THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

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

CONDUCTED BY

ALBERT C. L. G. GÜNTHER, M.A., M.D., Ph.D., F.R.S.,
WILLIAM CARRUTHERS, F.R.S., F.L.S., F.G.S.,
AND
WILLIAM FRANCIS, Ph.D., F.L.S.

VOL. XVII.—SIXTH SERIES.

LONDON:
PRINTED AND PUBLISHED BY TAYLOR AND FRANCIS.
SOLD BY SIMPKIN, MARSHALL, HAMILTON, KENT, AND CO., LD.;
WHITTAKER AND CO.: BAILLIÈRE, PARIS:
MACLACHLAN AND STEWART, EDINBURGH:
HODGES, FIGGIS, AND CO., DUBLIN: AND ASHER, BERLIN.
1896.

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

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

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

J. Taylor, *Norwich*, 1818.

ALERE FLAMMAM.

CONTENTS OF VOL. XVII.

[SIXTH SERIES.]

NUMBER XCVII.

NUMBER XCVIII.

NUMBER XCIX.

NUMBER C.

NUMBER CI.

NUMBER CII.

PLATES IN VOL. XVII.

Vol. 17. SIXTH SERIES. No. 97.

THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY,
INCLUDING
ZOOLOGY, BOTANY, AND GEOLOGY.

CONDUCTED BY

ALBERT C. L. G. GÜNTHER, M.A., M.D., PH.D., F.R.S.,
WILLIAM CARRUTHERS, F.R.S., F.L.S., F.G.S.,
AND
WILLIAM FRANCIS, PH.D., F.L.S.

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

WITH EIGHT PLATES.

LONDON:
TAYLOR AND FRANCIS, RED LION COURT, FLEET STREET.
Sold by Simpkin, Marshall, Hamilton, Kent, & Co., Ld.; Whittaker & Co.: Baillière, Paris: Maclachlan and Stewart, Edinburgh: Hodges, Figgis, & Co., Dublin: and Asher, Berlin.

Double Number. Price Five Shillings.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SIXTH SERIES.]

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

No. 97. JANUARY 1896.

I.—*On some Remains of the Pycnodont Fish*, Mesturus, *discovered by Alfred N. Leeds, Esq., in the Oxford Clay of Peterborough.* By A. SMITH WOODWARD, F.L.S., of the British Museum (Natural History).

[Plates I.–III.]

THE systematic position of the Mesozoic fishes originally named Pycnodonts by Agassiz * has hitherto remained problematical. Notwithstanding the general descriptions in the 'Poissons Fossiles,' the later memoirs of Wagner †, Heckel ‡, Thiollière §, and Vetter ||, and the smaller contribu-

* L. Agassiz, 'Recherches sur les Poissons Fossiles' (1833–44), vols. i., ii.

† A. Wagner, "Beiträge zur Kenntniss der in den lithographischen Schiefern abgelagerten urweltlichen Fische: Die Pycnodonten," Abh. k. bay. Akad. Wiss., math.-phys. Cl. vol. vi. (1851) pp. 6–59, pls. i., iii., iv.

‡ J. J. Heckel, "Beiträge zur Kenntniss der fossilen Fische Oesterreichs: Die Pycnodonten, Agass., oder Pleurolepiden, Quenst.," Denkschr. k. Akad. Wiss., math.-naturw. Cl. vol. xi. (1856) pp. 187–242, pls. i.–xi.

§ V. Thiollière, 'Description des Poissons du Jura dans le Bugey,' pt. i. (1854).

|| B. Vetter, "Die Fische aus dem lithographischen Schiefer im Dresdener Museum," Mittheil. k. mineral.-geol. Mus. Dresden, pt. iv. (1881).

tions of Quenstedt *, Zittel †, and others, the osteology of these fishes is still very incompletely known; and a much fuller knowledge is required before the problem of their relationships can be solved. One disadvantage under which nearly all authors hitherto have laboured is the crushed nature of the specimens. With perhaps only two exceptions ‡, all the important Pycnodont remains as yet described are flattened in the hard matrix of such formations as the Lithographic Stone of Bavaria and France, the English Purbeck Stone, and the fissile Cretaceous limestone of Mount Lebanon. Such specimens are admirable as displaying the trunk and fins, but rarely of much service in the matter of cranial osteology; and this must be thoroughly understood before there can be further progress in classification.

A new departure can now be made by the fortunate discovery of some beautiful skulls and other remains in the soft clay of Oxfordian age in the neighbourhood of Peterborough. Thanks to the skill and care of Mr. Alfred N. Leeds, F.G.S., who has already unearthed so many new Jurassic Vertebrata in this formation and locality, no less than five important specimens of the Pycnodont genus *Mesturus* are available for study. Though partly in concretionary clay, they are nearly all free from matrix, and can thus be examined almost as readily as the bones of a recent fish; the only difficulty consists in imperfections and fractures due to the circumstances of preservation. Except one specimen, which has been acquired by the British Museum, these fossils are in the private collection of Mr. Leeds, and will be referred to under their catalogue-numbers as follows:—

No. 1 (Leeds Catalogue).—Greater portion of head and squamation of abdominal region, with remains of paired fins. (Pl. I.)

No. 2 (Leeds Catalogue).—Hinder portion of head, with fragments of squamation and caudal fin, and detached mandible. (Pl. III. fig. 2.)

No. 23 (Leeds Catalogue).—Imperfect head, with jaws and remains of anterior squamation.

No. 24 (Leeds Catalogue).—Remains of head and pectoral arch, several elements being detached. (Pl. II.)

No. P. 6834 (British Museum Catalogue).—Several isolated bones of one skull, comprising the parasphenoid,

* F. A. Quenstedt, 'Handbuch der Petrefaktenkunde' (ed. 1, 1852, ed. 2, 1867, ed. 3, 1883), and 'Der Jura' (1858).

† K. A. von Zittel, 'Handbuch der Palæontologie,' vol. iii. (1887).

‡ *Mesodon rugulosus* (Ag.), A. S. Woodward, Proc. Geol. Assoc. vol. xii. (1892) p. 238, pl. iv. figs. 2–4. *Anomœodus Willetti*, A. S. Woodward, Geol. Mag. [3] vol. x. (1893) p. 489, pl. xvii. fig. 1.

supposed basisphenoid, right postfrontal, right and left squamosal, portion of right frontal, right and left operculum, and other fragments. (Pl. III. figs. 3–6.)

I. Description of Specimens.

Cranium.

The bones of the cranial roof form a continuous shield, much arched from side to side, and extend from the occiput to the rostrum without any fontanelle or loss of the tubercular ornamentation. The sutures between them can be readily recognized on close inspection, and the limits of some of the elements are remarkably inconstant. It is clear, indeed, that these are merely dermal bones, and there is so much difference between the cranial roof of the two best-preserved specimens, that it is necessary to describe them separately.

Specimen no. 1 *.—The hinder half of the skull in this fossil (Pl. I.) appears to exhibit its natural form; but from the middle of the orbits forwards it is much fractured and laterally compressed. The occipital crest is not much elevated, and the longitudinal median ridge of the roof is gently rather than sharply bent from side to side. A few fixed points can be definitely recognized, and it is necessary in the description to begin with these for the approximate determination of the more problematical bones. The occipital border of the cranium is exposed behind by the crushing of the numerous small supratemporal scales (Pl. I. figs. 1, 1 *a*, *s.t.*), and appears to have been directly transverse, with the exception of a short median peak formed by the supraoccipital element (*s.occ.*). The outer margin of the cranial roof is also well preserved on each side, and the exact limits both of the otic region and the orbits (*orb.*) are indicated. The margin of the supraoccipital plate (*s.occ.*) is distinct except in the hindermost part of its lateral sutures; it projects posteriorly to fit in a triangular notch of the median supratemporal, and is itself excavated in front for the reception of the pointed hinder extremity of another median plate (*p.eth.*), which partly separates the frontals. The latter elements are also readily recognized (*fr.*), and meet in the middle line anteriorly for nearly one quarter of their extreme length. Each frontal in this specimen is much crushed and fractured; but the sutures can be observed, and a detached fragment from another specimen (Brit. Mus. no. P. 6834) confirms the curious bifurcation of the hinder

* A diagram of the arrangement of the cranial roof-bones in this fossil is given in the recently published vol. iii. of the Catal. Foss. Fishes B. M. p. 192, fig. 30.

portion here indicated. The outer margin of the bone is excavated by the orbit (*orb.*), and exhibits a short and broad rounded process, extending downwards over the cheek near its anterior end, apparently covering the lateral ethmoidal (prefrontal) cartilage; posteriorly it first meets the squamosal (*sq.*), which also enters the border of the orbit, and then it is excavated by a deep re-entering angle, which divides it into an outer small, and inner large, posteriorly directed process; inwardly it is separated from its fellow of the opposite side by the supraoccipital (*s.occ.*) and another median element (*p.eth.*) behind, by the ordinary ethmoidal plates (*eth.*) in front, and only meets between these for the short length already mentioned; anteriorly the margin is not directly transverse, but inclined much forwards as it approaches the outer edge of the skull. The squamosal (*sq.*) is the last readily determinable element of the cranial roof, and in connexion with the specimen now being described it is interesting also to notice the detached examples of the same bone in the British Museum fossil no. P. 6834. Nearly one third of the outer margin of this bone enters the rim of the orbit, its hinder two thirds forming an almost straight edge above the opercular region; the posterior margin is at right angles to the latter, and the bone unites with adjoining elements in a very wavy suture. It is much broader behind than in front; and immediately behind the orbital rim there is a rugose facette on its inferior face for the articulation of the sphenotic (postfrontal). The smooth hyomandibular facette, which is not much extended, can also be observed; but the remainder of the attached surface of the bone exhibits no facettes. Of the problematical roof-bones, those between the frontal, squamosal, and supraoccipital (marked x in Pl. I. fig. 1 a) are the most difficult to understand. On the right side of the fossil, fitting into the posterior re-entering angle of the frontal, there is an irregularly triangular plate not extending so far as the occiput, and this element is apparently subdivided by a coalesced suture which obliquely crosses its middle. Another plate, not clearly exhibiting even coalesced sutures, completes the filling of the space between the last-described plate, the squamosal, frontal, and supraoccipital. On the left side of the fossil the same area is occupied by more numerous plates. One apparently equals the foremost triangular bone, but does not exhibit any trace of former subdivision. At least four elements correspond with the hinder bone, the two longitudinal sutures shown in Pl. I. fig. 1 a being open and the short transverse suture near the back apparently closed. The median plate (*p.eth.*) interposed between the posterior portion of the frontals and filling the re-entering angle in the anterior margin of the supraoccipital is bilaterally symmetrical, acutely pointed behind, and widest in front. Some of its median tuberculations are relatively very small. The ethmoidal and facial region in advance of the frontals is apparently completely covered with irregular polygonal plates (*eth.*), more finely tuberculated than the hinder portion of the cranial roof. Some of the posterior median ethmoidal plates are fused together, but indications of the original sutures are distinct. The vomerine region (*v.*), as usual in Pycnodonts, is shown to be very robust and provided with a regularly arranged pavement of teeth. Remains of an external tuberculated plate on the right side may perhaps represent the maxilla (Pl. I. fig. 1, *y*). The stout smooth premaxillæ (*pmx.*), each exhibiting the bases of three large teeth, are preserved at the end of the snout.

Specimen no. 24 (*Leeds Catalogue*).—The second well-preserved specimen (Pl. II.) wants the ethmoidal region, but displays the greater part of the cranial roof behind, especially on the right side. The supraoccipital plate (*s.occ.*) extends, as described before, in a short pointed process fitting into the large median supratemporal; but it differs in being much further produced forwards, and may, indeed, be regarded as the supraoccipital proper fused completely with the problematical median plate (*p.eth.*), which is a separate element in the above-described fossil. The frontals (*fr.*) are apparently similar in general form and proportions to those already described; but there is a marked difference in the circumstance that they do not meet at any point in the middle line. The supposed compound supraoccipital plate gradually contracts in width in its anterior half, but is prevented by truncation from ending quite in a point. Its contracting lateral margins articulate with the frontals; but its short front border is apposed to another median plate (*eth.*), which extends as far forwards as the ethmoidal tesseræ. This element is also antero-posteriorly elongated, but gradually widens to the foremost point of its suture with the frontals, and is then quickly narrowed again at its irregular articulation in front. It is doubtless equivalent to the triangular portion of the ethmoidal shield, which only extends into the frontal region for a very short distance in specimen no. 1. The outlines of two of the polygonal ethmoidal plates can be distinguished on the right side of the fossil immediately in advance of the frontal. Among inner bones the crushed ossified mesethmoid can be seen supporting the single dentigerous vomer, while a portion of the parasphenoid splint is exposed from its inferior aspect. The main part of this bone (fig. 1 *a*) is short, stout, and broad, produced below into a median longitudinal keel, and its basipterygoid processes (*bpt.*) are short, with a very coarsely dentated articular end. At the front extremity of the otic region the parasphenoid is abruptly truncated, the keel terminates in a roughened pointed knob (*k.*), and the element continues merely as a narrow slender median bar across the region of the orbit. A detached example of the same bone in specimen no. P. 6834 (Pl. III. figs. 3, 3 *a*) may be described in almost similar terms; but here the basipterygoid processes (*bpt.*) are turned a little more outwards and the median keel is partly broken away. The inner face (fig. 3 *a*) shows that this keel was hollow in its deepest portion; and there is a long median scar for articulation probably with the most anterior elements of the brain-case. A pair of foramina, one on either side of the posterior part of the median keel, seem to pierce the bone and open directly on its inner face.

Other Specimens.—The three more fragmentary specimens only remain for consideration, and may be dismissed with brief remarks. No. 2 (Leeds Catal.) is interesting as exhibiting the squamosals with the clearly defined straight occipital border of the skull; and in this fossil the supraoccipital has a less prominent hinder peak than is observed in the specimens described above. No. 23 (Leeds Catal.) is very much crushed and fractured, but the outline of the left frontal is distinct, and, if appearances be not deceptive, its connexions are different from those in both types described above. Here the frontal seems to meet its fellow of the opposite side for some distance, and the ethmoidal shield is disposed as in no. 1; but the hinder part of its inner suture is shaped as in no. 24, and was thus presumably articulated with a median plate much resembling the anterior end of the supraoccipital in the last-named fossil. The third and last specimen is the small group of isolated bones (Brit. Mus. no. P. 6834) of which the squamosal and parasphenoid have been incidentally described above. Among these the right postfrontal (sphenotic) is specially worthy of notice as being well preserved. It is small and meets the squamosal in a triangular rugose facette; its smooth outer face is triangular, while its equally smooth anterior face is gently concave, to form part of the hinder wall of the orbital cavity; inwardly it is roughened for articulation with another otic element; its posterior aspect takes part in the facette for the upper end of the hyomandibular; and its lower extremity shows a coarsely interdigitating articular surface. A problematical bone from the base of the skull (Pl. III. figs. 4, 4 *a*) is also interesting. It is bilaterally symmetrical and seems to have been formed in cartilage; and the only suggestion the present writer can make is that it represents a basisphenoid immediately behind the parasphenoid. It is longer than broad, and its presumably inferior face (fig. 4) exhibits a longitudinal keel which is partly broken away; it is narrowest at what appears to be its hinder extremity, while the lateral margins form sharp edges, each apparently notched near its anterior end. There is an oblique roughened articular surface behind, shown on the lower aspect (fig. 4, *p.f.*), and another similar surface, sloped in the opposite way, appears from the inferior aspect in front (*a.f.*), this fitting very well upon the parasphenoid if it happens to have been placed as here supposed. The inner face of this problematical bone (fig. 4 *a*) is comparatively flat, exhibiting only a possible articular surface at its narrowed posterior end. A pair of large foramina pierce the bone obliquely near its middle, the inferior opening being situated further forwards than its superior exit.

Jaws and Facial Bones.

The mandibular suspensorium is unknown and the pterygo-quadrate arcade is exhibited only in one specimen (no. 1). Like that of *Anomœodus Willeti*, this arcade is in the form of a delicate toothless plate (Pl. I. fig. 1, *ptq.*), but it is unfortunately only preserved and exposed in its most posterior portion, where the concavely arched front margin of the ecto-pterygoid passes into that of the quadrate (*qu.*). The latter element is comparatively robust, and it seems to exhibit a surface of attachment for the symplectic along nearly the whole of its hinder margin; at least an apparently articular surface may be observed in this position on both sides of the only known specimen. Its articular face for the mandible is irregularly oval, much deeper than broad, and slightly concave. The premaxillæ (*pmx.*) are robust, deep, and narrow, meeting in the middle line and each showing the bases of three teeth. They are smooth and overlapped by the tuberculated ethmoidal plates, and each is notched on its outer lateral margin. Whether or not any facial element can be identified with the maxilla is uncertain; but one large tuberculated cheek-plate (*y*), deeper behind than in front, extends down to the border of the upper jaw. This plate is very thin and toothless. A small cheek-plate (*z*) covers the outer face of the postfrontal bone, and there is evidence of equally small irregular suborbitals (*s.o.*). The mandible is sometimes partly obscured by the crushing of facial bones upon it; but the four specimens in the Leeds Collection suffice to exhibit all its elements. The dentary bone (Pl. I. fig. 1, *d.*; Pl. II. fig. 4; Pl. III. fig. 2, *d.*) is comparatively insignificant, thin, deep, and narrow, meeting its fellow in the middle line and bearing a row of four large teeth. The greater portion of its external surface is ornamented with tubercles, and it sends a postero-inferior process underneath the large angular plate. The latter plate (Pl. II. fig. 5; Pl. III. fig. 2, *ang.*) does not extend upwards so far as the oral margin, but it completes the hinder portion of the outer face of the mandibular ramus, and its hinder ascending portion meets a small coronoid bone (*cor.*) in a very wavy suture, which is frequently closed. The upper portion of the coronoid bone is very thin and quite smooth, and does not reach the tip of the great coronoid process of the splenial. Indeed, the splenial element (Pl. I. fig. 1, *spl.*; Pl. II. fig. 3; Pl. III. fig. 2, *spl.*) is exposed on the outer aspect of the entire margin of the mandibular ramus behind the short oral border of the dentary. It is much the largest and stoutest bone in the jaw, meeting its fellow of the opposite side at the symphysis and completely covered to the base of its coronoid elevation with a pavement of teeth. The articular bone (Pl. I. fig. 1, *art.*), on the inner face of the angular and apparently distinct, is always distorted by crushing, though considerably ossified.

