing with no such dashes . . . . *restricta,* Moore.

In this connection I may say that I have specimens from Java which combine the characters relied on by Mr. Leech for the separation of *feisthameli* and *curvifascia.*

Hab. India, generally distributed. Burmah, Perak, Andamans, Bali (*Doherty*); Java (*Piepers*); Nias (*Modigliani*); Philippines (*Semper*); Borneo, Arjuno, Java (*Doherty*); China (*Leech*); Liu Kiu Islands (*Pryer*).

! NOTOCRYPTA QUADRATA, n. sp. (Plate XX. fig. 3, ♂.)

♂. Nearest to *N. feisthamelii*, from which it differs in the general direction of the termen of the fore wing, which forms approximately a right angle with the dorsum, and in having the white band, which is cut short by vein 1 *a* and the upper edge of the cell, broader and more regular in outline; there are usually no hyaline spots, except those forming the band, but this is not a feature of much importance, as one specimen has a hyaline point near the middle of cell 4. On the underside the band is continued to the costa by an opaque white patch.

Expanse $36\frac{1}{2}$–$38\frac{1}{2}$ mm.

Hab. Kina Balu, Borneo (*Waterstradt*).

Described from two specimens in coll. Elwes received from Dr. Staudinger, who has others from the same locality.

! NOTOCRYPTA PARALYSOS.

Plesioneura paralysos, Wood-Mason & de Nicéville, Jour. As. Soc. Beng. 1881, p. 257.
Notocrypta paralysos, Watson, Hesp. Ind. p. 127 (1891).

Though this species has the genitalia characteristic of *N. feisthamelii*, the pure white spots on the hind wing below, two in number, distinguish it with certainty.

Hab. Andamans (*de Roepstorff*).

! NOTOCRYPTA BASIFLAVA.

Plesioneura basiflava, de Nicéville, Jour. As. Soc. Beng. 1888, p. 290, pl. xiii. fig. 7, ♂.
Notocrypta basiflava, Watson, Hesp. Ind. p. 130 (1891).

Hab. Nilgiris (*Hampson*).

NOTOCRYPTA INORNATA, n. sp. (Plate XXI. fig. 15, ♂.)

♂. Upperside dark brown: fore wing with a large oblong cell-spot, notched on its outer edge, and a large irregular oblong spot occupying about the middle third of cell 2 pure white, and forming together an oblique abbreviated discal band; a white point near the basal third of cell 3. Underside of fore wing as the upperside, save that the outer half of cell 1 *a* is almost entirely occupied by the white subtornal blotch. Body, antennæ, and legs concolorous with the wings; club of the antennæ whitish beneath. Second joint of palpi clothed with black and grey hairs intermixed.

Expanse 41 mm.

Hab. Kina Balu, Borneo (*Waterstradt*).

Described from a single example in coll. Staudinger.

NOTOCRYPTA MONTEITHI.

Plesioneura monteithi, Wood-Mason & de Nicéville, Jour. As. Soc. Beng. 1886, p. 391, pl. xviii. figs. 3, 3 *a*, ♀.
Notocrypta monteithi, Watson, Hesp. Ind. p. 129 (1891).
Carystus singularis, Mabille, Ann. Soc. Ent. Belg. xxxvii. p. 51 (1893).

This species differs from any form of *N. feisthamelii* in having on the fore wing a triangular spot, which occupies the basal third of cell 3, included in the white band. Very few specimens are known, all females.

Hab. Irangmara, Cachar (*Wood-Mason & de Nicéville*); Sumatra (*fide de Nicéville*); Java (*fide Mabille*); N. Borneo (*Pryer, in coll. Rothschild*). *Cf.* p. 215 *ante.*

Œrane, gen. nov.

Antennæ two-thirds the length of the costa; club slender; apiculus about one-fourth as long as the club. Palpi laxly scaled, second joint ascending, third long, acicular, erect. Fore wing (male): costa one-third longer than the dorsum; termen straight from the tornus to vein 5, subequal in length to the dorsum, vein 5 with its basal portion receding from vein 6 and therefore arising evidently nearer to vein 4 than to vein 6. Species blackish brown above, with an oblique white abbreviated discal band between vein 2 and the upper edge of the cell. Hind tibiæ with two pairs of spurs.

This genus contains at present the two species mentioned below, and as both of them exhibit the characters given above it cannot be said that one is more typical than the other.

They may be thus distinguished *inter se*:—

Subtornal blotch on fore wing below pale brown. Fore wing (male) apparently narrower, by reason that the angle between the dorsum and the straight part of the termen is about 115° . . . . *neæra*, de Nicév.

Subtornal blotch on fore wing below white, almost as pure as the discal band. Fore wing (male) apparently broader, by reason that the angle between the dorsum and the straight part of the termen is about 100° . . . . *microthyrus*, Mab.

! Œrane neæra.

Notocrypta neæra, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1891, p. 379, pl. G. fig. 27, ♀.

Hab. Pulo Laut, Perak (*Doherty*); Kina Balu, Borneo (*Waterstradt*).

There is a specimen in the Hewitson collection from Singapore unnamed.

Œrane microthyrus.

Plesioneura microthyrus, Mabille, Comptes Rendus Soc. Ent. Belg. iii. no. 31, p. lvii (1883).
Plesioneura mindorana, Staudinger, *in litt.*
Notocrypta microthyrus, Semper, Schmett. Philipp. p. 317 (1892).

Hab. Luzon, E. Mindanao (*Semper*); Mindoro (*coll. Staudinger*).

Herr Semper was mistaken in his statement that he had not the female of this species, the specimen submitted to us is undoubtedly of that sex.

In this species the pale band on the fore wing below is continued to the costa, and there is a tendency to the acquisition of this character in some females of *Œ. neæra.*

Udaspes.

Udaspes, Moore, Lep. Cey. i. p. 177 (1881); Watson, P. Z. S. 1893, p. 113. Type *folus*, Cr.

Antennæ about half as long as costa; club gradual; apiculus acute, about two-thirds as long as the club. Palpi porrect; third joint short, almost concealed. Fore wing: dorsum longer than the termen, the latter nearly evenly curved; vein 5 with its basal portion receding from vein 6 and therefore arising much nearer 4 than 6; vein 2 arising before the half-length of the cell. Hind wing nearly as broad as long; termen evenly rounded; cell less than half as long as the wing. Hyaline spots present in both wings. Tibial epiphysis present; hind tibiæ fringed and bearing two pairs of spurs. No alar sex-mark in the male.

The two species known to us may be distinguished as follows:—

Disc of the hind wing above white, completely surrounded by a broad dark brown border. Expanse about 42 mm. *folus*, Cr.

Hind wing above fuliginous brown, with a sharply defined rhomboidal white spot on the disc standing on vein 5 near the middle, and a white point just below it near the basal third of cell 3. Expanse about 33 mm. . . . . *stellata*, Ob.

! Udaspes folus.

Papilio folus, Cramer, Pap. Exot. i. pl. lxxiv. fig. 7 (1779).
Udaspes folus, Moore, Lep. Cey. i. p. 177, pl. lxviii. figs. 3, 3 *a* (1881); Distant, Rhop. Mal. p. 398, pl. xxxiv. fig. 3 (1886); Watson, Hesp. Ind. p. 125 (1891).

Hab. N.W. Himalaya (*Young*); Sikkim (*Möller*); Khasia (*Elwes*); Burmah (*Watson*, *Doherty*); Java (*Piepers*); Sambawa, Bali (*Doherty*).

! Udaspes stellata.

Plesioneura stellata, Oberthür, Études d'Ent. xx. p. 41, pl. ix. fig. 165 (1896).

Hab. Mænia, ? prope Ta-tsien-lo, E. Tibet (*coll. Oberthür*).

I am indebted to M. Charles Oberthür for a specimen of this distinct species, which he has recently received from his native collectors in Tibet.

Actinor.

Actinor, Watson, P. Z. S. 1893, p. 108. Type *radians*, Moore.

This genus was erected by Watson for the *Halpe radians* of Moore, an insect combining with its own peculiar facies most of the other characters of *Halpe*, save that the sex-mark is absent in the male and vein 2 of the fore wing arises near the basal third of the cell.

The pattern of the hind wing below is quite peculiar; the veins and two narrow irregular straight transverse bands are yellowish white, the antemedian band starts from the basal third of vein 1 *b* and passes over the base of vein 2 obliquely across the cell and is cut short by vein 8, the postmedian band starts from the apical fourth of vein 1 *b* and is continued in an almost regular zigzag to the apex of vein 6; there is a pale spot near the base of cell 7.

! ACTINOR RADIANS.

Halpe radians, Moore, P. Z. S. 1878, p. 690, pl. xlv. fig. 1; Watson, Hesp. Ind. p. 74 (1891).

Hab. Mandi, N.W. Himalayas (*Young*).

GEHENNA.

Gehenna, Watson, P. Z. S. 1893, p. 108. Type *abima,* Hew.

Distinguished from *Halpe* by the secondary sexual characters on the underside of the fore wing in the male, which consist of a thickening of the basal part of vein 2 and a portion of the lower edge of the cell near it, so as to form a swollen <, which is partly covered by a thick tuft of long black hairs springing from the dorsum near the base.

Three species are known to us, and may be distinguished as follows:—

1 (4). Male. Hind wing: vein 8 and the upper edge of the cell normal.
2 (3). Cell-spot on the fore wing geminate; hind wing below with "five undefined brown spots" (*de Nicév.*) . . . . *abima,* Hew.
3 (2). One moderately large spot next the lower edge of the cell on the fore wing, sometimes with another punctiform one just above it. Hind wing below brown, more or less closely covered with greyish-yellow scales, except on a large spot near the end of the cell and a triangular postmedian spot; the base of this brown triangle occupies about the basal half of vein 2, and its apex just reaches vein 6 . . . . *angulifera,* n. sp.
4 (1). Male. Hind wing: vein 8 and the upper edge of the cell forming a "tuning-fork" at their junction; upperside with a small oval oblique streak close to the base; underside dark reddish brown, immaculate, "frosted over with scattered golden-yellow scales" . . . . *græcæ,* de Nicév.

GEHENNA ABIMA.

Hesperia abima, Hew. Ann. & Mag. Nat. Hist. (4) xix. p. 83 (1877).

Hab. Macassar (*fide Hewitson*).

GEHENNA ANGULIFERA, n. sp. (Plate XIX. fig. 20, ♂.)

♂. Upperside brown: fore wing with four or five sordid yellowish-white spots placed as follows:—one near the apex of the lower edge of the cell, sometimes with a punctiform one just above it, one about twice as high as wide in cell 2, one roundish or subquadrate near the basal third of cell 3, and one small and roundish in cell 6. Underside: fore wing as on the upperside, but paler along the dorsum, and with the extra-discal portion more or less closely sprinkled with greyish-yellow scales: hind wing brown, more or less closely sprinkled with greyish-yellow scales, except on a spot near the end of the cell, and a curved postmedian band, the base of which occupies about the basal half of vein 2, and its apex just reaches vein 6. Fringes dark grey, the short scales darker, especially on the hind wing. Antennæ above dark brown, very finely spotted with white beneath, apiculus pale red on the underside. Body above brown; clothing of the palpi, breast, and legs of yellow and black hairs intermixed; abdomen beneath blackish, hind margins of the segments with a narrow band of whitish-grey scales.

Expanse 28 mm.

Hab. Mindoro.

Described from two specimens ex coll. Staudinger.

According to a specimen received from M. Mabille, this is the same as his *Pamphila rama*; we have not, however, been able to find any reference to the publication of the latter name.

GEHENNA GRÆÆ.

Gehenna grææ, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1895, p. 399.

Hab. N.E. Sumatra (*fide de Nicéville*).

CUPITHA, Moore.

Cupitha, Moore, Jour. As. Soc. Beng. 1884, pt. ii. p. 47; Watson, P. Z. S. 1893, p. 111. Type *purreea*, Moore.

A genus of a single species, best distinguished by the secondary sexual characters of the male. The pattern of the upperside is essentially the same as that found in *Telicota gola*, Moore. Male: fore wing with the dorsum angularly produced just before the middle, on the underside with a tuft of long hairs on the dorsum between the base and the angulation; hind wing above with an oval depression at the end of the cell filled with what appears to be a waxy matter, the middle of this depression is traversed by the confluent basal portion of veins 3 and 4, which thus form a loop above the lower margin of the cell.

! CUPITHA PURREEA.

Pamphila purreea, Moore, P. Z. S. 1877, p. 594, pl. lviii. fig. 10.
Cupitha tympanifera, Moore, Jour. As. Soc. Beng. 1884, p. 48.
Pamphila lycorias, Mabille, Ann. Soc. Ent. Belg. xxxvii. p. 54 (1893).

Hab. Sikkim (*Möller*); E. Pegu, Bali (*Doherty*); Java (*Fruhstorfer*); Nias (*Modigliani*); Camiguin de Mindanao (*Semper*); Palawan (*coll. Staudinger*).

Augiades.

Augiades, Hübn. Verz. p. 112 (1816); Watson, P. Z. S. 1893, p. 103. Type *sylvanus,* Esper.

Closely allied to *Erynnis,* the points of difference being practically those which separate the *Papilio sylvanus* of Esper from the *Papilio comma* of Linnæus. In *Augiades siva,* Moore, and its immediate allies, hyaline spots are more or less strongly developed in the fore wing.

Antennæ rather more than half as long as costa; club elongate, oval; apiculus longer than in *Erynnis,* in most species as long as the greatest width of the club. Third joint of palpi almost concealed, second joint laxly scaled.

In seven species examined there occurs a marked peculiarity in the male genitalia; the œdeagus has growing out of its lower side one or two large dissimilar horns, variously shaped and armed, sometimes nearly as large as the organ itself.

The species in coll. Elwes are distinguished as follows:—

1 (10). Hind wing below with the veins concolorous.
2 (3). Fore wing below with the blackish colour confined to the base and dorsum, bounded externally by the sex-mark, and above by vein 1 *a* . . . . *sylvanus,* Esp.
3 (2). Fore wing below with the dorsal half occupied by a suffused blackish patch, which is bounded above by the lower margin of the cell and vein 3.
4 (7). Hind wing above with pale spots in cells 2–6.
5 (6). Size larger. Fore wing below with a pale suffused spot near the middle of the dorsum. Œdeagus with one horn . . . . *subhyalina,* Brem.
6 (5). Size smaller. Fore wing below without a pale spot near the middle of the dorsum. Œdeagus with two horns . . . . *sylvanoides,* Leech.
7 (4). Hind wing above with pale spots in cells 2, 3, and 6.
8 (9). Sex-mark black. Fore wing below with the basal half of the costal region nearly concolorous with the ground-colour of the hind wing. Hind wing below with the pale spots silvery white, dark-edged . *siva,* Moore.
9 (8). Middle streak of the sex-mark whitish. Fore wing below with the basal half of the costal region reddish ochreous. Hind wing below with the pale spots neither silvery white nor dark-edged.
9*a* (9*b*). Expanse 33–35 mm. Lower distal angle of the lower lobe of the clasp acute . . . . *brahma,* Moore.
9*b* (9*a*). Expanse 43–47 mm. Lower distal angle of the lower lobe of the clasp obtuse . . . . *crateis,* Leech.
10 (1). Hind wing below with the veins black.
11 (12). Size smaller. Fore wing less pointed, its underside with the fringe deep yellow, the short scales dark brown for a varying distance from the apex. Œdeagus with one horn . . . . *ochracea,* Brem.
12 (11). Size larger. Fore wing more pointed, its underside with the fringe yellowish grey, passing into yellow near the tornus. Œdeagus with two horns . . . . *majuscula,* n. sp.

! AUGIADES SYLVANUS.

Papilio sylvanus, Esper, Schmett. i. 1, pl. xxxvi. fig. 1 (1778?); Hübner, Eur. Schmett. i. figs. 482–484 (1798–1803).

Hesperia venata, Bremer & Grey, Schmett. N. China's, p. 11, pl. iii. fig. 5 (1853); Ménétriés, Cat. Mus. Petr., Lep. i. pl. v. fig. 8 (1855).

Pamphila selas, Mabille, Pet. Nouv. ii. p. 233 (1878).

Pamphila herculea, Butler, Ann. & Mag. Nat. Hist. (5) vii. p. 140 (1881).

Hesperia hyrcana, Christoph, Iris, vi. p. 87 (1893).

Augiades sylvanus, Leech, Butt. China &c. p. 601 (1894).

Hab. Europe to Amurland, Korea (*Leech*); Japan (*Pryer*).

A male and female in coll. Rothschild, from Koko-nor, Tibet, expand only 23 mm. and 25 mm. respectively. We have not had an opportunity of comparing the male genitalia of this small form with those of specimens of normal size.

! AUGIADES SUBHYALINA. (Plate XXIV. fig. 58.)

Hesperia subhyalina, Bremer & Grey, Schmett. N. China's, p. 10, pl. iii. fig. 4 (1853).

Pamphila subhyalina, Ménétriés, Cat. Mus. Petr., Lep. i. pl. v. fig. 7 (1855).

Augiades subhyalina, Leech, Butt. China &c. p. 602, pl. xli. fig. 8, ♂ (1893–94).

Pamphila subhyalina, var. *tibetana*, Oberthür, Études d'Ent. xi. p. 28, pl. vi. fig. 45 (1886).

Hab. China (*Pratt*); Korea (*Leech*); ? Japan (*fide Leech*); Khasias (*Hamilton, fide Doncaster*).

Leech states that he has specimens intermediate between *A. tibetana* and *subhyalina*. We have seen no specimens from Japan, but three males from the Khasia hills, procured from Mr. Doncaster, are undoubtedly *subhyalina*.

! AUGIADES SYLVANOIDES. (Plate XXIV. fig. 59.)

Augiades sylvanoides, Leech, Butt. China &c. p. 604, pl. xli. fig. 4, ♂ (1893–94).

Hab. Ta-tsien-lo, Western China (*Pratt*).

AUGIADES SIMILIS.

Augiades similis, Leech, Butt. China &c. p. 605, pl. xli. fig. 6, ♂ (1893–94).

Differs from *sylvanoides*, Leech, in the darker (brown, not yellowish-green) ground-colour and more distinct pale spots of the hind wing below.

Hab. W. China (*Leech*).

! AUGIADES SIVA. (Plate XIX. fig. 28, ♂.)

Pamphila siva, Moore, P. Z. S. 1878, p. 692.

Telicota siva, Watson, Hesp. Ind. p. 57.

Hab. Khasias, 6000 ft. (*Elwes*); E. Pegu, Bernardmyo (*Doherty*).

Augiades bouddha.

Pamphila bouddha, Mabille, Ann. Soc. Ent. Fr. 1876, p. lvi.
Augiades bouddha, Leech, Butt. China &c. p. 603, pl. xli. figs. 7 ♀, 14 ♂ (1893–94).

Closely resembles *A. siva*, Moore, but the spots on the hind wing are larger and more quadrate.

Hab. Moupin (*David*).

! Augiades bouddha, var. consors.

Augiades bouddha, var. *consors,* Leech, t. c. p. 604, pl. xli. fig. 10, ♀.

We believe that this insect, which comes from Moupin, is really the female of *A. bouddha*, and that the female specimen from Omei-shan, figured on Leech's plate xli. fig. 7, belongs to another species. Mr. Leech himself observes that the Moupin female, the original of his plate xli. fig. 10, agrees better in the colour of the spots on the hind wing with the type male of *bouddha* figured by him than the Omei-shan female, the original of his plate xli. fig. 7; at the same time, the latter, which has the spots on the hind wing bright fulvous instead of white, agrees very well with Mabille's description of *bouddha*, female. The specimens figured appear to be the only ones which Mr. Leech had seen, and we have seen no others.

! Augiades brahma. (Plate XXV. fig. 61 *b*.)

Pamphila brahma, Moore, P. Z. S. 1878, p. 691, pl. xlv. fig. 8.
Telicota brahma, Watson, Hesp. Ind. p. 57.

Hab. Masuri, N.W. Himalayas (*Lang*); Kumaon (*Ramsay*); Fort White, Chin hills, 7000 ft. (*fide de Nicéville*).

The differences between *A. siva* and *brahma*, as given in the table, are well marked and constant; therefore the occurrence of the latter species in the Chin hills, where *A. siva* would be expected, is very curious.

! Augiades crateis. (Plate XXV. fig. 61 *a*.)

Augiades crateis, Leech, Butt. China &c. p. 603, pl. xli. figs. 9 ♀, 11 ♂ (1893–94).

Differs from *A. brahma*, Moore, in being larger, darker, and more strongly marked, especially on the hind wing below, and in the male genitalia; both have the whitish line on the black sex-mark in the male.

Hab. Omei-shan, Chia-kou-ho (*Leech*).

! Augiades ochracea. (Plate XXIV. fig. 60.)

Pamphila ochracea, Bremer, Bull. Acad. Pet. iii. p. 473 (1861); id. Lep. Ost-Sib. p. 33, pl. i. fig. 11 (1864).
Pamphila rickuchina, Butl. Cist. Ent. ii. p. 275 (1878).
Augiades ochracea, Leech, Butt. China &c. p. 605 (1893–94).

Hab. Japan (*Pryer*); Amurland (*Graeser*).

! AUGIADES MAJUSCULA, n. sp. (Plate XIX. fig. 21, ♂; Plate XXV. fig. 61.)

Resembles *A. ochracea* generally, and particularly in the black veining of the hind wing below, but is larger (exp. 41 mm.), and the fore wing has a much straighter termen, and therefore a more pointed appearance. The form of the œdeagus is quite distinct from that of *A. ochracea*, but is not to be distinguished from that of *A. sylvanus*.

Described from two males from China (*Pryer, in coll. Elwes*).

We should not have ventured to separate this species from *ochracea* if it had not been for the marked difference in the œdeagi, which are figured. Elwes obtained the types from a collection made many years ago by the late Mr. Pryer in China, mostly at Shanghai. He found specimens in Mr. Leech's collection marked *herculea*, Butl., which appear to be the same species.

TELICOTA.

Telicota, Moore, Lep. Cey. i. p. 169 (1881); Watson, P. Z. S. 1893, p. 102. Type *augias*, Lin.
Padraona, Moore, t. c. p. 170; Watson, t. c. p. 101. Type *mæsa*, Moore, = *dara*, Koll.

Under this generic name we bring together a number of species which agree well in general appearance and in all important points of structure. Antennæ more than half as long as costa; club gradual, of moderate size; apiculus as long as, or a little longer than the greatest width of the club. Palpi: second joint densely scaled, third joint short, conical, erecto-patent; or second joint laxly scaled, third joint acicular, sub-erect, sometimes almost as long as one-third of the diameter of the eye. Wings without hyaline spots. Basal portion of vein 5 in the fore wing receding from vein 6, vein 5 therefore arising much nearer to vein 4 than to vein 6; vein 5 in the hind wing obsolete. Upperside dark brown or black, with a yellow (fulvous or stramineous) band on each wing; that on the fore wing starts from the middle of the dorsum and runs obliquely outwards to join some pale spots in cells 6–8, it is sometimes broken into spots, and there is also sometimes a pale spot or spots in the cell, or an elongate triangular pale spot next the costa from the base to beyond the middle; the band on the hind wing is submedian, and does not reach the costa or the dorsum, but is in nearly all the species reproduced, outlined in black, on the underside. Tibial epiphysis present; hind tibiæ fringed with long hairs, and having two pairs of spurs.

The species known to us we arrange as follows:—

1 (16). Hind wing: termen distinctly excavate between veins 1 *b* and 2 or 1 *b* and 3, the tornus therefore apparently shortly produced into a rounded lobe.
2 (11). Male with an alar sex-mark.
3 (6). Sex-mark on the fore wing: a streak of androeonia reaching from the middle of vein 2 to the base of vein 4. (TELICOTA proper.)

4 (5). Fore wing above: lower outer angle of the yellow spots in cells 2–4 narrowly produced along the contiguous vein nearly or quite to the termen; terminal dark band brown. Lower apical angle of clasp rounded off, or at most barely evident . . . . . . *augias*, Linn.

5 (4). Fore wing above: lower outer angle of the yellow spots in cells 2–4 not, or but little, produced; terminal dark band black-brown. Lower apical angle of clasp produced into a triangular tooth, or, at least, strongly right-angled . . . . *bambusæ*, Moore.

6 (3). Sex-mark on the hind wing: a tuft of long hairs springing from an otherwise bare pale patch near the middle of cell 7 and the base of cell 6, and directed obliquely inwards and downwards.

7 (8). Fore wing above: no yellow spot in cell 5. Fore wing below brown, the pale band distinct . . . . *prusias*, Feld.

8 (7). Fore wing above with a suffused yellow spot near the middle of cell 5.

9 (10). Hind wing above bright fulvous as far as vein 7, thence to the costa warm dark brown . . . . *insularis*, n. sp.

10 (9). Hind wing above brown, with a broad postmedian yellow band, which nearly reaches the termen and is cut short by vein 6 . . *kuehni*, Plötz.

11 (2). Male without an alar sex-mark.

12 (15). Hind wing below with an irregular pale postmedian macular band outlined with black.

13 (14). Expanse of the male about 40 mm. Yellow band on fore wing narrower; pale spot in cell 2 of fore wing above not reaching the base of that cell; fore wing below with the basal part of the cell blackish. Apex of the tegumen tridentate . . . . *palmarum*, Moore.

14 (13). Expanse of the male about 44 mm. Yellow band on fore wing above broader, basal two-thirds of cell 2 on the fore wing above entirely yellow. Fore wing below with the cell entirely yellow. Apex of tegumen bidentate . . . . *augiades*, Feld.

15 (12). Hind wing below without distinct markings, ochreous brown passing into ochreous on the terminal half . . . . *simplex*, n. sp.

16 (1). Hind wing: termen practically straight (not excavate) between veins 1 *b* and 2 or 1 *b* and 3; tornus not produced.

17 (22). Fore wing above: cell 3 yellow at the extreme base and for about half its length.

18 (21). Pale discal marking on hind wing below band-like.

19 (20). Size larger. Cell of fore wing entirely black . . . . *concinna*, n. sp.

20 (19). Size smaller. Cell of fore wing with a yellow spot near the apex. *gola*, Moore.

21 (18). Pale discal marking on hind wing below subovate . . . . . . *paragola*, de Nicév.

22 (17). Fore wing above: cell 3 black at the extreme base.

23 (28). With a pale spot in each of cells 4 and 5 of the fore wing.

24 (29). Pale markings of the upperside deep yellow, sometimes inclining to fulvous.

25 (26). Male with a sex-mark on the fore wing above. Fore wing above: pale band regular, its inner edge straight. Sex-mark consisting of a dull streak of androconia along the inner edge of the yellow band from the middle of vein 1 *a* to the base of vein 4 . . . *rectifasciata*, n. sp.
26 (25). No sex-mark on the fore wing above in the male; the pale band irregular, broken outwardly at cells 4–5 . . . . *dara*, Koll.
27 (24). Pale markings of the upperside cream-yellow . . . . *dilutior*, n. sp.
28 (23). No pale spot in cells 4 and 5 of the fore wing . . . . *orphitus*, Mab.

!TELICOTA AUGIAS. (Plate XXV. figs. 62, 62 *a.*)

Papilio augias, Linn. Syst. Nat. i. p. 794 (1767).
Telicota augias, Distant, Rhop. Mal. p. 382, pl. xxxiv. fig. 23 (1886); Watson, Hesp. Ind. p. 55 (1891).

The sex-mark in the male is subject to some variation; generally it is broad and continuous, sometimes it is broken up into three pieces, and in a specimen from Menado it is continuous but only about half as wide as usual and its black edging is very narrow and regular.

Hab. Calcutta (*Minchin*); Akyab (*Adamson*); Poona (*Swinhoe*); Andamans, Perak, Pulo Laut, Sambawa (*Doherty*); Nias (*Modigliani*); Java (*Fruhstorfer*); Philippines (*Semper*); Hong-Kong (*Walker*).

!TELICOTA BAMBUSÆ. (Plate XXV. fig 63.)

Pamphila bambusæ, Moore, P. Z. S. 1878, p. 691, pl. xlv. figs. 11, 12 ♂ ♀.
Pamphila pythias, Mabille, Pet. Nouv. ii. p. 234 (1878); id. Ann. Soc. Ent. Belg. xxi. p. (1878).
Telicota bambusæ, Distant, Rhop. Mal. p. 382, pl. xxxv. fig. 12 (1886); Watson, Hesp. Ind. p. 56 (1891).

Pamphila eurotas, Felder [Sitz. Ak. Wiss., Math.-nat. Cl. xl. p. 461, *sep.* p. 14 (1860)], is, judging from a male specimen in the Felder Collection labelled in contemporary handwriting "*Hesp. eurotas*, Feld.," "Amboina," mainly distinguished from *T. bambusæ* by having the postmedian yellow band on the fore wing above only half as wide, narrowed towards the apex and only reaching just beyond vein 5.

Hab. Nilgiris (*Hampson*); Sikkim (*Möller*); Calcutta (*Minchin*); Assam, E. Pegu, Perak, Arjuno, Java, Bali (*Doherty*); Java (*Fruhstorfer*); Kina Balu (*Waterstradt*); Mt. Mulu, N. Borneo (*Hose*).

!TELICOTA PRUSIAS. (Plate XIX. fig. 14, ♂.)

Pamphila prusias, Felder, Sitz. Ak. Wiss., Math.-nat. Cl. xliii. p. 44 (1861).

In a female of this species sent by Semper the underside exactly agrees with that of the male, but is a little paler, thus differing from a specimen sent by Staudinger as the female of *T. prusias*, in which the hind wing below bears a sharply defined postmedian macular pale band between veins 1 *b* and 6.

Hab. Celebes (*coll. Stgr.*); Palawan (*Platen, Everett*); Philippines (*Semper*).

! TELICOTA INSULARIS, n. sp. (Plate XIX. figs. 26 ♂, 27 ♀.)

♂. Upperside: fore wing blackish brown; a broad fulvous postmedian band from the dorsum nearly parallel with the termen as far as the end of the cell, recurved from thence to the costa, a streak along the basal half of the costa and two streaks in the cell, the upper one occupying its entire length, the lower one only half as long, also fulvous: hind wing fulvous, the costal region as far as vein 6 and a little beyond that vein on the inner two-thirds of the wing black; a suffused anteciliary black line in cells 5–2, expanding in cell 1 *b* into a suffused spot; cells 1 and 1 *a* blackish; a tuft of long hairs springing from an otherwise bare pale patch near the middle of cell 7 and the base of cell 6 and directed obliquely inwards and downwards. Underside: fore wing yellowish red-brown, passing into yellow on the dorsum; basal half as far upwards as the cell black, the black portion bearing an oblong bare pale spot from the dorsum as far as the base of vein 2; a fine anteciliary line and the veins blackish; fringe deep yellow, the short scales blackish grey from the apex as far as vein 1 *a*: hind wing yellowish red-brown, brownish yellow from vein 2 to the dorsum, a fine anteciliary black line from the apex to vein 2; fringe deep yellow. Palpi clothed with yellow scales intermixed with black. Clothing of body above fulvous. Antennæ blackish, club pale beneath.

♀. Upperside: fore wing yellow-brown, pale markings as in the male but yellow rather than fulvous and the postmedian band narrower: hind wing yellow-brown, with a broad suffused median yellow band passing from the apex of cells 4–5 towards the dorsum; basal region clothed with long yellow hairs. Underside: fore wing as in the male, but the dark basal portion is blackish only and bears no pale patch, the dorsum as far as vein 1 *a* dusky; hind wing as in the male, but less strongly tinged with red.

A very distinct species, which comes nearest to *T. prusias.*

Expanse 42 mm.

Hab. Pulo Laut (*Doherty*). Types in coll. Elwes.

TELICOTA KUEHNI.

Hesperia kuehni, Plötz, Stett. ent. Zeit. xlvii. p. 101 (1886).
Padraona kuehni, Semper, Schmett. Philipp. p. 302 (1892).

Hab. Luzon (*Semper*); E. Celebes (*in coll. Godman & Salvin*).

! TELICOTA PALMARUM. (Plate XXV. figs. 64, 64 *a*.)

Pamphila palmarum, Moore, P. Z. S. 1878, p. 690, pl. xlv. figs. 6, 7, ♂ ♀.
Hesperia chrysozona, Plötz, Stett. ent. Zeit. xliv. p. 228 (1883).
Pamphila augiades, var. *bambusæ,* Staudinger, Iris, ii. pp. 144, 165 (1889).
Padraona palmarum, Watson, Hesp. Ind. p. 60 (1891).
Padraona chrysozona, Semper, Schmett. Philipp. p. 301, pl. xlix. figs. 13 ♂, 14 ♀, pl. B. fig. 11, larva (as *Telicota bambusæ*) (1892).

Hab. Calcutta (*de Nicéville*); Upper Assam (*Doherty*); Khasias (*Hamilton*); Java (*Piepers*); Luzon, Mindoro, Negros, Bohol, Mindanao (*Semper*); Palawan, Bunguran, Natuna Is. (*Everett*); Bukan, N. Borneo (*in coll. Rothschild*).

! TELICOTA AUGIADES. (Plate XXV. figs. 65, 65 *a.*)

Pamphila augiades, Felder, Sitzb. Ak. Wiss., Math.-nat. Cl. xl. p. 461 (1860).
Hesperia augiades, Felder, Reise Nov., Lep. iii. pl. lxxii. fig. 5 (1867).
♀ = *Hesperia acalle,* Hopf. Stett. ent. Zeit. 1874, p. 41.

Hab. Amboyna (*Felder*); Batavia (*ex coll. Snellen*). We are unable to give any characters by which the females of *T. palmarum* and *T. augiades* can be distinguished.

TELICOTA SIMPLEX, n. sp. (Plate XIX. fig. 15, ♂.)

♂. Upperside resembling that of *T. insularis,* save that the yellow streaks next the costa of the fore wing are less strongly developed, and in this respect it resembles *T. prusias*; no sexual tuft of hairs near the base of the costa of the hind wing. Fore wing below resembling that of *T. insularis,* but wanting the pale denuded patch near the middle of cell 1 *a,* which is correlated with the tuft of hairs on the upperside of the hind wing. Hind wing below ochreous brown, passing into ochreous near the middle.

Expanse 40 mm.

Hab. N. Celebes (*coll. Stgr.*). Type in coll. Staudinger.

Described from a single specimen from Minahassa sent by Staudinger as *kuehni,* Plötz. The latter species, however, according to a specimen received under that name from Semper, has in the male a sex-mark as in *prusias* and *insularis,* and the yellow colouring on the hind wing above is in the form of a distinct band, as stated in the original description.

! TELICOTA CONCINNA, n. sp. (Plate XXI. fig. 20, ♂; Plate XXV. figs. 67, *a, b.*)

♂. Differs from *gola,* Moore, in its larger size and the want of any yellow spot in the cell of the fore wing. Tegumen in the lateral aspect regularly decurved. In *gola* the tegumen in the lateral aspect is sinuate.

Expanse 28 mm.

Hab. Nilgiris (*Davison, Hampson*).

Described from two specimens in coll. Elwes.

! TELICOTA GOLA. (Plate XXV. figs. 66, *a, b.*)

Padraona gola, Moore, P. Z. S. 1877, pl. lviii. fig. 9, ♂; Leech, Butt. China, &c. p. 598, pl. x. fig. 12, ♂ (1892–94); Watson, Hesp. Ind. p. 59 (1891).
Padraona goloides, Moore, Lep. Cey. i. p. 171, pl. lxxi. figs. 3, 3 *a* (1880–81); Watson, Hesp. Ind. p. 601 (1891).
Telicota goloides, Distant, Rhop. Mal. p. 382, pl. xxxv. fig. 13, ♂ (1886).

Pamphila akar, Mabille, Comptes Rendus Soc. Ent. Belg. iii. no. 31, pl. lxxi. (1883).
Pamphila goloides, var. *akar*, Staudinger, Iris, ii. p. 146 (1889).
Padraona akar, Semper, Schmett. Philipp. p. 303, pl. xlix. fig. 16, ♂ (1892).

Hab. Nilgiris (*Hampson*); Ceylon (*Green*); Khasias (*Hamilton*); Andamans, Perak, Java, Bali, Sambawa, Pulo Laut (*Doherty*); Luzon, Guimaras, Camotes, Mindanao (*Semper*); Palawan, Kina Balu, Borneo (*Staudinger*); Nias (*Modigliani*).

TELICOTA PARAGOLA.

Padraona paragola, de Nicéville, Jour. As. Soc. Beng. 1895, p. 546.

Hab. N.E. Sumatra (*de Nicéville & Martin*); W. Borneo (*ex coll. Staudinger*).

Size of *T. gola*, but very distinct on the hind wing below, which is dark yellow-brow by reason of a sprinkling of yellow scales on a blackish ground and has a sharply defined subovate yellow discal patch.

We know this species only from a specimen sent by Staudinger which agrees with de Nicéville's description.

! TELICOTA RECTIFASCIATA, n. sp. (Plate XXI. fig. 17, ♂; Plate XXV. figs. 68, 68 *a*.)

♂. Differs from *dara*, Koll., in the following points:—Fore wing above: inner edge of the oblique pale band straight, bounded inwardly by a broad stripe of dull brown modified scales reaching from near the middle of vein 1 *a* to the base of vein 4; in *dara*, Koll., the inner edge of the pale band is irregular because the bases of the spots in cells 2 and 3 project inwardly out of line with the bases of the others forming the band.

Expanse 28–31 mm.

Described from three male specimens, one from Sikkim (*Möller*) and two from East Pegu (*Doherty*). We have not yet been able to identify the female of this species.

! TELICOTA DARA. (Plate XXV. figs. 69, 69 *a*.)

Hesperia dara, Kollar, Hügel's Kaschmir, vol. iv. p. 455 (1848).
Pamphila mæsa, Moore, P. Z. S. 1865, p. 509, pl. xxv. fig. 9.
Pamphila flava, Murray, Ent. Mo. Mag. xii. p. 4 (1875).
Pamphila nitida, Mabille, Pet. Nouv. ii. p. 114 (1877).
Pamphila taxilus, Mabille, Ann. Soc. Ent. Belg. xxi. p. (1878).
Pamphila trachala, Mabille, Pet. Nouv. ii. p. 237 (1878).
Pamphila mæsoides, Butler, Trans. Linn. Soc. Lond. ser. 2, Zool. vol. i. p. 554 (1879).
Padraona mæsoides, Moore, Lep. Cey. i. p. 171, pl. lxxi. figs. 5, 5 *a* (1881).
Telicota mæsoides, Distant, Rhop. Mal. p. 383, pl. xxxiv. fig. 24 (1886).
Padraona pseudomæsa, Moore, Lep. Cey. i. p. 170 (1881).
Padraona dara, Watson, Hesp. Ind. p. 57 (1891); Leech, Butt. China, &c. p. 596, pl. xl. figs. 13, 14, vars.
Pamphila hetærus, Mabille, Comptes Rendus Soc. Ent. Belg. iii. no. 31, p. lxxii (1883); Staudinger, Iris, ii. p. 145 (1889).
Padraona hetærus, Semper, Schmett. Philipp. p. 303, pl. xlix. fig. 15, ♀ (1892).

Pamphila zebra, Mabille, *sec. spec. comm.*
? *Pamphila sunias*, Felder, Sitzb. Ak. Wiss., Math.-nat. Cl. xl. p. 462, *sep.* p. 15 (1860).

This species varies much, in size, in the ground-colour of the hind wing below, and in the size of the spots which form the pale markings on the upperside. The pale spot in cell 6 on the hind wing below is absent or but feebly developed in certain males from Pulo Laut, Nias, Java, and Perak; in females from Pulo Laut and Nias, otherwise similar to the males last mentioned, this spot is present, but a female from Perak exactly resembles males from the same locality in wanting that spot.

This species seems to have a wider range and to be more generally abundant than any other Eastern Hesperid.

Elwes's collection contains forty-six males and thirty-six females from almost every part of tropical Asia, including Japan. Edwards has examined the genitalia of no less than fifteen specimens from various localities and finds considerable variation in degree, but no differences which can be treated as specific.

The five specimens now standing in the Felder collection as "*Pamphila sunias*" clearly do not belong to the species described by Felder under that name, for he says of the hind wing below "atomis nigris fasciam cingentibus." Of the specimens in question four are labelled "*Amboina*" and one, a male, "*Amboina, Doleschall.*" The latter agrees exactly with a specimen from Celebes sent by Dr. Staudinger as *Pamphila prusias*, Felder; the other three males are only distinguishable from the specimen last mentioned by the narrower pale band on the fore wing above (the pale spot in cell 2 reaches to about the half length of vein 2); the remaining specimen, a female, appears to be properly associated with the narrow-banded males, as the band on the fore wing above is not so wide as one would expect to find in the female of *T. prusias* having regard to the width of it in the male of that species.

Hab. N.W. Himalaya (*Young*); Sikkim (*Möller*, *Elwes*); Khasias (*Elwes*); Nagas, E. Pegu, Perak, Pulo Laut, Sambawa, Arjuno, Java, Bali (*Doherty*); Ceylon (*Mackwood*); Nias (*Modigliani*); Hong Kong (*Pryer*); Andamans (*de Roepstorff*); Java (*Piepers*); Philippines (*Semper*); Kina Balu (*Waterstradt*); Japan (*Pryer*); C. China (*Pratt*).

! TELICOTA DILUTIOR, n. sp. (Plate XXI. fig. 21, ♂.)

♂ ♀. Differs from *dara*, Koll., in the following points:—Pale markings of the upperside of a cream- or straw-yellow, the spots of which they are composed reduced in size; ground-colour of the hind wing below dark yellowish green, owing to the sparse clothing of yellow scales on the black parts.

Expanse 30–31 mm.

This species seems constantly different from any form of *dara*.

Described from several specimens, including three males and three females, from Pulo Laut (*Doherty*). Types in coll. Elwes.

Hab. Pulo Laut, Labuan, Kina Balu, Borneo (*Waterstradt*); N. Borneo (*Everett*).

! TELICOTA ORPHITUS.

Pamphila orphitus, Mabille, C. R. Ent. Belg. xxvii. p. lxxiv (1883).
Padraona pavor, de Nicéville, Jour. As. Soc. Beng. 1894, p. 53, pl. iv. fig. 8, ♂.

In the male of this species there are three tracts of androconia on the fore wing above, namely, a streak in cell 1 *a* next vein 1 *a* and occupying about the middle third of the latter, a roundish patch near the middle of vein 2 divided by that vein into two nearly equal parts, and a short streak in cell 2 next the base of vein 3.

Hab. N.E. Sumatra (*Martin*); Java (*fide Mabille*).

TELICOTA PHILÆNUS.

Pamphila philænus, Mabille, C. R. Ent. Belg. xxvii. p. lxxiii (1883).

Somewhat smaller than *T. orphitus,* Mab., which it resembles on the upperside, save that there are yellow spots in cells 4 and 5 of the fore wing and a yellow spot in cell 6 of the hind wing, which is half as large as that in cells 4–5, of which it adjoins the outer half; the hind wing below is unmarked pale ochreous, and there is on vein 2 of the fore wing above near its middle an oblong patch of androconia bounded above and below by a slight folding of the wing-membrane.

Hab. Malaysia (*fide Mabille*).

TELICOTA MARNAS.

Pamphila marnas, Felder, Sitzb. Ak. Wiss., Math.-nat. Cl. xl. p. 462, *sep.* p. 15 (1860).

The following particulars are taken from a male specimen in the Felder collection labelled in contemporary handwriting "*Hesp. marnas,* Feld.", "Amboina, Doleschall":—

♂. Upperside: fore wing brown, with the basal half of the costa, a geminate cell-spot continued towards the base and having its upper part extended for about half its length beyond the lower part, a streak in cell 1 *a* adjoining vein 1 *a* as far as the sex-mark, a streak along the basal two-thirds of the dorsum, an oblique postmedian band from vein 1 *a* to vein 4, a subquadrate spot near the apical third of cell 4, a smaller spot near the apical fourth of cell 5, and an oblong spot in each of cells 6, 7, and 8, deep yellow or fulvous; sex-mark an irregular line of pale brown androconia running from vein 1 *a* near the middle to vein 4 near the base, and separated from the inner edge of the postmedian band by an irregular linear tract of brown; hind wing brown; a few scales and the pubescence near the base, a broad irregular postmedian band reaching from vein 1 *b* to vein 6, and the indication of a spot near the apical third of cell 6 fulvous. Underside: fore wing as on the upperside save that the cell-spot is not continued towards the base, the streaks in cell 1 *a* and next the dorsum are wanting, and the spots in cells 5 to 8 are more strongly developed; fringe fuscous, passing into yellow at the tornus; hind wing brown, closely sprinkled with yellow scales, the pale markings as on the upperside save that there is a round yellow spot in the cell near the base of vein 6, and the pale spot in cell 6 is more strongly developed, reaching nearly to vein 7; fringe fuscous, yellow from the tornus to vein 2. Wing-length 14 mm.

HALPE.

Halpe, Moore, P. Z. S. 1878, p. 689; Watson, op. cit. 1893, p. 108.

Species of moderate or small size, brown or grey-brown above; fore wing with hyaline spots, but not one in cell 4; no hyaline spots in hind wing except in *H. submacula*, Leech. Antennæ longer than half the costa; club slender; length of the apiculus about twice the width of the club. Third joint of palpi short, porrect, nearly concealed. Fore wing: basal portion of vein 5 receding from vein 6, vein 5 therefore arising much nearer to vein 4 than to vein 6; or vein 5 straight, arising very little nearer vein 4 than vein 6, its basal portion not receding from vein 6; vein 2 from near the half-length of the cell (except in *separata*, *blanchardi*, and *subflava*, where it arises from the apical third of the lower margin of the cell); termen generally shorter than the dorsum. Hind wing: vein 5 nearly obsolete; in the males vein 7 is abruptly bent upwards at the base, and at the same point there is a corresponding deflexion of the upper margin of the cell, so that the whole subcostal vein of the hind wing forms a figure resembling a tuning-fork; the latter structure is correlated to a discal sex-mark on the fore wing and is found in a few other genera. Tibial epiphysis present; hind tibiæ with two pairs of spurs.

Sex-mark on the fore wing of the male a broad ridge of modified scales passing obliquely from below the basal third of vein 1 *a* to the base of vein 3; in structure this sex-mark consists of two large corneous pits filled with yellow flocculent hairs and covered with broad modified scales; vein 1 *a* is abruptly angulate before the middle.

The sex-mark is wanting in *H. astigmata*, Swinh., and *H. hieron*, de Nicév.

The following table includes all the species that we have been able to examine critically. The species of this genus can rarely be identified with certainty from figures:—

Males.

1 (58). Disc of hind wing above not occupied by a large suffused or well-defined yellow spot traversed by the brown veins.
2 (57). Hind wing below without silvery stripes.
3 (56). Clothing of breast and palpi not pure white.
4 (23). Club of antennæ banded with white on the upperside next to the apiculus.
5 (22). Hind wing without hyaline spots.
6 (9). Hind wing below with a sharply defined white median band running from the apex of cell 7 to the middle of cell 1 *b*, where it is abbreviated.
(8). Fore wing: pale spot in cell 2 about one-third as long as that cell. *zema*, Hew
8 (7). Fore wing: pale spot in cell 2 about one-sixth as long as that cell. *ormenes*, Weym.
9 (6). Hind wing below not as in paragraph 6.
10 (13). Hind wing below with a pale spot near the base of cell 7.

11 (12). Hind wing below with a more or less prominent white macular median band; white spot at the base of cell 7 conspicuous . . *cerata*, Hew.

12 (11). Hind wing below without a macular median band; white spot at the base of cell 7 inconspicuous; a suffused stramineous spot near the apical third of cell 1 *b*, a minute pure white spot in each of cells 2, 3, 4, 5, and 6, those in cell 3, 4, and 5 very minute and sometimes wanting. No sex-mark on fore wing above . *astigmata*, Swinh.

13 (10). No pale spot in the base of cell 7 on hind wing below.

14 (15). Fringe of hind wing pure white . . . . *insignis*, Dist.

15 (14). Fringe of hind wing not pure white.

16 (17). Fore wing above: pale spot in the cell geminate . . . . . . *hyrie*, de Nicév.

17 (16). Fore wing above: pale spot in the cell single, next the upper edge of the cell, at most with a punctiform pale spot below it.

18 (21). Fringe of the fore wing beneath whitish or chequered.

19 (20). Cell-spot in fore wing single, next the upper edge of the cell. Termen of the hind wing continuously rounded, the tornus consequently not appearing to be produced; the fringe pale brownish grey . . . . *kumara*, de Nicév.

20 (19). Cell-spot in the fore wing with a pale point next its lower edge. Termen of the hind wing somewhat straightened between veins 4 and 1 *b*, the tornus therefore appearing somewhat produced; the fringe white with the short scales brown. . . . . . . *knyvetti*, n. sp.

21 (18). Fringe of the fore wing beneath grey-brown, concolorous with the wing . . . . *fasciata*, n. sp.

22 (5). Hind wing with three hyaline spots . . . . *submacula*, Leech.

23 (4). Club of antennæ not banded with white on the upperside next the apiculus.

24 (51). Vein 2 of fore wing arising near the half-length of the cell.

25 (50). Hind wing below normally with markings.

26 (43). Pale pattern of hind wing below consisting of a straight oblique discal band and a more or less distinct subterminal band of suffused spots, the latter arising in a pale spot near the apical third of cell 1 *b* and becoming gradually obsolescent towards the apex. This pattern is frequently almost obsolete, but it is always possible to trace its relationship to the typical pattern as displayed in a well-marked example of *homolea*.

27 (30). Hind wing below: discal band sharply defined.

28 (29). Discal band on the hind wing below white, appearing on the upperside as an indistinct suffused pale patch . . . . . . *moorei*, Wats.

29 (28). Discal band on the hind wing below yellowish white, not appearing on the upperside . . . . *ceylonica*, Moore.

30 (27). Hind wing below: discal band suffused or obsolescent.

31 (42). Hind wing below with the pattern at least traceable.

32 (35). Hind wing below with the basal half of cells 4–5 stramineous.

33 (34). Size larger: a pale spot in cell 8 of fore wing above; long hairs on the disc of hind wing above brown . . . . *nephele*, Leech.

34 (33). Size smaller: no pale spot in cell 8 of fore wing above; disc of hind wing above conspicuously clothed with long grey hairs. . *sulphurifera*, H.-S.

35 (32). Hind wing below: basal half of cells 4–5 not stramineous, or if so the limits of the pale colour not sharply defined.

36 (37). Expanse 36 mm. *majuscula*, n. sp.

37 (36). Expanse about 30 mm.

38 (41). Fore wing: hyaline spot in cell 2 not crescent-shaped, generally oblong and straight-sided; ground-colour of the underside grey-brown.

39 (40). Fore wing below: fringe grey, not distinctly chequered; side horns of tegumen falcate, pointed, reaching about halfway to the apex. *sikkima*, Moore.

40 (39). Fore wing below: fringe whitish, distinctly chequered, at least next veins 2 and 3; side horns of tegumen nearly straight, reaching nearly to the apex, their apex rather obliquely truncate with the angles produced . . . . *homolea*, Hew.

41 (38). Hyaline spot in cell 2 of fore wing small and crescent-shaped; ground-colour of underside vinous brown . . . . *brunnea*, Moore.

42 (31). Hind wing below brown with a sprinkling of grey scales, the latter so arranged as very faintly to indicate subterminal and discal bands. Apex of tegumen, in the dorsal aspect, consisting of two broadly falcate incurved connivent teeth . . . . . *fusca*, Elwes.

43 (26). No pale discal band on the hind wing below, the pale markings there consisting of more or less distinct spots.

44 (45). Hind wing below ochreous brown, with a conspicuous white punctiform spot in each of cells 2 and 3 . . . . *sitala*, de Nicév.

45 (44). Hind wing below normally with a pale spot in each of cells 2, 3, and 6.

46 (47). Hind wing below brown, more or less closely covered with sulphureous scales[1] and thus appearing yellow or greenish yellow with brown veins . . . . *varia*, Murr.

47 (46). Hind wing below with the veins concolorous.

48 (49). Hind wing below closely sprinkled with grey scales and thus appearing greenish brown; a faint grey spot in cells 2, 3, and 6. *gupta*, de Nicév.

49 (48). Hind wing below closely sprinkled with ochreous scales and thus appearing greenish ochreous; an indistinct pale spot in each of cells 2, 3, and 6, and a suffused subterminal macular pale band. *debilis*, n. sp.

50 (25). Hind wing below without markings . . . . *aina*, de Nicév.

51 (24). Vein 2 of fore wing from the apical third of the lower edge of the cell.

52 (53). Hind wing below dull brownish green without markings . . . *separata*, Moore.

53 (52). Hind wing below with markings.

54 (55). Hind wing below brown, closely covered with ochreous scales, which form an indistinct suffused subterminal macular band . *blanchardi*, Mab.

55 (54). Hind wing below bright yellow, with a small black spot in each of cells 2, 3, and 7, and a blackish stripe in cell 1 *b* . . . . . *subflava*, Leech.

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[1] Sometimes there is little or no yellow scaling on the hind wing below, which is then greenish brown with three pale spots.

56 (3). Clothing of breast and palpi pure white . . . . *albipectus,* de Nicév.
57 (2). Hind wing below with silvery markings, namely a spot in the base of cell 7, a stripe occupying the whole of cell 6, a stripe occupying the basal two-thirds of cell 3, and a small oblong spot near the apical third of cell 2 . . . . *bivitta,* Ob.
58 (1). Disc of hind wing above with a large suffused or well-defined yellow patch traversed by the brown veins.
59 (60). Basal portion of vein 5 in the fore wing receding from vein 6, vein 5 therefore arising much nearer to vein 4 than to vein 6. A sex-mark on the fore wing above . . . . *decorata,* Moore.
60 (59). Vein 5 in the fore wing straight, arising very little nearer to vein 4 than to vein 6, its basal portion not receding from vein 6. No sex-mark on the fore wing above.
61 (62). Disc of hind wing above with one or more sharply defined yellow spots, of which that next the transverse vein is the largest and strongest . . . . *masoni,* Moore.
62 (61). Disc of hind wing above yellow, that colour suffused with the brown colour of the termen . . . . *honorei,* de Nicév.

! HALPE ZEMA.

Hesperia zema, Hewitson, Ann. & Mag. Nat. Hist. (4) xix. p. 77 (1877).
Halpe zema, Elwes, Trans. Ent. Soc. Lond. 1888, p. 455, pl. xi. fig. 7, ♂; Watson, Hesp. Ind. p. 74 (1891).
Hesperia ormenes, Plötz, Stett. ent. Zeit. 1886, p. 92; Weymer, t. c. 1887, p. 16, pl. ii. fig. 6.

Of *H. ormenes,* Weymer, described from Nias, I have two doubtful specimens from Pulo Laut and one from Bali which differ from *zema* only in the smaller size of the spots on fore wing. As, however, a Tavoy specimen is intermediate in this respect and a specimen in coll. Staudinger from Borneo is nearer to *zema* than to *ormenes,* we prefer to treat is as an inconstant variety of *zema.*

Hab. Sikkim (*Elwes, Möller*); Nagas (*Doherty*); Ataran Valley, Tavoy (*Tucker*); Borneo (*coll. Stgr.*); Pulo Laut, Bali (*Doherty*).

! HALPE CERATA.

Hesperia cerata, Hewitson, Ent. Mo. Mag. 1876, p. 152.
Halpe cerata, Elwes, Trans. Ent. Soc. Lond. 1888, p. 454, pl. xi. fig. 8, ♂; Watson, Hesp. Ind. p. 73.

Hab. Sikkim (*Möller*); Bhamo, Burmah (*in coll. Stgr.*); ? Philippine Islands (*Rössler, ex coll. Snellen,* as *sulphurifera,* H.-S.).

! HALPE ASTIGMATA.

Parnara astigmata, Swinhoe, Ann. & Mag. Nat. Hist. (6) v. p. 363 (1890).

♂. No sex-mark on the fore wing above. Upperside dark brown, with a purple shade on the fore wing; the latter with five hyaline spots, one, geminate, in the cell, and one each in cells 2, 3, 6, and 7, the last-named punctiform. Underside dark brown : fore wing with the hyaline spots as on the upperside and a very minute white spot in cell 8, a pale suffused macular subterminal band faintly indicated; hind wing a little warmer in colour than the fore wing by reason of a sprinkling of yellowish-grey scales, an inconspicuous white spot at the base of cell 7, a suffused stramineous spot near the apical third of cell 1 *b*, and a minute pure white spot in each of cells 2, 3, 4, 5, and 6, those in cells 3, 4, and 5 very minute and sometimes wanting, a pale suffused submarginal band faintly indicated. Fringes whitish grey, chequered with brown next the ends of the veins. Body and legs concolorous with the wings; palpi somewhat lighter, the second joint being clothed with ochreous and black scales intermixed. Antennæ above dark brown, conspicuously banded with white next the base of the pale red apiculus, spotted with white in front; club beneath pale ochreous.

The above description was written before we knew that the insect had been already described, and we therefore print it in the hope that it may prove useful to some who may not have ready access to the original description.

Hab. Nilgiri hills (*Hampson*).

HALPE INSIGNIS.

Baoris ? insignis, Distant, Rhop. Mal. p. 391, pl. xxxv. fig. 22 (1886).

Hab. Singapore (type); Tandjong Djatti, Sumatra (*Martin*). Type in coll. Rothschild

! HALPE HYRIE.

Halpe hyrie, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1891, p. 388, pl. G. fig. 34, ♂.

Hab. Naga hills (*Doherty*).

! HALPE KUMARA.

Halpe kumara, de Nicéville, Jour. As. Soc. Beng. 1885, p. 121, pl. ii. fig. 10, ♂ ; Watson, Hesp. Ind. p. 72.

Hab. Sikkim (*Möller*).

! HALPE KNYVETTI, n. sp. (Plate XXI. fig. 2, ♂.)

Besides the characters given in the table above this species has the hind wing below yellow-brown by reason of a close sprinkling of yellow scales on a brown ground: in one specimen there is a faint indication of a tendency to the pattern on the hind wing below found in *H. homolea* and its allies, in a suffused yellow spot near the apical third of cell 1 *b* preceded by traces of a dark postmedian macular band; in the other specimen the hind wing below is somewhat paler along the course of vein 1 *b*, but is otherwise unmarked. *H. knyvetti* may, however, be distinguished from any member of the *homolea* group by the white band on the upperside of the club of its antennæ next the apiculus.

Expanse 40 mm.

Described from two males from Sikkim in Elwes collection.

This species is undoubtedly close to *kumara*, of which I have but one specimen, but it seems sufficiently distinct.

Halpe fasciata, n. sp. (Plate XXI. fig. 7, ♀.)

♀. Upperside dark brown; fore wing with five white spots, one quadrate in cell 2, one subquadrate or roundish in cell 3, one (subquadrate or roundish) in each of cells 6 and 7, and one very small and indistinct next the upper edge of the cell. Underside grey-brown: fore wing somewhat darker on the disc, the white spots as on the upperside and a subterminal row of indistinct suffused whitish spots; hind wing with a subterminal row of indistinct suffused whitish spots. Fringe of the fore wing grey-brown concolorous with the wing, of the hind wing similar but indistinctly spotted with whitish. Antennæ above black with a white band next the apiculus, underside spotted with white. Body above dark brown, clothing of the breast and legs grey; abdomen beneath blackish, hind margin of the segments with a narrow indistinct pale band.

Expanse 33 mm.

Hab. Kina Balu, Borneo (*Waterstradt*).

Described from one example ex coll. Staudinger. Of the species known to us this species comes nearest to *kumara* and *knyvetti*, but it is in our judgment distinct from either. The close yellow scaling of the hind wing and the extra-discal portion of the fore wing on the underside so conspicuous in those two species is wanting in the specimen before us, but this may possibly be due to abrasion.

Halpe lucasii.

Hesperilla lucasii, Mabille, Ann. Soc. Ent. Fr. 1876, p. cliii.
Halpe lucasi, Leech, Butt. China, &c. p. 624 (1894).

We have not seen this species, but, according to Mr. Leech, it is allied to *H. kumara*, from which it differs in having a double spot in the cell of the fore wing, a more elongate hind wing, and a central series of four black spots on the hind wing below.

Hab. Moupin (*David*).

Halpe cænis.

Halpe cænis, Leech, Butt. China, &c. p. 625, pl. xlii. fig. 16, ♂ (1894).

Of this species, which was described from one male specimen taken in Western China at Chia-kou-ho in August, we transcribe the original description:—

"Blackish brown, clothed about the base of primaries and disc of secondaries with fulvous hairs. Sexual brand well defined; there are six white spots on primaries placed as in *H. varia*, Murray, but that at end of cell is double. Under surface of primaries fuliginous, much suffused with ochreous brown about costa and apex; spots as above: secondaries ochreous brown, with very faint indications of white central spots. Fringes whitish above, greyish beneath with faint chequering. Antennæ black above, ringed beneath with yellow; club yellow beneath, tipped with castaneous.

"Expanse 40 millim."

The figure of this species greatly resembles *H. kumara*, but differs in its larger size and in having the hind wing narrowed towards the tornus.

Hab. W. China (*coll. Leech*).

! HALPE SUBMACULA.

Halpe submacula, Leech, Entomologist, xxiii. p. 48 (1890); id. Butt. China, &c. p. 622, pl. xlii. fig. 13, ♂ (1894).

Hab. Central China (*Pratt*).

This is a very distinct species on account of the three large spots on the hind wing above.

HALPE BETURIA. (Plate XXI. fig. 13.)

Hesperia beturia, Hewitson, Descr. Hesp. p. 36 (1868).
Halpe beturia, Watson, P. Z. S. 1893, p. 110.

According to Watson this species "differs from *moorei* in having only four spots on the upperside in the male, two discal and two subapical, and the fringe is unicolorous throughout; in what appears to be the female there is an additional minute subapical spot, a minute indistinct spot at upper angle of cell, and the usual spot peculiar to the female on the submedian. On the underside of the hind wing all the spots are much diffused and irrorated with yellow. It is also a considerably larger insect, the male expanding 42 mm. and the female 43 mm."

Hab. Celebes (*fide Hewitson*).

We take this opportunity of figuring the type specimen in the British Museum.

! HALPE MOOREI.

Halpe moorei, Watson, P. Z. S. 1893, p. 109.
Halpe beturia, auct. *nec* Hew.
Halpe teliga, Swinhoe, Trans. Ent. Soc. Lond. 1893, p. 326.

Hab. Calcutta (*de Nicéville*); Khasia (*fide Swinhoe*); Trichinopoly (*Castets*); Burmah (*Watson, Manders*); Andamans (*de Roepstorff*).

! HALPE CEYLONICA.

Halpe ceylonica, Moore, P. Z. S. 1878, p. 690, pl. xlv. fig. 9.

Hab. Nilgiri hills (*Hampson*); Ceylon (*fide Moore*).

! Halpe nephele.

Halpe nephele, Leech, Butt. China, &c. p. 622, pl. xlii. fig. 15, ♂ (1894).

Hab. Western China (*Leech*).

Halpe majuscula, n. sp. (Plate XXI. fig. 6, ♂.)

♂. Upperside brown: fore wing with the usual *Halpe* sex-mark and four sordid yellowish hyaline spots, one each near the base of cells 2 and 3, and one (small and roundish or subquadrate) in each of cells 6 and 7. Underside grey-brown: fore wing with the pale spots as on the upperside and a narrow feeble, suffused, macular subterminal band; hind wing with a broad suffused macular median band and a subterminal band of about four suffused pale spots, of which the one near the apical third of cell 1 *b* is more than twice as large as the others. Fringe of the fore wing grey-brown, of the hind wing dark grey with the short scales grey-brown. Body above brown, breast and legs with grey clothing; abdomen beneath blackish, hind margins of the segments with a band of grey scales. Antennæ above dark brown, spotted beneath with yellowish grey; club yellowish grey beneath; apiculus pale red on the underside.

This species is very like *H. nephele*, Leech, but the markings on the hind wing below are paler and more suffused.

Expanse 36 mm.

Hab. Minahassa.

Described from one example ex coll. Staudinger.

! Halpe sulphurifera.

Cobalus sulphurifera, Herrich-Schäffer, Prod. Syst. Lep. iii. p. 82 (1867).
? *Hesperilla luteisquama*, Mabille, Bull. Soc. Ent. Fr. 1876, p. cxcix.
Halpe sulphurifera, Semper, Schmett. Philipp. p. 305 (1892).

A specimen of *H. luteisquama* sent by M. Mabille has cell 1 *a* on the fore wing below entirely brown; in Philippine specimens of *H. sulphurifera* this cell is crossed near the middle by an oblique white spot, which reaches from vein 1 *a* to vein 2, and is constricted near the middle in the female, but is less developed and scarcely reaches vein 2 in the male. It may be a distinct species.

Hab. Luzon, Mindoro, Guimaras, Bohol, Leyte, Sulu I. (*Semper*); Moupin (*fide Mabille*).

! Halpe sikkima. (Plate XXV. fig. 70.)

Halpe sikkima, Moore, P. Z. S. 1882, p. 407; Watson, Hesp. Ind. p. 70 (1891).
Pamphila homolea, var. *palawea*, Staudinger, Iris, ii. pp. 144, 165 (1889).
Halpe palawea, Semper, Schmett. Philipp. p. 358 (1892).

Judging from a specimen sent by Semper *palawea* is certainly not separable as a species from *sikkima*, of which the type is in Elwes's collection.

A specimen from Kina Balu, Borneo, sent by Staudinger, only differs from a specimen from East Pegu in wanting the pale spot in cell 7 of the fore wing.

Hab. Sikkim (*Elwes*); Nagas, E. Pegu (*Doherty*); Palawan (*Platen*).

! HALPE HOMOLEA. (Plate XXV. fig. 71.)

Hesperia homolea, Hewitson, Descr. Hesp. p. 29 (1868); Watson, Hesp. Ind. p. 71, note (1891).
Halpe sikkima, Elwes, Trans. Ent. Soc. Lond. 1888, p. 453 (in part.), pl. xi. figs. 3, 4, ♂.
Halpe aucma, Swinhoe, Trans. Ent. Soc. Lond. 1893, p. 325, *sec. spec. typ.*
Halpe perara, id. l. c., *sec. spec. typ.*
Halpe marta, id. l. c., *sec. spec. typ.*
Halpe wantona, id. l. c., *sec. spec. typ.*

Hab. Sikkim (*Elwes*); Nagas, E. Pegu, Pulo Laut, Perak, Bali (*Doherty*).

In Watson and de Nicéville's opinion this species is doubtfully distinct from *H. sikkima,* and the occurrence of both in Sikkim, Nagas, and Pegu would tend to confirm this opinion, but the genitalia of numerous specimens examined by Mr. Edwards prove the species to be distinct.

We are indebted to Col. Swinhoe for the opportunity of examining the male genitalia of his four species mentioned above.

A specimen in coll. Rothschild from Palawan (*Everett*), expanding only 25 mm., appears to belong here; this may be the "*Pamphila homolea,* Hew. ?, var. ? *palawea*" of Dr. Staudinger (Iris, ii. p. 144, 1889), which he subsequently (*t. c.* p. 165) elevated to the rank of a species; but it is to be remarked that whilst Dr. Staudinger's insect is stated by him to be separable from *homolea* by the want of any hyaline cell-spot on the fore wing, the specimen before us has two cell-spots on the fore wing, of which the upper one only is truly hyaline, the lower one being visible on the underside only.

HALPE HIERON.

Halpe hieron, de Nicéville, Jour. As. Soc. Beng. 1894, p. 54, pl. iv. fig. 1, ♂.

♂. Upperside grey-brown; pale spots proper to the fore wing obsolete or absent; no sex-mark. Underside pale brownish grey, closely and irregularly clothed with whitish-grey scales so as to indicate a pale macular subterminal band on the fore wing and a pale postmedian band on the hind wing; a suffused whitish-grey spot in each of cells 2 and 3 of the fore wing.

Expanse 29–31 mm.

Hab. Bekantschan, N.E. Sumatra (*Martin*).

HALPE BRUNNEA.

Halpe brunnea, Moore, Lep. Cey. i. p. 174, pl. lxx. figs. 4, 4 *a,* ♀ (1880–81).

♂. Upperside dark vinous brown: fore wing with four small hyaline white spots—one crescent-shaped in cell 2, one much smaller and roundish in cell 3, one punctiform in cell 6, and one very minute in cell 7. Underside pale vinous brown, disc of the fore wing darker; on the fore wing an indistinct subterminal pale macular band from the costa as far as vein 3, and an indication of a small whitish spot near the apical fourth of the upper edge of the cell; hind wing with the discal and subterminal bands as in *homolea*, save that the former is directed rather to a point beyond the apex of the wing than to the actual apex as in *homolea*. Fringe of the fore wing dark grey indistinctly chequered, of the hind wing dark grey with the short scales brown.

♀. Similar to the male, but having the pale cell-spot on the fore wing visible on the upperside.

Hab. Ceylon.

The above particulars are taken from a pair from Ceylon, ex coll. Rothschild. Moore's figures are not characteristic.

! Halpe fusca. (Plate XXV. fig. 72.)

Halpe fusca, Elwes, P. Z. S. 1892, p. 653, pl. xliii. fig. 1, .

Hab. Bernardmyo, Burmah (*Doherty*).

! Halpe sitala.

Halpe sitala, de Nieéville, Jour. As. Soc. Beng. 1885, p. 121, pl. ii. fig. 5, ♂; Watson, Hesp. Ind. p. 75 (1891).

Hab. Nilgiris (*Hampson*); Arnamalai hills (*Davison*).

Halpe latris.