Dentition.

Teeth are confined to the vomer, splenial, premaxilla, and dentary. They are all hollow, with a short base firmly anchylosed to the supporting bone. Certain displaced and unusually coloured dental crowns are more suggestive of the existence of successional teeth than any evidence the present writer has hitherto observed; but there is still no conclusive proof of such displacement of the worn teeth. Of the prehensile front teeth only one is preserved in the right dentary of no. 24 (Pl. II. fig. 4); its base is elevated, while the crown is transversely elongated and chisel-shaped, convex on the outer face, concave within. As already mentioned, each premaxilla bears three of these teeth, while each dentary has four, all about of equal size. The oral surface of the vomer (Pl. I. fig. 1 *b*; Pl. II. fig. 2) is flat and bears three principal longitudinal series of teeth, one median and a symmetrical pair on the lateral margins. The lateral teeth are not much inferior in size to those of the median series, but in the anterior half of the bone there is an intermediate pair of rows of teeth scarcely half as large as the others; and as these pass backwards they become more and more irregular, are supplemented with more intermediate teeth, the majority still smaller and all very irregularly arranged. The dentition on the splenial bone (Pl. I. figs. 1, 1 *c*; Pl. II. fig. 3) extends to its outer margin as far as the base of the coronoid process. There is one principal longitudinal series of oval teeth, about as large as the median vomerine series, but the long axis of each tooth oblique. The outermost row of teeth (wanting in the original of Pl. I.) is not much inferior in size, and, as in the vomer, the external end of each tooth is produced into a slight peak for grasping. Within the principal series one regular row of round teeth about half as large and an innermost irregular row of still smaller teeth can be observed. Between the principal and outermost series the same small teeth, disposed almost symmetrically with those on the inner side of the principal series, are also seen; but, except in the anterior third of the bone, these two rows are supplemented and partly disturbed by the interposition of other small teeth. All these tritoral teeth in both jaws are smooth and exhibit a shallow apical indentation, with a crimped margin, very rarely also with a slight median tubercle. The shape of the indentation varies with that of the tooth, and the hinder portion of its crimped border is not infrequently wanting.

Opercular and Branchiostegal Apparatus.

The opercular apparatus is well displayed, and the operculum and preoperculum can be readily identified. On the left side of no. 2 these bones are crushed a little downwards and the upper end of the hyomandibular is thus partly exposed, showing the short and deep process for the suspension of the operculum. The last-mentioned plate is also preserved among the isolated bones in Brit. Mus. no. P. 6834 (Pl. III. figs. 5, 6). It is comparatively small, deep and narrow, its truncated upper end twice as broad as the supratemporals (shown in Pl. I. fig. 1), its straight anterior border placed vertically at the line of the occiput, and its lower half tapering to a point. In front it is overlapped, as usual, by the preoperculum (*p.op.*), and there is a large hollowed articular facette (Pl. III. fig. 5 *a, f.*), well within on its anterior border near the upper extremity, for its suspension on the hyomandibular process. The preoperculum is the large irregularly triangular plate always conspicuous in Pycnodont skulls, and in no. 2 its hinder margin distinctly corresponds with that of the hyomandibular. On the right side of no. 1

(Pl. I. fig. 1, *p.op.*) it is shattered by fracture in front, but it is well preserved at the upper end; and in this fossil, as also in no. 2, there is shown interposed between it and the squamosal a small apparently nearly square plate (*z*), which is tuberculated as usual. The preoperculum thus does not extend upwards quite so far as the operculum, which seems to touch the hinder angle of the cranial roof; but its great expanded inferior portion reaches considerably further downwards on the cheek than the tapering lower end of the latter element. Below the preoperculum in no. 1 there are remains of two slender plates having the appearance of branchiostegal rays, the upper of considerable size, the lower very small and delicate. The first is also seen in nos. 2 and 23, and on the external face it is always in part tuberculated. The space between the mandibular rami (Pl. III. fig. 2) is completely covered with very small and delicate polygonal tessellated plates (*t.*), marked with a tubercular ornament as coarse as that of the other bones.

Appendicular Skeleton.

The post-temporal bone and supraclavicle are not recognizable. There is reason to believe that neither of them was exposed on the tuberculated exterior of the fish, for in no. 1 the expanded upper end of the first dorso-ventral series of flank-scales is shown to curve forwards and to be directly overlapped by the small supratemporals. The same arrangement is also suggested by no. 2, where the foremost scales are displaced and exhibit the comparatively fine tubercles of their hidden front margin. The clavicle is relatively small, and this element of the left side is detached in no. 24. Its exposed portion (Pl. II. fig. 6) is restricted and narrow, ornamented with tubercles only on its short inferior limb, while its long fibrous upper limb is considerably thickened. There is no laminar expansion of the bone bent inwards at its anterior border. The coraco-scapular attachment is shown on the inner face (Pl. II. fig. 6 *a*), but neither coracoid, scapula, nor basals are preserved, only the unjointed bases of the fin-rays in one specimen.

The pelvic fins are present, but quite small and insignificant. The best-preserved example in no. 1 exhibits only five rays, which are rather stout and soon become very closely divided and articulated at a short distance above the base. Nothing is known of the basal pelvic elements.

Of the median fins only a fragment at the origin of the caudal is preserved in no. 2. This is identifiable on comparison with the corresponding fin in a specimen of *Mesturus verrucosus* in the British Museum (no. 37023). The rays at the anterior border gradually increase in length. The two foremost rays are practically only elongated ridge-scales, the right and left halves of each being fused together at the apex; the next two rays are also unjointed, but exhibiting the two halves completely separated; the fifth ray shows three articulations, two being close together and the third a long distance further up; the succeeding rays are all closely jointed distally. Between the extremities of the second to the fifth rays on the anterior border there are four short and delicate regularly alternating intercalary rays, which may perhaps be termed fulcra.

Squamation.

The trunk is very incomplete in all the specimens, but considerable portions of the squamation of the abdominal region are preserved. The scales (Pl. III. fig. 1) are all thick and quadrangular, not strengthened within by any well-defined rib, but deeply imbricating, and united above and below both by the peg-and-socket articulation and by a jagged suture. This remarkable suture is most pronounced on the middle of the flank, reduced to a slight waviness towards the ventral border of the fish, while in one specimen (no. 23) it is comparatively feebly marked. The external face of each scale is ornamented with large and rounded closely arranged tubercles; but these are wanting towards the smooth hinder border, which is not denticulated. The very regular flank-series become less regular towards the ventral margin, and in no. 1 one series terminates in a wedge-shaped scale slightly above and in advance of the pelvic fins. Some of the flank-scales are about twice as deep as broad, while those of the ventral region are mostly about as broad as deep. The azygous ventral ridge-scales are very narrow, ornamented as the others, but having some of the tubercles pointed and delicately striated; they are destitute of any inwardly directed process, and merely unite with the adjoining scales by a jagged suture.

II. Systematic Determination.

The generic determination of the fossils thus described is rendered easy by the nature of the scales. The typical species of *Mesturus*, *M. verrucosus* *, as represented in the British

* A. Wagner, Abh. k. bay. Akad. Wiss., math.-phys. Cl. vol. ix. p. 338, pl. iii. fig. 1 (1862).

Museum by a fine specimen from the Bavarian Lithographic Stone (no. 37023), shows that most of the scales in this genus are united above and below by jagged sutures—a feature, so far as the present writer is aware, unique among fishes. The new Oxfordian specimens from Peterborough not only agree in exhibiting this peculiarity, but also in the general aspect of all the other parts which can be compared. Although the caudal fin is wanting in all these fossils, there can therefore be no doubt that they belong to the fan-shape-tailed *Mesturus* rather than to the fork-tailed *Gyrodus*, which is the only other genus displaying much resemblance.

With regard to specific characters, it may be remarked that these are usually sought among Pycnodonts in the tritoral dentition. The precise characters of the teeth of *M. verrucosus*, however, are unknown, and the dentition in three of the Oxfordian specimens now described is so remarkably similar, notwithstanding the striking differences in the arrangement of the bones of the cranial roof and the variation in the tubercular ornament, that it is difficult to form any judgment as to nomenclature. The specimen of *M. verrucosus*, however, in the British Museum is characterized by an irregular enlargement of the tubercles along the anterior half of the course of the "lateral line," while many of its scales display radiating structural lines; and both these features are wanting in the new fossils from the Oxford Clay. We therefore appear to be dealing with a new species, of which the dental characters are described in detail on p. 8, and it may be appropriately named *Mesturus Leedsi*, in compliment to its discoverer. The fossil no. 1 (Leeds Catalogue) must be regarded as the type specimen, and the others are provisionally associated with it until complete examples of each of these varieties are discovered.

III. Conclusions.

Two most important results are obtained from the new specimens of *Mesturus* now described. The arrangement of the cranial roof-bones of a Pycnodont fish is discovered for the first time, and the true nature of the opercular apparatus is determined. It is also interesting to observe a partial confirmation of the facts in regard to the arrangement of the jaws, which were revealed two years ago by the study of the Cretaceous genus *Anomœodus* *.

* A. S. Woodward, "On the Genus *Anomœodus*, with Remarks on the Structure of the Pycnodont Skull," Geol. Mag. [3] vol. x. (1893) p. 487, pl. xvii. fig. 1.

The bony shield of the cranial roof is remarkable for its close resemblance to the corresponding shield in *Acipenser* and certain Siluroids. It is, in fact, the first instance of this arrangement of plates recorded among fishes which exhibit a trunk and fin-skeleton on the same biological level as the Pycnodont type. Moreover, the disposition of the sutures is evidently as capricious as that in *Acipenser*; for not only do the parietal plates of no. 1 lack bilateral symmetry, but two specimens so closely similar in other respects as nos. 1 and 24 differ completely in the arrangement of the median roof-elements. It is also to be noted that in the allied genera *Mesodon*, *Microdon*, and *Gyrodus* there is only one parietal plate on each side, while from this in the two first-mentioned genera there arises a large posteriorly directed process with digitate extremity, which extends immediately beneath the dorsal scales of the trunk. In the Cretaceous *Coccodus* all the elements of the cranial roof are fused together. The external bones of the Pycnodont skull are thus of an anomalous and variable character.

The opercular apparatus is equally remarkable, and only parallelled among deep-bodied Teleostean fishes in which the jaws are displaced far forwards (e. g. *Lampris* and the Gymnodonts). The small operculum has hitherto been described as "supraclavicle;" but if any evidence of its identity is required beyond that described above, it is only necessary to examine a specimen of *Gyrodus* in the British Museum (no. 37108), where the element may be seen suspended by the opercular process of the hyomandibular *. The identification of the preoperculum ("operculum" of previous authors) is confirmed by its demonstrated relationships in *Anomœodus Willetti*. The two branchiostegal rays and the tesseræ of the gular region have previously been noticed in *Gyrodus*.

In estimating the taxonomic value of these and the generally-known characters of Pycnodonts it is necessary to remember two facts:—Firstly, that *Acipenser* and its living allies are proved by palæontology to be the degenerate descendants of ganoid fishes which had the cranial roof-bones arranged in a normal manner (cf. *Chondrosteus*); secondly, that the disposition of the opercular apparatus, as also the firm fixation of the pterygo-palatine arcade, observed in the Pycnodonts, is likewise met with in more than one group of the bony fishes—is, in fact, merely a physiological correlation (1) with the reduction in size of the outlet of the gill-cavity, (2) with the forward displacement of the mouth, and (3) with

* This fossil is described and figured in the recently published vol. iii. of the Catal. Foss. Fishes B. M. p. 235, pl. xvi. fig. 3.

the powerful development of the dentition. Thus the Pycnodonts *may* be closely related to other ganoid fishes with normal skulls, and their nearest allies *may* exhibit a quite ordinary opercular and branchiostegal apparatus if the mouth be less displaced or the dentition less powerful.

Having premised so much, it only remains to emphasize again the contention of Traquair * that the Pycnodont skeleton, considered apart from the head, is completely "Lepidosteoid" in character. This emphasis is all the more necessary since, even in a modern handbook, which is authoritative in most respects, the exploded errors of thirty years ago are allowed undue influence, and the "special" difference between Pycnodonts and the Palæozoic Platysomidæ is said to consist in "the dentition and arrangement of the jaws" †. As a matter of fact, all the fundamental differences are in the trunk. In Pycnodonts the tail is atrophied-heterocercal, the rays of the dorsal and anal fins are supported by a single series of endoskeletal elements of equal number, and there are no infraclavicles. Even the most specialized of known Platysomidæ never exhibit the faintest approach to this combination of characters; the heterocercal tail and multiple-rayed median fins are as pronounced in the most specialized as in the most generalized types. The summit of Platysomid evolution seems to have been attained by the anomalous Permian genus *Dorypterus*. The only known link between the grade of fish to which *Platysomus* belongs and the higher grade in which the Pycnodonts must be placed is the Triassic family of Catopteridæ, where the upper caudal lobe is hemiheterocercal, while the rays of the dorsal and anal fins are nearly as few as their supports, which are ranged in only one series. Present knowledge is therefore in favour of the supposition that the Pycnodonts are a secondary modification of the higher or "Lepidosteoid" grade, which was first reached through comparatively generalized types of fishes resembling the Catopteridæ.

In fact, making allowance for the morphological changes necessitated by a reduced branchial outlet and a forwardly displaced mouth—further, admitting that the anomalous arrangement of the cranial roof-bones is the result of degeneration—there is little to distinguish the Pycnodonts from *Lepidotus*, *Dapedius*, and their allies. It is certainly noteworthy that *Lepidotus* itself, which has the most highly developed tritoral dentition, exhibits very few branchiostegal

* R. H. Traquair, "On the Structure and Affinities of the Platysomidæ," Trans. Roy. Soc. Edinb. vol. xxix. (1879), pp. 382–386.

† K. A. von Zittel, 'Grundzüge der Palæontologie' (1895), p. 574.

rays and no gular plate, while the cheek-plates are very irregularly subdivided. It is also curious that the allies of this genus and *Dapedius* (e. g., *Tetragonolepis* and *Aetheolepis*) are the only known "Lepidosteoids" in which the caudal squamation degenerates behind a definite straight line, as it does in so many Pycnodonts. On the whole, therefore, it is reasonable to refer the fishes under discussion to a place among the "Lepidosteoids" corresponding with that occupied by *Acipenser* among the "Acipenseroids" and by the Siluridæ among ordinary Physostomi.

EXPLANATION OF THE PLATES.

Mesturus Leedsi, sp. n.—Oxford Clay, Peterborough. All the figures natural size unless otherwise stated.

Plate I.

Fig. 1. Head &c., right lateral aspect, with right mandibular ramus removed, one-half nat. size. [Leeds Collection, no. 1.]

Fig. 1 *a.* Ditto, superior aspect, one-half nat. size. *art.*, articular; *d*, dentary; *eth.*, ethmoidal plates; *fr.*, frontal; *op.*, operculum; *orb.*, orbit; *p.eth.*, posterior ethmoidal; *p.op.*, preoperculum; *pct.*, pectoral fin; *pmx.*, premaxilla; *ptq.*, pterygo-quadrate arcade; *qu.*, quadrate; *s.o.*, suborbitals; *s.occ.*, supraoccipital; *s.t.*, supratemporals; *spl.*, splenial; *sq.*, squamosal; *v.*, vomer; *x*, parietals; *y*, maxilla (?); *z*, undetermined dermal plate.

Fig. 1 *b.* Ditto, vomerine dentition.

Fig. 1 *c.* Ditto, left splenial dentition, wanting outermost series.

Plate II.

Fig. 1. Imperfect head, superior aspect, two-thirds nat. size. [Leeds Collection, no. 24.] Letters as in Pl. I.

Fig. 1 *a.* Ditto, parasphenoid, inferior aspect, two-thirds nat. size. *bpt.*, basipterygoid process; *k.*, knob; *pas.*, main part of bone; *pt.f.*, postfrontal (sphenotic).

Fig. 2. Ditto, vomerine dentition.

Fig. 3. Ditto, left splenial with dentition.

Fig. 4. Ditto, right dentary, outer aspect.

Fig. 5. Ditto, right angular, outer aspect.

Fig. 6. Ditto, left clavicle, outer and inner (6 *a*) aspects.

Plate III.

Fig. 1. Portion of squamation. [Leeds Collection, no. 1.]

Fig. 2. Mandible. [Leeds Collection, no. 2.] *ang.*, angular; *cor.*, coronoid; *d.*, dentary; *spl.*, splenial; *t*, tesseræ.

Fig. 3. Parasphenoid, inferior and superior (3 *a*) aspects. [British Museum, no. P. 6834.] *bpt.*, basipterygoid process.

Fig. 4. Supposed basisphenoid, inferior and superior (4 *a*) aspects. [Ditto.] *a.f.*, anterior facette; *p.f.*, posterior facette.

Fig. 5. Right operculum, outer and inner (5 *a*) aspects. [Ditto.] *f.*, facette for hyomandibular suspension.

Fig. 6. Left operculum, imperfect below, outer aspect. [Ditto.]

II.—*Descriptions of new Reptiles and Batrachians from Colombia.* By G. A. Boulenger, F.R.S.

The new Reptiles and Batrachians described below form part of a collection made at Buenaventura, near the coast, and at Cali, on the west slope of the Cordillera, at an altitude of 3200 feet, by Mr. W. F. H. Rosenberg. A selection from the collection has been acquired by the Trustees of the British Museum, including the types of the new species.