Halpe latris, Leech, Butt. China, &c. p. 623, pl. xlii. fig. 17, ♂.

Chiefly differs from *H. sitala* in having the dorsum of the hind wing below blackish as far as vein 1 *b*.

Hab. Ta-tsien-lo (*Leech*).

! Halpe varia.

Pamphila varia, Murray, Ent. Mo. Mag. xi. p. 172 (1875).
Halpe varia, Leech, Butt. China, &c. p. 621, pl. xlii. fig. 18, ♂ (1894).

Hab. Japan (*Pryer*, *Leech*).

! Halpe gupta.

Halpe gupta, de Nieéville, Jour. As. Soc. Beng. 1886, p. 255, pl. xi. fig. 1, ♂; Watson, Hesp. Ind. p. 73 (1891).

Hab. Sikkim (*Möller*).

Halpe debilis, n. sp. (Plate XXI. figs. 1 ♂, 5 ♀.)

♂. Upperside brown: fore wing with six sordid white hyaline spots—two oblong, one each in cells 2 and 3, three small and oblong, one each in cells 6, 7, and 8; the cell-spots narrowly confluent and appearing as one spot much constricted in the middle. Underside greenish ochreous, the disc of the fore wing blackish; hind wing with an indistinct whitish spot in each of cells 2, 3, and 6, and a pale suffused subterminal macular band. Fringe of the fore wing pale grey, becoming whitish towards the tornus, of the hind wing whitish with the short scales grey. Antennæ blackish spotted with yellow in front; club and part of the shaft yellow beneath; apiculus pale red. Body above concolorous with the wings. Clothing of the second joint of palpi, breast, legs, and abdomen beneath greyish yellow.

♀. Similar to the male, but having on the fore wing a triangular white spot in cell 1 *a* next vein 1 *a* just beyond the middle, and the cell-spots broadly confluent and therefore forming one solid spot scarcely constricted in the middle.

Expanse 32–34 mm.

Hab. Khasia hills.

Described from one pair ex coll. Rothschild.

! HALPE AINA.

Halpe aina, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1890, p. 176, pl. B. fig. 8, ; Watson, Hesp. Ind. p. 72 (1891).

Hab. Sikkim (*Möller*).

! HALPE SEPARATA.

Halpe separata, Moore, P. Z. S. 1882, p. 407; Elwes, Trans. Ent. Soc. Lond. 1888, p. 454, pl. xi. figs. 5 ♂, 6 ♀; Watson, Hesp. Ind. p. 71.

Hab. Sikkim (*Elwes*); Nagas (*Doherty*).

Type in coll. Elwes.

! HALPE BLANCHARDI.

Hesperilla blanchardi, Mabille, Ann. Soc. Ent. Fr. 1876, p. cliii.
Halpe blanchardi, Leech, Butt. China, &c. p. 625, pl. xlii. fig. 19, ♂ (1894).

Hab. West China (*Leech*).

! HALPE SUBFLAVA.

Halpe subflava, Leech, Butt. China, &c. p. 625, pl. xlii. fig. 21, ♂ (1894).

A very distinct and well-named species on account of the clear yellow colour of the hind wing below.

Hab. Western China (*Leech*).

HALPE ALBIPECTUS.

Halpe albipectus, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1891, p. 389, pl. G. figs. 35 ♂, 36 ♀.

Hab. Maingyé, Shan hills (*Manders*).

♀ type in coll. Elwes.

HALPE BIVITTA.

Pamphila bivitta, Ob. Etud. d'Ent. xi. p. 28 (1886).
Pamphila albivitta, id. t. c. p. 38, pl. vi. fig. 46.
Halpe bivitta, Leech, Butt. China, &c. p. 623 (1894).

Hab. West China (*Pratt*).

HALPE DECORATA.

Halpe decorata, Moore, Lep. Cey. i. p. 173, pl. lxxi. fig. 2 (1881); Watson, Hesp. Ind. p. 76 (1891).

Hab. Avisawella, Ceylon (*in coll. Rothschild*).

This is a true *Halpe*, which bears much resemblance on the upperside to *H. honorei*, de Nicév. The hind wing below is chrome-yellow, with the termen narrowly and suffusedly pale brown, and with several small irregular pale brown spots placed as follows:—two beyond the middle of cell 1 *b* divided by the intraneural fold, two in cell 2 at equal distances from the base and apex of that cell and from each other, one near the basal third of cell 3, one near the middle of cells 4–5, one across the basal fourth of cell 6, and two in cell 7 at equal distances from the base and apex of that cell and from each other. These particulars are taken from a male specimen ex coll. Rothschild.

! HALPE MASONI.

Pamphila masoni, Moore, P. Z. S. 1878, p. 842, pl. lii. fig. 5, ♂.
Isoteinon masoni, Elwes & de Nicéville, Jour. As. Soc. Beng. 1886, p. 442, pl. xx. fig. 4, ♂; Watson, Hesp. Ind. p. 85 (1891).

Hab. Burmah (*Watson, Adamson*).

! HALPE HONOREI.

Halpe honorei, de Nicéville, P. Z. S. 1887, p. 464, pl. xl. fig. 8, ♀; Watson, Hesp. Ind. p. 75 (1891).

Hab. Nilgiris (*Hampson*); Trichinopoly (*Castets*).

HALPE ORNATA.

Hesperia ornata, Felder, Reise Nov., Lep. iii. p. 515, pl. lxxii. fig. 6, ♂ (1867).
Parnara ornata, Wood-Mason & de Nicéville, Jour. As. Soc. Beng. 1886, p. 382, pl. xviii. figs. 7, 7 *a*, ♂; Watson, Hesp. Ind. p. 38 (1891).

We have not seen this species.

Hab. Buitenzorg, Java (*Felder*); Doarband, Cachar (*Wood-Mason & de Nicéville*).

ONRYZA.

Onryza, Watson, P. Z. S. 1893, p. 112, pl. ii. fig. 5.

A monotypic genus, of which, through the kindness of Col. Adamson, we have been able to examine the type. It is distinguished from the *masoni* section of *Halpe* chiefly by the sex-mark of the male, which is in the form of "a patch of long recumbent hairs on the upperside of the hind wing, attached along vein 8 from close to the base of the wing."

ONRYZA MEIKTILA.

Parnara? meiktila, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1891, p. 386, pl. G. fig. 32, ♂.

Hab. Meiktila, Upper Burmah, Upper Chindwin, Feb. (*Adamson*); Poungadaw, Burmah (*Watson*); Ataran Valley, Burmah (*Bingham, fide de Nicéville*).

ITON.

Iton, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1895, p. 399. Type *semamora*, Moore.

This is a genus established by Mr. de Nicéville for *semamora*, Moore, and *watsonii*, de Nicév. Both these species have been placed in the genus *Parnara*; and if the form of their antennæ, palpi, and wings, and the venation be compared with that of some species of *Parnara*, such as *P. austeni*, their relationship to that genus will at once be evident. The chief point of distinction lies in the pattern of the hind wing below, of which the main diagnostic feature is the fact that the discoidal cell is wholly white, and cells 4–5 and 6 are white except at the apex. The male of *semamora* has a patch of long upturned hairs near the middle of the dorsum of the fore wing below; the same sex of *watsonii* has no alar sex-mark.

! ITON SEMAMORA.

Hesperia semamora, Moore, P. Z. S. 1865, p. 791.
Hesperia barea, Hewitson, Trans. Ent. Soc. Lond. ser. 3, vol. ii. p. 490 (1866), *fide* de Nicéville.
Parnara semamora, Watson, Hesp. Ind. p. 46 (1891).

Hab. Sikkim (*Möller, Gammie*); Tilin Yaw, Burmah (*Watson*); Khasia (*Hamilton*); Pegu, Pulo Laut (*Doherty*).

! ITON WATSONII.

Parnara watsonii, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1890, p. 223; id. op. cit. 1891, p. 388, pl. G. fig. 29, ♂; Watson, Hesp. Ind. p. 46 (1891).

Hab. East Pegu (*Doherty*); Tilin Yaw (*Watson*); Fort Stedman, Shan hills (*Manders*).

We have seen, from the collection of Col. Adamson, an aberrant male specimen of this species taken at Kaléwa, on the Chindwin River, in October; on the upperside of the hind wing the white patch is quite as extensive as in some specimens of *semamora*, but the hind wing below, although very much abraded, still retains the characteristic pattern of *watsonii*; the clasp-form can, without dissection, be made out sufficiently well to show that in this respect it agrees very well with *watsonii*, and is absolutely distinct from *semamora*.

PARNARA.

Parnara, Moore, Lep. Cey. i. p. 166 (1881); Watson, P. Z. S. 1893, p. 105. Type *guttatus*, Brem.
Chapra, Moore, t. c. p. 169. Type *mathias*, Fab.
Baoris, Moore, t. c. p. 165; Watson, t. c. p. 106. Type *oceia*, Hew.
Caltoris, Swinhoe, Trans. Ent. Soc. Lond. 1893, p. 323.

Body robust, fore wing pointed, upperside brown with a few white or yellowish-white spots. Antennæ as long or longer than half the costa; club moderate; apiculus distinct, as long or longer than the greatest width of the club. Palpi: second joint densely scaled; third joint obtuse, very short, and almost concealed. Fore wing with a series of bare (and therefore hyaline) white spots, of which the position and full complement is as follows:—one each, decreasing in size, near the bases of cells 2, 3, and 4; one each, of nearly equal size, in cells 6, 7, and 8; and two near the apex of the cell; sometimes there is a white spot in cell 1 *a*, but this does not properly belong to the hyaline series, as it is not usually bare on the underside, but is represented there by a suffused whitish spot; it does not appear that there is ever a pale spot in cell 5, except in *P. beavani* and the female of *P. assamensis*; the pale spot in cell 4 is normally always present, its absence occurs most frequently in *P. oceia*; vein 5 arises much nearer 4 than 6, and curves upward from the base, and vein 2 arises at about the half-length of the cell. Hind wing: sometimes with a series of white spots, but without any pattern on the underside, save a row of spots: vein 2 from the apical fourth of the cell, vein 5 obsolete. Legs as in *Gegenes*.

Zelleri, Led., *tulsi*, de Nicév., and *cœrulescens*, Mab., are true Parnaras in venation. *P. pugnans*, de Nicév., has vein 2 of the fore wing arising from near the basal third of the cell.

The generic term *Parnara*, as here used, includes *Parnara* proper, *Chapra* and *Baoris*, Moore, and *Caltoris*, Swinhoe. Distant and Watson use *Baoris* in the same sense, but as the first three names are synchronous in publication, and both *Baoris* and *Chapra* were definitely limited by their author to species possessing a certain kind of alar sex-mark in the male, we prefer the term *Parnara* on the ground that it was not so limited, and that it has been in use for the majority of the species for a long time. The presence or absence of some of the pale spots on the wings is a very useful character for the separation of species in this difficult genus, particularly when it is correlated with differences in the male genitalia. In the species of the *oceia* group, however, the number of the pale spots has proved perfectly unreliable as a distinctive character, but this fact does not affect the utility of the character where other species are concerned. It has not been found practicable to form any linear arrangement of the species which shall satisfactorily indicate their natural affinities *inter se*, but the consecutive arrangement here adopted will probably be found as useful as any other yet proposed.

The following table, which deals with male insects only, sets forth the characters by means of which we separate the species known to us:—

Males.

1. Hind wing above with a tuft of long hair on the basal half of vein 6 covering a suboval patch of androconia. (*Baoris.*) .	2.
Fore wing below with an upturned tuft of long hair near the middle of the dorsum	*plebeia,* de Nicév.
Fore wing above with a linear whitish sex-mark from the middle of vein 1 *a* to the basal third of vein 2. (*Chapra.*)	3.
Wings without a sex-mark. (*Caltoris.*)	7.
2. Hind wing below plain brown	*oceia,* Hew.
Hind wing below greenish yellow-brown	*leechii,* n. sp.
Hind wing purple-brown, plain brown in cells 1 *a* and 1 *b* . .	*simillima,* n. sp.
3. Sex-mark of even width throughout	4.
Sex-mark constricted near the middle	*nascens,* Leech.
4. Hind wing below with three or more pale spots	5.
Hind wing below unspotted	*brunnea,* Snell.
5. Hind wing above with white spots (forming a row), one in each of cells 2, 3, and 4, or 2, 3, 4, and 5	*sinensis,* Mab.
Hind wing above with no such row of white spots	6.
6. Hind wing above with an ill-defined whitish spot in cells 6 and 3; hind wing below with the pale spot in cell 6 the most strongly developed. Fore wing with the pale spot in cell 2 subquadrate. Size larger	*subochracea,* Moore.
Hind wing above without pale spots. Hind wing below with the pale spot in cell 6 not more strongly developed than the others. Fore wing generally with the pale spot in cell 2 narrow and oblique, about twice as high as wide. Size smaller	*mathias,* Fab.
7. Hind wing below without a white band from the middle of the costa to the dorsum just before the tornus	8.
Hind wing below with a white band of the kind last mentioned .	*hasoroides,* n. sp.
8. Hind wing below not marked with purple or whitish purple . .	10.
Hind wing below marked with purple or whitish purple . . .	9.
9. Hind wing below with a very suffused whitish-purple median band	*tulsi,* de Nicév.
Hind wing below with a postmedian row of purple spots in cells 1 *b* to 6	*cœrulescens,* Mab.
10. Hind wing below without markings, or at most with one pale spot	11.
Hind wing below with more than one well-defined pale spot . .	21.

11. Fore wing without eell-spots, or if one is present it is plaeed next the upper edge of the eell	12.
Fore wing with one or two eell-spots, if there is only one it is plaeed next the lower edge of the eell	14.
12. Fore wing with a white spot in eell 1 *a*, next vein 1 *a* just beyond the middle	*philippina*, H.-S.
Fore wing without any sueh spot	*kumara*, Moore.
14. Pale spot iu eell 4 of fore wing above small and roundish . .	15.
Pale spot in eell 4 of fore wing above oblong, as long as that in eell 3	*pugnans*, de Nieév.
15. Hind wing below unspotted. Not more than one pale spot in eell 1 *a* of the fore wing	16.
Hind wing below with a minute whitish spot near the middle of eell 2. Two pale spots in eell 1 *a* of the fore wing, one of whieh is punetiform and plaeed next to vein 2	*bromus*, Leeeh.
16. Fringes not yellow	17.
Fringes bright yellow	*aurociliata*, n. sp.
17. Without a pale spot in eell 8 of the fore wing	18.
With a pale spot in eell 8 of the fore wing, and also in eell 1 *a* next vein 1 *a* just beyond the middle	*pagana*, de Nieév.
18. Hind wing below deep warm brown, darker than the apieal region of the fore wing below	*moolata*, Moore.
Not as above	19.
19. Fore wing below with the pale spot near the middle of eell 1 *a* obsolete or absent; the dise not mueh darker than the remainder	20.
Fore wing below with a suffused blaekish diseal pateh from the base to the middle, the pale spot near the middle of eell 1 *a* distinet, suffused	*cahira*, Moore.
20. Expanse 46 mm.	*robusta*, n. sp.
Expanse 37–41 mm.	*austeni*, Moore.
21. Hind wing above with a more or less distinet row of pale spots near the middle	22.
Hind wing above without a row of pale spots near the middle .	26.
22. Pale spots on the hind wing in a straight row, gradually deereasing in size from eells 2–5 [1]	*guttatus*, Brem.
Not as above	23.

[1] This is very characteristic of the majority of specimens, but in the smaller ones in which the pale spots on the hind wing are only feebly developed (*bada*, Moore) this character is not so obvious; these latter, however, may always be distinguished from *colaca* and *bevani* by the absence of any trace of the pale spot near the middle of cell 1 *a* on the fore wing above. In all the forms the structure of the tegumen is characteristic of the species.

23. Hind wing below: pale spots in cells 4–5 contiguous, but distinct, frequently there is also a pale spot in cell 6 . . . . 24.
Hind wing below: pale spots in cells 4–5 coalescing to form one quadrate spot, no pale spot in cell 6 . . . . 25.

24. Hind wing below greenish ochreous, pale spot in cell 2 subequal in size to that in cell 4. Side lobes of tegumen spiniform . *pellucida,* Murr.
Hind wing below russet-green, pale spot in cell 2 distinctly smaller than that in cell 4. Side lobes of tegumen capitate. [1] *contigua,* Mab.

25. Fore wing above: pale spots yellowish white, the lower edge of that in cell 2 twice or nearly twice as long as its inner edge. Apex of the œdeagus (seen from below) produced on the left side into a long sharp horn, the right side spinose . . . . *eltola,* Hew.
Fore wing above: pale spots white, the lower edge of that in cell 2 one and a half times or less than one and a half times as long as its inner edge. Apex of the œdeagus produced into two subequal spinose lobes . . . . *discreta,* n. sp.

26. Hind wing below with no pale spot in the cell . . . . 27.
Hind wing below with a large white spot in the cell near the apex of its upper edge. Species otherwise resembling *pellucida,* Murray . . . . *jansonis,* Butl.

27. Hind wing below with the pale spots not black-bordered . . . 28.
Hind wing below with the pale spots black-bordered . . . . *zelleri,* Led.

28. Expanse not exceeding 37 mm. . . . . 29.
Expanse 46 mm. or more . . . . 31.

29. Fore wing with a pale spot in cell 4 and also in cell 8 . . . 30.
Fore wing with no pale spot in cells 4 or 8. Hind wing with two hyaline points—one near the middle of each of cells 2 and 3 . . . . *bipunctata,* n. sp.

30. Fore wing below: no pale spot in cell 5, termen straight or feebly concave between veins 1 *a* and 3. Tegumen with a long thin sharp dorsal horn reaching from the middle to the apex . . . . *colaca,* Moore.
Fore wing below: frequently with a minute pale spot in cell 5 (always present in the female), termen evenly curved throughout. Tegumen with no such horn . . . . *bevani,* Moore.

31. Hind wing above with a small pure white spot in cell 4; spots on the fore wing pure white . . . . *assamensis,* W.-M.&deNicév.
Hind wing above with no such spot; spots on the fore wing sordid white . . . . *conjuncta,* H.-S.

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[1] In specimens from Perak some of the spots on the hind wing are wanting, but the species may always be known by the form of the tegumen.

! PARNARA OCEIA. (Plate XXV. figs. 74, *a*, *b*, *c*.)

Hesperia oceia, Hewitson, Descr. Hesp. p. 31 (1868); Wood-Mason & de Nicéville, Jour. As. Soc. Beng. 1881, p. 258.

Hesperia farri, Moore, P. Z. S. 1878, p. 688; Watson, Hesp. Ind. p. 44 (1891).

Baoris oceia, Moore, Lep. Cey. i. p. 165 (1881); de Nicéville, Jour. As. Soc. Beng. 1883, p. 85, pl. x. fig. 11, ♀; Watson, Hesp. Ind. p. 29 (1891).

Baoris penicillata, Moore, Lep. Cey. i. p. 166 (1881); Watson, t. c. p. 30.

Baoris scopulifera, Moore, P. Z. S. 1883, p. 532.

Baoris unicolor, Moore, P. Z. S. 1883, p. 533; *nec* Distant, Rhop. Mal. p. 381, pl. xxxv. fig. 11 (1886).

Baoris sikkima, Swinhoe, Ann. & Mag. Nat. Hist. 1890, v. p. 362.

Hab. Sikkim (*Möller*), Nagas (*Doherty*), Andamans (*de Roepstorff*); Philippines (*Semper*), Palawan (*Platen*); Khasia hills (*Swinhoe*).

! PARNARA LEECHII, n. sp. (Plate XXI. fig. 3, ♂; Plate XXV. figs. 73, *a*, *b*, *c*.)

Baoris oceia, Leech, Butt. China, &c. p. 616, pl. xlii. fig. 6, ♂.

Differs from the preceding and following species in the colour of the hind wing below and in the clasp-form as figured.

Though there is but a single specimen in Elwes's collection in somewhat worn condition, yet we have examined several in Mr. Leech's collection which confirm our belief that the true *oceia* does not occur in China.

Hab. Central and Western China (*Pratt*); Foochow, Ningpo (*Leech*).

! PARNARA SIMILLIMA, n. sp. (Plate XXI. fig. 22, ♂; Plate XXVI. figs. 75, *a*, *b*, *c*.)

Though the slightly paler colour of the hind wing below from cell 1 *b* to the dorsum distinguishes this species from any examples of *oceia* or *leechi* that we have seen, yet the marked difference of the genitalia as figured are the best proof of its specific difference. Described from one male in Elwes's collection.

Hab. Pulo Laut (*Doherty*).

! PARNARA PLEBEIA.

Parnara plebeia, de Nicéville, P. Z. S. 1887, p. 466, pl. xl. fig. 2, ♂; Watson, Hesp. Ind. p. 40 (1891).

Pamphila mormo, Mabille, Ann. Soc. Ent. Belg. xxvii. p. 53 (1893).

The male of this species is readily distinguished by the tuft of long hair near the middle of the dorsum of the fore wing below, a feature not noted in the original description; the female may be separated from the same sex of *austeni* by the colour of the hind wing below, which in *plebeia* is simple umber-brown, and in *austeni* ochreous brown.

A male from Kina Balu, Borneo, ex coll. Staudinger, has the termen less oblique than other males in coll. Elwes, including one from Pulo Laut, and the white spots on the fore wing are reduced in size.

Hab. Sikkim (*Möller*, *Elwes*); Pulo Laut (*Doherty*); Kina Balu (*Waterstradt*); Java (*fide Mabille*).

! PARNARA BRUNNEA.

Pamphila brunnea, Snellen, Tijd. Ent. xix. pl. vii. fig. 4 (1876).
Chapra cære, de Nieéville, Jour. Bomb. Nat. Hist. Soc. 1891, p. 388, pl. G. fig. 33, ♂.
Pamphila sodalis, Mabille, Ann. Soc. Ent. Belg. xxxvii. p. 53 (1893).

Hab. W. Java (*ex coll. Snellen*); Pulo Laut, Bali (*Doherty*).

! PARNARA SINENSIS.

Gegenes sinensis, Mabille, Bull. Soc. Zool. Fr. 1877, p. 232.
Chapra prominens, Moore, P. Z. S. 1882, p. 261; Watson, Hesp. Ind. p. 33 (1891).
Pamphila similis, Leech, Ent. xxiii. p. 48 (1890).
Parnara sinensis, Leech, Butt. China, &c. p. 608, pl. xlii. fig. 11, ♂ (1894).

Hab. China (*Pratt*); N.W. Himalaya (*Young*); Sikkim, Khasia (*Elwes*); Nagas, Bali (*Doherty*).

! PARNARA SUBOCHRACEA. (Plate XXI. fig. 26, ♂; Plate XXVI. fig. 83.)

Chapra subochracea, Moore, P. Z. S. 1878, p. 691; Watson, Hesp. Ind. p. 32 (1891).
Chapra mathias, var., de Nieéville, Jour. Bomb. Nat. Hist. Soc. 1889, p. 176, pl. B. fig. 7, ♂.

This species is undoubtedly distinct from *P. mathias*, Fab., differing both in the particulars given in the table above and the form of the male genitalia.

Hab. Barrackpur, near Calcutta (*Minchin*), Nilgiris (*Hampson*), Cachar (*fide de Nicéville*), Peermaad, Travancore (*ex Doncaster*).

! PARNARA MATHIAS. (Plate XXVI. fig. 84.)

Hesperia mathias, Fabricius, Ent. Syst., Suppl. p. 433 (1798).
Hesperia thrax, Lederer, Verh. zool.-bot. Ges. Wien, 1855, p. 194, pl. i. figs. 9, 10.
Chapra mathias, Moore, Lep. Cey. i. p. 169, pl. lxx. figs. 1, 1 *a* (1881); Watson, Hesp. Ind. p. 31 (1891).
Baoris mathias, Distant, Rhop. Mal. p. 380, pl. xxxv. fig. 10 (1886).
Hesperia agna, Moore, P. Z. S. 1865, p. 791.
Chapra agna, Moore, Lep. Cey. i. p. 169 (1881); Watson, Hesp. Ind. p. 32 (1891).
Hesperia chaya, Moore, P. Z. S. 1865, p. 791.
Baoris chaya, Distant, Rhop. Mal. p. 380, pl. xxxiv. fig. 9 (1886).

Pamphila mencia, Moore, Ann. & Mag. Nat. Hist. (4) xx. p. 52 (1877).
Parnara mencia, Leech, Butt. China, &c. p. 607, pl. xlii. fig. 14, ♂ (1894).

This seems to be about the most widely distributed and generally common species in Asia, extending from Syria to the Liukiu Islands and Sambawa. It occurs all over India from Kashmir to Malabar, and from Bombay to Pegu and the Malay Peninsula. In addition to the above-named localities, I have it from Borneo, Bali, Japan, and China; and Semper states that it is generally distributed in the Philippines. Holland also records it, as *Baoris chaya*, from Hainan.

! PARNARA NASCENS.

Parnara nascens, Leech, Butt. China, &c. p. 614, pl. xlii. fig. 8, ♂ (1894).

Differs from *sinensis*, Mab., in the following particulars:—Upperside darker brown, the pale spots less strongly developed, one only in cell of fore wing, that in the upper half, sex-mark of the male interrupted in the middle; underside dark brownish green.

Hab. Central China (*Pratt*).

! PARNARA PHILIPPINA. (Plate XXI. figs. 4 ♂, 8 ♀; Plate XXVI. figs. 85, *a*, *b*, *c*.)

Cobalus philippina, Herrich-Schäffer, Prod. Syst. Lep. iii. p. 81 (1869).
Hesperia seriata, Moore, P. Z. S. 1878, p. 688.
? *Baoris seriata,* Moore, Lep. Cey. i. p. 166, pl. lxix. figs. 4, 4 *a* (1881).
Parnara seriata, Watson, Hesp. Ind. p. 42 (1891).
Parnara philippina, Semper, Schmett. Philipp. p. 298, pl. xlix. fig. 12, ♂ (1892).

The type of *Baoris seriata*, Moore, in the British Museum from Ceylon is a female; the wide range of the species suggests that it occurs in other localities, but we know it only from those here mentioned. Though Semper has identified *P. philippina*, H.-S., with *P. seriata*, Moore, yet we think that this identification must remain somewhat uncertain, and we have not been able to compare the Eastern specimens here treated of with the type.

Hab. Ceylon (*in Brit. Mus.*) N. Canara (*Aitken*); Philippines (*Semper*); Amboina (*Stgr.*); Palawan (*fide Stgr.*). Sangir, Talaut (*Doherty*).

! PARNARA KUMARA. (Plate XXVII. figs. 90, *a*, *b*, *c*.)

Hesperia kumara, Moore, P. Z. S. 1878, p. 687.
Baoris kumara, Moore, Lep. Cey. i. p. 166, pl. lxix. figs. 2, 2 *a* (1881).
Parnara kumara, Watson, Hesp. Ind. p. 41 (1891).

Hab. Kina Balu, Borneo, Java (*Staudinger*); Sikkim (*Möller*); Nilgiris (*Hampson*); Arjuno, Java (*Doherty*).

! PARNARA BROMUS.

Parnara bromus, Leech, Butt. China, &c. p. 614, pl. xlii. fig. 10, ♂ (1894).

We recently received from Dr. Staudinger two insects from Folo (? in the Philippine Islands), as *Pamphila philippina*; of these the reputed male is a female of *P. bromus*, Leech, agreeing exactly with the description and figure cited above, and the female is a specimen of that sex of *P. toona*, Moore.

I have great doubt as to whether *P. bromus* can be separated from *P. philippina*. Leech's plate, which seems to represent a female and not a male, as stated, is indistinguishable from a female of *philippina*, from the Philippines, which I received from Dr. Staudinger. Semper, however, states that *philippina* never has a transparent spot in the middle cell of the fore wing, whilst Leech's plate and one of my specimens show two.—H. J. E.

The fact remains that in *philippina* the cell-spots of the fore wing are wanting, or, at most, feebly developed, and the hind wing below is unspotted, and in *bromus* there are two well-developed cell-spots visible on the upperside of the fore wing, and the hind wing below bears a small pale spot near the middle of cell 2. We have not seen any intermediate specimens.

PARNARA CANARAICA.

Parnara canaraica, Moore, P. Z. S. 1883, p. 534; Watson, Hesp. Ind. p. 42 (1891).

♂. Fore wing with eight white spots including two in the cell; hind wing above without markings; hind wing below with two discal white spots.

♀. Fore wing with ten pale spots, eight placed as in the male and two in cell 1 *a*—one punctiform next vein 2 near the middle, and one triangular next vein 1 *a* near the middle; hind wing above with three discal semi-diaphanous spots; hind wing below with four discal white spots and a fifth at the end of the cell.

Expanse 38–47 mm.

Hab. Canara (*Ward*).

We have not seen this species, which bears some resemblance to *P. bromus*, Leech; but that species has the two pale spots in cell 1 *a* of the fore wing above in both sexes similar to those found in the female of *P. canaraica*, and the latter species is well distinguished by the five white spots on the hind wing below.

! PARNARA PAGANA.

Parnara pagana, de Nicéville, P. Z. S. 1887, p. 465, pl. xl. fig. 7, ♂; Watson, Hesp. Ind. p. 40 (1891).

All the specimens of this species in Elwes's collection have spots in cells 6, 7, and 8.

Hab. Sikkim (*Möller*); Pegu (*Doherty*); Tenasserim, Borneo (*coll. Stgr.*); Selesseh, Sumatra (*in coll. Rothschild*).

! PARNARA MOOLATA. (Plate XXVI. figs. 86, *a*, *b*, *c*.)

Hesperia moolata, Moore, P. Z. S. 1878, p. 843.
Pamphila dravida, Mabille, Pet. Nouv. ii. p. 242 (1878).
Baoris moolata, Distant, Rhop. Mal. p. 379, pl. xxxiv. fig. 10, ♂ (1886).
Parnara moolata, Watson, Hesp. Ind. p. 42 (1891).
Parnara cahira, Semper, Schmett. Philipp. p. 298, *sec. spec. comm.* (*nec* Moore).
Caltoris onchisa, ♀, Swinhoe, Trans. Ent. Soc. Lond. 1893, p. 323, *sec. spec. typ.*

Hab. Khasia (*Hamilton*); Perak, Pulo Laut (*Doherty*); West Java (*coll. Snellen*); Philippines (*Semper*); Palawan, Kina Balu, Borneo (*Staudinger*); Selesseh, Sumatra (*in coll. Rothschild*).

! PARNARA AUROCILIATA, n. sp. (Plate XXI. fig. 23, ♂; Plate XXVI. figs. 87, *a*, *b*, *c*.)

A species at once distinguished by its bright yellow fringes.

♂. Upperside deep warm brown: fore wing above with seven yellowish-white hyaline spots—two in the cell, of which the upper is the smaller, one in each of cells 2, 3, 4, 6, and 7, the three last-named punctiform, and a small yellowish-white spot next vein 1 *a* near the middle. Underside clear rich brown, somewhat darker in the basal region of the fore wing; pale spots as on the upperside, but the spot in cell 1 *a* suffused. Fringes bright chrome-yellow, brown next cell 7 of the fore wing and cells 4–7 of the hind wing, the short scales brown throughout. The punctiform hyaline spots on the fore wing have a tendency to disappear.

Expanse 45–48 mm.

Hab. Sikkim (*Möller*). Type in coll. Elwes.

We separate this species from *P. pagana* and *P. kumara* with some doubt, but the genitalia are different from those of both those species.

! PARNARA CAHIRA. (Plate XXI. fig. 25, ♀; Plate XXVII. figs. 91, *a*, *b*, *c*.)

Hesperia cahira, Moore, P. Z. S. 1877, p. 593, pl. lviii. fig. 8.
Parnara cahira, Watson, Hesp. Ind. p. 43.

Moore's figure above cited does not agree with his description. It is said by Wood-Mason and de Nicéville (Jour. As. Soc. Beng. 1881, p. 258) that the female of *oceia*, Hew., was described by Moore as that of his *cahira*; but it does not appear certain that these authors examined the type of *cahira*.

Hab. East Pegu (*Doherty*); Andamans (*de Roepstorff*); Nias (*Modigliani*); China (*fide Staudinger*).

Mr. de Nicéville ("List of the Butterflies of Sumatra," Jour. As. Soc. Beng. 1895, p. 550) states that he has from Sumatra specimens which agree with Moore's figure and description of *cahira*, also specimens which agree with Moore's description and

Elwes's woodcut of *austeni*, also specimens agreeing with Moore's description of *moolata*, and specimens agreeing with Moore's figure and description of *kumara*; and he goes on to say that all his Sumatran specimens appear to him to represent one species, and that it may be subsequently found on an examination of the prehensores of the male that some of these species may be valid. We give below a table of characters drawn from the male genitalia sufficient for the separation of these species by any person of moderate experience in the examination of such objects. The figures will assist in the elucidation of these characters.

A. Lower distal angle of the lower lobe of clasp produced much beyond the upper angle in a long nearly straight lobe; the upper distal angle produced into a recurved lobe . . . . *moolata.*

B. Lower distal angle of the lower lobe of clasp rounded, not produced.
- *a.* The two lobes forming the apex of the tegumen (seen from beneath) broad, flat, and subtruncate, their apices in the vertical aspect triangular . . . . *austeni.*
- *b.* The two lobes forming the apex of the tegumen (seen from beneath) narrow, pointed, and separate at the apex . . . . *kumara.*
- *c.* The two lobes forming the apex of the tegumen (seen from beneath) rather broad, curved, and connivent at the apex . . . . *cahira.*

We also repeat here the external characters by which these four species may be distinguished *inter se*:—

Males.

1 (2). Fore wing without cell-spots, or if one is present it is placed next the subcostal; no white spot near the middle of vein 1 *a* . . . . *kumara.*

2 (1). Fore wing with one or two cell-spots; if there is only one it is placed next the median.

3 (4). Fore wing above with a white spot, sometimes reduced to a point, near the middle of vein 1 *a*. Fore wing below with a suffused blackish discal patch from the base to the middle; the pale spot near the middle of cell 1 *a* distinct, suffused. Hind wing below ochreous brown . . . . *cahira.*

4 (3). No white spot near the middle of vein 1 *a* on the fore wing above.

5 (6). Underside: apical region of the fore wing paler than the disc of the hind wing, the latter deep warm (vinous) brown. Lower distal angle of the lower lobe of the clasp much produced . . . . *moolata.*

6 (5). Underside: apical region of the fore wing concolorous with the disc of the hind wing, the latter reddish yellow-brown. Lower distal angle of the lower lobe of the clasp rounded . . . . *austeni.*

With regard to the females of these species an exact knowledge can only be obtained from specimens taken *in cop.*, but no real difficulty arises except as to the females of

P. kumara and *P. austeni.* Judging from the material in coll. Elwes, it appears probable that of those females in which the cell-spots are absent from the fore wing, those which have a white point in cell 1 *a* near the middle of vein 2 should be referred to *P. austeni*, and those in which this spot is wanting to *P. kumara.* The female of *P. moolata* differs from the male in having a white spot near the middle of vein 1 *a* in the fore wing, and the female of *P. cahira* does not differ from its male in the number of white spots on the fore wing.

! Parnara robusta, n. sp. (Plate XXI. fig. 19, ♂; Plate XXVII. figs. 88, *a*, *b*, *c*.)

♂. Differs from *P. cahira* in its larger size, the want of a large suffused blackish patch on the disc and a pale suffused spot near the middle of cell 1 *a* on the fore wing below, the browner and less ochreous colour of the hind wing below, and the clasp-form, as may be seen from the figures.

Expanse 46 mm.

Hab. Sangir (*Doherty*).

Described from a single specimen in coll. Elwes.

! Parnara austeni. (Plate XXVII. figs. 89, *a*, *b*, *c*.)

Baoris austeni, Moore, P. Z. S. 1883, p. 533.

Parnara austeni, Elwes, Trans. Ent. Soc. Lond. 1888, p. 448, fig. 3; Leech, Butt. China &c. p. 613, pl. xlii. fig. 7, ♂ (1894); Watson, Hesp. Ind. p. 43 (1891).

Caltoris onchisa, ♂, Swinhoe, Trans. Ent. Soc. Lond. 1893, p. 323, *sec. spec. typ.*

The female of this species has no pale spots in the cell of the fore wing, a character which it shares with the females of *P. plebeia*, *P. kumara*, and *P. rhypara.*

Hab. Sikkim (*Möller*); Khasia (*Hamilton*); Coonoor, Nilgiris (*Davison*, *Hampson*); Ceylon (*Green*); Andamans (*de Roepstorff*); Kweichow, China (*coll. Leech*).

We are indebted to Col. Swinhoe for the loan of his types of *Caltoris onchisa* and permission to dissect the genitalia of the male. Having availed ourselves of this permission we are satisfied that the male is *P. austeni*; the female specimen, however, belongs, as before pointed out, to *P. moolata.* The pale subapical fascia on the fore wing below in the specimens appears to us to be the result of accident rather than normal wing-pattern.

! Parnara conjuncta. (Plate XXVII. figs. 92, *a*, *b*, *c*.)

Goniloba conjuncta, Herrich-Schäffer, Prod. Syst. Lep. iii. p. 75 (1869), *fide* Snellen.

Gegenes javana, Mabille, Bull. Soc. Zool. Fr. 1877, p. 232.

Hesperia narooa, Moore, P. Z. S. 1878, p. 687, pl. xlv. fig. 4.

Parnara narooa, Moore, Lep. Cey. i. p. 167, pl. lxix. figs. 3 *a*, *b* (1881); Watson, Hesp. Ind. p. 39 (1891).

Baoris narooa, Distant, Rhop. Mal. p. 380, pl. xxxiv. fig. 12, ♀ (1886).

Though we have no specimens from India or Ceylon, yet we think the plate in 'Lep. Ceylon' sufficiently identifies the species, which has been hitherto known as *narooa*, Moore.

Hab. Java (*Piepers*); Nias (*Modigliani*); Perak (*Doherty*); Kina Balu (*Waterstradt*); Sumatra (*in coll. Stgr.*); Philippines (*Semper*).

! PARNARA ASSAMENSIS.

Parnara assamensis, Wood-Mason & de Nicéville, Jour. As. Soc. Beng. 1882, p. 65; id. op. cit. 1886, p. 382, pl. xviii. figs. 5, 5 *a*, ♂, pl. xvii. figs. 7, 7*a*, ♀; Watson, Hesp. Ind. p. 37 (1891).

Hab. Sikkim (*Elwes*); Khasia (*Hamilton*); Nagas (*Doherty*).

! PARNARA GUTTATUS. (Plate XXVI. fig. 76).

Eudamus guttatus, Bremer & Grey, Schmett. N. China's, p. 10, pl. iii. fig. 2 (1853).
Goniloba guttatus, Ménétriés, Cat. Mus. Petr. Lep. i. pl. v. fig. 4 (1855).
Hesperia fortunei, Felder, Verh. zool.-bot. Ges. Wien, xii. p. 489 (1862); id. Reise Nov., Lep. pl. lxxii. fig. 11 (1866).
Pamphila mangala, Moore, P. Z. S. 1865, p. 792.
Hesperia bada, Moore, P. Z. S. 1878, p. 688.
Parnara bada, Moore, Lep. Cey. i. p. 167, pl. lxx. figs. 2, 2 *a* (1881).
Hesperia nondoa, Plötz, Stett. ent. Zeit. 1886, p. 97, *fide* Fruhstorfer.
Parnara guttata, Elwes, Trans. Ent. Soc. Lond. 1888, p. 445; Watson, Hesp. Ind. p. 34 (1891).

Hab. India, generally distributed, China, Japan (*Leech*, *Pryer*); Liu Kiu Islands (*Pryer*); Perak, Pulo Laut, Bali (*Doherty*); Java (*Fruhstorfer*); Kina Balu, Borneo (*Waterstradt*).

We have two females from Java sent by Herr Fruhstorfer under the name *Hesperia nondoa*; these correspond with males from Pulo Laut and Perak which are undoubtedly *P. guttatus*; the underside of all these specimens is darker and the arrangement of the pale spots on the hind wing is less evidently rectilinear than is usual in *P. guttatus*, and the cell-spots in the fore wing are entirely wanting. Further, we have received seven specimens from the island of Bali, collected by Doherty, which vary very much in the number and position of the spots on the hind wing, one of them being without these spots either above or below. We were inclined to treat these specimens as belonging to a distinct species, but an examination of the genitalia goes to show that they are only extreme forms of *guttatus*.

! PARNARA CONTIGUA. (Plate XXVI. figs. 78, 78 *a*.)

Pamphila contigua, Mabille, Bull. Soc. Zool. Fr. 1877, p. 232 (note).
Hesperia toona, Moore, P. Z. S. 1878, p. 689, ♂.
Parnara toona, Wood-Mason & de Nicéville, Jour. As. Soc. Beng. 1886, p. 383, ♀; Watson, Hesp. Ind. p. 45.
Pamphila scortea, Mabille, Ann. Soc. Ent. Belg. xxxvii. p. 53 (1893).

This species has wrongly been placed as a synonym of *P. pellucida*, from which it differs in the darker ground-colour and smaller spots of the hind wing below, and also in the form of the male genitalia. We have examined Mabille's types of *contigua* and *scortea*.

Hab. Sikkim (*Möller*); Khasia (*Elwes*); Nagas, Pegu, Perak, Pulo Laut, Sambawa, Bali (*Doherty*); Hong Kong (*Pryer*).

! Parnara eltola. (Plate XXVI. figs. 79, *a*, *b*.)

Hesperia eltola, Hewitson, Ex. Butt. iv., *Hesp.* pl. iv. fig. 40 (1869).

Parnara eltola, Wood-Mason & de Nicéville, Jour. As. Soc. Beng. 1886, p. 384, pl. xviii. figs. 6, 6 *a*, ♂; Watson, Hesp. Ind. p. 45 (1891); Leech, Butt. China &c. p. 613 (1894).

This species is distinguished from the next by the yellower colour of the pale spots on the upperside, which is most marked in the males, and by having the apex of the œdeagus, as seen from below, produced on the left side into a long sharp horn, and the right side spinose.

Hab. Sikkim (*Elwes*); Nagas (*Doherty*).

! Parnara discreta, n. sp. (Plate XXI. fig. 16, ♂; Plate XXVI. figs. 80, *a*, *b*.)

Closely allied to *P. eltola*, Hew., from which it differs in the following particulars:—

♂. Pale spots on fore wing above sordid white, that in cell 2 shorter in proportion, its inner and outer edges nearly parallel; ground-colour of the underside and the fringes, especially those of the hind wing, paler. Apex of the œdeagus produced into two subequal spinose horns, side lobes of the tegumen narrow and simple.

♀. Pale spot in cell 2 of fore wing comparatively shorter; underside, especially of hind wing, paler.

Hab. Khasias (*Elwes*); Sikkim (*Möller*); Tenasserim (*Bingham*); E. Pegu, Bernardmyo, Burmah (*Doherty*).

This species may be distinguished from *P. eltola* (with which it is probably mixed in collections) at first sight by the purer white of the pale spots on the upperside; and the difference in the male genitalia affords conclusive evidence of its distinctness.

Parnara pellucida. (Plate XXVI. figs. 77, 77 *a*.)

Pamphila pellucida, Murray, Ent. Mo. Mag. xi. p. 172 (1875).

Thymelicus pellucida, Staudinger, Rom. Mém. sur Lép. iii. p. 152, pl. viii. fig. 3 (1887).

Parnara pellucida, Leech, Butt. China &c. p. 611 (1894).

The ground-colour of the hind wing below is not sufficiently bright in Staudinger's figure above cited.

Hab. Japan (*Pryer*, *Leech*); Ussuri, Amurland (*Dörries*, *fide Stgr.*).

Parnara jansonis.

Pamphila jansonis, Butler, Cist. Ent. ii. p. 284 (1878).

Parnara jansonis, Leech, Butt. China &c. p. 612, pl. xlii. fig. 12, ♂ (1894).

Hab. Japan (*Pryer*).

Parnara bipunctata, n. sp. (Plate XIX. fig. 5, ♂.)

♂. Upperside: fore wing brown, heavily clothed with ochreous hair-scales towards the base; six sordid whitish hyaline spots—two remote in the cell, one large, pentagonal, in cell 2, one, smaller and subquadrate, in cell 3, and one, minute and punctiform, in each of cells 6 and 7; an elongate triangular yellow spot next vein 1 *a* beyond the middle: hind wing ochreous by reason of the hair-scales; the costa brown as far as vein 6, and the termen narrowly and suffusedly brown; two pale points on the disc, one near the middle of each of cells 2 and 3. Underside ochreous green, disc of the fore wing brown: fore wing with the pale spot next vein 1 *a* larger and more suffused than on the upperside, the other spots as on the upperside; hind wing with the two pale points as on the upperside. Fringes brown, becoming ochreous grey towards the tornus of each wing. Antennæ blackish, spotted with yellowish on the underside; club yellowish beneath. Second joint of palpi clothed with ochreous and black hairs intermixed. Body and legs ochreous brown.

Expanse $36\frac{1}{2}$ mm.

Hab. Batchian.

Described from one specimen ex coll. Staudinger.

At first sight this species bears some resemblance to *P. contigua*, Mab., from which, however, it is abundantly distinct.

! Parnara colaca. (Plate XXVI. fig. 81.)

Hesperia colaca, Moore, P. Z. S. 1877, p. 594, pl. lviii. fig. 7.

Parnara colaca, Elwes, Trans. Ent. Soc. Lond. 1888, p. 446, fig. 1; Watson, Hesp. Ind. p. 36 (1891).

Parnara cingala, Moore, Lep. Cey. i. p. 167, pl. lxx. figs. 3 *a*, 3 *b* (1881).

Hab. Sikkim (*Möller*); Ranchi (*Irvine*); Bangalore (*Minchin*); Trichinopoly (*Castets*); Andamans, Bali (*Doherty*); Nias (*Modigliani*); Ceylon (*fide Moore*).

! Parnara bevani. (Plate XXVI. fig. 82.)

Hesperia bevani, Moore, P. Z. S. 1878, p. 688.

Parnara beavani, Elwes, Trans. Ent. Soc. Lond. 1888, p. 447, fig. 2.

Parnara bevani, Watson, Hesp. Ind. p. 36 (1891).

Parnara thyone, Leech, Butt. China &c. p. 610, pl. xlii. fig. 4, ♂ (1894).

A specimen of *P. thyone* from Moupin, presented by Mr. Leech, seems inseparable from *P. bevani*.

Hab. N.W. Himalayas (*Hocking, Young*); Sikkim, Khasias, Bombay (*Elwes*); Nagas (*Doherty*); Kina Balu (*Waterstradt, in coll. Stgr.*); Moupin, E. Tibet (*Kricheldorf*).

PARNARA FLEXILIS.

Isoteinon flexilis, Swinhoe, P. Z. S. 1885, p. 147, pl. ix. figs. 9, 10; Watson, Hesp. Ind. p. 85 (1891).

♀. Size of *P. colaca* or *P. bevani*. Upperside brown: fore wing with the hyaline spots small, two in the cell, one next the middle of vein 1 *a*, one in each of cells 2, 3, 6, 7, and 8, that in cell 4 only indicated on the underside. Hind wing below brown, clothed with grey scales so as to give the appearance of a dark subterminal band. Fringes brownish grey, the short scales whitish grey.

Hab. Poona.

These particulars are taken from the type specimen in the British Museum. This is, we think, a very doubtful species.

! PARNARA ZELLERI.

Hesperia zelleri, Lederer, Verh. zool.-bot. Ges. Wien, 1855, p. 194.

A little known, though very distinct species, easily distinguished by the black-bordered pale spots on hind wing below.

Hab. Beyrout, Syria (*Zach*); Esmir, Busagha, near Tangier, Morocco (*Walker*).

! PARNARA TULSI.

Parnara tulsi, de Nicéville, Jour. As. Soc. Beng. 1883, p. 86, pl. x. fig. 1, ♂; Watson, Hesp. Ind. p. 44 (1891).

Hesperia jolanda, Plötz, Stett. ent. Zeit. xlvii. p. 95 (1886) (*fide* Mabille).

Hab. Sikkim (*Möller*); Java (*Fruhstorfer*).

Though this species does not seem to have been found in any part of Burmah or the Malay peninsula, I have a specimen from Java which is identical.

! PARNARA CÆRULESCENS.

Pamphila cærulescens, Mabille, Ann. Soc. Ent. Fr. 1876, p. lv.

Parnara cærulescens, Leech, Butt. China &c. p. 615, pl. xlii. fig. 9, ♂.

Hab. Wa-ssu-kow, Ta-tsien-lo (*ex coll. Leech & Oberthür*).

! PARNARA PUGNANS.

Parnara pugnans, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1891, p. 384, pl. G. fig. 30, ♀.

Hab. Pulo Laut (*Doherty*); Nias (*Modigliani*).

PARNARA HASOROIDES, n. sp. (Plate XXI. fig. 11, ♂.)

♂ ♀. Upperside brown. Underside brown: the hind wing with a broad white band from the middle of the costa to the dorsum just before the tornus, but interrupted in cell 1 *b*; the longer portion of this band is distinctly contracted at each end in the male, less distinctly so in the female. Antennæ brown, the club yellowish beneath.

Fringes brown. Body above brown. Clothing of the second joint of palpi, breast, and legs dark grey. Abdomen beneath brown.

Expanse 45–48 mm.

Hab. Halmaheira; Batchian (*ex coll. Stgr.*).

Described from one pair ex coll. Staudinger.

The band on the hind wing below resembles that found in *Hasora hurama*, Butl., save that in the latter it is not interrupted in cell 1 *b*.

Parnara uma.

Parnara uma, de Nicéville, Jour. As. Soc. Beng. 1888, p. 592, pl. xiii. fig. 9, ♀; Watson, Hesp. Ind. p. 38 (1891).

♀. Upperside brown: fore wing with a geminate cell-spot and five others, one in each of cells 2, 3, 6, 7, and 8, white. Hind wing below vinous brown, with a broad silvery-white subcostal streak, adjoining at its apex the last of a postmedian series of silvery-white subquadrate spots which commences in cell 1 *b*.

Hab. Karen hills, Burma.

The single specimen from which this species was described appears to be still unique.

Parnara philotas.

Baoris (*Parnara*) *philotas*, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1895, p. 402, pl. Q. fig. 60,

Upperside brown: fore wing and hind wing each with two hyaline white spots one in each of cells 2 and 3. Underside "thickly covered with 'old-gold' coloured scales"; dorsum of the fore wing broadly dark purplish brown; pale spots as on the upperside.

Expanse 30 mm.

Hab. Travancore (*Ferguson*); North Canara (*Bell*).

We doubt whether this insect belongs to the genus *Parnara*. The figure shows the colour of the underside to be dull greenish ochreous.

Parnara unicolor.

Baoris unicolor, Distant, Rhop. Mal. p. 381, pl. xxxv. fig. 11, ♂ (1886).

Hab. Malacca (*Eichhorn*)

Through the kindness of Dr. Staudinger we have had the opportunity of making a critical examination of the unique type of this species. The specimen is a male and a true *Parnara* in venation and in the number and position of the tibial spurs. At the base of the fore wing above, between the dorsum and the submedian, there is a long raised space about equal in length to one-fifth of the dorsum; this is probably a sex-mark and confined to the male. In the fore wing the first median segment is about two and a half times as long as the second, which is a little more than twice as long as the third; the transverse vein is oblique, and vein 5 arises much nearer 4 than 6 and curves upwards from its base. The palpi and the apices of the antennæ are now wanting, but there is one hind leg still left which has two pairs of spurs in the usual position. The specimen is in a worn condition.

Mr. de Nicéville named this species, which he had not seen, as the type of his genus *Idmon* (*vide* p. 198, *ante*), but his generic description does not apply to it.

PARNARA DISTICTUS.

Baoris distictus, Holland, Trans. Amer. Ent. Soc. xiv. p. 123, pl. ii. fig. 4 (1887).

Hab. Hainan (*Henry, fide Holland*).

"*Male.* Upper surface uniformly olive-brown, cilia pale cinereous. Primaries with two small, triangular, semi-diaphanous white spots beyond the middle of the wing and between the submedian nervules. Underside lighter than the upper, with a hoary lustre, especially on the posteriors. A few scarcely visible light scaleless spots may be detected adjacent to the two white spots of the primaries, which reappear on the underside. A curved submarginal row of obscure brown spots is found upon the secondaries. Underside of palpi and head white. Expanse of wings $1\frac{3}{8}$ inches. Type in coll. Holland."

Not having seen or been able to identify this species, we transcribe the original description. Its distinctive characters appear to be a subterminal series of obscure brown spots on the hind wing below, and the "underside of palpi and head white."

GEGENES.

Gegenes, Hübn. Verz. p. 107 (1816); Watson, P. Z. S. 1893, p. 104. Type *pygmæus*, Hübn.
Philoodus, Rambur, Faun. Ent. Andal. ii. p. 308 (1840). Type *nostrodamus*, Fab.

A genus resuscitated by Watson for the reception of the *Papilio nostrodamus* of Fabricius and two or three other species; it would be more convenient to treat it as a section of *Parnara*, in which it would be well distinguished by its short antennæ.

Antennæ about one-third as long as the costa; club elongate ovate; apiculus scarcely evident. Fore wing with vein 2 from the half-length of the cell in both sexes, vein 5 much nearer 4 than 6. Hind wing feebly excavated between veins 1 *b* and 2, vein 5 obsolete, vein 2 from apical fourth of cell. Tibial epiphysis present. Hind tibiæ with two pairs of spurs.

GEGENES NOSTRODAMUS.

Papilio nostrodamus, Fabricius, Ent. Syst. iii. p. 323 (1793).
Papilio pygmæus, Hübner, Eur. Schmett. i. figs. 458–460 (1798–1803).
Hesperia karsana, Moore, P. Z. S. 1874, p. 576, pl. lxvii. fig. 6.
Chapra nostrodamus, Watson, Hesp. Ind. p. 33 (1891).

Hab. Gibraltar (*Walker*); Biskra, Algeria (*Elwes*); Beyrout (*Zach*); Quetta (*Swinhoe*); Samarkand (*Haberhauer*); N.W. Himalaya (*Young*).

Erynnis.

Erynnis, Schrank, Fauna Boica, ii. p. 157 (1801); Watson, P. Z. S. 1893, p. 99. Type *comma,* Linn.
Ocytes, Scudder, Syst. Rev. p. 55 (1872). Type *metea,* Scudd.

The species of this genus are best known by their resemblance to the *Papilio comma* of Linnæus. Antennæ about half as long as the costa; club abrupt, subovoid; apiculus minute. Third joint of palpi almost concealed, second joint densely scaled. *Erynnis comma*, Linn., varies much in the details of the wing-pattern, but the essential pattern on the hind wing below remains the same, even in those specimens which at first sight seem to be the most distinct. Several American forms of this species have been investigated in great detail by Scudder (Mem. Bost. Soc. Nat. Hist. ii. pp. 341–353, pls. x., xi.), but the differences in the male genitalia which he figures appear to us, for the most part, mere differences of degree.

! Erynnis comma.

Papilio comma, Linneus, Faun. Suec. p. 285 (1761); Esper, Schmett. i. pl. xxiii. figs. 1 *a, b* (1777); Hübn. Eur. Schmett. i. figs. 479–481 (1798–1803).

Hab. Europe to Amurland.

The following varieties of *E. comma* may be treated as more or less constant local races, but we have not seen sufficient examples to enable us to form an opinion as to how far their distinctions are really constant.

! Erynnis comma, var. catena.

Hesperia comma, var. *catena,* Staudinger, Stett. ent. Zeit. 1861, p. 357.

Hab. Lapland (*Staudinger*).

Erynnis comma, var. dimila.

Pamphila dimila, Moore, P. Z. S. 1874, p. 576; de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1892, p. 355, pl. J. fig. 9, ♀; Watson, Hesp. Ind. p. 160.
Erynnis comma, var. *dimila,* Leech, Butt. China, &c. p. 595, pl. xli. fig. 12, ♂ (1892–94).
Erynnis dimila, de Nicéville, Jour. As. Soc. Beng. 1894, p. 52, pl. i. fig. 7,

Hab. N.W. Himalayas (*Hellard*); Ta-tsien-lo (*fide Leech*).

! Erynnis comma, var. florinda.

Pamphila florinda, Butler, Cist. Ent. ii. p. 285 (1878).
Erynnis comma, var. *florinda,* Leech, Butt. China, &c. p. 594, pl. xli. fig. 17, ♂ (1892–94).

Hab. Japan (*Pryer*).

I have no specimens of *comma* from Amurland, and therefore cannot say whether the form described by Staudinger [Rom. Mém. sur Lép. vi. p. 211 (1892)] as var. *repugnans* is a well-marked form or not; but I think that when he speaks of *florinda* as more probably a var. of *sylvanus* and not of *comma* he cannot have seen the true *florinda*, which is clearly more nearly allied to *comma* than to *sylvanus*, which also occurs in Japan.—H. J. E.

Adopæa.

Adopæa, Billberg, Enum. Ins. p. 81 (1820); Watson, P. Z. S. 1893, p. 98. Type *thaumas*, Hufn.
Pelion, Kirby, List Brit. Rhop. (1858). Type *thaumas*, Hufn.

A small group of species associated together on account of their resemblance, greater or less in degree, to the *Papilio thaumas* of Hufnagel (*linea*, Wien. Verz.). Antennæ short, generally less than half as long as the costa; club elongate, gradual, not apiculate. Third joint of palpi acicular, suberect, nearly as long as half the diameter of the eye.

The species are distinguished as follows:—

Males.

1 (10). Veins of hind wing below concolorous.
2 (9). With a sex-mark on fore wing above.
3 (8). Sex-mark continuous, leaving the extreme base of cell 2 free.
4 (5). Fore wing below with the black patch in the base of cell 1 *a* sharply defined and confined to the basal third of the wing . . . . . . *thaumas*, Hufn.
5 (4). Fore wing below with the black patch in the base of cell 1 *a* spreading along the dorsum or almost obsolete. Hind wing below with no distinct stripe of the same colour as the disc of fore wing in cell 1 *b*.
6 (7). Costa of the fore wing one-third longer than the dorsum. Hind wing below and apical area of fore wing below sordid greenish yellow, disc of fore wing below rusty yellow . . . . *hyrax*, Led.
7 (6). Costa of the fore wing one-fourth longer than the dorsum. Hind wing below and fore wing below, except a broad space along the dorsum, rust-yellow or greenish yellow . . . . *actæon*, Rott.
8 (3). Sex-mark interrupted, one end of the long piece filling the base of cell 2. *lineola*, Ochs.
9 (2). No sex-mark on fore wing above . . . . *stigma*, Stgr.
10 (1). Veins of hind wing below black.
11 (16). Sex-mark wanting.
12 (15). Fore wing above: the dark outline of veins 6–10 more or less spreading and confluent near their bases to form a dark patch beyond the end of the cell, basal third of the wing more or less dark.
13 (14). Upperside without purple reflection; veins on the underside less broadly black . . . . *sylvatica*, Brem.
14 (13). Upperside with a purple reflection; veins on the underside more broadly black . . . . *tenebrosa*, Leech.
15 (12). Fore wing above: dark outline of veins 6–10 free throughout, basal third of the wing concolorous . . . . *nervulata*, Mab.
16 (11). Sex-mark present. Fore wing above: basal third concolorous, dark marginal band narrow . . . . *leonina*, Butl.

! Adopæa thaumas.

Papilio thaumas, Hufnagel, Berl. Mag. ii. p. 62 (1776); Esper, Schmett. i. 1, pl. xxxvi. figs. 2, 3 (1778?), i. 2, pl. xcviii. figs. 5–10 (1790?).
Papilio linea, Wien. Verz. p. 160 (1776); Hübner, Eur. Schmett. i. figs. 485–487 (1798–1803).
♀. *Papilio venula*, Hübner, Eur. Schmett. i. figs. 666–669 (1803–18).

Hab. Europe to Asia Minor.

! ADOPÆA HYRAX.

Hesperia hyrax, Lederer, Wien. ent. Mon. v. p. 149, pl. i. fig. 6 (1861).

Hab. Amasia, Asia Minor, Syria.

! ADOPÆA ACTÆON.

Papilio acteon, Rottemburg, Naturf. vi. p. 30 (1775); Esper, Schmett. i. 1, pl. xxxvi. fig. 4 (1778 ?); Hübner, Eur. Schmett. i. figs. 488–490 (1798–1803).

Hab. S. and C. Europe; Asia Minor; N. Africa; Canaries (*Leech*); Samarkand (*Haberhauer*).

ADOPÆA HAMZA.

Hesperia hamza, Oberthür, Études d'Ent. i. p. 28, pl. iii. figs. 2 *a–c* (1876).

Very near to *A. actæon*, from which it appears to be best distinguished by the more fulvous colour of the upperside and the want of the suffused pale curved macular band which is seen just beyond the end of the cell on the fore wing of *A. actæon.*

Hab. Oran (*Oberthür*).

We have not any specimens which we can identify from Oberthür's plate. A male from Lambessa in the Province of Constantine appears to us to be inseparable from *A. lineola.*

! ADOPÆA LINEOLA.

Papilio lineola, Ochsenheimer, Schmett. Ent. i. 2, p. 230 (1808).
Papilio virgula, Hübner, Eur. Schmett. i. figs. 660–663 (1803–18).

Hab. Europe to Amurland; Algeria (*Oberthür*).

! ADOPÆA STIGMA.

Thymelicus (*Hesperia*) *stigma*, Staudinger, Stett. ent. Zeit. xlvii. p. 252 (1886).

This species belongs to the *sylvatica* group, but the veins on the underside are not black; the fore wing above has the dark terminal band sharply defined, the basal third concolorous, and the transverse vein rather conspicuously dark.

Hab. Turkestan.

! ADOPÆA SYLVATICA.

Pamphila sylvatica, Bremer, Bull. Acad. Petr. iii. p. 474 (1861); id. Lep. Ost-Sib. p. 34, pl. iii. fig. 10 (1864).
Adopæa sylvatica, Leech, Butt. China &c. p. 591, pl. xl. figs. 5 ♂, 8 ♀ (1892–94).

Hab. Amurland, Japan (*Pryer*); Korea (*Leech*).

! ADOPÆA TENEBROSA.

Adopæa tenebrosa, Leech, Butt. China &c. p. 591, pl. xl. figs. 6 ♂, 9 ♀ (1892–94).

The difference between this species and *A. sylvatica* are but trifling, and the genitalia afford no distinctive characters; as, however, it can be separated by its darker colour from *A. sylvatica*, we retain the name for the Chinese form.

Hab. Kiukiang (*Pratt*).

ADOPÆA NERVULATA.

Pamphila nervulata, Mabille, Ann. Soc. Ent. Fr. 1876, p. lvi.
Adopæa nervulata, Leech, Butt. China &c. p. 592, pl. xl. fig. 3, ♂ (1892–94).

The insect here dealt with is that described and figured by Leech; whether it is the true *nervulata* of Mabille remains doubtful, since the specimens do not possess the "striga anticarum sexuali nigra filiformi" mentioned in the original description.

Hab. Moupin (*fide Mabille*); Ta-Chien-lu, Wa-ssu-kow (*fide Leech*).

! ADOPÆA LEONINA.

Pamphila leonina, Butler, Cist. Ent. ii. p. 286 (1878).
Thymelicus leonina, Staudinger, Mém. sur Lép. iii. p. 151, pl. viii. fig. 2, ♂ (1887), vi. p. 210 (1892).
Adopæa leonina, Leech, Butt. China &c. p. 592, pl. xl. figs. 1 & 4 ♂, 2 ♀ (1892–94).

Hab. Japan (*Pryer*); Amurland (*fide Staudinger*).

ADOPÆA ASTIGMATA, Leech.

Adopæa leonina, var. *astigmata*, Leech, Butt. China &c. p. 593, pl. xl. fig. 7, ♂ (1892–94).

Differs from typical *leonina* in wanting a sex-mark in the male and being rather more suffused with black. The male genitalia are similar to those of *A. leonina*, but so also are those of *A. tenebrosa*.

Hab. Chang-yang, C. China (*Pratt*).

ISMENE.

Ismene, Swainson, Zool. Ill. i. pl. xvi. (1820–21); Moore, Lep. Cey. i. p. 157 (1881); Watson, Hesp. Ind. p. 9 (1891); id. P. Z. S. 1893, p. 125, pl. i. figs. 14–16, pl. ii. figs. 11, 12, pl. iii. fig. 18.

This genus and the four which succeed it form a natural group well distinguished by the form of the palpi, which have the second joint appressed and densely scaled, and the third joint porrect, long, and slender, about half as long as the diameter of the eye. In most of the species of this genus the club of the antennæ is as long as or longer than the shaft. Vein 5 in the fore wing straight, its base equidistant from veins 4 and 6 or (in *mahintha* and *ionis*) a trifle nearer to vein 6 than to vein 4. Vein 3 of hind wing arising close to the end of the cell.

The species known to us may be distinguished as follows:—

Males.

1 (26). Fringe of hind wing orange-red, more particularly near the tornus.
2 (17). Fore wing above with a sex-mark.
3 (14). Sex-mark deep black, sharply defined.
4 (11). Vein 1 *a* of fore wing distorted next the sex-mark.
5 (10). Hind wing: vein 6 approaching vein 5 in a deep curve.
6 (9). Costa of the hind wing folded over on to the upper surface of the apex.
7 (8). Expanse 48 mm. Long hairs clothing disc of thorax and base of hind wing above brilliant greenish blue . . . . *œdipodea,* Sw.
8 (7). Expanse 66 mm. Long hairs clothing disc of thorax and base of hind wing above brown . . . . *œdipus,* Stgr.
9 (6). Costa of the hind wing not folded over on to the upper surface of the apex . . . . *ataphus,* Wats.
10 (5). Hind wing: vein 6 straight . . . . *tuckeri,* n. sp.
11 (4). Vein 1 *a* of fore wing straight.
12 (13). Hind wing below: no straight pale band from the costa. Sex-mark running from the middle of vein 1 *a* to the base of vein 3, and composed of four short irregular stripes, of which the two in cell 1 *a* are confluent . . . . *mahintha,* Moore.
13 (12). Hind wing below with a whitish postmedian band running straight from the apical third of the costa to the apical fourth of vein 1 *b*. Sex-mark continuous, more than twice as high as wide, running from the middle of vein 1 *a* to the base of vein 3. *ionis,* de Nicév.
14 (3). Sex-mark fuliginous, suffused.
15 (16). Fore wing below with a sharply defined whitish spot in the cell near its apical third, and a curved series of suffused pale spots, one each in cells 4–8 . . . . *jaina,* Moore.
16 (15). No sharply defined whitish spot in the cell of fore wing below, nor subapical curved series of suffused pale spots . . . . . . *fergusonii,* de Nicév.
17 (2). Sex-mark wanting.
18 (23). Hind wing below not green, with black longitudinal lines.
19 (22). Clothing of the front of palpi orange-yellow.
20 (21). Expanse 70 mm. Cell 6 of hind wing above concolorous . . . *etelka,* Hew.
21 (20). Expanse 57 mm. Cell 6 of hind wing above whitish, except at the base and apex . . . . *harisa,* Moore.
22 (19). Clothing of front of palpi grey. Cell 6 of hind wing above concolorous . . . . *anadi,* de Nicév.
23 (18). Hind wing below emerald-green with fine black longitudinal lines, for the most part two in each cell, equidistant from each other and from the veins.
24 (25). Fore wing above plain brown, except a pale streak next the basal half of the costa . . . . *vasutana,* Moore.

25 (24). Fore wing above fulvous, passing into brown beyond the middle; basal half of veins 1 *a*, 2, and 3 (except the extreme base of vein 1 *a*) broadly margined with black, the confluent bases of veins 7–11 also black . . . . *septentrionis*, Feld.
26 (1). No orange-red in fringe of hind wing.
27 (32). Hind below green or whitish green, the veins broadly bordered with black. Tibial pencil yellow or pale.
28 (29). Hind wing below uniformly striped with black and green throughout . . . . *amara*, Moore.
29 (28). Hind wing with a broad pale stripe through the cell.
30 (31). This stripe divided beyond the transverse vein by the dark borders of vein 5. Fore wing above with the basal half of cell 2 grey-brown, a little paler than the apical half . . . . *gomata*, Moore.
31 (30). This stripe continued to the termen, the dark borders to vein 5 only indicated at the extreme apex. Fore wing above with the basal half of cell 2 sordid yellowish white . . . . *lara*, Leech.
32 (27). Hind wing below pale brown. Tibial pencil dark brown . . . *aquilina*, Speyer.

! Ismene œdipodea.

Ismene œdipodea, Swainson, Zool. Ill. i. pl. xvi. (1820–21).

We have only a single male of this species from Java, and rely on Mr. Watson for its identification with the description of Swainson.

Hab. Java (*Piepers*); Sumatra (*fide de Nicéville*); Palawan (*in coll. Rothschild*).

! Ismene œdipus.

Ismene œdipus, Staudinger, MS.

We have a single specimen of this species sent by Dr. Staudinger with the name of *œdipus*. The species does not appear to have been described, but it is distinguished from *œdipodea* by its much larger size, and the fact that the long hairs clothing the centre of the thorax and the base of the hind wing above are brown instead of greenish blue.

Expanse 66 mm.

Hab. Sula Island (*fide Staudinger*).

! Ismene ataphus.

Ismene ataphus, Watson, P. Z. S. 1893, p. 126.
Ismene œdipodea, Moore, Lep. Cey. i. p. 158, pl. lxiv. figs. 2*a*, *b* (1881); Watson, Hesp. Ind. p. 10 (1891).

The female of this species resembles the male, but wants the black patch near the base of the fore wing above, and the long hairs clothing the base of the wings show, in certain aspects, a brilliant greenish-blue colour.