Anolis Rosenbergii.

Allied to *A. bitectus*, Cope. Head twice as long as broad, slightly longer than the tibia; forehead deeply concave; frontal ridges indistinct; upper head-scales strongly keeled, on the end of the snout tricarinate; scales of the supraorbital semicircles enlarged, in contact with each other or separated by one series of scales; five to nine enlarged supraoculars; occipital larger than the ear-opening, separated from the supraorbitals by one or two series of scales; canthus rostralis angular; loreal rows six or seven; five upper labials to below the centre of the eye; ear-opening moderate, roundish. Gular appendage large; gular scales keeled. Body short, compressed; no dorso-nuchal crest. Dorsal scales large, hexagonal, juxtaposed, strongly keeled, in ten or twelve longitudinal series; lateral scales minutely granular; ventral scales larger than dorsals, rhomboidal, pointed, imbricate, sharply keeled. The adpressed hind limb reaches the eye; digits very feebly dilated; 16 lamellæ under phalanges II. and III. of the fourth toe. Tail rounded, slightly compressed at the base, twice and two thirds as long as head and body. No enlarged postanal scales. Pale greyish brown above; a white streak from below the eye to the middle of the side of the body, passing above the ear; a large dark light-edged spot on the upper surface of the tibia; a blackish blotch on each side of the body, in front of the hind limb; lower parts white; gular appendage bluish black, with series of white scales.

	millim.
Total length	163
Head	12
Width of head	6
Body	33
Fore limb	20
Hind limb	35
Tibia	11
Tail	118

Two specimens, male and half-grown, from near Buenaventura.

Anolis notopholis.

Allied to *A. tropidonotus*, Ptrs. Head once and two thirds to once and three fourths as long as broad, as long as the tibia; forehead concave; frontal ridges feebly marked, short and divergent; all the upper head-scales strongly keeled; scales of the supraorbital semicircles enlarged, in contact with each other or separated by one or two series of scales; two to five enlarged supraoculars; occipital feebly enlarged, separated from the supraorbitals by two or three series of scales; canthus rostralis angular; loreal rows six or seven; seven to nine upper labials to below the centre of the eye; ear-opening large, vertically oval. Gular appendage large; gular scales keeled. Body short, compressed; no dorso-nuchal fold. Dorsal scales very large, the largest fully twice as large as the ventrals, hexagonal, subimbricate, sharply keeled, forming eight or ten longitudinal series, the two median series formed of smaller scales; lateral scales very small, imbricate, keeled; ventral scales rhomboidal, rounded or truncate behind, sharply keeled. The adpressed hind limb reaches the nostril or the end of the snout; digits very slightly dilated; 14 or 15 lamellæ under phalanges II. and III. of the fourth toe. Tail slightly compressed, once and three fourths to twice as long as head and body. No enlarged postanal scales. Bronzy or golden above, with a series of large black oblique spots on each side of the back; a black stripe on each side of the nape, bifurcating on the back of the head, the outer branch extending to the eye; a black line from the eye to the nostril, below the canthus rostralis; lower parts pale golden; gular appendage vermilion-red.

	♂. millim.	♀. millim.
Total length	148	147
Head	14	15
Width of head	8	9
Body	34	37
Fore limb	21	22
Hind limb	42	46
Tibia	14	14
Tail	100	95

Several specimens from near Buenaventura.

Homalocranium longifrontale.

Eye about half as long as the snout. Rostral broader than deep, just visible from above; internasals not half as long as the præfrontals; frontal hexagonal, obtuse-angled in front, acute-angled behind, twice as long as broad, much longer than its distance from the end of the snout, shorter than the parietals; nostril between two nasals, the posterior widely separated from the præocular; two postoculars; temporals 1 + 1; seven upper labials, second in contact with the præfrontal, third and fourth entering the eye; first lower labial in contact with its fellow behind the symphysial; four lower labials in contact with the anterior chin-shields, which are longer than the posterior. Scales in 15 rows. Ventrals 158; anal divided; subcaudals 85. Pale brown above, with five dark brown longitudinal lines; head and nape black; a yellow band across the snout; a yellow blotch on each side of the head behind the eye; a round yellow spot on each side of the vertex, between the supraocular and the parietal, another pair on the back of the head between the parietal and the second temporal, and a yellow dot on each parietal near the median suture; the black of the nape bordered with yellow behind; a series of blackish dots along the outer row of scales; lower parts white.

Total length 1800 millim., tail 803.

A single male specimen from Cali.

Allied to *H. melanocephalum*, L., but distinguished by the longer frontal shield and the longer tail.

Leptognathus leucomelas.

Body strongly compressed. Eye large. Rostral a little broader than deep, not visible from above; internasals half as long as the præfrontals; frontal as long as broad, as long as its distance from the end of the snout, shorter than the parietals; nasal divided; loreal once and a half as long as broad, bordering the eye; no præocular; præfrontal entering the eye; two postoculars; temporals 1 + 2; seven upper labials, third and fourth entering the eye; first lower labial in contact with its fellow behind the symphysial; three pairs of chin-shields, first longer than broad. Scales in 15 rows; vertebrals strongly enlarged, the largest nearly twice as broad as long. Ventrals 188; anal entire; subcaudals 85. Dark grey above, spotted with black, with black white-edged annuli, some of which are broken on the vertebral line; head blackish, speckled with white; belly white, speckled and spotted with black, and irregularly barred by the black annuli.

Total length 570 millim., tail 130.

A single female specimen from Buenaventura.

Hylodes raniformis.

Tongue cordiform. Vomerine teeth in two short transverse series close together, behind the level of the choanæ. Head a little broader than long; snout obtusely pointed, longer than the diameter of the orbit, with angular canthus rostralis and concave loreal region; nostril much nearer the tip of the snout than the eye; interorbital region as broad as the upper eyelid; tympanum distinct, half the diameter of the eye. Fingers moderate, first longer than second; subarticular tubercles very strong; toes long, one-third webbed; disks moderate; a rather strong elliptical inner metatarsal tubercle; a very indistinct outer metatarsal tubercle. The tibio-tarsal articulation reaches beyond the tip of the snout. Skin smooth. Greyish olive above, with ill-defined darker spots; a light vertebral stripe sometimes present; a streak above the tympanum and below the canthus rostralis blackish; lips spotted with blackish; limbs dark-spotted or with very indistinct dark cross-bars; hinder side of thighs whitish, reticulate with dark brown; lower parts white, throat sometimes speckled with brown. Male with an internal vocal sac.

From snout to vent 70 millim.

Several specimens; Buenaventura and Cali.

This species is closely allied to *H. palmatus*, Blgr., but distinguished by the broader interorbital region, the smooth skin, and the much larger size.

Hylodes bufoniformis.

Tongue circular, nicked behind. Vomerine teeth in two strong transverse series close together behind the level of the choanæ. Head very large, much depressed, broader than long, broader than the body; snout broadly rounded, with obtuse canthus and concave loreal region; nostril much nearer the tip of the snout than the eye; interorbital space narrower than the upper eyelid; tympanum distinct, vertically oval, three fifths the diameter of the eye. Fingers short, merely swollen at the end, first longer than second; subarticular tubercles strong; toes short, webbed at the base, dilated into well-developed disks at the end; subarticular tubercles moderate; inner metatarsal tubercle elliptical, two thirds the length of the inner toe; outer metatarsal tubercle very indistinct. The tibio-tarsal articulation reaches the eye. Skin of body and limbs smooth; sides of head covered with small warts. Olive above, marbled with darker; flanks marbled with black; limbs with dark cross-bars; hinder side of thighs blackish, with small round whitish spots; lower parts white, throat and limbs dotted or reticulated with brown.

From snout to vent 60 millim.

A single female specimen from Buenaventura.

Hylodes erythropleura.

Tongue oval, scarcely nicked behind. Vomerine teeth in two very small groups close together behind the level of the choanæ. Head moderate, as long as broad; snout rounded, with distinct canthus and slightly concave loreal region; interorbital space as broad as the upper eyelid; nostril nearer the tip of the snout than the eye; tympanum distinct, one third the diameter of the eye. Fingers moderate, dilated into moderately large disks, first shorter than second; subarticular tubercles moderate; toes with a slight rudiment of web, disks moderate; two small metatarsal tubercles. The tibio-tarsal articulation reaches halfway between the eye and the end of the snout. Skin smooth above; belly granular. Greyish above, sides of head and body darker; three darker stripes along the back; three dark light-edged bars on the upper lip; throat and belly whitish, much freckled with grey; sides of belly, sides of thighs, and lower surface of tibia carmine-red.

From snout to vent 31 millim.

A single female specimen from Cali.

Allied to *H. cerasinus*, Cope, and *H. Urichii*, Bttgr., both of which have longer hind limbs; moreover, the former has the tympanum smaller, the latter larger.

Hyla variabilis.

Tongue circular, entire, free behind. Vomerine teeth in two small groups between the choanæ. Head rather small, a little broader than long; snout rounded, as long as the diameter of the orbit; canthus rostralis indistinct; loreal region oblique, slightly concave; nostril equally distant from the end of the snout and the eye; interorbital space nearly as broad as the upper eyelid; tympanum moderately distinct, two fifths to one half the diameter of the eye. Fingers one-fourth webbed; disks as large as the tympanum; no projecting rudiment of pollex; toes three-fourths webbed; no tarsal fold. The tibio-tarsal articulation reaches the tympanum or the posterior border of the eye. Skin smooth; belly and lower surface of thighs coarsely granular. Pale greyish to dark purplish brown above, uniform or with more or less numerous black dots; young with a whitish streak, dotted with black, on each side of the head and back, and with dark cross-bars on the limbs, which disappear in the adult; lower parts pale yellow, uniform in the young, throat and belly reticulate or marbled with brown in the adult. Male with an internal gular vocal sac.

From snout to vent 38 millim.

Numerous specimens from Cali.

III.—*Descriptions of Two new Lizards from the Transvaal.* By G. A. Boulenger, F.R.S.

Pachydactylus affinis.

Snout a little longer than the diameter of the orbit. Ear-opening oval, oblique. Digits short, distinctly broader at the end than at the base, the dilated part with four or five lamellæ inferiorly. Head covered with minute granules, which are larger on the snout; back of head and temples with scattered slightly enlarged granules; naso-rostrals separated by one granule; rostral broader than deep; eight upper labials; six lower labials, the anterior larger than the symphysial, which is longer than broad. Body covered with very small granules intermixed with rather small, strongly keeled, oval tubercles, disposed irregularly; ventral scales small, increasing in size from throat to groin. Greyish above, irregularly spotted all over with dark brown; a dark brown streak on each side of the head, passing through the eye; lower parts white.

	millim.
Total length	68
Head	12
Width of head	9
Body	32
Fore limb	13
Hind limb	16
Tail (reproduced)	24

A single male specimen from the Rustenburg District, Transvaal, collected by Mr. W. Ayres.

This species is nearly related to *P. capensis*, Smith, and *P. formosus*, Smith, but easily distinguished by the much smaller dorsal tubercles and the absence of large tubercles on the occiput and temples.

Agama microterolepis.

Head rather small, much depressed. Nostril tubular, directed upwards and backwards, on the canthus rostralis. Upper head-scales smooth ; occipital enlarged ; sides of head near the ear and neck with groups of short spines ; ear-opening large, larger than the eye-opening. Throat much plicate ; no gular pouch. Body much depressed, covered with very small uniform scales, dorsals and laterals keeled, ventrals smooth ; dorsal scales converging and increasing in size towards the vertebral line ; 90 to 100 scales on the vertebral line from the origin of the fore limbs to the origin of the hind limbs, 150 to 160 round the middle of the body ; a slight indication of a nuchal crest ; no dorsal crest. Tibia a little longer than the skull. Digits moderate ; fourth finger slightly longer than third ; fourth toe slightly longer than third, fifth extending beyond first. Tail about twice as long as the distance from gular fold to vent, depressed at the base, slightly compressed at the end, with a rudimentary keel or low crest in the male ; scales moderately large, strongly keeled, disposed quincuncially or forming irregular annuli. Male with a row of anal pores. Dark greyish olive above, with dark brown marblings and rings ; vertebral line yellowish ; tail with dark brown annuli, which are interrupted below ; throat bluish grey ; belly and lower surface of limbs bluish grey in the male, white in the female.

	millim.
Total length	270
Head	23
Width of head	23
Body	87
Fore limb	60
Hind limb	75
Tail	160

Three specimens from the Rustenburg District, Transvaal, collected by Mr. W. Ayres.

IV.—*On the* Coccinellidæ *of Japan*. By G. Lewis, F.L.S.

Before Mr. G. R. Crotch left for America in 1872 he determined the species of Coccinellidæ I then had from Japan, and furnished me with a list of the species. The list was afterwards published in the Ent. Month. Mag. x.

pp. 54–56 (1873); but only four of the species indicated as new were described as such in Crotch's 'Revision of the Coccinellidæ,' a posthumous work printed by the Syndics of the Cambridge University Press, and published in 1874. Since 1874 Weise has described five species as new from Japan, and Harold and myself one each; the present paper introduces eighteen more, and brings the total number known to fifty-seven. Twelve of these are either identical or similar to European species; the others are either known Oriental species or species of an Oriental type.

The synonymy of the Coccinellidæ as a family is long and perplexing, and I do not think it would serve any useful purpose to repeat any part of it here: students who wish for an elaborate list of names can easily compile one from the Munich Catalogue of 1874 and from the pages of the 'Zoological Record' for subsequent years. *Coccinella decempunctata*, L., requires two pages in the Munich Catalogue, which gives seventy names, but Crotch, in his 'Revision,' is content to cite nine; as a specialist in the group he deemed this sufficient. Neither have I noticed varietal names, as these also are recorded in the works named, and I consider all such names an unnecessary adjunct to a synonymy already confusing. Some varietal names have been given apparently under the assumption that particular species have certain similar aspects which are repeated in various individuals over and over again; but in *Ptychantis axyridis*, Pall., a curious variety may be found which may not occur again (the patterns of this insect are almost as diversified as those of the kaleidoscope), and a name given to such a variety would be a "specimen" name, and would have no right to a place in any catalogue. If varietal names are or have been given to specimens which ultimately prove to be good species, priority cannot be claimed for the names; they have no status unattached to known and described species to which the authors originally assigned them.

Epilachna, Chevrolat.

The species of this genus are phytophagous, and as such differ from the others of this series.

Epilachna niponica, sp. n.

Hemisphærica, parum opaca; capite disco nigro-maculato; thorace in medio triangulariter maculato, utrinque bipunctato; scutellum nigro vel rufo, dense punctulato; elytris 28-maculatis.

Mas. Segmento ventrali quarto canaliculato.

L. $7\frac{1}{2}$–$8\frac{1}{4}$ mill.

Hemispherical, above reddish brown with a pinkish tinge, somewhat opaque; the head clearly and rather densely punctulate, with a discal, rather transverse, black mark; the thorax with a median somewhat triangular black patch, the pointed end of which touches the basal edge; on the disk it widens out transversely, leaving a clear margin behind the head more or less wide, near the base, in a line with the eye, are two black spots on either side; the scutellum red or black, usually red, densely punctulate; the elytra with shallow punctures and a faint alutaceous sculpture, and more generally over the whole surface is a fine punctuation, the twenty-eight spots occupy corresponding positions to those of a typical *E. 28-punctata*, Linn., but they are larger and the two behind the scutellum join, the two sutural spots on the disk also sometimes join, beneath in the epipleural fold there is a long irregular streak, black; the abdomen, fourth segment of male is canaliculate in the middle, surface of the channel usually red, rarely black, body beneath black; the legs, thighs with an elongate black spot or wholly infuscate. The apices of the elytra are less widely rounded off than those of *E. 28-maculata*, Motsch.

Hab. Nikko and Miyanoshita. Also found near the Junsai Lake feeding on a species of *Physalis*, and usually resting on the underside of the leaves. Fusan (*Leech*).

Epilachna 28-maculata, Motsch.

Epilachna vigintioctomaculata, Motsch. Etud. Ent. vi. p. 40 (1857); Crot. Rev. Coc. p. 48 (1874).

Hemisphærica, parum opaca; thorace in medio nigro; scutello rufo; elytris 28-maculatis; metasterno infuscato.
L. $6\frac{1}{2}$–7 mill.

Hemispherical, somewhat opaque, in colour similar to *E. niponica*; the head immaculate, somewhat densely but very finely punctulate; the thorax with a transverse black mark on the disk and a small spot midway between it and the basal edge; on either side of the discal mark are two other spots which sometimes join; the scutellum is usually red, faintly and finely punctulate; the elytra, surface sculpture similar to that of *E. niponica*, but sometimes fainter, with twenty-eight spots, the pair behind the scutellum are separated by a narrow sutural margin, the other spots agree with those of *E. 28-punctata*, Linn.; epipleural fold usually without a mark, but sometimes there is a faint infuscate streak; the fourth segment of the abdomen in male slightly impressed.

Hab. Yokohama and other places. Common.

Epilachna 28-punctata, Fabricius.

Coccinella 28-punctata, Fabr. Syst. Ent. p. 34 (1775).

Crotch labelled some of my specimens from South Japan "*E. 28-punctata*, F.," and they are different to those I found near Yokohama and other places more in the north, and which I refer to *E. 28-maculata*, Motsch. The differences are chiefly in size and colour generally and in the form of the thorax, which in *E 28-maculata* is more markedly transverse, and the shoulders also are wider. Crotch remarks of *E. 28-punctata*, F., "This species varies almost to infinity, and gradually runs into the common six-spotted type, so that I cannot give any structural differences;" but Crotch, so far as I know, never saw typical specimens of *E. 28-maculata* nor any examples from the north.

Hab. Nagasaki and Konosé. Oshima (*Oberthür*).

Epilachna admirabilis, Crotch.

Epilachna admirabilis, Crot. Revis. Coc. p. 81 (1874).