Hab. Kangra (*Hocking*); Sikkim (*Möller*); Khasia (*Hamilton*); E. Pegu (*Doherty*).

! Ismene tuckeri, n. sp. (Plate XX. fig. 4, ♂.)

♂. Not distinguishable on the upperside from the male of *I. ataphus*, Wats., but differs from that species in the following particulars:—Fore wing below having the yellow tinge replaced by greenish. Hind wing, vein 8 evenly curved throughout, vein 6 straight; underside pale greenish brown with pale green streaks very narrowly edged with purple, the latter placed as follows: two in cell 1 *b*, one in each of cells 2 to 8, and one near the middle of the cell.

Expanse 44 mm.

Hab. Tavoy (*Tucker*).

Described from one example in coll. Elwes, taken in Feb. 1892.

! Ismene jaina.

Ismene jaina, Moore, P. Z. S. 1865, p. 782; Watson, Hesp. Ind. p. 10 (1891).

Hab. Sikkim (*Möller*); Khasia (*Hamilton*); E. Pegu (*Doherty*).

! Ismene fergusonii.

Ismene fergusonii, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1892, p. 345, pl. J. fig. 6, ♂.

Hab. Nilgiri hills (*Hampson*); N. Canara (*coll. Swinhoe*).

Female resembling the male, save that the sex-mark is wanting and the long hairs clothing the disc of the thorax and the base of the wings are bluish grey.

! Ismene etelka.

Ismene etelka, Hewitson, Exot. Butt. iv., *Ismene*, figs. 14, 15 (1867).

This species is easily distinguished in the male from *I. fergusonii* by the absence of the sexual patch on the fore wing and the much deeper and more extended orange-red markings below. The female on the upperside is brown with a purple shade, passing into greenish blue towards the base of the wings; on the fore wing below there is a suffused postmedian macular pale band, and the disc of the wing has a deep purple shade.

Hab. Kina Balu (*Waterstradt*); Singapore (*coll. Staudinger*); Lawas, N. Borneo (*Everett*).

! Ismene harisa.

Ismene harisa, Moore, P. Z. S. 1865, p. 782.

Choaspes harisa, de Nicéville, Jour. As. Soc. Beng. 1883, p. 84, pl. x. fig. 8, ♂; Distant, Rhop. Mal. p. 373, pl. xxxiv. fig. 22, ♂ (1886); Watson, Hesp. Ind. p. 6 (1891).

Female brown above, with a metallic greenish-blue shade from the base of the wings, but not covering the apical area of the fore wing or the terminal area of the hind wing.

Herr Snellen sent a female specimen from Java, not distinguishable from this species, with the name *consobrina*, Plötz.

Hab. Sikkim (*Möller*); Khasia (*Hamilton*); Nagas, Arjuno, Java (*Doherty*); Burmah (*Watson*); West Java (*Piepers*).

! Ismene anadi.

Choaspes anadi, de Nicéville, Jour. As. Soc. Beng. 1883, p. 83, pl. x. fig. 6, ♂; Watson, Hesp Ind. p. 7 (1891).

The female of this species is said to differ from the male only in being larger and darker, the upperside of the hind wing concolorous with the rest of the wing, not broadly pale ochreous as in the male; this is remarkable when we consider the close relationship of this species to *I. harisa*, which has a dissimilar female.

Hab. Sikkim (*Möller*); Khasia (*Hamilton*).

! Ismene vasutana.

Ismene vasutana, Moore, P. Z. S. 1865, p. 782.
Choaspes vasutana, Watson, Hesp. Ind. p. 8 (1891).

This species is remarkable amongst its congeners for the greater or less development of hyaline spots in the fore wing; the full complement of these is one in each of cells 2 and 3, but in the more usual state of the male that in cell 3 only is visible on the upperside, that in cell 2 being traceable on the underside only or wanting altogether; sometimes these spots are quite absent from the upperside and their presence is only indicated by a pale dot near the base of cell 3 on the underside.

It appears from Mr. de Nicéville's remarks (Jour. Bomb. Nat. Hist. Soc. 1895, p. 404) that a somewhat similar development of these pale spots occurs in *I. mahintha*, Moore.

The female is brown above, with a pale greyish-green shade from the base of the wings, passing into purple near the middle of the fore wing and about the apical third of the hind wing; the hyaline spots on the fore wing are well developed.

Hab. Sikkim (*Möller*); Nagas (*Doherty*).

! Ismene septentrionis.

Ismene septentrionis, Felder, Reise Nov., Lep. iii. p. 525, pl. lxxiii. fig. 3 (1867); Leech, Butt. China, &c. p. 636 (1894).
Ismene striata, Hewitson, Exot. Butt. iv., *Ismene*, pl. i. figs. 6, 7 (1867).

Hab. Shanghai (*Dr. Muirhead, fide Felder*); China (*fide Hewitson*); Siao-Lou (*ex coll. Oberthür*).

! ISMENE MAHINTHA.

Ismene mahintha, Moore, P. Z. S. 1874, p. 575, pl. xlvii. fig. 4, ♂ ; Watson, Hesp. Ind. p. 11 (1891).

A female of this species is recorded by Wood-Mason and de Nicéville (Jour. As. Soc. Beng. 1886, p. 378) as taken at Silcuri, Cachar, on 7th June ; but this sex does not appear to have been separately described and we have never seen it.

Hab. Bernardmyo, Burmah (*Doherty*).

! ISMENE IONIS.

Ismene ionis, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1895, p. 403, pl. Q. fig. 61, ♂.

Hab. Sambawa (*Doherty*) ; West Java (*Fruhstorfer, fide de Nicéville*).

! ISMENE AMARA.

Ismene amara, Moore, P. Z. S. 1865, p. 783.
Choaspes amara, Watson, Hesp. Ind. p. 8 (1891).

The female of this species usually closely resembles the male ; but a specimen from the Naga hills has the upperside a little darker than usual, and the veins of the fore wing bordered with dark purple, broadly for some distance from the base, the purple colour gradually narrowing and not reaching the termen.

Hab. Sikkim (*Möller*) ; Khasia (*Hamilton*) ; Nagas (*Doherty*).

! ISMENE GOMATA.

Ismene gomata, Moore, P. Z. S. 1865, p. 783, ♂.
Ismene lorquini, Mabille, Bull. Soc. Ent. Fr. 1876, p. x ; id. Ann. Soc. Ent. Fr. 1876, p. 266 (*fide* Semper).
Choaspes gomata, de Nicéville, Jour. As. Soc. Beng. 1883, p. 83, pl. x. fig. 7, ♀ ; Watson, Hesp. Ind. p. 7 (1891).

Female with the upperside purple-brown with a metallic bluish-green shade, which is strongest towards the base of the wings ; underside as in the male, save that the ground-colour of the fore wing is dark purple-brown and there is in each of cells 2 and 3 a suffused oblong pale spot.

A female specimen kindly sent by Herr G. Semper as the *Choaspes lorquini* of his work only differs from a female of *I. gomata* from Java in having the suffused oblong pale spots in cells 2 and 3 of the fore wing below visible also on the upperside.

Hab. Sikkim (*Möller*) ; Java (*Piepers*) ; Philippines (*Semper*).

! ISMENE LARA. (Plate XX. fig. 14, ♀.)

Ismene gomata, var. *lara,* Leech, Butt. China, &c. p. 634, pl. xxxix. fig. 12 (1894).

With regard to specific validity this insect stands in the same relation to *I. gomata,* Moore, as *I. fergusonii,* de Nicév., does to *I. jaina,* Moore.

Although the sexes resemble the respective sexes of *I. gomata,* both may be distinguished from that species by their slightly larger size and the much greater development of the pale markings on both upper and under sides.

Hab. Western China (*Pratt*).

! ISMENE AQUILINA.

Ismene aquilina, Speyer, Stett. ent. Zeit. 1879, p. 346; Staudinger, Rom. Mém. sur Lép. vi. p. 214 (1892); Leech, Butt. China, &c. p. 635 (1894).
Ismene jankowskii, Oberthür, Etud. d'Ent. v. p. 23, pl. i. fig. 2 (1880).
Proteides chrysæglia, Butler, P. Z. S. 1881, p. 856.

According to the figure the female of *I. jankowskii*, Ob. (the only sex figured), differs from females in Elwes's collection from Yesso in having the spots on the fore wing above not so pale and the pale postmedian band continued towards the dorsum by two spots in cell 1 *a* divided by the intraneural fold, instead of stopping short at vein 2; but we agree with Staudinger in considering this a synomym of *aquilina*.

Hab. Japan (*Pryer*); Amur (*Christoph*).

HASORA.

Hasora, Moore, Lep. Cey. i. p. 159 (1881); Watson, P Z S. 1893, p. 127. Type *badra,* Moore.
Parata, Moore, t. c. p. 160. Type *chromus,* Cr.

Vein 1 *a* of fore wing angularly bent near the base in both sexes. Tornus of hind wing distinctly produced. Vein 2 of fore wing arising nearer the base in the male than in the female. Pale spots on the fore wing better developed in the female than in the male, and sometimes present in that sex only. Hind tibiæ in the male fringed.

The species known to us we distingush as folliows:—

1 (16). Hind wing below without a pale band from the costa towards the tornus.
2 (13). Fringe of the hind wing not yellow in the tornal region.
3 (8). Hind wing below with a pale spot in the cell, next the transverse vein.
4 (7). Termen of hind wing distinctly concave from vein 3 to vein 1 *b*, the tornus therefore distinctly produced.
5 (6). Hind wing below: pale cell-spot small and roundish, less than half as wide as the cell . . . . *badra,* Moore.
6 (5). Hind wing below: pale cell-spot large and subquadrate, nearly as wide as the cell, the pale spot in cell 1 *b* correlatively larger . . . . *gnæus,* Plötz.
7 (4). Termen of hind wing straight from vein 3 to vein 1 *b*; the hind wing therefore simply angulated at the apex of vein 1 *b* . . *anura,* de Nicév.
8 (3). No pale spot in the cell on hind wing below.
9 (12). Sex-mark on the fore wing of the male a broad seam of modified scales passing from the dorsum near the middle to the base of vein 3.

10 (11). Underside brown: fore wing with a large suffused subtriangular dark purple patch adjoining the costa from the middle to about the apical sixth; hind wing with a suffused dark purple median band from the costa towards the dorsum . . . . *celænus,* Cr.

11 (10). Purple suffusion of underside much less evident than in *celænus,* almost absent . . . . *simplicissima,* Mab.

12 (9). No sex-mark on the fore wing of the male. Hind wing below in the male pale purple, with a pale cell-spot and postmedian band faintly indicated; in the female the purple is replaced by pale green . . . . *violacea,* Stgr.

13 (2). Fringe of the hind wing yellow in the tornal region.

14 (15). Hind wing below sharply divided just beyond the middle into a dark basal and a paler terminal portion, the latter chrome-yellow from the tornus and passing gradually into pale brown near vein 3 . . . . *myra,* Hew.

15 (14). Hind wing below brown, with a deep black tornal patch preceded by a pale ray in cell 1 *a* and an oblong pale yellow spot in cell 1 *b* . . . . *mus,* n. sp.

16 (1). Hind wing below with a pale band from the costa towards the tornus.

17 (24). Pale band on hind wing below interrupted near vein 1 *b*.

18 (21). No sex-mark on fore wing above in the male.

19 (20). No pale point in cell 6 of the fore wing. Pale band on hind wing below narrow bluish white, both its edges somewhat suffused. *mæstissima,* Mab.

20 (19). A pale point in cell 6 of fore wing. Pale band on hind wing below with its inner edge usually more sharply defined than the outer edge . . . . *chabrona,* Plötz.

21 (18). Male with a sex-mark on fore wing above.

22 (23). Expanse 39–48 mm. Tegumen with two pairs of long curved horns . . . . *chromus,* Cr.

23 (22). Expanse 46–50 mm. Tegumen without horns . . . . . . *inermis,* n. sp.

24 (17). Pale band on hind wing below not interrupted near vein 1 *b*.

25 (30). Pale band on hind wing below white.

26 (29). Hind wing below from the base to the white band purple, more or less tinged with green.

27 (28). Fore wing in the male with a white spot in cell 6. Pale band on hind wing below broad, suffused, tinged with purple on the edges and near the dorsum, reaching the latter in its præapical fourth . . . . *proximata,* Stgr.

98 (27). No white spot in cell 6 of the fore wing of the male . . . . *proxissima,* n. sp.

29 (26). Hind wing below from the base to the white band plain brown, the white band constricted near vein 3 to about half of its previous width, its outer edge straight . . . . *borneensis,* n. sp.

30 (25). Pale band on hind wing below yellow.

31 (32). Hind wing above brown, with a broad yellow median band from the costa to the tornus. The pale cell-spot and those in cells 2 and 3 on the fore wing above sharply defined hyaline and contiguous . . . . *chuza*, Hew.

32 (31). Hind wing above yellow, with a broad brown band along the costa and termen, receding a little from the latter between veins 7 and 1 *b*. The pale cell-spot and those in cells 2 and 3 of the fore wing above suffused, contiguous, not denuded of coloured scales . . . . *saida*, Hew.

! Hasora badra.

Goniloba badra, Moore, P. Z. S. 1865, p. 778.
Hasora badra, Moore, Lep. Cey. i. p. 159, pl. lxv. figs. 4, 4 *a* (1881); Watson, Hesp. Ind. p. 12 (1891).
Ismene quadripunctata, Mabille, *sec. spec. comm.*

Hab. Sikkim (*Möller*); Khasia (*Hamilton*); Akyab (*Adamson*); Tavoy (*Tucker*); Nias (*Modigliani*); Pulo Laut, Bali (*Doherty*).

! Hasora gnæus.

Ismene gnæus, Plötz, Stett. ent. Zeit. xlv. p. 58 (1884).
Ismene badra, var. *celebica*, Staudinger, Iris, ii. p. 138 (1889).
Hasora gnæus, Semper, Schmett. Philipp. p. 290 (1892).

Hab. Mindanao (*Semper*); Mindoro, Palawan (*Staudinger*).

We accept Semper's identification of this form. It is near to *badra*, but the absence of purple gloss on the underside and conspicuously larger spot at base of hind wing below, which seems constant, appear to justify its separation.

! Hasora anura.

Hasora anura, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1889, p. 170, pl. B. figs. 5 ♂, 1 ♀; Watson, Hesp. Ind. p. 12 (1891); Leech, Butt. China, &c. p. 639, pl. xxxix. fig. 10, ♀ (1894).

Hab. Sikkim (*Möller*); Moupin (*Kricheldorf*).

Hasora hadria.

Hasora hadria, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1889, p. 172.
Hasora badra, Distant, Rhop. Mal. p. 374, pl. xxxv. fig. 3, ♂ (1886), *fide* de Nicéville.

We have not seen this species, and therefore transcribe the author's account of it:—

"? Hesperia badra, Butler (*nec* Moore), Trans. Linn. Soc. Lond., Zoology, second series, vol. i. p. 554. n. 3 (1877); *Hasora badra*, Distant (*nec* Moore), Rhop. Malay. p. 374. n. 1, pl. xxxv. fig. 3, *male* (1886).

"*Habitat.* Perak, ? Malacca.

"Expanse: ♂, 2·1 inches.

"Description: *Male.* Upperside both wings as in *H. anura*, mihi. Fore wing lacking the subapical yellow dot (this, however, is a trivial character). Underside both wings dull brown, not slightly glossed with purple as in *H. anura*, or strongly so as in *H. badra*, Moore. Hind wing with a small anal lobe bearing a black patch, in *H. anura* there is no black patch or anal lobe, in *H. badra* both are large. This species is probably variable with regard to the presence or absence of a white or greyish spot in the cell of the hind wing on the underside, and a white or greyish streak above the anal angle, as in the two allied species above named; Mr. Distant describing a '*var.*' of this species as lacking these characters. I have not figured this species, as Mr. Distant has done so in his 'Rhopalocera Malayana.' I have described it from a single male from Perak in the collection of the Indian Museum, Calcutta, which Mr. Distant ticketed '*Hasora badra*,' Moore (var.)."

This is, to us, a doubtful species, as the description is contradictory. First we read, "upperside both wings as in *H. anura*," and then a few lines afterwards "hind wing with a small anal lobe bearing a black patch, in *H. anura* there is no black patch or anal lobe." It is true that the species is said to be represented by Distant's figure, but there is no more anal lobe in that figure than in *H. anura* (of which we have specimens), and certainly no black patch near the tornus of the hind wing below.

! HASORA CELÆNUS.

Papilio celænus, Cram. Pap. Exot. iv. p. 393, A, B.
Hasora celænus, de Nicéville, Jour. As. Soc. Beng. 1895, p. 554.

Hab. Amboina, Sumatra (*fide de Nicéville*).

! HASORA SIMPLICISSIMA.

Ismene simplicissima, Mabille, Bull. Soc. Ent. Fr. sér. 5, vol. vi. p. xxv (1876); Staudinger, Iris, ii. p. 138 (1889).
Hasora simplicissima, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1895, p. 405, pl. Q. figs. 62 ♂, 63 ♀.
Ismene philetas, Plötz, Stett. ent. Zeit. xlv. p. 56 (1884).
Parata simplicissima, Semper, Schmett. Philipp. p. 292 (1892).

Hab. Philippines (*Semper*); Palawan (*Platen, fide Stgr.*); Burmah, Sumatra (*fide de Nicéville*); Bali (*Doherty*).

! HASORA VIOLACEA.

Ismene violaceus, Staudinger, MS.?

On the upperside the female of this species is brown with a violet-purple shade, which is strongest in the apical region of the fore wing and on the lobe of the hind wing. This purple shade is absent or but faintly indicated in the male.

Hab. Amboina (*coll. Stgr.*).

HASORA MÆSTISSIMA.

Ismene mæstissima, Mabille, Bull. Soc. Ent. Fr. 1876, p. xxv; id. Ann. Soc. Ent. Fr. 1876, p. 263; Staudinger, Iris, ii. p. 136 (1889).

Hab. Mindanao (*Semper*); Palawan (*Platen, fide Stgr.*); Kina Balu (*Waterstradt*).

HASORA VITTA.

Hesperia vitta, Butl. Trans. Ent. Soc. 1870, p. 498; id. Lep. Ex. pl. lxix. fig. 9; *cf.* de Nicéville Jour. Bomb. Nat. Hist. Soc. 1895, p. 408.

? *Hasora vitta,* Swinh. Trans. Ent. Soc. 1893, p. 329.

Hab. Sarawak (*Low, fide Butler*).

We have never seen a specimen of this species, which is described and figured as without any apical spot on the fore wing. We have seen a Bornean specimen from Staudinger's collection which has this spot, which is constant in *chabrona* from all localities. There is no other character by which we can distinguish *vitta,* Butler, as described, and we are therefore unable to say whether it is a good species confined to Borneo, as de Nicéville suggests, or a mere aberration of *chabrona.*

! HASORA CHABRONA.

Ismene chabrona, Plötz, Stett. ent. Zeit. xlv. p. 56 (1884).

Hasora vitta, Distant (*nec* Butl.), Rhop. Mal. p. 375, pl. xxxv. fig. 4, ♂ (1886); Semper, Schmett. Philipp. p. 291 (1892), *sec. spec. comm.*

Hasora chabrona, de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1895, p. 406.

Hab. Sikkim (*Möller*); Assam, E. Pegu (*Doherty*); Andamans (*de Roepstorff*); Java (*Piepers*); Kina Balu (*Waterstradt*).

HASORA COULTERI.

Hasora coulteri, Wood-Mason & de Nicéville, Jour. As. Soc. Beng. 1886, p. 378, pl. xviii. figs. 8 ♂, 8*a*, 8*b* ♀; Watson, Hesp. Ind. p. 14 (1891); de Nicéville, Jour. Bomb. Nat. Hist. Soc. 1895, pp. 407, 408.

We have not seen this species. It "is very closely allied to *H. chabrona*; the females of the two species may be distinguished on the underside of the hind wing by both the edges of the discal white band being sharply defined in *H. coulteri,* much blurred in *H. chabrona.* The female of *H. coulteri* possesses the subapical spot to the fore wing, which is lacking in the male, and by the absence of which, together with the discal band, it is distinguished from the same sex of *H. chabrona.*" The male has not the male mark as in *chromus,* the upperside of the fore wing being "without spots, but with three ill-defined discal bands composed of modified scales arranged along each side of the submedian nervure, and of the first and second median nervules, and probably concealed by setæ in the living insect."

Hab. Silcuri, Cachar (*Wood-Mason & de Nicéville*).

HASORA CHROMUS. (Plate XXVII. figs. 93, 93 *a*.)

Papilio chromus, Cramer, Pap. Exot. iii. pl. cclxxxiv. fig. E, ♂ (1782).

Ismene malayana, Felder, Wien. ent. Mon. iv. p. 401 (1860); id. Reise Nov., Lep. iii. pl. lxxii. fig. 15 (1866).

Parata chromus, Moore, Lep. Cey. i. p. 161, pl. lxv. figs. 1 *a*, *b* (1881); Watson, Hesp. Ind. p. 16 (1891).

Parata malayana, Watson, t. c. p. 18.

Parata alexis, Moore, l. c. figs. 2 *a*, 2 *b*; Watson, t. c. p. 17.

Hasora chromus, Leech, Butt. China, &c. p. 638, pl. xxxix. fig. 7 (1894).

This species varies much in size; the smallest specimen I have expands 39 millim. The pale band on the hind wing below varies in width and shape; its inner edge is always straight, but its outer edge may be either straight, when the band is narrow (about 1 mm. wide or a mere line), or sinuate, when the band is about 3 mm. wide in its widest part. In Sikkim specimens the brown ground-colour of the hind wing below is washed with metallic purple inclining to green, and in specimens from the Andamans the green colour predominates over the purple, except in the space beyond the pale band (these latter seem to be the true *malayana*, Feld.); in some specimens the greenish-purple colour is scarcely visible in the space beyond the pale band; these differences, however, are not correlated with differences in locality and cannot usefully be made the basis for grouping specimens.

Hab. Sikkim (*Möller*); Khasia (*Elwes*); Burmah (*Doherty*); Andamans (*de Roepstorff*); Ceylon, Bangalore (*Minchin*); Pulo Laut (*Doherty*); Java (*Piepers*).

! HASORA INERMIS, n. sp. (Plate XX. fig. 16; Plate XXVII. figs. 94, 94 *a*.)

This species closely resembles *H. chromus*, from which it differs by its larger size and the different form of the male genitalia. The male has the sex-mark on the fore wing above and wants the pale point in cell 6 of that wing; the female resembles that sex of *H. chabrona* in having on the fore wing a somewhat crescent-shaped whitish hyaline spot in each of cells 2 and 3, and a whitish point near the basal third of cell 6.

Expanse 46–50 mm.

Hab. Liu Kiu Islands (*Pryer*).

Described from one pair in coll. Elwes. The species can only be distinguished with certainty by the male genitalia.

HASORA PROXIMATA.

Ismene proximata, Staudinger, Iris, ii. p. 137 (1889).

Hasora proximata, Semper, Schmett. Philipp. p. 291, pl. xlix. fig. 6, ♀ (1892).

Hab. Mindanao (*Semper*); Palawan, Celebes (*Platen, fide Stgr.*).

HASORA PROXISSIMA, n. sp. (Plate XXI. fig. 10, ♂.)

♂. Upperside brown. Underside: fore wing brown, paler along the dorsum, basal third of the disc thickly clothed with coarse darker scales, a purple streak next the upper edge of the cell and a curved series of suffused purple spots beyond the end of the cell from the costa to cell 3: hind wing with a white band from just before the apex of the costa to the dorsum just before the tornus, from the base to the band purple-brown shot with green, beyond the band plain brown; the inner edge of the band is evenly curved (the convexity towards the base of the wing) from the costa to vein 1 *b*, whence it runs straight to the dorsum and is tinged with purple and green, the outer edge is nearly straight from the costa to vein 1 *b*, where it is angulated.

Expanse 41 mm.

Hab. Mindoro (*coll. Stgr.*).

Described from one specimen ex coll. Staudinger.

H. proximata and *H. proxissima* belong to a group, not represented in our region by any species, which we may call the *hurama* group, because they agree with that species from North Australia in having the band on the hind wing below continuous from the costa to the dorsum, whilst in all the specimens in Elwes's coll. of *chabrona* (10) and *chromus* (30) this band, though very variable in breadth, coloration, and distinctness, is interrupted near vein 1 *b* by the black subtornal patch. The differences between *proxissima* and *proximata* are precisely those between *vitta*, Butl., and *chabrona*, Plötz, namely the presence or absence of the apical spot on the fore wing. This may or may not be a constant character, but it is constant in the only species of which we have a good series, namely *chabrona*. All these four species want the sex-mark which is so conspicuous in *H. chromus*, and the round spot at base of hind wing below which distinguishes the *badra* group.

! HASORA BORNEENSIS, n. sp. (Plate XX. figs. 8 ♂, 11 ♀.)

♂. Upperside brown, the dorsal half of the hind wing yellow-brown, by reason of the thick clothing of paler hair-scales. Underside: fore wing brown, with a suffused whitish > with its apex to the termen between veins 1 *a* and 3, transverse vein indistinctly pale, and a suffused indistinct macular pale band from beyond the end of the cell towards the tornus as far as cell 2: hind wing brown, with a cream-white band from the preapical fifth of vein 8 to the dorsum just before the tornus, the outer edge of this band is straight from vein 8 to the apical seventh of vein 1 *b*, where the short piece which runs to the dorsum forms an obtuse angle with the remainder, its inner edge is almost straight from vein 8 to the base of vein 3, whence it is irregularly curved outward, and the width of the band is thus reduced to about one-half of its previous width; tornal region somewhat darker than the remainder of the wing, but without any black patch. Fringes pale grey, becoming paler towards the tornus of each wing; the short scales grey-brown. Antennæ brown, the club and apiculus reddish beneath. Body above concolorous with the wings. Second joint of palpi clothed with grey and black hairs intermixed. Clothing of breast and legs brown, of the abdomen beneath ochreous.

♀. Upperside: fore wing brown, with six yellowish-white hyaline spots—one about as high as wide across the apical third of the cell, its outer edge notched, one about one and a half times as high as wide lying obliquely across cell 2, its outer edge concave, one about one and a half times as high as wide with its outer edge concave across cell 3, and three others small and oblong or suboval, one in each of cells 6, 7, and 8; hind wing dark brown, the dorsal half thickly clothed with bright ochreous hair-scales. Underside: fore wing brown, the costal region as far as the end of the cell paler; the hyaline spots as on the upperside, a subtriangular white spot next the upperside of vein 1 *a* beyond the middle and sometimes a minute suffused white spot in cell 1 *a* next the lower outer angle of the hyaline spot in cell 2. Otherwise as in the male.

Expanse 46–50 mm.

Hab. Kina Balu, Borneo (*Waterstradt*).

Described from two pairs ex coll. Staudinger.

! HASORA MYRA.

Ismene myra, Hewitson, Exot. Butt. iv., *Ismene*, pl. i. fig. 3, ♂ (1867).

We give a full description of both sexes of this species; the female does not appear to have been described.

♂. Upperside: fore wing warm brown; hind wing brown from the costa about as far as vein 3, thence to the apex ochre-yellow; pubescence of both wings yellow-brown. Underside: fore wing grey-brown, suffusedly paler along the dorsum, beyond the end of the cell, and at the apex: hind wing dark brown from the base to beyond the middle, the limit of that colour well defined and passing from the costa at the level of the apical fourth of vein 8 in a straight line to the apical third of vein 1 *b*, where it is broken by a pale streak along the course of the vein last-named and then passes to the dorsum; the space beyond this dark basal shade is pale brown in the apical region and ochre-yellow in the tornal region, those colours passing gradually the one into the other. Fringe of the fore wing brown, a little paler towards the tornal angle; of the hind wing brown at the apex, passing gradually into ochre-yellow as the tornal angle is approached. Clothing of body and legs yellow-brown, paler on the abdomen.

♀. Fore wing similar to that of the male but with hyaline spots placed as follows:—a small triangular one in the cell near the base of vein 3, one in each of cells 2 and 3, narrow oblique and nearly or quite reaching from side to side of those cells, and one (small and roundish) in each of cells 6 and 7. Hind wing similar to that of the male, but with the yellow portion more extensive and the limits of the brown and yellow colours more sharply defined.

Expanse, ♂ 46 mm., ♀ 52 mm.

Hab. Java (*Piepers*).

! HASORA MUS, n. sp. (Plate XX. figs. 2 ♂, 5 ♀.)

♂. Upperside brown, inclining to yellow-brown towards the dorsum of the hind wing; subtornal region of the termen of the hind wing blackish. Underside: paler than the upperside and more decidedly yellow-brown, the middle of the dorsal region of the fore wing dull ochreous; tornus of the hind wing with a large deep black oblong patch from the dorsum nearly to vein 2, preceded by an oblong yellow patch near the apical third of cell 1 *b* and a yellow ray in cell 1 *a*. Fringe of the fore wing grey-brown; of the hind wing grey-brown from the apex to near vein 5, thence gradually becoming yellow. Antennæ blackish, a little paler on the underside. Body above concolorous with the wings. Clothing of second joint of palpi yellow, the lateral bristles black, that of the underside and legs dull ochreous.

♀. Hind wing above blackish brown, the dorsal half thickly clothed with ochreous hair-scales, otherwise like the male.

Expanse $36\frac{1}{2}$–$38\frac{1}{2}$ mm.

Hab. Kina Balu (*Waterstradt*).

Described from a pair sent by Dr. Staudinger now in Elwes's collection. He has other similar specimens, and we have seen in M. Oberthür's collection from Perak what may be the same species.

! HASORA CHUZA.

Ismene chuza, Hewitson, Exot. Butt. iv., *Ismene*, pl. i. fig. 4 (1867).
Choaspes chuza, Distant, Rhop. Mal. p. 373, pl. xxxiv. fig. 27 (1886).

Hab. Nagas, Upper Burmah, Pulo Laut (*Doherty*); S.E. Borneo (*coll. Schönberg*); Java (*Piepers*).

! HASORA SAIDA.

Ismene saida, Hewitson, *l. c.* fig. 5, ♀.
Parata saida, Semper, Schmett. Philipp. p. 293 (1892).
Parata gentiana, Semper, *l. c.*, *sec. spec. comm.*

Hab. Luzon, Samar, Bohol, Mindanao (*Semper*); Philippines (*Hewitson*).

In the male the spots forming the pale discal band on the fore wing above are pale yellow, opaque, confluent, and suffused at the edges; in the female they are whitish hyaline, angular, and contiguous but sharply defined. Felder's description of his *Ismene gentiana* (Reise Nov., Lep. iii. p. 527) agrees well with this insect, but not so his figures (*t. c.* pl. lxxii. figs. 18, 19).

BIBASIS.

Bibasis, Moore, Lep. Ceyl. i. p. 160 (1881); Watson, P. Z. S. 1893, p. 128. Type *sena*, Moore.

Fore wing: vein 1 *a* not distorted near the base. Hind tibiæ in the male thickly scaled above and bearing a pencil of hairs as in *Ismene*.

The clothing of large flattened scales, which imparts to the hind tibiæ of the male in this genus and *Ismene* their fusiform shape, really forms a case in which the tibial pencil is enclosed.

We distinguish three species of this genus, of which the diagnostic characters are as follows:—

1 (4). Pubescence of hind wing above lighter or darker yellow-brown. Upper edge of clasp with a spinose lobe near the base.
2 (3). Outer edge of the pale band on the hind wing below suffused and becoming purplish . . . . *sena,* Moore.
3 (2). Outer edge of the pale band on the hind wing below as sharply defined as the inner edge . . . . *uniformis,* n. sp.
4 (1). Pubescence of the hind wing above bright rust-yellow. No spinose lobe on the upper edge of the clasp near the base . . . . *sambavana,* n. sp.

! BIBASIS SENA.

Goniloba sena, Moore, P. Z. S. 1865, p. 778.
Bibasis sena, Moore, Lep. Cey. i. p. 160, pl. lxv. figs. 3, 3 *a* (1881); Watson, Hesp. Ind. p. 15 (1891).

Hab. Sikkim (*Möller*); Khasias (*Hamilton*); Nagas (*Doherty*); N. Canara (*Aitken*).

! BIBASIS UNIFORMIS, n. sp. (Plate XXVII. fig. 95.)

Ismene sena, var. *palawana,* Staudinger, Iris, ii. p. 139 (1889).
Bibasis sena, var. *palawana,* Semper, Schmett. Philipp. p. 292 (1892).

Differs from *B. sena* in having the outer edge of the white band on the hind wing below as sharply defined as the inner edge. Specimens from Java and Kina Balu, Borneo, have more or less whitish-purple suffusion, sometimes forming one or two spots near the end of the cell on the fore wing below, as in *B. sena*; this is entirely wanting in var. *palawana*, Stgr., which also has the pale subdorsal patch on the fore wing below pure white.

Hab. Java (*ex coll. Snellen*); Kina Balu (*Waterstradt*); Palawan (*fide Staudinger*); Luzon (*fide Semper*).

The male genitalia of Javan and Bornean specimens agree with those of *B. sena*, of which this is, doubtless, an insular form.

! BIBASIS SAMBAVANA, n. sp. (Plate XXVII. fig. 96.)

The single male example of this species is, unfortunately, not in a condition for detailed description, but as it, nevertheless, presents diagnostic characters it has been thought well to point these out. It appears probable that in the colour and pattern of the underside it will prove to resemble *B. sena* rather than *B. uniformis*; but, however this may be, it is readily distinguished from either by the bright rust-yellow hairy clothing of the inner part of the hind wing above, which in *B. sena* and *B. uniformis* is olive, and the different clasp-form. The latter will be best appreciated from the figures.

Hab. Sambawa (*Doherty*). Type in coll. Elwes.

Badamia.

Badamia, Moore, Lep. Cey. i. p. 156 (1881); Watson, P. Z. S. 1893, p. 128. Type *exclamationis,* Fab.

Fore wing very narrow, its greatest width equal to three-fourths of the length of the termen; hind wing with the termen deeply, almost semicircularly, concave from vein 3 to vein 1 *b*. Vein 2 of fore wing arising near the base of the cell in both sexes. Vein 3 of hind wing arising well before the end of cell. Hind tibiæ in the male fringed.

Badamia exclamationis.

Papilio exclamationis, Fabricius, Syst. Ent. p. 530 (1775).
Papilio ladon, Cramer, Pap. Ex. iii. pl. cclxxxiv. fig. C, ♀.
Ismene thymbron, Felder, Sitzb. Ak. Wiss. Math.-nat. Cl. xl. p. 461, sep. p. 14 (1860).
Badamia exclamationis, Moore, Lep. Cey. i. p. 157, pl. lxvi. figs. 2, *a*, *b* (1881); Watson, Hesp. Ind. p. 3 (1891).

The specimen in coll. Felder labelled in contemporary handwriting "*Ismene thymbron,* Feld.," "Amboina, Doleschall," is a male of *B. exclamationis*, only differing from Indian examples in the slightly warmer tint of the upperside.

Hab. N.W. Himalaya (*Young*); Sikkim, Khasia (*Elwes*); Andamans (*de Roepstorff*); Burmah, Bali, Pulo-Laut (*Doherty*).

Rhopalocampta.

Rhopalocampta, Wallengren, Rhop. Caffr. p. 4; Watson, P. Z. S. 1893, p. 129. Type *forestan,* Cr.
Choaspes, Moore, Lep. Cey. i. p. 158 (1881). Type *benjamini,* Guér.

Watson diagnoses this genus by the absence of vein 5 in the hind wing, but this vein, though perhaps less evident than in the allied genera, is present in the three species which we possess The hind tibiæ in the male bear a long pencil the distal half of which is held close to the tibia by a thick fringe of hair-like scales.

The species known to us we distinguish as follows:—

1 (4). Hind wing above with the subtornal angulation black, more or less widely margined with yellow.
2 (3). Hind wing shorter, vein 1 *b* subequal in length to the dorsum of the fore wing. Pale spaee near the tornus of the hind wing below orange-red . . . . *benjamini,* Guér.
3 (2). Hind wing longer, vein 1 *b* about one-fifth longer than the dorsum of the fore wing. Pale space near the tornus of the hind wing below lemon-yellow . . . . *crawfurdi,* Distant.

4 (1). Hind wing above with the subtornal angulation and the adjacent region entirely yellow.

5 (6). Upperside dark brown with a dull purple shade, pubescence of thorax above dull green; hind wing narrower, tornus more produced . . *subcaudata*, Feld.

6 (5). Upperside brown with brilliant purple reflections, passing into pale green towards the base of the wings, pubescence of thorax above bluish grey; hind wing broader, its tornus less produced . . . . *renidens*, Mab.

! RHOPALOCAMPTA BENJAMINI.

Thymele benjamini, Guérin, Delessert's Souv. Voy. Ind. ii. p. 79, pl. xxii. figs. 2, 2*a* (1843).
Choaspes benjamini, Moore, Lep. Cey. i. p. 159, pl. lxiv. figs. 1, *a*, *b* (1881); Watson, Hesp. Ind. p. 5 (1891).
Rhopalocampta benjamini, Leech, Butt. China &c. p. 641 (1894).

As a rule the sexes may be distinguished by colour, the males being dark greenish and the females bluish at the base of the wings and on the body, but one Japanese male has the tint of the female.

Hab. Kumaon (*Ramsay*); Sikkim (*Möller*); Khasia (*Hamilton*); Nagas (*Doherty*); Nilgiris (*Morris*); Ceylon (*Green*); Japan (*Pryer*, *Leech*); Moupin (*Kricheldorf*).

! RHOPALOCAMPTA CRAWFURDI.

Choaspes crawfurdi, Distant, Rhop. Mal. p. 372, pl. xxxiv. fig. 26 (1886).
Choaspes electra, Stgr. MSS.

Hab. Province Wellesley (*Distant*); Perak, Pulo Laut (*Doherty*); Borneo (*ex coll. Stgr.*); Lawas, N. Borneo, April (*Everett*).

! RHOPALOCAMPTA SUBCAUDATA.

Ismene subcaudata, Felder, Reise Nov., Lep. iii. p. 526, pl. lxxii. figs. 20, 21 (1867).

Hab. Java (*Piepers*); Bali (*Doherty*).

RHOPALOCAMPTA RENIDENS.

Ismene renidens, Mabille, Compte Rendus Soc. Ent. Belg. iv. no. 16, p. lxxviii (1891).
Choaspes renidens, Semper, Schmett. Philipp. p. 289 (1892).

Hab. Philippines (*Semper*).

EXPLANATION OF THE PLATES.

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Fig. 1. *Celænorrhinus balukinus*, n. sp., ♂: p. 117.
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Fig. 4. ,, *dentatus*, n. sp., ♂: p. 119.
Fig. 5. ,, *fulvescens*, n. sp., ♂: p. 120.

Fig. 6 *Celænorrhinus saturatus*, n. sp., ♂: p. 120.
Fig. 7. ,, *lativittus*, n. sp., ♂: p. 121.
Fig. 8. ,, *maculicornis*, n. sp., ♂: p. 116
Fig. 9. ,, *affinis*, n. sp., ♀: p. 121.
Fig. 10. ,, *batchianus*, n. sp., ♂: p. 122.
Fig. 11. *Coladenia agnioides*, n. sp., ♂: p. 128.
Fig. 12. ,, *sobrina*, n. sp.. ♂: p. 126.
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Fig. 24. *Arnetta vindhiana*, Moore, ♂: p. 199.
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West, Newman chromo

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Horace Knight ad nat. lith.

West, Newman chromo

ORIENTAL HESPERIIDÆ

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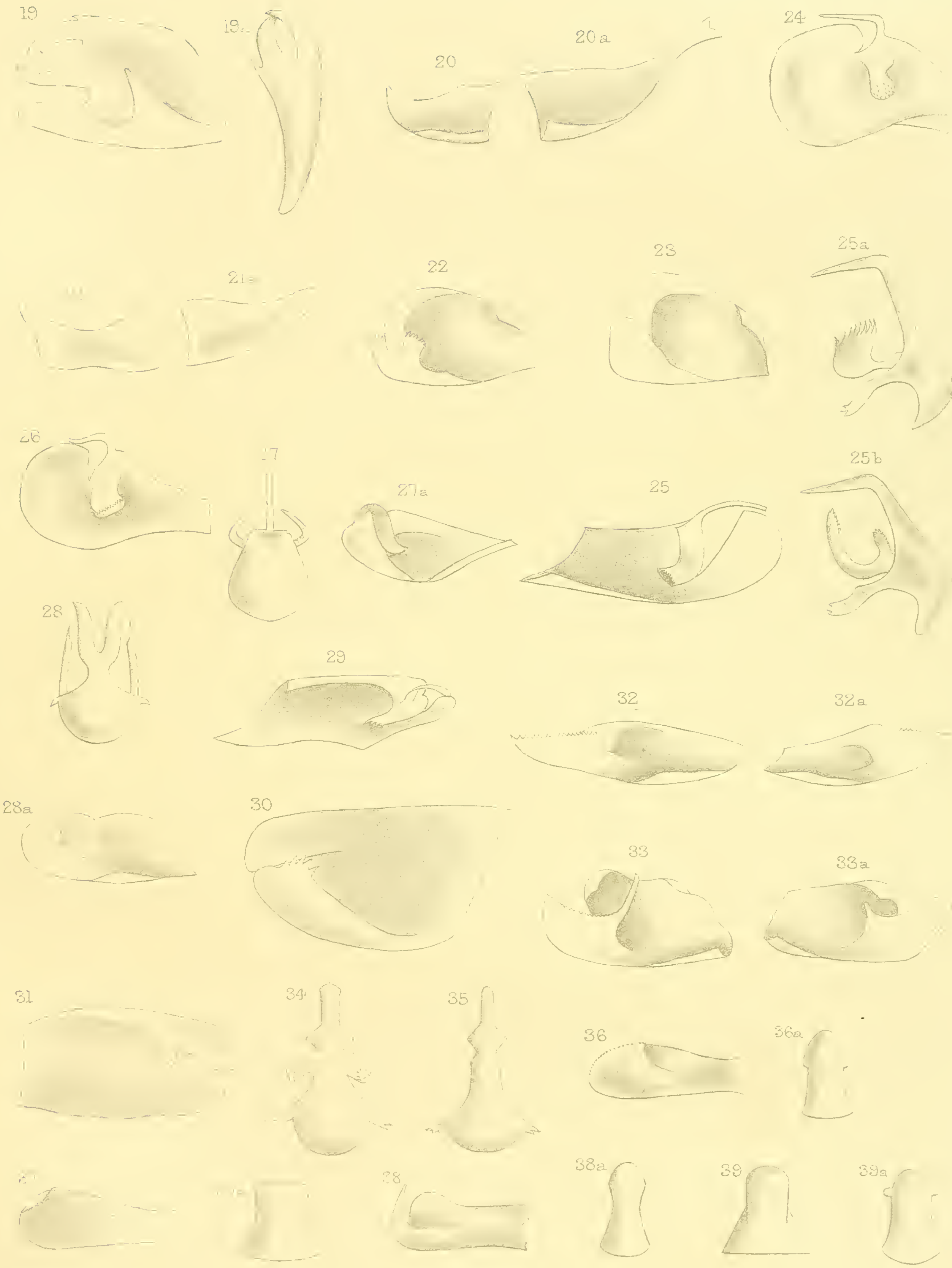

J Edwards ad nat. del.

West Newman lith.

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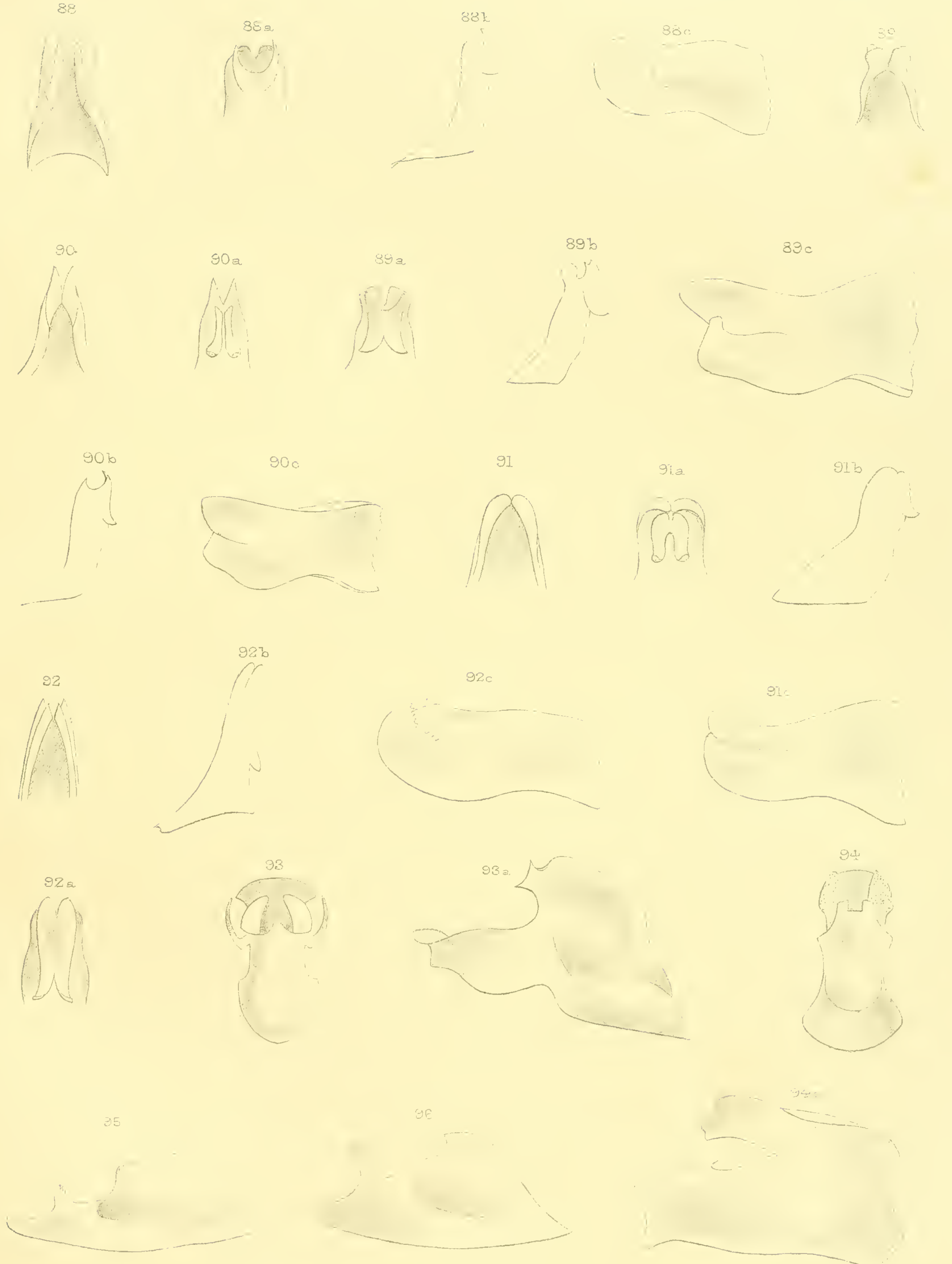

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ORIENTAL HESPERIIDÆ

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VII. *On the Morphology of the Skull in the Paraguayan* Lepidosiren *and in other Dipnoids.* *By* Professor T. W. Bridge, *Sc.D., F.Z.S., Mason College, Birmingham.*

Received May 10, 1897, read June 1, 1897.

[Plates XXVIII. & XXIX.]

Contents.

I. *Introduction.*

The skull which forms the subject of the following description belonged to one of the numerous specimens of *Lepidosiren* collected by the German traveller Dr. Bohls in the region of the Upper Paraguay River, and brought to Europe in 1894. As to the specific identity of the Paraguayan specimens with the Amazonian *Lepidosiren paradoxa*, it is at present premature to express a decided opinion, but on the evidence so far available I see no reason to question the probability that the two are referable to the same species. In any case, as Lankester [20] has shown, the distinction which Ehlers [8] has attempted to draw between his Paraguayan species *L. articulata* and *L. paradoxa*, as regards the segmentation or non-segmentation of the axial cartilage of the pectoral and pelvic fins, seems to have no foundation in fact.

In order to facilitate the comparison of my Paraguayan specimen with others obtained from the same region, and with the *Lepidosiren paradoxa* of the Amazons, the following measurements were made, and are here expressed in terms of the ratios adopted by Lankester [20, p. 15]:—

Total length in centimetres.	Head-length unit.	Ratio of total length.	Ratio of inter-membral length.	Ratio of post-pelvic length.	Ratio of cervico-dorsal length.
75	1	9·2	4·51	3·17	2·7

It may be remarked that the ratios exhibit a general agreement with those of the larger of the two specimens in the Oxford University Museum [Lankester, *l. c.* p. 15], except that their relative values are smaller, a fact due to the greater value of the unit of measurement, that is, the head-length, in the former as compared with the latter specimen. For the rest it may be said that my specimen had the usual black colour of the Paraguayan specimens, and in the character of its skin-areas and denticulated scales closely resembled the specimen described and figured by Lankester. The cloaca was situated to the left of the medio-ventral line, and both the pectoral and pelvic fins were supported by an axial skeleton in the form of an obviously-segmented rod of cartilage. Exclusive of the cranial rib, the specimen had 54 pairs of ribs, or one pair fewer than the specimens described by Bischoff and Hyrtl. Lastly, it may be added that the specimen was a male, with the characteristic series of villous processes along the postero-medial margins of its pelvic fins.

The first detailed account of the structure of the skull of *Lepidosiren paradoxa*, and certainly the most important, is that given by Bischoff in his well-known and copiously-illustrated memoir [2] published in 1840. This was followed a few years later (1845) by Hyrtl's monograph [18], which, however, contained but a single figure of the skull, viz. a lateral view. Hyrtl corrected one or two errors in Bischoff's memoir, and slightly modified the nomenclature of certain of the cranial elements, but otherwise added little to our knowledge of the structure of the skull; indeed, as he himself says, "Die Schädelknochen wurden von Bischoff so vollständig abgehandelt, dass ich mich hier nur in eine Aufzählung, nicht in eine Beschreibung derselben einzulassen brauche" (*l. c.* p. 613). Brühl [4] two years later (1847) reproduced several of Bischoff's figures, and suggested certain modifications in the names of some of the cranial bones, but in other respects his description is obviously based on the work of his distinguished predecessor.

The figures given in Bischoff's memoir, although for the most part accurate, nevertheless justify the criticism that neither the shape nor the sutural boundaries of the various bones are always represented with sufficient clearness, and are further defective in that sufficient attention has not been given to the structure of the chondrocranium. In several points the text also needs revision, more particularly in the light of modern researches in cranial morphology.

Of other Dipnoids, the cranial anatomy of *Protopterus* has perhaps been the more fully treated. The first account by Owen [25] was very imperfect, but was revised and certainly improved in his 'Comparative Anatomy and Physiology of Vertebrates' [26]. Peters [34], Huxley [14], and Cobbold [6] have also contributed to our knowledge of the skull of this Dipnoid. It is to Wiedersheim [41], however, that we are indebted for the best account of the skull of *Protopterus*, and his admirable paper has the additional merit of being illustrated by excellent and accurate figures.

The skull of the remaining Dipnoid, *Ceratodus*, was first described and figured by Günther [11], whose account was subsequently revised, and also amplified in certain particulars, in an eminently suggestive paper by Huxley [15].

The object of the present communication is (*a*) to place in the hands of morphologists the results of a detailed investigation into the structure of the skull of the Paraguayan *Lepidosiren*, illustrated by accurate and carefully-drawn figures; (*b*) to revise the accounts of the skulls of *Protopterus* and *Ceratodus* given by preceding writers; and (*c*) to institute a more detailed comparison of the differences and resemblances between the various Dipnoid skulls than has yet been made.

I desire also to express my thanks to the Council of the Royal Society for a grant from the Research Fund in aid of this and other investigations.

II. *Description of the Skull of the Paraguayan* Lepidosiren.

In somewhat striking contrast to the relatively short and bluntly-conical shape of the head, the skull, when stripped of its investing skin and powerful muscles, appears relatively longer and more sharply conical in contour. The narrowest portion of the skull is the central region, or that part which lies directly behind the eyes, expanding anteriorly in the nasal region, and widening even more behind in the auditory and laterally-deflected suspensorial regions. Viewed laterally the skull presents a strikingly carnivorous appearance, largely due to the existence of a prominent sagittal crest along the medio-dorsal line of the fronto-parietal bone, and to the backwardly-projecting "lambdoid" margin in which that bone terminates dorsad to the occipital plane.

Of the various cranial bones the fronto-parietal (the parieto-frontal of Bischoff and Hyrtl; in *Protopterus*, the parietal of Owen, Peters, and Cobbold, and the "Fronto-parietale" of Wiedersheim) (Pl. XXVIII. figs. 1, 2, and 4; Pl. XXIX. figs. 13–19 *f.p.*), from the share which it takes in the formation of the roof and side-walls of the cranial cavity, is perhaps the most important. In shape each lateral half of the bone is somewhat triangular (fig. 1), the broad bases of the two halves meeting in the medio-dorsal line, and there forming a strong longitudinal sagittal crest or ridge (figs. 1, 2, and 4, *sg.c.*) which serves for the origin of the more superficial portion of the temporal muscle. In no other Fish with which I am acquainted are the temporal muscles so powerfully developed in proportion to the size of the skull as in *Lepidosiren*, and in none do these muscles extend so far on to the dorsal surface of the skull. It is to the exceptional development of the temporal and masseter muscles that the bluntly-conical shape of the head is mainly due, since they are principally responsible for the thickening of what, so far as the skull alone is concerned, would otherwise be almost the narrowest portion of the head. From the sagittal crest the lateral portions of the fronto-parietal extend downward and outward, and form a gable-roof for all that portion of the skull which lies posterior to the nasal capsules, varying, however, in their relations to the cranial cavity and to the chondrocranium in different regions. Thus, in the anterior part of their extent (figs. 1, 4, and 15), the lateral portions of the bone, after forming the roof of the cranial cavity, curve sharply downward to the inner side of the trabecular cartilage, and by it are separated from the palato-pterygoid bone (fig. 15), eventually terminating on each side in an obliquely-fissured and somewhat irregular inferior margin (fig. 4), without, however, quite meeting the cartilaginous plate which, in front of the parasphenoid, forms the cranial floor. More posteriorly the fronto-parietal, as it descends from the roof into the side-walls of the cranial cavity, meets on each side the upturned lateral margin of the parasphenoid (figs. 4, 16, and 17) in a broadly V-shaped suture, which is best seen in a vertical longitudinal section of the skull (fig. 4), but is hidden externally by the trabecular cartilage (fig. 1, *tr.c.*). More posteriorly still (figs. 17 and 18) each lateral portion of the bone is continued outward from the cranial roof, externally to the cartilaginous auditory capsule, and thence is prolonged downward and outward in close relation with the outer surface of the suspensorial cartilage, extending almost as far as the articular surface for the mandible ; eventually the bone tapers to a contracted apex, which is wedged in between the hinder part of the palato-pterygoid bone and the squamosal, articulating with the superior margin of the former and the anterior borde of the latter (fig. 1). Behind the auditory capsule (figs. 1 and 19) the fronto-parietal overlies the cartilage of the supraoccipital region, and its lateral margins, converging from below upward and backward, project beyond the chondrocranium, and, after overlapping the two exoccipital bones and the first neural arch, terminate dorsally in a backwardly-projecting conical process (figs. 1 and 2). The converging lateral margins of the bone simulate the appearance of the characteristic "lambdoid" crest of the carnivorous Mammalia (fig. 2, *ld.c.*), and serve for the insertion of a portion of the lateral musculature of the trunk. From what has been stated as to the extent and relations of the fronto-parietal bone, it is obvious that it forms not merely the roof but also the lateral walls of all that section of the cranial cavity which lies between the mesethmoid region anteriorly and the auditory capsule posteriorly, and further, that in addition to strengthening the cranial roof in the auditory and post-auditory regions of the skull, it also contributes to the rigidity of the articular condyle for the lower jaw by investing the outer surface of the suspensorial cartilage.

Anteriorly to the fronto-parietal, and resting on the cartilaginous internasal septum, and also extending laterally so as to partially invest the fenestrated dorsal walls of the olfactory capsules, is a relatively thick and somewhat triangular bone (Pl. XXVIII. figs. 1, 2, and 4 ; Pl. XXIX. figs. 11 and 12, *d.e.*). The broad hinder margin of the bone is connected by a tough fibrous tissue, and not by suture, with the anterior edge of the fronto-parietal (fig. 4), and from this point the bone gradually contracts to a blunt apex which terminates a little posterior to the laterally-diverging cornua trabeculæ and the base of the prenasal process (fig. 2)[1]. The bone has been termed "premaxilla" by Natterer [24], Bischoff, and Hyrtl, apparently from its relations to what these writers considered to be premaxillary teeth, and it is obvious that it is the homologue of an almost precisely similar bone which in *Protopterus* is the conjoined premaxilla and nasal of Owen [26], the ethmoid of Peters and Rose [36], and the nasal of Cobbold, Miall [22], Wiedersheim, and Huxley [14]. In *Ceratodus* the equivalent bone has been regarded by both Günther and Huxley as an "ethmoid."

That the bone is not a "premaxilla" is proved by the fact that the latter element is invariably developed in front of the most anterior portion of the chondrocranium, which is certainly not the case with the bone in question, while the so-called "premaxillary teeth" are without doubt the representatives of the vomerine teeth of other Fishes and of Amphibia. The possibility that the bone may represent a pair of conjoined nasals cannot be so easily rejected, although, so far as I am aware, the fusion of two such elements to form a median nasal bone is without precedent in any other Fishes. For the term "ethmoid" much more may be said, but in the application of this name a distinction must be drawn between the characteristic mesethmoid of Teleosts, which is always an ossification of the mesethmoid cartilage, and the "supra-ethmoid" (Parker), which is a dermal bone situated directly beneath the superficial skin, and altogether external to the cartilage. From its position, external to the cartilage and immediately beneath the skin, it may be concluded that the Dipnoid bone is not a mesethmoid element, while it is obvious that it is in every way the exact counterpart of the bone which in some Teleosts (e. g. *Salmo*) has been termed "supra-ethmoid" by Parker [27], and in such Fishes exists in conjunction with ordinary paired nasals. For these reasons it seems preferable to regard the Dipnoid bone as a "dermal ethmoid." It may be mentioned that a similar median bone, with essentially similar relations to the nasal region of the skull, exists in *Polypterus* and in many fossil Fishes, such as, for example, the Arthrodira (e. g. *Coccosteus*) and the Palæoniscidæ.

Two singular bones, which for the present will be referred to as "supraorbital" elements, take origin from near the anterior margin of the fronto-parietal, and thence arch upward and backward nearly to the hinder end of the skull, lying immediately beneath the external skin and dorsad to the fronto-parietal, from which they are widely separated by the great temporal and masseter muscles (Pl. XXVIII. figs. 1, 2, and 4, *ec.e.*). At its anterior end (fig. 2) each bone is expanded laterally so that the two are only slightly separated from each other, while the outer margin forms the dorsal boundary of the orbit. At this point also (fig. 1) each is horizontally forked in such a way as to clip a backwardly-projecting process derived from the contiguous

[1] The transverse suture described and figured by Bischoff (*l. c.* tab. iii. fig. 4) as extending across this bone, and the curiously angular relations of the two portions, are obviously the result of an accidental fracture, as Hyrtl (*l. c.*) pointed out.

portion of the palato-pterygoid bone (figs. 1 and 2, *p.pt.a'.*), and to this process, as well as to the fibrous connection between the dermal ethmoid and the fronto-parietal, the anterior portion of the bone is firmly connected by ligamentous fibres. The extremity of the outer division of the fork approaches closely to the posterior margin of the cartilaginous olfactory capsule, but does not in any way contribute to the formation of a hinder wall to the capsule. Posteriorly, the bones contract to the condition of slender, laterally-compressed rods, and at the same time become widely separated from each other, eventually terminating behind in pointed extremities.

The identification of these bones, which are present in all existing Dipnoi, and have, on the whole, similar relations to other cranial structures as already described for *Lepidosiren*, has given rise to much divergence of opinion. Bischoff (*l. c.*) termed them "jugal" bones ("Jochbeine?"), although it is evident that he entertained some doubt as to the accuracy of his interpretation. By Hyrtl (*l. c.*) they were named superciliary bones ("Superciliarknochen"). In *Protopterus* the homologous structures have been termed "Frontale, incl. Frontale post" (Peters, *l. c.*), "frontals" (Cobbold, *l. c.*), "super-temporal" (Owen, *l. c.*), "supraorbital" (Huxley, *l. c.*), "tendon-bones" ("Sehnenbeine," Wiedersheim, *l. c.*), and in *Ceratodus* "os frontale" (Günther, *l. c.*), "frontal," Miall (*l. c.*), and "inner lateral bones," but probably representing the frontals of *Polypterus* (Huxley, *l. c.*). The term "jugal" is obviously inappropriate, as Cobbold pointed out, and "superciliary" or "supraorbital" are purely descriptive names based on the relation of the anterior portion of each bone to the orbital cavity. It is also clear that the bones in question have nothing in common with the bones ordinarily termed "frontals" in other Fishes, inasmuch as, except at their anterior extremities, they are widely separated from the proper cranial roof by the whole thickness powerful jaw-muscles, and lie directly beneath the dermis and scales of the superficial skin. On the other hand, the term "Sehnenbein," applied by Wiedersheim to the essentially similar bone in *Protopterus*, is somewhat novel, and on this point his own words may be quoted. After referring to the position of the two bones dorsad to the proper cranial roof, Wiedersheim says:—"Am frischen Präparat ist der ganze Zwischenraum von dem zum Processus coronoideus mandibulæ ziehenden M. temporalis ausgefüllt, und mit der gewaltigen Entwickelung des genannten Kaumuskels bringe ich auch die Entstehung der beiden sonderbaren Knochenlamellen in Verbindung, d. h. ich halte sie für in Folge des Muskelzuges entstandene Ossificationszonen in der Fascia temporalis resp. in der fast den ganzen Kopf einhüllenden subcutaneus Fasciæ überhaupt. Mit dem bis jetzt dafür gebrauchten Namen 'Supraorbitalknochen' ist nichts erklärt, ja der Name is schon deswegen nicht passend, weil sie sich weit über das Gebiet der Augenhöhle hinaus erstrecken" (*l. c.* pp. 46–47). According to Wiedersheim, therefore, the bones are to be regarded as ossifications in the superficial temporal fasciæ of the head, and presumably on that account are not to be compared with any of the ordinary cranial bones of other Fishes.

The origin of the temporal fasciæ and their relations to the bones, muscles, and other structures of the head in *Lepidosiren* may be briefly described. The superficial stratum of each of the great dorso-lateral trunk-muscles passes into a thin fibrous fascia which, after extending over the temporo-masseter muscles, blends anteriorly with a fibrous ring encircling the orbit, and is also attached to the posterior curvature of the antorbital cartilage, finally becoming continuous in front with the fibrous investment of the nasal capsules. Inferiorly, the fascia is continuous with the tough fibrous tissue investing the outer surface of the hinder portion of the mandible. Dorsally, the fascia becomes continuous with the external margin of the supraorbital bone of its side, and, reappearing on the inner margin, becomes, in turn, continuous with the inner margin of the corresponding bone of the opposite side of the skull

From the relations of the two supraorbital bones to the temporal fasciæ it would seem at first sight that the suggestion of Wiedersheim in the case of *Protopterus* is equally applicable to *Lepidosiren*. When, however, the position and relations of the equivalent bones in *Ceratodus* are carefully examined, it is not quite so clear that the name "Sehnenbein" is *wholly* accurate in either instance.

For the hinder part of its extent each supraorbital bone in the latter Dipnoid is a thin but relatively much wider plate than in either *Protopterus* or *Lepidosiren*, and becomes almost fibrous at its irregular free posterior margin, where it is continuous with the equivalent of the more posterior portion of the temporal fascia. In this region the bone lies externally to the jaw-muscles, but, unlike its representative in other Dipnoi, is connected with its fellow through the intervention of a similarly-situated bony lamina which is the "postero-median" bone of Huxley [15, fig. 7 B], and the "scleroparietal" of Günther [11, pl. xxxiv. fig. 4, *a*]. More anteriorly, as it passes over the orbit, the bone thickens considerably, but nevertheless so far retains the position and relations of the supraorbital bone of *Lepidosiren* and *Protopterus*. Instead, however, of terminating in the orbital region, the bone extends forward, closely investing the dorsal wall of the hinder part of the cartilaginous nasal capsule, and at the same time suturally articulates internally with the outer margin of the dermal ethmoid (Pl. XXIX. fig. 20 *ec.e.*). The preorbital portion of the bone forms moreover a characteristic descending process which, passing downward between the orbit and the nasal capsule, becomes greatly thickened laterally [1], and also closely applied to the lateral wall of the chondrocranium in the region of the mesethmoid. Finally, the process terminates inferiorly in a sutural articulation with the dorsal edge of an ascending lamina derived from the dentigerous palatine portion of the palato-pterygoid bone (fig. 20, *p.pt.a.*). It is obvious, therefore, that the preorbital section of the bone forms not only a partial roof, but in addition a posterior wall to the olfactory capsule, and at the same time

[1] The centre of this part of the bone contains a cavity filled with fatty connective tissue.

constitutes the anterior boundary of the orbit. Comparison of the preorbital portion of the supraorbital bone of *Ceratodus* with the bone which in certain Amphibia has been termed "external ectethmoid" by Parker [30, p. 172; also 28] and "prefrontal" by Wiedersheim [42, 43] proves that the two are essentially similar in position and in their relations to contiguous cranial structures. Although absent in the Perennibranchiate Urodela, an "external ectethmoid" in varying degrees of development is present in all Caducibranchiata (Derotremata) (e.g. *Amphiuma*, *Cryptobranchus*, *Menopoma*), and generally also in both the Mecodont (e.g. *Salamandra*, *Triton*) and Lechriodont (e.g. *Ellipsoglossa*, *Ranodon*, *Amblystoma*, *Desmognathus*, *Spelerpes*) sections of the Salamandrida (Myctodera). In all the Urodela in which it is present, the "ectethmoid" or "prefrontal" is a membrane-bone in relation with the antero-external extremity of the frontal of its side, partially investing the hinder part of the roof of the nasal capsule, and also, by its extension downward towards the palatine region, forming the boundary between the orbital and nasal regions of the skull [1]. In several instances the bone extends to a varying distance backward over the orbit, the roof of which it helps to form. The similarity of the two bones in all essentials is so striking that it is difficult to avoid the conclusion that the "supraorbital" of *Ceratodus* and the "external ectethmoid" or "prefrontal" of the Urodele Amphibia are homologous structures. In *Protopterus* and *Lepidosiren* the relations of the so-called "supraorbital" bones are admittedly somewhat different. In these genera each bone forms a roof to the orbital cavity, and even extends slightly downward in front of it, but certainly not so far as to enable it to form a posterior wall, and still less a partial roof, to the nasal capsule. On the contrary, the bones seem to have been displaced dorsally and backward, as it were, by the upward and backward growth of an ascending process from the palato-pterygoid. Nevertheless, it is scarcely possible to doubt that the "supraorbital" bones are homologous cranial elements in all three genera and also with the Amphibian ectethmoid, although it may be admitted that in *Protopterus* and *Lepidosiren* the homology is less obvious at first sight, owing to the secondary displacement of the bones by the ascending process of the palato-pterygoids, and might not even have occurred to any one but for the fact that *Ceratodus*, in retaining the primitive relations of these bones, affords the necessary clue to their real nature.

There is one feature, however, in which the Dipnoid "external ectethmoid" differs from its Amphibian representative, and that is the extension of the bone backward to the occipital region of the skull, but for this difference I am inclined to think that the exceptional development of the Temporalis muscle is wholly responsible. In *Lepidosiren* this muscle begins posteriorly as a cranial extension of the deeper stratum of the dorso-lateral trunk-musculature. On the lateral surface of the hinder part of the skull

[1] A similar bone ("prefrontal") is also present in the Labyrinthodont Amphibia [Stegocephala], and in Reptilia.

it becomes greatly thickened by the addition of fibres having their origin from the outer surface of the fronto-parietal bone, including its sagittal crest; from the median vertical fibrous sheet which continues the crest as far externally as the superficial temporal fascia, and alone in this region separates the temporal muscles of opposite sides of the head; and also from the outer margin and ventral surface of the hinder two-thirds, or postorbital portion, of the external ectethmoid. From this extensive origin the Temporalis runs obliquely downward and forward, anteriorly and externally to the much less developed Masseter muscle, to its insertion into the coronoid process of the mandible. These facts suggest that the unusual backward extension of the external ectethmoid is due to the necessity of providing an additional surface for the origin of an exceptionally developed muscle. It is not only possible, but even probable, that the hinder or postorbital section of each ectethmoid owes its existence to the ossification of the temporal fascia investing this muscle, and to this extent it is possible to agree with Wiedersheim that the bone is a "Sehnenbein." Nevertheless, and for the reasons mentioned above, it may be maintained that the orbital and preorbital portions of the bone represent a true "external ectethmoid" element.

The identification of the "supraorbital" bones with the Amphibian "external ectethmoids" removes almost the only difficulty in the way of the comparison of the cranial bones of the Dipnoi with those of other Vertebrata. Parker's term "external ectethmoid" is not, perhaps, the most suitable name for the bones under discussion; dermal ectethmoids, or, in order to distinguish these paired bones from the median dermal ethmoid and the true mesethmoid bone, dermal lateral ethmoids, are much more convenient terms.