This species is described by Crotch as being like *E. macularis*, Muls.; the head is immaculate and clearly punctulate; the thorax black, with the anterior angles red, lateral margins and anterior border also sometimes red; the scutellum black; the elytra ten-spotted, scutellar and discal sutural spots are common to both wing-cases, in the middle of each elytron is a third spot, the fourth is humeral, fifth on the middle of the elytra edge, the last is before the apex; all the spots are large, and in one example in thirteen the sutural-discal and the two outer spots join (this form agrees with Crotch's type, which I have seen); the under surface and legs usually pale, but the abdominal segments are sometimes partly infuscate. I have not observed any sexual differences in the ventral segments.

Hab. Hakone, Nikko, and abundant at Shiba, near Tokio; China (*Crotch*).

Anisosticta kobensis, sp. n.

Oblongo-ovata, pallide flava; thorace 6-nigro-punctato; elytris 19-punctatis, distincte punctulatis.

L. $3\frac{1}{2}$–4 mill.

The form and number of the spots agree very closely with those of *A. 19-punctata*, Linn., but the general colour is paler and the spots much larger; the elytral punctuation larger and much clearer, and the legs more slender. The outline of the body is narrower.

Hab. Kawasaki, near Kobé; a small series found under reeds in September. Also at Niigata and Honjo in Tokio.

Hippodamia 13-punctata, Linnæus.

Coccinella tredecimpunctata, Linn. Syst. Nat. p. 336 (1758).

Hab. Kawasaki and Nikko; two examples only. Common in Europe and some parts of Siberia.

Coccinella 12-maculata, Gebler.

Coccinella duodecimmaculata, Gebl. Mém. Mosc. ii. p. 76 (1832).

Crotch says the prosternal process is raised (Rev. Coc. p. 110), but in two specimens I have examined it is flat and bistriate; this character is therefore not constant, although I have seen it in Chinese examples.

Hab. Kashiwagi. Two examples only.

Coccinella 8-maculata, Fabricius.

Coccinella octomaculata, Fabr. Spec. Ins. i. p. 97 (1781).

In my former list the synonymic name of *C. arcuata*, F., 1787, was used.

Hab. Nagasaki. Four examples.

Coccinella 7-punctata, Linnæus.

Coccinella septempunctata, Linn. Syst. Nat. p. 365 (1758).

In Crotch's 'Revision' this species and *C. Bruckii*, Muls. 1866, are considered to be distinct species; but in a note Crotch says that the specimens from Japan "seem to afford a passage to *C. 7-punctata*, Linn." My series from Japan consists of both forms, and I think that *C. Bruckii*, Muls., is only a varietal name.

Hab. All the islands. Very common.

Coccinella transversoguttata, Faldermann.

Coccinella transversoguttata, Fald. Mém. Ac. Petr. ii. p. 454 (1835).

This species was first described from Siberia. Specimens from Eastern Asia and Japan are very finely but clearly punctulate on the thorax and elytra. I have some examples in the Gorham collection from Mexico (a locality given by Crotch, Revis. p. 116), in which this punctuation is obsolete.

Hab. Niigata, Hakodate, and Sapporo.

Coccinella ainu, sp. n.

Nigra, supra convexa, nitida; elytris rufis, 12-nigro-punctatis, parum dense punctulatis.
L. 5–5½ mill.

In colour very similar to *C. 11-punctata*, Linn., but more broadly oval, and the elytra have a humeral spot. The head black, with two yellow spots touching the interior edge of the eye, punctulate; the thorax, punctuation clearer than that of the head, anterior angles broadly pale; the pale patches are sometimes joined by a pale anterior narrow margin; the elytra, on either side of the scutellum is a pale triangular spot, and behind it a large black sutural spot common to both wing-cases; in the dorsal region, but quite clear of the suture, are four more black spots (sometimes the posterior pair are smaller than the anterior pair), on the lateral area are three smaller spots on either side, the basal or humeral spot is nearer to the intermediate spot than the intermediate spot is to the apical one. The surfaces of the elytra are more distinctly punctulate than in either *C. 11-punctata*, L., or *C. 7-punctata*, L. Beyond the pale thoracic margin noticed above I have not seen any variation of importance.

Hab. Sapporo and Mororan, in August 1880. Found abundantly in company with *C. Crotchi* in the flowers of "immortelles" growing in a dry river-bed.

Coccinella ronina, sp. n.

Oblongo-ovata, nigra, nitida; capite in medio flavo-maculato; thorace utrinque pallide marginato: elytris 4-maculatis, maculis flavis vel rufis.
L. 4–4½ mill.

Oblong-ovate, black, shining; the head black, with a pale median spot between the eyes, finely punctulate; the thorax punctulate like the head, with a pale lateral band or border rather broad and of equal width throughout; the scutellum very small and punctulate; the elytra also punctulate, each wing-case with two pale or red spots placed longitudinally in a line with each other near the centres of the wing-cases; a point between the spots would indicate the centre of each elytron; the epipleural rim is very narrow, especially near the humeral angle; the ventral segments are laterally pale or reddish.

Hab. Oyama in Sagami and Junsai in Yezo.

Coccinella 14-pustulata, Linnæus.

Coccinella quatuordecimpustulata, Linn. Syst. Nat. ed. x. p. 368 (1758).

Hab. Kashiwagi, Yokohama, Fukui, Fujisan, and Sapporo. Common.

Coccinella Crotchi, Lewis.

Coccinella Crotchi, Lew. Ann. & Mag. Nat. Hist. (5) iv. p. 466 (1879).

This species does not seem to vary much in colour.

Hab. Oyayama, Maiyasan, Awomori, and Sapporo.

Leis 15-maculata, Hope.

Coccinella quindecimmaculata, Hope, Zool. Misc. p. 30 (1831).

Hab. Nagasaki. Two examples. Evidently confined to the south of Japan. Oshima (*Oberthür*).

Ptychantis axyridis, Pallas.

Coccinella axyridis, Pall. Iter. iii. p. 29 (1773).

The synonymy set forth by Crotch and Harold does not quite agree, and so probably requires adjustment. It consists of eighteen to twenty names.

Hab. All the islands and in China. Late in autumn, when this species assembles for hibernation, it may be seen congregating in countless multitudes. I saw it assemble in Kiu Kiang in 1863, its vast numbers filling the crevices of the large pagoda near the river. In 1880 I saw a similar multitude at Nikko lining the shutters of a house. The most dissimilar looking individuals I found *in cop.*

Anatis halonis, sp. n.

Breviter ovalis, supra convexa; elytris 16-punctatis; *C. ocellatæ* proxime affinis, sed pedibus robustioribus et colore dissimili.
Long. $8\frac{1}{2}$–9 mill.

Shortly oval, convex, shining; body beneath black, ventral segments sometimes laterally pale; the head with somewhat acinaciform punctures, black, with a yellow spot on the inner edge of the eye and a smaller pale spot within the anterior ocular emargination; the thorax distinctly and densely punctulate, with the lateral rim best-marked at the base, anteriorly the rim is very feeble, pale yellow, with an irregular **M**-shaped mark in the middle, and exterior to it on either side before the posterior angles is an isolated black dot; the scutellum red or black; the elytra, the spots are similar in position to those of *C. ocellata*, L., the scutellar pair are very small and round and equidistant from the scutellum and the suture, surrounded by a pale halo-like circle, the other spots correspond with those of *C. ocellata*, but are all small, being encroached upon by the pale margin, so much so, indeed, that in the median spot before the apex the black dot is obliterated or is very faint; the legs pale reddish brown, tarsi somewhat robust, posterior tibial carina almost obsolete.

Knowing how variable *C. ocellata* is, I should have considered this a variety of it had I not found the tarsi more robust and the tibial carina distinctly feeble. I have not, however, seen a specimen of *C. ocellata* coloured like the present insect.

Hab. Niohosan (Ent. xxi. p. 108, 1887) and Tsukubayama in June on firs.

Thea 12-*guttata*, Poda.

Thea duodecimguttata, Poda, Ins. Græc. p. 25 (1762).

Hab. Kobé, Kamiichi, and Yokohama.

Thea cincta, Fabricius.

Thea cincta, Fabr. Suppl. Ent. Syst. p. 77 (1798).

All my specimens (thirty-four in number) of this species agree in colour; there are two black spots on the basal edge of the thorax, and the elytra are immaculate. The anterior edge of the thorax is very thin and pellucid, and the black eyes are seen through it and appear like two additional spots.

Hab. Nagasaki, in great profusion, 29th May, 1881.

Calvia 10-*guttata*, Linnæus.

Coccinella decemguttata, Linn. Syst. Nat. p. 583 (1767).

Hab. Kashiwagi, Plain of Fujisan, and Sapporo; three examples. In Europe it is found in alders and sallows.

Calvia 14-*guttata*, Linnæus.

Coccinella quatuordecimguttata, Linn. Syst. Nat. p. 367 (1758).
Anisocalvia quatuordecimguttata, Linn., Crot. Revis. p. 144 (1874).

This species has three transverse spots on the anterior dorsal area, while *C.* 15-*guttata* has but two; but I cannot see any character to separate these two species from each other generically. Harold merges *Calvia* and nineteen other genera in *Halyzia*.

Hab. Sapporo and on the Plain of Fujisan. Five examples.

Calvia 15-guttata, Fabricius.

Coccinella quindecimguttata, Fabr. Gen. Ins. p. 217 (1777).

This species differs from the last in usually having two oblique spots on the thorax before the scutellum and only two transverse dorsal spots, as stated above.

Hab. Nagasaki, Tokio, and Niigata. In the British Museum there are some large specimens from China labelled *C. septenaria*, Muls.

Cœlophora inæqualis, Fabricius.

Coccinella inæqualis, Fabr. Syst. Ent. p. 80 (1775).

Hab. Nagasaki. Only seen once.

Propylea japonica, Thunberg.

Coccinella japonica, Thunb. Nov. Spec. Ins. p. 12, fig. 12 (1781).

In some of its varieties this species resembles *C. conglobata*, Linn., but as my Japanese specimens differ from those of Western Europe (being narrower and more variable in colour), I prefer to use Thunberg's name. Crotch thought my specimens belonged to the Linnean species. It is not easy to find two specimens exactly alike, and in recent years eight varietal names have been added to the earlier list by Sajó, Croissandeau, and Weise. One varietal name of Mulsant's which belongs to this form or species has been placed by Crotch under *P. dissecta*, Muls.

Hab. All the islands. Very abundant.

Verania discolor, Fabricius.

Coccinella discolor, Fabr. Suppl. Ent. Syst. p. 77 (1798).

Hab. Nagasaki. Four examples.

Synonycha grandis, Thunb.

Coccinella grandis, Thunb. Nov. Sp. Ins. p. 12, fig. 13 (1781).

Hab. Nagasaki and Simabara. Also found on Oshima, Ruikiuan group.

Ithone mirabilis, Motschulsky.

Leis mirabilis, Motsch. Schrenck's Reis. ii. p. 246, pl. ii. fig. 28 (1860).
Ithone mirabilis, Sols. Hor. Ent. Ross. viii. p. 276 (1871); Lew. Ent. p. 153 (1893).
Aiolocaria mirabilis, Crot. Revis. Coc. p. 178 (1874).

Ménétries and Mulsant placed this species in *Synonycha*, and Crotch, apparently overlooking Solsky's paper, founded the genus *Aiolocaria* to receive it. I have examined Hope's types of *Coccinella hexaspilota* in the British Museum and some other Indian specimens similar in colour; but they appear so different to the Siberian and Japanese specimens (to which Hope's name is not appropriate), that I am reluctant to follow authors who consider the names synonymous. I have two specimens with the elytra entirely black and one with black elytra and a small red humeral spot. For the first variety the name of *nigra* has been recently suggested by a continental author; *nigripennis* would have been a better name.

Hab. Sannohé, Morioka, Sendai, and Shirakawa. Seen continuously in great multitudes in October on telegraph-posts during two days' travel. Now and then I stopped to look for varieties, but found only two specimens with the elytra entirely black.

Chilomenes 4-plagiata, Schönherr.

Chilomenes quadriplagiata, Schön. Syn. Ins. ii. p. 195 (1808).

Hab. Nagasaki and Kobé. Also China, Manchuria, India, Celebes, and Australia (*Crotch*).

Chilocorus rubidus, Hope.

Chilocorus rubidus, Hope, Gray, Zool. Misc. p. 31 (1831).

In my former list this species stood as *C. tristis*, a varietal name of Faldermann's, 1835. Some of my specimens are wholly reddish brown, others are black with a well-defined discal red blotch on each elytron; Crotch noticed this peculiarity.

Hab. Nagasaki and Yokohama. Siberia and China.

Chilocorus similis, Rossi.

Coccinella similis, Ross. Faun. Etr. i. p. 68, t. vii. fig. 4 (1790).

Crotch (p. 185 of his 'Revision') apparently overlooked Rossi's name, and employed Scriba's name of *C. renipustulatus*, which is two years later. Crotch says (Revis. p. 185) that the Japanese "specimens are exactly like *C. bivulnerus*, Muls., in the round punctiform dot exhibiting no trace of any transverse tendency."

Hab. Yokohama and other places. Common.

Chilocorus mikado, sp. n.

Hemisphæricus, nitidus, subtus brunneo-rufus; thorace elytrisque nigris; pedibus corpore concoloribus.
L. $4\frac{1}{4}$ mill.

Hemispherical, shining; the head, body beneath, and legs brownish red; the thorax and elytra black, the latter not thickly punctulate on the disk, but distinctly and rather rugosely punctured laterally. Crotch considered this species belonged to *C. nigritus*, Fabr., and recorded it as such (Revis. p. 184); but it does not agree with any Indian specimen I have seen in the punctuation of the elytra, and it also differs in having the scutellum more than as large again. The anterior tibiæ are angulate on the outer edge near the base.

Hab. Nagasaki.

Sticholotis Hilleri, Weise.

Sticholotis Hilleri, Weise, Stett. ent. Zeit. p. 238 (1885).

"Suborbicularis, sat convexa, ferruginea, supra glabra, nitida, crebre sat fortiter punctata; elytris sutura et margine laterali nigro-limbatis, maculis 6 nigris lunulisque 4 flavis signatis, in singulo striis 2 brevibus punctatis prope suturam."
L. 3 mill.

I did not meet with this species, but Herr R. Hiller has kindly given me an example.

Hab. Hagi in Yamaguchi (*Hiller*).

Sticholotis substriata, Crotch.

Sticholotis substriata, Crot. Rev. Coc. p. 201 (1874).

This species has two dorsal rows of punctures, and it is the type of the genus *Sticholotis*.

Hab. Nagasaki, Kobé, and Yokohama.

Sticholotis punctata, Crotch.

Sticholotis punctata, Crot. Rev. Coc. p. 201 (1874).
Sticholotis rufosignata, Weise, Stett. ent. Zeit. xlvi. p. 239 (1885).

Hab. Nagasaki, Kobé, and Yokohama. In February 1881 I found this and the previous species hibernating in large numbers in old *Camelliæ*.

Sticholotis pictipennis, sp. n.

Suborbicularis, convexa, nitida, supra distincte punctata; capite

rufo; thorace, angulis anticis exceptis, nigro; elytris rufis, 4-nigro-maculatis; subtus pedibus brunneis.
L. $1\frac{3}{4}$ mill.

This species is much smaller than *S. punctata*, Crotch, and the punctuation is much finer on the thorax; the head red; the thorax black, with the anterior angles obscurely red; the elytra red, with a discal black spot common to both wing-cases, two black lateral spots, one on each side on the middle of the border, and an apical spot which corresponds with the one on the dorsum; the underside and legs brown.

This is the only species of this series which has the bases of the elytra clearly red and without marking; it is a very distinct species.

Hab. Konosé and Ichiuchi in Higo.

Pentilia nigra, Weise.

Pentilia nigra, Weise, Deutsche ent. Zeit. xxiii. p. 149 (1879).

"Rotundata, modice convexa, nigra, pubescens; antennis, palpis pedibusque obscure ferrugineis."
L. $\frac{2}{3}$ mill.

Hab. Nagasaki, Ichiuchi, Fukushima, and Oyama in Sagami.

Hyperaspis japonica, Crotch.

Cryptogonus japonicus, Crot. Revis. Coc. p. 203 (1874).
Hyperaspis testaceicornis, Weise, Deutsche ent. Zeit. xxiii. p. 149; Arch. f. Nat. p. 212 (1887).

Hab. Kuroheiji, Nagasaki, Kashiwagi, Miyanoshita, and Yokohama.

Hyperaspis asiatica, sp. n.

Ovalis, convexa, supra punctulata; fronte pallide rufa; thorace utrinque late rufo; elytris nigris, macula rotundata pone medium pallide rufa; prosterno lato, bistriato.
L. 3 mill.

This species closely resembles *H. reppensis*, Herbst, but it differs in the punctuation, colour of the head and thorax, and in having a much broader prosternum. The head, face pale red, base narrowly black; the thorax broadly pale red at the sides and narrowly pale on the anterior margin, disk and base black; the elytra with a reddish pale spot on either side well before the apex, but nearer the outer margin than the suture, surface clearly punctulate; the prosternum broad, with two distinct raised lines on the keel, which start from the base and anteriorly join about the middle (these lines in *H. reppensis* are indistinct and longer, and do not join in front); the metasternum, punctures clear and distinct and larger than those of *H. reppensis*; the antennæ, anterior and intermediate legs pale red; hinder tibiæ pale, with the femora black.

Hab. Nagasaki.

Aspidimerus orbiculus, Gyllenhal.

Aspidimerus orbiculus, Gyll. Schön. Syst. Ins. i. p. 205 (1808); Crot. Revis. Coc. p. 203 (1874) (*Cryptogonus*); Weise, Best. Tab. ii. p. 63 (1885).

Schönherr, a contemporary of Gyllenhal, seems to have considered that this species belonged to Gyllenhal; I have not seen the original description.

Hab. Nagasaki and South Japan generally. Common.

Platynaspis Lewisii, Crotch.

Platynaspis Lewisii, Crot. Revis. Coc. p. 198 (1874).

The face of this species is sometimes wholly black and the spaces between the dorsal spots yellow. I have two specimens, both from high altitudes (Miyanoshita and Oyama in Sagami), in which the elytra are black, with a small red spot at the base on either side of the scutellum. Crotch omitted to mention that he had seen Japanese specimens of this species; in the 'Revision' he only refers to an example from Shanghai. Weise states (Deutsche ent. Zeit. p. 413, 1892) that *Microrrhymbus*, Gerst. 1871, = *Platynaspis*, Redt. 1843.

Hab. Tokio, Yokohama, and Kobé.

Amida, gen. nov.

Type *Scymnus tricolor*, Har.

This new generic name I propose for an insect which measures 4–4½ millim. and has most of its characters similar to those of *Scymnus*. The eyes, however, are very different, being large, more finely faceted, and the inner edges are straight and parallel to each other, leaving a bilateral facial space (very noticeable) between them; the antennæ long and slender, 11-jointed, first two large, bulbiform, and distinctly separate; terminal three joints form an elongate club; the terminal abdominal segment is very narrow and transverse; the tibiæ are swollen on the outer edge, the claws with a robust inner process.

Amida tricolor.

Scymnus tricolor, Har. Deutsche ent. Zeit. xxi. p. 87 (1877).

"Testaceus, thorace nigro-trimaculato; elytris basi suturaque, hac medio latius, rufis, utriusque maculis tribus marginalibus nigro-piceis, una humerali, altera media majore, tertia apicali."
L. 4–4½ mill.

Hab. Yamaguchi (*Hiller*), and at Nara, not common.

Plotina, gen. nov.

Type *P. versicolor.*

This generic name is proposed for a small species which superficially resembles a *Scymnus* without pubescence; but the eyes are small and somewhat coarsely faceted; the antennæ longer, two basal joints bulbiform and clearly separate, after the sixth joint the articulations become larger and form an elongate club, the tenth and eleventh joints appear to be connate and to form a conical mass; the anterior tibiæ are constricted at their bases, claws simple and but very feebly enlarged at the bases; the prosternum widens and flattens out immediately in front of the coxæ; there is no keel, but in the coxal area there are two short lateral striæ which diverge anteriorly; the mesosternum transverse and arched at the sides, anteriorly and posteriorly straight; the elytra, epipleural fold wide and only narrowing behind the posterior coxæ.

Plotina versicolor, sp. n.

Breviter ovata, convexa, testacea, nitida, haud pubescens; thorace basi transversim nigro-maculato; elytris 12-maculatis, maculis nigris.
L. 2½–2¾ mill.

The head clearly punctulate, brownish or testaceous, usually darker before the neck; the thorax yellowish brown, with a black transverse patch before the scutellum, the patch extends on either side to a point behind the eyes; the elytra rather paler than the thorax, with twelve black spots—one round on the humeral area, two other similar spots along each lateral margin, one more oblong in the centre of each wing-case, and two sutural spots on each elytron, the first just before the disk, the second well before the apex; the sutural margin is often brownish, and so also is the space between the oblong discal spot and the marginal spot in a line with it; the legs and surface beneath concolorous.

Hab. Oyama in Sagami. Five examples.

Scymnus pilicrepus, sp. n.

Breviter ovalis, convexus, dense griseo-pubescens; capite rufo, vix dense et minute punctulato; thorace dense punctulato, margine laterali rufo; elytris sparse punctulatis, punctis grossis intermixtis, apice rufis; pedibus rufo-brunneis.

L. $2\frac{3}{4}$–3 mill.

Shortly oval, convex, densely clothed with grey pubescence; the head red, densely but minutely punctured; the thorax black, with the lateral margin red, the red margin widens out towards the back of the eye, rather densely punctured, the punctures being distinctly largest before the scutellum; the elytra black, with the apices clearly red, surface punctured with rather large shallow punctures intermixed with a fine punctuation; the prosternum is bistriate, truncate between the striæ both before and behind, with the intermediate area somewhat roughly punctured; the meso- and metasternum are clearly punctured and with the first abdominal plate black, the second and third abdominal segments are infuscate in the middle, the others wholly red; the legs and tarsi reddish brown.

This is the largest species of *Scymnus* known from Japan, as *S. tricolor*, Har., is now placed in another genus.

Hab. Yokohama, Kiga, Ichiuchi, and Kashiwagi.

Scymnus sylvaticus, sp. n.

Breviter ovalis, convexus, dense griseo-pubescens; capite thoraceque rufis; elytris nigris, apice rufis.

L. $2\frac{1}{2}$ mill.

This species is as large again as *S. dorcatomoides*, Weise, but the coloration is very similar, although the apical red area is much broader and straighter towards the epipleuræ. The abdominal segments are red and the legs also, but the metasternum is infuscate. This species is perhaps closely allied to *S. apiciflavus*, Motsch., an Indian species.

Hab. Nagasaki and Yokohama.

Scymnus dorcatomoides, Weise.

Scymnus dorcatomoides, Weise, Deutsche ent. Zeit. p. 151 (1879).

"Oblongo-ovatus, convexus, niger, nitidus; capite, thorace, elytrorum apice plus minusve pedibusque rufo-flavis; abdomine toto vel apicem versus flavo; thorace dense subtilissime punctato; laminis abdominalibus integris.

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

Hab. Nagasaki and Chiuzenji. Common also at Yokohama.

Scymnus phosphorus, sp. n.

Ovalis, convexus, niger, nitidus, griseo-pubescens; elytris bimaculatis, maculis rufis; pedibus parum infuscatis.
L. 2 mill.

This species agrees with *S. Hareji*, Weise, in form and size, but it is black, with two relatively large red spots on each elytron well before the apex; the spots leave a rather wide black margin both at the suture and on the lateral edge. The punctuation also is closer.

Hab. Tagami, near Nagasaki. Two examples only.

Scymnus Hareja, Weise.

Scymnus Hareja, Weise, Deutsche ent. Zeit. p. 150 (1879).

"Ovalis, convexus, griseo-pubescens, niger, capite thoraceque rufoflavis, pedibus elytris gutta utrinque ad medium apiceque flavis: laminis abdominalibus abbreviatis.
"L. $\frac{3}{4}$ lin."

Hab. Hagi (*Hiller*); Maiyasan, near Kobé.

Scymnus Hoffmanni, Weise.

Scymnus Hoffmanni, Weise, Deutsche ent. Zeit. p. 152 (1879).

"Ovatus, modice convexus, subnitidus, rufo-testaceus; thorace nigro, angulis anticis plus minusve rufo-testaceis; elytrorum marginibus (posticis exceptis) nigris. Laminis abdominalibus integris, dense fortiterque punctatis.
"L. $\frac{2}{3}$ lin."

Hab. Kobé, Yokohama, and Nagasaki. Very common.

Scymnus niponicus, sp. n.

Breviter ovalis, brunneus, nitidus, griseo-pubescens; capite rufobrunneo; thorace ante scutellum infuscato, antice lateribus rufo-brunneo; elytris infuscatis, in medio longitudinaliter obscure rufis; subtus parum infuscatus; pedibus testaceis.
L. $1\frac{3}{4}$–2 mill.

This species is very similar to *S. subvillosus*, Goeze, but the thorax is narrower.

Hab. Yokohama and Nagasaki.

Scymnus hilaris, Motschulsky.

Scymnus hilaris, Motsch. Etud. Ent. p. 119 (1858); Weise, Deutsche ent. Zeit. p. 151 (1879).

Weise has determined this species. The original specimen Motschulsky had came from India, but the author's description is not satisfactory.

Hab. Nagasaki, Kiga, and Tokio. Widely distributed and common.

Scymnus paganus, sp. n.

Ovalis, convexus, brunneus, nitidus, griseo-pubescens; thorace distincte punctato; elytris lateribus leviter punctulatis.
L. $2\frac{1}{2}$ mill.

Oval, convex, uniformly brown, shining, with grey pubescence; the head obscurely punctulate; the thorax distinctly punctured, punctures rather coarse but not densely set; there is an extremely fine basal line seen under the microscope; the scutellum also punctured; the elytra are punctured similar to the thorax in the scutellar region, but gradually become finer to the apex and lateral margins, sometimes behind the scutellum there is a small sutural area, somewhat dusky; the prosternum has a flat keel, with a lateral stria on each side and the interspace rather roughly punctured; the mesosternum also punctured, but not densely.

This species is much more oval than any of the preceding, but not so oblong as the two following.

Hab. Nagasaki, Yuyama, and Oyama in Sagami.

Scymnus fortunatus, sp. n.

Oblongo-ovatus, piceo-brunneus, convexus; capite rufo; thorace in medio nigro; elytris nigris, transversim late bifasciatis, fasciis rufo-sanguineis.
L. $2\frac{1}{2}$ mill.

Oblong-oval, body pitchy brown, convex above and distinctly punctulate, with a grey pilosity; the head red; the thorax red, with a median area black, the black marking extending along the base; the scutellum black; the elytra black, with a transverse red band over the metasternum, band anteriorly deeply bisinuous and externally not reaching the epipleural margin; at the suture a wider black margin is left, posteriorly near the middle of the wing-case it connects with a second rather smaller transverse band, apex widely black; the legs obscurely reddish brown.

I found a closely allied species to this in Ceylon; the colours are very similar as well as the general form.

Hab. Nagasaki, 25th May, 1881. One example only.

Scymnus patagiatus, sp. n.

Oblongo-ovalis, convexus, griseo-pilosus, capite thoraceque utrinque rufo-brunneis; elytris in medio testaceis, cum marginis nigris.

L. 2 mill.

Oblong-oval, convex, greyly pilose; the head minutely but clearly punctulate, reddish brown; the thorax infuscate, with the lateral margins rarely reddish brown; the scutellum black; the elytra with a large pale testaceous oblong area in the middle of each wing-case, which is somewhat parallel at the sides, surrounded by a blackish margin, which is broadest at the apices and near the scutellum; the legs testaceous.

Hab. Nagasaki. Not uncommon.

[*Scymnus ferrugatus*, Moll (Füssly, Neu. Mag. Heft ii. p. 183, 1785), a European species, has been recorded from Japan by Weise; but as he suggested, without any description, a varietal name for it, it is open to doubt whether Moll's species really occurs in Japan or only a species resembling it. Illiger also gave a varietal name to an insect he considered was *S. ferrugatus* from Siberia. I have not included it in the list.]

Rodolia, Mulsant.

Rodolia, Mulsant, Spec. p. 902 (1851).

In the Ann. Soc. Ent. Belg. xxxix. p. 148 (1895), Weise rightly places the species hitherto included in *Novius* in this genus. The anterior tibiæ are widely and conspicuously emarginate in *Rodolia* on the inner edge.

Rodolia limbatus, Motschulsky.

Novius limbatus, Motsch. Bull. Mosc. i. p. 178 (1866).

"*Novius limbatus*, Motsch., statura *Nov. cruentati* sed rotundior. Subrotundatus, convexus, nitidus, brevissime cinereo-puberulus, niger, thoracis marginis, elytrorum limbo, basi suturaque rubris; thorace valde transverso; elytris thorace latioribus, subrotundatis.

"L. $1\frac{3}{4}$ lin."

Hab. Nagasaki and other places, common; Pekin (*David*).

Rodolia naræ, sp. n.

Ovalis, subtus infuscatus, nitidus, dense griseo-pubescens; capite nigro; thorace obscure bimaculato; elytris marginibus rufis, disco obscure brunneis, undique distincte punctulatis.

L. $4\frac{3}{4}$ mill.

Oval, body dusky, above shining, and clothed with short and close greyish pubescence; the head dusky or black, obsoletely punctulate; the thorax reddish brown, with two somewhat obscure dusky blotches near the base but in a line with each eye, margins clearly red, surface without visible punctuation; the scutellum minutely punctulate, somewhat dusky; the elytra very distinctly and somewhat densely punctulate, broadly margined with red, the internal area of each elytron obscurely brown; the epipleural rim is very fine, finer than that of *R. limbata* and the others of this series.

The dorsal punctuation is a distinguishing character in this species.

Hab. Nara, 30th June, 1881.

Rodolia concolor, Lewis.

Novius concolor, Lew. Ann. & Mag. Nat. Hist. (5) iv. p. 466 (1879).

I have an example in which the thorax is marked with black and the scutellum wholly black.

Hab. Kobé and Nara.

Rodolia rufocincta, sp. n.

Ovalis, niger, griseo-pubescens; elytris margine extus abdominisque segmenta rufis.

L. $5\frac{1}{2}$–$5\frac{3}{4}$ mill.

Oval, black, with short and close greyish pubescence; the head and thorax feebly punctulate, lateral margins of the last obscurely reddish near the base, but distinctly red at the anterior angle; the elytra more distinctly punctulate than the thorax, with the lateral margins narrowly red; the red margin is broadest from the humeral angle to about one third of the elytral length, from whence it gradually narrows to the apex; the abdomen, segments above and below red; the legs blackish.

This species is distinctly more oval than either *R. limbatus* or *R. concolor*.

Hab. Kiga, Nikko, and Chiuzenji. Three examples only.

List of Species.

Epilachna niponica.
—— 28-maculata, *Motsch.*
—— 28-punctata, *F.*
—— admirabilis, *Crot.*
Anisosticta kobensis.
Hippodamia 13-punctata, *L.*
Coccinella 12-maculata, *Gebl.*
—— 8-maculata, *F.*
—— 7-punctata, *L.*
—— transversoguttata, *Fald.*
—— ainu.
—— ronina.
—— 14-pustulata, *L.*
—— Crotchi, *Lew.*
Leis 15-maculata, *Hope.*
Ptychantis axyridis, *Pall.*
Anatis halonis.
Thea 12-guttata, *Poda.*
—— cincta, *F.*
Calvia 10-guttata, *L.*
—— 14-guttata, *L.*
—— 15-guttata, *F.*
Cœlophora inæqualis, *F.*
Propylea japonica, *Thunb.*
Verania discolor, *F.*
Synonycha grandis, *Thunb.*
Ithone mirabilis, *Motsch.*
Chilomenes 4-plagiata, *Schön.*
Chilocorus rubidus, *Hope.*
—— similis, *Rossi.*
Chilocorus mikado.
Sticholotis Hilleri, *Weise.*
—— substriata, *Crot.*
—— punctata, *Crot.*
rufosignata, *Weise.*
—— pictipennis.
Pentilia nigra, *Weise.*
Hyperaspis japonica, *Crot.*
testaceicornis, *Weise.*
—— asiatica.
Aspidimerus orbiculus, *Gyll.*
Platynaspis Lewisii, *Crot.*
Amida tricolor, *Har.*
Plotina versicolor.
Scymnus pilicrepus.
—— sylvaticus.
—— dorcatomoides, *Weise.*
—— phosphorus.
—— Hareja, *Weise.*
—— Hoffmanni, *Weise.*
—— niponicus.
—— hilaris, *Motsch.*
—— paganus.
—— fortunatus.
—— plagiatus.
Rodolia limbatus, *Motsch.*
—— naræ.
—— concolor, *Lew.*
—— rufocincta.

V.—*A Revision of the British Jurassic Bryozoa.*—Part III. *The Genus* Berenicea. By J. W. Gregory, D.Sc., F.G.S.

[Continued from vol. xvi. p. 451.]

Family **Tubuliporidæ** (continued).

Genus Berenicea, Lamouroux, 1821.

Diagnosis.—Tubuliporidæ in which the zoarium is a thin, flat, encrusting sheet. The zoœcia are tubular. The peristome is either flush with the surface or somewhat raised.

Type species: *B. prominens*, Lamx. Syn. *B. obelia* (Johnst.).

1. *Berenicea spatiosa* (Walford), 1889.

Tubulipora spatiosa, Walford, 1889, Bry. Shipton, Part I., Quart. Journ. Geol. Soc. vol. xlv. p. 567, pl. xviii. figs. 10–12.

Diastopora diluviana, pars, Vine, 1884, Polyz. Richmond Boring, Quart. Journ. Geol. Soc. vol. xl. p. 787.
Diastopora Lamourouxi (non Edw.), Vine, 1884, ibid. p. 789.
Diastopora microstoma, pars, id. ibid. p. 788.

Diagnosis.—Zoarium an irregular thin encrusting sheet.

Zoœcia visible throughout. The distal portions are reflexed at right angles. The general aspect has therefore that of a number of rings scattered over a thin crust. The raised portions taper slightly towards the free end.

Peristomes highly raised. Orifices circular.

Oœcia somewhat pyramidal.

Formula.—3 1 2 *i* 0 *.

Distribution.—Great Oolite, near Bath and Richmond. Bathonian of France and Germany.

2. *Berenicea compressa* (Goldfuss), 1829.

Aulopora compressa, Goldfuss, 1829, Petref. Germ. Bd. i. p. 84, pl. xxxviii. fig. 17.
Stomatopora compressa, Bronn, 1848, Ind. Pal., Nomen. p. 1201.
Cellepora compressa, Quenstedt, 1851, Flözgeb. Württemb. ed. 2, p. 357.
Diastopora compressa, Quenstedt, 1852, Handb. Petref. p. 637, pl. lvi. figs. 11, 12.
Berenicea compressa (excl. syn.), Waagen, 1868, Zone *Amm. Sowerbyi*, Geogn. pal. Beitr. Bd. i. p. 645.
Diastopora Lamourouxi, pars, M.-Edwards, 1838, Mém. Cris., Ann. Sci. nat. Zool. sér. 2, t. ix. p. 225.
Aulopora flabellulum, Quenstedt, 1881, Petref. Deutsch. Bd. vi. Abt. 1, p. 112, pl. 147. fig. 27.
Berenicea insignis, Reuss, 1867, Bry. braun. Jura Balin, Denk. k. Akad. Wiss. Wien, Bd. cxxvii. p. 6, pl. i. figs. 3 *a*, 4 *b*.
Diastopora stomatoporides, Vine, 1881, Notes Diastoporidæ, Quart. Journ. Geol. Soc. vol. xxxvii. p. 384, pl. xix. figs. 1–10.