Underlying the base of the cranium, and extending backward from a point at some distance behind the symphysis of the palato-pterygoid bones to the level of the first neural arch, is the well-developed parasphenoid ("Keilbein" of Bischoff; in *Protopterus* the "Basilare" of Peters, "sphenoid" of Cobbold, "basioccipito-sphenoid" of Owen, and the "parasphenoid" of Huxley and Wiedersheim; in *Ceratodus* the "basal" bone of Günther, and "parasphenoid" of Huxley), (Pl. XXVIII. figs. 3 and 4; Pl. XXIX. figs. 16–19, *ps.*). Viewed from below (fig. 3) the bone appears somewhat spatulate in shape, the anterior half widening considerably, and having its lateral margins deflected and at the same time closely applied to the inner surfaces of the palato-pterygoid bones, more particularly where the latter bones curve downward to form the articular condyles for the lower jaw. Anteriorly, the bone terminates at some distance behind the palato-pterygoid symphysis, not, however, as in *Protopterus*, by an abruptly-truncated transverse margin, but by a contracted and somewhat conical extremity. From the auditory region backward the bone gradually narrows, and by lateral compression becomes greatly thickened, eventually terminating in an almost pointed extremity ventrad to the basal cartilage of the occipital region. The share taken by the parasphenoid in conjunction with the fronto-parietal in forming the side-walls of the central portion of the cranial cavity has already been mentioned (see fig. 4). Reference to transverse sections of the skull (figs. 16 and 17) will show that in this region each lateral margin of the parasphenoid divides into an ascending lamina which meets the descending portion of the fronto-parietal internally to the trabecular cartilage, and a deflected lamina which, as mentioned above, overlaps the inner surface of the palato-pterygoid bone of its side. These sections also prove that in the same region the parasphenoid alone forms the floor of the cranial cavity, the cartilaginous basis cranii being here entirely absent. Perhaps the two most remarkable features in connection with the parasphenoid of *Lepidosiren* are the share which, with the fronto-parietal, it takes in forming the lateral walls of the cranial cavity, and the somewhat abrupt termination of the bone anteriorly, so that a considerable area of the cartilaginous basis cranii is freely exposed between its anterior margin and the palato-pterygoid symphysis.

The bone termed "palatine" by Bischoff and Hyrtl in *Lepidosiren*—in *Protopterus* considered as equivalent to the maxilla, pterygoid and palatine (Owen), or termed "Gaumenkieferbein" (Peters), "palatine" (Cobbold), "Pterygo-palatinum" or "palato-pterygoid" (Wiedersheim and Huxley); and in *Ceratodus* "pterygo-palatine" (Günther, Huxley)—is one of the most characteristic elements in the Dipnoid skull (Pl. XXVIII. figs. 1–4; Pl. XXIX. figs. 12–17, *p.pt.*). The bone seems to represent a pterygoid element ossified continuously with a "tooth-bone" formed by the fusion of the strongly-developed palatal teeth, and may therefore rightly be regarded as a palato-pterygoid.

Posteriorly the bone makes its appearance at a point immediately anterior to the foramen for the exit of the hyomandibular division of the Facial nerve in the form of a relatively wide thin plate, closely applied to the inner surface of the suspensorial cartilage, and overlapped along its inner and dorsal margin by the deflected lateral edge of the parasphenoid (fig. 3). Traced downward towards the articular extremity of the suspensorial cartilage the bone thickens somewhat, and forms the inner margin of the articular surface for the lower jaw (figs. 3 and 4). From this point the palato-pterygoid loses its lamellar character and becomes an exceptionally strong, laterally-compressed bone, arching upward and forward towards the nasal capsule. In the latter part of its extent it is in relation by its dorsal margin with the band-like trabecular cartilage (fig. 1), and by it is separated from the sutural union of the descending lamina of the fronto-parietal and the parasphenoid (fig. 16). In front of the anterior termination of the latter bone the palato-pterygoid skirts the lateral margin of the cartilaginous basis cranii (fig. 15). On reaching the hinder boundary of the nasal capsule, each palato-pterygoid begins to curve obliquely inward and forward, and is finally united with its fellow in an elongated and exceptionally massive symphysis which is interposed between the two nasal capsules, and dorsally is in contact with their roof in the median plane (figs. 3, 4, and 12). The extraordinary development of the symphysial portions of the two bones is doubtlessly associated with their function as basal supports for the powerful palatal teeth, but the effect produced on the nasal region of the skull is remarkable, and will be referred to subsequently. As described by Wiedersheim in *Protopterus,* the symphysial extremity of each bone is produced into three processes which, when viewed ventrally (fig. 3), appear to radiate outward from the median line of the symphysis. Of these processes, the hindermost and strongest is nearly transverse, or at most has but a slight backward inclination, and, projecting outward, terminates in a pointed extremity (figs. 1–3 and 13, *at. p.*). This is the equivalent of the "Processus antorbitalis" of Wiedersheim, and, in conjunction with the body of the bone, supports ventrally the basal portion of the posterior and largest of the three plate-like palatine teeth (fig. 3, *p.p.t.*). The central process is transversely disposed and supports the much smaller central tooth (*m.p.t.*), while the third is directed obliquely outward and forward, and forms the basis of the anterior and smallest of the palatal teeth (*a.p.t.*). In addition to the three tooth-supporting processes, the anterior portion of each palato-pterygoid gives off from its dorsal border a stout conical process, corresponding to the "Processus ascendens" of Wiedersheim, which is directed obliquely upward and backward, and terminates in a pointed extremity projecting a little beyond the level of the cranial roof (figs. 1 and 5, *p.pt.a.*). The process extends so far backward as to overlap the anterior margin of the fronto-parietal (fig. 1), and fill up what would otherwise be an oblique notch or fissure between the lateral, or descending, and the dorsal portions of that bone, and therefore, as seen in figs. 4 and 13, contributes to the formation of the outer wall of the extreme anterior section of the cranial cavity and of the olfactory fossa of its side. Dorsally, the two processes are separated from each other by the anterior extremity of the fronto-parietal (figs. 2 and 5), and each is overlapped, and partially hidden from view, by the expanded anterior section of the dermal ectethmoid. On the outer surface of each process there is a strong lateral ridge, coincident in direction with the inclination of the process itself, but terminating above in a free projecting extremity, which is clipped by the bifurcate outer margin of the anterior extremity of the ectethmoid (figs. 1, 2, 5, and 13, *p.pt.a'.*).

The squamosal bone ("Quadrate," Bischoff and Hyrtl; in *Protopterus*, the "Quadrate," Peters, "tympanic," Owen, "zygomatic" or "jugal," Cobbold, "squamosal," Huxley and Wiedersheim; in *Ceratodus*, the "squamosal" of Günther and Huxley) invests the outer surface of the hinder part of the suspensorial cartilage (Pl. XXVIII. figs. 1 and 2; Pl. XXIX. figs. 17 and 18, *sq.*). For the dorsal two-thirds of its extent it is a relatively thin plate, somewhat ovate in shape, its posterior margin coinciding with the hinder edge of the suspensorial cartilage (fig. 1). Inferiorly, the bone is constricted to a neck-like portion, but, again expanding, terminates in a rounded margin, which forms the outer surface of the articular condyle for the lower jaw. For a portion of its extent the anterior border of the bone overlaps the ventral termination of that portion of the fronto-parietal which extends on to the outer surface of the suspensorium (fig. 1).

The chondrocranium of *Lepidosiren* presents several interesting features, and for convenience in description may be divided into (1) an occipito-periotic region, including also the suspensorium; (2) a central trabecular portion; and (3) an anterior or ethmo-nasal region.

The occipito-periotic region consists of a thick basal cartilage underlying the foramen magnum and extending in the floor of the cranial cavity as far forward as the middle of the periotic capsule, where it terminates somewhat abruptly on the cranial surface of the parasphenoid by a well-defined transverse margin, immediately behind the position occupied by the pituitary body (Pl. XXVIII. fig. 4, and Pl. XXIX. fig. 19). A slight concavity on the upper surface of the parasphenoid is the only indication of a pituitary fossa (Pl. XXIX. fig. 18). Into the axis of the basal cartilage (fig. 4) the filiform intracranial portion of the notochord (*no.*) is prolonged, and may be traced in sections nearly as far forward as the cartilage itself extends. On its ventral surface the basal cartilage is in close relation with the hinder part of the parasphenoid, while behind, where it becomes continuous with the chordal sheath, the cartilage helps to support dorsally and laterally the bases of a pair of ossified "basi-dorsals" forming the lateral elements of the first neural arch (Pl. XXVIII. figs. 1 and 4, *n.a.*). Anteriorly to the "basi-dorsals" are the two exoccipital bones (figs. 1 and 4; Pl. XXIX. fig. 19, *eo.*), each of which consists of an inwardly-curved basal plate resting on the upper surface of the basal cartilage, but separated mesially from its fellow by an intervening tract of the same cartilage. Each bone then curves upward (fig. 4), forming the side-walls of the hindermost section of the cranial cavity, and terminates dorsally in a thick plate of cartilage which occupies the supraoccipital region, beneath the hinder part of the fronto-parietal bone, and forms the actual roof of the cranial cavity in this region (fig. 19). In a transverse section of the cranium taken through the two exoccipitals (fig. 19), it is seen that the dorsal cartilage extends downward for some distance on each side into the substance of the exoccipital, dividing the latter for a portion of its extent into an outer lamina of bone, which dorsally abuts against the outer margin of the fronto-parietal, and an inner lamina ending above in the dorsal cartilage. Each occipital (fig. 4) is deeply constricted in the centre, owing to the presence of a deep notch in its anterior and posterior margins, the anterior notch forming the posterior boundary of the foramen for the Vagus nerve (x.), the posterior transmitting the roots of the Hypoglossal or first spinal nerve (*sp.n'*).

The basal cartilage and the cartilage of the supraoccipital region, though otherwise distinct, become continuous in front of the foramina for the Vagus nerves with the laterally-bulging cartilage of the periotic capsule, and through the latter with the proximal portion of the suspensorial cartilage (fig. 4).

Externally and dorsally (fig. 1), the periotic capsules are completely hidden from view by the lateral extension of the fronto-parietal, except for a narrow tract on each side immediately above the upper extremity of the squamosal. In a ventral view, however, each capsule is well seen between the foramina for the Facialis and Vagus nerves, the rounded prominence which it presents in this region corresponding to the outer wall of the recess for the sacculus (fig. 3)

In a vertical longitudinal section of the skull (Pl. XXVIII. figs. 4 and 6) the cavity of the periotic capsule appears as a relatively spacious lateral diverticulum of the cranial cavity, the inner wall of the capsule, which in Elasmobranchs and Amphibians separates the two cavities, having completely atrophied in *Lepidosiren*, as in *Ceratodus* and *Protopterus*, and also in all existing Ganoids and Teleosts. The cavity of the capsule exhibits a division into two deep recesses, of which the more external and dorsal lodges the "pars superior" (utriculus) (fig. 6, *ut.r.*) of the auditory organ, while the more internal and inferior contains the "pars inferior" or sacculus. The numerous foramina perforating the periotic capsule will be referred to subsequently.

The suspensorium consists of a somewhat triangular lamina of cartilage, the broad base of which is continuous dorsally with the outer wall of the auditory capsule and with the hinder portion of the trabecular cartilage, and thence is continued obliquely downward and forward to the articular condyle for the lower jaw (Pl. XXVIII. fig. 3, and Pl. XXIX. fig. 18, *ar.c.*). So complete is the investment of its external surface by the fronto-parietal and squamosal bones that only a small portion of the cartilage is visible just above the mandibular articulation (Pl. XXVIII. fig. 1). Ventrally, however, the suspensorial cartilage (Pl. XXVIII. fig. 3) may be seen anteriorly and externally to the foramen for the exit of the hyomandibular branch of the Facial nerve, but even here the cartilage is extensively invested by the hinder part of the palato-pterygoid. The posterior margin of the suspensorial cartilage is deeply emarginate (fig. 3), so that in a ventral view the inner surface of the squamosal is partially exposed, and in the same view a rounded prominence near the hinder margin of the cartilage indicates the point of attachment of the hyoid arch. A characteristic foramen termed by Hyrtl (*l. c.*) the "Schlafengrube" perforates the suspensorial cartilage at its junction with the periotic capsule (Pl. XXVIII. figs. 1 and 2, *t.f.*; Pl. XXIX. fig. 18), and in a ventral view is visible near the base of the skull (fig. 3).

The suspensorial cartilage of *Lepidosiren* must be regarded as the metapterygo-quadrate or proximal portion of the mandibular arch, the equivalent of the palato-pterygoid cartilage of the more typically autostylic skulls of *Chimæra* and *Ceratodus*, having undergone complete atrophy or become replaced by the palato-pterygoid bone. It is worthy of note that the suspensorium makes a much more open angle with the fore part of the basicranial axis than in *Protopterus* or in *Ceratodus*, and the effect of this on the curvature of the palato-pterygoid bone is such that, in passing from the articular end of the suspensorium to the nasal region, the bone describes a segment of a larger circle in the former Dipnoid than in either of its congeners.

The pulley-like articular condyle for the mandible (Pl. XXVIII. figs. 1, 2, 3 and 4, *ar.c.*) is concave from side to side and convex from before backward. It is formed in the centre by the distal extremity of the suspensorial cartilage, strengthened on its inner surface by the hinder part of the palato-pterygoid bone, and externally by the inferior extremity of the squamosal. No trace of a true quadrate ossification could be detected.

The trabecular region of the chondrocranium may be considered to begin as an extension forward of the cartilage of the auditory capsules in the form of two parallel cartilaginous rods or plates, situated one on each side of the anterior half of the cranial cavity. At its origin from the periotic capsule each trabecular rod is also continuous with the anterior portion of the suspensorial cartilage, and forms a relatively thick plate of cartilage, invested externally by the lateral extension of the fronto-parietal, and separated from the cranial cavity by the ascending lamina of the parasphenoid, the descending plate of the same bone closely investing its inferior margin (Pl. XXIX. fig. 17, *tr.c.*). More anteriorly the rod contracts, and, owing to the diminished lateral growth of the fronto-parietal, now becomes visible in a side view of the skull, externally and parallel to the line of junction of the latter bone with the parasphenoid (Pl. XXVIII. fig. 1, and Pl. XXIX. fig. 16, *tr.c.*)[1]. More anteriorly still the trabecular rods blend inferiorly with the cartilaginous lamina which, in front of the termination of the parasphenoid, alone forms the basis cranii, and, at the same time increasing somewhat in vertical extent, become overlapped internally by the lateral portions of the fronto-parietal, and partially also externally by the palato-pterygoids (Pl. XXIX. fig. 15). On approaching the nasal capsules, each trabecular cartilage detaches itself from the basis cranii, and, still further contracting, assumes the condition of a slender laterally-compressed rod, which curves downward across the outer surface of the fronto-parietal and palato-pterygoid bones (Pl. XXVIII. fig. 1, and Pl. XXIX. figs. 13 and 14, *an.p.*), and then passes ventrally between the antorbital process of the last-mentioned bone and the hinder wall of the nasal capsule. The cartilage now becomes very slender, and, after giving off a short anteriorly-directed process (fig. 1) below and parallel to the outer margin of the nasal capsule, enters the posterior margin of the upper labial fold of its side, and thence describes a bold curve backward beneath the eye. Eventually the rod curves downward and slightly forward,

[1] A similar reduction of the central or interorbital region of the chondrocranium to the quasi-primitive condition of two laterally-situated cartilaginous trabecular rods occurs also in several Urodele Amphibia, such as, for example, *Menobranchus* (Huxley, 17, and Wiedersheim, 43) and *Amphiuma* (Wiedersheim, *l. c.*). The resemblance of the latter to *Lepidosiren* is also heightened by the fact that in both cases the cranial roof-bones suturally articulate on each side with the parasphenoid to form the lateral walls of the cranial cavity. Comparison of transverse sections through the cranium of *Lepidosiren* (Pl. XXIX. figs. 16 and 17) with similar sections of, for example, the skull of *Menobranchus* (Wiedersheim, figs. 40 and 42) will sufficiently illustrate this point. The occurrence of similar parallel modifications in the Ophidian skull is sufficient to prove that, however striking may be the structural resemblances between the Amphibian and Dipnoid skulls in these respects, they are nevertheless homoplastic in their nature.

and finally terminates in the inferior margin of the labial fold (Pl. XXVIII. figs. 1–4, *an.p'*). Although regarded by both Bischoff (*l. c.*) and Hyrtl (*l. c.*) as pertaining to the system of labial cartilages, there can, I think, be little doubt that, from the point of its separation from the cartilaginous basis cranii, each of these singular rods represents an "antorbital process,"[1] almost identical in its mode of origin and relations with a homologous cartilaginous process which exists in many Elasmobranchs (the "seitlicher Vorsatz der Ethmoïdal-Region" of Gegenbaur, 10, or "antorbital or ethmo-palatine process" of Parker, 29), and more especially in the Urodele Amphibia ("antorbital process" of Wiedersheim, 43, or "ethmo-palatine cartilage" of Parker, 28, 30). Ordinarily in both Elasmobranchs and Urodela the process is either directed outward at right angles to the axis of the skull, or inclined slightly backward, but it is interesting to note that in some Urodela (e. g. *Menopoma* and *Siredon*) the antorbital process is directed forward as in *Lepidosiren*, parallel to the outer margin of the nasal capsule, with which it may even fuse anteriorly (*Menopoma*), or, as in *Siredon*, remain distinct (Wiedersheim, 43).

The singular development of the antorbital process in *Lepidosiren* is evidently associated with its function as a skeletal support for the posterior portion of the overlapping and somewhat pendulous upper labial fold of this Dipnoid. It may be mentioned that besides its skeletal support the labial fold is provided with special muscles, either as derivatives from the anterior portion of the contiguous temporal muscle, or arising independently from the temporal fascia (Hyrtl, *l.c.*), and also with an abundant nerve-supply by the ramus buccalis of the Facialis nerve.

After the separation and divergence of the two antorbital cartilages, the cartilaginous basis cranii becomes pushed upward, as it were, by the palato-pterygoid symphysis, and, rapidly contracting in width, fuses with the nasal roof in the median line, dorsad to the symphysis and beneath the dermal ethmoid (fig. 4). Immediately posterior to the palatine symphysis a vertical mesethmoid cartilage divides the much-contracted anterior section of the cranial cavity into two short, laterally-situated, tubular passages for the transmission of the Olfactory nerves to the nasal sacs (fig. 4, and Pl. XXIX. fig. 13, *ms.e.*). Dorsally and posteriorly the mesethmoid cartilage is prolonged into a median styliform process (Pl. XXVIII. fig. 5, and Pl. XXIX. fig. 14, *st.p.*) which extends backward for a short distance in the cranial roof internally to the fronto-parietal bone, and is presumably a remnant of the more extensive cartilaginous cranial roof of the embryo. Inferiorly, the mesethmoid cartilage is coincident with a small oval vacuity in the basicranial cartilage, through which it may be seen, in a ventral view of the skull, immediately behind the palatine symphysis (Pl. XXVIII. fig. 3, and Pl. XXIX. fig. 13, *b.c.v.*). Anteriorly to this vacuity the vertical extent of the mesethmoid becomes rapidly diminished by the upward growth of the symphysis, and finally, after blending

[1] Wiedersheim (*l. c.*) was the first to regard the representatives of these cartilages in *Protopterus* from this point of view.

below with the basicranial cartilage, becomes continuous in the median line with the cartilage of the nasal roof. The tubular passage on each side of the mesethmoid cartilage is limited externally by the ascending process of the palato-pterygoid, and not, as in *Ceratodus*, by an extension of the lateral wall of the chondrocranium, and communicates anteriorly with the nasal sac of its side dorsad to the palatine symphysis.

The internasal septum (Pl. XXVIII. fig. 4, and Pl. XXIX. fig. 11, *i.n.s.*) begins as an inconspicuous inwardly-projecting ridge from the median line of the cartilaginous nasal roof, but is separated from the mesethmoid cartilage by a deep arch-like notch (fig. 4) resulting from the upward growth of the palatine symphysis. Anteriorly to the symphysis the septum increases in vertical extent and also thickens somewhat, supporting on its ventral margin the two acutely-conical vomerine teeth (Pl. XXVIII. figs. 3 and 4; Pl. XXIX. fig. 11, *vo.t.*). In front of the anterior boundary of the nasal capsules the internasal septum projects into the upper lip in the form of a short prenasal process terminating in two short laterally-directed cornua (Pl. XXVIII. figs. 2, 3, and 5, *pn.p.*). Laterally, the septum is prolonged outward into two thin laminæ of cartilage with deflected and slightly thickened external margins, which form the roof and outer walls of the dorsally-convex and ventrally-concave nasal capsules (Pl. XXVIII. figs. 1, 2, and 5, *n.c.*). Dorsally, the internasal septum, and to some extent also the roof of each capsule, are invested by the dermal ethmoid (fig. 2).

As in *Ceratodus* and *Protopterus*, the continuity of each nasal roof is interrupted by a series of vacuities which in *Lepidosiren* are elongated and somewhat oval in shape, transversely disposed, and in the fresh specimen filled in by fibrous membrane [1]. At the anterior margin of each nasal capsule the cartilage is somewhat thicker than elsewhere, and laterally projects outward in the form of a thickened and slightly recurved process (figs. 1, 2, 5, *t.c.*). From their position, and their relations to the anterior boundary of the nasal capsules, I am inclined to regard these cartilages as representing the persistent trabecular cornua of the embryonic skull; in any case, they closely resemble the well-known trabecular cornua which Parker [31] has described in such Anurous Amphibia as, for example, *Bufo ornatus*. By Rose [36], on the contrary, the equivalent cartilages in *Protopterus* are regarded as representing a pair of "upper labials," but on what grounds it is difficult to see. With the exception of a thin rod of cartilage (Pl. XXVIII. figs. 3 and 12, *sn.p.*), which extends inward from the deflected outer margin of each nasal capsule and passes between the ventrally-situated anterior and posterior narial apertures to a fibrous attachment to the

[1] With the exception of the Dipnoi, this curious fenestration of the nasal roof occurs in no other Vertebrates except certain Urodele Amphibia [Wiedersheim 43, H. H. Wilder 44], and affords another instance of the many homoplastic modifications which are to be noticed in the two groups.

[Since the above footnote was written, I have been informed by Professor Howes that the nasal capsules of a skull of *Cestracion philippi*, in the Museum of the Royal College of Science at South Kensington, exhibit feeble, but nevertheless unmistakable, indications of fenestration.]

internasal septum, the two capsules are entirely devoid of any cartilaginous floor. These rods may be termed the subnasal cartilages.

The most noteworthy feature in connection with the olfactory region of the skull of *Lepidosiren* is the effect produced on the chondrocranial elements by the relatively massive development of the palatine symphysis. Not only has the dorsal growth of the symphysis completely interrupted the direct continuity of the internasal septum and mesethmoid cartilage, so that the symphysial portions of the palatines (Pl. XXVIII. fig. 4, and Pl. XXIX. fig. 12, *p.sy.*) are in actual contact with the hinder part of the nasal roof in the median line (fig. 12), but, by its extension anteriorly and mesially between the two nasal sacs for nearly two-thirds of their extent, the symphysis, and not the true internasal septum, forms the actual median division between the two capsules. Reference to fig. 12 will sufficiently illustrate these modifications and also show how, in consequence of its forward extension, the symphysis reduces the vertical dimension of each capsule, while at the same time contributing to the support of the nasal floor.

As will be shown later on, the accounts given by different writers as to the existence of upper labial cartilages in the Dipnoi are not always easy to reconcile one with another or with actual facts, and not infrequently they are mutually contradictory.

In *Lepidosiren* the structures erroneously regarded as labial cartilages by Bischoff and Hyrtl are without doubt antorbital cartilages, formed as lateral outgrowths from the anterior trabecular region of the chondrocranium, between the orbital and nasal regions, and, as already mentioned, may be considered as the equivalents of similarly-situated cartilages in the Elasmobranchs and Urodele Amphibians. The true upper labials were overlooked by both of these writers, but there can be no question as to their existence. Attached by ligament to the posterior margin of each nasal capsule, near its junction with the internasal septum, there is a slender cartilaginous filament which passes directly downward, immediately anterior to the initial descending portion of the antorbital process, and ends in the fibrous posterior wall of the nasal capsule (Pl. XXVIII. figs. 1, 3, and 5, *u.l.c.*). These filaments represent a single pair of upper labial cartilages, and are the only structures which can be recognized as such in *Lepidosiren*.

The anterior section of the cranial cavity for a short distance behind the mesethmoid cartilage is completely filled by a dense mass of extremely tough fibrous tissue, continuous dorsally with the fibrous connection between the dermal ethmoid and the fronto-parietal, and also filling up the two olfactory passages. The hinder face of this fibrous plug is slightly hollowed out for the reception of the anterior extremity of the brain. The mass is also traversed by the two Olfactory nerves as they pass forward to enter the two olfactory passages, and into it projects the median styliform process from the mesethmoid cartilage (Pl. XXIX. fig. 14).

The lower jaw of *Lepidosiren* is very similar to that of *Protopterus*, as described by

Wiedersheim (*l. c.*), and each ramus consists of articular, coronoid, and dentigerous regions, and a persistent and curiously-modified Meckelian cartilage (Pl. XXVIII. figs. 7 and 8, and Pl. XXIX. fig. 9).

Meckel's cartilage consists of a thick proximal portion (fig. 8, *mk.c.*), deeply excavated posteriorly so as to form a concave, transversely-disposed, articular surface for the suspensorium, and of a thin band-like extension of the foregoing, which makes its appearance on the outer surface of the ramus in front of the angular bone (fig. 7), and thence runs forward in a groove near the lower border of the splenial (*sp.*) as far as the mandibular symphysis, where it becames continuous with its fellow of the opposite side in an expanded symphysial plate (fig. 9). In the angle between the anterior and central of the three cutting tooth-plates with which each mandibular ramus is furnished, the Meckelian cartilage gives off a vertically-disposed ascending process (fig. 7). Three similar, but shorter, processes are also given off from the upper margin of the symphysial plate, of which two are supero-lateral and one central, and lie in the angle which the anterior tooth-plate forms with its fellow of the opposite ramus (fig. 9). A short cartilaginous nodule may also be found between the central and posterior tooth-plates, but is connected with the Meckelian cartilage only by fibrous tissue (fig. 7). Morphologically, it is possible that the symphysial plate and its supero-lateral processes may represent lower labials, as Rose (*l. c.*) has suggested in the case of *Protopterus*; but at present no valid reason has been assigned for regarding them as other than expansions or outgrowths from the Meckelian cartilage for the support of certain folds of mucous membrane which occupy the outer angles of the tooth-plates, and, as Rose (*l. c.*) himself as shown, are important factors in the process of tooth-regeneration and growth.

Two bones only are represented in each half of the mandible. Of these, the splenial (in *Protopterus*, the "dentary" of Owen, Peters, and Miall, and the "articulare" of Wiedersheim; in *Ceratodus*, the "dentary" of Günther, and the "splenial" of Huxley) is by far the larger, and forms nearly the whole of the bony portion of each ramus, retaining, however, its primary and normal position in relation with the inner surface of Meckel's cartilage (figs. 7–9, *sp.*). Posteriorly and dorsally it rises into an unusually strong coronoid process (*cor.p.*) for the insertion of the powerful temporal and masseter muscles, and anteriorly articulates and partially fuses with its fellow in an exceptionally massive symphysis (fig. 8, *m.sy.*), which, internally as well as externally, is produced into a strong "spina mentalis" (fig. 8, *s.m.i.*; fig. 9, *s.m.e.*). For the anterior half of its extent the bone supports dorsally the three splenial or mandibular tooth-plates (fig. 7, *a.m.t.*, *m.m.t.*, *p.m.t.*). The second bone is the "angular" (in *Protopterus* the "articular" of Owen, the "dentale externum" of Wiedersheim, and the "angular" of Peters and Miall; in *Ceratodus*, the "articulary" of Günther, and the "angular" of Huxley). It is a relatively small bone (figs. 7, 9, *an.*), commencing at the extreme angle of the jaw and thence extending for a short distance forward, external to the proximal portion of Meckel's cartilage, ultimately terminating at the point where the latter makes its appearance on the outer surface of the ramus (fig. 7). There is no representative in *Lepidosiren* of the bone which in *Ceratodus* has been identified by Huxley (*l. c.*) as a dentary element.

The hyoid arch consists of but a single element on each side—the equivalent of the cerato-hyal of other Fishes. It is a somewhat curved, relatively thick bar, cylindrical in the middle, laterally compressed proximally, but club-shaped inferiorly, where it is somewhat loosely connected by ligament with its fellow (Pl. XXVIII. figs. 1, 3, and 4, *c.h.*). Dorsally, the proximal extremity of the cerato-hyal is connected with the skull by a strong hyo-suspensorial ligament (figs. 3, 4, *hy.s.l.*), which is partly inserted into a rounded prominence on the inner surface of the suspensorial cartilage near its hinder margin, and is partly continued as a broad band of fibres to the ventral surface of the parasphenoid. A strong hyomandibular ligament also takes origin from the outer surface of the proximal end of the cerato-hyal, and thence passes obliquely downward to an insertion into the angle of the lower jaw. Structurally, the cerato-hyal consists of an axial cartilaginous portion, invested, except at its proximal and distal extremities, by a relatively thin sheath of superficial bone. There is no trace of any structures corresponding to the hyomandibular, or basi- or glosso-hyal, cartilages of *Ceratodus*.

A curious patch of cartilage is attached to the anterior surface of the distal portion of the cerato-hyal, external to the osseous sheath, and quite distinct from the cartilage of the distal extremity (Pl. XXVIII. fig. 1). As to the significance of this cartilage I can express no opinion beyond suggesting the possibility that it may be the remnant of a cartilaginous hyoidean ray, and may therefore be included in the category of those cartilages (vestigial hyoidean rays) which will be subsequently described in connection with the opercular and interopercular bones. The existence of several similar patches of cartilage in relation with the external surfaces of the ossified portions of the hyomandibular and cerato-hyal elements of *Acipenser* has already been noticed by Parker and Howes [32 *a*], by whom the cartilages in question were regarded as "rudimentary branchial rays" (*l. c.* p. 174). The presence of such nodules or patches of cartilage in connection with *both* hyoidean segments in this Ganoid affords a further resemblance to the hyoidean rays of Elasmobranchs, and strengthens the above suggestion as to the real nature of the still more reduced and vestigial rays of *Lepidosiren*.

The opercular bones are represented in *Lepidosiren* by two elements—an operculum and an interoperculum ("Kiemendeckelstücke," Bischoff; "Opercularknochen," Hyrtl; in *Protopterus*, "Kiemendeckelstücke," Peters; "opercularia," Wiedersheim). The operculum (in *Protopterus*, "preoperculum," Owen; "symplectic," Cobbold; in *Ceratodus*, "opercular," Günther and Huxley) is a relatively slender bone, situated immediately behind and parallel to the posterior margin of the squamosal (Pl. XXVIII. fig. 1, *op.*). Its inferior extremity forms a small disc-like base, and is closely attached by ligament to the hinder border of the squamosal, a little dorsad to the articular extremity of the latter bone. The interoperculum (in *Protopterus*, "branchiostegal," Owen, "preoperculum," Cobbold; in *Ceratodus*, "suboperculum," Günther, "interoperculum," Huxley) is also a somewhat slender bone, shorter than the operculum, with a hooked ventral or distal extremity, and situated directly behind and parallel to the last-mentioned element (fig. 1, *i.op.*). The operculum is attached by strong ligamentous fibres to the hinder margin of the squamosal and the suspensorial cartilage, while the interoperculum is similarly connected with the outer surface of the proximal portion of the cerato-hyal, with the operculum, and also with the contiguous margins of the squamosal and the suspensorial cartilage. A strong but nevertheless slender ligament extends also from the ventral extremity of the interoperculum obliquely downward and forward to its insertion into the inferior margin of the mandible.

The interesting series of cartilages first described by Huxley [15] in connection with the inner surface and distal extremity of the operculum and interoperculum of *Ceratodus* are also represented in *Lepidosiren*, although apparently overlooked both by Bischoff and Hyrtl. Closely applied to the inner surface of the interoperculum, and considerably wider than the bone itself, is a thin lamina of cartilage (Pl. XXVIII. figs. 1 and 4, *v.hy.r.*), the upper extremity of which is segmented off from the rest as an apical piece and projects somewhat beyond the extremity of the bone. In the operculum, however, the only indication of these structures is in the form of a thin nodule of cartilage attached to the inner surface of the upper extremity of the bone and projecting slightly beyond it (fig. 1, *v.hy.r.*). As Huxley (*l. c.*) has suggested in the case of *Ceratodus*, these cartilages may be regarded as vestiges of the cartilaginous hyoidean rays of Elasmobranchs, and in the latter group are often arranged in two series, a dorsal series attached to the hinder margin of the hyomandibular and represented in the Dipnoi by the opercular cartilages, and a ventral series connected with the cerato-hyal, and having as their Dipnoid equivalents the interopercular cartilages. The presence of vestigial cartilaginous hyoidean rays in conjunction with bony opercular elements seems to be peculiar to the Dipnoi; at any rate, after a careful search I have failed to find any indication of their existence in those Fishes in which one might with some reason expect to find them, viz.:—*Acipenser*, *Polyodon*, *Polypterus*, and *Amia*. It is interesting to notice, however, that in *Polyodon* [3] the bony operculum and interoperculum still retain the rayed character of their cartilaginous predecessors.

The branchial arches of *Lepidosiren* have been briefly described, but not figured, by both Bischoff and Hyrtl. They are five in number (Pl. XXIX. fig. 10), and separate four linear branchial clefts. On each side the arches consist of a series of slender, unsegmented, cartilaginous rods, distinct from one another and from their fellows of the opposite side, and situated in the walls of the pharynx immediately external to the pharyngeal mucous membrane. Dorsally and ventrally their extremities are connected by a fibrous band; but, apart from the fact that the dorsal band is loosely connected with the fibrous tissue of the base of the skull, no special ligamentous attachments to the latter could be perceived. The first arch, which, in consequence of the suppression of the hyoidean cleft, is in close proximity to the inner surface of the hinder margin of the suspensorial cartilage, dorsad to the upper extremity of the cerato-hyal, is the longest of the series, but very slender. The second is much stouter, but shorter, slightly expanded at its ventral extremity, and bifurcate and grooved at its dorsal end for the reception of the second aortic arch. The third is somewhat more slender than the second, but thicker than the first or fourth, and is neither grooved nor forked dorsally. The fourth and fifth resemble the third, but are very slender, the fifth being much the shortest of the series. No trace of the two basibranchial elements, described by Huxley (*l. c.*) as present in *Ceratodus*, or of the epibranchial elements described by Ridewood [35 *a*] as existing in connection with the second and third branchial arches in *Protopterus*, could be detected in *Lepidosiren*.

It may be mentioned that, in consequence of the suppression of the hyoidean or hyobranchial cleft, the hyoidean hemibranch really projects into the cleft separating the first and second branchial arches.

The characteristic "cranial rib" of other Dipnoi is present also in *Lepidosiren*, and was erroneously designated by Bischoff (*l. c.*) "Suspensorium der Schulter" (Pl. XXVIII, figs. 1–4, *c.r.*). Its dorsal extremity is furnished with two rounded cartilaginous condyles for articulation with a suitably-modified concavity in the chondrocranial cartilage between the Vagus foramen in front and above, the exoccipital behind, and the lateral edge of the parasphenoid below. Its extremities are cartilaginous, but the rest of its extent consists of an axial core of cartilage invested by a relatively thick bony sheath. Morphologically, it may be considered to represent the costal element pertaining to the first neural arch.

The attachment of the dorsal extremity of each lateral half of the pectoral girdle to the skull is effected by a stout ligament which extends from the postero-lateral portion of the cranium, behind and a little dorsad to the Vagus foramen, and is inserted into the upper extremity of the supraclavicle. There is apparently no representative of the "post-temporal" of *Protopterus* and *Ceratodus*.

The only account of the cranial nerves of *Lepidosiren* (*L. paradoxa*, Fitz.) is that given by Hyrtl (*l. c.*), whose description, in so far as the course and distribution of the larger branches are concerned, is in the main accurate, although characterized by the defect that the author has not always been successful in discriminating between the branches of the Facialis and those of the Trigeminus. In order to ascertain their relations to the various cranial foramina, a careful investigation of the peripheral distribution of the various cranial nerves of the Paraguayan *Lepidosiren* was made, with the result that my own observations proved to be in fairly close agreement with those previously recorded by Hyrtl, and more especially with the account given of the cranial nerves of *Protopterus annectens* in a recent and admirable paper by Pinkus [35]. In the present communication it is intended to refer only to those cranial nerves or their branches which are related to cranial foramina, or to certain definite regions of the skull. The nomenclature of the nerves will be that adopted by Pinkus in the case of *Protopterus*.

The Olfactory Nerve [i.]. In passing from the olfactory lobes to the nasal sacs these nerves traverse the olfactory passage on either side of the mesethmoid cartilage (Pl. XXIX. figs. 13, 14, and 15, i.), and reach their destination after passing forward dorsad to the palatine symphysis.

The Optic Nerve [ii.] This nerve leaves the cranial cavity through a linear cleft between the ascending process of the palato-pterygoid and the anterior margin of the lateral plate of the fronto-parietal, which is apparently a remnant of the much more extensive antero-lateral cranial vacuity of *Protopterus*, and in the latter Dipnoid also transmits the Optic nerve (Pl. XXVIII. figs. 1 and 4, ii.).

With regard to the nerves supplying the muscles of the eye-ball, viz. the Motor Oculi, the Patheticus, and the Abducens, the earlier writers, among whom may be mentioned Owen, Hyrtl, and Humphry, failed to find any evidence of their existence in the particular Dipnoi they examined. Wiedersheim [41] was apparently the first to discover the Motor Oculi nerve in *Protopterus*, although at the time he was unable to state with certainty whether it arose independently from the brain or was a branch of the Trigeminus. More recently Pinkus (*l. c.*) proved that in the same Dipnoid all three nerves are present, and not only determined their precise origin from the brain but also their distribution in the eye-muscles. Similarly with the muscles themselves, Owen [25] asserted that no such muscles were present in *Protopterus*, and hence the absence of their nerves. Hyrtl (*l. c.*) described four recti in *Lepidosiren*, but failed to find the two obliqui. Humphry [13] also found the four recti in *Protopterus*, but no oblique muscles. Pinkus (*l. c.*), on the contrary, found that the latter Dipnoid not only possessed the usual recti, but superior and inferior oblique muscles in addition. It is therefore extremely probable that all Dipnoi possess a complete series of eye-muscles and also a Motor Oculi, a Patheticus, and an Abducens for their innervation, as in the generality of Vertebrates. In the Paraguayan *Lepidosiren* there is no doubt as to the existence of the usual six eye-muscles, but, with the exception of the Motor Oculi, I was unable to detect any trace of their nerves. The analogy of *Protopterus* suggests, however, that my failure to discover the Patheticus and Abducens was probably due to the extreme tenuity and fineness of these nerves rather than to their absence. Unfortunately, lack of the necessary additional material prevented me from resorting to the only satisfactory method of determining with absolute certainty the presence or absence of the nerves in question, viz. by sections of the head and brain.

The Motor Oculi (iii.).—The third cranial nerve traverses one of the oblique fissures in the ventral margin of the fronto-parietal (Pl. XXVIII. fig. 4, iii.), about midway between the foramen for the Optic nerve and that for the ophthalmic branch of the

Trigeminus (v.′). Externally, the nerve issues from the cranial cavity immediately dorsad to the trabecular cartilage, and thence passes forward to the usual eye-muscles (Pl. XXVIII. fig. 1, iii.).

The Trigeminus (v.).—The various divisions of the Fifth and Seventh cranial nerves and certain of their principal branches are related to a considerable number of diversely-situated cranial foramina. With the exception of the ramus ophthalmicus of the Fifth nerve, their primary branches may almost be said to leave the cranial cavity by a single large foramen leading into a lateral diverticulum of the cavity situated at the junction of the trabecular and periotic cartilages, and bounded anteriorly by the former and posteriorly by the latter cartilage. This diverticulum will in future be referred to as the Gasserian recess. The separation and divergence of the primary branches of these nerves lead to the formation of a number of closely-related foramina of various sizes, either at the outer extremity of the recess or in its margins and floor.

The first division of the Trigeminus, or the ramus ophthalmicus, leaves the cranial cavity by a separate foramen in the hinder part of the trabecular cartilage, immediately behind the junction of the parasphenoid and fronto-parietal bones (Pl. XXVIII. fig. 6, v.′), and, after a short course obliquely outward and forward, emerges on the lateral surface of the skull a little dorsad to the first appearance of the trabecular cartilage externally (Pl. XXVIII. fig. 1, v.′). From this point the nerve passes directly forward parallel to the trabecular cartilage and dorsad to the eye. One branch of its ramus ophthalmicus profundus traverses a foramen in the fibrous tissue of the posterior wall of the nasal capsule, situated immediately anterior to the root of the upper labial cartilage (fig. 1), and then runs forward between the cartilaginous roof of the capsule and the membranous wall of the enclosed olfactory sac; eventually the nerve issues from the nasal capsule through a minute foramen in the extreme anterior part of its roof (Pl. XXVIII. figs. 2 and 5, v.′*p.*), and is then joined by another branch of the same nerve, which, in its course to the junction, has remained external to the nasal roof and parallel to the outer margin of the dermal ethmoid. The ramus maxillaris and the ramus mandibularis emerge through a single large foramen in the outer extremity of the Gasserian recess (Pl. XXVIII. fig. 6, v.″), which is apparent externally in the angle between the dorsal extremity of the squamosal and the hinder margin of the suspensorial portion of the fronto-parietal (Pl. XXVIII. figs. 1 and 2, v.″). The foramen does not open directly on to the lateral surface of the skull, but into the "Schlafengrube" (figs. 1 and 2, and Pl. XXIX. fig. 18, *t.f.* and v.″), and through the latter communicates with the exterior. The nasal branch of the ramus maxillaris traverses a foramen (fig. 1) between the root of the upper labial cartilage and the adjacent portion of the antorbital process, and then enters the nasal capsule. In its course downward to the lower jaw the ramus mandibularis runs parallel to the anterior margin of the squamosal and in contact with the outer surface of that bone. A small branch of this nerve disappears through a minute foramen on the outer surface of the mandible, between the angular and splenial bones (Pl. XXVIII. fig. 7, v.‴). Humphry [13] has described a similar branch in *Protopterus*, and also states that it perforates the lower jaw, but the statement is contradicted by Pinkus (*l. c.*). Such a nerve certainly exists in *Lepidosiren* and behaves as described above.

The Facialis (vii.).—The superior palatine branch of this nerve leaves the Gasserian recess by a very small foramen in its floor (Pl. XXVIII. fig. 6, vii.′). After entering the foramen the nerve pursues a forward course, perforating the trabecular cartilage, and then runs between the cartilage and the palato-pterygoid and parasphenoid, near the sutural line of the two bones; eventually, the nerve emerges through a small aperture in the angle between the antero-lateral margin of the parasphenoid and the inner border of the palato-pterygoid (Pl. XXVIII. fig. 3, vii.′), and is distributed to the oral mucous membrane. One or two branches of the nerve can be traced forward, dorsad to the palatine symphysis and directly beneath the upwardly-tilted basicranial cartilage, and appear to supply the vertical folds of mucous membrane in the angles of the palatine tooth-plates.

The "nervus lateralis facialis" (Pinkus, *l. c.*) leaves the Gasserian recess by the same foramen which transmits the maxillary and mandibular divisions of the Trigeminus (Pl. XXVIII. fig. 6, v.″). Soon after emerging from the "Schlafengrube" (Pl. XXVIII. figs. 1 and 2, *t.f.*) the nerve divides into a ramus buccalis and a ramus ophthalmicus superficialis, the latter accompanying one of the branches of the ramus ophthalmicus profundus of the Trigeminus over the dorsal surface of the nasal capsule to the skin of the snout.

The ramus hyomandibularis traverses a relatively large foramen in the postero-inferior wall of the Gasserian recess (Pl. XXVIII. fig. 6, vii.). After perforating the periotic capsule the foramen opens into the "Schlafengrube," and through it the ramus hyomandibularis reaches the inner or under surface of the suspensorial cartilage (Pl. XXVIII. figs. 3 and 4, Pl. XXIX. fig. 18, vii.), where it divides into opercular, hyoidean, and external and internal mandibular branches. At the emarginate posterior border of the suspensorial cartilage (fig. 3, vii.″) the ramus mandibularis internus passes forward between the cartilage internally and the contracted inferior portion of the squamosal externally, and reappears on the outer surface of the suspensorium a little above its articular condyle (Pl. XXVIII. figs. 1 and 2, vii.″). At this point the nerve is joined by a branch of the ramus mandibularis of the Trigeminus, and then extends obliquely downward and forward to the outer surface of the lower jaw. The corresponding nerve in *Ceratodus* (Van Wijhe, 40) and also in *Protopterus* (Humphry, *l. c.*, Pinkus, *l. c.*) behaves in an almost precisely similar fashion.

The communicating branch between the Facialis and Vagus nerves emerges from the Gasserian recess through the same foramen which also transmits the maxillary and mandibular divisions of the fifth nerve and the nervus lateralis facialis (figs. 1 and 2, v.′). In its course backward to join the great lateral branch of the Vagus, the ramus communicans occupies a slight groove on the exposed outer surface of the periotic capsule at its junction with the proximal border of the suspensorium, and between the dorsal extremity of the squamosal and the lateral margin of the fronto-parietal (fig. 1). When viewed from the interior of the cranial cavity (Pl. XXVIII. fig. 6) four foramina may be seen in the cartilage of the periotic capsule, of which two are dorsally situated and lie close together, just within the cavity of the capsule. The other two may be seen on opposite sides of the utricular recess, near its anterior and posterior lips. The dorsally-situated foramina (fig. 6, *v.s.c.*) are the extremities of the tubular canals in which the anterior and posterior vertical semicircular canals are lodged, while each of the remaining foramina (*h.s.c.*) transmits the ampullary end of a vertical canal and, in addition, one extremity of the horizontal semicircular canal.

The Glossopharyngeus (ix.).—From the cranial cavity the foramen for this nerve is seen just within the hinder margin of the utricular recess (fig. 6, ix.). It perforates the posterior portion of the periotic capsule and becomes visible externally just in front of the aperture for the Vagus (Pl. XXVIII. figs. 1 and 3, ix.).

The Vagus (x.).—The foramen for this nerve is bounded anteriorly by the periotic cartilage, and behind by an emargination in the anterior edge of the exoccipital bone (Pl. XXVIII. figs. 4 and 6, x.). The depression into which the cartilage opens externally lodges the extraordinarily large Vagus ganglion (Pl. XXVIII. figs. 1 and 3, x.).

The Anterior Spinal Nerves.—As correctly described by Hyrtl (*l. c.*), the dorsal and ventral roots of the first spinal nerve (Hypoglossal) emerge through a deep but narrow notch in the hinder border of the exoccipital (Pl. XXVIII. figs. 1 and 4, *sp.n.*^{1}), but the roots of the second nerve, instead of traversing a foramen in the exoccipital as in *Protopterus*, perforate the fibrous wall of the neural canal between that bone and the first neural arch (figs. 1 and 4). The main trunks of the two nerves pass downward and a little forward, and unite to form the brachial nerve externally to the proximal third of the "cranial rib."

Wiedersheim figures and describes in *Protopterus* (*l. c.* fig. 10) a branch of the Vagus as fusing with the main trunk of the first spinal nerve (Hypoglossal), dorsad to the junction of the latter with the second and third spinal nerves to form the brachial nerve. The existence of this singular anastomosis has also been affirmed by Iversen [19] and more recently by Newton Parker [33]. On the other hand, it is expressly stated by Pinkus (*l. c.*): "Vaguselemente habe ich in den Plexus brachialis nicht übertreten sehen, im Gegensatz zu den Angaben von Wiedersheim, Iversen, und Parker, und in Uebereinstimmung mit dem Befund bei *Lepidosiren paradoxa*" (p. 331).

With reference to *Lepidosiren* it may be stated that although the brachial nerve contains no "Vaguselemente," yet a connection does undoubtedly exist between a branch of the Vagus and the Hypoglossal. Near the point of junction of the Hypoglossal with the second spinal nerve to form the brachial nerve the former gives off a fine branch, which, after a short course obliquely downward and forward across the outer surface of the "cranial rib," joins a slender branch of the Vagus. The latter nerve evidently corresponds to a similar nerve in *Protopterus*, described by Pinkus (*l. c.* p. 325) as being peripherally distributed to the tongue-muscles and to the musculature of the pharyngeal wall. Hence it follows that, although a ramus communicans does connect the Hypoglossal with the Vagus-group of nerves, yet the brachial nerve contains no Vagus fibres; and further, we have the interesting possibility that the fibres of the Hypoglossal contribute both to the formation of the brachial plexus and to the innervation of the muscles of the tongue.

The Larger Blood-vessels and the Cranial Foramina.—An examination of the relations of some of the larger blood-vessels to the cranial foramina yielded results substantially agreeing with the previously recorded statements of Hyrtl (*l. c.*).

The superior jugular or anterior cardinal vein emerges from the cranial cavity through the Vagus foramen (Pl. XXVIII. fig. 1, x.), and is at once joined by the inferior or external jugular vein.

The internal carotid artery perforates the base of the skull near the outer margin of the parasphenoid (Pl. XXVIII. fig. 3, *in.c.*), and ultimately enters the cranial cavity through a small foramen near the inferior margin of the Gasserian recess (Pl. XXVIII. fig. 6, *in.c.*). After its origin from the first aortic arch the external carotid traverses the "Schlafengrube," and, in company with the mandibular and maxillary branches of the Trigeminus nerve, appears on the lateral surface of the skull. It then breaks up into several branches for the supply of the temporal and masseter muscles and the orbital region, and also sends a considerable branch to the lower jaw, which in its course accompanies the ramus mandibularis of the Fifth nerve.

III. *Revision and Comparison of the Structure of the Skull in* Ceratodus, Protopterus, *and* Lepidosiren.

A. *Ceratodus.*

In comparing the cranial characters of the three genera it will be advantageous and certainly convenient to begin with the skull of *Ceratodus*. For the necessary data I shall rely principally on the accounts of Günther and Huxley, but in certain minor details on the results of my own observations.

The most obviously distinctive feature in the skull of *Ceratodus* is the retention throughout life of a complete chondrocranium, forming the continuous dorsal, lateral, and ventral walls of the cranial cavity. To this may be added the fact that the ethmoidal and nasal regions are better developed and more normal than in any other Dipnoi. By way of illustration, as well as for the sake of comparison with other types, a brief description of the ethmo-nasal region may be given.

The anterior section of the cranial cavity is continuous with two tubular olfactory passages, situated immediately dorsad to the palato-pterygoid symphysis and provided with complete cartilaginous walls, continuous behind with the rest of the chondrocranium. Mesially, the two passages are separated by a thick vertical mesethmoid cartilage (Pl. XXIX. fig. 20, *ms.e.*). More anteriorly the floor and outer wall of each olfactory passage terminate somewhat abruptly, leaving a large foramen for the entrance of an Olfactory nerve into the nasal sac of its side, but the mesethmoid cartilage and the overlying chondrocranial roof are directly continuous with the internasal septum and with the cartilaginous laminæ which grow out on each side from the dorsal edge of the septum to form the irregularly-fenestrated roof of the nasal capsules. The more normal condition of the mesethmoid region in *Ceratodus* may be associated with the relative thinness of the symphysial portions of the two palato-pterygoid bones, so that the vertical constriction of this region by the excessive thickening of the symphysis, which is so characteristic a feature in *Lepidosiren*, does not take place, and, in consequence, the mesethmoid cartilage and internasal septum are freely continuous, and the palatine symphysis remains widely separated from the chondrocranial roof. Comparison of figs. 12 and 20 (Pl. XXIX.), representing equivalent sections through the symphysis in *Ceratodus* and *Lepidosiren*, will sufficiently illustrate these remarks.

The roof of the two nasal sacs terminates somewhat in front of the internasal septum in a thin, marginally-rounded lamina of cartilage (Huxley, *l. c.* fig. 7, *a.*), without presenting any recognizable indications of trabecular cornua, and without exhibiting so much as a vestige of the bicornuate prenasal process of other Dipnoi.

The presence of representatives of the antorbital cartilages of other Dipnoi is doubtful. The central trabecular region of the chondrocranium is directly continuous with the cartilaginous side-walls of the mesethmoid region, internally to the junction of the preorbital portion of the dermal ectethmoid and the ascending process of the palato-pterygoid ; and if, as Rose [36] suggests, the hinder upper labial cartilages of Huxley are really the equivalents of antorbital processes, it is obvious that they have lost their primitive continuity posteriorly with the trabecular cartilage (Pl. XXIX. fig. 20, *an.p.*).

The characteristic plug of dense fibrous tissue which in *Lepidosiren* fills up the anterior section of the cranial cavity is entirely absent in *Ceratodus*, and the anterior extremity of the brain is in close relation with the hinder edge of the mesethmoid cartilage.

Posteriorly, the separation between the skull and the vertebral column is less evident than in either *Lepidosiren* or *Protopterus*, inasmuch as at least two pairs of "basidorsals," representing the lateral elements of two neural arches, are partially confluent with one another and also with the cartilage of the exoccipital region of the skull.

The suspensorium approximates more closely to the typical autostylic or Chimæroid condition than in any other existing Dipnoid. The metapterygo-quadrate cartilage is very strongly developed, especially behind, where it is prolonged into a thin but wide cartilaginous plate which, on each side, helps to roof in the branchial apparatus, while a narrow strip of cartilage extending forward from the distal end of the suspensorium along the dorsal border of the palato-pterygoid bone as far as the ethmoidal region, and continuous dorsally with the lateral margin of the cartilaginous basis cranii, may be regarded as representing a palato-pterygoid cartilage. Further, it may be affirmed that the condyle for the lower jaw is somewhat more anteriorly situated than in *Lepidosiren*, or, in other words, the suspensorium of *Ceratodus* is inclined forward to a greater extent and makes a more acute angle with the fore part of the basicranial axis.

The identification of upper labial cartilages in *Ceratodus* is by no means easy to determine satisfactorily. Günther (*l. c.*) apparently overlooked the existence of possible representatives of these structures, but subsequently two pairs of cartilages were discovered by Huxley (*l. c.*), the position and relations of which he thus describes:—"One of them lies in the roof of the mouth, just in front, and on the inner side, of the posterior nasal aperture. It is fixed to the mesethmoid cartilage (*m.c.*) by fibrous bands, and is broader behind than in front. The inner edge of this cartilage is concave, the outer convex, and it has a nearly horizontal direction. The second cartilage [*l. c.* figs. 4, 5, 7, 2] is stouter, and lies behind, and on the outer side of, the posterior nasal aperture. Its dorsal end is attached to the base of the skull and the anterior part of the palato-pterygoid cartilage, just above the middle of the palatine tooth. It then descends into the upper lip, near the angle of the mouth" (*l. c.* pp. 32–33). Huxley's description of the first of these cartilages, which provisionally may be called an anterior upper labial, is quite accurate, except that its mesial attachment is rather to the internasal septum than to the mesethmoid cartilage; and it may also be added that the outer extremity of the cartilage extends into the horizontal fibrous septum between the two narial apertures. On the other hand, his description of the "posterior upper labial" is not quite correct, inasmuch as the dorsal attachment of the cartilage is neither to the base of the skull nor to the anterior part of the palato-quadrate cartilage; on the contrary, the dorsal or proximal extremity of the cartilage is connected by ligament with the fibrous suture between the ascending process of the palato-pterygoid bone and the preorbital portion of the ectethmoid, and hence by the sutural union of these bones the cartilage is widely separated from the chondrocranial portion of the skull. It is, in fact, somewhat difficult to be quite sure that Huxley's posterior labials are not the equivalents of antorbital cartilages, such as are present in *Lepidosiren* and *Protopterus*, but otherwise wholly absent in *Ceratodus*, and, indeed, have been so considered by Rose [36], whose view is corroborated by the fact that each cartilage extends downward into the upper lip, near the angle of the mouth. At the same time, it is evident that these cartilages differ from the antorbital processes of other Dipnoi in not being *continuous* posteriorly with the trabecular region of the chondrocranium, although it is at least possible that this want of continuity may be the result of the exceptional forward and downward growth of the dermal ectethmoid in front of the eye. It is also equally clear that the cartilages in question do not precisely agree in position with the upper labials of *Lepidosiren*, inasmuch as they have no ligamentous connection with the hinder margin of the nasal roof. Considered either as antorbital processes or as labial cartilages, there can be no doubt that their position and relations have been greatly modified by the extensive preorbital growth of the dermal ectethmoid, which seems to have dissociated them, as it were, from their primitive relations to the chondrocranium or to the nasal capsules, as the case may be, and in the absence of developmental data it seems impossible to decide as to the real nature of these structures. The anterior upper labials of Huxley have certainly nothing in common with the undoubted upper labials of other Dipnoi, since they lie anteriorly to the posterior nasal aperture, practically, in the floor of the nasal sac between the two narial openings—that is to say, in the position occupied by the inner half of the subnasal cartilage in *Lepidosiren*; and if they are rightly to be regarded as upper labials, it is evident that they must represent an additional pair of these structures which have no counterpart in any other Dipnoi. For my own part, I am inclined to believe that these cartilages owe their existence to the dismemberment of a subnasal cartilage, primitively continuous with the outer margin of the cartilaginous nasal roof, and therefore cannot be true labials. There are several facts which seem to be in harmony with this suggestion. In the first place, the so-called anterior labials of *Ceratodus* and the subnasal cartilages of *Lepidosiren* occupy precisely similar positions in the floor of each nasal sac between the anterior and posterior nasal apertures, and both are attached, internally or mesially, to the internasal septum by fibrous tissue. Further, the outer margin of each nasal capsule in *Ceratodus* gives off a short lateral process (Huxley, *l. c.* p. 37, fig. 7), which coincides externally with the position of the "anterior labial" internally and ventrally, and may possibly represent the outer portion of a transversely-divided subnasal cartilage. Lastly, the subnasal cartilage of *Lepidosiren* is somewhat constricted at one point—a fact which may perhaps be taken to suggest the possibility of its inner portion becoming segmented off from the rest as an independent cartilage similar to the supposed anterior upper labial of *Ceratodus*.

The only endochondrial bones in *Ceratodus* are the two exoccipitals. They have been correctly described by Huxley as two hollow cones of bone embedded in the side-walls of the skull near its junction with the vertebral column. Each is said to be "wider above and externally than below and internally, where it lies above the notochord" [*l. c.* p. 38]. I may add that the bones are so thickly invested externally by cartilage as to be completely hidden in a lateral view of the skull, and for this reason in all probability they escaped the notice of Günther.

With the exception of a fronto-parietal bone, which is entirely absent, and the presence of a "scleroparietal" (Günther, *l. c.*), and also of a series of four or five circumorbital ossicles, the skull-bones of *Ceratodus* correspond with those of *Lepidosiren*, although differing somewhat from them in their regional extension and their precise relations to the chondrocranium.

The dermal ethmoid is a relatively larger bone than in other Dipnoi, and extends so far posteriorly as to project beyond the mesethmoid region, and by its sutural union with the "scleroparietal" (Günther) widely separates the two ectethmoids. The bone identified by me as the equivalent of the Amphibian dermal ectethmoid is a much larger and more important element than in *Lepidosiren*, and has already been sufficiently described (p. 331). The most noticeable feature about it is the downward growth and lateral thickening of its preorbital portion, so that a conspicuous bony antorbital protuberance separates the nasal from the orbital region of the skull. The mesial area on the dorsal surface of the skull, between the two dermal ectethmoids, which in *Lepidosiren* is occupied by an extension of the temporal fasciæ, is filled up in *Ceratodus* by a thin, even partially transparent lamina of bone—the "scleroparietal" of Günther, or the postero-median bone of Huxley. The squamosal bone consists of two distinct but nevertheless continuous portions, the representatives of Huxley's "preopercular" and "proper squamosal" divisions. The first of these overlies the suspensorial cartilage and is a relatively narrow bone, evidently the equivalent of the entire squamosal of *Lepidosiren*. The second portion is an extension of the dorsal extremity of the former in the shape of an expanded, fan-like, but thin plate of bone, situated externally to the jaw-muscles, and articulating superiorly by an extensive suture with the outer margin of the postorbital portion of the dermal ectethmoid and with one of the circumorbital ossicles. The hinder portions of the dermal ectethmoids, the "scleroparietal," and the dorsal portions of the squamosals all combine to form the eminently characteristic supracranial roof. As regards the mode of development of these various factors, there is to my mind little doubt that they are ossifications of the temporal fasciæ. The parasphenoid is a purely ichthyic bone, and in no way contributes to the formation of the lateral walls of the cranial cavity. It is a relatively much larger bone than in other Dipnoi, extending so far anteriorly as slightly to overlap the palatine symphysis and entirely hide from view the extensive area of basicranial cartilage which is freely exposed behind the symphysis in *Lepidosiren*, while laterally it slightly overlaps the inner surfaces of the two palato-pterygoid bones. Posteriorly the bone extends for a relatively greater distance beneath the notochord than in other Dipnoi, reaching to about the origin of the third pair of ribs.

The palato-pterygoid bones are less massive structures, and their symphysial portions, although disposed much as in *Lepidosiren* and overlapped by the nasal sacs, are but moderately thick plates. Owing to the smaller size of the tooth-plates, there are no conspicuous lateral projections from the palatine bones for their support, and there is no obvious representative of the "processus antorbitalis" of *Lepidosiren*. A feebly-developed ascending process is present, and articulates with a descending plate derived from the preorbital portion of the dermal ectethmoid, the two processes being closely applied to the lateral chondrocranial wall of the mesethmoid region. Perhaps the only other noteworthy feature is the more vertical position which each bone assumes in passing from the distal end of the suspensorial cartilage to the symphysis anteriorly—a peculiarity which evidently owes its explanation to greater forward inclination of the suspensorium itself.

The opercular and interopercular bones and their cartilaginous vestigial hyoidean rays are essentially similar to those of other Dipnoi, but on the whole are perhaps better developed.

The three suborbital bones described by Huxley were represented in the specimen examined by myself by four [1] somewhat irregularly-shaped and tubular ossicles which lodged the infraorbital division of the sensory canals of the head. There is a similar but much larger bone situated somewhat above and behind the orbit, articulating internally with the supraorbital margin of the dermal ectethmoid and behind with the lamellar portion of the squamosal, where it is also in fibrous connection with the hindermost of the infraorbital series. This bone is likewise traversed by a tubular canal, and, as it transmits the supraorbital sensory canal, may perhaps be considered as the remains of a supraorbital series of ossicles. The latter bone is apparently the one figured by Huxley (*l. c.* fig. 7, p. 37), and by him described as one of the component elements of the supracranial roof. It has also been figured by Miall [22] as a "postorbital" bone.

The lower jaw is very unlike that of other Dipnoi. It is relatively much more slender and has little more than a rudiment of a coronoid process. The largest bones are those described by Huxley as the splenial and the angular, but while the former is wholly restricted to the inner surface of the ramus, the latter forms the outer surface and extends from the articular extremity nearly to the mental symphysis of the two splenial elements. The two dentary plates described by Huxley are peculiar to *Ceratodus*. Anteriorly to the symphysis the two Meckelian cartilages unite in a forwardly-projecting concave lamella, regarded by Günther as representing "lower labial cartilages," but doubtfully so considered by Huxley. There is no trace of the vertically-disposed processes which in *Lepidosiren* are derived from the Meckelian cartilages and support the folds of mucous membrane projecting into the angles between the mandibular tooth-plates.

The hyoid arch is much more complete than in any other Dipnoid, and was originally described by Günther (*l. c.*) as consisting of a pair of basihyals and a glossohyal. Ridewood [35 *a*] subsequently showed that the paired basihyals are really hypohyals, and the "glossohyal" a true basihyal. In addition to these elements there is also a variously-shaped cartilage attached by ligament to the inner and hinder margin of each suspensorial cartilage, dorsad to the upper extremity of the cerato-hyal, and considered by its discoverer, Huxley (*l. c.*), and also by Gadow (9 *a*) and Ridewood (*l. c.*), to represent a hyomandibular element. On the authority of Ridewood (*l. c.*) it would

[1] Traquair (37, p. 9) found five suborbital bones in a specimen which he examined.

appear that the ventral or symplectic extremity of the hyomandibular element may be segmented off as a separate cartilage, and further, that an additional nodule of cartilage, which is occasionally found in the hyo-suspensorial ligament, "may possibly have the value of an interhyal" (*l. c.* p. 636). No trace of any patches of cartilage or "vestigial hyoidean rays" could be detected in connection with the cerato-hyal in the only specimen of *Ceratodus* which I have had the opportunity of examining.

Ceratodus has five branchial arches, with a rudiment of a sixth if Huxley has correctly interpreted the nature of a small nodule of cartilage at the ventral extremity of the fifth arch. The first four are bisegmental, consisting of a "long ventral and a short dorsal piece of cartilage"; the last, of a single cartilage only. Two small cartilages situated in the median and ventral line, between the ventral extremities of the branchial arches, have been considered by Huxley to represent "anterior and posterior meso-branchials" (*l. c.* p. 27).

There is a well-developed hyoidean cleft between the hyoid arch and the first branchial arch.

A representative of the "cranial rib" of other Dipnoi is present, but its relations to the ossified "basi-dorsals" of the first neural arch are precisely those of the succeeding ribs to their basi-dorsals.

The attachment of the dorsal extremity of each lateral half of the pectoral girdle to the skull is effected by "a thin broad lamella of an obliquely ovate shape, entirely ossified" (Günther, *l. c.* p. 531), and directed obliquely backward and outward. It is directly connected by ligament at its upper or inner extremity with the lateral wall of the chondrocranium, between the Vagus foramen and the exoccipital, and distally also by ligament with the supraclavicle of Parker. The bone has been termed "supra-scapula" by Günther, and its equivalent in *Protopterus* "suprascapula" (Peters, *l. c.*) and "post-temporal" (Parker, 32).

B. *Protopterus.*

With the exception of minor structural features, and certain modifications of nomenclature, the data necessary for the comparison of the skull of this Dipnoid with those of *Ceratodus* and *Lepidosiren* have been principally taken from Wiedersheim's paper (*l. c.*).

Owing to the development of a large fronto-parietal bone and the share which it takes in forming the roof, and also, in conjunction with the parasphenoid, the lateral walls of the cranial cavity, the chondrocranium has largely atrophied, leaving, neverthe-less, an occipito-periotic portion and an ethmo-nasal region, connected by a pair of laterally-situated and relatively narrow, band-like, trabecular cartilages, which in the middle portion of the skull are the only remains of the complete chondrocranium of *Ceratodus.* The occipito-periotic cartilage is somewhat more extensive than in *Lepido-siren*, the cartilage of the supraoccipital region extending on the inner surface of the fronto-parietal as far forward as the anterior limit of the periotic capsules, while the exoccipital bones are invested externally, but not internally, by cartilage. In fact the chondrocranium is complete dorsally and laterally in the periotic and post-auditory regions, and would also be so ventrally were it not that the basal cartilage ceases a little behind the middle of the periotic region. The trabecular cartilages are similar to those of *Lepidosiren*, but of somewhat greater vertical extent in the region immediately anterior to the periotic capsules, and for a short distance behind the junction of the fronto-parietal and parasphenoid they even contribute to the formation of the lateral walls of the cranial cavity (Wiedersheim, *l. c.* Taf. ii. fig. 5). Precisely as in *Lepidosiren*, the trabecular cartilages become continuous in front of the anterior termination of the parasphenoid with the persistent and upwardly-deflected basicranial cartilage of this region; but, again separating from it anteriorly, they diverge outward and downward across the outer surface of the palato-pterygoid bone in the form of extremely slender antorbital cartilages. The latter curve downward and backward into the hinder margin of the upper labial fold and there terminate, but without extending forward into its inferior border, or giving off anteriorly-directed processes. The continuity of the trabecular and antorbital cartilages has been described by Wiedersheim (*l. c.*), although, curiously enough, it is not represented in any of his figures. Peters (*l. c.*), however, was the first to show the relations of the two structures in his figure of the skull of a *Protopterus* from Zambesi, and indeed gives a more accurate representation of the shape and curvature of the antorbital process than any other figure with which I am acquainted.

From the point where the basicranial cartilage begins to be deflected upward by the palato-pterygoid symphysis the ethmo-nasal portion of the chondrocranium differs but little from that of *Lepidosiren*, and the figures given of this region in the latter Dipnoid are, in the main, equally applicable to *Protopterus*. Trabecular cornua, subnasal cartilages, and a bilobed prenasal process are present, and in every respect are almost identical with the corresponding structures in *Lepidosiren*. In both genera the fenestration of the roof of the two nasal capsules is regular and almost symmetrical. The presence of subnasal cartilages was overlooked by Wiedersheim, although they had previously been figured by Peters (*l. c.* Taf. ii. fig. 3, *k'*), whose accuracy in this respect I am able to confirm. I notice that Wiedersheim (*l. c.* Taf. ii. fig. 5) represents that portion of the internasal septum which carries the two vomerine teeth as segmented off from the hinder part of the septum and separated from it by a curved vertical suture, and a statement to the same effect occurs in the text (*l. c.* p. 52). With reference to this point I can only say that in a skull which I have had the opportunity of examining no such division could be detected, and the septum was continuous throughout its extent. The same figure is also slightly inaccurate in not representing the mesethmoid cartilage which, as in *Lepidosiren*, is situated immediately behind the palato-pterygoid symphysis.

Although previously unnoticed, or at all events unrecorded [1], a well-marked basicranial vacuity or cleft is present, and may be seen in a ventral view of the skull close to the hinder margin of the palatine symphysis. It is oval in shape, and filled up by a thick fibrous sheet continuous internally with the fibrous mass which occupies the ethmoidal portion of the cranial cavity.

From a comparison of the figure of a plastic model of the nasal region given by Rose (*l. c.* fig. 4) with a similar model of the same region figured by himself, Pinkus (*l. c.* fig. 7) infers that the cartilaginous laminæ which separate the oval vacuities in the nasal roof increase in number with the growth of the fish and still further subdivide pre-existing vacuities.

No mention is made of the existence of upper labial cartilages in *Protopterus* either by Owen or Cobbold, or even in the excellent and much more recent paper by Wiedersheim. According to Huxley [16] there are "two upper labial cartilages—one fibro-cartilaginous immediately behind the anterior narial aperture, and the other behind the posterior narial opening. These answer to the upper labial cartilages of *Chimæra* and *Cestracion*" (*l. c.* p. 181). Rose (*l. c.*) describes two pairs of upper labials, an anterior pair represented by the terminal lobes of the prenasal process, and a posterior pair which evidently correspond to the thickened and laterally-recurved anterior margins of the nasal capsules in *Lepidosiren*. Peters (*l. c.*) has also figured, but without describing, two pairs of upper labials.

Huxley's account is not very clear, but from his statement of their position I think there can be no doubt that his anterior labials are really the subnasal cartilages, and not true labials at all, while his description of the posterior labials leaves one in doubt whether he is referring to the antorbital cartilages or to the equivalents of the undoubted upper labials of *Lepidosiren*. The identification of upper labials given by Rose is certainly based on insufficient evidence, inasmuch as there is at present no reason to believe that the cartilages which he terms labials have developed independently of the nasal region of the chondrocranium, and I have already given reasons for the view that his posterior labials are persistent trabecular cornua, such as not infrequently form the anterior walls of the nasal capsules in many Anurous Amphibia. The posterior labials of Peters are really the antorbital processes, but from their position it would seem probable that the structures figured by him (*l. c.*) as anterior labials are the representatives in *Protopterus* of the single pair of upper labials of *Lepidosiren*.

With the object of clearing up the obscurity as to the existence of upper labials in *Protopterus*, I made a careful examination of a skull of this Dipnoid, with the result that there is no doubt that *Protopterus* and *Lepidosiren* are in close agreement so far

[1] A linear shading in one of Peters's figures (*l. c.* Taf. ii. fig. 3) may be intended to represent this vacuity, but no further reference is made to it, either in the figure or in the text.

as these structures are concerned. *Protopterus*, in fact, has but a single pair of upper labial cartilages, which, in position and relations, are identical with those of *Lepidosiren*, and also with the so-called "anterior labials" correctly figured by Peters sixty years ago, but apparently overlooked by every subsequent writer.

The suspensorial cartilage of *Protopterus* differs from that of *Ceratodus* in the restricted antero-posterior dimension of its proximal portion, which does not therefore arch backward over the branchial apparatus to the extent it does in the latter genus, and also in the absence of any representative of a palato-pterygoid cartilage. The cartilage figured by Wiedersheim (*l. c.* Taf. ii. fig. 3, *tr.*) fringing the dorsal border of each palato-pterygoid bone, and rightly named by him the "pars trabecularis cranii," lies above the level of the cranial floor, and is therefore a remnant of the lateral chondrocranial wall and not a palato-pterygoid cartilage. The suppression of the latter cartilage is perhaps to be associated with the increased relative thickness of the palato-pterygoid bone, and its more intimate relations with the lateral margins of the basis cranii. On the other hand, *Protopterus* agrees with *Ceratodus* and differs from *Lepidosiren* in the degree of inclination of the suspensorium to the basicranial axis.

The two exoccipitals of *Protopterus* are peculiar in that they meet and fuse dorsally beneath the cartilage of the supraoccipital region. Wiedersheim regards them as representing a "supraoccipitale," but the resemblance of the lateral halves of the bone to the paired bones of *Lepidosiren*, both in shape and in their relations to the foramina for the exit of the Vagus and Hypoglossal nerves, is sufficiently close to justify one in regarding them as a pair of confluent exoccipital elements.

The remaining bones of the skull are on the whole very similar to those of *Lepidosiren*. As compared with *Ceratodus* the most striking differences relate to the presence of a fronto-parietal forming a complete gable-roof to the cranial cavity, except for a limited extent between its anterior margin and the dermal ethmoid, and also, in conjunction with the marginal ascending plates of the parasphenoid, contributing to form the bony side-walls of the central region of the same cavity. It may be remarked, however, that in the suspensorial region the fronto-parietal is restricted to the cranial roof, and does not in any way invest the outer surface of the periotic capsule or the suspensorial cartilage, or hide in an external view the continuity of either with the trabecular cartilage. To these features may be added the absence of a complete supracranial roof, due to the want of a "scleroparietal" and of the superficial lamellar plates of the squamosal, combined with the relative narrowness of the dermal ectethmoids. The characteristic preorbital or nasal section of the dermal ectethmoid of *Ceratodus* is wholly wanting in *Protopterus*, the bone being displaced upward and backward by the growth of an exceptionally large ascending process from the palato-pterygoid bone. Nevertheless, the dermal ectethmoids are much better developed than in *Lepidosiren*, and, in the absence of a "scleroparietal," their expanded anterior portions meet in a median suture dorsad to the fronto-parietal.

A noteworthy feature in *Protopterus* is the existence of extensive lateral vacuities in the side-walls of the anterior section of the cranial cavity, between the anterior margins of the lateral plates of the fronto-parietal bone and the ascending processes of the palato-pterygoids, which are continuous dorsally with a fissure between the fronto-parietal and the dermal ethmoid. These vacuities are filled up by a tough fibrous membrane, continuous internally with a dense mass of fibrous tissue previously mentioned as obliterating the cranial cavity in this region, while the dorsal fissure is closed by the fibrous tissue which extends between the contiguous margins of the fronto-parietal and the dermal ethmoid, and is also continuous internally with the cranial mass of the same tissue.

The parasphenoid is much more restricted in its relations to the basis cranii than in *Ceratodus*, inasmuch as it terminates somewhat abruptly by a nearly straight transverse margin at some distance behind the palatine symphysis, and only very slightly projects backward beneath the post-cranial section of the notochord. In the share which it takes in forming the lateral walls of the cranial cavity, and in its relation to the trabecular cartilages and the palato-pterygoid bones, the parasphenoid differs but little from its homologue in *Lepidosiren*.

The palato-pterygoids are also essentially similar to those of *Lepidosiren*, especially in the modifications produced in the ethmo-nasal region of the chondrocranium by the massive development of their symphysis. They have well-marked lateral processes for the partial support of the two anterior tooth-plates, and a strong "antorbital process" for the posterior plate. There are also stout ascending processes which, in addition to carrying the dermal ectethmoids, form the outer walls of the olfactory fossæ anteriorly to the lateral cranial vacuities.

There is a ring of fibrous tissue encircling the orbit, but no circumorbital bones are developed in it. The opercular and interopercular elements are essentially similar to those of *Ceratodus*, but relatively smaller.

Vestigial hyoidean rays have not previously been recorded as existing in *Protopterus*, but there is no doubt as to their existence. The opercular cartilage closely resembles the corresponding piece in *Ceratodus* (Huxley, *l. c.* p. 38). It is horseshoe-shaped and closely applied to the inner surface of the upper third of the operculum. The interopercular cartilage, on the other hand, is essentially similar to its representative in *Lepidosiren*.

The hyoid arch is a much simpler structure than in *Ceratodus*, and, as in *Lepidosiren*, there is no trace of hyomandibular, hypohyal, or basihyal elements. As in the latter Dipnoid, there is a patch of cartilage (vestigial hyoidean ray) on the outer surface of the distal portion of each cerato-hyal. No mention of this cartilage is made by Wiedersheim, although it is apparently figured by Peters (*l. c.* Taf. ii. fig. 2), without, however, being indicated by reference-letters or referred to in the text.

As regards the precise number of branchial arches in *Protopterus*, there is some discrepancy in the statements of different writers. According to Owen [25], Peters [34], McDonnell [21], and Wiedersheim [41], there are six branchial arches. Newton Parker [33] states, however, that there are but five, and is apparently doubtful as to the existence of the arch which Wiedersheim (*l. c.* p. 56, fig. 8) figures and describes as situated in front of the first cleft and forming the first of the series of six. There is also some obscurity as to the existence of a hyobranchial or hyoidean cleft. Neither Owen nor Peters is explicit on this point, although from their statements as to the position and relations of the gill-filaments and branchial clefts the absence of a hyoidean cleft may perhaps be inferred. Wiedersheim figures (*l. c.* fig. 8) the first cleft as situated between his first and second branchial arches, but there is no special reference in the text to the presence or absence of a hyobranchial cleft. On the other hand, according to Newton Parker (*l. c.* pp. 161–162), a hyobranchial cleft is present, and has in relation with its anterior wall the hyoidean hemibranch or "opercular gill."

On examining the branchial region of a specimen of *Protopterus* 31 cm. in length, I had no difficulty in detecting the presence of an extremely slender, unsegmented, cartilaginous filament, 7 mm. in length and rather less than 1 mm. wide, situated immediately in front of the first branchial cleft and forming its anterior boundary. The mucous membrane covering the posterior margin of the filament carried a series of minute tooth-like projections, similar to the single row of the second arch and to the double series found on the anterior and posterior margins of the succeeding arches, with the exception of the last, which has but a single row. The cartilage occupies a position precisely similar to the first branchial arch in *Lepidosiren*, being in close relation with the hinder margin of the suspensorial cartilage, dorsad and posterior to the proximal extremity of the hyoid arch. It is scarcely open to doubt that this slender cartilaginous rod represents the first of a series of six branchial arches, and, as there is certainly no cleft anterior to it, the conclusion that the hyobranchial cleft has undergone total suppression necessarily follows. It may be mentioned that Pinkus (*l. c.* p. 318) records the presence of a small piece of cartilage embedded in the oral mucous membrane opposite the first gill-arch. The cartilage is apparently very small, being only 1·08 mm. in length in a specimen 14 cm. long, and 2·36 mm. in one 17 cm. in length. "Sein Bau entspricht genau dem der übrigen Kiemenbogen, nur dass es bloss eine, und zwar mediale, Reihe zahnartiger Zacken trägt, deren die übrigen Bogen je zwei, eine mediale und eine laterale, besitzen." After discussing the relations of the cartilage to the branches of the Glossopharyngeal and Vagus nerves, Pinkus concludes :—"Ich rechne diesen rudimentären Kiemenbogen bei der Zählung nicht mit, sondern zähle, der Innervation und dem üblichen Schema entsprechend, den darauf folgenden Bogen als ersten Kiemenbogen. Demnach liegt die erste Kiemenspalte zwischen diesem Kiemenbogen und dem Hyoid, die zweite Kiemensplate zwischen diesem Kiemenbogen und dem zweiten Kiemenbogen" (p. 318). I am not quite certain that the cartilage Pinkus describes is identical with the one which, in agreement with Wiedersheim, I have described as existing in front of the first cleft, although it is extremely probable that such is the case ; but I entertain no doubt whatever that the latter cartilage is the first branchial arch and that the hyobranchial cleft has been completely suppressed, and further that, as in *Lepidosiren*, the hyoidean hemibranch or pseudobranch is in relation with the anterior wall of the cleft between the first and second branchial arches.

In Wiedersheim's description all the remaining five branchial arches are represented as simple, non-jointed, and very slender rods of cartilage. The second arch is the longest, but is scarcely thicker than the others, neither is its dorsal end bifurcate or grooved. The remaining arches gradually decrease in length, the sixth being much the shortest of the series. According to Ridewood (*l. c.*), on the contrary, the second and third branchial arches differ from all the others, and resemble the branchial arches of *Ceratodus*, in that each is provided with a dorsal or "epibranchial" segment in addition to the relatively much longer ventral or cerato-branchial portion which, apparently, is alone represented in Wiedersheim's figures. Meso- or basi-branchial cartilages appear to be wholly absent in *Protopterus*.

The lower jaw is strikingly different from that of *Ceratodus*. The two rami are relatively shorter and more strongly developed, with a remarkably high coronoid process, and uniting anteriorly in a massive symphysis. As in *Lepidosiren*, practically the whole of the osseous portion of each ramus is formed by the splenial, the dentary being absent altogether, and the angular reduced to an insignificant splint on the outer surface of the articular extremity. The Meckelian cartilages unite anteriorly in a vertically-disposed symphysial plate, terminating above in a median and two lateral processes. According to Wiedersheim (*l. c.*), a short ascending process is given off from each cartilage and occupies the angle between the anterior and central tooth-plates. I notice, however, that in one of Peters's figures of his Zambesi *Protopterus* the Meckelian cartilage is represented as giving off an additional process behind the one referred to above, and, moreover, both are represented as if they were suturally distinct from the cartilage itself (*l. c.* Taf. ii. fig. 5). The additional process is apparently represented by a free nodule of cartilage in *Lepidosiren* (Pl. XXVIII. fig. 7).

In *Protopterus* the "cranial rib" has become displaced from its normal relations to the elements of the first neural arch, and moved forward to an articulation with the chondrocranium between the Vagus foramen and the exoccipital.

The foramina for the major divisions of the cranial nerves have the same general arrangement as in *Lepidosiren*. It need only be mentioned that each Optic nerve escapes through a small foramen in the fibrous sheet which closes the lateral cranial vacuity of its side, and that the foramen for the Motor Oculi perforates the side-wall of the skull at some distance behind the Optic nerve, but anteriorly to the aperture for the ramus ophthalmicus of the Fifth nerve. The roots of the first two spinal nerves are transmitted through two separate foramina in the exoccipital bone.

The dorsal extremity of the pectoral girdle is connected with the occipital region of the skull by a stout fibrous band, in which is embedded what Parker [32] describes as "a thin, subfalcate, subcutaneous bone" (*l. c.* p. 21), and which he designates the "post-temporal." The bone is relatively much smaller than in *Ceratodus*, and has apparently lost its direct articulation both with the skull and with the supraclavicle.

C. *Lepidosiren.*

In the main the skull of *Lepidosiren* closely resembles that of *Protopterus*. The most important of its structural peculiarities may be briefly summarized as follows :—

The chondrocranial portion of the skull exhibits further indications of atrophy, especially in the occipito-periotic region. The cartilaginous roof, which in *Protopterus* extends as far forward as the anterior limit of the auditory capsules, has receded somewhat in *Lepidosiren* and is now restricted to the supraoccipital region. The exoccipitals are invested neither externally nor internally by cartilage, and hence the complete occipital ring of cartilage in *Protopterus* becomes divided in *Lepidosiren* into a dorsal and a basal plate, which are only connected through their continuity anteriorly with the periotic capsules. The trabecular cartilages are considerably reduced in thickness and in height, and are now represented by relatively slender, laterally-compressed bands, slightly increasing in vertical extent as they become continuous with the periotic and suspensorial cartilages, but only to a very slight extent do they become visible from the interior of the cranial cavity. The styliform process of the mesethnoid cartilage is also shorter than in *Protopterus*. On the other hand, the antorbital cartilages are somewhat better developed, and, in addition to supporting the inferior and hinder margin of the upper labial folds, are prolonged into anteriorly-directed processes.

The suspensorial cartilage is essentially similar in structure to that of *Protopterus*, except for the emargination of that part of its posterior margin which is covered externally by the squamosal. Undoubtedly its most interesting feature is the rotation backward of its articular extremity to a greater extent than in any other Dipnoid, and hence its forward inclination is less, and the angle which it makes with the fore part of the basicranial axis greater, than in either *Ceratodus* or *Protopterus*. The effect of this recession of the condylar extremity of the suspensorium on the palato-pterygoid bone is that the latter is not only of greater relative length, but deviates more from the vertical, and describes a segment of a larger circle in passing forward to its symphysial termination, than in either of the other two genera.

The two exoccipital bones are distinct, but nevertheless closely approximated both dorsally and ventrally.

The fronto-parietal is a relatively much larger bone in every dimension than in *Protopterus.* In the anterior part of its extent not only does the bone completely invest the dorsal surface of the cranium, but through the extension of its lateral or descending plates as far forward as the ascending processes of the palato-pterygoids, and posteriorly as far back as the periotic capsules, the lateral walls of the entire pre-auditory section of the cranial cavity are formed wholly by bone. Hence it follows that the lateral cranial vacuities of *Protopterus* have no existence in *Lepidosiren,* or at most are only represented on each side by a narrow suture, or rather fissure, between the ascending process of the palato-pterygoid and the anterior and lateral margins of the fronto-parietal, while the more or less extensive area of trabecular cartilage which, in a vertical longitudinal section of the skull of *Protopterus,* is visible in front of the periotic capsule, becomes entirely concealed from view in *Lepidosiren.* More posteriorly, in the suspensorial region, the fronto-parietal of *Protopterus* is confined to the cranial roof, and, except for its partial investment by the squamosal, the whole extent of the suspensorial cartilage and its continuity with the periotic capsule and the trabecular cartilage are clearly visible in an external and lateral view. In *Lepidosiren,* on the contrary, a lateral and downward extension of the bone almost completely invests the outer surfaces of the periotic and suspensorial cartilages, and, in a similar view, effectually hides the continuity of the latter with the trabecular cartilage. The sagittal crest is somewhat better developed in *Lepidosiren* than in *Protopterus,* and to this may be added a "lambdoid" ridge, which, owing to the relative narrowness of the hinder portion of the fronto-parietal, is scarcely indicated in the latter Dipnoid.

The dermal ectethmoids are scarcely so well developed as in *Protopterus.* Their anterior portions are much narrower and fail to meet in a median suture: hence the fronto-parietal and its characteristic crest may be seen between them in a dorsal view of the skull. (Compare Pl. XXVIII. fig. 2, and Wiedersheim, *l. c.* Taf. ii. fig. 1.)

Lepidosiren has but five simple, unsegmented, branchial arches, the sixth arch, like the fifth cleft, having been suppressed [1]. As compared with *Protopterus,* a noticeable feature is the exceptional thickness of the second arch, and its dorsal cleft or groove for an aortic arch.

As previously mentioned, the position and relations of the foramina for the exit of the cranial nerves are nearly identical in the two genera. It may be pointed out that the Optic nerves in *Lepidosiren* escape through the two clefts or fissures which represent the anterior cranial vacuities of *Protopterus,* and further that in the former Dipnoid only the roots of the first spinal nerve (Hypoglossal) perforate the exoccipital, the second pair simply traversing the fibrous tissue which intervenes between that bone and the first neural arch.

[1] The distinct epibranchial elements of the second and third arches in *Protopterus* are wholly unrepresented in *Lepidosiren*

The connection of the pectoral girdle with the postero-lateral regions of the skull is entirely by ligament, the "post-temporal" bone of *Ceratodus* and *Protopterus* being wholly unrepresented.

From what has been stated as to the structural differences and resemblances between the skulls of the three genera of existing Dipnoi it may be inferred that, while all three conform to the same fundamental type of structure, and at the same time exhibit successive stages of modification in the same general direction, the skull of *Ceratodus* is by far the most generalized and primitive; and further, that of the two remaining genera the skull of *Lepidosiren* represents but a slightly more specialized type when compared with the skull of *Protopterus*. In support of the first statement it is only necessary to recall the more complete development of the chondrocranium in *Ceratodus*, especially in the ethmo-nasal, interorbital, and palato-pterygoid regions, the absence of a fronto-parietal bone, the feeble development of the exoccipitals, the segmentation of the branchial arches, the more complete hyoid arch with its hyomandibular, hypohyal, and basihyal elements, the presence of a dentary splint in the lower jaw, and also the retention of a series of suborbital ossicles. On the other hand, *Protopterus* and *Lepidosiren* differ from *Ceratodus* and agree with each other in the extensive atrophy of the central region of the chondrocranium, the absorption of the palato-pterygoid cartilage, the characteristic constriction of the nasal from the ethmoidal region through the massive growth of the palatine symphysis, the development of a fronto-parietal bone, and the increased size and importance of the exoccipitals. It is none the less obvious, however, that in both genera specialization due to the increased development of certain cranial structures has proceeded side by side with the reduction or suppression of others. Of the latter process we have examples in such modifications as the atrophy of the dentary element of the lower jaw and of the suborbital bones, and the reduction in the hyoid arch by the loss of its hyomandibular, hypohyal, and basihyal elements, while the substitution of lungs for gills as the more important respiratory organs is clearly responsible for the reduction in size and simplification of the branchial arches, the closure of the hyoidean cleft, and the relatively smaller size of the opercular bones. Finally, the slightly more pronounced specialization of the skull of *Lepidosiren* is evidenced by the further atrophy of the chondrocranium and the compensating increase in the size of the fronto-parietal and in the extent of its relations to the cranial and suspensorial regions. To these features may be added the increased backward rotation of the suspensorial cartilage, the somewhat greater development of the antorbital cartilages, and the total suppression of the sixth branchial arch and of the epibranchial elements of the second and third arches. Briefly, it may be said that if the skull of *Ceratodus* be taken to represent a relatively early larval stage, the skulls of *Protopterus* and *Lepidosiren* are comparable to two immediately succeeding and very much later stages, while, with one or two exceptions, the differences between the two latter genera are much the same in nature and extent as those which distinguish the skull of first- and second-year Frogs.

It cannot, however, be too strongly emphasized that in any comparison of the skulls of *Protopterus* and *Lepidosiren* it is important that due regard should be paid to the size and age of the specimens upon which such comparison is based. According to Günther [12, p. 357] *Protopterus* sometimes attains a length of six feet, whereas most of the specimens which have reached Europe, and furnished the needful material for the hitherto-published papers on the structure of the skull, seem to have been comparatively small and relatively young examples in which it is improbable that the skull had attained its final and complete development. Hence it is by no means improbable that, if comparison were made with larger and older specimens of *Protopterus*, some at least of the cranial modifications in *Lepidosiren*, which have been mentioned as distinctive of the genus, would either disappear or become so far softened down as to lose much of whatever importance they now seem to possess. That this is probable is evident from the fact that certain of the more obvious differences in the cranial structure of the two genera are precisely those which might easily be bridged over by older specimens of *Protopterus*. On this point it is only necessary to refer to the greater development of the fronto-parietal, the further retrogression of the chondrocranium, and the greater backward rotation of the suspensorium in *Lepidosiren*.

IV. *The Structure of the Skull in Fossil Dipnoi.*

When the range of comparison is so far extended as to include the extinct Dipnoid families, the Dipteridæ, Phaneropleuridæ, and Ctenodontidæ[1], it is obvious that, while the fossil types exhibit a general agreement with existing Dipnoi in the main outlines of their cranial structure, they differ from the latter, as well as from one another, in several striking and significant features. Broadly speaking, it may be affirmed that all known fossil Dipnoi agree with their living representatives and differ from all other Fishes in possessing the following combination of cranial characters:—

(A.) Complete and typical autostylism.

(B.) The presence of characteristic triturating palatal teeth, supported by palato-pterygoid bones, symphysially united beneath the ethmoidal region of the skull, and probably associated with the absence of premaxillæ and maxillæ in the upper jaw.

[1] I have here followed the classification of the fossil Dipnoi as given by Smith Woodward [45]. Traquair [39] has suggested the separation of *Uronemus* from the Phaneropleuridæ as the type of a distinct family [Uronemidæ], and the union of the remaining genus *Phaneropleuron* with the Dipteridæ and Ctenodontidæ in one comprehensive family of Ctenodontidæ.

(C.) The great development of the splenial bones of the lower jaw for the sole support of mandibular teeth, similar to the palatal teeth of the upper jaw, and their union anteriorly in a stout mental symphysis, to which may be added the absence of dentigerous dentary elements.

(D.) The presence of only two opercular bones—an operculum and an interoperculum—and, unless represented by the squamosal, the absence of a distinct preopercular element.

Apparently the only constant cranial character in which all fossil Dipnoi differ from existing Dipnoi is the multiplicity and almost Acipenseroid arrangement of their cranial roofing-bones [1]. These bones seem to be most numerous in *Dipterus* (*D. valenciennesi*). A medio-dorsal longitudinal series can be distinguished, flanked on each side by several rows of longitudinally-disposed lateral plates. The inner lateral row of plates on each side tend to meet in pairs between the median plates, so as to interrupt the sutural continuity of the latter. A similar tendency to alternation may be also exhibited by the lateral series of plates, but their arrangement is far from regular, and is not always symmetrical on opposite sides of the cranial roof. There is a general similarity to *Dipterus* in the disposition of the cranial plates in other extinct Dipnoi, and it is worthy of note that in *Ctenodus* the plates become somewhat reduced in number, and two of the median series, the most anterior and the most posterior, become so far enlarged as to be distinguishable as a dermal ethmoid and a dermo-supraoccipital [Fritsch, 9]. But, except in the most general manner, it is practically impossible to correlate any of these plates with the numerically-reduced and more definitely-disposed cranial roof-bones of the average Ganoid or Teleostean skull. To what extent the dermal plates are represented in living Dipnoi it is extremely difficult to say. Dollo [7] regards the sparsely-represented dermal cranial bones of existing types as the remains of the much more numerous plates of the fossil Dipnoi. If this be so, the most anterior of the medio-dorsal series of plates in the latter, and a solitary pair of the lateral plates in the orbital or ethmoidal region, may be represented in *Ceratodus*, *Protopterus*, and *Lepidosiren* by the median dermal ethmoid and the paired dermal ectethmoids or lateral ethmoids respectively. On the other hand, if the "scleroparietal" of *Ceratodus* is a "tendon-bone," it probably has no counterpart in any fossil Dipnoid; and as the fronto-parietal of *Protopterus* and *Lepidosiren* is situated wholly internal to the jaw-muscles, which could scarcely have been the case with any of the cranial plates of *Dipterus* and its allies, the same conclusion may be suggested with regard to this bone.

There are also other differences in cranial structure, which, if not distinctive of all fossil Dipnoi, are nevertheless characteristic of particular families or genera, and, so far as our knowledge at present extends, the more important of these may be briefly reviewed.

[1] See remarks by Smith Woodward on *Ctenodus* [45, p. 253].

i. *The existence of endochondrial ossifications.*—There is not wanting evidence that in some fossil forms the cartilaginous elements of the skull must have been replaced by bone to an extent which has no parallel in existing types. Thus, Traquair, who was the first to demonstrate the autostylic character of the skull in the Dipteridæ and thereby conclusively prove the accuracy of the earlier suggestion of Günther [11] as to the relationship of this family to the Dipnoi, in his important paper on the skull of *Dipterus* [37], remarks "that the chondrocranium was very much more extensively ossified than that of *Ceratodus*; in fact, its side-walls were entirely occupied by bone apparently as far as the interorbital region." "The bony matter surrounding the foramen magnum may be held to represent the exoccipitals, and in front of it on each side the walls of the otic region are distinctly ossified—though, from the abraded condition of this part in all the skulls, it is hardly possible to trace any sutural lines marking off distinct osseous elements" (*l. c.* p. 5). There is also said to be a distinct quadrate provided with a facet for articulation with the mandible. "In fact, we have here before us, as nearly as possible, a counterpart in bone of the suspensorial cartilage of *Ceratodus*" (*l. c.* p. 6). Further, in the same Dipnoid there is an ossified articular element in the lower jaw (Traquair, *l. c.*), in addition to the usual angular and splenial bones.

There is no satisfactory evidence of the existence of endochondrial bones in any other extinct Dipnoi, with the possible exception of the bone termed "Gehörkapsel" in *Ctenodus* (Fritsch, *l. c.*), and doubtfully regarded as a periotic ossification. In the latter Dipnoid, according to Fritsch, there is an ossified cerato-hyal and a basihyal and, in addition, certain bones which he conjectures may represent the cerato-branchial elements of some of the branchial arches.

ii. *The presence of additional dermal bones in connection with the upper and lower jaws.*—Of these we have examples in the median dentary at the mandibular (splenial) symphysis of *Dipterus* (Traquair, *l. c.*), and the premaxillæ and maxillæ which support the pointed conical "marginal" teeth of *Phaneropleuron* (Traquair, 38), and, in addition, the several bones which, in the lower jaw of the same Dipnoid, carry similar teeth. The presence of "marginal teeth" and supporting dermal bones in this genus must, however, be regarded as at least open to doubt, although usually cited as one of the distinctive characters of the Phaneropleuridæ.

In a paper subsequent to the one quoted above, Traquair [39] remarks of *Phaneropleuron andersoni*:—"As for the conical teeth described by Huxley, I have satisfied myself that they are merely the outer denticles of ctenodont plates. Whiteaves's statement that in *Scaumenacia curta* 'both the upper and under jaws are armed with smooth, conical, and somewhat compressed teeth,' I have never been able to confirm—at least, if marginal teeth are hereby meant" (*l. c.* p. 264).

iii. *The presence of jugal plates.*—*Dipterus* has two pairs of such plates—an anterior and a posterior pair. Jugal plates are also present in *Phaneropleuron*, but are said to be absent in *Ctenodus*[1].

iv. *The presence of circumorbital ossicles.*—In *Dipterus* there is series of bony plates encircling the orbit and covering the cheek, and also forming the upper border of the hinder part of the mouth [Traquair, 37]. According to Fritsch [*l. c.*], circumorbital ossicles are probably present in *Ctenodus*, but of their existence in *Phaneropleuron* I have been unable to find any evidence.

v. *The squamosal bone.*—This element is certainly present in *Ctenodus*, and has been described and figured by both Miall [23] and Fritsch (*l. c.*) as being very similar to its homologue in *Ceratodus*. As to the character or even the presence of this bone in the Dipteridæ and Phaneropleuridæ I can find no evidence.

vi. *The parasphenoid.*—The parasphenoid of *Dipterus* and *Ctenodus* is known, but not, so far as I am aware, in *Phaneropleuron*. It has been described and figured in the first-mentioned genus by Traquair [37], and in *Ctenodus* by Barkas [1], Miall [23], and Fritsch (*l. c.*). In both *Dipterus* and *Ctenodus* the bone extends as far forward as the palatine symphysis, thus filling up the whole space bounded anteriorly and laterally by the palato-pterygoid bones, and in this respect these genera resemble *Ceratodus*, while differing from *Protopterus* and *Lepidosiren*. In *Dipterus* the parasphenoid seems not to have extended beyond the posterior limit of the skull, but in *Ctenodus*, as Barkas (*l. c.* p. 51) pointed out, the exceptional length of the bone suggests that it extended for some distance beneath the vertebral column, thus affording an additional point of agreement to the many which are apparent when the skulls of *Ctenodus* and *Ceratodus* are compared.

vii. *The opercular bones.*—There is perhaps some variation in the relative size of the opercular bones in different extinct Dipnoi, but it is certain that they are usually much larger than in any existing members of the group.

viii. *The presence of ganoin.*—As an investment to more or fewer of the skull-bones, the presence of ganoin is most evident on the outer surface of the cranial roofing-bones, the opercular bones, and the lower jaw of the Dipteridæ. In *Ctenodus* and *Phaneropleuron* this characteristic investment is either entirely absent or restricted to fewer bones, at all events so far as the cranial elements are concerned.

As to the question whether the fossil Dipnoi are to be regarded as more primitive than the living Dipnoi there is considerable difference of opinion. According to Smith Woodward [45], the former are more specialized than any existing Dipnoi, and the more generalized types have alone survived to represent the group at the present day. In an elaborate and suggestive essay 'Sur la Phylogénie des Dipneustes,' Dollo [7] has arrived at exactly opposite conclusions. According to his views, *Dipterus* (*D. valenciennesi*) is to be considered the most primitive Dipnoid, the

[1] Traquair [39, p. 265] has expressed a doubt as to the assumed absence of jugal plates in this genus.

remaining genera—*Scaumenacia*, *Phaneropleuron*, *Uronemus*, and *Ctenodus*, in the order mentioned—representing successive grades of modification in the same general direction, and culminating in the living genera *Ceratodus*, *Protopterus*, and *Lepidosiren* as the final terms of an evolutionary series. It is not suggested that the sequence of the genera represents descent in a direct line, but rather that the genera are to be regarded as lateral offshoots of the main line of descent, while at the same time illustrating the general direction of the evolution of the group. Commencing with *Dipterus valenciennesi*, the principal modifications in cranial structure which the different genera exhibit in ascending order are (*a*) reduction in the number of the cranial dermal bones; (*b*) the gradual loss of their investment of ganoin; (*c*) the suppression of the jugal plates; and (*d*) reduction in the size and importance of the opercular elements [1].

Viewed from the standpoint of cranial structure alone, there are grave difficulties which militate against the acceptance of at least one, and that perhaps one of the most important, of Dollo's conclusions. So far from *Dipterus* being the most primitive of known Dipnoi, it is obvious, as Traquair [37] has pointed out, that in some of its cranial features this genus has attained a higher grade of specialization than any existing Dipnoid. In proof of this it is only necessary to refer to the more extensive ossification of the chondrocranium, the presence of a quadrate bone as the functional suspensorium, and the existence of an articular element in the lower jaw, all of which are features without parallel in any of the living genera. If we admit the accuracy of Dollo's view, that *Dipterus* represents the most primitive type of the Dipnoid stock, it will be necessary to assume the possibility of an ossified skull so far degenerating as to lose almost all trace of endochondrial ossification, and secondarily revert to the condition of a skull so completely cartilaginous, and so primitive in other respects, as that exhibited by the living *Ceratodus*. So far as I am aware, there is no evidence to justify belief in such a possibility.

As to the relations of the fossil Dipnoi to one another and to their living allies, it is difficult to arrive at any satisfactory conclusion from the facts of cranial structure alone, and the difficulty is increased by the want of definite and precise information on many important points in connection with the fossil Dipnoi, more particularly as to the condition of the chondrocranial portion of the skull. On the evidence at present available it seems probable that *Ceratodus* is the most primitive of known Dipnoi, and that *Protopterus* and *Lepidosiren* are the specialized and direct descendants of some *Ceratodus*-like ancestor. Of the fossil Dipnoi, *Ctenodus* certainly, and possibly also *Phaneropleuron*, approach more closely to *Ceratodus* than do *Dipterus* and its allies. The last-mentioned Dipnoi, on the contrary, seem to represent a divergent and terminal branch of the Dipnoid stem, and to include the most highly-specialized examples of the group.

[1] It must be mentioned that Dollo's comparison is not restricted to the skull, but includes also the mesial and paired fins, the scales and other structures of the various fossil and living genera.

In the present communication it is not intended to refer to the obscure problem of the phylogenetic origin of the Dipnoi themselves. An exhaustive and suggestive discussion of this question is to be found in the previously-cited paper by Dollo. There is, however, one point which may be referred to as having a direct bearing on this problem.

In common with several other morphologists, Dollo regards the Crossopterygii as the ancestral stock from which the Dipnoi have been derived, and bases his conclusion on the prevalence in certain fossil Dipnoi of characters common to the two groups, such as, for example, the existence of lobate paired fins, the presence of jugal plates, the ventral position of the narial apertures (in some Crossopterygii), and the ganoid investment of certain of the cranial bones. The obvious difficulty presented by the hyostylism of the Crossopterygii, and the pronounced autostylism of the Dipnoi, is met by the bold suggestion that the latter is an adaptive modification associated with the development of the peculiar Dipnoid type of dentition, which has also conditioned the suppression of the usual dentigerous bones, the premaxillæ, the maxillæ, and the dentaries. In support of this suggestion, Dollo emphasizes the association of autostylism with massive palatal teeth in the Holocephala and the incipient autostylism of *Cestracion* with the cochliodont dentition of that Selachian.

With regard to Dollo's theory of the adaptive character of autostylism, and its independent acquisition by widely different groups of Fishes, it may be remarked that the autostylism of the Cyclostomes and Amphibia still remains as a difficulty in the way of its acceptance, inasmuch as in neither group can the prevalence of autostylism be explained as due to the peculiarities of an exceptionally-developed dentition. It is nevertheless quite possible, and in my opinion even probable, that other factors besides peculiarities of dentition may condition the evolution of autostylism, and one of these may be the development of a suctorial mouth supported by a more or less elaborate system of labial cartilages. In the latter case the advantage derivable from the fixation by autostylism of the primary skeletal elements of the upper jaw may conceivably be quite as great as that gained in the case of a massive dentition. But, apart from the reasons advanced by Dollo, there are other considerations which suggest the derivation of the autostylism of the Dipnoi from a hyostylic type of skull.

As shown by Huxley [15], the upper extremity of the hyoid arch (cerato-hyal) in *Ceratodus* is connected with the suspensorial cartilage through the intervention of a cartilaginous element which he regards as the representative of the hyomandibular bone or cartilage of other Fishes. A similar interpretation may perhaps be assigned to the upper division of the hyoid arch in *Chimæra*, which, like the hyomandibular of Elasmobranchs, carries the dorsal series of hyoidean rays. Assuming the correctness of this interpretation of the nature of these cartilages, and that they are really homodynamous with the hyomandibular element of the majority of Fishes, an obvious inference is at once suggested. In practically all existing Elasmobranchs and Teleostomi, or at all events with only a single exception (*Notidanus*), the hyomandibular forms the common suspensorium of the mandibular and hyoid arches, and is associated with a hyostylic condition of the skull. The small size of the hyomandibular element in *Ceratodus* may be due to its reduction to the condition of a purely vestigial structure, but none the less does the noteworthy fact of its retention in the most primitive of existing Dipnoi suggest that it may be regarded as a remnant of the primitive hyostylic condition of the skull in the ancestors of the Dipnoi [1]. A similar significance may also be attached to the hyomandibular of *Chimæra*, at all events to the extent of suggesting the origin of the Holocephala from hyostylic ancestors. For these reasons I am inclined to agree with Dollo that autostylism is a purely adaptive modification, and may occur independently in diverse groups of Fishes wherever any advantage is to be gained from the fixation by fusion to the skull of the primitive elements of the upper jaw (palato-quadrate cartilage) for the purpose of providing the needful support for a massive and peculiar dentition, or even, as I have suggested above, for a system of labial cartilages in a suctorial mouth.

While agreeing with Dollo as to the adaptive character of autostylism, I may add that this does not necessarily imply agreement with his views as to the phylogenetic origin of the Dipnoi from the Crossopterygii. The theory is eminently controversial, and, although the author has much to say in its favour, there are nevertheless, in my opinion, weighty objections to its implicit acceptance, as well as no less cogent reasons for assigning to the Dipnoi a more remote ancestry. My object in referring to this question is rather to point out that autostylism in itself must not necessarily be regarded as an indication of genetic affinity. The necessity for caution in this respect is illustrated by certain recent views as to the supposed affinity of the Arthrodira (*Coccosteus*, *Dinichthys*, and their allies) to the Dipnoi. Thus, Smith Woodward [45], in discussing the affinities of the latter group, remarks: "the evidence in favour of the autostylic character of the Coccostean Fishes has now accumulated to such an extent that we venture to regard them as an order of Dipnoi" (*l. c.* p. xxi). It is quite possible that further research may confirm the accuracy of these views, but for the present I venture to think that their ultimate proof must rest on other grounds than the occurrence of autostylism.

[1] With reference to this point the following remarks by Gadow [9 *a*, p. 459] may be quoted: "It is highly probable that in the ancestral Dipnoi the hyomandibula was much larger, and that it was already, as in Teleosteans, broken up into a proximal cranial persisting part, and into a distal or symplectic element, which later on, when the hyostylic support of the jaws was superseded, either persisted [*Proteus*, &c.], or ultimately became lost [*Ceratodus*, *Salamandrina*]."

V. References to previous Literature.

1. Barkas, J. W.—On the Sphenoid, Cranial Bones, Operculum, and supposed Ear-bones of *Ctenodus*. Jour. Roy. Soc. New South Wales, 1877, p. 51.
2. Bischoff, T. H. W.—*Lepidosiren paradoxa*, anatomisch untersucht und beschrieben. Leipzig, 1840. Transl. in Ann. d. Sc. Nat. vol. xiv. 1840, p. 116.
3. Bridge, T. W.—On the Osteology of *Polyodon folium*. Phil. Trans. Roy. Soc. Lond. vol. 169, 1878, p. 683
4. Brühl, C. B.—Anfangsgründe der vergleichenden Anatomie aller Thierklassen. Wien, 1847, p. 216, Atlas, tab. xviii.
5. Burckhardt, R.—Das Centralnervensystem von *Protopterus annectens*. Berlin, 1892.
6. Cobbold, T. S.—On the Cranial Bones of *Lepidosiren annectens*. Proc. Zool. Soc. Lond. 1862, p. 129.
7. Dollo, Louis.—Sur la Phylogénie des *Dipneustes*. Bull. de la Société Belge de Géologie, tom. ix. 1895, p. 79.
8. Ehlers, E.—On *Lepidosiren paradoxa*, Fitzinger, and *Lepidosiren arcuata*, sp. n., from Paraguay. Ann. & Mag. Nat. Hist. ser. 6, vol. xiv. 1894, p. 1. (Translated from the Nachrichten der k. Gesellschaft der Wissenschaften zu Göttingen, 1894.)
9. Fritsch, A.—Fauna der Gaskohle und der Kalksteine der Permformation Böhmens, Bd. ii. Heft 3, p. 56.

9*a*. Gadow, H.—On the Modifications of the First and Second Visceral Arches, with special reference to the Homologies of the Auditory Ossicles. Phil. Trans. Roy. Soc. Lond. vol. 179 B, 1888, p. 451.

10. Gegenbaur, C.—Untersuchungen zur vergleichenden Anatomie der Wirbelthiere. Leipzig, 1872.
11. Günther, A.—Description of *Ceratodus*, a genus of Ganoid Fishes recently discovered in rivers of Queensland, Australia. Phil Trans. Roy. Soc. Lond. vol. 161, 1871, p. 511.
12. Idem.—The Study of Fishes. Edinburgh, 1880.
13. Humphry, G. M.—The Muscles of *Lepidosiren annectens*, with the Cranial Nerves. Jour. Anat. & Phys. vol. vi. 1872, p. 253.
14. Huxley, T. H.—Manual of the Anatomy of Vertebrated Animals. London, 1871, pp. 168–170.
15. Idem.—Contributions to Morphology.—Ichthyopsida. No. 1. On *Ceratodus fosteri*, with Observations on the Classification of Fishes. Proc. Zool. Soc. Lond. 1876, p. 24.
16. Idem.—On the Position of the Anterior Nasal Apertures in *Lepidosiren* (*Protopterus annectens*). Proc. Zool. Soc. Lond. 1876, p. 180.
17. Idem.—On *Menobranchus lateralis*. Proc. Zool. Soc. Lond. 1874, p. 186.
18. Hyrtl, J.—*Lepidosiren paradoxa*. Monographie. Abhand. d. Böhm. Gesellsch. Bd. iii. 1845, p. 605.
19. Iversen, M.—Bemerkungen über die dorsalen Wurzeln des *Nervus hypoglossus*. Ber. der Naturforsch. Gesellsch. zu Freiburg, i. B. 1893, Bd. vii. Heft 2.
20. Lankester, E. Ray.—On the *Lepidosiren* of Paraguay and on the External Characters of *Lepidosiren* and *Protopterus*. Trans. Zool. Soc. Lond. vol. xiv. pt. i. 1896, p. 11.

21. McDonnell, R.—Observations on the Habits and Anatomy of the *Lepidosiren annectens*, Roy. Dublin Soc. Jour. ii. 1858–59, p. 388 ; also Nat. Hist. Review, Lond. vol. vii. 1860. p. 93.

22. Miall, L. C.—Monograph of the Sirenoid and Crossopterygian Ganoids. Palæontogr. Soc. Lond. 1878.

23. Idem.—On some Bones of *Ctenodus*. Proc. Geolog. & Polyt. Soc. W. Riding, Yorkshire, vol. vii. p. 289.

24. Natterer, J.—*Lepidosiren paradoxa*. Ann. d. Wiener Museums, Bd. ii. 1839, p. 167, tab. x.

25. Owen, Richard.—Description of the *Lepidosiren annectens*. Trans. Linn. Soc. Lond. vol. xviii. 1839, p. 327.

26. Idem.—Comparative Anatomy and Physiology of Vertebrates, vol. i. 1866, p. 82.

27. Parker, W. K.—On the Structure and Development of the Skull in the Salmon (*Salmo salar*, L.). Phil. Trans. Roy. Soc. Lond. vol. 163, 1873, p. 95.

28. Idem.—On the Structure and Development of the Skull in the Urodelous Amphibia.—Part I. Phil. Trans. Roy. Soc. Lond. vol. 167, 1876, p. 529.

29. Idem.—On the Structure and Development of the Skull in the Sharks and Skates. Trans. Zool. Soc. Lond. vol. x. 1878, p. 189.

30. Idem.—On the Morphology of the Skull in the Amphibia Urodela. Trans. Linn. Soc. Lond. Series 2, Zoology, vol. ii. 1879, p. 165.

31. Idem.—On the Structure and Development of the Skull in the Batrachia.—Part. III. Phil. Trans. Roy. Soc. Lond. vol. 172, 1881, p. 1.

32. Idem.—Structure and Development of the Shoulder-girdle and Sternum in the Vertebrata. Ray Society, 1868.

32 *a*. Idem.—On the Structure and Development of the Skull in Sturgeons (*Acipenser ruthenus* and *A. sturio*). Phil. Trans. Roy. Soc. vol. 173, 1882, p. 139.

33. Parker, W. N.—On the Anatomy and Physiology of *Protopterus annectens*. Trans. Roy. Irish Academy, vol. xxx. 1892, p. 109.

34. Peters, W.—Ueber einem dem *Lepidosiren annectens* verwandten Fisch von Quellimane. Archiv für Anatomie, Phys., und wissenschaftliche Medicin [Johannes Müller], 1845, pp. 1–14.

35. Pinkus, F.—Die Hirnnerven des *Protopterus annectens*. Abdruck aus den morphologischen Arbeiten, Bd. iv. Heft ii. p. 275.

35 *a*. Ridewood, W. G.—On the Hyoid Arch of *Ceratodus*. Proc. Zool. Soc. Lond. 1894, p. 632.

36. Rose, Carl.—Ueber Zahnbau und Zahnwechsel der Dipnoer. Anatom. Anzeiger, Jena, 1892, p. 821.

37. Traquair, R. H.—On the Genera *Dipterus*, Sedg. & Murch., *Palædaphus*, Van Beneden und De Koninck, *Holodus*, Pander, and *Cheirodus*, M'Coy. Ann. & Mag. Nat. Hist. ser. 5 vol. ii. 1878, p. 1.

38. Idem.—On *Phaneropleuron andersoni* [Huxley], and *Uronemus lobatus* [Agassiz]. Jour. Geolog. Soc. Ireland, n. s. vol. iii. 1871, p. 41.

39. Idem.—Notes on the Devonian Fishes of Campbelltown and Scaumenac Bay in Canada, No. 3. Geol. Mag. 1893, p. 262.

40. Van Wijhe, J. W.—Ueber das Visceralskelet und die Nerven des Kopfes der Ganoiden und von *Ceratodus*. Niederländisches Archiv für Zoologie, Bd. v. Heft 3, 1882, p. 207.

41. Wiedersheim, R.—Das Skelet und Nervensystem von *Lepidosiren annectens* [*Protopterus* ang.] Morphologische Studien, Heft i. Jena, 1880, p. 45.

42. WIEDERSHEIM, R.—*Salamandrina perspicillata* und *Geotriton fuscus.* 1875.
43. IDEM.—Das Kopfskelet der Urodelen. Leipzig, 1877.
44. WILDER, H. H.—Die Nasengegend von *Menopoma alleghaniense* und *Amphiuma tridactylum,* Zool. Jahrbücher, Bd. v. Heft 2, 1892.
45. WOODWARD, A. S.—British Museum Catalogue of Fossil Fishes, pt. ii. 1891.

VI. EXPLANATION OF THE PLATES.

The cartilaginous portions of the skull are tinted blue. Unless otherwise stated, the figures are of the natural size. The lettering is uniform in both Plates.

PLATE XXVIII.

Fig. 1. Lateral view of the skull of the Paraguayan *Lepidosiren.*

Fig. 2. View of dorsal surface.

Fig. 3. Ventral view. The cerato-hyal, cranial rib, and interoperculum of the left side have been removed. The vestigial hyoidean ray of the right interoperculum is not shown.

Fig. 4. Vertical longitudinal section of the skull.

Fig. 5. Dorsal view of the nasal region and the anterior portions of the palato-pterygoid and fronto-parietal bones. The ectethmoids have been removed.

Fig. 6. View of the periotic capsule from the interior of the cranial cavity. × 2.

Fig. 7. External lateral view of the lower jaw.

Fig. 8. Internal lateral view.

PLATE XXIX.

Fig. 9. External view of the mandibular symphysis.

Fig. 10. Branchial arches of the left side.

Figs. 11–19. Tranverse sections through the skull at the various points indicated by dotted lines in fig. 21.

Fig. 11.	Transverse	section through	A–B	in fig. 21.
Fig. 12.	,,	,,	C–D	,,
Fig. 13.	,,	,,	E–F	,,
Fig. 14.	,,	,,	G–H	,,
Fig. 15.	,,	,,	I–J	,,
Fig. 16.	,,	,,	K–L	,,
Fig. 17.	,,	,,	M–N	,,
Fig. 18.	,,	,,	O–P	,,
Fig. 19.	,,	,,	Q–R	,,

Fig. 20. Transverse section through the nasal region of *Ceratodus fosteri.*

Fig. 21. Outline lateral view of the skull of the Paraguayan *Lepidosiren* to show the planes in which the transverse sections (figs. 11–19) have been taken. The ectethmoids, opercular bones, and the hyoid arch have been removed.

References to Lettering.

a.m.t. Anterior mandibular tooth-plate.
an. Angular.
an.p. Antorbital process.
an.p′. Labial portion of antorbital process.
a.p.t. Anterior palatal tooth.
ar. Articular surface of mandible.
ar.c. Articular extremity of suspensorial cartilage.
at.p. Antorbital process of the palato-pterygoid.
b.c. Cartilaginous "basis cranii."
b.c.v. Basicranial vacuity or cleft.
c.h. Cerato-hyal.
cor.p. Coronoid process of the mandible.
c.r. "Cranial rib."
d.e. Dermal ethmoid.
ec.e. Dermal ectethmoid.
eo. Exoccipital.
f.p. Fronto-parietal.
hy.s.l. Hyo-suspensorial ligament.
i.n.s. Internasal septum.
i.op. Interoperculum.
ld.c. "Lambdoid crest."
mk.c. Meckelian cartilage.
m.m.t. Middle mandibular tooth.
m.p.t. Middle palatal tooth.
ms.e. Mesethmoid cartilage.
m.sy. Mandibular symphysis.
n.a. First neural arch.
n.c. Nasal capsule.
no. Notochord.
n.s. Nasal sac.
n.sp. Neural spine.
op. Operculum.
p.c. Periotic capsule.
p.m.t. Posterior mandibular tooth.
pn.p. Prenasal process.
p.pt. Palato-pterygoid bone.
p.p.t. Posterior palatal tooth.
p.pt.a. Ascending process of the palato-pterygoid.
p.pt.a′. Spur on the ascending process of the palato-pterygoid, to which the ectethmoid is attached.
ps. Parasphenoid.
p.t. Palatal tooth (*Ceratodus*).
p.sy. Palatal symphysis.
s.m.e. Spina mentalis externa.
s.m.i. Spina mentalis interna.
sn.p. Subnasal cartilage.
sp. Splenial.
sq. Squamosal.
sg.c. Sagittal crest.
s.r. Saccular recess.
st.p. Styliform process.
sus.c. Suspensorial cartilage.
tr.c. Trabecular cornu.
tr.c. Trabecular cartilage.
u.l.c. Upper labial cartilage.
ut.r. Utricular recess.
v.hy.r. Vestigial hyoidean rays.
vo.t. Vomerine teeth.
1, 2, … First, second, … Branchial arches.

Foramina.

i. Olfactory nerve.
ii. Optic nerve.
iii. Motor oculi.
v′. Ramus ophthalmicus of the Trigeminus.
v″. Ramus maxillaris and the ramus mandibularis of the Trigeminus, the Nervus Lateralis Facialis, and the ramus communicans between the Facial nerve and the lateral branch of the Vagus.
v′.p. Branch of ramus ophthalmicus profundus (Trigeminus).
v‴. Branch of ramus mandibularis (Trigeminus).
vii. Ramus hyomandibularis (Facialis).
vii′. Superior palatine branch of the Facialis.
vii″. Ramus mandibularis internus (Facialis).
ix. Glossopharyngeal.
x. Vagus, and internal jugal or anterior cardinal vein.
h.s.c. Ampullary extremity of the vertical semicircular canal and the horizontal canal.
in.c. Internal carotid artery.
$sp.n^1$. Dorsal and ventral roots of first spinal nerve (Hypoglossal).
$sp.n^2$. Dorsal and ventral roots of the second spinal nerve.
t.f. Temporal foramen ("Schlafengrube").
v.s.c. Vertical semicircular canals.

Skull of Lepidosiren

Skull of Lepidosiren.

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Continued on page 3 of Wrapper.

VIII. *On the Mammals obtained by Mr. John Whitehead during his recent Expedition to the Philippines.* *By* OLDFIELD THOMAS. *With Field-notes by the Collector.*

Received May 19, 1897, read June 15, 1897.

[PLATES XXX.–XXXVI.]

MR. JOHN WHITEHEAD, whose exploration of Mount Kina Balu has already rendered him famous as a collector, has during the last three years been engaged in the exploration of the islands of the Philippine group, partly at his own expense, and partly at that of the "subscribers to the Whitehead Fund," to whose generosity the National Museum owes the donation of the whole of the specimens that the subscribers had a claim to under Mr. Whitehead's agreement with them.

As the exploration has been so remarkably successful, it is only fitting that an acknowledgment of their generosity should be appended to this account of the Mammals obtained during the expedition. Their names are as follows:—Messrs. Matthew, James, and Andrew Arthur, the Duke of Bedford, Major Cooper Cooper, the late Mr. Alexander Dennistoun, Mr. John Dennistoun, the late Lady Huntingtower, the late Mr. Henry Seebohm, Mr. J. G. Sandeman, and Mr. J. T. Thomasson.

The Philippine Islands, however rich in birds, have always previously been looked upon as a group very poor in Mammals, especially in comparison with the rich faunas of the other islands of the East Indian Archipelago. This poverty was particularly evident in regard to really peculiar indigenous Mammals; for, with the exception of *Phlœomys cumingi*, scarcely a Mammal was known from the group other than members of widely-distributed genera, of which the Philippine species were either identical with or closely allied to Palawan, Bornean, or Celebean forms.

Little, therefore, could have been expected from the expedition further than the discovery of a few fresh species of genera known to inhabit the group, and this, so far as regards the islands other than Luzon, is just what has occurred. But in the great northern island of the group Mr. Whitehead has made a most wonderful and unexpected discovery, that of a new and peculiar Mammal-fauna inhabiting the Luzon highlands, and, so far as is yet known, mostly isolated on a small plateau on the top of Monte Data, in the centre of Northern Luzon, at an altitude of from 7000 to 8000 feet.

The plateau itself, as will be seen by Mr. Whitehead's notes below, is of extremely small size, but in spite of this fact he obtained there specimens of the following remarkable series of animals :—

Crocidura grayi.
Felis domestica (feral).
Paradoxurus philippinensis.
Celænomys silaceus. New genus and species.
Chrotomys whiteheadi. New genus and species.
Rhynchomys soricoides. New genus and species.
Phlœomys pallidus.
Mus everetti.
Mus luzonicus. New species.
Mus decumanus (feral).
Mus chrysocomus.
Mus ephippium negrinus.
Batomys granti. New genus and species.
Carpomys melanurus and *C. phæurus.* New genus and two new species.
Crateromys schadenbergi.

In addition to these, *Crunomys fallax*, a new genus and species, was obtained in the district of Isabella, east of Monte Data.

Therefore no less than six new genera and eight new species were discovered in the island, a proportion of novelty that has perhaps never been equalled in the history of Mammal-collecting.

Besides these new forms, Mr. Whitehead discovered a new genus and species of Bat in Mindoro and several additional species of Bats and Rodents in that and other islands.

What are the true affinities of the isolated fauna of Luzon is a question that is not easy to answer, for the representative forms are mostly so peculiar as to render their zoological relationships more or less doubtful. On the whole, the connections, such as they are, seem to be partly with Celebes and partly with the Australian region. Thus *Rhynchomys* seems to have its nearest ally (*Echiothrix*) in Celebes ; *Mus chrysocomus* is actually a Celebean species ; while *Chrotomys*, *Celænomys*, and *Crunomys* belong to a subfamily, the Hydromyinæ, hitherto known only from Australia and New Guinea. Finally, *Crateromys* seems to have its nearest ally in *Lenomys* from Celebes, and in another new genus not yet described that occurs in New Guinea.

On the other hand, *Phlœomys* is so isolated that I can make no suggestions as to what is its nearest ally, and *Carpomys* and *Batomys* belong to a group of arboreal genera scattered over the oriental part of the East Indian Archipelago. This group of genera may possibly either have a definite alliance one to the other, independent of *Mus*, or may be isolated survivors of an older murine fauna, of which *Mus* has now gained the dominant position, or finally may all be independent offshoots of the same central genus. Probably the second of these hypotheses approaches nearest to the truth, although one or two of the less differentiated genera, such as *Vandeleuria*, may have arisen in the third way.

In any case, Science is to be congratulated on the wonderful series of new forms which Mr. Whitehead's exploration of the little plateau of Monte Data has placed at her service, and I feel sure that, when they are studied by someone better able than I am to make out their complicated relationships, our general knowledge of geographical and phylogenetic evolution will be by their aid materially increased.

The following are Mr. Whitehead's general notes on the collection :—

"The Mammals were collected during a period of three years spent in the Philippine Islands. As my time was occupied chiefly with ornithology and no special effort was made to collect Mammals, the results may be looked upon as fairly satisfactory.

"The largest collection, and at the same time the most interesting, was formed in the highlands of the Province of Lepanto, North Luzon, chiefly on Monte Data, a table-topped mountain of from 7000 to 8000 feet in altitude. A few specimens come from Cape Engaño, the most northern point of East Luzon, and a few Rats and a new Bat from the highlands of Mindoro. In Negros very few Mammals were met with. In Samar several interesting forms were obtained, including *Tarsius philippensis*, but, with the exception of a new Pigmy Squirrel, all well known to naturalists.

"Monte Data, my chief collecting-ground, is inhabited by a peculiar wild tribe of Malays, not of Negrito stock, who call themselves Igorrotes. I found them very pleasant savages, and, fortunately for me, they knew the value of coins. By purchasing all the animals brought to my camp, I soon had quite thirty Igorrote collectors hard at work most of the day with their little terriers, digging out Rats and snaring the larger mammals and birds. The various small Rats they brought in alive—and often had their hands much bitten—as I refused to deal in dead specimens, the skulls being generally smashed to bits. In less than a month's time the tent was festooned with rat-skins hanging up to dry, my collection consisting of over one hundred specimens. A perusal of the list (see p. 378) will give the reader an idea of the Rodents obtained on this mountain.

"The table-top of Monte Data is perhaps over three miles long, by one mile (or more in places) broad. The vegetation consists chiefly of oaks and pines, all well clothed in lichen and other parasitic plants, but the undergrowth of bamboo, fern, and raspberry is very thick. The ground is much burrowed by Rats; and I may mention that the largest known species of Old-World Scops Owl comes from this place, showing that the food-supply is both abundant and nutritious. In Mindoro I was most unfortunate, visiting that island in the wet season. We were unable to leave our tent for days together, and during three months only some five days were fine. A variety of the Common Rat was soon attracted to our camp, where it became quite a nuisance. In Negros my camp was also infested with Rats, many of which we trapped.

"The distribution of Mammalia throughout the Philippine Archipelago is most interesting, but the larger islands are by no means thoroughly explored—more especially Mindoro, Mindanao, and the Pacific coast of North and Central Luzon.

"In the larger islands of Luzon, Mindoro, Panay, Negros, and Cebu, we find neither *Tarsius*, *Galeopitheeus*, nor *Seiurus*; but all these Bornean genera are found in Samar and Leite. *Tarsius* is wanting from Mindanao and Bohol, but when the larger island is explored it will doubtless be met with there also.

"In Luzon and Mindoro no indigenous *Felis* has yet been discovered; this genus occurring in Panay, Negros, and Cebu. Though it has not yet been obtained in Mindanao, I expect it will be eventually discovered in that great island.

"It is possible that *Felis* does not occur in Samar and Leite, as these islands are much more to the east and may have missed the migration—as apparently the Negros, Panay, and Cebu group have missed that of *Sciurus* and other genera. If *Felis* is confined to the Negros group, it seems probable that Man was the agent of introduction of this Bornean animal.

"Luzon has many wonderful Rodents peculiar to it, notably such genera as *Phlœomys* and *Crateromys*. In the island of Marinduque, *Phlœomys* also occurs; but this island, by its birds alone, is really a part of Luzon, from which island it is separated by a strait equal, however, to that which separates Luzon from Mindoro.

"Mindoro is remarkable for its Tamarau (*Bubalus mindorensis*), an animal perhaps more nearly allied to the Anoa of Celebes than to any other. It is interesting to notice the absence of such Bornean genera as *Tupaia*, *Mydaus*, *Arctictis*, *Hystrix*, and *Sciurus*, which are found in Palawan and the Calamianes, but have never been able to cross into Mindoro. There are, however, several Palawan birds in Mindoro which are not met with in any other of the true Philippine Islands.

"In the west-central islands Panay, Negros, and Cebu, we find a paucity of Mammals, giving one the idea that any land-connection with Mindanao must have been either very ancient or of brief duration; while in the east-central islands Samar, Leite, and Bohol, we meet with several genera in common with Mindanao and Borneo. It is perhaps possible to state with some certainty that the true Philippine group has received no Mammals from Borneo *viâ* Palawan, but several genera from Borneo and perhaps Celebes *viâ* Mindanao, which have been unable to spread further north than Samar; and at that period of migration there was no land-connection with North-west Mindanao and the Negros group. Luzon probably received its peculiar Rodents *viâ* Formosa, and they were unable to spread beyond that island; but at present the highlands of Formosa are a *terra incognita*.

"There are, however, four genera of Mammalia which are dispersed throughout the entire Philippine Archipelago, viz. *Macacus*, *Paradoxurus*, *Viverra*, and *Sus*, all of which are found in Borneo and Palawan, and all of which are carried about by man; for to me it seems impossible to account in any other way for such a general distribution of these four genera, while so many other genera are so strangely and strictly distributed. *Cervus* is also found in many of the Philippines, but its exact distribution is probably unknown, neither have I heard of Palawan as a locality; it is also an animal much carried about by man. *Cervus* and *Sus* are also able, and doubtless do increase their distribution by swimming from island to island; nearly every small island off the coast of the large islands being inhabited by *Sus*. On the top of Monte Data there were small herds of semi-wild pigs belonging to the Igorrotes, and doubtless many must revert to their wild state. Therefore I am much inclined to look upon man as the chief agent in the distribution of the Pig. Deer, of course, are conveyed everywhere and put down with the idea of affording future sport."

Macacus cynomolgus (Linn.).

a, ♂. Barit, Abra Dist., N. Luzon, Nov. 11, 1894.

"The Long-tailed Green Monkey is common throughout the Philippine group. It, as is usual with the various members of this great family, does much harm among the crops planted by man. In North Luzon monkeys infest the forests in the neighbourhood of native plantations, especially those of maize and sweet potatoes; in Samar the rice-fields had to be carefully guarded from their attacks. From the sea-coast to the tops of the mountains the Chongo is ubiquitous. In North Luzon small bands frequented the flat summit of Monte Data, where during the winter months the temperature is as low as 28° Fahr. In Mindoro and Negros we also noticed it at 6000 feet.

"*Distribution.* Found commonly throughout the Philippine Islands, including Palawan.

"Native Tagalo name, 'Chongo.'"—J. W.

Tarsius philippensis Mey.

Tarsius philippensis Meyer, Abh. Mus. Dresd. 1894–95, no. 1, p. 1 (1894).

a, b. Yg. ♂, adult ♀. Samar, June 16, 1896.

Dr. Meyer makes a primary character of the asserted nakedness of the tarsi in the Philippine *Tarsius*, but both these specimens, which may be looked upon as topotypes, instead of having "tarsi denudati" ("vollkommen nackt"), should rather be described, like Dr. Meyer's *T. sangirensis*[1], as "tarsis fere nudis." The exact differences between the last-named and the Philippine *Tarsius* are not stated by Dr. Meyer when carefully explaining why it is distinct from *T. fuscus*.

[1] Abh. Mus. Dresd. 1896–97, no. 1, p. 9 (1896).

"This remarkable mammal is found in the islands of Samar and Leite, where it is called by the Bisayas 'Magou.' So far as I am aware, it has not been obtained in Luzon or Mindoro to the north, or in Masbate, Cebu, Negros, or Panay, islands to the west and north-west of Samar. It probably occurs in the great island of Mindanao, and perhaps in Bohol, to the south of Leite.

"In habits the 'Magou' is nocturnal, as the enormous owl-like eyes would lead one to suppose; it frequents abandoned clearings, where the new growth has sprung up to a height of some twenty feet, and in Samar, where the ground is also thickly covered with ferns and other plants to a height of some three feet. In such places this little animal easily conceals itself during the day. I had the good fortune to see a 'Magou' in such a locality one day in Samar. The *Tarsius* was clinging to the stem of a small tree just above the fern-growth, with its peculiar hands round the tree; it was awake and intently watching my movements, and permitted me to approach as close as I wished: when, doubtless, at the least sudden movement of my hands it would have jumped to the ground and made off in the thick undergrowth. During the night the 'Magou' is very active, and may often be heard, in localities where they are numerous, uttering a peculiar squeak like a monkey. From its habit of feeding only on insects, this animal has a strong Bat-like smell.

"In Samar, where at different times I kept several 'Magous' alive, I found them very docile and easily managed during the day. They fed freely off grasshoppers, sitting on their haunches on my hand. When offered an insect, the 'Magou' would stare for a short time with its most wonderful eyes, then slowly bend forward and with a sudden dash would seize the insect with both hands and instantly carry it to its mouth, shutting its eyes and screwing up its tiny face in a most whimsical fashion. The grasshopper was then quickly passed through the sharp little teeth, the kicking legs being held with both hands. When the insect was beyond further mischief, the large eyes of the 'Magou' would open, and the legs and wings were then bitten off, while the rest of the body was thoroughly masticated. My captives would also drink fresh milk from a spoon. After the sun had set this little animal became most difficult to manage, escaping when possible, and making tremendous jumps from chair to chair. When on the floor it bounded about like a miniature kangaroo, travelling about the room on its hind legs with the tail stretched out and curved upward, uttering peculiar shrill monkey-like squeaks, and biting quite viciously when the opportunity offered. During the day the pupil of the eye becomes so contracted that it appears only as a fine line, but after dark it is so expanded as to fill up most of the iris.

"The popular native idea is that the 'Magou' feeds on charcoal, the reason for this being that the animal is generally found after the old plantations have been cut down and burnt, the 'Magou' doubtless having returned to its old haunts from which it had been driven by the woodcutters. This delusion is fatal to all captured 'Magous,' as they are immediately put on a diet of charcoal, and therefore soon starve to death."—J. W.

PTEROPUS JUBATUS Eschsch.

a, b, c. 3 ad. sk. ♂ ♀. Barit, Abra Dist., N. Luzon, Nov. 1894.

These specimens, practically topotypes of the species, which was described from Manila, have the brilliant golden napes and apparently all the other characters described by Prof. Elliot as diagnostic of his *Pt. auri-nuchalis*[1]. It seems probable, therefore, that this latter name should be considered as a synonym of *Pt. jubatus*, of which the range no doubt extends over the whole of the Philippines.

"This large Fruit-Bat was in immense numbers in the Province of Abra, N. Luzon, where it had taken possession of a long, low range of hills, well covered with forest. Just at sunset these Bats issued from their roosting-place in thousands towards all points of the compass. Numbers of those that passed the Abra river dipped to drink in the stream, but seemed afraid, making often several attempts before they dared to come low enough to touch the water. On the sea-coast also the large Fruit-Bats often dip to drink in the sea on calm evenings. This Bat has a peculiar, though not disagreeable, odour. The wings are quite sticky to the touch. Met with in North-Central Luzon."—J. W.

PTEROPUS VAMPYRUS (Linn.).

a, b. Verae, Catanduanes Island, Sept. 1894.

This species occurs in every collection made in the Philippines, and is evidently common throughout the archipelago.

"In the island of Samar we obtained several examples, which were unfortunately burnt with my collection on the s.s. 'Weyland.' In Samar this Bat was found roosting during the day in the mangrove-swamps in great numbers.

"My specimens were obtained in the islands of Catanduanes, South Luzon, and Samar."—J. W.

XANTHARPYIA AMPLEXICAUDATA (Geoffr.).

a, b, ♂ ♀. Highlands of Benguet, Luzon, 5000 feet, Feb. 24, 1894.

These specimens represent Gray's "*Eleutherura philippinensis*," from Manila. Although stated to have been received from Gould, no doubt the type of that form was originally obtained by Cuming.

[1] Field Col. Mus. Publ. vol. i. p. 77 (1896).

Genus Harpyionycteris Thos.

Harpyionycteris Thos., Ann. Mag. N. H. (6) xviii. p. 243 (1896).