Diagnosis.—Zoarium thin, irregular, in flabelliform sheets, sometimes suborbicular in shape.

Zoœcia very long, cylindrical, visible throughout their length. Some zoœcia expanded just below the orifices. Zoœcia sinuous, punctulate.

Peristomes very slightly raised, distant, very irregularly arranged.

Oœcia large; low rounded domes or pyriform; coarsely punctulate.

* The formulæ are used as explained in Ann. & Mag. Nat. Hist. ser. 6, vol. xv. p. 227, with the following additions :—The fourth term indicates shape of zoarium, *d* being discoid, *i* irregular, and *f* flabelliform. The final number shows the distance between the peristomes, 0 being scattered, 1 slightly crowded, 2 crowded, and 3 very crowded.

The new species will be figured in a forthcoming British Museum Catalogue.

Formula.—1 0 3 *f* 0.

Distribution.—Mid Lias—Cornbrash, England. Lias—Corallian, Germany and Austria.

3. *Berenicea Sauvagei*, sp. n.

Diagnosis.—*Zoarium* of large thin circular disks.

Zoœcia very long, cylindrical, sometimes expanded a little below the orifice; visible throughout their length; slightly sinuous; minutely punctulate.

Peristomes slightly raised, distributed regularly in a quincuncial pattern.

Formula.—1 0 3 *d* 1.

Distribution.—Bradford Clay, Bradford, Wilts.

Affinities.—This species resembles *B. Archiaci* in its long zoœcia, but it has no known oœcia; the zoaria are larger; the zoœcia are longer, more sinuous, and not so markedly radial in arrangement. It is nearer to *B. Allaudi*, from which it differs in the quincuncial arrangement of the orifices and the greater length of the zoœcia.

Among the species with irregular zoaria it must be compared with *B. compressa* (Goldf.). With this it agrees in the length of its zoœcia, their faint punctulation, and the slight expansion just below the raised portion of the orifice. The species differ, however, in the greater distance of the orifices in the old species, and their very irregular distribution. One has only to compare the crowded regular quincuncial orifices of *B. Sauvagei* with Vine's figure (*op. cit.* pl. xix. figs. 3 and 7) to see the extent of this difference.

4. *Berenicea portlandica*, sp. n.

Diagnosis.—*Zoarium* small, discoid. Zoœcia arranged at first on a somewhat flabelliform plan. Borders of zoarium a little irregular. The zoarium is a thin sheet.

Zoœcia long, cylindrical; front wall ornamented by several sharp ridges, usually five or six on each zoœcium. Zoœcia visible throughout their length.

Peristomes flush or raised on lower margin, circular.

Formula.—0–0″ 0 . 3 *d* 0.

Distribution.—Portland Oolite, Tisbury, Wilts.

Affinities.—This species greatly resembles Haime's figure of *Berenicea striata* (Jur. Bry. pl. vii. figs. 8 *a*, *b*), owing to the transverse ribbing. The two species are closely allied; thus, *B. striata* has a formula of 1 1 2 *f* 0. The differences between the zoœcia of the two species are that those of *striata* have higher peristomes and are more fusiform and shorter. These seem sufficient to separate them, apart from the differences in the zoaria, which in *striata* are irregular and flabelliform. The specimens occur on an *Ostrea* found in the Portland Oolite at Tisbury, and they are of interest as the only Bryozoa known from this stage in England. The species is well marked; its nearest Cretaceous ally is *B. clementina*, d'Orb.*, which is, however, nearer to *B. striata*. *B. portlandica* differs from *B. clementina* in having a discoid zoarium, the orifices more scattered, and longer zoœcia.

5. *Berenicea striata*, Haime, 1854.

Berenicea striata, Haime, 1854, Bry. Jur., Mém. Soc. géol. France, sér. 2, t. v. p. 179, pl. vii. figs. 8 *a*, *b*.
? *Diastopora striata*, Vine, 1883, 3rd Rep. Foss. Polyz., Rep. Brit. Assoc. 1882, p. 264.
Non *Berenicea striata*, Manzoni, 1875, Brioz. Castrocaro, p. 44, pl. vi. fig. 74, pl. vii. fig. 79.

Diagnosis.—*Zoarium* flabellate, irregularly lobed or discoid. Forms a thin sheet.

Zoœcia somewhat fusiform, very long, ornamented by sharp transverse ridges. Zoœcia visible throughout.

Peristomes slightly raised.

Formula.—1 1 3 *f* 0.

Distribution. — Inferior Oolite, Cheltenham, England. Lias, Belgium and Germany (Lothringen). Braun Jura, Austria.

6. *Berenicea Allaudi* (Sauvage), 1889.

Rosacilla Allaudi, Sauvage, 1889, Bry. Jur. Boulogne, Bull. Soc. géol. France, sér. 3, t. xvii. p. 46, pl. iv. figs. 1–5.
Berenicea Allaudi, Gregory, 1894, Cat. Jur. Bry. Yk. Mus., Rep. Yorks. Phil. Soc. 1893, p. 60.

Diagnosis.—*Zoarium* a large thin disk, somewhat irregular at the borders; surface flat.

Zoœcia cylindrical, somewhat fusiform, visible throughout, of medium length, punctulate; front wall traversed by slight undulations.

Peristomes slightly elevated, irregularly arranged.

Formula.—1 1 1 *d* 0.

Distribution. — Great Oolite, Bedford; Inferior Oolite, Dorset, England. Callovian and Oxfordian, France.

7. *Berenicea Archiaci*, Haime, 1854.

Berenicea Archiaci, J. Haime, 1854, Bry. Jur., Mém. Soc. géol. France, sér. 2, t. v. p. 180, pl. ix. figs. 11 *a*, *b*.

---

* D'Orbigny, Pal. franç., Terr. crét. t. v. p. 865, pl. 636. figs. 1, 2.

Dacryopora Archiaci, Terquem, 1855, Pal. Moselle (sep. copy), p. 26.
Berenicea ventricosa, G. R. Vine, 1881, Diastoporidæ Lias and Ool., Quart. Journ. Geol. Soc. vol. xxxvii. p. 385, pl. xix. figs. 15–17.
Berenicea oolitica, G. R. Vine, 1881, *op. cit.* p. 386, pl. xix. figs. 11–14.

Diagnosis.—*Zoarium* discoid, a thin sheet.

Zoœcia not visible throughout their whole length, long, cylindrical.

Peristomes well raised, crowded at the margins, more distant in the middle, irregularly arranged.

Oœcia large, pyriform, closed sacs, which bulge out above the general level of the zoarium, disposed somewhat irregularly.

Formula.—1 0 2 *d* 1.

Distribution.—Mid Lias—Cornbrash, England. Lias—Sequanian, Germany and France.

8. *Berenicea diluviana*, Lamouroux, 1821.

Berenicea diluviana, Lamouroux, 1821, Expos. méth. p. 81, pl. lxxx. figs. 3, 4.
Non *Diastopora diluviana*, M.-Edwards, 1838, Mém. Cris., Ann. Sci. nat. Zool. sér. 2, t. ix. p. 228, pl. xv. fig. 3, pl. xiv. fig. 4.
Reptomultisparsa diluviana, d'Orbigny, 1852, Pal. franç., Terr. crét. t. v. p. 876.
Rosacilla diluviana, Sauvage, 1889, Bry. Jur. Boulogne, Bull. Soc. géol. France, sér. 3, t. xvii. p. 44, pl. iv. fig. 11.
Diastopora spatiosa, Walford, 1889, Bry. Shipton Gorge, Part I., Quart. Journ. Geol. Soc. vol. xlv. p. 573, pl. xvii. figs. 7, 8.

Diagnosis.—*Zoarium* in large irregular encrusting sheets. Young forms are flabelliform.

Zoœcia of medium length, cylindrical. Young, central zoœcia seen throughout; the more adult, peripheral zoœcia are crowded and thus not wholly seen. Front wall plain or crossed by faint transverse ridges.

Peristomes slightly raised in peripheral zoœcia; central ones almost flush; irregularly distributed, but in large zoœcia there may be patches in which they are linear.

Oœcia pyriform, fairly narrow, usually but slightly exceeding the zoœcia in width.

Formula.—1–1″ 0 2 *i* 0.

Distribution.—Inferior Oolite—Corallian, England. Lias—Bathonian, France, Germany, Austria.

9. *Berenicea parvitubulata*, sp. n.

Diagnosis.—*Zoarium* thin irregular sheets, much lobed when large.

Zoœcia very narrow, cylindrical, of medium length; central zoœcia flabellate and visible throughout their length. Peripheral zoœcia more crowded and visible only in part; surface plain.

Peristomes small, slightly raised, from $\frac{1}{3}$ to $\frac{1}{4}$ the width of those of *B. diluviana.*

Oœcia low, rounded domes, three or four times the width of the zoœcia.

Formula.—1 0 2 *i* 0.

Distribution.—Cornbrash, Rushden; Bradford Clay, Bradford; Great Oolite, Richmond Boring.

Affinities.—This species is characterized by the delicacy and narrowness of its zoœcia. It thus takes the place in the *Berenicea* series held by *S. Waltoni* in the *Stomatopora* and *D. mettensis* in the *Diastopora* series.

Its nearest ally is *B. diluviana*, from which it differs only in the size of the zoœcia and the less elevation of the peristome. It differs from *B. undulata* (Mich.) in the absence of the wavy ridges which occur in that species, and also by the size of the orifices. The smallness of the apertures reminds one of the species described as *B. microstoma* by Haime. This, however, is only a synonym of *B. undulata* (Mich.), while the true *D. microstoma* of Michelin is referred to the genus *Reptomultisparsa.* It differs from this, in addition to the generic characters, by the orifices being more crowded and smaller, and the surface plain.

10. *Berenicea boloniensis* (Sauvage), 1889.

Rosacilla boloniensis, Sauvage, 1889, Bry. Jur. Boulogne, Bull. Soc. géol. France, sér. 3, t. xvii. p. 48, pl. iii. figs. 9–10.

Rosacilla corallina, Sauvage (non Étallon), 1889, ibid. p. 47, pl. iii. figs. 11–15.

Diagnosis.—*Zoarium* irregular sheets.

Zoœcia not visible throughout, slightly fusiform, raised at the extremities, which are crowded together; front wall punctulate.

Peristomes raised, owing to crowding of zoœcia; fairly regularly arranged, generally irregularly quincuncial, in long series.

Oœcia irregular, wide, extending across four to six zoœcia.

Formula.—1 0″ 1 *i* 1.

Distribution.—Bradford Clay, England. Corallian and Sequanian, near Boulogne; Sequanian, Bavaria.

11. *Berenicea scobinula* (Michelin), 1840.

Diastopora scobinula, Michelin, 1840, Icon. Zooph. p. 10, pl. ii. fig. 12.

Non *Diastopora scobinula*, Haime, 1854, Bry. Jur., Mém. Soc. géol. France, sér. 2, t. v. p. 186, pl. viii. figs. 6 *a*, *b*.
Berenicea scobinula, d'Orbigny, 1852, Pal. franç. Terr. crét. t. v. p. 860.
? *Berenicea corallina*, Étallon, 1861, Mém. Soc. Émul. dép. Doubs, sér. 3, t. vi. p. 212.
Berenicea tenera, Reuss, 1867, Denk. k. Akad. Wiss. Wien, Bd. cxxvii. p. 8, pl. i. fig. 9.

Diagnosis.—*Zoarium* circular, forming very large disks, often somewhat irregular.

Zoœcia crowded, so visible only at distal ends; cylindrical, long, punctulate.

Peristomes slightly raised, arranged regularly along slightly curved lines.

Formula.—1 0 2 *d* 1.

Distribution.—England: Bradford Clay, Wilts; Cornbrash, Yorkshire. Bajocian—Corallian: France, Germany, Austria.

12. *Berenicea coartata*, sp. n.

Diastopora diluviana, pars, Vine, 1884, Polyz. Richmond Boring, Quart. Journ. Geol. Soc. vol. xl. p. 787.

Diagnosis.—*Zoarium* in somewhat thick irregular sheets.

Zoœcia very crowded and visible only at the ends.

Peristomes well raised, quincuncial in arrangement, very densely packed; the distance of the orifices from one another is only equal to their diameter.

Formula.—2 0 1 *i* 2.

Distribution.—Inferior Oolite, Cotteswolds; Great Oolite, Richmond Boring and Bath.

Affinities.—This species is most closely allied to *B. scobinula*, Mich. From this it differs in the much greater crowding of the raised portions of the zoœcia, and from these being regularly quincuncial in arrangement. In *B. exilis*, Reuss (*B. cricopora*, Vine), the distal portions of the zoœcia rise from a flat crust. In *B. coartata* they are so closely packed that no flat basal expansion can be seen between them. The species seems to me exceptionally well marked.

13. *Berenicea verrucosa* (M.-Edwards), 1838.

Diastopora verrucosa, M.-Edwards, 1838, Mém. Cris., Ann. Sci. nat. Zool. sér. 2, t. ix. p. 229, pl. xiv. figs. 2, 2 *a*.
Berenicea verrucosa, Vine, 1880, Rev. Fam. Diastoporidæ, Quart. Journ. Geol. Soc. vol. xxxvi. p. 357.
Cellepora orbiculata, Goldfuss, 1827, Petref. Germ. Bd. i. p. 28, pl. xii. fig. 2.
Non *Cellepora orbiculata*, pars, Quenstedt, 1881, Petref. Deutschl. Bd. vi. Ab. 1, p. 108, pl. cxlvii. figs. 22, 23.
Diastopora orbiculata, d'Orbigny, 1850, Prod. Pal. t. ii. p. 25.
Berenicea orbiculata, Haime, 1854, Bry. Jur., Mém. Soc. géol. France, sér. 2, t. v. p. 181.

Diagnosis.—*Zoarium* a thick circular disk.

Zoœcia crowded, so only visible for distal portions; cylindrical, punctulate, slightly above medium length.

Peristomes well raised, disposed on a slightly irregular quincuncial arrangement.

Oœcia large, irregular, a third or a quarter of a zoœcium in width.

Formula.—2 0 1'' *d* 1.

Distribution.—Inferior Oolite—Cornbrash, England. Bajocian—Kimeridgian, France and Germany.

14. *Berenicea exilis*, Reuss, 1867.

Berenicea exilis, Reuss, 1867, Bry. braun. Jura Balin, Denk. k. Akad. Wiss. Wien, Bd. cxxvii. p. 8, pl. ii. fig. 3.

Diastopora cricopora, Vine, 1881, Further Notes *Diastopora*, Quart. Journ. Geol. Soc. vol. xxxvii. p. 387, pl. xix. figs. 18–25.

Diagnosis.—*Zoarium* thin irregular sheets.

Zoœcia crowded and visible only at the ends.

Peristomes well raised, irregularly distributed; those of adjoining parallel zoœcia distant from one another from two to three times their diameter.

Oœcia small, round, hemispherical, equal in width to two or three zoœcia.

Formula.—2 0 1 *i* 1.

Distribution.—Inferior Oolite: Cornbrash, England. Bathonian, France and Austria.

Indeterminable Species recorded in Britain.

1. *Berenicea crussolensis* (Dumortier).

Diastopora crussolensis, Dumortier, 1874, Etud. Pal. Dép. Jur. Rhône, t. iv. p. 226, pl. xlviii. figs. 11, 12.

Non *Diastopora crassolensis*, Vine, 1883, 3rd Rep. Foss. Bry., Rep. Brit. Assoc. 1882, p. 264.

Distribution.—Upper Lias: Crussol, France.

2. *Berenicea? margopunctata*, Waagen, 1868.

? *Berenicea margopunctata*, Waagen, 1868, Pal. Geogn. Beitr. Bd. i. pp. 535, 646, pl. xxxii. fig. 12.

? *Berenicea* cf. *margopunctata*, Walford, 1883, Relation of Northampton Sand, Quart. Journ. Geol. Soc. vol. xxxix. p. 239.

Distribution.—British: Inferior Oolite, Coombe Hill (*fide* Walford). Foreign: Bajocian, Würtemburg.

Synopsis of Species.

I. Zooecia visible throughout.
  A. Peristomes high, sharply reflexed .... *spatiosa.*
  B. Peristomes low.
    a. Zooecia long:
      (1) plain, irregular; zoarium irregular .... *compressa.*
      (2) plain, regular .... *Sauvagei.*
      (3) striated:
        peristomes flush; zooecia cylindrical .... *portlandica.*
        peristomes raised; zooecia fusiform ...... *striata.*
    b. Zooecia short .... *Alluudi.*

II. Central zooecia seen throughout; peripheral zooecia visible only at ends.
  A. Zoarium discoid .... *Archiaci.*
  B. Zoarium irregular:
    (1) peristomes low:
      mouth of normal size .... *diluviana.*
      mouth small .... *parvitubulata.*
    (2) peristomes raised .... *boloniensis.*

III. Zooecia visible only at ends.
  A. Zooecia regularly arranged.
    Zoarium discoid; peristomes not crowded...... *scobinula.*
    Zoarium irregular; peristomes very crowded .. *coartata.*
  B. Zooecia irregularly arranged.
    Zoarium discoid.............................. *verrucosa.*
    Zoarium irregular .... *exilis.*

VI.—*A new West-Indian Tanaid.* By the Rev. THOMAS R. R. STEBBING, M.A., F.L.S.

[Plate IV.]

ISOPODA CHELIFERA.

Family Tanaidæ.

DOLICHOCHELIA, gen. nov.

The eye-lobes not soldered to the head; the eyes pigmented.

First antennæ very elongate, with the flagellum multiarticulate, not hirsute.

Masticatory organs in the male obsolete.

First gnathopods of the male chelate, having the three basal joints short and little tumid, while the following three are extremely elongated and rather slender.

Uropods biramous, the outer branch minute but distinctly two-jointed, the inner multiarticulate.