Index with a claw. Wings from the sides of the hairy back, inserted behind at the junction of the first and second toes. No tail. Hind limbs apparently very short. Interfemoral membrane obsolete, buried in thick fur.

Dentition.—I. $\frac{1}{1 \text{ or } 0}$, C. $\frac{1}{1}$, P. $\frac{3}{3}$, M. $\frac{2}{3} \times 2 = 28$ or 30.

Teeth (Plate XXXV. figs. 1–4). Upper incisors large, touching each other and the canines; shaped, when viewed in front, almost like those of *Desmodus*, each with a long oblique cusp touching its fellow in the middle line of the skull, but in section each is broadly triangular, with a broad posterior basal ledge. Canines with a large posterior secondary cusp, about half as high as the main cusp, and with a broad postero-internal basal ledge, but no additional internal cusps; its direction much more slanting forward than usual, as is the lower canine also, so that the two cross each other nearly at right angles, instead of being approximately parallel. First two premolars about as in *Cynopterus*. Molars oblong in section and of a peculiar cuspidate character, the lateral longitudinal walls to the usual median groove broken up into several minute cusps, none of which are at all specially lengthened. Below, the incisors are practically obsolete, being minute and almost crowded out [1] by the large canines, which touch each other in the middle line, and have each an antero-internal and a postero-external secondary cusp and a broad posterior ledge.

It is difficult to say with certainty to what previously known genus this remarkable form is most nearly allied. Its peculiar canines to a certain extent recall those of *Harpyia*, but this resemblance may be either accidental or due to their common descent from the (presumably) cuspidate-toothed ancestors of the Pteropodidæ [2]. On the whole it may be most conveniently placed near *Xantharpyia* and *Boneia*, with which it shares certain external characters, an indical claw, and the cheek-tooth formula of P. $\frac{3}{3}$, M. $\frac{2}{3}$; but the unique incisors, the short bi- and tricuspidate canines, and the multicuspidate molars separate it widely even from these, and render it one of the most isolated of all the genera of the group. Its skull and dentition are figured on Plate XXXV. figs. 1–4.

Harpyionycteris whiteheadi Thos. (Plate XXX. fig. 1.)

Size about as in *Xantharpyia amplexicaudata*. Fur soft, close and woolly, especially posteriorly. General colour of the fur all over, above and below, a uniform chocolate-brown, a little darker on the face, and a little lighter on the nape and shoulders.

[1] In the single type-specimen one lower incisor only is present, the other having fallen.

[2] See P. Z. S. 1888, p. 473.

Wing-membranes dark, with a few whitish spots scattered about them. Ears of medium length, rounded at their tips. Fur of the back extending thinly on to the forearms, and covering the hind limbs densely down to the roots of the claws. Interfemoral membrane barely a tenth of an inch wide, wholly buried in the fur.

Dimensions of the type (an adult skin of doubtful sex) :—

Forearm 84 millim. (=3·3 inches); head and body 140; ear 17; index-finger and claw 60; third finger, metacarpal 59, first phalanx 44, second phalanx 54.

Skull; basal length 37·5; greatest breadth 23·8; interorbital breadth, tip to tip of postorbital processes, 6·9. Front of canine to back of $m.^2$ 17.

Hab. Mindoro, alt. 5000 feet. Dec. 1895.

"This interesting new Fruit-Bat was shot by me in the highlands of Mindoro at an altitude of 5000 feet. It was flying round some high trees at dusk, at which time I generally sat out near my camp on the look-out for nocturnal birds. The specimen, when shot, fell into some tangled undergrowth, and it was only after a careful search with a lamp that my servant found it.

"*Distribution.* Mindoro, 5000 feet."—J. W.

CARPONYCTERIS AUSTRALIS Pet.

a. ♀. Negros.

"Obtained a short way up the Canloan volcano."—J. W.

HIPPOSIDERUS DIADEMA Geoffr.

a. Manitoc, Albay, S.E. Luzon, Aug. 1894.
b. Catanduanes, Sept. 24, 1896.

PIPISTRELLUS IMBRICATUS (Horsf.).

a. ♀. Manila.

A young individual, apparently of this rare species.

"Picked up in a dying state on the side-walk in Manila."—J. W.

MYOTIS MACROTARSUS (Waterh.).

a, ad. al. ♀. Manila, May 20, 1876. Presented by Mr. Whitehead.

This Bat was originally discovered by Cuming, and no other specimen has been received by the British Museum until now. I fail to see, either in the fresh specimen or in the type, that the wing-membrane is attached to the body much nearer to the spine than is usual, a character on which Dobson lays some stress. The black claws of the type, also specially mentioned by him, may have been caused by some fluid in which the specimen had been put, for Mr. Whitehead's fresh specimen, unquestionably identical specifically, has the claws of the normal pale colour.

"Brought to me by some boys in Manila."—J. W.

Kerivoula whiteheadi Thos.

Kerivoula whiteheadi Thos. Ann. Mag. N. H. (6) xiv. p. 460 (1894).

a. ♂. Molino, Isabella, N.E. Luzon, May 1894. *Type*. Presented by Mr. Whitehead.

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 millim.; 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.

Type. B.M. 94. 10. 9. 2.

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.*

Miniopterus schreibersi pusillus Dobs.

a, b. Barit, Abra, Luzon. Presented by Mr. Whitehead.

"Captured in a butterfly-net, while chasing each other round my room."—J. W.

Galeopithecus philippinensis Waterh.

a. ♂. Samar, June 10, 1896.

"Fairly common in Samar and Leite, and on the small islands between; I have also seen dozens of skins from the island of Bohol. Several Spaniards do quite a trade in the skins of this Lemur, which are of all shades of brown, grey, and even bright yellow. Generally beautifully mottled, but at times quite unmarked.

"The Flying Lemur passes the day in sleep, clinging to the trunk of some large tree

—and doubtless the coloration of the tree-bark is selected to match the fur by the resting animal, for I have shot in Malacca grey specimens on grey-barked trees.

"The 'Caguang' of the Bisayas."—J. W.

Crocidura (Croc.) grayi Dobs.

Crocidura (*Croc.*) *grayi* Dobs. Ann. Mag. N. H. (6) vi. p. 494 (1890).

a. Benguet, Luzon, Feb. 1894. Presented by Mr. Whitehead.
b. Monte Data, Feb. 1895.

This Shrew was described by Dr. Dobson from two specimens in the British Museum that had been received from the Zoological Society's old collection, and had been obtained by Mr. H. Cuming. Although merely labelled "Philippines," they were most probably from Manila.

Luzon also contains a member of the subgenus *Pachyura*, examples of which in the British Museum have been labelled by Dr. Dobson as *C. murina*. Probably they represent Peters's *C. luzoniensis* [1].

Felis minuta Temm.

a. Negros.

"This handsome little Cat is apparently found only in the islands of Panay, Negros, and Cebu; but as it also occurs in the great continental island of Borneo, doubtless it will some day be found in Mindanao. One of my hunters declared that he shot at a Wild Cat in Samar among some rough broken-up limestone, into which the wounded animal unfortunately disappeared. I think we may say for certain that this Cat does not occur in Luzon, which is so well cultivated that it could scarcely have escaped detection. In Mindoro it might be possible for this animal to have escaped detection, as the island is perhaps, after Mindanao, the wildest and most densely covered with forest of the whole group.

"In Negros, where we obtained a specimen of *Felis minuta*, the animal frequented the sugar-plantations, where it finds an abundance of rats. During harvesting operations this Cat is often captured by the natives, who form a ring round the last patch of standing cane. One of my collectors said that he saw this animal as high as 6000 feet, on Canloan volcano.

"*Distribution*. Panay, Negros, and Cebu."—J. W.

Felis domestica L.

Reference has already been made [2] to what appears to be a feral Domestic Cat obtained by Mr. Whitehead on Monte Data. Mr. Whitehead's own notes on the subject are as follows:—

[1] MB. Ak. Berl. 1870, p. 595.

[2] Ann. Mag. N. H. (6) xviii. p. 245 (1896).

"In North Luzon we obtained a very large specimen of a Wild Cat, on the mountains at an altitude of 7000 feet. This animal, I am told, is a feral race of the Domestic Cat, *Felis domestica*, but it is unlike any Cat that exists in the native villages of to-day, being nearly double the size of any Igorrote Cat, and tabby marked, on a rather sandy ground. My friend Mr. A. H. Everett, however, informs me that he obtained a Wild Cat very like it in Celebes, which turned out to be an offspring of some escaped Domestic Cat."—J. W.

VIVERRA TANGALUNGA Gray.

a. Cape Engaño, N. Luzon, May 17, 1895.

"We met with this beautifully marked Musang at Cape Engaño, the most northern point of East Luzon. One of the specimens obtained is much more clearly marked than the other, and also slightly larger. This Musang was also snared by the natives. In habits it resembles *Paradoxurus*, both being decidedly nocturnal and expert tree-climbers.

"*Distribution.* Found in all the larger islands of the Philippines, including Palawan (Bourns and Worcester)."—J. W.

PARADOXURUS PHILIPPINENSIS Jourd.

a. ♂. La Trinidad, Benguet Dist., N. Luzon, Feb. 8, 1894.
b. ♀. Monte Data, Lepanto, N. Luzon, Feb. 1895.

"Common throughout North Luzon, especially in the high mountains, where melanistic forms seem to occur on an average of one to two with brown ones. The Musang is easily secured by the Igorrote hunter, by setting springes in the narrow mountain pathways, the space on each side of the snare being carefully stopped, forcing a passing animal to walk over the trap, which generally nooses it by one of the fore-paws. In these mountain-paths will be noticed the numerous excreta of this animal, which are often composed of the seeds of small forest fruits; but if a coffee-plantation be in the vicinity the excreta are made up of coffee-stones, the pulpy encasement of the coffee-pip being very sweet. The Musang is, as might be expected, a great enemy to all sorts of poultry, killing simply for amusement after hunger has been satisfied. Met with in North Luzon from the coast up to 8000 feet.

"*Distribution.* Found in all the larger islands of the Philippines, including Palawan."—J. W.

SCIURUS SAMARENSIS Steere.

a. Samar, June 6, 1896.

The figure given by Dr. Meyer [1] of this species is evidently very much over-coloured,

[1] Abh. Mus. Dresd. 1896–97, no. 6. p. 29, pl. xi. fig. 2 (1896).

as neither Mr. Whitehead's specimen nor one of Steere's co-types in the British Museum has feet anything like so strikingly black as is there shown.

The British Museum possesses examples of three species of middle-sized Squirrels from the Philippines—*S. steerei* Günth., of Palawan and Balabac, *S. philippinensis* Waterh., of which, besides the much-deteriorated type from "Mindanao," Mr. Everett has sent examples from Zamboanga and Basilan, and *S. samarensis* Steere, of Samar. Whether, as the localities would indicate, *S. mindanensis* Steere (*S. cagsi*, Mey.) is synonymous with *S. philippinensis*, or is most closely allied to *S. samarensis*, I am not at present able to determine.

"Met with both in Samar and Leite, but by no means common, being difficult to see or shoot owing to the great height of the forest trees in these islands.

"The 'Alalaksing' of the Bisayas."—J. W.

NANNOSCIURUS SAMARICUS sp. n.[1] (Plate XXX. fig. 2.)

a. ♀. Samar, June 30, 1896. *Type.*

Allied to *N. concinnus* Thos., but greyer and less rufous. Two premolars present in the adult.

Size and general characters very much as in *N. concinnus.* Fur, however, much shorter and more velvet-like, the hairs about 5 millim. long on the back. General colour of head and body finely grizzled olive-grey, with only a faint tinge of rufous on the back, thus contrasting with the broadly rufous-washed *N. concinnus.* Under surface rather thinly haired, dirty greyish, not defined on the sides. Limbs dusky, upper sides of hands and feet dusky grizzled grey, a few orange-tipped hairs on the digits. Characters of sole-pads apparently much as in *N. concinnus.* Tail similar to that of the allied species, but the rufous rings on the hairs are less developed, and the black ones more, so that the general result is darker.

Skull apparently very similar to that of the allied species, but the nasals are somewhat narrower.

Two upper premolars present, the anterior minute, styliform, circular, the posterior considerably larger, but still much smaller than $m.^1$. Molars all much more rounded than in *N. concinnus*, their transverse scarcely exceeding their longitudinal diameter.

Dimensions of the type, an adult female, in skin:—

Head and body 88 millim.; tail, without hair 69, with hair 94; hind foot (moistened) 25·2.

Skull: greatest breadth 16·2; nasals, length 7·7, breadth 3·1; interorbital breadth 10; tip to tip of postorbital processes 12·6; diastema 6; length of cheek, with series ($p.^4$ to $m.^3$) 4·1, of three molars only 3·0. Lower jaw: condyle to incisor tip 18·2; bone only 15·5.

[1] See preliminary diagnosis in Minutes of P. Z. S. for June 15, 1897 (published June 19).

This little Squirrel is perhaps merely the representative of *N. concinnus* in Samar, as it seems probable that there are really two premolars in that animal as in the other Malayan *Nannosciuri*. The original specimen was described by me as having only one premolar; but this latter proves on further examination [1] to be the milk-premolar, a fact which renders it rather uncertain whether the adult may not have the additional anterior premolar generally present.

Apart from this question, *N. samaricus* may be readily distinguished from *N. concinnus* by its longer fur, much more rufous coloration, and rounder molars.

"Like the last species, but less often observed."—J. W.

CELÆNOMYS, g. n.[2]

Colour normal. External form as in *Chrotomys*.

Skull (Pl. XXXV. fig. 12) broad and strong, evenly rounded, without ridges, very wedge-shaped in lateral view, owing to the great height of the brain-case, and the uniform way in which the fronto-nasal and palatal profiles approach each other anteriorly. Nasals short, not overhanging the incisors. Brain-case smooth and rounded. Interparietal strap-like, fairly well developed. Anteorbital foramen little expanded above, the front edge of its outer plate vertical, not produced forward. Palatal foramina very small. A distinct incisive fissure [3] present, nearly half the size of one of the palatal foramina. Posterior nares broad. Lower edge of mandible peculiarly flattened just behind the symphysis, and pierced with a large number of minute foramina. Coronoid processes long, strongly curved backward.

Teeth. Incisors much thrown forward, simple, rounded and bevelled in front in a manner similar to that found in *Lophuromys*. Molars $\frac{2}{2}$ (Pl. XXXV. fig. 11), in essential structure like the anterior two of *Chrotomys* (see below), but the ridges and crests less sharp, although this may be (indeed probably is) due to wear, a point which cannot be settled until young examples are examined. No trace of a third molar either above or below.

Type. *C. silaceus* Thos.

This genus, although it has the same reduced number of teeth as *Hydromys* and *Xeromys*, is no doubt really most closely allied to *Chrotomys*, to which, both in external form and in the general shape of the skull, it presents considerable resemblance. Still, besides the absence of *m.*³, it may be distinguished by its normal coloration, longer and narrower brain-case, and larger interparietal.

[1] *Cf.* Forsyth-Major, P. Z. S. 1893, pl. xi. fig. 7.

[2] κελαινός, dark-coloured; in contradistinction to *Chrotomys*, derived from χρώς, colour, in allusion to the striking coloration of *Chrotomys whiteheadi*.

[3] By this term I refer to a small mesial opening present, in a great many different forms, between the two premaxillæ, just behind the incisors.

The suppression of $m.^3$ in *Celænomys* is an interesting sign of its relationship to the Australian members of the subfamily, *Hydromys* and *Xeromys*, both of which have only two molars, while the other two Philippine genera, *Chrotomys* and *Crunomys*, have the normal Murine number of three molars.

Celænomys silaceus (Thos.) (Plate XXXI. fig. 1.)

Xeromys (?) *silaceus* Thos. Ann. Mag. N. H. (6) xvi. p. 161 (1895).

a, b. Monte Data, Feb. 1895.

Size of a common Rat. Fur soft, close and velvety, hairs on posterior back about 10–12 millim. in length. General colour uniform slaty grey, very finely grizzled with whitish, but so finely as scarcely to affect the general grey tone. Sides of muzzle nearly black. Under surface rather paler than the back, not sharply defined, the hairs slaty grey basally, washed with buffy white terminally. Eyes small, not black-ringed. Ears short, uniform greyish. Hands and feet as far as the metapodials dark grey, the digits whitish or flesh-coloured. Tail rather shorter than the body without the head, thinly haired, brown above basally, whitish below and at the tip.

Skull as already described.

Dimensions of the type (♂) taken in skin:—

Head and body (probably rather stretched) 195 millim.; tail 110; hind foot (moistened) 33·4.

Skull, see p. 395.

Hab. Monte Data, Lepanto, N. Luzon, 8000 feet.

"This curious Mammal at first sight might easily be confounded with *Rhynchomys sorieoides*, and, like that animal, was also obtained on the table-topped summit of Monte Data. It seems rare, only two specimens having been snared in some five weeks. The skull and teeth, instead of being frail as in *Rhynchomys*, are powerful, and much more nearly allied to *Chrotomys*. The eye is small as in *Rhynchomys*, and the outward appearance quite as Shrew-like. The habits of this peculiar Mammal I am quite unable even to guess at.

"*Distribution.* High mountains of Central Northern Luzon."—J. W.

Chrotomys.

Chrotomys Thos. Ann. Mag. N. H. (6) xvi. (1895) p. 161.

Colour abnormal among Muridæ, the back prominently striped. Form suited for a terrestrial, not aquatic life. Size about as in the common Rat. Fur soft and straight. Muzzle apparently not cleft. Eyes rather small. Ears well developed. Tail rather short, thinly haired, scaly. Pollex with a rounded nail; other digits, including hallux, with well-developed, little-curved claws.

Skull (Pl. XXXV. fig. 9) in general form not unlike that of *Celænomys*, but even more wedge-shaped owing to its greater height posteriorly. Nasals short, their anterior end level with the middle of the incisive fissure. Interorbital region similarly rounded and unridged. Brain-case broader and shorter, so that its breadth is equal to its length. Interparietal very small, a mere narrow transverse slip. Anterior edge of zygoma-plate slightly concave, the plate little developed. Incisive fissure large, quite half as large as one of the palatal foramina, which are, as usual in this group, very small. Posterior nares large and open, the hinder edge of the palate level with the posterior lamina of $m.^2$. Pterygoids large, projecting downward considerably below the level either of the molars or bullæ. Lower jaw as in *Celænomys*.

Teeth. Incisors pale yellow, thrown forward, simple, rounded in front. Molars $\frac{3}{3}$ (Pl. XXXV. fig. 8), the anterior two very similar in structure to those of *Xeromys* (figured P. Z. S. 1889, pl. xxix. fig. 10), but $m.^1$ has its middle lamina simpler (more as in *Hydromys*) and its posterior lamina is almost obsolete, while $m.^2$ has its posterior supplementary cusp more definitely postero-external, the difference in position being no doubt due to the presence of the additional molar behind. $M.^3$ quite small, transversely or obliquely oval in section. In size $m.^2$ and $m.^3$ together are barely two thirds the length of $m.^1$.

Below, $m._1$ is of the most ultra-hydromyine character, without any of the suppressed cuspidation of the anterior margin found in *Xeromys*, and even without the supplementary postero-external cusp found in both the Australian genera. $M._2$ as in *Xeromys*. $M._3$ nearly circular, about one-sixth the size of $m._2$, slightly larger than $m.^3$.

CHROTOMYS WHITEHEADI Thos. (Plate XXXII.)

a–d. Monte Data, Lepanto, 8000 feet, Feb. 1895.

Size of *Mus rattus*. Fur soft and thick, but not specially long. General colour greyish brown, tending in some specimens to rufous; a well-defined buff or orange line extending from between the eyes down the back nearly to the tail, shown up on each side by a broad shining black band. Under surface dull slaty buff, not sharply defined on the sides. Top of muzzle dark brown, continuous with the dark edgings to the central yellow band. Ears of medium length, fairly covered with minute hairs, uniformly blackish brown. Metapodials shining grey, digits nearly naked, whitish. Tail short, slender, about half the length of the head and body, thinly hairy, brownish black above, rather paler below, extreme tip whitish.

Skull and teeth as already described.

Dimensions of the type, an adult male, measured in skin:—

Head and body 196 millim.; tail 111; hind foot (moistened) 35.

Dimensions of skull, see p. 395.

Type. B.M. 95. 8. 2. 19.

Owing to the remarkable modification in its colour, quite unique among Muridæ, this animal may be looked upon as one of the most striking of all Mr. Whitehead's discoveries. Scientifically, it shares with *Celænomys* and *Crunomys* the interest attaching to the occurrence of the subfamily Hydromyinæ away from the Australian region, to which the only two previously known genera are confined. No member of the group has as yet been found in any of the intervening islands, although it is possible that when the higher mountains of the archipelago are more thoroughly explored other forms referable to the subfamily will also be found to occur there.

"This handsome Rat was obtained on the summit of Monte Data. It is said by the natives to feed on sweet potatoes and grass, and to frequent the neighbourhood of their plantations. *Chrotomys* is also met with at almost the sea-level, as I saw in Manila a specimen obtained in the Forest of Tarlac in Central Luzon to the north of that city.

"*Distribution.* Probably throughout Luzon."—J. W.

CRUNOMYS[1], g. n.

External characters, apparently much as in *Xeromys*, though the number of mammæ and sole-pads cannot at present be determined. Fur thickly mingled with spines. Ears short and rounded. Hallux with a claw. Tail rather short, thinly haired, apparently flattened at end, but this appearance may be simply due to contraction in drying.

Skull (Pl. XXXV. fig. 6) with the peculiar shape characteristic of many Water-Rodents, such as *Hydromys*, *Ichthyomys*, and others; low, flattened, its frontal profile *concave*. Nasals long, overhanging the incisors in front. Interorbital region broad, its edges with scarcely a trace of beading. Interparietal large. General shape of anteorbital foramina almost exactly as in *Chrotomys*, the outer plate not produced forward. Incisive fissure minute. Anterior palatine foramina short. Posterior edge of palate just level with the hinder edge of $m.^3$.

Molars (Pl. XXXV. fig. 5) much worn in the only specimen, so that it is difficult to make out their exact structure. It is, however, clear that they are more murine in structure than is the case with the other members of the Hydromyinæ; in $m.^1$ the anterior lamina is oblique just as in the other genera of the Hydromyinæ, but in other respects might almost be that of *Mus* itself. $M.^2$ is also very murine, having a small antero-internal cusp, a long middle lamina, and a mesial circular one posteriorly; $m.^3$ is subcircular, with a small antero-internal cusp. Below, on the other hand, the teeth are not unlike those of *Chrotomys*, except that $m._3$ is bilaminate as in *Mus*, a difference that one would expect to occur owing to the greater development of this tooth in *Crunomys*.

Type. *Crunomys fallax*.

This genus is most interesting from an evolutionary point of view, for it adds

[1] *κρουνιος*, a well-spring; *κρουνοί*, torrents or streams.

another to the links that connect the aberrant *Hydromys* with the true Murinæ, and is indeed the last link needed. For we may take five main characters as distinguishing *Hydromys* from an ordinary *Mus*, viz.: (1) aquatic form; (2) flattened skull; (3) reduced plate to zygoma-root; (4) two molars only; and (5) peculiar molar structure. The first discovered linking genus, *Xeromys*, was murine as to 1, 2, and 3, hydromyine as to 4 and 5; then came *Chrotomys*, murine as to 1, 2, and 4, hydromyine as to 3 and 5. *Celænomys*, described above, is like *Chrotomys*, but also hydromyine as to 4; and now comes *Crunomys*, murine as to 1, 4, and to a certain extent the highly important 5 (molar structure), but with the hydromyine 2 and 3, in addition to the short palatal foramina found in all the genera mentioned.

Like all annectant genera, *Crunomys* is most difficult to place satisfactorily in the system, and it is only with much hesitation that I have included it in the Hydromyinæ, a position which will have to be revised when specimens showing the unworn dentition, the mammary formula, and other characters are available for examination.

The following is a rough synopsis of the genera now considered to belong to the Hydromyinæ[1]:—

Molars $\frac{2}{2}$.
- Aquatic. Skull flattened; frontal profile concave . . . . 1. *Hydromys*.
- Terrestrial. Skull rounded; frontal profile normal . . . .
  - Outer wall of anteorbital foramen slightly projected forward . . . 2. *Xeromys*.
  - Outer wall of anteorbital foramen not projected forward . . . . 3. *Celænomys*.

Molars $\frac{3}{3}$.
- Molars strictly hydromyine in structure. Back striped. Fur soft. Terrestrial, fossorial . . . . 4. *Chrotomys*.
- Molars more murine. Back unstriped. Fur spiny. Semi-aquatic . . 5. *Crunomys*.

The first two are Australian, the last three Philippine.

CRUNOMYS FALLAX, sp. n.[2] (Plate XXXIII. fig. 1.)

Size about as in *Xeromys myoides*. Fur short and close, profusely mixed with flattened spines; neither hairs nor spines longer than about 6 mm. on the back. General colour pale greyish, lined with yellowish on the back. Dorsal spines white, darkening to black at their tips. Belly dirty greyish white, not sharply defined, the hairs slaty basally, dull whitish terminally. Sides of muzzle brown. Whiskers numerous, long, mixed black and white. Ears short, uniformly brown. Hands and feet greyish brown on the metapodials, lightening to white on the digits; fifth hind toe

[1] Since this paper was read an additional genus, *Leptomys*, has been described from New Guinea (Ann. Mus. Genov. (2) xviii. 1897). It has $\frac{3}{3}$ molars, like *Chrotomys* and *Crunomys*.

[2] See preliminary diagnosis in Minutes of P. Z. S. for June 15, 1897 (published June 19).

reaching to the end of the 1st phalanx of the fourth. Tail about the length of the body without the head, uniformly short-haired, black, rather lighter along the middle of its under surface.

Skull-dimensions (in millim.) of Rhynchomys *and* Hydromyinæ, *all from type specimens.*[1]

	Rhynchomys soricoides. ♂.	*Celænomys silaceus.* ♂.	*Chrotomys whiteheadi.* ♂.	*Crunomys fallax.*
Basal length	44	34	37·5	(Lambda to nasal tip
Basilar length	41·5	31·7	35	20·5.)
Greatest breadth	19·5	19	21	(*c.*) 12·1
Nasals, length	20	12	13·2	9·2
,, breadth	3·8	3·3	4·1	2·8
Interorbital breadth	6·9	6·9	6·8	4·6
Interparietal, length	3·2	2·8	2·2	—
,, breadth	10·5	8·6	7·5	9·1
Length of anterior zygoma-root	2·5	3·6	2·9	1·7
Palate, length from henselion	24·5	17·1	20	11
Diastema	16·8	13·1	15·2	7·2
Anterior palatine foramina, length	6·5	3·5	4·4	3·5
,, ,, breadth	2·1	1·6	2·1	1·5
Length of upper molar series	—	—	5·2	3·6
,, $m.^1$ and $m.^2$ combined	2·5	3·8	4·8	3·2
Lower jaw, condyle to incisor-tip	34	—	31·2	16·5
,, bone only	30	21·5	25·1	13·7
,, height, coronoid to angle	9·7	10	11·1	—
,, ,, ramus below $m._1$	3·3	4	5	3·1

Skull as already described.

Dimensions of the type, measured in skin, and all merely approximate :—

Head and body 105 millim. ; tail 79 ; hind foot 23 ; ear 10.

Skull, see above.

Hab. Isabella, Central N. Luzon. Alt. 1000 feet. Coll. May 1894.

Type. B.M. 97. 4. 8. 4. Presented by Mr. Whitehead.

This little animal might readily be, and indeed for some time was, taken for a species

[1] A few of these measurements differ to a minute extent from those previously published, these latter having been taken before the skulls were perfectly cleaned. The present measurements may be considered as the more correct.

of *Mus* allied to the group of *M. ephippium*, of which specimens are often found with more or less spinous fur. Mr. Whitehead, however, from the character of the place where he took it, thought it would prove to be a peculiar form, and his opinion has been most fully confirmed by an examination of its skull.

The following are Mr. Whitehead's notes on its capture :—

"In one of my wanderings through the parched-up forests of Isabella (in North-Central Luzon) I noticed a small red kingfisher (*Ceyx melanura*) fly into the scrub near a small stream. Having only a large gun with me, I sent my servant back to the village for a small collecting-gun. While seated beside the stream, a small mouse was observed among some large stones on the opposite side, busily searching after food. I opened one of my 16-bore cartridges and picked out all the shot (No. 6) but four or five pellets, and luckily killed the small animal without much damage being done. Being sure, from its peculiar habits, that it must be something interesting, I carefully skinned it and sent it home, and am now rewarded by the addition of another new generic form to this already interesting collection."

RHYNCHOMYS Thos.

Rhynchomys Thos. Ann. Mag. N. H. (6) xvi. p. 160 (1895).

Form rather Shrew-like. Muzzle enormously elongate. Feet normally murine, pollex with a broad nail. Tail Rat-like, scaly, thinly haired.

Skull (Pl. XXXV. fig. 10) of very peculiar shape, the brain-case broad, smooth and rounded, and the muzzle narrow and much elongated. Nasals long and narrow, terminating behind at the same level as the premaxillæ; viewed in profile they show a curious rise at their anterior extremity, the general frontal profile being practically an even slope from the crown to a point at the end of the anterior third of the nasals, and then bending upward again, as shown in the figure. Interorbital region smooth, evenly rounded, quite unridged. Interparietal large, transversely oblong, unusually variable as to its exact shape. Anteorbital foramen typically murine in essentials, but its outer wall very narrow and much slanted backward, so that the anterior edge of the upper root—the bridge—is actually posterior to the hinder edge of the lower root. In these respects it recalls the S. American *Oxymycterus*. Zygomata slender, low, and little sloped vertically. Palate long and narrow; a distinct incisive fissure present; palatal foramen of normal size, but comparatively far forward in the skull, so that their posterior end is nearly their full length in front of the molars. On each side, just in front of $m.^1$, there is a distinct raised ridge about a couple of millimetres long, and there is a somewhat similar ridge behind the last molar in the lower jaw; these ridges are very possibly used to supplement the minute teeth in eating. Posterior bony palate broad and produced far back; posterior nares rather narrow; internal pterygoid processes large, triangular, projecting far downward, in fact below the level of the tips of the incisors; external processes practically or quite obsolete, so that there are in this animal no enclosed pterygoid fossæ. Bullæ small, but not of abnormal structure.

Lower jaw exceedingly low, slender, and little curved. Coronoid processes very fine, slanted backwards.

Teeth (Pl. XXXV. fig. 7) extraordinarily reduced, the dental armature in *Rhynchomys* being less in proportion to the size of the animal than in any other Rodent, perhaps even—apart from the Cetacea—than in any other toothed mammal. Incisors white above, pale yellow below; the upper ones not grooved, very short, narrow, slender, and forming the arc of a very small circle, so that their roots come opposite the anterior end of the palatal foramina, and the chord of the circle they describe is barely more than a third of the diastema. Molars $\frac{2}{2}$, so minute that it is difficult to understand of what use they can be to the animal; *m.*[1] oval, flat-crowned, or with low indistinct cusps, but without quite young specimens it is impossible to make out for certain whether there is any true cuspidate structure; *m.*[2] about half the size of *m.*[1] and a shorter oval in outline.

Lower incisors very slender, and, owing to the oblique set of their enamel-covered faces, they wear to an unusually fine point, as sharp as a needle. Lower molars very similar both in size and shape to those of the upper jaw. In one specimen the posterior lower tooth is altogether absent on both sides, so that there is only one molar present; this fact shows strikingly the tendency there is to a progressive reduction of the molar teeth.

Type. *Rhynchomys soricoides.*

This most remarkable genus, by its peculiar Shrew-like appearance, reduced teeth, elongate muzzle, and other characters, seems at first sight perfectly isolated from any other known group, and in my recent classification of Rodents it was made the type of a subfamily of the Muridæ, the Rhynchomyinæ[1]. But among the Rodents then included in the Murinæ—on account of its strictly murine molars—there occurs the genus *Echiothrix*[2], a native of Celebes, which also has an elongated snout. This animal, of which the Museum now possesses two perfect specimens from N. Celebes,

[1] P. Z. S. 1896, p. 1017.

[2] Described by Gray, P. Z. S. 1867, its correct locality determined by Jentink, Notes Leyd. Mus. v. p. 177 (1883); renamed by me *Craurothrix*, Ann. & Mag. N. H. [6] xviii. p. 246 (1896). As I have now joined those who think that names should be retained as originally spelt, whether classically right or wrong (except in the case of obvious misprints), I am now prepared to consider that Peters's *Echinothrix* of 1853 does not preoccupy Gray's *Echiothrix* of 1867, and therefore again recognize the latter term. Those who are not of this opinion must call it *Craurothrix*. That the missing out of the letter *n* is not a misprint is shown by Gray having written on the type skin what appears to be "*Echithrix*," might be "*Echiothrix*," but is certainly not "*Echinothrix*."

collected by Mr. Charles Hose, I have carefully compared with *Rhynchomys*, and have come to the conclusion that, in spite of the absence of any tendency towards a reduction in the dentition, there is a genuine relationship between the two forms. In the Celebean animal the general shape of the skull is very similar to that found in *Rhynchomys*: the peculiar anterior nasal bulging is present; the brain-case is similarly smooth and rounded; the supraorbital and temporal ridges, although present, are very small; the zygomatic root is slightly slanted back; and the posterior palatal region is strikingly similar to that of *Rhynchomys* both in the breadth and shape of the posterior nares, and the entire suppression of the external pterygoids. The incisors again—or at least the upper ones[1]—in size, proportions, and position are more like those of *Rhynchomys* than of ordinary murines.

On the other hand, the molars of *Echiothrix* are absolutely murine, and show no trace of reduction or any other peculiarity. The third molar is, of course, present above and below, and is of full murine proportions.

On the whole it seems probable that we have in *Echiothrix* a form which bears to *Rhynchomys* very much the relation that *Crunomys* does to *Hydromys*, being, as in that case, the first commencement of a line of modification which culminates in a genus sufficiently distinct to demand subfamily separation from the main trunk of the Murinæ. If this be true, it would then probably be best to include all the members of the diverging branch within the special subfamily, even if nearer to the trunk than to the extremity, and I would therefore suggest, as in the case of *Crunomys*, that *Echiothrix* should be transferred to the Rhynchomyinæ, a name which would be particularly suitable owing to the long snout being the most obvious character that the two genera have in common.

It is, of course, just possible that when unworn teeth of *Rhynchomys* are examined they will show a structure quite incompatible with the view that this form is related to *Echiothrix*, but it seems to me that the many cranial characters which the two forms have in common render this possibility very unlikely.

RHYNCHOMYS SORICOIDES Thos. (Plate XXXI. fig. 2.)

Size of a common Rat. Fur thick, close, and velvety, about 14 or 15 millim. long on the back. General colour dark olivaceous grey, becoming more yellowish in old age. Under surface dirty grey, not sharply defined, but becoming lighter and more sharply defined in old examples; a white patch sometimes present on the throat or chest.

[1] The lower incisors of *Echiothrix* are perfectly unique in being widely separated from each other terminally, so that, being also very long, their tips bite up on each side of the upper incisors, which project down between them. How far up they actually go in life on the sides of the muzzle cannot be determined without the examination of fresh or spirit specimens, but their splay is sufficient for the whole muzzle to close down between them.

Sides of snout obscure whitish, top blackish. Eyes small, not noticeably ringed. Ears rather large, thinly haired, the anterior half of their outer and posterior half of their inner surfaces blackish. Wrists and metacarpals brown above, digits whitish or flesh-coloured. Hind feet similarly coloured. Tail shorter than head and body, very finely ringed, clothed with short hairs, not pencilled terminally, blackish above, scarcely paler below, the extreme tip white in most specimens.

Skull and teeth as above described.

Dimensions of the type, measured in skin (♂):—

Head and body 215 millim.; tail 146; hind foot (moistened) 41.

Skull, see p. 395.

Hab. Monte Data, 8000 feet.

The following are Mr. Whitehead's notes on this most peculiar animal. It is unfortunate that he has no positive knowledge of its habits or food, as its anomalous dentition is certain to be correlated with some food very unusual among Muridæ; very possibly, as Mr. Whitehead suggests, it eats caterpillars or worms, for it is difficult to imagine any vegetable food for which its reduced dentition and Shrew-like snout would be at all suitable:—

"This interesting Shrew-Rat was obtained on the summit of Monte Data, where only five specimens were snared. I am unfortunately unable to give any account of the habits of this extraordinary mammal. The Igorrotes told me that it lives on grass, which is probably untrue, the teeth apparently being quite unfitted for such food; insects and worms are probably the diet suited to such rudimentary molars. The eye is, comparatively speaking, small, which leads me to believe that *Rhynchomys* is a diurnal-feeding Rat, like the true Shrews.

"*Distribution.* High mountains of Central Northern Luzon."

PHLŒOMYS PALLIDUS Nehring.

a. ♂. La Trinidad, Benguet Dist., N. Luzon, Feb. 9, 1894.

b, c. ♂ ♀. Cape Engaño, Lepanto, N. Luzon, May 1895.

d. Monte Data, Luzon, Feb. 1895.

The specimens sent by Mr. Whitehead all belong to the larger soft-haired form to which Dr. Nehring applied the name of *P. cumingi*, var. *pallidus*, but which appears to me to be sufficiently distinct to demand specific recognition.

When Dr. Nehring first suggested the name, Dr. Meyer considered him wrong in doing so, and, with some whitish and piebald specimens before him, quoted a letter of mine, informing him that the original series of *P. cumingi* also contained both black and piebald specimens, and that therefore the species was to be regarded merely as a very variable one. On now looking again at the original specimens in the Museum collection, I find, to my surprise, that there is among them a bad, but perfectly typical, specimen of *P. pallidus*, received from Mr. Cuming in 1853, some time after Mr. Waterhouse described *P. cumingi*, of which it was noted at the time to be a "variety." This specimen is, of course, that referred to in my letter to Dr. Meyer, it not having been up till now distinguished from the typical dark-coloured *P. cumingi*.

P. pallidus differs from *P. cumingi* in its larger size, longer and much softer fur, and paler colour. It is, however, very variable in colour, as has been described by Dr. Meyer on his specimens, and as those of Mr. Whitehead confirm. One of the latter even has no dark saddle-mark, a characteristic that seems to be nearly invariably present. In the skulls also there is an astonishing degree of variability in the size and shape of the interparietal bone, a variability I have never seen equalled elsewhere. But I have quite failed to divide the forms into two or more races, as the characters drawn from the interparietal run altogether at cross purposes to those drawn from the external ones.

"This splendid Rodent, larger and more powerful even than *Crateromys schadenbergi*, is, on the high mountains of North-west Luzon, much rarer than that species. In six months I obtained only four specimens, all of which were captured by the Igorrotes, aided by their dogs. This Rat, they told me, lived in old tree-trunks, and one specimen was slightly singed, having been smoked out of a hole in an old tree. The *Phlœomys* is also found on the coast-level, two of my specimens having been shot at Cape Engaño as they were ascending trees in the early morning. The Engaño pair have much shorter fur and are browner underneath than those obtained in the higher altitudes, but still show the same black markings on face and shoulders; two of the highland specimens are without black markings, but are undersized and probably immature. It is possible that *Phlœomys pallidus* is a grey variety of *P. cumingi*, which is a brown-coloured animal, as we find three distinct varieties of *C. schadenbergi*.

"A grey *Phlœomys* occurs in the island of Marinduque to the S.W. of Luzon. The specimen I saw was in a kerosene-oil tin on a steamer in which I was a passenger. This animal had a white face like those just mentioned from Lepanto.

"*Distribution.* Luzon and Marinduque.

"Igorrote name, 'Eŭt-eŭt.'"—J. W.

MUS EVERETTI Günth.

a–c. ♂ ♀. Monte Data, 7500 feet, Feb. 1895.

This fine Rat was hitherto known only from a single specimen, the type, now in the British Museum, and Mr. Whitehead's beautiful skins are therefore particularly acceptable.

"Much commoner than the next species, which is found in the same locality."—J. W.

MUS LUZONICUS Thos.

Mus luzonicus Thos. Ann. Mag. N. H. (6) xvi. p. 163 (1895).

a, b. ♀. Monte Data, Lepanto, Luzon, 8000 feet, Feb. 1895. *a*, type.
c. Yg. al. Lepanto Highlands, Luzon. Presented by Mr. Whitehead.

Allied to, and of about the same size and dorsal colour as, the last species. Fur much longer and softer, the wool-hairs about 20 millim. long on the back, and the longer hairs from 30 to 40. General colour coarsely grizzled brown, resulting from a mixture of buffy yellow and black; the wool-hairs dark slaty basally, their tips for 4 or 5 millim. buff, the long hairs black, but some of them with their extreme tips whitish. Under surface dull slaty buff, not defined on the sides; the hairs slaty basally, buff terminally. Head clearer greyish, owing to the tips of the shorter hairs being rather whitish than yellow. Eyes with an indistinct blackish ring, most marked posteriorly above. Ears of medium length, very thinly haired, their backs blackish, finely edged with white. Upper surface of hands and feet hoary, some of the hairs blackish, and others (the majority) silvery white. Tail rather shorter than in *Mus everetti*, well haired, though not pencilled, coarsely scaled (scales 8 or 9 to the cm.), its proximal half or two-thirds black above, paler below, its distal portion white all round.

Skull (Pl. XXXVI. fig. 4) markedly distinguished from that of *M. everetti*, and perhaps from all other Rats of so great a size, by the reduction of the supraorbital ridges, which merely form a fine beading along the edges of the frontal, and practically disappear halfway along the parietals. Brain-case smooth, round, and swollen; and this character is present all over the skull, which is unusually smooth and without ridges and angles. Posterior nares broad and open, the palatal edge opposite the hinder margin of $m.^3$ Bullæ smaller than in *M. everetti*.

Incisors yellow, not the dark orange of *M. everetti*. Molars broader than in that animal, the laminæ more simply transverse, and the outer cusp of each lamina less distinctly defined from the middle cusp.

Dimensions of type (♀) measured in skin:—

Head and body 240 millim.; tail imperfect (of another specimen 200); hind foot (moistened) 47.

Dimensions of skull of type, see p. 404. Another specimen has a basilar length of 44 millim. by a greatest breadth of 28·6.

Hab. Monte Data, Luzon.

"Scarce on Monte Data, where only four specimens were obtained."—J. W.

It is curious that two large Rats of the group with white-tipped tails should inhabit the Data plateau; but, like as they are in size and colour, there can be no question that they are of perfectly distinct species.

MUS DECUMANUS Pall., var.

a. Monte Data, Luzon, Feb. 1895.

This is a Rat so similar to some of the forms of *Mus decumanus* that, like the *Felis domestica* above referred to, I can only suppose it to be the slightly modified descendant of introduced examples.

MUS RATTUS L., var.

a. ♀. Negros, 6500 feet.

b. ♂. Mindoro, coast-level, Dec. 1895.

The single specimen of the *Mus rattus* group from Negros seems sufficiently like the Bornean variety to be provisionally referred to it. In many ways it has more the aspect of some of the Indian forms of the species, such as *M. rattus rufescens*, than any other Philippine or Bornean Rat that I have seen.

A coast-level example from Mindoro may also be placed here. Its differences from the highland *Mus mindorensis* are very striking.

MUS MINDORENSIS sp. n.[1]

a–e. 5 sks. Monte Dulangan, Mindoro, 5000 feet, Dec. 1895.

A Rat of the group of *Mus rattus*, apparently forming a peculiar insular race.

Size of *Mus rattus* or rather smaller. Fur straight, sleek, and shining. General colour very dark as compared with the ordinary eastern forms of the group, *Mus neglectus*, &c.; back a dark finely grizzled brown, the grizzling much finer than usual. The light colour in the grizzling is a deep orange, becoming rather more yellowish on the sides. Under surface whitish or dirty slaty grey, not defined from the upper colour, and not unlike in tone that of typical house-haunting specimens of *Mus musculus*. Face uniformly dark like the body, hairs round base of ears behind nearly black. Ears rather short, almost naked, the hairs so minute that a lens is needed to see them at all. Hands and feet blackish above, the digits scarcely paler. Tail decidedly shorter than the head and body, smooth, very thinly haired, almost naked, finely scaled (about 10 rings to the cm.), uniformly black above and below.

Skull very uniform in character throughout the series. Brain-case rounded, swollen. Supraorbital edges with the usual ridges rather weakly developed, and scarcely to be distinguished on the posterior half of the parietals. Interparietal large, its anterior edge slightly curved forward. Palatal foramina large and well open, reaching posteriorly just to the level of the front edge of the anterior root of $m.^1$. Posterior edge of palate broad, squarish. Bullæ rather smaller than in typical *Mus rattus*.

Dimensions of the type, an adult male in skin:—

Head and body 190 millim.; tail 163; hind foot (moistened) 32·5.

[1] Preliminary diagnosis in Minutes of P. Z. S. for June 15, 1897 (published June 19).

Dimensions of skull, see next page.

Type. B.M. 97. 3. 1. 4.

This Rat is one of the group allied to *Mus rattus*, so widely distributed over the East Indian Archipelago. The Bornean examples of the group I have provisionally termed *M. neglectus*, Jent., and have hitherto also used this name for Philippine specimens. The five highland Mindoro skins before me are, however, so uniformly different from any other specimens seen that they evidently ought to have a distinctive name.

On the other hand, as already noticed, a coast-level specimen from Mindoro is in no way separable from ordinary Philippine examples of *M. neglectus*. No doubt the highland forms are more or less indigenous, while those from the coast have been more lately introduced.

"I obtained several specimens of a variety of *Mus rattus* as high as 5000 feet in the forests of Mount Dulangan, Mindoro, and also on the Canloan volcano in Negros at an altitude of over 6000 feet. Like all the forms of *Mus rattus*, they were a great nuisance, entering my tent at night and biting holes in my rice-bags, often running over my body.

"The specimens from the two islands differ slightly in outward appearance of the fur. The Mindoro Rat is peculiar in being of a much darker brown on the back, and the belly is mouse-grey. The fur is fine and short, and the tail is nearly black. The Negros specimens, on the other hand, are more common looking, sandy brown on the back, with the underparts nearly white; the fur is also much longer, and the tail grey. *Mus rattus* seems to turn up in some form or other over the whole world, especially on high mountains."—J. W.

MUS CHRYSOCOMUS Hoffm.

a. ♂. Monte Data, Lepanto, 8000 feet, Feb. 1895.

This interesting species, which differs from almost every other member of the genus in the entire absence of sharp supraorbital edges or ridges, has hitherto been recorded only from Celebes. The present specimens, however, seem to agree closely both with Herr Hoffmann's description and figure, and also with the notes which, by the kindness of Dr. Meyer, I was allowed to take on the typical specimen when in Dresden.

"Common in the potato-fields on the top of Monte Data."—J. W.

MUS EPHIPPIUM NEGRINUS subsp. n.

a, b. ♂ ♀. Negros, 6600 feet. *a*, type.

c. ♂. Monte Data, Luzon, 8000 feet, Feb. 1895.

Similar in essential characters to the small, coarse-haired, brownish or rufous animal known as *M. ephippium*, Jent., but rather larger, much longer and softer furred, and more greyish smoky in colour.

Fur long and soft, the wool-hairs about 15 and the longer hairs 18 millim. in length on the back. General colour dark smoky grey, almost blackish along the middle of the back, lightening to buffy or yellowish on the sides. Belly not sharply defined, the hairs slaty at the base, yellowish white at the tip. Hands and feet silvery whitish above. Tail nearly as long as the head and body, uniformly brownish, or slightly paler below.

Dimensions of the type, an adult male, in skin:—

Head and body (apparently much stretched) 155 millim.; tail 135; hind foot (moistened) 26·5.

Skull, see below.

This is evidently an insular highland form of the common little Rat spread over the Malay Archipelago, to which I have generally applied the name of *Mus ephippium*, but which will perhaps be found to grade into the earlier described *Mus concolor*, Bly. In any case, however, the highland form now described seems worthy of subspecific distinction.

"Common among the Igorrote sweet-potato fields on the top of Monte Data."—J. W.

Skull-dimensions (in millim.) of Species of Mus, Batomys, *and* Carpomys.

	Mus luzonicus. ♀.	*Mus mindorensis.* ♂.	*Mus ephippium negrinus.* ♂.	*Batomys granti.* ♂.	*Carpomys melanurus.* ♂.	*Carpomys phæurus.* ♂.
Basal length	44	36	(Lambda to nasal	40·5	39·3	36
Basilar length	40·2	32·8	tip 30·3.)	37	36·3	33
Greatest breadth	25·7	19·5	16	22·2	24·5	23
Nasals, length	19·8	14·5	13·1	19·5	16	14·5
„ breadth	5·9	4·7	3·6	5	5·6	4·6
Interorbital breadth	7	6·1	5·2	5·5	5·2	6·1
Interparietal, length	5·3	5·6	—	5	6·1	4·8
„ breadth	11·6	11	—	9·6	11	13
Anterior zygoma-root, length	6·1	3·8	3·6	4·5	5·1	3·8
Palate, length from henselion	23	19	16	19	19	16·4
Diastema	13·5	11·2	9·7	12·8	12	11
Anterior palatine foramina, length	3·2	7	6·5	8·5	7·8	7·7
„ „ combined breadth	3	2·6	2·5	3·1	2·7	2·8
Length of upper molar series	9·3	6·5	5	7·8	8·8	6·1
Lower jaw, condyle to incisor-tip	33·2	26	22	30·2	29·5	26·6
„ bone only	31	23·2	19·7	26·7	27	24

Batomys Thos.

Batomys Thos. Ann. Mag. N. H. (6) xvi. p. 162 (1895).

General external form very much as in *Carpomys*, but with a shorter, though similarly hairy, tail. Eyes surrounded by a distinct naked, or at least very finely haired, ring, a peculiarity which forms one of the readiest means of distinguishing *Batomys* from *Carpomys* externally. Fore feet rather elongated; pollex with a nail. Hind feet broad; sole-pads as usual six in number, but all very large, and both the fourth (hallucal) and fifth (usually small and rounded) elongated like the sixth; pads not striated. Whole of heel hairy to the level of the hinder end of the last sole-pad. Fifth hind toe reaching to the base of the third phalanx of the fourth; hallux just to the base of the second toe.

Skull (Pl. XXXVI. fig. 8) more elongate and murine than that of *Carpomys*, in general outline not unlike that of *Eliomys quercinus*. Brain-case small, face comparatively long. Interorbital space rather narrow, its edges with only the slightest indication of ridges. Interparietal fairly large. Anterior edge of zygoma-root not projected forwards. Anterior palatine foramina large. Bullæ small.

Incisors narrow, smooth in front. Molars (Pl. XXXVI. fig. 5) in their pattern like those of *Mus*, not of *Carpomys*, but instead of being distinctly brachyodont, as are those of nearly all other Murines, they are more or less hypsodont, the crown at least as high above the bifurcation of the roots as it is broad. Molar laminæ, as in *Mus*, 3—2—2; transverse, not oblique; $m.^2$ and $m.^3$ with well-defined antero-internal supplementary cusps. $M._1$ and $m._2$ also with distinct posterior mesial supplementary cusps.

This genus, although with a striking external resemblance to *Carpomys*, is really more nearly allied to *Mus*, as its elongate skull and the pattern of its molars indicate. Its curious bare eyelids and hypsodont molars are, however, characters in which it is different from all the other Eastern arboreal genera.

Batomys granti Thos. (Plate XXXIII. fig. 2.)

Batomys granti Thos. t. c. p. 162.

a–c. 2 adult and 1 immature. Monte Data, Feb. 1895.

Size of a large Rat. Fur thick, close, and rather coarse. General colour coarsely grizzled fulvous and black all over above, the face, however, more greyish; posterior back and rump tending more towards rufous. Ears of medium length, more thinly haired than in *Carpomys*, their backs black or dark brown. Under surface dirty buff, not sharply defined; the bases of the hairs slate-colour throughout, though an indistinct whitish mesial line is sometimes present. Metacarpals and metatarsals brownish mesially, whitish laterally and on the digits. Tail thickly and uniformly clothed (except for its body-furred basal half-inch) with dark brown or black hairs, some 7 to 9 millim. in length, the scales quite hidden.

Skull and teeth as already described. Palatine foramina just reaching backward to the front edge of $m.^1$; palate ending behind opposite the posterior lamina of $m.^2$.

Dimensions of the type, an adult male in skin:—

Head and body 204 millim.; tail (doubtfully perfect) 121; hind foot (moistened) 35·5.

Dimensions of skull, see p. 404.

Hab. Plateau of Monte Data.

Type. B.M. 95. 8. 2. 15.

This interesting animal, which, with very much the general appearance of *Carpomys melanurus*, is entirely different in essential characters, I have named in honour of my friend and colleague Mr. W. R. Ogilvie Grant, by whom all the business matters connected with Mr. Whitehead's expedition were managed, and who has himself worked out and described the magnificent collection of birds, which contained examples of no less than fifty new species.

"This interesting new Rat was captured for me by the Igorrotes, with the aid of their small terriers; it seems rare, only three specimens being obtained. *Batomys granti* is at first sight the same animal as the next species, *Carpomys melanurus*, but has a bare ring round the eye, and when alive is easily separated from *Carpomys* by this character. The two animals, however, which externally appear almost identical, have the teeth so different that they have been separated by Mr. Thomas into different genera. Found at 7000 feet on Monte Data.

"*Distribution.* Highlands of Central Northern Luzon."—J. W.

CARPOMYS Thos.

Carpomys Thos. Ann. Mag. N. H. (6) xvi. p. 161 (1895).

Form more or less as in such arboreal Murines as *Hapalomys* and *Pithechirus*. Fur thick and woolly. Pollex with a large nail; other digits, including the non-opposable hallux, with claws. Tail long, well haired. Mammæ 0—2 = 4.

Skull (Pl. XXXVI. figs. 6 and 7) with a large rounded brain-case and short face. Supraorbital region without sharp ridges or overhanging ledges. Interparietal large; zygoma-root as in *Crateromys*, i.e. without any forwardly-projecting plate, the front edge vertical or even concave. Anterior palatine foramina fairly long. Bullæ small.

Teeth (Pl. XXXVI. fig. 3). Incisors smooth in front. First and second upper molars, as compared with those of *Mus*, each with an additional lamina, formed apparently by the normal posterior lamina being doubled round on itself. The last molar is normal, so that the laminar formula is 4—3—2. Both $m.^2$ and $m.^3$ have well-marked antero-internal supplementary cusps. In the lower jaw $m._1$ has an additional lamina in front, and both it and $m._2$ have well-marked posterior supplementary cusps, while the last-named has in addition an antero-external one.

It is difficult to decide what are the exact relationships of *Carpomys*, and it can only be said that it adds one more to the list of Oriental genera of Muridæ modified for an arboreal life, such as *Hapalomys*, *Pithechirus*, *Chiropodomys*, and *Vandeleuria*.

This new genus contains two handsome Dormouse-like species with long hairy tails and fluffy fur. Both are evidently of arboreal habits.

With a certain superficial resemblance to each other, the two species of *Carpomys* may be readily distinguished by their differently-coloured tails, the extension of the body-fur on to that organ in *C. melanurus*, and by the very much larger teeth, both absolutely and proportionally, of the same species.

CARPOMYS MELANURUS Thos. (Plate XXXIV. fig. 2.)

Carpomys melanurus Thos. Ann. Mag. N. H. (6) xvi. p. 162 (1895).

a–d. 3 ad. & 1 yg. sks., ♂ ♀. Monte Data, 7000–8000 feet, Feb. 1895.

Size about as in *Mus rattus*. Fur soft, thick, and woolly. General colour deep fulvous, coarsely lined with black. Under surface and inner sides of limbs dull yellowish white, the bases of the hairs slate. Ears of medium size, well haired, dark brown, nearly black. Limbs to wrists and ankles furred and coloured like body. Metapodials brown mesially, laterally and on the digits white. Tail longer than head and body, its basal inch or two thickly furry like the body, and of the same colour; the rest closely covered with shining black hairs, some 5 to 7 millim. in length, entirely hiding the scales; not specially tufted at tip.

Skull (Pl. XXXVI. fig. 6) with the nasals broad in front, abruptly narrowing backward. Interorbital region narrow, broader in front than behind, and the traces of ridges mounting on to the top, and approaching each other to within 2 millim. in the middle line. Palatal foramina parallel-sided, attaining at once their greatest width anteriorly. Palate ending opposite the front edge of $m.^3$.

Teeth broad and heavy. Incisors broad, slightly flattened in front in old specimens; dark yellow above, rather more whitish below. Molars (Pl. XXXVI. fig. 3) very broad and large (see skull-measurements), their combined length exceeding that of the palatal foramina.

Dimensions of the type, an adult male, in skin:—

Head and body 197 millim.; tail 211; hind foot (moistened) 34·2.

Skull, see p. 404.

Type. B.M. 95. 8. 2. 12.

"The black-tailed *Carpomys* differs much from the next species, *C. phæurus*, both in size, colour, and length of fur; in fact it has externally the appearance of *Batomys*. On Monte Data, where both these new forms were obtained, it was more numerous than either *Batomys* or the next species.

"*Distribution*. Highlands of Central Northern Luzon."—J. W.

CARPOMYS PHÆURUS Thos. (Plate XXXIV. fig. 1.)

a–c. 3 ad. sks., ♂ ♀. Monte Data, 7000–8000 feet, Feb. 1895.

Size rather less than in *C. melanurus.* Quality of fur and general colour almost exactly as in that species. Ears rather smaller, less thickly hairy, and not prominently black. Belly-hairs dull buffy white to their roots, not slaty basally. Tail with the body-fur not extending on to its base more than in ordinary Rats, more thinly haired than in *C. melanurus*, so that the scales, which are very small, running about 13 to the centimetre, are visible through the hairs; in colour it is uniformly dark brown, occasionally approaching black, but never the deep shining black of *C. melanurus.*

Skull (Pl. XXXVI. fig. 7), as compared with that of *C. melanurus*, with the nasals less expanded anteriorly and less abruptly tapering posteriorly. Interorbital space comparatively broad and parallel-sided, the rudimentary ridges not approaching each other on the top. Palatal foramina pointed in front, gradually broadening backward. Palate ending opposite to front of $m.^3$.

Teeth light and delicate. Incisors comparatively narrow. Molars, in marked contrast to those of *C. melanurus*, quite small in proportion to the size of the animal, but of the same essential structure.

Dimensions of the type, an adult male in skin:—

Head and body (stretched) 195 millim.; tail 178; hind foot (moistened) 31.

Skull, see p. 404.

Type. B.M. 95. 8. 2. 14.

"The brown-tailed *Carpomys* was somewhat rare on Monte Data. The Igorrotes used to hunt for the various Rats on Monte Data in small parties accompanied by their dogs, and spent most of the day at this—to them—curious occupation. The animals that I saw captured were dug out from among the roots of trees by the aid of spears and choppers. The flat table-top of Monte Data is much burrowed by various species of Rodents; the Igorrotes, unlike the Kina Balu Dusans, not trapping Rats for their food.

"*Distribution.* Highlands of Central Northern Luzon."—J. W.

CRATEROMYS.

Crateromys Thos. Ann. Mag. N. H. (6) xvi. p. 163 (1895).

Size very large; general form not unlike that of *Phlœomys.* Claws smaller and tail bushier than in that genus.

Skull, in a very general way, not unlike that of a gigantic *Neotoma*, strikingly different from that of *Phlœomys.* Muzzle slender. Zygomata squarely and boldly expanded. Interorbital region narrow, narrowing backward, edged with distinct but not exaggerated ridges, which pass backward on to the parietal and interparietal bones, and show no tendency to overhang the temporal fossæ. Interparietal large.

Palatal foramina long. Outer and inner pterygoids well developed. Bullæ very small, though more inflated than in *Phlœomys*.

Incisors not large in proportion to the size of the animal, flat in front. Molars (Pl. XXXVI. fig. 2) large and heavy, separated in the middle line by a distance less than their breadth; rather hypsodont, though less so than in *Batomys*; their pattern, while in the number of laminæ and cusps essentially as in *Mus*, yet peculiar on account of the diminution or suppression of the external and the great development of the internal cusp of each lamina. On this account the longitudinal groove between the inner and middle cusps, in which the inner cusp-row of the lower molars works, approaches the centre of the tooth-row, instead of being close to its inner edge. As an accompaniment to this development of the inner cusp of each lamina, the point of separation between it and the centre cusp is marked by a sharp and deep infolding of the anterior enamel wall of the lamina; this notch is so deep in many cases as almost to cut the lamina in two. Below, the two halves of each lamina are strongly bent backward, so as to form a sharp angle with each other in the middle line. $M._1$ and $m._2$ with well-developed supplementary posterior cusps; $m._3$ with its posterior lamina sharply notched in behind, so as to give it a very definite cordate shape.

Altogether the molars have a general resemblance to those of the remarkable *Mus meyeri*, Jentink, an animal which (as may be seen from the footnote [1]) I think should also form a peculiar genus.

CRATEROMYS SCHADENBERGI (Mey.). (Plate XXXVI. fig. 2.)

Phlœomys (?) *schadenbergi* Mey. Abh. Mus. Dresd. 1894–5, no. 6 (1895).

Crateromys schadenbergi id. op. cit. 1896–7, no. 6, p. 32, pl. xiii. figs. 3–6 (skull), xiv. (animal) (1896).

a–c. Monte Data, Feb. 1895.

This fine animal was first discovered by Dr. Schadenberg, but it is to Mr. Whitehead that our chief knowledge of it is due, as the former's specimen was only a skin without

[1] LENOMYS g. n.

Form Rat-like. Feet short and broad; pollex forming a large rounded projection of the hand, on the top of which the small nail is placed; hallux short, not opposable, its terminal pad large, covering nearly the whole of its under surface, its claw shorter, blunter, and more curved downward than those of the other digits; palmar and plantar pads all very large.

Molars (Pl. XXXVI. fig. 1) very large, the space between them less than their breadth. All three cusps of each lamina very strongly defined, the points of junction on each side of the central cusp marked anteriorly by a notch, and posteriorly by a backward projection of the enamel. $M.^2$ and $m.^3$ have, besides the usual antero-internal supplementary cusp, another one to balance it antero-externally, while the latter tooth has also a mesial supplementary cusp posteriorly. Lower molars very like those of *Crateromys*, but $m._1$ has two, and $m._2$ has one supplementary external cusp. These characters may be seen in the figures of the skull quoted below and in that of the teeth on Pl. XXXVI.

Type. *Mus meyeri*, Jent. N. L. M. i. p. 12 (1878); Cat. Ost. Leyd. Mus. (M. P.-B. ix.) p. 211, pl. vii. figs. 5–8 (1887); Hoffmann, Abh. Mus. Dresd. 1887, no. 3, fig. 2.

a skull, which Dr. Meyer placed, not unnaturally, in the genus *Phlœomys*. On the arrival of Mr. Whitehead's series, the form was generically separated by myself, and a little later Dr. Meyer published a second account of the animal, with coloured figures. No further description of it is therefore necessary.

"Schadenberg's great Rat seems to be fairly common among the high mountains of Central N.W. Luzon. Like most Rodents, it is of nocturnal habits, and therefore the domestic economy of this Rat, or perhaps Squirrel-Rat, is difficult to describe. The Igorrotes, however, captured a number of specimens for me, some, they said, from holes in trees, others from holes among the tree-roots; they described the animal as feeding on fruits up in the trees, and not on the fallen ones. As this Rat was nearly always brought to me alive, I often allowed it to climb the pine-trees, which it did with perfect ease. In the day these animals tried to hide from the sun as much as possible, and I formed an opinion that they were dull and inoffensive creatures, until one day, directly an Igorrote opened the basket in which he carried the captured Rat, the animal sprang out, and was back in the basket again in a second, but the Igorrote's thumb had the top nearly bitten off. The cry of the *Crateromys* is a curious 'Thewŏ thewŏ thewŏ,' uttered so shrilly that the notes might proceed from some of the peculiar forest insects.

"Generally speaking, *Crateromys* is jet-black; about 30 per cent. are of a beautiful white-grey, and some 15 per cent. piebald, black and white. This distribution of colouring has nothing to do with age, as both grey and black young ones were obtained. The Igorrote name for this curious mammal is 'Bū-ŭt.'

"*Distribution.* High mountains of Central Northern Luzon."—J. W.

Bubalus mindorensis Heude.

Bubalus mindorensis Heude, Mém. Hist. Soc. Chin. ii. p. 50 (1888); Meyer, Abh. Mus. Dresd. 1896–7, no. 6, p. 12 (1896).
Probubalus mindorensis Steere, P. Z. S. 1888, p. 415.

"This interesting little Bovine is not uncommon in the huge virgin forests that cover nearly the entire island of Mindoro. It is, however, difficult to hunt the animal successfully, unless a number of beaters, accompanied by good dogs, are employed. I foolishly followed a professional (!) native hunter about for several days; but, although we found a number of fresh tracks, we never saw a sign of a 'Tamarau.' The 'Tamarau,' as the natives name this animal, is also found high up on the mountains. I have seen regular tunnelled pathways through the thick bamboo undergrowth which covers the mountain-sides above 6000 feet. But the animal is so small that one has to bend double or go on one's hands and knees, making it quite impossible to follow up the tracks. On moonlight nights the 'Tamarau' might be heard bellowing on the mountain-side, generally far away and above my mountain-camp. The aboriginals of Mindoro told me that they never attack the 'Tamarau,' being too much afraid of it;

the only reduction of its numbers is caused by a few sporting Spaniards and one or two professional Indian hunters.

" *Distribution.* The island of Mindoro."—J. W.

Sus celebensis philippinensis Nehr.

a. Head-skin and skull, ♂. Cape Engaño, N. Luzon. Presented by Mr. Whitehead.

"This Pig may be said to be ubiquitous throughout the whole Philippine group, passing the entire day in seclusion in the forests, and sallying forth at night into the maize- and rice-fields, where it does much damage.

" Native name 'Babui.' "—J. W.

EXPLANATION OF THE PLATES.

PLATE XXX.

Fig. 1. *Harpyionycteris whiteheadi* (p. 384).
Fig. 2. *Nannosciurus samaricus* (p. 389).

PLATE XXXI.

Fig. 1. *Celænomys silaceus* (p. 391).
Fig. 2. *Rhynchomys soricoides* (p. 398).

PLATE XXXII.

Chrotomys whiteheadi (p. 392).

PLATE XXXIII.

Fig. 1. *Crunomys fallax* (p. 394).
Fig. 2. *Batomys granti* (p. 405).

PLATE XXXIV.

Fig. 1. *Carpomys phæurus* (p. 408).
Fig. 2. ,, *melanurus* (p. 407).

PLATE XXXV.

Skulls and Teeth of Philippine Mammals.

Figs. 1–4. *Harpyionycteris whiteheadi* (p. 384), fig. 2 nat. size, figs. 1, 3, and 4 twice nat. size.
Fig. 5. *Crunomys fallax* (p. 394), upper and lower molars, much magnified.
Fig. 6. ,, ,, skull, nat. size and twice nat. size.

Fig. 7. *Rhynchomys soricoides* (p. 398), upper and lower molars, much magnified.

Figs. 8, 9. *Chrotomys whiteheadi* (p. 392), molars, magnified, and skull nat. size.

Fig. 10. *Rhynchomys soricoides* (p. 398), skull, nat. size.

Figs. 11, 12. *Celænomys silaceus* (p. 391), molars, magnified, and skull, nat. size.

PLATE XXXVI.

Skulls and Teeth of Philippine Mammals.

Fig. 1. *Lenomys meyeri* (p. 409), upper and lower molar teeth, much magnified.

Fig. 2. *Crateromys schadenbergi* (p. 409), upper and lower molar teeth, much magnified.

Fig. 3. *Carpomys melanurus* (p. 407), upper and lower molar teeth, much magnified.

Fig. 4. *Mus luzonicus* (p. 401), skull, nat. size.

Fig. 5. *Batomys granti* (p. 405), upper and lower molar teeth, much magnified.

Fig. 6. *Carpomys melanurus* (p. 407), skull, nat. size.

Fig. 7. ,, *phæurus* (p. 408), skull, nat. size.

Fig. 8. *Batomys granti* (p. 405), skull, nat. size.

All the enlarged figures of the molar teeth, upper and lower, are of those of the right side; the figures of the upper molars are placed on the left, and those of the lower on the right.

J. Smit del et lith.

Mintern Bros imp.

1. HARPYIONYCTERIS WHITEHEADI.
2. NANNOSCIURUS SAMARICUS.

J. Smit del. et lith.

Mintern Bros. imp.

1. CELÆNOMYS SILACEUS.
2. RHYNCHOMYS SORICOIDES.

J. Smit del. et lith.

Mintern Bros imp.

CHROTOMYS WHITEHEADI.

J Smit del. et lith.