The name (formed from δολιχός, long, and χηλή, a claw) points to the close relationship which this genus bears to *Leptochelia*. It is, in fact, inosculant between *Leptochelia*, Dana, and *Heterotanais*, Sars. The latter is distinguished from the former by two characters, its subchelate first gnathopods and its uropods with a two-jointed outer branch. In the second of these characters it agrees with *Dolichochelia*, from which it is strongly distinguished in regard to the gnathopods. To have had to separate *Dolichochelia* from *Leptochelia* merely on the ground that the minute outer branch of the uropods is two-jointed in the one and uniarticulate in the other, might have been necessary, but would have been a hard necessity. The new West-Indian genus, however, is fortunately not dependent solely on so small a difference, being strikingly separated from both the nearly related genera by the slenderly elongated first antennæ and first gnathopods.

Dolichochelia Forresti, sp. n.

The front margin of the head-shield projects but slightly, forming a very obtuse angle, the corners being shallowly excavate for the ocular lobes. The part of the shield to which the first gnathopods (or chelipeds) are attached is wider than the front. The pleon at its base is as wide as the trunk, but narrows distally with a gentle curve; the sixth segment, which is very little longer than that preceding it, ends in an obtuse angle similar to that of the frontal margin.

The eye-lobes have a convex outer margin and are not very sharply pointed in front. The pigment is black in the mounted specimen.

First Antennæ.—These are as long as the animal from the front of the head to the apex of the pleon. The first joint is dilated at the base, for the rest slender, its length forming two fifths of the whole antenna. The second joint is rather less than three quarters the length of the first. The third is a fifth of the length of the second, and so slender as to look like a part of the flagellum, among the eight joints of which the first is the shortest. The joints carry two or three setæ apiece, giving an appearance very unlike that produced by the conspicuous sensory filaments in the adult males of *Leptochelia* and *Heterotanais*.

Second Antennæ.—The first three joints are very small, together not equal to the fourth. The fifth is two thirds the length of the fourth and is distally armed with a seta. The minute tubercle which represents the flagellum carries two setæ. The whole antenna is shorter than the flagellum in the first pair.

First Gnathopods.—These chelipeds are remarkable both for the threatening gape of the chela and for their length, which is double that of the animal's body. The second joint is the stoutest, yet not much dilated, a little longer than broad. The third joint is short, almost triangular. The fourth is of great length, narrowest near the base and nowhere very wide. The fifth is still longer, with a curvature at its base adapted for the folding together of these long slender joints; its narrow immovable digit forms less than half of the total length of the joint and ends in a sort of pointed claw over which three setules are distributed, another setule occupying a small prominence of the inner margin near the base of the claw. The movable finger is somewhat longer than the immovable one, slender, pointed, curved, with irregular margins.

Second Gnathopods.—As usual in this group, these are gnathopods only in name, and differ but slightly from the following ambulatory feet. They are scarcely, if at all, larger than the fifth peræopods, having the second joint narrower, but the fourth and fifth joints a little wider than is the case in that pair.

Peræopods.—The general structure is the same in all. The second joint is the longest, in the last three pairs somewhat dilated. The third joint is very short, the fifth joint is a little longer than the fourth, and the sixth considerably longer than the fifth. There are some spinules about the distal end of the sixth joint. In the first and second pairs the finger is small, in the other three pairs it is nearly as long as in the second gnathopod.

Pleopods.—All the five pairs are constructed as in *Leptochelia.*

Uropods.—The peduncles are a little longer than broad. The inner branch has six joints, of which the first is the widest, the fourth the longest. The outer branch has two joints, together not equalling the length of the first joint of the inner branch. All the joints of the branches are setiferous.

Length.—From head to tail the specimen measured less than a tenth of an inch.

Habitat.—The single specimen (a male) comes from Antigua, where it was found at Long Island, at the mouth of Parham Harbour, in shallow water, with sandy bottom, covered with algæ, by Mr. W. R. Forrest; and I do myself the pleasure of associating the species with the name of that acute observer.

From an unmounted specimen with which Mr. Forrest has favoured me since the above description was passed for press it appears that the lateral margins of the head anteriorly are slightly concave, that the first three free segments of the peræon are very decidedly shorter and a little broader than the following three, that, viewed dorsally, there is a constriction between the third and fourth and between the fourth and fifth free segments, and that the first five segments of the pleon are slightly broader than the immediately preceding segments of the peræon. In both specimens the mouth-organs appear to be in a very rudimentary condition.

In his recent contribution to the Crustacea of the Plankton Expedition Dr. H. J. Hansen gives some weighty reasons for adopting the view that the families of the Apseudidæ and Tanaidæ should form a separate order, which he calls Tanaidacea, coordinate with the Amphipoda, Isopoda, and Cumacea. I shall not easily be convinced that the new order is required. It is much more a question of convenience than of scientific accuracy. Though the two families in question have points in common with the Amphipoda and Cumacea, they are trenchantly distinguished from both of those groups. On the other hand, they have the dorso-ventrally depressed body which is so prevalent among the Isopoda, and in detail they show several points of agreement with various members of the Isopodan families. Thus the peculiarity in *Apseudes* that the second antennæ have an exopod has its parallel in *Stenetrium* and *Janira*. In *Stenetrium*, Haswell, and *Phreatoicus*, Chilton, the first gnathopods have a prehensile hand to some extent equivalent to that found in the Apseudidæ and Tanaidæ. In the Gnathiidæ and the Cryptoniscian forms among the Epicaridea there occur pleopods strongly resembling forms of those appendages in the families just mentioned. The uropods of the Tanaidæ cannot be considered remote from those of the Asellidæ; and the coalescence of the first peræon-segment with the cephalon is exhibited in a more or less marked degree in the male sex of the Gnathiidæ.

In regard, then, to the acceptance of the proposed new order, Tanaidacea, in exchange for the group of the Isopoda Chelifera, the important question arises, *cui bono*? For whose advantage will the change be made? So long as the higher classificatory divisions are capacious, they hold out a welcome to new discoveries; but when their boundaries are contracted, the next new species is liable to find itself left out in the cold, and then perhaps a new order must be established for a solitary form. Moreover, when the breaking-up of a fairly satisfactory group is once begun, the process is likely to continue, since the importance of differences on which suborders and families have been established can be magnified at will to justify the elevation of a family to the rank of a suborder, and of a suborder to the rank of an order.

Note on Apseudes Latreillii (*Milne-Edwards*?).

In the description given of this species by Professor G. O. Sars in 1880, and more fully in 1886, it is stated that the segments of the peræon are without ventral spines. In the description of it by Norman and Stebbing, published in 1886, it is said that the carapace and peræon-segments are "without spiny armature either on the sides or ventral surface, except that the last segment of the peræon has a large spine-like projection on the middle of its under surface." These statements appear to need a little modification, for, among numerous specimens dredged this summer in Salcombe estuary, a few, not otherwise distinguishable from the rest, show a ventral spine on the fourth as well as one on the seventh peræon-segment. The spine in question is pointed slightly forward, and arises from the middle of the hinder part of the ventral surface of the segment. Being placed just between the legs it is not always easy to detect, though its size is considerable.

EXPLANATION OF PLATE IV.

Dorsal view of the specimen, with both pairs of antennæ and both uropods, but the limbs of the left side only.

n.s., natural size.
oc., front of head with the eyes.
a.s., upper antenna; *a.i.*, lower antenna; *gn.* 1, first gnathopod (or cheliped) of the right side; *gn.* 2, second gnathopod; *prp.* 1–5, the five peræopods; *plp.*, one of the pleopods; *ur.*, terminal portion of pleon with the uropods.

All the separate parts are magnified to the same scale, with the exception of the cheliped, which is a little less magnified than the others.

VII.—*Descriptions of new Species of Butterflies of the Genus* Catasticta *in the British Museum.* By Arthur G. Butler, Ph.D. &c.

The following species have been in the Museum without names for many years; and, as I find that they are unquestionably not described, I propose to name them now.

Catasticta sinapina, sp. n.

♂. Resembles *C. nimbice* on the upper surface, excepting that the central ochreous band is more distinctly divided by the veins, the spots composing it on the primaries smaller; the postmedian series consists of larger spots, and the marginal spots on the secondaries are larger; the latter wings are more elongated at anal angle; the under surface is quite unique in colouring, the ground-colour mustard-yellow, and the veins and markings purplish brown; the pattern corresponds almost exactly with that on the under surface of *C. susiana*.

Expanse of wings 56 millim.

Pucartambo, Peru (*Whitely*).

We purchased this insect in 1872, but at that time I was not in a position to decide whether or no it was undescribed; it should stand near *C. susiana*.

Catasticta reducta, sp. n.

Euterpe colla, Hewitson (nct Doubleday), in Coll. Hewits.

♂. Pattern of both surfaces as in *C. anaitis*, but this species is much smaller and has all the markings of the upper surface ochreous, irrorated with purplish brown; the nervures are much more broadly blackish; the secondaries have a marginal series of small white spots: the macular bands on the under surface of the primaries are clear ochreous, those towards apex being more falciform.

Expanse of wings 52 millim.

Ecuador (*Buckley*).

Local form *boliviana*.

Differs from the typical form in having all the markings of the upper surface clear ochreous, with scarcely a trace of dark irroration.

Expanse of wings 51–54 millim.

Bolivia.

The above species is represented in Hewitson's collection by seven examples—four from Ecuador and three from Bolivia—and incorrectly identified by him as *Euterpe colla*. In the same drawer an example of Doubleday's species is associated with a specimen of *C. zancle*, and wrongly identified as *C. nimbice*.

Catasticta strigosa, sp. n.

♂. Form, size, and general aspect above of *C. hebra*;

deep olive-brown, the lower third of the discoidal cell of primaries sparsely irrorated with sulphur-yellow scales, the cell surrounded by a series of longitudinal tapering rays, sulphur-yellow irrorated with brown, the pointed extremities of the first six of these rays being cut off by a stripe of the ground-colour from apical fourth of costa to external angle: secondaries sulphur-yellow, irrorated with brown, but with the nervures and a broad external border which emits pyramidal spurs along the nervures deep olive-brown; three elongated clear yellow spots terminating the second to fourth internervular streaks: under surface similar to *C. ctemene* ♂, but the yellow patch on the primaries broken up into narrow streaks by the broad brown borders to the nervures.

Expanse of wings 67 millim.

Pucartambo, Peru (*Whitely*).

Catasticta straminea, sp. n.

Allied to *C. eurigania* from Ecuador, but the upper surface deep buff or straw-yellow, with all the veins black; three elongated spots placed obliquely on the black apical area, the middle one large, the others small: secondaries with the outer border broadly black, with a deep sinus in the radial interspace.

Expanse of wings 47 millim.

Hab. ——?

Two specimens of this species stood in Hewitson's collection with two of his *C. eurigania* from Ecuador and two of *C. notha* from Bolivia, the label "*eurigania*" standing below the three species. Unfortunately Hewitson neglected to label the present species with its locality.

VIII.—*Descriptions of some new South-African Spiders of the Family* Heteropodidæ. By R. I. Pocock, of the British Museum of Natural History.

[Plate VIII.]

Selenops Spenceri, sp. n. (Pl. VIII. figs. 8, 8 *a*.)

♀. *Colour* yellowish brown; carapace partially clothed with white hairs, which, contrasting with the yellow of the integument, gives it a mottled appearance, a fine dark line on its lateral edges, and the region of the eyes deeply pigmented with black. Abdomen thickly mottled above with fine brown and white spots; clothed with whitish hairs below. Sternum, labium, maxillæ, coxæ, and lower surface of limbs pale yellow, rather scantily covered with silky white hairs. Mandibles reddish yellow, very faintly infuscate distally, sparsely covered with longish white hairs. Palpi pale, with a fuscous spot at each end of the tarsus. Legs with femora faintly variegated with stripes; patellæ, tibiæ, and protarsi with a proximal fuscous spot, the one on the protarsus very broad; tibiæ in addition with a broad band in the distal half and protarsus with a narrower one at its distal extremity.

Carapace considerably wider than long, its width a little less than the length of the fourth tibia; cephalic region slightly elevated, the face moderately high; the clypeus about as high as the diameter of the anterior median or posterior median eye. The anterior medians separated by a space which is distinctly less than their diameter, a little closer to the posterior median, which are more than twice their size, and have advanced much less to the front than is usual in *Selenops*, and stand so high that, when viewed from the front, their inferior edge is only a little below the level of the inferior edge of the anterior median; the anterior lateral oval, less than half the size of the anterior median, but in the same straight line, situated on the lower side of an elevation which bears on its posterior lateral surface the posterior lateral eye, which is considerably larger than the posterior median.

Inferior mandibular margin armed with 3 strong teeth in front and 2 behind.

Palp: femur with 5 spines above; patella with 3, one internal larger, two median setiform; tibia with 6 spines; tarsus with a transverse row of 6 very long spines in its proximal half, 3 below at the apex, and 1 on the inner surface. Some of the spines on the palp pale, some black.

Legs 4, 3, 2, 1, armed above with 3 pairs of spines, those of the anterior row black, of the posterior pale; also with 3 on their anterior surface, the proximal of these pale. Patella with 1 posterior spine; tibiæ of first and second legs with 7 pairs of inferior spines, protarsi with 3 pairs; tibiæ of third with 2 pairs of inferior spines, protarsus with 1 pair; tibia and protarsus of fourth only weakly spined; tarsi and protarsi of first and second weakly and biserially scopulate, of third and fourth not or hardly scopulate.

Sternum almost circular, a little longer than wide, widest between the coxæ of the second legs.

Vulva with the form of a longitudinally oblong plate, with its anterior two-thirds deeply hollowed with an oval or horseshoe-shaped excavation; the plate laterally and posteriorly overgrown with hairs.

Measurements in millimetres.—Total length 11; length of carapace 5·6, width 6·5; length of first leg (from base of femur) 25, of second 26·5, of third 27·3, of fourth 28·5.

Loc. Durban (*H. A. Spencer*). A single female example.

Apparently resembling *S. atomarius*, Simon (Bull. Soc. Zool. Fr. xii. p. 465, 1887), from Port Elizabeth, in having the median eyes forming a strongly recurved line, but differing in having 7 pairs of spines upon the lower surface of the anterior tibiæ instead of 5, and also apparently in the form of the vulva.

It is an interesting fact connected with *Selenops* that the females of this genus do not, like *Heteropoda*, make a lenticular cocoon and carry it about with them, but attach their eggs to some foreign object, and cover them with a sheeting ot thin, smooth, parchment-like silk.

Palystes Johnstoni, sp. n. (Pl. VIII. figs. 1–1 *c*.)

♀. *Colour.*—Upperside of legs and carapace castaneous, but clothed uniformly with a thick layer of greyish-white hairs, a transverse stripe of yellowish-white hairs on the clypeus; upperside of abdomen pale brown, deeper in the hinder half above the anus, where the brown area is bordered by a deep chocolate-brown sinuous edge, which separates it from the white posterior lateral portions of the abdomen; in front the upperside of the abdomen is ornamented with 2 fine rather indistinct dark-coloured longitudinal lines, which meet posteriorly in a point; lower surface of abdomen whitish, mottled with yellow spots; the epigastric region blackish, but covered with golden-yellow hairs, and behind this region there is a narrow deep brown transverse crescentic stripe. Palpi yellower than the legs, uniformly coloured above and below, but the tarsal segment apically infuscate. Mandibles blackish brown, clothed with golden-yellow hairs, but not noticeably striped. Maxillæ with their distal third pale; labium with pale border. Sternum clothed with yellow hairs; 2 thickish black stripes crossing its middle transversely, the anterior of these in a line with the dark stripe on the second coxæ, the posterior, which is angular, each half being directed obliquely forwards to touch the stripe in front, being similarly continuous with the dark anterior half of the third coxæ. Legs having their coxæ black in front, yellow behind; femora of first and second legs with the basal half reddish brown; all the tibiæ with 2 spots of the same colour, 1 at their proximal end, the other just past the middle; the scopulæ of the protarsi fiery red, of the tarsi greyish brown, the rest of the lower surface of the legs yellowish white.

Carapace as long as tibia, $+\frac{1}{3}$ of patella of fourth leg; width equalling length of tibia of third leg.

Legs 1–2, 4, 3. Femora unarmed below; tibiæ armed with 6 long spines in 3 pairs, a pair springing from each of the spots and 1 pair at the distal end; protarsi with 2 pairs of long spines in their proximal half; femora with 3 anterior, 3 posterior, and 2 superior spines, that of the fourth, however, with only 2 posterior spines; patella with 1 anterior and 1 posterior spine; tibiæ with 1 superior, 2 anterior, and 2 posterior spines; protarsi with 2 anterior and 2 posterior spines.

Vulva. (As in figure.)

Measurements in millimetres.—Total length 24; length of carapace 11·2, width 9; length of first leg 46, of second 46, of third 34, of fourth 40.

♂. Colour as in ♀, but abdomen with the pattern less well defined, and the lower surface of the femora mottled with yellow spots.

Palp. (As in figure.)

Measurements in millimetres.—Total length 17; length of carapace 8·2, width 7; length of first leg 45, of second 43·5, of third 32, of fourth 38.

Loc. Zomba, 3000–9000 ft. (*H. H. Johnston*): types. Also an immature specimen of apparently the same species from Ugogo (*Emin Pasha*).

This species seems in some respects to resemble *P. Höhneli* of Simon (Ann. Soc. Ent. Fr. 1889, p. 129) from Kilima Njaro, the resemblance between them being especially noticeable in the colour of the legs. It is to be observed, however, that Simon makes no mention of the banding on the sternum or coxæ, and according to the measurements the first and fourth legs are almost equal in length.

Palystes Ellioti, sp. n. (Pl. VIII. figs. 2, 2 *a*.)

Closely allied to *P. Johnstoni*, but having more black upon the maxillæ and sternum, only the distal fourth of the lower surface of the first and second femora palely yellow, and a broad brown band running backwards on the ventral surface of the abdomen from the epigastric fold to the spinners. The vulva is also quite distinct (see fig. 2).