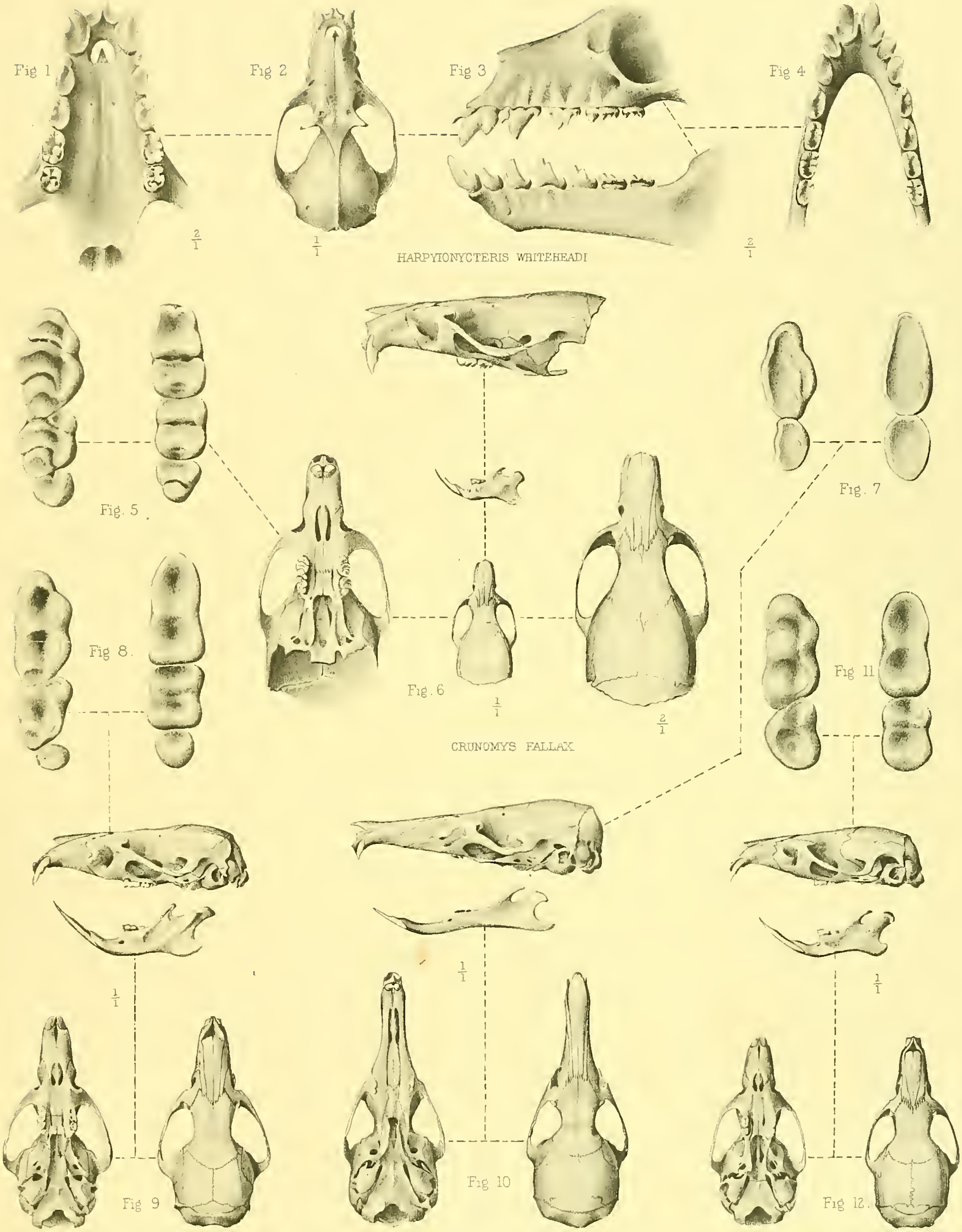
Mintern Bros imp.

1. CRUNOMYS FALLAX.
2. BATOMYS GRANTI.

J. Smit del. et lith.

Mintern Bros imp.

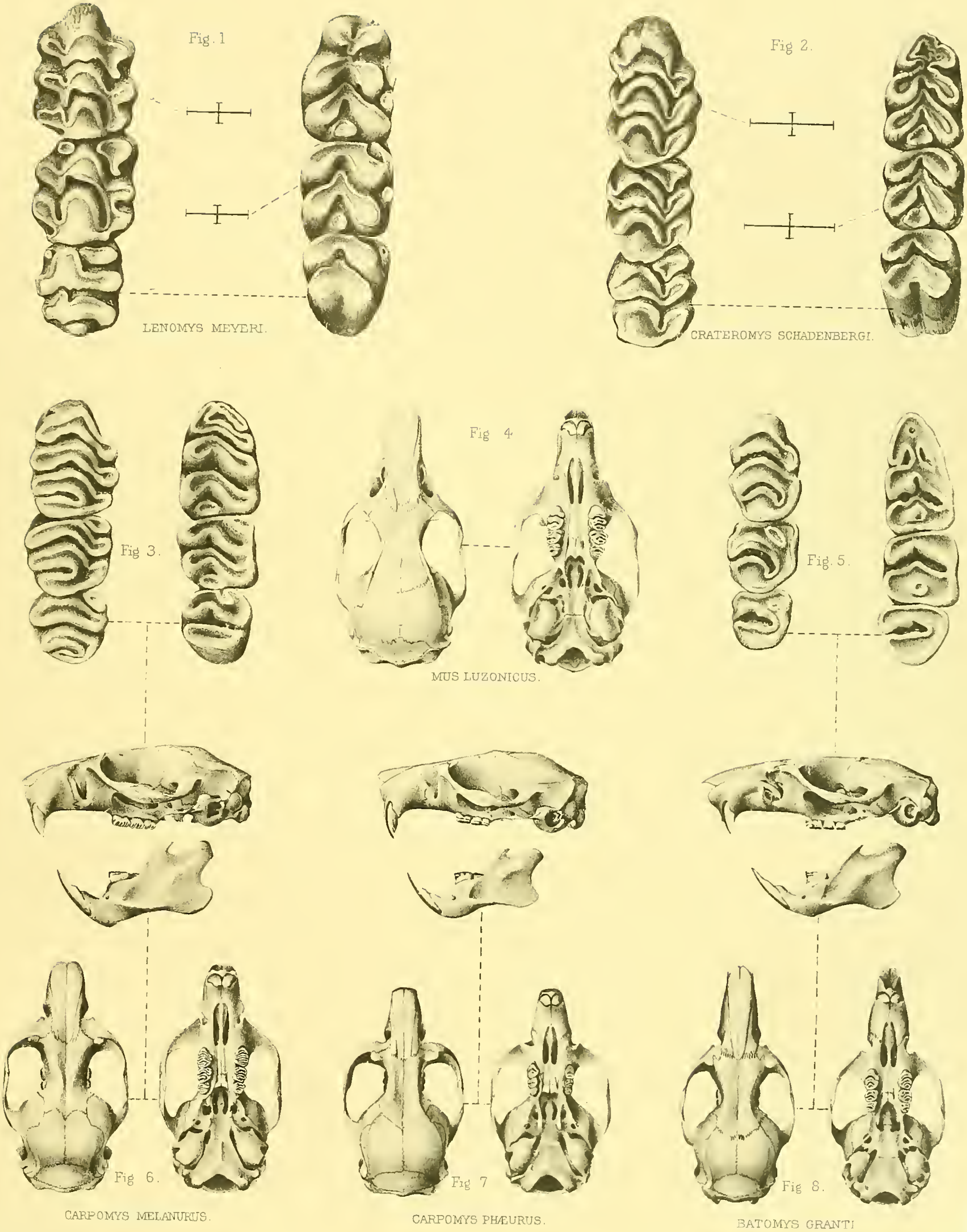
1. CARPOMYS PHÆURUS.
2. CARPOMYS MELANURUS.



H. Grönvold del.

Collotype, Morgan & Kidd

SKULLS AND TEETH OF PHILIPPINE MAMMALS



H Grönvold. del

Collotype. Morgan & Kidd. Richmond

SKULLS AND TEETH OF PHILIPPINE MAMMALS

TRANSACTIONS

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Continued on page 3 of Wrapper.

IX. *On the Lepidosiren of the Amazons; being Notes on five Specimens obtained between* 1895–97, *and Remarks upon an Example living in the Pará Museum.*

By Dr. Emil A. Goeldi, *C.M.Z.S., Director of the Pará Museum.*

Received September 16, 1897, read December 14, 1897.

[Plates XXXVII. & XXXVIII.]

Contents.

I. Introduction.

The undeniable deficiency of original investigations upon the biology of the Amazonian Lepidosiren, made by naturalists and scientific travellers in the native country of this interesting Dipnoan fish, will, I think, sufficiently justify the following communication. Sufficient proof of this deficiency is found in the recent memoir by Prof. E. Ray Lankester [1], in which the following passage occurs (p. 19):—" . . . . We have no drawing or record of freshly-killed or living specimens of Lepidosiren." On the other hand, a considerable number of articles and notes have been published during the last few years by myself and others relating to the general features of the natural history of Lepidosiren and its allies, and to the history, description, and number of specimens existing in the museums of the Old and New Worlds, so that I may take it for granted that these particulars are known to the public, and that I may be allowed to restrict myself to such a short account of the subject as is indicated by the title of this paper.

The rediscovery of the Amazonian Lepidosiren, together with the elucidation of its habitat, distribution, and mode of life, formed one of my principal projects from the time I assumed my present position (1894). I will not here repeat the details of my efforts; it will be sufficient to state that I organized a methodical propaganda all over

[1] "On the *Lepidosiren* of Paraguay, and on the External Characters of *Lepidosiren* and *Protopterus*," Trans. Zool. Soc. Lond. xiv. p. 11 (1896).

the native country of Lepidosiren, and that these efforts were at last successful. Three years' continuance of them put into my hands five specimens of the celebrated Dipnoan, one of which was living—material more important than all that was then existing elsewhere in the scientific world.

II. Geographical Distribution.

My original supposition that *Lepidosiren paradoxa* would probably exist and be found all over Amazonia, and that the geographical distribution would be much larger than was generally admitted, proved to be right. My first specimen I got from the Atlantic coast of the island of Marajó [1], certainly a somewhat remarkable locality [2]. A second small specimen was brought to me from Santarem, the exact locality being Igarapé Ayayá, Fazenda Taperinha, in the immediate neighbourhood of that town [3]. Two larger specimens I got afterwards from Obydos, the exact locality being Paraná de Baixo, likewise not very far from Santarem. One of these specimens, captured with a fishing-hook, lived for several hours, and a telegram from Obydos, sent by Senador M. F. Machado (whose interest and help in this and similar ichthyological matters deserve public acknowledgment), made me hope to receive it alive by the next steamer of the Amazon Company. However, this hope was not fulfilled; the specimen died, but was saved as a spirit-specimen. From Obydos finally I received a fifth specimen, captured by Deputado Lourenzo Valente do Conto. This example has lived now nearly four months in the Pará Museum, and seems to be quite well, being treated with great attention and care.

In order to bring up to date my sketch of the distribution of the Amazonian Lepidosiren, as recently published by me [4], it is necessary to add the localities Santarem and Obydos. This done, it will easily be seen at a glance that the localities form almost a continuous chain along the main stream, entering even some of the more important affluents (the Ucayale, Madeira, Rio Negro, Tapajóz) and the Atlantic side of Marajó. Thus my original supposition has already assumed the shape of a positive fact.

III. Sex and Measurements.

Four of my specimens I judge to be females. Designating the specimens, in the succession and order above indicated, with the letters A to E, they would be the individuals A, B, D, E. If, on the one hand, the question seems somewhat problematical

[1] The specimen is now in the British Museum. The details of its capture are recorded in 'Nature,' vol. liv. p. 270 (1896).

[2] In September 1896 I visited the spot where it was obtained. It was a papyrus-meadow, submersed for several months every year. I made a tolerable photograph of the spot where the specimen had been captured.

[3] I am indebted for this specimen to Dr. Augusto Olympio, formerly 'Deputado,' and now Director of Public Instruction of the State of Pará (January 18th, 1897).

[4] Boletim do Museu Paraense, i. p. 442 (Oct. 1896).

in regard to the individual B, in which small size and youth may perhaps hide the characteristic exterior sexual signs, on the other hand, there is no doubt that specimen A from Marajó Island (now in the possession of the British Museum) is an adult female, the ovaries having been rendered visible by a section. Individual C, from Obydos, is evidently a male, as it shows the villi distinctly on the left abdominal fin. The right abdominal fin exists only in the form of a short prominence or stump, having been probably bitten away by some carnivorous fish.

We have, therefore, a numerical proportion of 4 females to 1 male. This may be purely casual, but the possibility cannot be denied that there may exist in this Dipnoan a real predominance of females over males. Unfortunately I do not possess any information upon this point as regards the large collection of Paraguayan Lepidosiren recently made by Dr. Bohls and sent to Europe.

Concerning the measurements of my five Amazonian Lepidosirens, I have drawn up the following table:—

A. 59 cm.	D. 70 cm.
B. 39 cm.	E. 60–70 cm. [approxim.].
C. 59 cm.	

Individual B, from Santarem, is only 32 mm. in dorso-ventral diameter; individual C 49 mm., having a circumference of 14·8 cm.; individual D is 70 mm. in dorso-ventral diameter.

IV. Situation of the Anus, and external Colour.

The asymmetrical position of the anus (on the left side, near the pelvic fin), already noticed by the original describers of *Lepidosiren paradoxa*, is repeated again on all my five recent individuals.

As regards the external colour of Lepidosiren, it seems to me that the difference between dark and brown individuals ought to be considered as a secondary matter, often merely produced by the effects of alcohol, and not peculiar to the living animal. This is shown by my four spirit-specimens A–D. The specimens A and B are now decidedly and uniformly dark, the former nearly black, the latter of a slaty colour. Individual C is now dark above and brownish below; on the individual D brownish spots, and more or less extended patches of the same colour, are still to be observed on the dorsal side. I am personally convinced that the brownish colour is, as a rule, predominant in the living and fresh animal. The picture of our living Lepidosiren exhibited before this meeting of the Zoological Society has been executed with great care, and is highly instructive upon this point.

The following passage in Prof. Lankester's memoir (Trans. Zool. Soc. vol. xiv. p. 24) refers to this subject:—"The most striking and uniform difference which I have observed is the colour: the Paraguayan specimens are black, the Brazilian specimens are clear brown. There is, however, little doubt that this is largely, if not altogether, due to the longer action of alcohol and sunlight upon the Brazilian specimens." But this should be taken in connection with my observations on the subject taken *in loco* and from fresh material.

V. Segmentation of Limb-axis.

I have already had occasion to state my opinion upon this question in my letter to Dr. A. Günther, published in 'Nature' (liv. p. 270). In the first individual sent to me from Marajó, I discovered that the segmentation, considered by Prof. Ehlers to constitute a peculiarity of his Paraguayan *Lepidosiren articulata*, exists also in the Amazonian Lepidosiren, as clearly shown by Prof. Lankester in the above-mentioned memoir. The segmentation of the cartilaginous limb-axis evidently escaped the notice of the first describer Bischoff, but this oversight does not materially detract from the value of the excellent memoir upon Lepidosiren issued in 1840 by the celebrated anatomist of Vienna.

VI. System of Lateral Lines.

It seems that nobody has added anything more to the knowledge of the lateral-line system since Bischoff's memoir, and that anatomist only mentioned and figured the lateral line of the head-region of Lepidosiren. The recent figures of Lepidosiren and *Protopterus* contained in Prof. Lankester's memoir show what I consider to be a median lateral line on each side of the body; but in the text of his article no allusion or description is found referring to this point. Although surprising, however, this circumstance may be easily understood. Dead specimens of Lepidosiren generally become rapidly dark and the lateral lines cannot be so distinctly perceived, as I have had occasion to verify in my own spirit-specimens. Fig. 2, Pl. XXXVII., taken from our living Amazonian Lepidosiren, shows most distinctly six lateral lines—that is, three on each side of the body, running longitudinally and in a straight line from head to tail.

a. Median line.
b. Dorsal line.
c. Ventral line.

The best-developed line, being nearly uninterrupted, is the median, giving out from time to time small vertical branches, generally two together, towards the dorsal line. The dorsal line is less developed, being composed of longer or shorter, straight or curved marks, the longitudinal and lineiform arrangement of which is recognized without difficulty despite the numerous interruptions. It seems that these marks are small lateral branches, similar to those of the median line, but directed downward in the places where the dorsal line remains better preserved. Very well developed is also the ventral line, emitting vertical branches downward, nearly reaching the true ventral margin and almost touching the corresponding branches of the other side. When our living Lepidosiren exposes to view the ventral side, the appearance may very well be compared to that of a rope-ladder. Probably the same relation exists between the dorsal and median lines of both sides of the body.

Our figure (Pl. XXXVII. fig. 2) gives an adequate though not diagrammatic reproduction of the lateral-line system of Lepidosiren. Whether or to what degree these lateral branchings may be related to a metameric arrangement I cannot say.

In any case it is here shown that Lepidosiren possesses a complicated system of lateral lines, hitherto unknown—a system which I do not know to exist in the same high development in any other living species of fish. It would be very advisable to pay special attention to this point when examining specimens of the African *Protopterus* and the Australian *Ceratodus*.

VII. Popular Names of Lepidosiren and its Habits in a free State.

Between Obydos and Pará it seems that the popular names most frequently used to designate the *Lepidosiren paradoxa* are " tariira-boia " and " pirarucú-boia "; sometimes the abridged forms " boia " or " cobra " are also employed. The first name is composed of " tariira," the Amazonian term for the freshwater fish which is called " trahíra " or " traira " in South Brazil (*Macrodon trahira*). The first half of the second name consists of the native name for *Arapaima gigas*. Senador Machado informs me that these trivial names have their origin in the fear of the native fishermen, who state that our Dipnoan bites severely, and are convinced that it is poisonous.

As yet we know but very little about the habits of Lepidosiren in a natural state. From the information kindly given to me verbally and in letters by Senador Machado and Civil Engineer Vicente Chermont de Miranda, I may extract the following :—*Lepidosiren paradoxa* is an inhabitant of submersed regions, where the water is shallow and does not possess a depth of many metres. Both my informants believe it to be more common than generally supposed, but the only chance of obtaining it is during the Amazonian summer, *i. e.* the dry season. When the water nearly disappears and only small pools are left in the natural holes and depressions, the Lepidosiren is found left in them. As it is fond of disturbing the water of these pools, beating it with its tail and making violent evolutions with its eel-like body, the search for it then becomes easier, and only in such localities is the opportunity afforded of securing living specimens intact. The locality in which the first Marajó specimen was caught (Fazenda Dunas), and which I visited in September 1896, was in such a condition [1]. I saw the pool between

[1] Senhor Vicente Ch. de Miranda informs me that in December 1894 he observed on his possessions on the Atlantic side of Marajó, in the locality called " Rego do Jacaré-magro," $2\frac{1}{2}$ kilometres distant from the coast, two specimens of " an unknown fish," which he recognized afterwards as identical with the Lepidosiren sent to me. One was 41 centimetres long, the other 27 centimetres; the former was no doubt a female.

the roots of some papyrus-tufts, not more than a step distant from a long ditch, which at the midsummer period of my visit had sufficient water for a boat.

The question arises what becomes of the Lepidosirens when even these pools dry up. There is very little doubt that they hide in the lower regions of the mud, and thus survive the drying of the pools. This is also the opinion of my above-mentioned informants, and I agree with it entirely, the more so as it establishes a parallel with the summer lethargy of the African *Protopterus annectens.* My two informants intend to clear up the matter, and to dig out the torpid Lepidosirens from the dried-up pools.

The fact that two of my specimens from Obydos had been caught with a hook baited with fish certainly proves, as Senador Machado writes, that *Lepidosiren paradoxa* occasionally subsists on this kind of food.

VIII. Habits of Lepidosiren in Captivity.

On the 27th April, 1897, our establishment received the news that Senhor Deputado Lourenzo V. do Conto had brought from Obydos a rare living fish, which was destined for the Museum. Sending one of the native keepers of our modest Zoological Garden for it, I asked him on his return what kind of fish he had brought. He replied a "poraqué" (*Gymnotus electricus*). Thinking that the creature was really what he said, and somewhat surprised that so common a fish as *Gymnotus electricus* should be spoken of as "a rare fish" worthy of being carried from Obydos, while plenty of them existed all round the city of Pará in every ygapó pool, I ordered it to be put in the aquarium together with our other living *Gymnoti.* There the captive remained, through this singular mistake, for nearly a month. What was my surprise when one day we discovered that the supposed "poraqué" was in reality a *Lepidosiren paradoxa*! The prisoner's condition was at once ameliorated by removing him to a separate aquarium in the Museum-building. Since that time we have had the specimen constantly under our personal observation, and it seems to be thriving and in good health.

The specimen arrived with a large wound on the left side, nearly in the middle of the body. I do not know the nature and cause of the wound, but I have the pleasure of stating that it is now smaller, and that probably in a few weeks it will have perfectly healed. The tail also shows the results of some former mutilations, which is frequently the case with nearly all creatures cohabiting with such voracious colleagues as the "piránhas" (*Piraya*) and "jacarés" are. It is an interesting fact that our Lepidosiren lived nearly a month together with a number of large and small *Gymnoti* without the slightest sign of having been injured by these companions, which certainly cannot be called agreeable. Nevertheless I have no intention of repeating the experiment.

Our Lepidosiren now lives in a large glass aquarium, such as is commonly used in biological stations. The bottom has a stratum (1 decimetre high) of mud, leaves, and other vegetable matter. A vigorous growth of algæ helps to increase this stratum. The remainder is filled with fresh water, which is renewed every fourth day. As food, small pieces of meat, fish, ampullarias, crustaceans, as well as mandioca-roots, are constantly offered to it, but up to this time no one has seen our Lepidosiren actually take any of these things. It is, however, in a better state of nutrition than when it it arrived; it is decidedly fat and round. Therefore it eats something, and it probably does so when it burrows half the length of its body in the mud, as frequently seen.

For respiration it comes from time to time to the surface of the water, and puts out a portion of the head. The operation lasts several seconds. In the large aquarium this act is only repeated at intervals of several hours, but when placed in a smaller one—such as I used for my photographs of the living animal—the respirations at the surface are much more frequent, the intervals being perhaps of a quarter of an hour's duration. The respiration is sometimes singularly prolonged. When descending, a series of air-bubbles is generally expelled from the branchial aperture on each side of the anterior part of the body. The whole body is covered with a viscous or gluey substance, which fills the water with whitish flakes, when the Dipnoan executes more rapid and violent evolutions (see my photographs, Pl. XXXVIII.).

During the day and when undisturbed our Lepidosiren is a quiet and passive creature, not changing its curled position for hours. Only once we have noticed it attempt to bite the finger of the keeper. It remains generally indifferent even when small living animals are offered it with the pincers. When disturbed it executes most elegant and varied evolutions, and shows itself to be a first-class swimmer, at least as good as *Anguilla* and *Muræna*.

I had the rare pleasure of exhibiting the living *Lepidosiren paradoxa* at a public meeting of our Museum Society in Pará on the night of June 3rd, 1897, which was honoured with the presence of the State's Governor, Dr. Paes de Carvalho, a distinguished physician, and of a large number of persons interested in our scientific work. Some days afterwards I received from Dr. O'Connor, of Oxley, Queensland, the news that living specimens of *Ceratodus* (the Dipnoan of the opposite side of the southern hemisphere) had been caught for the first time in Australia.

Pará, August 26th, 1897.

EXPLANATION OF THE PLATES.

PLATE XXXVII.

Fig. 1. *Lepidosiren paradoxa*, half natural size.

Fig. 2. Outline of the body, showing the lateral lines.

Fig. 3. Head seen from below.

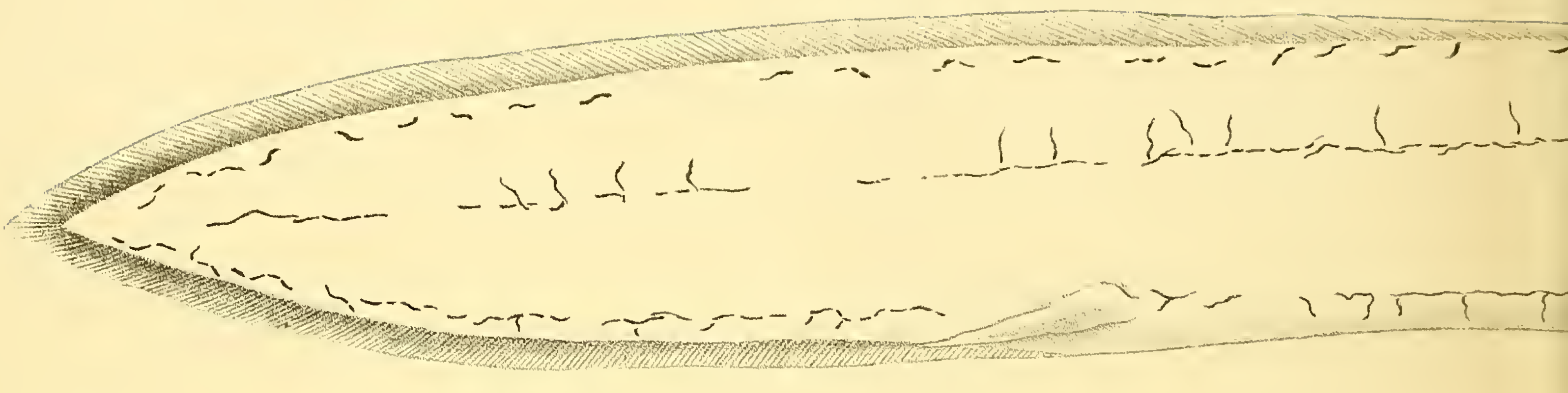
Fig. 4. A portion of the body, side view, in order to show the exact aspect of the

"lozenge-shaped areas" on the living animal. The lateral lines of this portion are accurately represented.

Fig. 5. *Lepidosiren paradoxa* during respiration on the surface.

PLATE XXXVIII.

Figs. 6–13. Evolutions of the living *Lepidosiren paradoxa* in a small aquarium (from instantaneous photographs taken by myself). Figs. 6 and 7 show the Dipnoan in the act of respiration on the surface.



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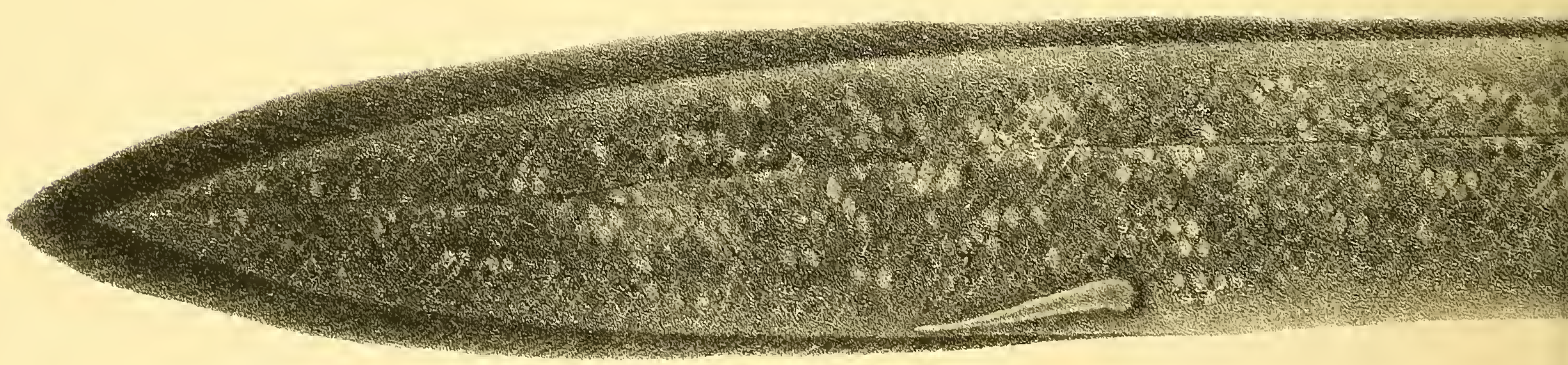
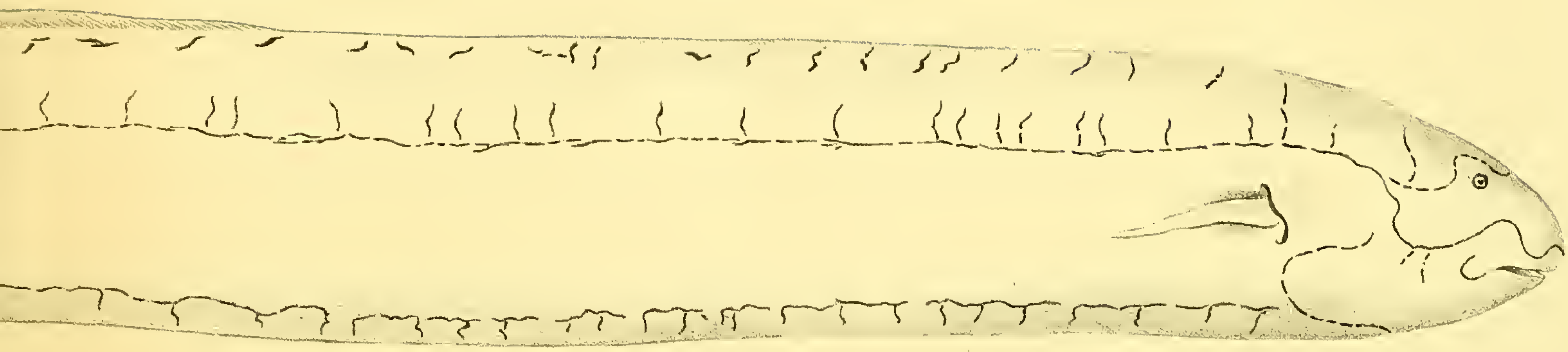


P. J. Smit lith

LEPIDO.



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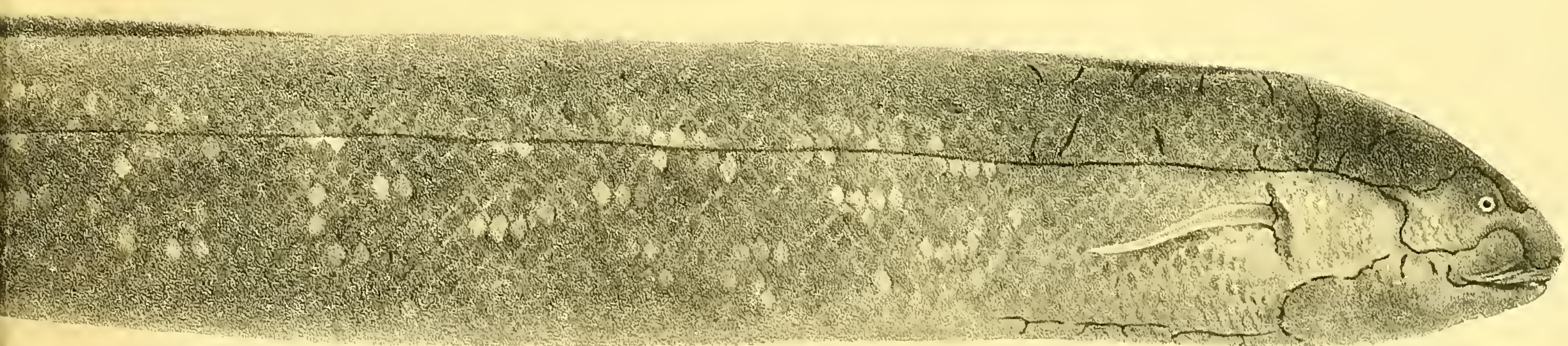

PARADOXA

Mintern Bros imp.

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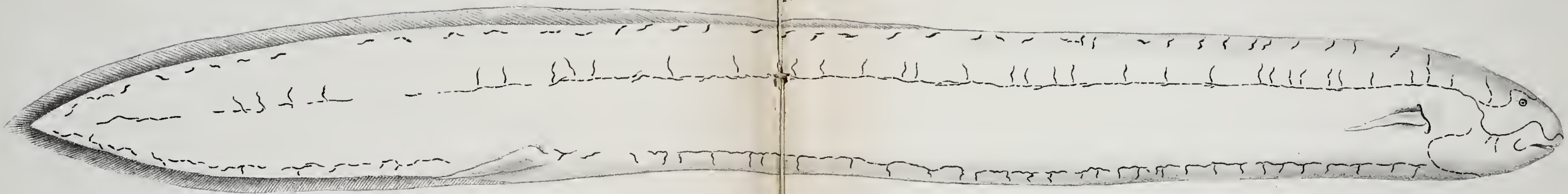

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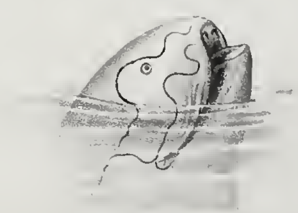

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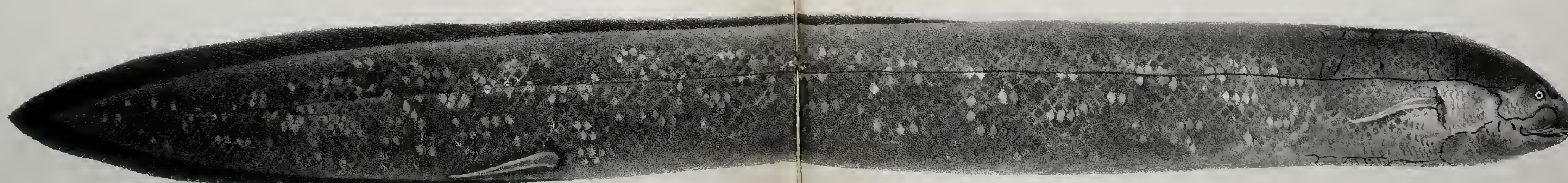
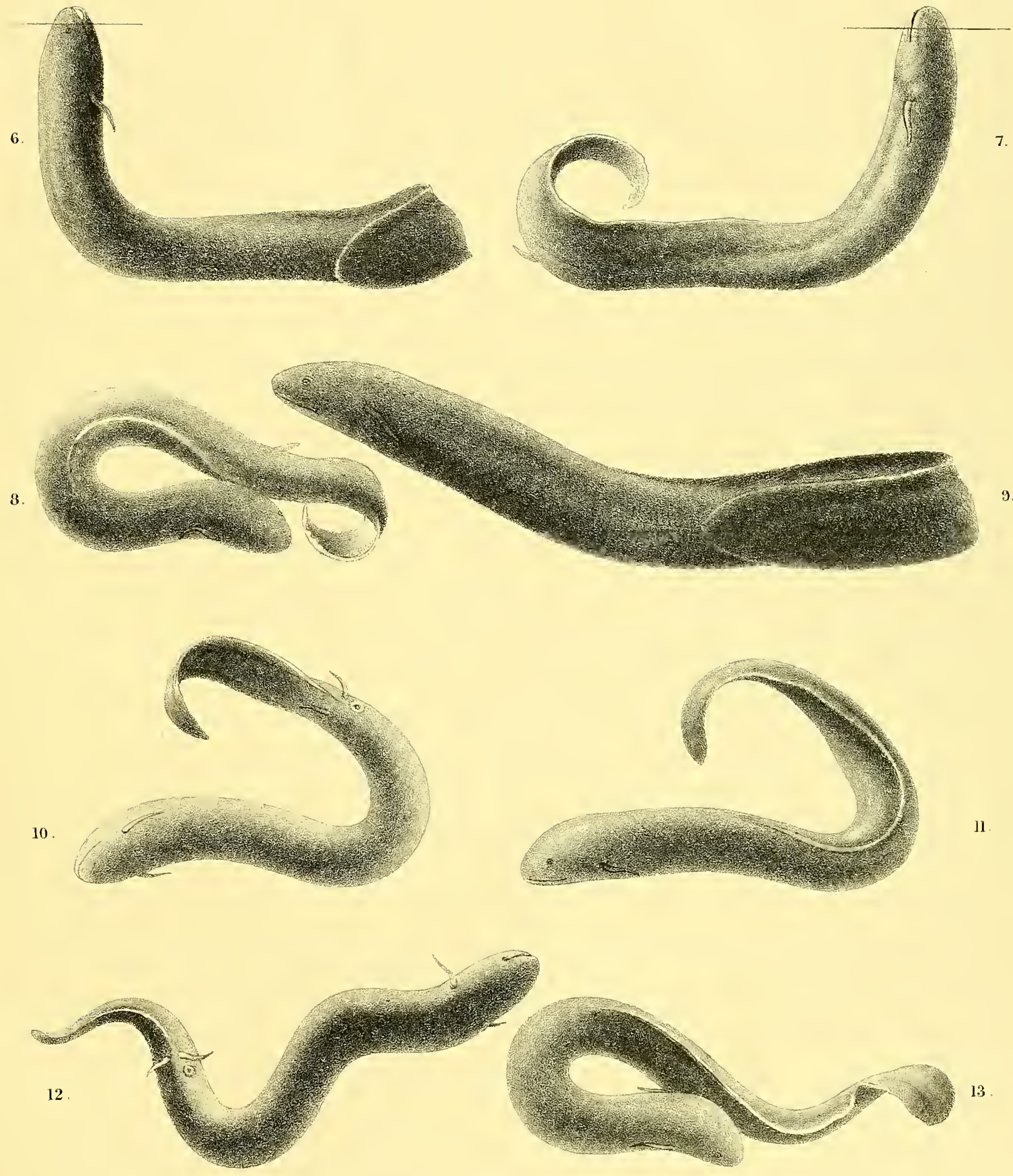


P. J. Smit lith.

LEPIDOSIREN PARADOXA.

Mintern Bros imp.



P.J. Smit lith.
Mintern Bros. imp.

EVOLUTIONS OF THE LIVING LEPIDOSIREN PARADOXA.

X. *On a Collection of Fishes from the Rio Jurua, Brazil.*

By G. A. Boulenger, *F.R.S.*, *F.Z.S.*

Received December 8th, 1897, read February 1st, 1898.

[Plates XXXIX.-XLII.]

The Collection dealt with in this paper, and acquired by the Trustees of the British Museum, was made, in July 1897, by Dr. J. Bach, of La Plata, in the Rio Jurua, an affluent of the Amazons, the Fish-fauna of which had not been previously explored. The list here given will fill up an important gap in our knowledge of the distribution of South-American Fishes. As many as nine new species were discovered by Dr. Bach in the comparatively short time he was able to devote to this exploration. No doubt a more extensive collection in the same river, which I believe it is his intention to make in the near future, if circumstances permit, would result in very numerous additions to this list, which evidently contains but a small proportion of the representatives of this important class of Vertebrates in the Rio Jurua.

SCIÆNIDÆ.

1. Sciæna amazonica Cast.

PLEURONECTIDÆ.

2. Solea fischeri Stdr.

3. Soleotalpa unicolor Gthr.

SILURIDÆ.

4. Sorubim lima Bl. Schn.

5. Platystoma juruense, sp. n. (Plate XXXIX.)

Upper jaw projecting very slightly beyond the lower. Bands of small, equal, villiform teeth in jaws and palate; vomerine band as broad as præmaxillary, single, notched in the middle, very narrowly separated from the much narrower palatine bands. Depth of body $5\frac{3}{5}$ times in total length, length of head $3\frac{1}{2}$ times. Head $1\frac{2}{3}$ as long as broad, its greatest width $1\frac{2}{5}$ width of mouth; fontanelle very small; eye extremely small, its diameter 4 times in interorbital width, a little nearer opercular border than end of snout; occipital process narrow, not reaching basal bone of dorsal spine; maxillary barbel extending nearly to extremity of ventral; inner mandibular barbel extending to middle of pectoral, outer to middle of ventral. Branchiostegal rays 11. Dorsal I 6, originating at equal distance from the end of the snout and the middle of the adipose fin; spine rather feeble, not serrated, $\frac{3}{4}$ length of head. Adipose fin as long as base of dorsal or anal. Pectoral not reaching ventral; spine feebly serrated, $\frac{3}{5}$ length of head. Anal 14. Caudal deeply forked, both lobes produced into long filaments. Yellowish brown, with 9 equidistant dark brown cross-bands; head dark brown above.

Total length 190 millim.

A single specimen.

6. Pimelodus maculatus Lacép.

7. Pimelodus modestus Gthr.

8. Centromochlus heckelii Filippi.

9. Cetopsis candiru Ag.

10. Oxydoras stenopeltis Kner.

11. Oxydoras trimaculatus, sp. n. (Plate XL. fig. 1.)

No teeth in the upper jaw. Depth of body $4\frac{1}{2}$ times in total length, length of head $3\frac{2}{3}$ times. Snout compressed, pointed, covered with skin; posterior nostril close to the eye; diameter of eye nearly equal to length of snout, 3 times in length of head, $1\frac{1}{2}$ interorbital width; cheeks and opercles covered with skin; skull striated above, granulate on the sides; fontanelle not produced as a groove posteriorly; bases of the six barbels united by the fold of the lower jaw; maxillary barbels branched, extending to base of pectoral spine; mandibular barbels short. Gill-cleft extending to below posterior border of eye. Humeral process striated, broader than and half as long as pectoral spine, obliquely truncated posteriorly. Pectoral spine as long as or slightly longer than dorsal, $1\frac{1}{4}$ length of head, extending to middle of ventral, very strongly serrated, especially on the inner side. Dorsal I 5; spine feebly serrated in front, strongly behind, equally distant from the end of the snout and the adipose fin. Adipose fin half as long as base of anal. Anal 13. No shields between the dorsal fins or on the belly. Lateral shields 31–32, nearly half as deep as the body, with serrated border and moderately strong hooked spines. Caudal deeply bifurcate. Yellowish; a black spot on the dorsal, involving the base of the spine and of the first three rays; a small, elongate, horizontal black spot at the base of each lobe of the caudal.

Total length 62 millim.

Three specimens.

Closely allied to *O. stenopeltis* Kner, which differs in the presence of an occipito-nuchal groove, the smaller eye, the presence of dorsal shields, and the absence of black spots on the fins.

12. Oxydoras trachyparia, n. sp. (Plate XL. fig. 2.)

No teeth in the upper jaw. Depth of body equal to length of head, $3\frac{2}{3}$ times in total length. Snout rounded, rugose except in the internarial space on each side; posterior nostril close to the eye; diameter of eye nearly equal to length of snout, rather more than $\frac{1}{3}$ length of head, equal to interorbital width; præopercle, subopercle, and opercle bony, rugose; cranial bones granulate; fontanelle not produced as a groove posteriorly; barbels not fringed (or, rather, maxillary barbels with a single basal barb), their bases united by a fold of the lower jaw; maxillary barbel not reaching opercular cleft; mandibular barbels short. Gill-cleft extending to below posterior border of eye. Humeral process granulate, broader than and half as long as pectoral spine, obliquely truncated posteriorly. Pectoral spine as long as dorsal, as long as head, strongly serrated on the inner side, rather feebly on the outer. Dorsal I 6; spine rather strongly serrated on both sides, a little nearer the adipose fin than the end of the snout. Adipose fin half as long as anal. Anal 13. No shields between the dorsal fins or on the belly. Lateral shields 33–34, nearly half as deep as the body, with serrated border and rather feeble hooked spines. Caudal deeply bifurcate. Pale olive above, whitish on the sides and beneath; fins white.

Total length 93 millim.

Two specimens.

This species, which further demonstrates the untenability of the genus *Hemidoras* as distinct from *Oxydoras*, stands nearest to *H. nattereri* Stdr., which differs in the fringed maxillary barbels, the more forward position of the posterior dorsal, and the smaller lateral shields.

13. Oxydoras bachi, sp. n. (Plate XL. fig. 3.)

No teeth in the upper jaw. Depth of body equal to length of head, $3\frac{2}{3}$ times in total length. Snout obtusely pointed, covered with skin; posterior nostril slightly nearer the eye than the anterior nostril; diameter of eye $\frac{1}{2}$ length of snout, $\frac{1}{4}$ length of head, $\frac{2}{3}$ interorbital width; cheek and opercle covered with skin; skull striated above, granulate on the sides; fontanelle not produced as a groove posteriorly; barbels not fringed, their bases united by a fold of the lower jaw; maxillary barbels just reaching opercular cleft; mandibular barbels short. Gill-cleft extending to below centre of eye. Humeral process striated, twice as broad and half as long as pectoral spine, obliquely truncated posteriorly. Pectoral spine longer than dorsal, a little longer than head, strongly serrated on both sides. Dorsal I 5; spine rather feebly serrated on both sides, a little shorter than the head, a little nearer the adipose fin than the end of the snout. Adipose fin not half as long as anal. Anal 11. No shields between the dorsal fins or on the belly. Lateral shields 30, $\frac{1}{3}$ depth of body, with serrated border and moderately strong hooked spines. Caudal deeply bifurcate, with rounded lobes. Pale olive above, white below; fins white.

Total length 90 millim.

A single specimen.

Closely allied to *O. brevis* Kner, which is distinguished by the longer dorsal spine, the narrower humeral process, the longer adipose dorsal, and the number (13–14) of anal rays.

14. Oxydoras elongatus, sp. n. (Plate XL. fig. 4.)

No teeth in the upper jaw. Depth of body 5 times in total length, length of head $3\frac{1}{2}$ times. Snout obtusely pointed, covered with skin; posterior nostril twice as distant from the anterior as from the eye; diameter of eye nearly twice in length of snout, $4\frac{1}{2}$ times in length of head, $1\frac{2}{5}$ in interorbital width; cheeks and opercles covered with skin; cranial bones granulate; fontanelle not produced as a groove posteriorly; barbels not branched, their bases united by the fold of the lower jaw; maxillary barbels extending to opercular cleft; mandibular barbels short. Gill-cleft extending to below posterior border of eye. Humeral process granulate and striated, twice as broad and half as long as pectoral spine, tapering to a point posteriorly. Pectoral spine as long as dorsal, nearly as long as head, extending to base of ventrals, strongly serrated on the inner side, more feebly on the outer. Dorsal I 6; spine feebly serrated in front, more strongly behind, equally distant from the end of the snout and the adipose fin. Adipose fin not half as long as base of anal. Anal 12. No shields between the dorsal fins or on the belly. Lateral shields 33, small, pluricuspid, with rather feeble hooked spines. Caudal deeply bifurcate. Olive above, white below; lateral shields and fins orange.

Total length 105 millim.

A single specimen.

Resembles most *O. humeralis* Kner, which has minute teeth in the upper jaw, and much larger lateral shields, their depth being about $\frac{2}{5}$ that of the body and their border bearing more numerous small spines.

15. Callichthys armatus Gthr.

16. Plecostomus emarginatus C. & V.

17. Chætostomus bachi, sp. n. (Plate XLI. fig. 1.)

About 16 teeth on each side in each jaw. Depth of body $4\frac{1}{2}$ times in total length, length of head 3 times. Head very slightly longer than broad, entirely rough with small spines; snout rounded; diameter of eye 6 times in length of head, 3 times in length of snout, $3\frac{1}{2}$ times in interorbital width; no postorbital groove; longest erectile præopercular spines as long as diameter of eye; barbel minute, hardly $\frac{1}{2}$ diameter of eye. Throat and belly covered with small rough shields. Dorsal I 7; first ray a little shorter than head. Pectoral spine as long as head, covered with small spines, reaching middle of ventral. Ventral I 5, $\frac{2}{3}$ length of head. Anal I 4. Caudal obliquely truncated, lower ray $1\frac{1}{2}$ as long as upper. Shields on body rough with small spinules, without keels, 26 in a longitudinal series. Pale olive, with rather indistinct, large, rounded, darker spots; caudal with dark cross-bars.

Total length 110 millim.

A single specimen.

Nearest allied to *Ch. ologospilus* Gthr., which differs in the forked caudal fin and the naked belly.

18. Hypoptopoma guentheri Blgr.

19. Loricaria rostrata Spix.

20. Loricaria filamentosa Stdr.

21. Loricaria acipenserina Kner.

22. Acestra gladius, sp. n. (Plate XLI. fig. 2.)

Length of head $3\frac{1}{2}$ times in total length. Snout exceedingly long and narrow, sword-shaped, the præ-oral part as long as the rest of the head, the length of the rostrum 14 times its least width; no bristles on the head; eye small, its diameter $3\frac{1}{2}$ times in interorbital width; upper angle of gill-opening nearer origin of dorsal than tip of snout. Dorsal I 6; first ray $\frac{1}{2}$ length of head. Pectoral not reaching ventral. Anal I 5; first ray $\frac{2}{5}$ length of head. Caudal deeply emarginate, with the outer rays produced into very long filaments. Body moderately depressed; 7 scutes between occiput and dorsal, the second and third more than twice as broad as long; 3 series of ventral scutes, 6 on each side between pectoral and ventral. Tail strongly depressed. 32 scutes along each side, those on the body forming two obscure keels coalescing a little behind the vertical of the anal. Uniform olive-grey; fins white, pectorals and ventrals with grey bars, caudal with a black band along the upper lobe.

Total length 215 millim.

Two specimens.

Closely allied to *A. oxyrhyncha* Kner. Distinguished by the absence of bristles on the snout and the broader dorsal scutes.

23. Stegophilus nemurus Gthr.

24. Vandellia cirrhosa C. & V.

See remarks in P. Z. S. 1897, pp. 901 and 902.

The following is a description of the four specimens in Dr. Bach's collection:—

Depth of body 7 to 10 times in total length, length of head 8 to 10 times. Head much depressed, nearly as long as broad; snout rounded, as long as the diameter of the eye, which is $3\frac{1}{2}$ times in length of head; interorbital space one half to two thirds diameter of eye; mouth inferior; posterior nostrils between the eyes; maxillary barbel nearly half length of head; opercle and præopercle each with a bundle of erectile spines. Body slightly compressed. Pectoral as long as head *minus* snout. Dorsal 9, in the posterior fourth of the body. Anal 8–9, originating below middle of dorsal. Caudal truncated. Caudal peduncle twice as long as deep. Uniform white.

Total length 62 millim.

CHARACINIDÆ.

25. Curimatus dobula Gthr.

26. Curimatus alburnus M. & T.

27. Tetragonopterus multiradiatus Stdr.

28. Tetragonopterus orbicularis C. & V.

29. Tetragonopterus maculatus L.

30. Chirodon alburnus Gthr.

31. Chalcinus nematurus Kner.

32. Gastropelecus stellatus Kner.

33. Gastropelecus pectorosus Garm.

34. Anacyrtus knerii Stdr.

35. Anacyrtus limæsquamis Cope.

36. Anacyrtus affinis Gthr.

37. Cynodon pectoralis Gthr.

38. Cynodon vulpinus Spix.

39. Serrasalmo piraya Cuv.

40. Myletes albiscopus Cope.

CLUPEIDÆ.

41. Cetengraulis juruensis, sp. n. (Plate XLI. fig. 3.)

Depth of body 5 times in total length, length of head $3\frac{1}{2}$ times. Snout very strongly projecting, a little shorter than diameter of eye, which is $5\frac{1}{2}$ times in length of head and $1\frac{1}{3}$ in interorbital width; jaws toothless; maxillary extending to articulation of mandible; cleft of mouth nearly $\frac{1}{2}$ length of head. Gill-rakers long, finely denticulate, about 40 on lower part of anterior arch. Dorsal 13, originating at equal distance from end of the snout and base of caudal. Pectoral a little more than $\frac{1}{2}$ length of head, extending a little beyond base of ventral. Anal 23, originating below posterior rays of dorsal. Caudal peduncle twice as long as deep. Caudal deeply forked. Scales 38 in a longitudinal series, 10 in a transverse series. Olive above, silvery on the sides and below; snout blackish above; fins pale orange, caudal rays blackish at the end.

Total length 140 millim.

A single specimen.

This fish, the first freshwater representative of the genus *Cetengraulis*, is nearest to *C. edentulus* Cuv., which differs in the deeper body.

42. Pristigaster cayanus Cuv.

OSTEOGLOSSIDÆ.

43. Arapaima gigas Cuv.

Dr. Bach has shown me the photograph of a large specimen taken by him.

GYMNOTIDÆ.

44. Sternarchus nattereri Stdr.

45. Sternarchus macrolepis Stdr.

46. Sternarchus oxyrhynchus M. & T.

47. Sternarchus tamandua, sp. n. (Plate XLII.)

Snout produced into a long, nearly straight tube, the length of which equals 4 times its least depth; mouth very small, with several rows of minute teeth; eye extremely minute, a little nearer the opercular cleft than the end of the snout. Depth of body half length of head. A very strongly developed adipose fin runs along the whole length of the body, from which it is easily detached. Pectoral $\frac{1}{3}$ length of head. Vent under the chin. Anal 220, originating a little in advance of gill-opening, longest rays rather more than $\frac{1}{2}$ depth of body. Scales very small, larger on the upper half of the body than on the lower; lat. l. 85. The tail, in the unique specimen, has been injured during life, and bears a short, regenerated caudal fin. Uniform yellowish white.

Total length 400 millim.

This fish is very rare in the Jurua River, and but a single specimen could be procured by Dr. Bach.

It is a most remarkable form, differing very considerably from any of the species with which we are acquainted.

48. Rhamphichthys blochii Kaup.

49. Steatogenys elegans Stdr.

The presence of a filament of adipose tissue, similar to the dorsal fin of *Sternarchus*, in a groove along each side of the mental region, to which attention has been drawn by Steindachner in describing his *Rhamphichthys elegans*, warrants, in my opinion, the establishment of a new genus, for which I propose the name *Steatogenys.*

50. Sternopygus virescens Val.

TETRODONTIDÆ.

51. Tetrodon psittacus Bl. Schn.

EXPLANATION OF THE PLATES.

PLATE XXXIX.

Platystoma juruense, p. 421, with upper and lower views of head and outline of præmaxillary and palatal teeth.

PLATE XL.

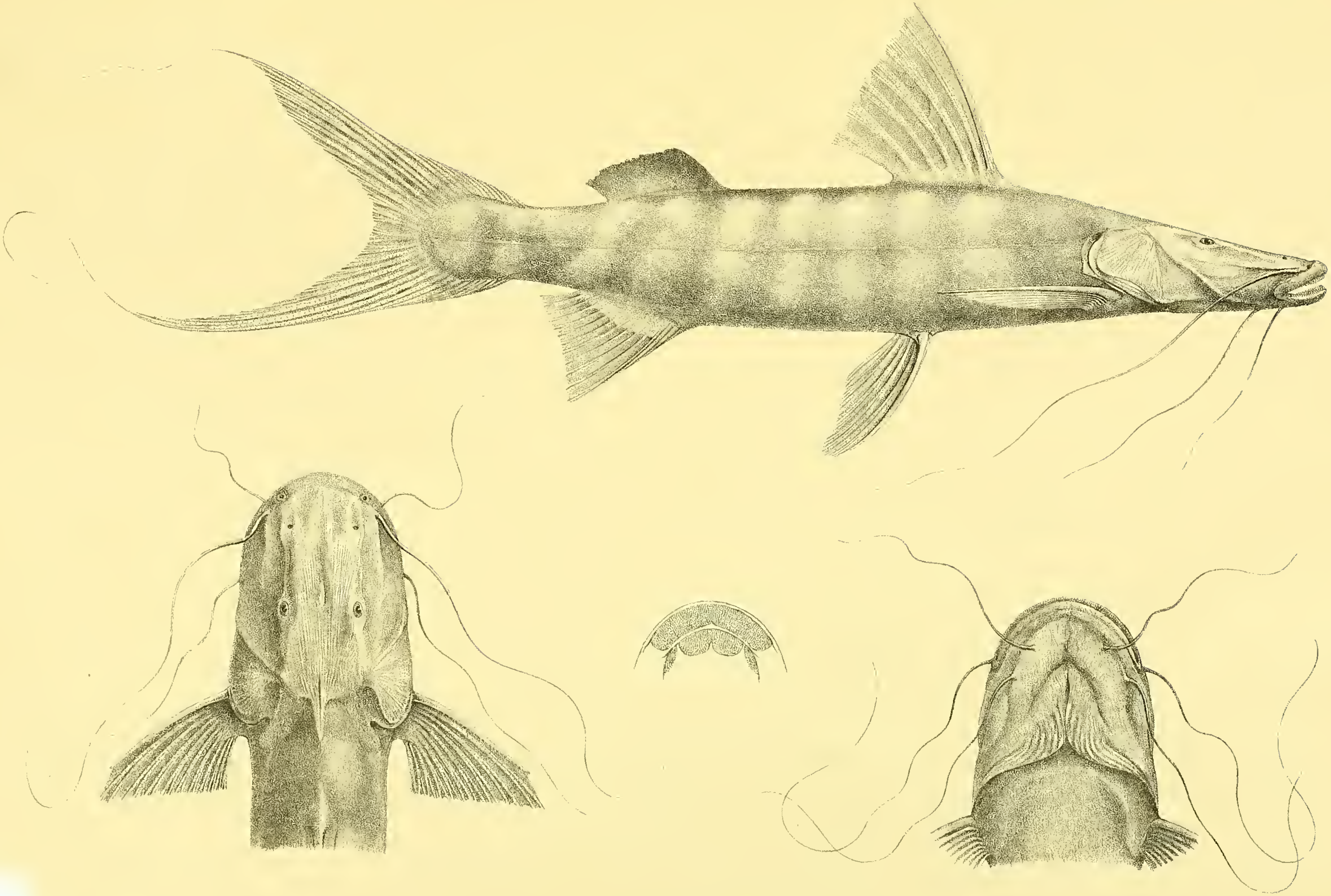
Fig. 1. *Oxydoras trimaculatus*, p. 422.
Fig. 2. *Oxydoras trachyparia*, p. 423.
Fig. 3. *Oxydoras bachi*, p. 423.
Fig. 4. *Oxydoras elongatus*, p. 424.

PLATE XLI.

Fig. 1. *Chætostomus bachi*, p. 425.
Fig. 2. *Acestra gladius*, p. 425.
Fig. 3. *Cetengraulis juruensis*, p. 427.

PLATE XLII.

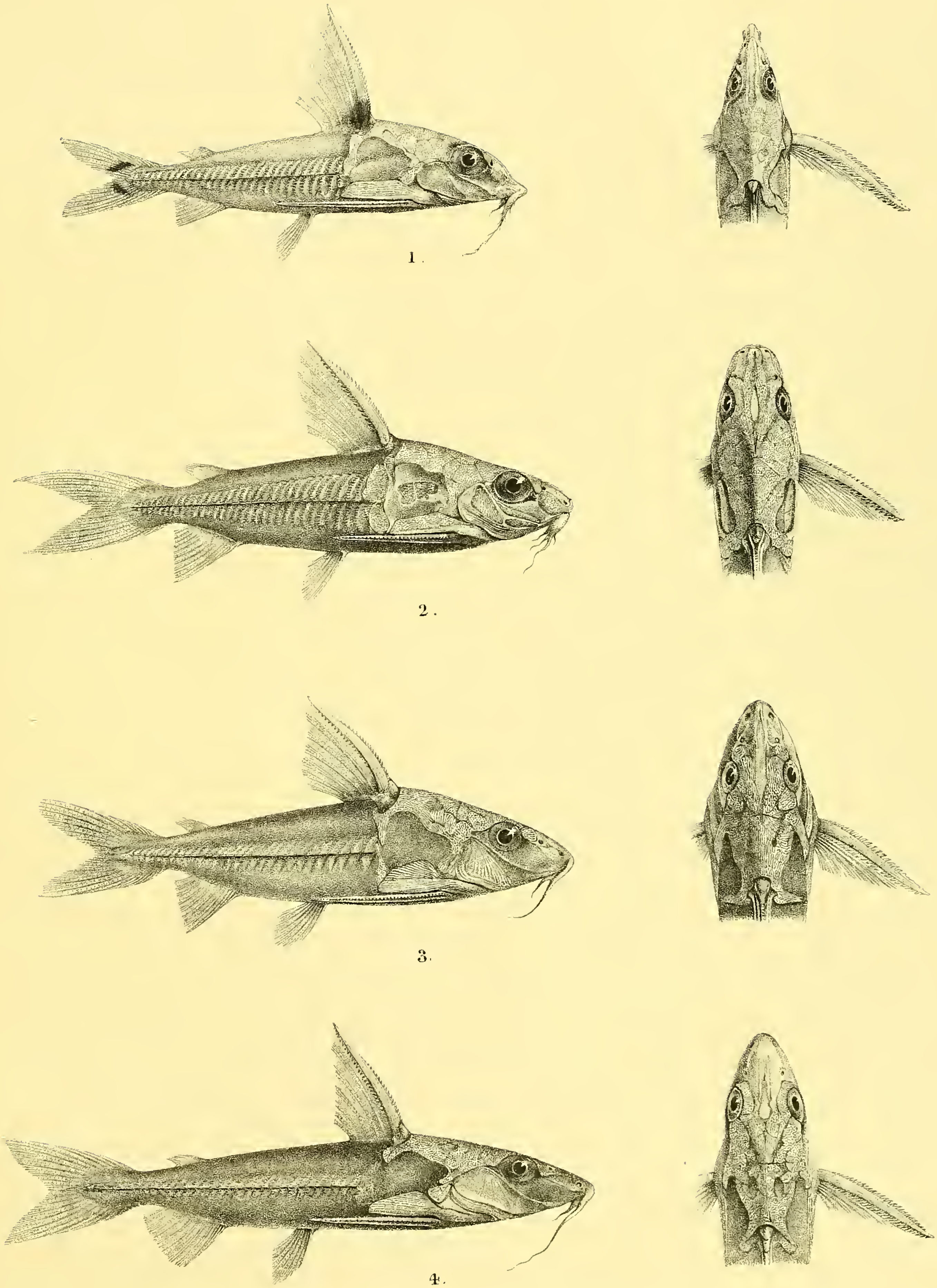
Sternarchus tamandua, p. 427, with upper view of head.



J. Green del. et lith.

PLATYSTOMA JURUENSE.

Mintern Bros. imp.



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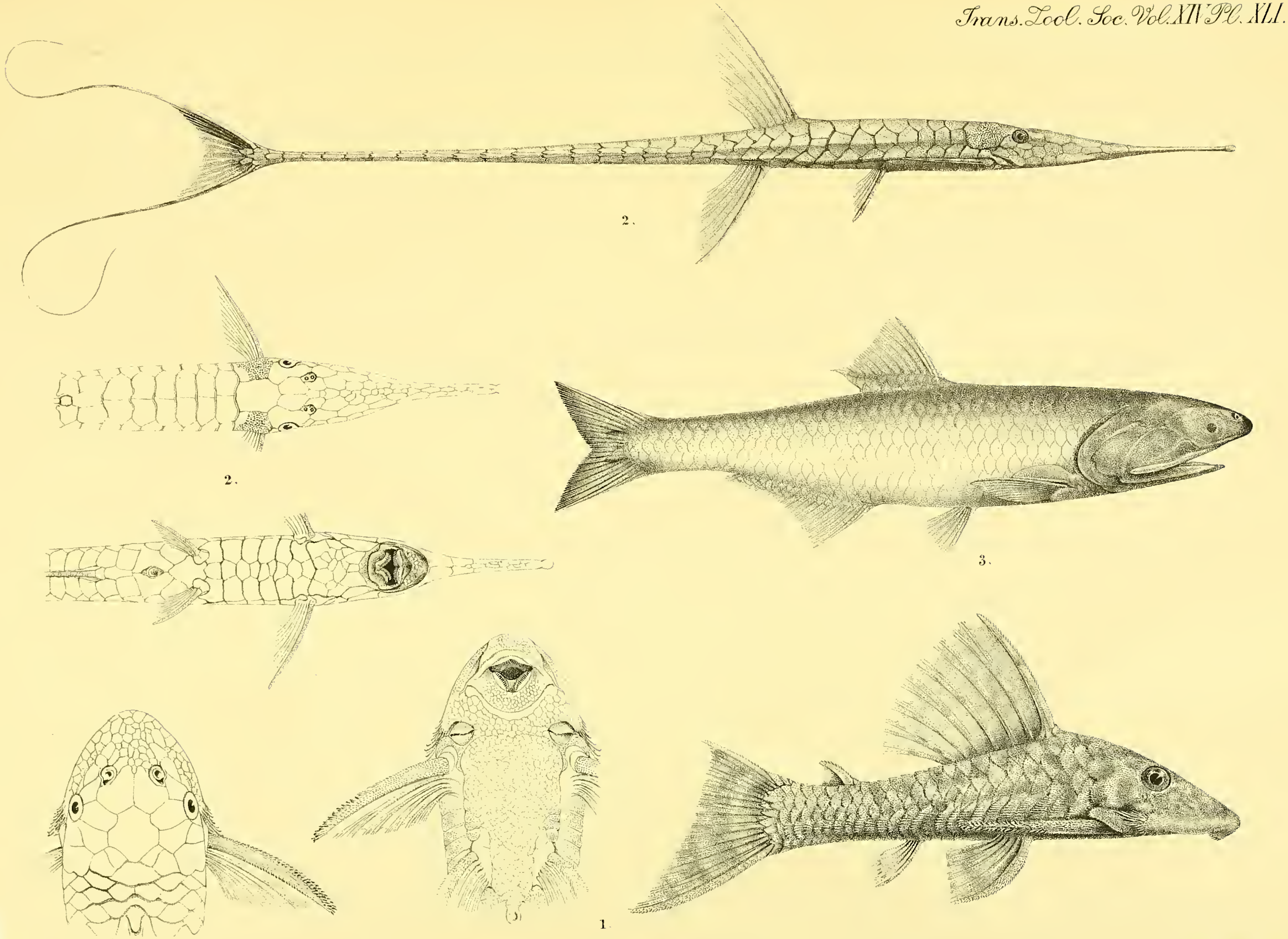
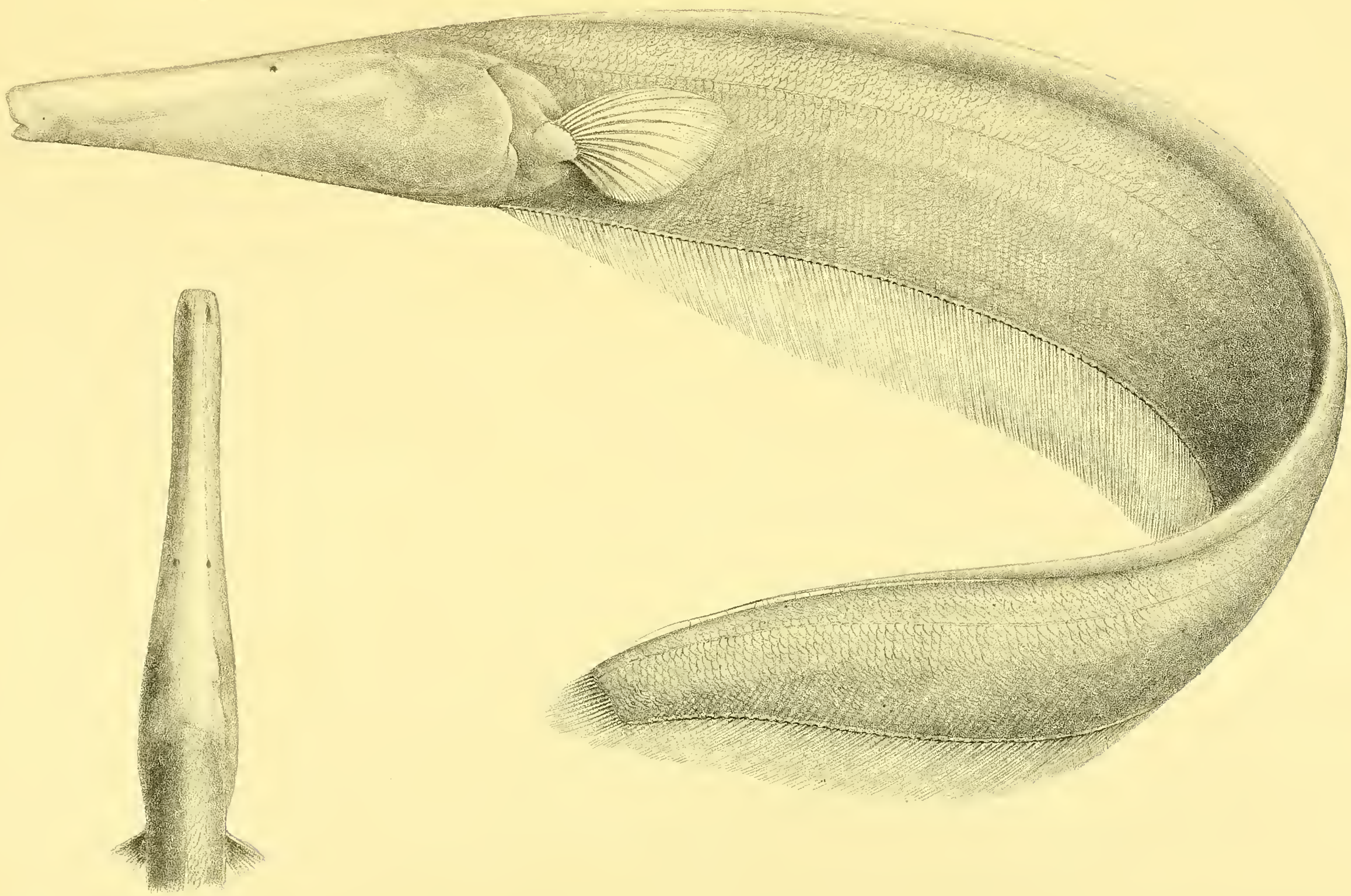


J. Green del. et lith.

Mintern Bros. imp.

1. CHÆTOSTOMUS BACHI. 2. ACESTRA GLADIUS. 3. CETENGRAULIS JURUENSIS



J. Green del et lith.

STERNARCHUS TAMANDUA.

Mintern Bros. imp.

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Continued on page 3 of Wrapper.

XI. *On new or imperfectly-known Species of* Ostracoda, *chiefly from New Zealand.*

By G. Stewardson Brady, *M.D., LL.D., D.Sc., F.R.S.*

Received February 8, 1898, read March 15, 1898.

[Plates XLIII.-XLVII.]

For the opportunity of describing the following species of Ostracoda I am indebted to Mr. G. M. Thomson of Dunedin, New Zealand, and to Dr. Meinert and Dr. H. J. Hansen of the Museum of Zoology, Copenhagen. Mr. Thomson's specimens are the result of his own labours in the pursuit of natural history at Dunedin, Brighton, and other places in New Zealand; those sent to me from Copenhagen belong to the museum of that city, and were dredged in Lyttelton Harbour and Akaroa Harbour by Mr. H. Suter. One very interesting species (*Eupathistoma natans*) is from an altogether different geographical area, having been taken in the Bay of Bengal; for specimens of this species I have to thank my friend Mr. I. C. Thompson, F.L.S., of Liverpool.

Though, except in the case of *Eupathistoma*, there is nothing very strikingly new in the morphology of the species here noticed, there are many points of interest as showing deviations from the usual types of structure; for example, the setose armature of the first pair of antennæ in *Trachyleberis scabrocuneata*, the peculiar hairy cushions covering the valves of *Sarsiella*, the adventitious concretionary nodules found on the limbs of *Philomedes sculpta*, and the shell-glands and ducts of *Philomedes flexilis.*

The species described or noticed in the present paper are as follows:—

Loxoconcha punctata, Thomson, Otago, Brighton: p. 441.
Xestoleberis luxata, sp. nov., Lyttelton Harbour: p. 441.
„ *olivacea*, sp. nov., Brighton: p. 442.
„ *compressa*, sp. nov., Brighton: p. 442.
Cythere brunnea, sp. nov., Lyttelton Harbour; p. 442.
„ *innominata*, nom. nov., Brighton: p. 443.
„ *truncula*, sp. nov., Lyttelton Harbour: p. 444.
Trachyleberis scabrocuneata, G. S. Brady, Lyttelton Harbour: p. 444.
Cytherideis novæ-zealandiæ, sp. nov., Lyttelton Harbour: p. 446.
Cytherella eburnea, sp. nov., Lyttelton Harbour: p. 447.

In addition to these, there have been described the following New-Zealand species which are unknown to me:—

Cypris novæ-zealandiæ, Baird.
„ *ciliata*, Thomson.
„ *littoralis*, Thomson.
Cythere atra, Thomson.

The memoirs quoted in this paper are the following. They are indicated in the synonymy by the numbers attached to them in the list:—

Baird, W. (1).—Descriptions of several New Species of Entomostraea. (Proceedings of the Zoological Society of London, part xviii. Annulosa, plates xvii, xviii.) 1850.

Brady, G. S. (1).—A Monograph of the recent British Ostracoda. (Transactions of the Linnean Society, vol. xxvi.) 1868.

„ (2).—The Voyage of H.M.S. 'Challenger.' Report on the Ostracoda. 1880.

„ (3).—Notes on Entomostraca collected by Mr. A. Haly in Ceylon. (Journal of the Linnean Society, Zoology, vol. xix.) 1885.

„ (4).—On Ostracoda collected by H. B. Brady, Esq., LL.D., F.R.S., in the South-Sea Islands. (Transactions of the Royal Society of Edinburgh, vol. xxxv. part ii.) 1888.

„ (5).—A Supplementary Report on the Crustaceans of the group Myodocopa obtained during the 'Challenger' Expedition, with Notes on other new or imperfectly-known species. (Transactions of the Zoological Society of London, vol. xiv. part iii.) 1897.

Brady, G. S., & Norman, A. M. (1).—A Monograph of the Marine and Fresh-water Ostracoda of the North Atlantic and of North-west Europe.—Part ii. Myodocopa, Cladocopa, and Platycopa. (Transactions of the Royal Dublin Society, vol. v., ser. ii.) 1896.

Dana, J. D. (1).—Crustacea of the United States Exploring Expedition. 1852.

Jones, T. R. (1).—A Monograph of the Tertiary Entomostraca of England. (Palæontographical Society.) 1856.

Müller, G. W. (1).—Die Ostracoden des Golfes von Neapel und der angrenzenden Meeres-abschnitte. 1894.

NORMAN, A. M. (1).—Last Report on Dredging among the Shetland Isles. (British Association Reports.) 1868.

PHILIPPI, A. (1).—Zoologische Bemerkungen in Arch. Naturg. 6 Jahrg. 1840.

SARS, G. O. (1).—Nye Bidrag til Kundskaben om Middelhavets Invertebratfauna. (Archiv for Mathematik og Naturvidenskab.) 1887.

„ (2).—On some Freshwater Ostracoda and Copepoda raised from dried Australian Mud. (Christiania Videnskabs-Selskabs Forhandlinger, no. 8.) 1889.

THOMSON, G. M. (1).—On the New Zealand Entomostraca. (Transactions of the New Zealand Institute, vol. xi.) 1878.

Genus ASTEROPE Philippi.

Asterope Philippi (1), 1840; G. O. Sars (1), p. 11; Brady & Norman (1), p. 629.
Cylindroleberis Brady (1), p. 465; G. W. Müller (1), p. 216.
Cypridina Auctorum.

ASTEROPE AUSTRALIS Brady. (Plate XLIII. figs. 1–8.)

Asterope australis Brady (4), p. 515, pl. iv. figs. 1, 2.

Shell of the *male*, seen from the side (fig. 1), ovate, height equal to more than half the length, anterior extremity evenly rounded, with a short, wide beak and a rather wide but shallow antennal notch; posterior extremity evenly rounded; dorsal margin very slightly but evenly arcuate, ventral almost straight. Seen from above (fig. 2), the outline is elongate-ovate, widest in the middle, much more than twice as long as broad; extremities broadly rounded, lateral margins gently and evenly curved. Surface of the shell smooth, destitute of hairs or sculpture, excepting at the posterior extremity, which bears two tufts of very fine hairs. Secondary branch of the antenna (fig. 5) with a large and very crooked terminal unguis, which bears near its base a very long and stout seta, the last joint (dactylon) having two much shorter setæ. Post-abdomen (fig. 8) armed, on each lamina, with a series of seven ungues, which progressively increase in size and amount of curvature from the first to the last, the larger of the series very finely ciliated on the concave margin. Length of the shell 1·6 mm. Colour (of spirit-specimens) yellowish white; the black eye-spot very conspicuous.

The shell of the *female* (figs. 3, 4) is somewhat smaller than that of the male, and seen laterally is higher behind than in front; seen from above it is subacuminate in front and narrowly rounded behind; the posterior extremity has no setose tufts. The secondary branch of the antenna consists of a simple cylindrical one-jointed stem, which ends in a single long seta (fig. 6). Length 1·4 mm.

Hab. Males, taken abundantly in the surface-net, Otago Harbour; a single female specimen in a dredging from Akaroa Harbour, depth 6 fathoms, and Lyttelton Harbour, 1–5 fathoms. The Otago gathering consisted almost entirely of males, the lesser swimming-power of the females doubtless keeping most of them at or near the bottom. The shell in most specimens is flexible and submembranaceous, but occasionally hard and calcareous, the soft ones probably imperfectly matured after moulting. The types of the species were described by me from specimens taken amongst the South-Sea Islands, and do not differ from the New Zealand examples except in being rather larger.

Asterope quadrata, sp. n. (Plate XLV. figs. 17–21.)

In general appearance this is very like *A. australis*, but it is somewhat smaller, and seen dorsally has much more obtuse extremities, having almost parallel lateral margins; the inner antennal branch of the male (fig. 19) is very broadly clawed, and the larger ungues of the post-abdominal laminæ in the female (fig. 21) are not only finely pectinated, but bear a few longer interspersed setæ—about five on the last and three on the penultimate unguis; in the male, however, of which only one mutilated specimen was seen, there is only a simple pectination. Shell extremely thin and membranous. Length 1·3 mm.

Hab. Lyttelton Harbour, dredged in a depth of 1–5 fathoms.

Asterope grisea, sp. n. (Plate XLIII. figs. 9–14.)

Shell of the *female*, seen from the side, elongated, elliptical (fig. 9), height scarcely as much as half the length, and nearly equal throughout; extremities evenly rounded, the posterior rather the narrower of the two; dorsal and ventral margins evenly and very slightly curvate. Seen from above (fig. 10) the outline is narrowly ovate, the width equal to two-fifths of the length, slightly tapered towards the front, broader and rounded off behind. Shell chitinous, flexible, perfectly smooth, colour greyish. Length 2·8 mm. Frontal tentacle cylindrical, its terminal joint slightly dilated at the base; secondary branch of the antenna (fig. 12) small, simple, with a small apical seta; spines of the post-abdominal laminæ (fig. 14) long, slender, very delicately ciliated. Claw of the secondary antennal branch in the male (fig. 11) much thickened and dilated at its base.

Hab. Akaroa Harbour; many specimens dredged in a depth of 6 fathoms. Only one male could be found, and this was a good deal damaged; its only marked peculiarity, so far as could be made out, was the extreme length of the antennular setæ.

Genus Cyclasterope G. S. Brady.

Cyclasterope Brady (5), p. 85.

Cyclasterope ovulum, sp. n. (Plate XLIII. figs. 24–30.)

Shell of the *female* (figs. 24, 25), seen from the side, nearly circular, slightly narrowed and produced in front, antennal notch small and shallow; seen from above, ovate, widest in the middle, twice as long as broad, subacuminate in front, narrowly rounded behind. Shell dense and calcareous, smooth, finely punctate. Length 8 mm., height 6·6 mm.

Frontal tentacle (fig. 27) three-jointed, the median joint very short and constricted at the base, distal joint conical, with a much-attenuated apex; secondary branch of the antenna (fig. 26) three-jointed, cylindrical, ending in a long seta, the two basal joints bearing a few marginal hairs; teeth of the bifid extremity of the vermiform limb (fig. 28) corrugated, their apices formed by a small spine, which is overhung by a knobbed columnar process: abdomen fringed distally with closely-set hairs; post-abdominal laminæ (fig. 29) bearing three very stout, blunt, and strongly curved distal ungues, which bear two marginal rows of closely-set lancet-shaped spinules (fig. 30); in front of the ungues is a series of about nine long ringed and pinnated setæ. *Male* unknown.

Hab. Rock-pools, Stewart Island.

This fine species closely resembles in external aspect *C. orbicularis*, of which a single specimen from Valparaiso was described by me (*loc. cit.*), but *C. ovulum* is much larger, and differs in many points as regards the soft parts.

CYCLASTEROPE TENERA, sp. n. (Plate XLIV. figs. 27–29.)

Female. Shell, seen from the side (fig. 27), almost circular, slightly narrower towards the front, length about one-seventh greater than the height, very thin, membranous, and slightly wrinkled; anterior and inferior margins beset with distant, rigid hairs. Secondary antennal branch (fig. 28) simple, three-jointed, with a long apical seta; falcate process of the mandible bearing numerous marginal spines and teeth; the post-abdominal claws are three in number (fig. 29), very unequal in length, and armed with closely-set short marginal spinules. Length 1·5 mm.

Hab. Lyttelton Harbour, 1–5 fathoms. One specimen only.

CYCLASTEROPE ZEALANDICA (Baird). (Plate XLIII. figs. 15–23.)

Cypridina zealandica Baird (1), p. 257, pl. xvii. figs. 11–13.

Shell of the *female* (figs. 15, 16), seen from the side, very broadly ovate, length about one-fourth greater than the height, the outline forming a perfect oval except at the antennal notch, which is small and shallow; seen from above, ovate, compressed, greatest width in the middle, and equal to half the length; extremities rather wide and evenly rounded, slightly emarginate at the contact of the valves. Shell calcareous, finely punctate and, towards the anterior extremity, faintly wrinkled in a transverse direction (fig. 23). Length 5 mm., height 4 mm. Secondary branch of the antenna (fig. 19) cylindrical, three-jointed, geniculated, the first joint bearing a tuft of marginal setæ near its extremity, second joint with three small marginal setæ externally and a long seta on its internal distal angle, last joint obliquely truncate and mucronate at its apex; ungues of the post-abdominal laminæ (fig. 21) stout, subequal, and strongly curved, bordered with rows of lanceolate spinules (fig. 22), which, towards the bases of the ungues, have also intermediate smaller spinules; in front of the ungues a row of about ten flexuous ringed setæ, which gradually decrease in length until they give place to a fringe of densely-set fine hairs. Length 5 mm., height 4 mm.

Shell of the *male* (fig. 17), seen from the side, subovate, somewhat narrowed towards the front, greatest height situated in the middle and equal to nearly three-fourths of the length; anterior extremity rounded, beak sharp and curved, antennal notch wide; posterior extremity subtruncate, rounded off below, abruptly angulated at its junction with the dorsal margin, which is almost straight for the greater part of its length, but is well rounded in front, and slopes steeply behind to join the posterior border; surface minutely and closely punctate, fringed at the two extremities with long, fine hairs. Length 6·25 mm., height 4·5 mm. Terminal joint of the secondary antennal branch (fig. 18) forming a strong claw, very stout and constricted near the middle; penultimate joint armed on the opposing margin with a fascicle of very thick, rigid setæ.

Hab. Dredged in Lyttelton Harbour, 2–5 fathoms. Only few specimens, the males badly mauled, and their limbs clogged with mud so as to be viewed with difficulty.

Dr. Baird's figures and description agree well with these specimens, and his notice of the wrinkled shell-surface confirms the impression that this is the form to which he refers.

Genus Philomedes Lilljeborg.

Philomedes agilis Thomson.

Philomedes agilis Thomson (1), p. 257, pl. xi. figs. C. 8 *a–e*, D. 1 *a–g*; G. S. Brady (5), p. 90, pl. xvi. figs. 13–16.

Taken in the surface-net, Otago Harbour. Males only.

Philomedes sculpta, sp. n. (Plate XLIV. figs. 15–20.)

Shell of the *male* (fig. 15), seen from the side, elongated, subrhomboidal, highest in the middle and narrowing gradually to the extremities, height equal to half the length; anterior extremity produced to a subacute point, notch obsolete; posterior extremity produced below the middle into a wide, wedge-shaped, obtusely-pointed beak, above which it is rather deeply sinuated; dorsal margin moderately and evenly curved throughout its whole length, ventral almost straight in the middle and bent sharply upward towards each extremity. Seen from above (fig. 16), the outline is compressed, subovate, greatest width in front of the middle, and equal to less than half the length; anterior extremity wide, subtruncate, mucronate in the middle, and emarginate towards the sides; posterior narrower, bluntly pointed, lateral margins convex and irregularly sinuous. Surface of the shell undulated, covered with irregular, small, polygonal pittings, and raised into two principal longitudinal ribs which join near the front, forming a single short median ridge, but remain separate behind, running into a marginal ridge; the spaces between, and less conspicuously outside of, these ribs are marked with smaller, curved, anastomosing ridges; the anterior margin round about the antennal notch (fig. 17) has a thin laminated flange marked by delicate transverse lines. Secondary branch of the antenna (fig. 18) geniculated between the second and third joints; first joint very short, bearing two short marginal setæ, second and third very long and nearly equal, second with three long setæ on its outer margin, third rugose with a number of wart-like protuberances on its opposing surface, and bearing a single seta near the distal and proximal ends respectively; extremity blunt and slightly furrowed longitudinally; post-abdominal laminæ (fig. 19) armed with three principal ungues and seven smaller ones, the first of the smaller series situated between the second and third larger ones. Length 2·6 mm.

Hab. Taken abundantly in the surface-net, Otago Harbour. Males only.

An interesting peculiarity of this species consists in its tendency to develop calcareous concretions on the setæ of the antennæ and antennules, and sometimes in other situations. These concretions are extremely dense and dark-coloured, and when broken present a radiated crystalline appearance. Treated with a weak acid, they are seen under the microscope to effervesce freely, and in time to disappear almost entirely, so that they are probably composed chiefly or altogether of calcium carbonate. Two or more setæ are sometimes immovably soldered together by a concretion of this kind, which must, one would think, materially interfere with the locomotion of the animal. Though *P. sculpta* is especially liable to these concretions, they are sometimes met with in other species; in *P. sculpta*, however, full-grown specimens seem rarely to be free from them. Though in this gathering the majority of examples had shells of a flexible or membranous kind, some few were distinctly dense and calcareous. These differences may perhaps depend upon the lapse of time in relation to exuviation; but I am disposed to think that in the case of flexible shells there is often a larger development of the concretions above referred to, in which case it may be allowable to look upon them as pathological products which have withdrawn the lime otherwise available for shell-formation. A broken fragment of one of the nodules is shown in fig. 20. It is just possible that a species described by me from one dried shell under the name *Streptoleberis crenulata* may be identical with *P. sculpta*, but this I cannot decide with any certainty (see 5, p. 515, pl. iv. figs. 3, 4).

PHILOMEDES FLEXILIS, sp. n. (Pl. XLIV. figs. 1–14; Plate XLV. figs. 15, 16.)

Shell of the *female* (Pl. XLIV. figs. 1, 2; Pl. XLV. figs. 15, 16), seen from the side, irregularly lozenge-shaped, widest in the middle, greatest width equal to about two-thirds of the length; anterior extremity somewhat produced and narrowed, beak inconspicuous, antennal notch shallow; posterior extremity narrowed, running out below the middle into a wide, blunt, and massive tuberosity; dorsal margins boldly arched (in old specimens rugged and ending in a tuberous projection); ventral margin moderately convex. Seen from above, the outline is irregularly polygonal, with wide extremities and subparallel sides, the laterally-produced rostrum and the posterior beak forming large terminal protuberances. Except in old specimens (Pl. XLIV. figs. 1, 2) the shell is flexible and membranaceous, and covered with rounded or subangular pittings (fig. 12); each valve bears three flexuous longitudinal ribs which, viewed dorsally, stand out very conspicuously as irregular translucent flanges on each lateral margin; rostrum and adjoining shell-margin bordered with a thin, semitransparent, radially-striated lamina; posterior extremity fringed with a few very small recurved hairs. Just within the anterior margin, and below the antennal sinus, a small patch of the shell is marked with a series of about ten parallel striæ (fig. 13). Frontal tentacle (fig. 4) slender, filiform, sharply pointed, its median portion divided into about sixteen very small joints, base bulbously dilated. Secondary branch of the antenna (fig. 6) composed of a single (?) curved, sickle-shaped joint, which bears on its outer edge, near the base, three short setæ, near the middle one extremely long plumose seta, and at the blunt apex a short flexuous seta. The setæ of the swimming-branch, in small specimens (fig. 7), are short and non-plumose, but in fully-grown ones longer and plumose. The principal chewing segment of the second maxilla (fig. 8) is in the form of a blunt, broad-ended lobe, with one broad tooth-like process at its inner end, and two similar but larger processes at the outer end; these are sometimes, though not always, of a deep purple colour; spines of the vermiform foot (fig. 9) with very thick peduncles; post-abdominal ungues about ten in number, progressively increasing in length from the first, which is extremely small (fig. 10); the seventh, ninth, and tenth ungues are stout, and bear rather stout and short marginal teeth; the eighth and all the other ungues are more slender and only feebly ciliated. Eyes usually wanting, but sometimes well developed, deeply pigmented and distinctly visible through the shell (fig. 11). On the inner surface of the rostrum lies a convoluted "shell-gland" which seems to communicate with a nipple-like tubular prominence opening near the margin of the shell (fig. 14). Length 2–2·3 mm. The shell of the *male* is much narrower and more elongate (fig. 3), but in other respects agrees with that of the female; the eyes are well developed (fig. 4), and the secondary antennal branch (fig. 5) is very similar to that of *P. sculpta*.

Hab. The specimens from which the description is drawn up were taken numerously by the dredge in depths of 1–5 fathoms in Lyttelton Harbour. Others which I refer to the same species occurred in a dredging from 6 fathoms in Akaroa Harbour. These, however, differ slightly from the types in having generally an almost smooth shell with little or no trace of ribs, though in not a few specimens the ribs are quite apparent, and are in character like those of the types.

The great majority of specimens possess a quite flexible and membranous shell, but two or three (probably very old individuals) occurred in which it had become dense and calcareous, the various processes and ridges being at the same time strongly developed (figs. 1, 2). In some examples, which I suppose to be immature, the antennal setæ are very short and non-plumose, like those of G. W. Müller's genus *Pseudophilomedes*, but in most cases they are long and strongly plumed. A peculiarity which I do not understand is the presence in a very few female specimens of well-developed eyes, organs of which in most cases I have been able to find no trace; another unintelligible point is the red coloration, in some specimens, of the teeth of the second maxilla. Of course it is possible that two distinct species may be mixed up in my description, though I scarcely think that is the case. I am not aware that the shell-gland has been previously noticed, and it is only in two or three specimens that I have found it; the duct which I have figured is probably connected with the gland, though I have not certainly made out the connection; the structure is probably an excretory one and homologous with the green gland of higher crustacea.

Genus Eupathistoma [1], gen. nov.

Shell membranous, in shape not unlike *Philomedes*. Antennules and antennæ nearly alike in both sexes, and similar to those of *Cypridina*, except that the antennules of the male have no suckers; margins of the mouth provided with three pairs of finger-like sensory processes; mandibles and maxillæ as in *Cypridina*; terminal armature of the vermiform foot one-sided, consisting of several unequal, slender lashes, the longest of which are longer than the diameter of the limb; post-abdomen as usual in Cypridinidæ.

In general character this genus is intermediate between *Cypridina* and *Philomedes*, but the sensory mouth-organs are very remarkable, and seem to have no parallel among other Myodocopa. One pair, at least, of these appendages has an arrangement of olfactory (?) filaments exactly like that found in the antennules of the Daphniadæ.

Eupathistoma natans, sp. n. (Plate XLIV. figs. 21–26.)

Shell seen from the side (fig. 21) elongated, subrhomboidal, greatest height equal to more than half the length; anterior extremity obliquely truncated and slightly concave, distinctly angulated at its dorsal end, very acutely and prominently angular below, where it merges in a wide, well-rounded antennal sinus; posterior extremity produced below the middle into a wide, bluntly-rounded beak; dorsal margin almost flat in the middle, sloping rather steeply to the anterior extremity, and with a steeper curve behind to its junction with the posterior beak, ventral margin rather boldly convex, more fully rounded in front than behind; seen from above (fig. 22), evenly ovate, twice as long as broad, mucronate behind, narrowly rounded in front. Length 2 mm. Male and female nearly alike. The sensory mouth-appendages consist of three pairs of finger-like or conical processes (fig. 24), one pair of which (*a*) are simple

[1] *εὐπαθὴς*, sensitive; *στόμα*, a mouth.

cones with terminal rosettes of short olfactory (?) setæ, a second pair (*b*) consisting each of two coalescent cones, a third (*c*) longer and finger-like with crenated margins. The mandible (fig. 23) has four long terminal ungues and a short seta; its chewing-lobe (fig. 23 *a*) is setose and ends in two slender mucrones; and the antepenultimate joint bears, like *Cypridina*, a short apical process with a lancet-shaped point and two lateral setæ (fig. 23 *b*). Lateral setæ of the vermiform limb few, generally not more than eight; terminal setæ long, filiform, not at all tooth-like, unilateral (fig. 25). Post-abdominal laminæ (fig. 26) bearing nine pectinated marginal ungues, which are progressively longer from first to last.

Hab. Taken abundantly in the surface-net in the Bay of Bengal, lat. 14° N. For these specimens I am indebted to my friend Mr. I. C. Thompson, F.L.S., of Liverpool.

Genus Sarsiella Norman, 1869.

Sarsiella Norman (1), p. 293; Brady & Norman (1) (♀), p. 677.
Nematohamma Brady & Norman (1) (♂), p. 680; G. W. Müller (1), p. 213.

Sarsiella hanseni, sp. n. (Plate XLV. figs. 1–12.)

Shell of the *female*, seen from the side (fig. 1), subquadrate, height equal to four-fifths of the length; anterior extremity very wide, truncate, slightly irregular, but almost straight, posterior narrower, deeply excavated, and bounded above and below by two prominences, the lower of which is much the largest and forms a stout sub-triangular beak; dorsal margin slightly arcuate, somewhat sinuous, highest in the middle, whence it slopes very gently towards the front, but steeply and with a distinct curve backward, ventral margin more strongly convex and sinuated in front of the posterior beak. Seen from above (fig. 2), the outline is elongated and subquadrangular, of nearly equal width throughout, width equal to more than half the length; anterior extremity wide, flattened, but deeply emarginate in the middle, posterior almost as wide as the greatest width of the shell, abruptly truncated and slightly prominent in the middle; lateral margins subparallel, very slightly divergent from behind forward, almost rectangular at their junction with the posterior extremity, but rounded off in front. The substance of the shell is flexible and submembranaceous, closely pitted with small impressed puncta and irregularly waved and ribbed; the anterior and inferior margins form a continuous elevated ridge; two longitudinal ribs run parallel to, but at a considerable distance within, the dorsal and ventral margins; there is a flexuous central rib between these two, rising near the front of the valve, and becoming lost behind the middle; between this and the dorsal rib is another rib which begins with a sharp bend in front of the middle, and, gradually becoming stronger, passes backward and ends in a curve a little within the posterior margin. Between these principal ribs the valves are irregularly corrugated; all the ribs are beset with long and rather coarse hairs (fig. 3), and the dorsal surface bears patches of very short, rigid, and closely-set hairs (figs. 2, 11), which have dilated subglobular or crutch-shaped apices. Length 1·05, height ·85 mm. Shell of the *male* (fig. 4) elongated, not unlike that of *Philomedes*, nearly twice as long as high; surface-markings scarcely so pronounced as those of the female. Length 1·1 mm. The limbs of the *female* differ scarcely at all from those of *S. capsula*, which has been fully described by G. O. Sars and G. W. Müller. Post-abdominal laminæ narrow, its four marginal ungues very slender, and increasing progressively in length from the first to the last, which is at least four times as long as the first (fig. 10), their inner margins sparingly spinulose. The mandible of the *male* (fig. 8) differs from that of the female in being more profusely setiferous, and in having only one, instead of three, terminal ungues; the antennule (fig. 5) has on the penultimate joint a cushion-like prominence which bears a dense brush of innumerable long fine hairs; extremity of the vermiform limb truncated, and without the pairs of hooks which are found in the female. Copulative organ (fig. 12) ending in two stout and blunt chitinous hooks. Secondary branch of the antenna (fig. 6) three-jointed, geniculated; inner margin of the second joint bearing at the base two very long and stout spine-like setæ; terminal joint slightly thickened at its base, blunt and angularly bent. Post-abdomen like that of the female.

Hab. Plentiful in a dredging, from 1–5 fathoms, in Lyttelton Harbour.

The extremely hirsute character of the shell and the peculiar cushion-like patches of knobbed hairs, forming a sort of interrupted nimbus round the edges when seen dorsally, are very characteristic. But the surface-sculpture is not easily seen while the shell is immersed, and when removed from liquid it very speedily shrivels and loses its proper markings. The genus *Nematohamma* Brady & Norman was founded on male specimens of a *Sarsiella*, the relation of which to the female form was then unknown.

Sarsiella hispida, sp. n. (Plate XLV. figs. 13, 14.)

Shell membranous, thin and flexible, seen from the side subrhomboidal (fig. 13), height equal to two-thirds of the length; anterior extremity narrowed, rounded; posterior much wider, subtruncate, sloping very steeply, and terminating in a long conical beak; dorsal margin almost flat in the middle, whence it slopes gently toward the front; near its hinder end it is distinctly sinuated and terminates in an abrupt angle; ventral margin boldly arcuate, with a slight sinuation (antennal notch) near the anterior extremity; seen from above (fig. 14), subquadrate, oblong, sides nearly parallel, but indented near the middle, obtusely rounded in front, rectangularly truncated behind, with a large median mucronate process. Shell densely hispid, and on the dorsal aspect bearing patches of short, rigid, clubbed hairs; surface of the valves flexuously ribbed in a longitudinal direction. Length 1·5 mm.

Hab. Akaroa Harbour; dredged in a depth of 6 fathoms.

The test of this species is so very thin that it is impossible to examine it in the dry condition owing to its rapid shrivelling, and the markings are very difficult to make out accurately in fluid; the disposition of the ridges seems, however, to be very much like that of *S. hanseni.*

Genus Cypris O. F. Müller.

Cypris viridis Thomson. (Plate XLV. figs. 22–24.)

Cypris viridis Thomson (1), p. 253, pl. xi. fig. A. 2 *a–g.*

Shell of the *female* short and very tumid; seen from the side (fig. 22) reniform, very slightly depressed in front, height equal to nearly two-thirds of the length; extremities well rounded, dorsal margin boldly and evenly arched, ventral slightly sinuated in the middle; seen from above (fig. 23), very broadly ovate, greatest width behind the middle and equal to about three-fourths of the length, anterior extremity abruptly tapered and subacute, posterior broadly rounded; lateral margins strongly arcuate, converging steeply towards the front. Shell-surface finely punctated and covered with short, rather rigid hairs; the anterior and posterior extremities bordered by a narrow, pellucid flange, which is fringed with a single series of very fine hairs; behind this flange is a thicker band marked by irregular transverse glandular (?) streaks; left valve overlapping the right on the dorsal and posterior aspects. Colour an opaque dark green. Length ·9 mm. Post-abdominal rami (fig. 24) very small and slender; terminal seta as long as the ramus itself, lateral seta about half as long and attached very near the apex; the minor apical seta is extremely minute.

Hab. "In pools about Dunedin and Taieri Plan" (*G. M. Thomson*).

Genus Cyprinotus G. S. Brady.

Cyprinotus Brady (3), p. 301; G. O. Sars (2), p. 5 (separate copy).

Cyprinotus flavescens, sp. n. (Plate XLVI. figs. 28, 29.)

Shell, seen from the side (fig. 28), reniform, highest in the middle, height equal to rather more than half the length; extremities rounded, anterior wide and almost subtruncate, posterior narrower and slightly depressed; dorsal margin forming an evenly flattened arch, ventral gently sinuated towards the front; seen from above (fig. 29) the outline is compressed, ovate, widest in the middle, more than twice as long as broad, gradually tapered towards the acuminate anterior extremity, narrowly rounded behind; surface of the valves quite smooth. Colour yellowish. Length 2·2 mm.

Hab. Dunedin district (exact locality lost).

The soft parts of the animal agree accurately with those of the typical *Cyprinotus*, but there is not so much inequality of the valves as in the better-known species.

Genus Loxoconcha G. O. Sars.

Loxoconcha punctata Thomson. (Plate XLVI. figs. 3–5.)

Loxoconcha punctata Thomson (1), p. 255, pl. xi. fig. B. 3 *a–k*.

Shell of the *female*, seen from the side (fig. 3), subrhomboidal, height equal to more than two-thirds of the length; extremities obliquely rounded, the anterior sloping steeply above the middle and rounded off ventrally, posterior forming a bold curve from below to the dorsum, where it ends in an abrupt angle; dorsal margin forming a flattened arch with an excavation where it joins the posterior extremity, ventral very slightly sinuated in the middle; seen from above (fig. 14), lozenge-shaped, twice as long as broad, widest in the middle, whence it tapers rather suddenly to the extremities, which are subacuminate and nearly equal. Surface of the shell smooth, bearing numerous small papillæ; valves flattened out at the extremities, forming a bordering flange which is continued, though feebly, along the ventral margin. Colour generally greyish, but variable, as is also the texture of the shell. Length ·57 mm. The shell of the *male* is rather larger (·7 mm.), and has the characteristic shape of that sex in *Loxoconcha*.

Hab. Otago Harbour, among seaweed and in rock-pools, Brighton, New Zealand.

This species has been described and figured by Mr. G. M. Thomson (*loc. cit.*); but, as the 'Transactions' of the New Zealand Institute are not generally accessible, I here re-figure the female.

Genus Xestoleberis G. O. Sars.

Xestoleberis luxata, sp. n. (Plate XLVI. figs. 20–27.)

Shell of the *female* compressed, subreniform, left valve much larger than the right, and overlapping everywhere except on the ventral margin (figs. 20, 21); seen from the side, nearly twice as long as high, highest behind the middle, depressed in front; anterior extremity narrow, rounded but somewhat flattened, posterior wide and boldly rounded; dorsal margin forming a continuous curve, flattened toward the front, but boldly rounded behind, ventral sinuated in front of the middle; seen from above, compressed, ovate, twice as long as broad, widest behind the middle, tapering gently towards the front, well rounded behind; shell-surface smooth, marked with numerous very small circular papillæ. Colour yellowish white. Length ·6 mm. Antennules (fig. 24) six-jointed, bearing two setæ on the second joint, one on the third, three on the fourth, one on the fifth, and three on the sixth, all of them short; the mandibular branchia (fig. 26) consists of only two setæ, and the animal is, in other respects, similar to the typical *Xestoleberis*.

Hab. On algæ in Lyttelton Harbour, New Zealand.

In most species of *Xestoleberis* there is some inequality of the valves, but in this species it is more pronounced than in any other known to me.

XESTOLEBERIS OLIVACEA, sp. n. (Plate XLVI. figs. 6, 7.)

Shell, seen from the side (fig. 6), subreniform, greatest height situated in the middle and equal to two-thirds of the length; extremities well rounded; dorsal margin boldly and evenly arched, sloping steeply behind, more gradually in front, ventral rather deeply sinuated in front, boldly arcuate behind, where it forms a curve continuous with that of the posterior extremity; seen from above (fig. 7), ovate, nearly twice as long as broad, widest in the middle, lateral margins evenly and boldly arcuate; anterior extremity subacuminate, posterior narrowly rounded. Shell-surface perfectly smooth and without markings, excepting a dark eye-spot. Colour dark olive. Length ·55 mm.

Hab. Rock-pools, Brighton, New Zealand.

XESTOLEBERIS COMPRESSA, sp. n. (Plate XLVI. figs. 10–19.)

Shell, seen from the side (fig. 10), reniform, highest in the middle, height equal to more than half the length; anterior extremity obliquely rounded, posterior boldly and evenly rounded; dorsal margin boldly arched, ventral rather deeply sinuated in the middle; seen from above (fig. 11), compressed, ovate, fully twice as long as broad, acuminate in front, rounded behind. Shell-surface smooth, marked with distant, very minute papillæ. Colour yellowish. Length ·46 mm. Antennules (fig. 13) six-jointed, third, fourth, and fifth joints each with a single strong apical spine and a slender seta, sixth joint with two setæ; second joint fringed externally with fine, short hairs; in other respects like typical *Xestoleberis*.

Hab. Rock-pools, Brighton, New Zealand.

G. W. Müller notes that in many, if not in all, species of *Xestoleberis* the shell bears a crescentic pellucid patch behind the eyes, and of this he gives several figures. I have not been able to find this patch in any of the species here described, though in *X. compressa* there is, at any rate in some specimens (fig. 10), a similar mark in front of the eyes. But the shell in this species and in others of the same genus is liable to the presence of similar irregular spots on various parts.

Genus CYTHERE O. F. Müller.

CYTHERE BRUNNEA, sp. n. (Plate XLVII. figs. 8–15.)

Male. Shell, seen from the side (fig. 8), subreniform, greatest height in front of the middle, and equal to more than half the length; anterior extremity wide, rather obliquely rounded, forming a very wide band or fillet, which ceases above at the highest point of the valve, but is continued in a narrower form along the ventral margin, and as far as the postero-dorsal angle; posterior extremity much narrower than the anterior, subtruncate, rounded off below, almost angular above; dorsal margin slightly arcuate, sloping continuously and evenly from the front backward;

ventral deeply sinuated in front of the middle, behind which it is slightly convex; seen from above, the outline is narrowly ovate, nearly thrice as long as broad (fig. 9), rounded behind and tapered gradually to the obtusely-pointed anterior extremity. Shell-surface covered with closely-set angular pittings, except on the marginal flange (fig. 10), the flange itself marked with closely-set, fine, radiating lines (lacunæ?) on its broad inner zone, and on the narrower outer zone with distant short hairs. Length ·66 mm. Antennules (fig. 11) six-jointed, each of the last four joints bearing a stout apical spine, the last three having also one or two setæ which are not very much longer than the spines; urticating seta of the antenna slightly longer than the limb; poison-gland large and lobose. Mandible (fig. 12) stout, broad, and many-toothed; palp three-jointed, the long middle joint being again imperfectly divided into three, terminal joint much narrower than the rest, finger-like, and bearing three broad apical setæ and two short hairs; the long median joint has an apical brush of seven long hairs arising from a short external process; its inner margin has three very stout, curved, plumose setæ, that of the distal segment being much longer than the other two; the middle of the outer margin has a fascicle of very short, fine hairs; the short basal joint bears two very small, plumose branchial (?) setæ. Three pairs of feet, sparingly setiferous (figs. 13, 14), with strong curved ungues. Copulative organs complex (fig. 15), enclosing a coiled spermatic duct, with two stout plumose setæ on the free margin. Female unknown.

Hab. A few specimens taken in Lyttelton Harbour among algæ.

The antennæ of this species with their long and stout urticating setæ, and the mandible-palps with their slender terminal joint and stout, falcate setæ, correspond closely with the same organs as seen in *Cythere albomaculata* Baird, and in no other species with which I am acquainted.

Cythere innominata, nom. nov. (Plate XLVI. figs. 1, 2.)

Cythere truncata[1] Thomson (I), p. 254, pl. xi. fig. C. 2 *a–c*.

Shell, seen laterally (fig. 1), subquadrate, highest in front, greatest height much more than half the length; anterior extremity broadly rounded, irregularly crenulated or almost dentated; posterior narrow, rounded off above and below, subtruncate below the middle, but deeply excavated above; dorsal margin sloping gently and in a slightly sinuous line from the front; ventral nearly straight behind its junction with the anterior encircling fillet, gently upcurved toward the posterior extremity; seen from above (fig. 2), elongated, compressed, widest behind, nearly thrice as long as broad, lateral margins converging gradually, but with irregular sinuations from near the hinder end to the front, which is obtusely pointed; from the widest point the sides converge

[1] This specific name has been already used by Reuss for a Tertiary species. I therefore propose the new name *innominata*.

abruptly to the posterior extremity, which is narrow and truncated; surface of the shell irregularly rugose, the ridges taking a transverse direction at the posterior end; a conspicuous polished tubercle on the anterior hinge. Length 1·3 mm.

Hab. In rock-pools, Brighton, New Zealand. Two or three specimens only.

The shell is somewhat like in general appearance to G. W. Müller's genus *Paracytheridea*, but, so far as I have been able to observe, it does not agree with that genus in minor details. The types described by Mr. Thomson were got among algæ in Otago Harbour.

CYTHERE TRUNCULA, sp. n. (Plate XLVII. figs. 16, 17.)

Shell, seen from the side (fig. 16), subquadrangular, greatest height near the front, and equal to about two-thirds of the length; anterior extremity obliquely and not very strongly rounded; posterior very wide, almost rectangularly truncated, produced below the middle, where it bears three short, stout, and blunt teeth; dorsal margin sloping rather steeply and irregularly from the front backward; ventral almost straight for about three-fourths of its length, where it forms a prominent abrupt angle, and thence curves upward to the posterior extremity; seen from above, the outline is lozenge-shaped or subhexagonal (fig. 17), widest in the middle, the width being nearly equal to the height; extremities wide, truncated, and irregularly emarginate; lateral margins strongly arcuate, prominent in the middle, and converging rather steeply to each extremity. Surface of the shell covered with large irregularly-angulated fossæ; a large polished tubercle over the anterior hinge; anterior margin fringed with coarse hairs. Length ·75 mm.

Hab. Among weeds in Lyttelton Harbour. One specimen only.

Genus TRACHYLEBERIS [1], gen. nov.

Shell beset with prominent nodules or spines. Antennules six-jointed, devoid of spines, but bearing numerous slender setæ; antennæ four-jointed, that of the female with a very short, falcate, urticating seta, which is absent from that of the male; mandible-palp with a small branchial plate bearing three upwardly-directed filaments, a very short one directed downward, and one very minute, horizontal ray. The remaining limbs as in *Cythere*; in front of the first pair of legs in the male a pair of one-jointed setiferous appendages.

TRACHYLEBERIS SCABROCUNEATA (G. S. Brady). (Plate XLVII. figs. 1–7, 18–25.)

Cythere scabrocuneata Brady (2), p. 103, pl. xvii. figs. 5 *a–f*; pl. xxiii. figs. 2 *a–c*.

Shell of the *male* (figs. 1, 2), seen from the side, elongated, subquadrate, greatest height near the front, and equal to rather less than half the length; anterior extremity

[1] τραχὺς, rough; λεβηρὶς, a shell.

forming a steep curve above the middle, below the middle well rounded and broken up into a series of short blunt teeth; posterior extremity irregularly emarginate, narrowed and wedge-shaped, most prominent below the middle; dorsal margin slightly sloping from before backward, and broken into an irregular jagged line; ventral almost straight, with an upward bend behind. Seen from above, the outline is compressed, subovate, more than twice as long as broad, the whole circumference excessively jagged and uneven, tapered at the extremities, which are obtuse, deeply emarginate in front; surface covered with large irregularly-rounded nodules, and beset with coarse, rigid hairs. A large polished tubercle over the anterior hinge; hingement of two terminal teeth on the right corresponding with depressions on the left valve. Length 1·1 mm. Shell of the female shorter and more tumid. Antennules (figs. 18, 19) six-jointed, the last three joints bearing each three or four setæ, each of which is about as long as the last four joints of the antennule; the second and third joints have one seta each, the first none; the last joint of the antenna (fig. 20) is small, and bears a long, slender unguis with two setæ; the penultimate joint has three fascicles of long setæ, and, near its base, a brush of small, short hairs; second joint small, bearing a single long seta and a few small hairs; first joint (in the female) with a short, strongly-curved, urticating seta—none in the male. Mandible wide and many-toothed; palp (fig. 3) four-jointed, its last joint rather shorter and much more slender than the preceding; branchial plate (fig. 21) five-rayed; præcrural appendages (fig. 25) elongated, quadrilateral, apices rectangularly truncate, and bearing numerous very fine long hairs; legs similar to those of the Cytheridæ generally (figs. 22–24), their terminal claws very long, slender, and moderately curved; the second joint of the last leg in the male (fig. 24) bears four small, but dense, fascicles of hairs; that of the female (fig. 4) has only one. Post-abdomen in the female (fig. 5) forming two trisetose lobes.

Hab. Dredged abundantly in Lyttelton Harbour, depth 1–5 fathoms.

This species was first described from specimens (shells only) taken during the cruise of the 'Challenger' in various depths, down as far as 40 fathoms: the localities were East Moncœur Island, Bass's Straits; Inland Sea, Japan; and Wellington Harbour, New Zealand. The very long and slender setæ of the antennules—as long as those of many Cypridæ (*Bairdia*, *Macrocypris*, *Paracypris*, &c.)—seem to entitle this species to a separate generic position, and further distinctive characters are found in the peculiarities of the mandibular branchial plate, the urticating antennal setæ, and the setose armature of the third pair of legs in the male.

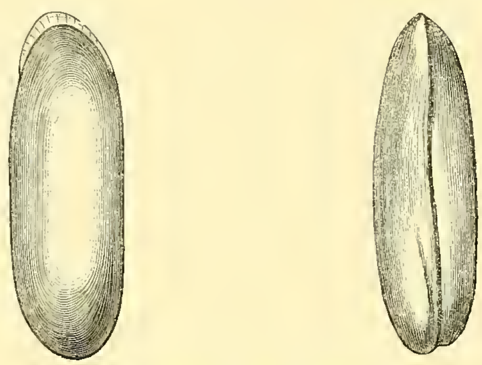
Genus CYTHERIDEIS Jones.

Cytherideis T. R. Jones (1), p. 46; G. S. Brady (1), p. 454; Brady & Norman (1), p. 226.

CYTHERIDEIS NOVÆ-ZEALANDIÆ, sp. n. (Figs. 1–4).

Shell, seen from the side (fig. 1), suboval, elongated, three times as long as broad; extremities obliquely rounded, the anterior bordered with a narrow flange; dorsal margin quite straight, ventral straight, but indented at its junction with the anterior border; seen from above (fig. 2), ovate, more than thrice as long as broad, sides only slightly arcuate, anterior extremity subacuminate, posterior rounded, right valve overlapped by the left; surface smooth. Antennule (fig. 3) six-jointed, bearing several

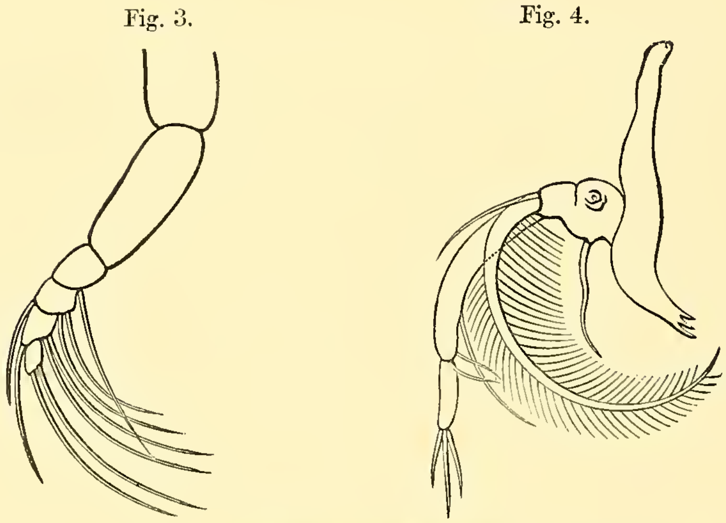
Fig. 1. Fig. 2.



Cytherideis novæ-zealandiæ.

Fig. 1. Shell, seen from left side, × 55.
Fig. 2. „ „ above, × 55.

Fig. 3. Fig. 4.



Cytherideis novæ-zealandiæ.

Fig. 3. Antennule, × 210.
Fig. 4. Mandible and palp, × 210.

long setæ, which are crowded together on the last four joints; mandible slender and feebly toothed (fig. 4); palp very long and slender, destitute of branchial rays, basal joint bearing one extremely long and stout, falcate, plumose seta, and two much shorter, simple setæ; penultimate joint with two, last joint with three, small apical setæ. Length ·88 mm.

Hab. One specimen only in a dredging from Lyttelton Harbour, 1–5 fathoms.

Family CYTHERELLIDÆ Sars.

Genus Cytherella Jones.

Cytherella eburnea, sp. n. (Plate XLVI. figs. 8, 9.)

Shell, seen from the side (fig. 8), subelliptical, about twice as long as high; extremities well rounded, dorsal and ventral margins nearly straight. Seen from above (fig. 9), the outline is club-shaped, widest near the posterior extremity, width equal to more than one-third of the length; anterior extremity very obtusely rounded, posterior much wider, subtruncate, with rounded angles; lateral margins converging slightly from behind to the anterior extremity. Surface of the valves quite smooth and polished. Colour grey. Length ·9 mm.

Hab. Lyttelton Harbour, among weeds. One specimen only found.

EXPLANATION OF THE PLATES.

PLATE XLIII.

Asterope australis, p. 431.

Fig. 1.	Shell of male, seen from left side,	× 40.
Fig. 2.	„ „ above,	
Fig. 3.	Shell of female, seen from right side,	
Fig. 4.	„ „ above,	
Fig. 5.	Inner branch of antenna, ♂,	× 210.
Fig. 6.	„ „ ♀,	
Fig. 7.	Process of mandibular foot, × 180.	
Fig. 8.	Post-abdominal lamina, × 180.	

Asterope grisea, p. 432.

Fig. 9.	Shell of female, seen from right side,	× 25.
Fig. 10.	„ „ above,	

Fig. 11. Inner branch of antenna, ♂, × 100.
Fig. 12. ,, ,, ♀, × 84.
Fig. 13. Terminal teeth of vermiform limb, × 210.
Fig. 14. Post-abdominal lamina, × 84.

Cyclasterope zealandica, p. 433.

Fig. 15. Shell of female, seen from right side, } × 8.
Fig. 16. ,, ,, above, }
Fig. 17. Shell of male, seen from right side, × 8.
Fig. 18. Inner branch of antenna, ♂, } × 50.
Fig. 19. ,, ,, ♀, }
Fig. 20. A terminal tooth of vermiform limb, × 540.
Fig. 21. Post-abdominal lamina, × 25.
Fig. 22. Teeth at base of unguis of same, × 250.
Fig. 23. Sculpture of anterior margin of shell, × 25.

Cyclasterope ovulum, p. 432.

Fig. 24. Shell of female, seen from left side, } × 6.
Fig. 25. ,, ,, below, }
Fig. 26. Inner branch of antenna, ♀, × 40.
Fig. 27. Frontal tentacle, × 40.
Fig. 28. Terminal teeth of vermiform foot, × 250.
Fig. 29. Post-abdominal lamina, × 25.
Fig. 30. Marginal teeth of caudal ungues, × 250.

PLATE XLIV.

Philomedes flexilis, p. 435.

Fig. 1. Old shell of female, seen from right side, }
Fig. 2. ,, ,, below, } × 25
Fig. 3. Shell of male from right side, }
Fig. 4. Eyes and frontal tentacle, ♂, × 84.
Fig. 5. Inner branch, antenna, ♂, × 40.
Fig. 6. ,, ,, ♀, × 40.
Fig. 7. Outer branch, antenna, ♀, × 84.
Fig. 8. Principal tooth of second maxilla, × 210.
Fig. 9. End of vermiform limb, × 210.
Fig. 10. Post-abdominal lamina, × 84.
Fig. 11. Eye of female, × 210.

Fig. 12. Portion of lining membrane of shell, × 84.
Fig. 13. Rostrum and laminar border, × 60.
Fig. 14. Shell-gland, × 200.

Philomedes sculpta, p. 434.

Fig. 15. Shell of male, seen from left side, } × 25.
Fig. 16. „ „ above, }
Fig. 17. Rostrum and marginal lamina, × 40.
Fig. 18. Inner branch of antenna, ♂, × 110.
Fig. 19. Post-abdominal lamina, × 84.
Fig. 20. Fragment of concretion, × 84.

Eupathistoma natans, p. 437.

Fig. 21. Shell of male, seen from right side, } × 25.
Fig. 22. „ „ below, }
Fig. 23. Mandible, × 84.
a, *b*. Processes of same, × 210.
Fig. 24. Oral sense-organs, × 210.
Fig. 25. End of vermiform foot, × 210.
Fig. 26. Post-abdominal lamina, × 84.

Cyclasterope tenera, p. 433.

Fig. 27. Right valve of lamina, seen from inside, × 30.
Fig. 28. Inner branch of antenna, × 84.
Fig. 29. Post-abdominal lamina, × 84.

PLATE XLV.

Sarsiella hanseni, p. 438.

Fig. 1. Shell of female, seen from right side, }
Fig. 2. „ „ above, } × 50.
Fig. 3. Left valve, seen as transparent object, }
Fig. 4. Shell of male, seen from left side, }
Fig. 5. Antennule of male, × 84.
Fig. 6. Inner branch of antenna, ♂, × 210.
Fig. 7. Mandible of female.
Fig. 8. „ male.
Fig. 9. End of vermiform limb, × 210.
Fig. 10. Post-abdominal lamina, × 120.
Fig. 11. Hairs from dorsal cushion, × 300.
Fig. 12. Copulative organ, ♂, × 210.

Sarsiella hispida, p. 439.

Fig. 13. Shell of female, from left side, × 50.
Fig. 14. „ „ above, × 40.

Philomedes flexilis, p. 435.

Fig. 15. Shell of female, from right side, × 35.
Fig. 16. „ dorsal view (rather oblique), × 35.

Asterope quadrata, p. 432.

Fig. 17. Outline of shell (♀), seen from left side, } × 40.
Fig. 18. „ „ above, } × 40.
Fig. 19. Inner branch of antenna, ♂, × 210.
Fig. 20. „ „ ♀, × 210.
Fig. 21. Post-abdominal lamina, ♀, × 210.

Cypris viridis, p. 440.

Fig. 22. Shell of female, seen from left side, } × 50.
Fig. 23. „ „ above, } × 50.
Fig. 24. Post-abdominal ramus, × 210.

PLATE XLVI.

Cythere innominata, p. 443.

Fig. 1. Shell, seen from right side, } × 84.
Fig. 2. „ „ above, } × 84.

Loxoconcha punctata, p. 441.

Fig. 3. Shell of female, seen from right side, } × 84.
Fig. 4. „ „ above, } × 84.
Fig. 5. Portion of shell-margin, × 210.

Xestoleberis olivacea, p. 442.

Fig. 6. Shell of female, seen from left side, } × 84.
Fig. 7. „ „ above, } × 84.

Cytherella eburnea, p. 447.

Fig. 8. Shell, seen from left side, } × 50.
Fig. 9. „ „ above, } × 50.

Xestoleberis compressa, p. 442.

Fig. 10. Shell, seen from right side, } × 84.
Fig. 11. „ „ above, }
Fig. 12. Portion of shell-margin, × 210.
Fig. 13. Antennule of female, } × 210.
Fig. 14. Antenna of female, }
Fig. 15. Mandible and palp of female, × 210.
Fig. 16. Foot of second pair, × 210.
Fig. 17. „ third pair, × 210.
Fig. 18. Post-abdomen, × 250.
Fig. 19. Copulative organ, ♂, × 250.

Xestoleberis luxata, p. 441

Fig. 20. Shell, seen from right side, }
Fig. 21. „ „ above, } × 84.
Fig. 22. „ „ behind, }
Fig. 23. Muscle-spots, × 210.
Fig. 24. Antennule, × 210.
Fig. 25. Antenna, × 210.
Fig. 26. Mandible and palp, × 210.
Fig. 27. Post-abdomen and third foot, × 210.

Cyprinotus flavescens, p. 440.

Fig. 28. Shell, seen from right side, } × 25.
Fig. 29. „ „ above, }

PLATE XLVII.

Trachyleberis scabrocuneata, p. 444.

Fig. 1. Shell of male, seen from left side, } × 53.
Fig. 2. „ „ above, }
Fig. 3. Mandible and palp, × 210.
Fig. 4. Foot of third pair, ♀, × 120.
Fig. 5. Post-abdomen, ♀, × 210.
Fig. 6. Copulative organ, ♂, × 100.
Fig. 7. Portion of shell-margin, anterior, × 84.

Cythere brunnea, p. 442.

Fig. 8. Shell of female, seen from left side, } × 84.
Fig. 9. „ „ above, }

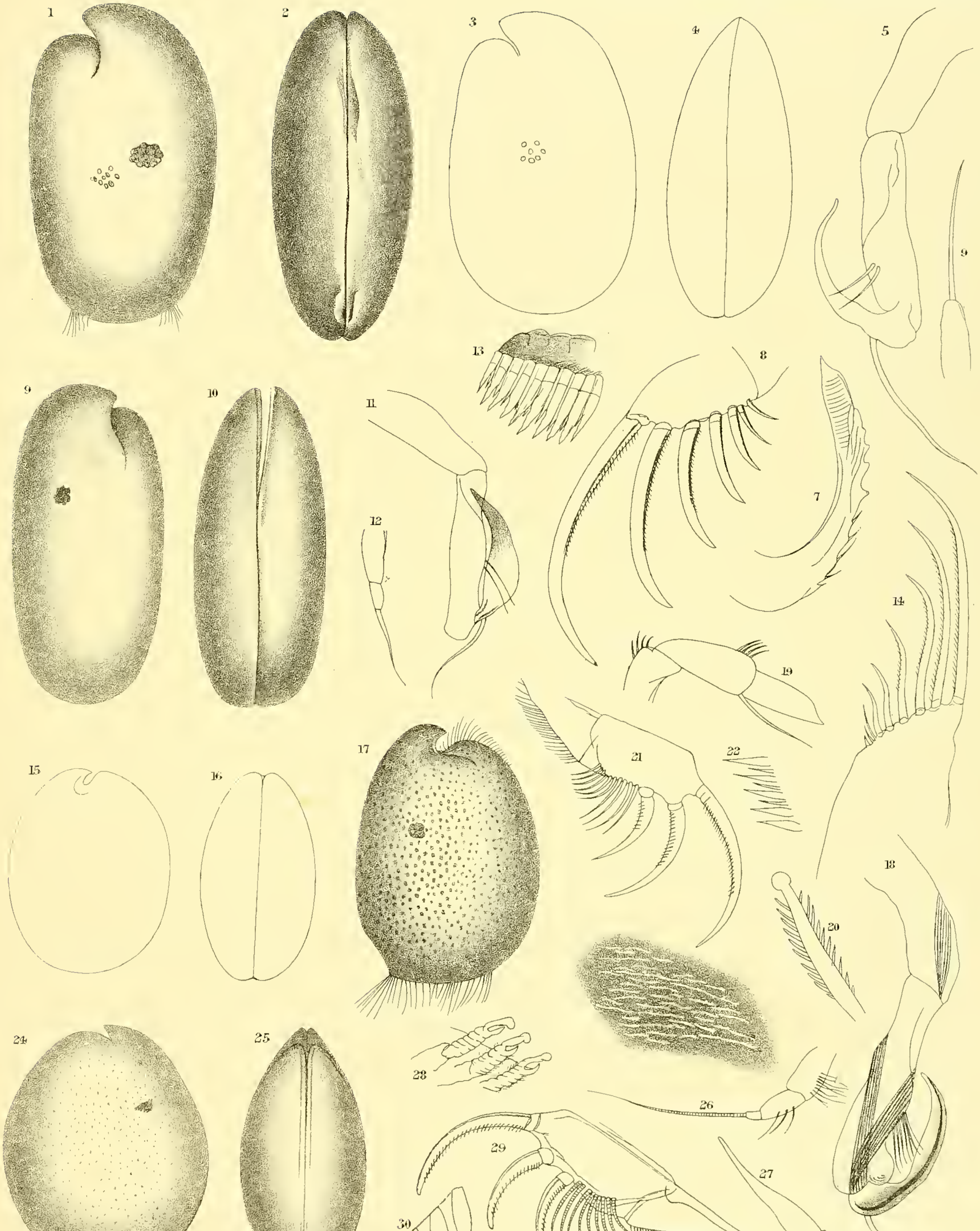
Fig. 10. Portion of shell-margin, × 250.
Fig. 11. Antennule, × 210.
Fig. 12. Mandible and palp, × 210.
Fig. 13. Foot of first pair, × 210.
Fig. 14. „ third pair, × 210.
Fig. 15. Copulative organ, ♂, × 210.

Cythere truncula, p. 444.

Fig. 16. Shell, seen from left side, } × 84.
Fig. 17. „ „ above, }

Trachyleberis scabrocuneata, p. 444.

Fig. 18. Antennule, × 110.
Fig. 19. Last four joints of antennule, × 250.
Fig. 20. Antenna of female, × 180.
Fig. 21. Branchial plate of mandible, × 210.
Fig. 22. Leg of first pair, ♂, × 210.
Fig. 23. „ first pair, ♀, × 210.
Fig. 24. „ third pair, ♂, × 110.
Fig. 25. Præcrural appendage, ♀, × 210.



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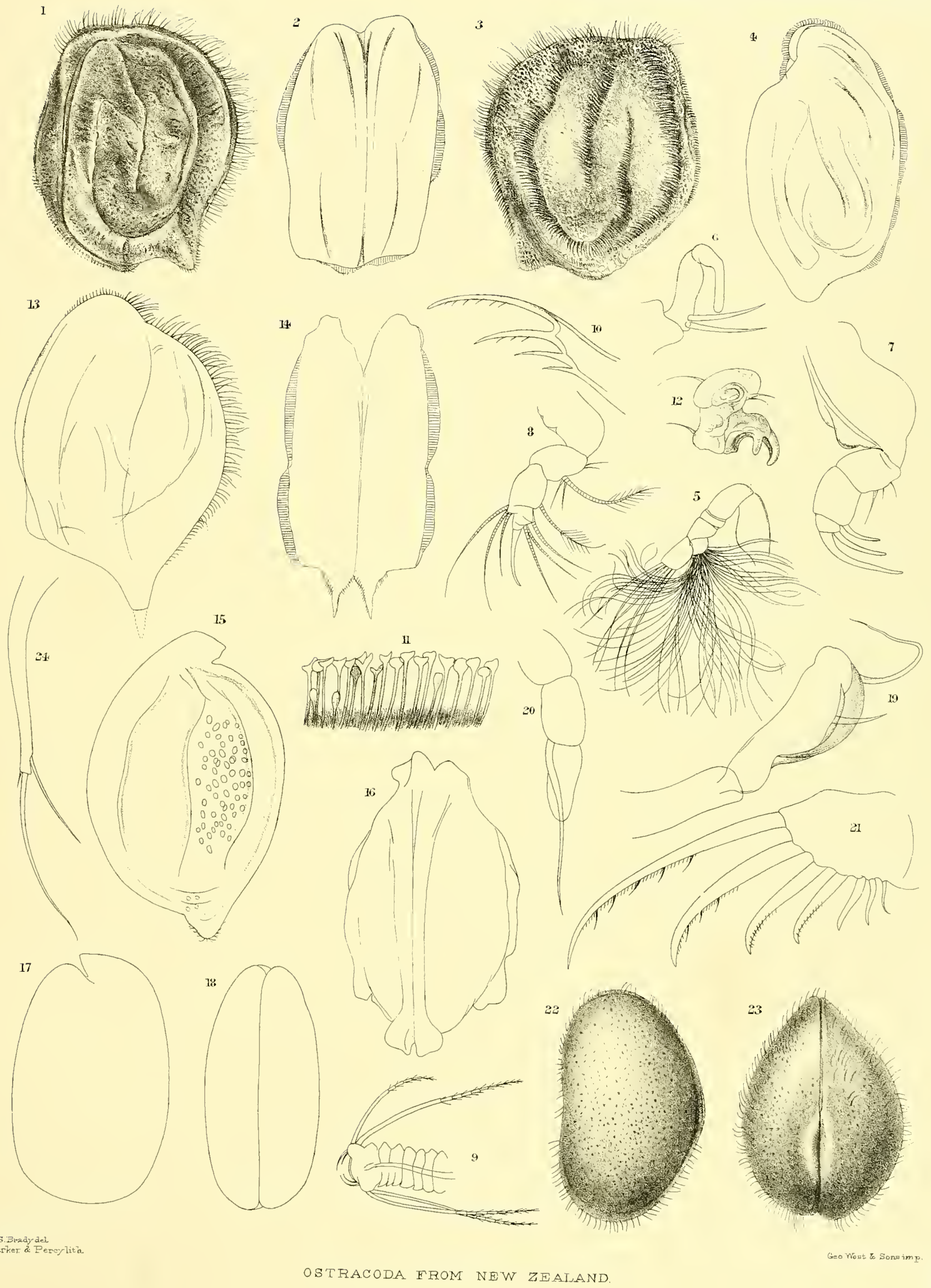

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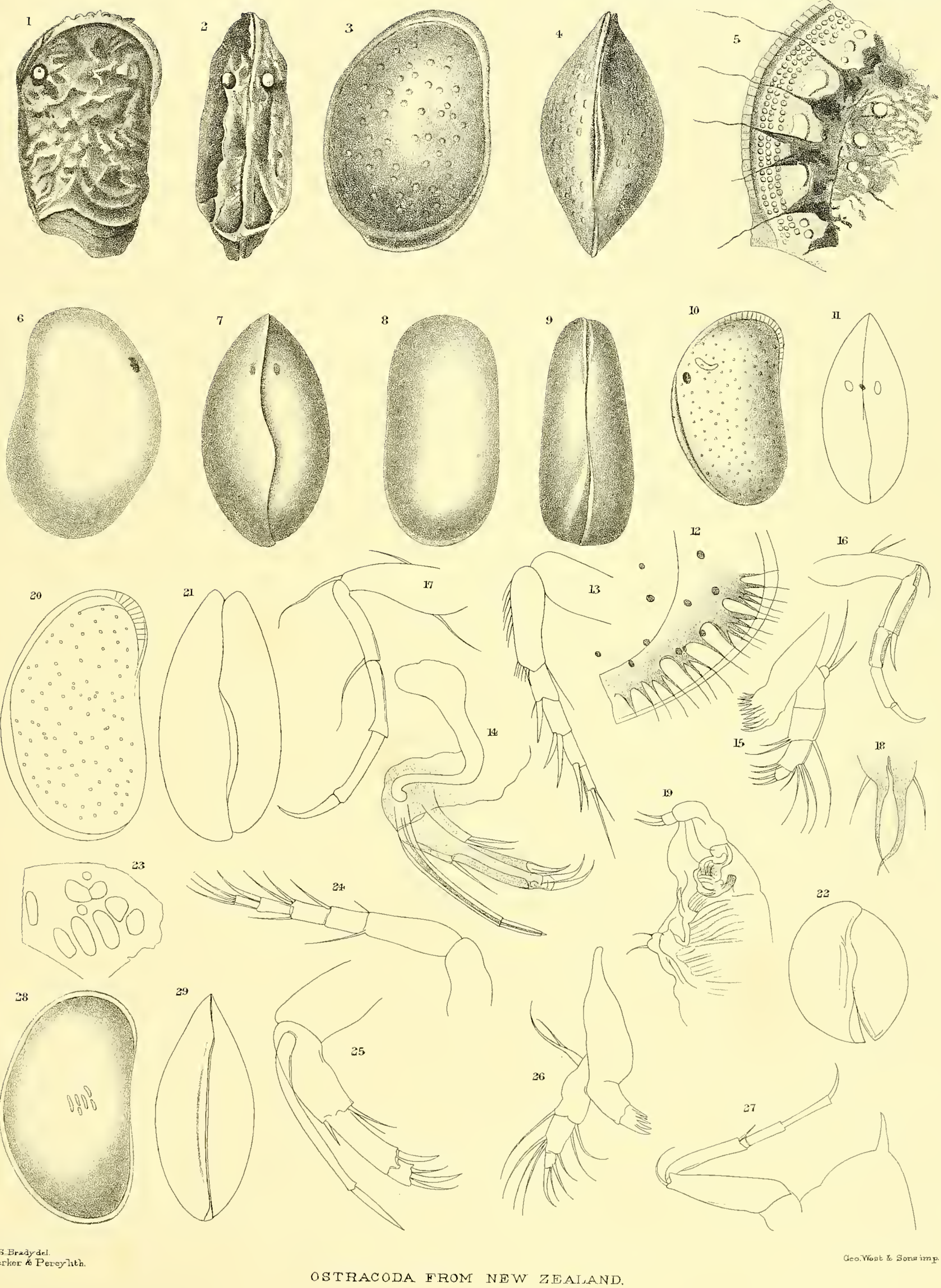

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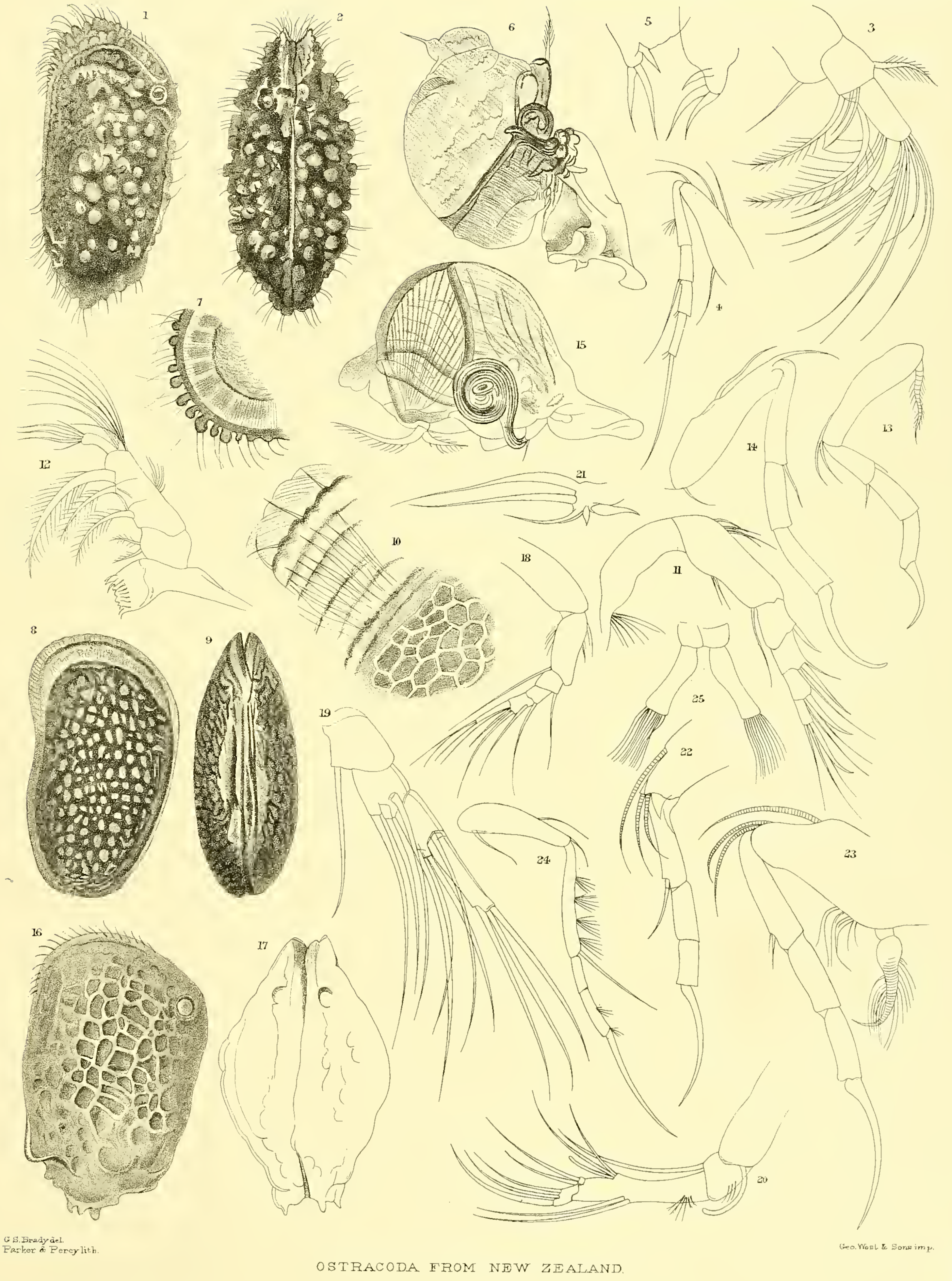

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