Loc. Uganda, E. Africa (*G. F. Scott Elliot*).

Palystes Spenceri, sp. n. (Pl. VIII. figs. 3, 3 *a*.)

♀. Upperside of trunk and limbs clothed with dirty yellowish-brown hairs, the legs faintly mottled with darker spots; the carapace without distinct pattern, sometimes, however, with a paler median band and a paler marginal line; the clypeus with a distinct white band, which is thickest in the middle. The abdomen ornamented above as in *P. Johnstoni*, but the distinction between the brown patch and the sides of the abdomen less well defined; the sides and lower surface a uniform yellowish brown. Mandibles not striped, black, but clothed with whitish-yellow hairs. Palpi ochre-yellow; tarsus distally fuscous below. Maxillæ and labium as in *P. Johnstoni*. Sternum yellow, with a single fuscous band crossing it in a line with the dark front half of the second coxæ. Coxæ of legs whitish yellow, with their anterior third blackish brown. Femora of first and second pairs with their basal half or almost two thirds deep reddish brown, the rest of the segment bright yellow, mottled with small brown spots; femora of third and fourth yellowish, mottled; patella bright yellow below; tibiæ also bright yellow, with a large basal brownish-red spot, and a second just past the middle; these spots sometimes rather indistinct upon the third and fourth legs. Protarsal and tarsal pads fuscous. Mandibles armed as in *P. Johnstoni*. Legs and palpi of the same relative length and spine-armature as in that species; but the examination of a large series of specimens shows that the number of spines is not quite constant.

Vulva. (As in figure.)

Measurements in millimetres.—Total length 39·5; length of carapace 14, width 12; length of first leg 55·5, of second 55, of third 41, of fourth 48.

♂. With the carapace browner on the summit than in the female; the posterior brown patch upon the abdomen not defined. The 4 pairs of femora almost of the same colour, being a brownish yellow, mottled with smaller dark spots.

Palp. (As in figure.)

Measurements in millimetres.—Total length 23; length of carapace 11, width 9; length of first leg from base of femur 54, of second 53·5, of third 39, of fourth 46, tibia of fourth 11·8.

Loc. Durban. A large number of specimens including the types obtained by Mr. H. A. Spencer.

Judging from the list of localities from which the Museum has received this species, it appears to be widely distributed in the south-eastern parts of Cape Colony. I cannot, however, discover that it has yet received a name, unless, indeed, the *Heteropoda natalia* of Karsch (Zeits. ges. Naturwiss. 1878, p. 772) be the same species. This last-named form will probably be found to belong to *Palystes*, seeing that it has the white clypeus, the banded sternum, and the eyes of the front row of the same relative size as in the other South-African representative of this genus.

Palystes lunatus, sp. n. (Pl. VIII. fig. 5.)

Colour.—Carapace chestnut, clothed with yellowish-brown hair, with a fine white median line and the usual white clypeal band; mandibles black, clothed with yellowish-brown hair, with the white stripes scarcely apparent; legs and palpi chestnut, clothed with yellowish-brown hairs above; coxæ with only their anterior surfaces infuscate; femora of a uniform yellowish brown below; patellæ whitish yellow; tibiæ banded as usual with fuscous and whitish yellow; sternum clothed with yellow hairs, but marked in addition with 2 transverse fuscous bands which fuse in the middle; labium and maxillæ black, chestnut only at the tips; abdomen without very definite pattern above, obscurely mottled, deeper coloured posteriorly, and marked with 2 longitudinal blackish stripes in front; pale yellowish brown below, with a short narrow transverse black band in front of the epigyne, and a broad whitish crescentic one behind it, the rest of the area between the epigastric fold and the maxillæ marked with a few whitish spots and 4 fine longitudinal fuscous bands.

Vulva. (As in figure.)

Measurements in millimetres.—Total length 29; length of carapace 12·5, width 10; length of first leg (from base of femur) 46·5, of second 46·5, of third 38, of fourth 42·5.

Loc. S. Africa (*Dr. Quain*).

Differs from *P. Spenceri* in having 2 transverse fuscous bars across the sternum, the femora of a uniform tint below, a deep transverse crescentic band behind the epigastric fold, and the form of the vulva; in the latter characteristic, as well as in the colour of its sternum and femora, it also differs from *P. superciliosus* of L. Koch.

Palystes pulchripes, sp. n. (Pl. VIII. figs. 4, 4 *a*.)

? *Palystes superciliosus*, L. Koch, Die Arachniden Australiens, ii. p. 706.

♀. Closely related to *P. lunatus*, but with the carapace paler chestnut, with no median white band; the palpi pale yellow, with fuscous tips; the distal third of the maxillæ yellow; the sternum with a single dark band across it, and the lower surface of the femora variegated as in *P. Spenceri*, the basal half being blackish and the distal bright yellow, although mottled. In one of the specimens the posterior end of the abdomen is ornamented above very much as in the figure of *P. superciliosus* published by Koch, but in two others this pattern is not visible.

Vulva small, pale-coloured, represented by a horny transverse bilobed plate, something like that of *P. superciliosus* of Koch (*op. cit.* pl. lxi. fig. 1 *a*); but the anterior lobes much shallower. There are, moreover, no posterior lobes and no transverse bar such as Koch has depicted.

Length 28 millim.; length of cephalothorax 12, width 9·5; length of first and second legs 42, of third 31·5, of fourth 36·5.

Loc. Port Elizabeth (*H. A. Spencer*).

Three apparently adult females were obtained at the above locality. They appear to be very nearly allied to *P. superciliosus* of Koch, but seem quite distinct, provided that Koch's figure of the vulva of *superciliosus* is correct.

Panaretus (?) *distictus*, sp. n. (Pl. VIII. figs. 7, 7 *a*.)

♀. *Colour.*—Carapace pale castaneous, covered with pale yellow hairs intermixed with rather stouter black ones; in the cephalic region there are some longish setæ, black at the base and pale distally; faint lines of black pigment radiating from the fovea; the lateral margin posteriorly narrowly black, the cephalic region mottled with small yellow spots; many longish yellow hairs between the eyes, but no white clypeal band. Mandibles pale castaneous, clothed with white or black-and-white hairs, and variegated with small black spots. Labium, maxilla, and sternum pale yellow, clothed with white hairs, with a few black-and-white ones intermixed; coxæ of the same colour, but variegated with small black spots; legs ferruginous or ochre-yellow, not noticeably banded, but mottled above with minute whitish spots; the femora mottled below with black spots; abdomen reddish brown above, finely mottled with minute black and white spots; yellowish white laterally and below and spotted with black, and furnished on each side of the spinners with a large elongate but irregularly shaped black patch, which is emphasized above by a fine border of white hairs.

Carapace very high in its posterior half, lightly convex towards the ocular area, cephalic region narrower; its length just exceeding that of the fourth tibia. *Eyes* of posterior row subequal in size and evenly spaced, forming a slightly recurved line; those of the anterior row also slightly recurved when viewed from above, straight when seen from the front, the lower edge of the laterals being on the same level as that of the median; the anterior median about as large as the eyes of the hinder row, but much smaller than the anterior laterals and considerably nearer to them than they are to each other, the space between them being about equal to their diameter; space between the anterior and posterior lateral a little greater than the diameter of the former; the *clypeus* a little longer than the diameter of the anterior lateral eye.

Legs long and slender, 2, 1, 4, 3; their spine-armature approximately the same as in *Palystes Johnstoni* and the rest.

The *vulva* of large size and projecting vertically downwards. (For structure, see figure.)

Measurements in millimetres.—Total length 13; length of carapace 6, width 5; length of first leg (from base of femur) 24, of second 24·5, of third 19, of fourth 21.

Loc. East London (*H. A. Spencer*).

Judging from M. Simon's diagnosis of *Penaretus*, this species differs from the Oriental members of the genus in having the legs longer and the mandibles weaker, less geniculate, and normally hairy from base to apex.

Olios Spenceri. (Pl. VIII. fig. 6.)

♀. *Colour.*—Carapace pale castaneous, clothed with whitish hairs; mandibles black, maxillæ and labium chestnut; abdomen clothed above with yellowish-white hairs, with a median black stripe consisting of triangular spots, and mottled at the sides with blackish spots and short stripes; pale below, vulva deep black. *Palpi* reddish yellow, tarsal scopula fuscous; legs reddish yellow, clothed with yellowish-white hairs, scopulæ fuscous; tibiæ with two faint fuscous bands.

Carapace as wide as long; moderately convex, its width just equal to the length of tibia of first leg. *Eyes* of posterior row straight, subequal, and nearly evenly spaced; eyes of front row closer together, subequal, the median a little nearer each other than each is to the lateral, the space between median and lateral about equal to a diameter.

Mandibles sparsely hairy; armed below with 4 teeth behind and 2 in front.

Palp: femur with a cluster of 5 spines above distally; patella and tibia with 1 external and 1 internal; tarsus with 1 external and 3 internal. *Legs* 2, 1, 4, 3; the second excelling the first by its tarsus; the third and fourth only slightly unequal; femora of first, second, and third armed above with 8 spines (3, 2, 3), of fourth with 6 (3, 2, 1);

tibiæ of first, second, and third also armed with 8 spines, 2 in front, 2 + 2 below, 2 behind; tibia of fourth with 6 spines, the posterior pair missing; protarsi also with 8 spines, 2, 2 below, 2 in front, and 2 behind; that of the fourth leg with some extra apical spines.

Abdomen elongate oval. *Vulva* of large size, occupying the whole of the middle of the epigastric plate, nearly circular, its posterior border emarginate, the middle of the emargination deeply notched, the notch passing into a deep sulcus, which divides the vulva into two halves; the surface of the plate marked with a deep oval excavation.

Measurements in millimetres.—Total length 15·5; length and width of carapace 7; length of first leg 27, of second 29·5, of third 21·5, of fourth 22·5.

Loc. Durban (*H. A. Spencer*). A single female specimen.

Mr. H. A. Spencer also obtained in S. Africa specimens of the two following species of Heteropodidæ:—

1. *Palystes megacephalus* (C. Koch), Die Arachn. xii. p. 25 (1848) (*Ocypete*).

Loc. Port Elizabeth. Adult male and female.

This species is, I think, generically distinct from the rest of the S.-African species of *Palystes*. The carapace is both higher and longer, the width falling considerably short of the distance between the posterior border and the eyes of the hinder row. These eyes, too, are not evenly spaced as in *Palystes*, the distance between the two medians being noticeably less than that between the medians and the laterals. The legs, moreover, are distinctly less "laterigrade" than is usual with the Heteropodidæ.

2. *Palystes castaneus* (Latr.). (Pl. VIII. fig. 9.)

Thomisus castaneus, Latr. Nouv. Dict. Hist. Nat. xxxiv. p. 30 (1819) (*teste* Simon).

Olios castaneus and *fuscus*, Walck. Ins. Apt. i. pp. 571–573 (1837) (*teste* Simon).

Ocypete melanogaster, C. Koch, Die Arachn. xii. p. 31 (1845).

Ocypete nobilis (Fabr.), C. Koch, *ibid.* p. 37, ♀ (probably not *nobilis* of Fabricius, which is said to be Indian).

Mr. Spencer obtained three examples of this handsome species at Cape Town.

In the figure of the vulva that L. Koch has published (Die Arachn. Australiens, pl. lx. fig. 4 *b*) the median notch on the posterior border should have been represented as much deeper and angular, and the ridges defining the two anterior depressions as much stronger.

In addition to being smaller than the female, the male differs in having the lower surface of the femora white, but rather thickly mottled with small brown spots—these segments, at least on the anterior two pairs of legs, being in the female reddish brown, and not spotted. The male, in fact, agrees so closely with the description of *Ocypete melanogaster* of C. Koch (Die Arachniden, xii. p. 31) that I have not hesitated to regard the latter as the male of *castaneus*.

The palpus is distally much enlarged, the tarsus bearing in the middle of its external edge a smooth black excrescence; the external portion of the bulb consists of a swollen semicircular densely coriaceous skeletal piece, and from this three long processes pass forwards to the apex of the alveolus, the external of these being membranous and fimbriated, the median straighter, more horny, and apically hooked. The proximal end of the tarsus narrowed to form a slender neck. The prominence on the tibia very stout, and bearing one long process, which curves abruptly inwards and supports on its base an angular tooth, while a third strong, hooked, but short tooth rises from the external angle of the prominence.

EXPLANATION OF PLATE VIII.

Fig. 1. *Palystes Johnstoni*, sp. n. ♀, upper view, nat. size.
Fig. 1 *a*. Ditto. Lower view.
Fig. 1 *b*. Ditto. Vulva.
Fig. 1 *c*. Ditto. Palp of ♂.
Fig. 2. *Palystes Ellioti*, sp. n. Vulva.
Fig. 2 *a*. Ditto. Lower view of trunk, nat. size, to show pattern of colours.
Fig. 3. *Palystes Spenceri*, sp. n. Vulva.
Fig. 3 *a*. Ditto. Palp.
Fig. 4. *Palystes pulchripes*, sp. n. Vulva.
Fig. 4 *a*. Ditto. Lower view of trunk, to show pattern.
Fig. 5. *Palystes lunatus*, sp. n. Vulva.
Fig. 6. *Olios Spenceri*, sp. n. Vulva.
Fig. 7. *Panaretus* (?) *distictus*, sp. n. Vulva.
Fig. 7 *a*. Ditto. Lower view of trunk, nat. size.
Fig. 8. *Selenops Spenceri*, sp. n. Vulva.
Fig. 8 *a*. Ditto. Face.
Fig. 9. *Palystes castaneus* (Latr.). Margin of vulva.

IX.—*On a new Species of* Hylecœtus (Lymexylonidæ) *from Japan.* By G. Lewis, F.L.S.

I found only one species belonging to the Lymexylonidæ in Japan, but it was widely distributed; my most southern specimens were taken on the heights of Ichibuyama, near Yuyama, lat. 32°, and the most northern at Sapporo, lat. 44°. In the Munich Catalogue, 1869, there are only twenty-two species of Lymexylonidæ given, and these are assigned to three genera—*Atractocerus*, *Hylecœtus*, and *Lymexylon*. It is most probable that a species of *Lymexylon* is to be found in Japan, and it is reasonable to look for and expect to find a species of *Atractocerus* in the southern provinces or in the group of islands lying to the south of Kiushiu, as *Atractocerus* contains species having a wide range, and several are known to occur in the islands of the Eastern Archipelago.

Hylecœtus cossis, sp. n.

Elongatus, parallelus, testaceus, pubescens; capite dense punctato, opaco, infuscato vel nigro; thorace inæquali, vago haud dense punctato; elytris obsolete 3-costatis, apice infuscatis.

L. 10–16 mill.

Elongate, parallel at the sides, brownish or reddish yellow, head opaque, thorax and elytra somewhat shining; the head densely punctate, punctures subocellate, with the narrow interstices between them raised and running together, black, but rarely infuscate, and in one large female the head is reddish between the antennæ and behind the eyes and the neck is red; the thorax uneven, punctures shallow and not closely set, interspaces smooth, anterior angles rounded off, posterior angles better marked; the scutellum tripartite, obtuse behind, with a carina on the anterior median area which anteriorly splits into two (perhaps of use for stridulation); the elytra vaguely 3-costate, interstices roughish, finely and rather densely punctulate, apices infuscate; the antennæ and mouth-organs reddish brown, or sometimes dusky, the large palpi in male black; the legs brownish yellow. The female, when the surface is not abraded, has the head thickly hirsute.

This species doubtless varies considerably in size; the measurements given above are taken from eight examples only.

Hab. Yuyama, Oyama in Sagami, Nikko, and Sapporo.

X.—*Description of a new Species of* Thauria (*Moore*), *a Genus of* Amathusiinæ. By PHILIP CROWLEY, F.L.S. &c.

Thauria intermedia, sp. n.

Male.—Upperside. Fore wing deep brown, slightly shot with purple, the base ferruginous brown, crossed by a broad oblique creamy-white band from the costa just beyond the cell to the outer margin below first median nervure; two subapical spots, the upper creamy white, the lower less defined and tinged with blue. Hind wing deep brown, the base suffused with ferruginous brown; the apex and the anal third from discoidal nervule to the anal angle rich orange-brown.

Underside. Similar to *T. pseudalaris*, the band of the fore wing being about double the width and the ocelli of the hind wing being much larger and more pronounced.

Expanse 4·5 inches.

Hab. Burma and Tenasserim.

In collections Crowley, Adams, and Brit. Mus.

This species has hitherto been confounded with *T. pseudalaris*, and is mentioned by Messrs. Elwes, De Nicéville, Moore, and Distant as such. It is at once distinguished from the true *pseudalaris*, which occurs in Perak, Malacca, and Salanga, by the much greater breadth and paler colour of the band.

XI.—*A List of the Species of* Amphidromus, *Albers, with Critical Notes and Descriptions of some hitherto undescribed Species and Varieties.* By HUGH FULTON.

[Plates V.–VII.]

HAVING had opportunities of examining a large number of specimens, including most of the types, of this admittedly difficult genus, I have thought that a list of all the known species might be useful. I have endeavoured to arrange the species according to their affinities, and have given a figure of all the unfigured species. The genera or subgenera *Pseudopartula* and *Beddomea* are omitted from this list, the species of which have sometimes been included with *Amphidromus*, but they appear to me to be, from their conchological characters, sufficiently distinct to stand apart.

My thanks are due to Prof. A. Lang (for permission to view Mousson's types), Prof. Dr. E. von Martens, Dr. Aug. Brot, and M. Jules Mabille (for kind assistance while examining specimens at their respective museums). I am also indebted to Mr. S. Hansen, of Copenhagen, for comparing specimens with Müller's types, and to Dr. Jousseaume for notes on *A. Perrieri* and *A. hemicyclus* of Rochebrune. Lastly, I am especially indebted to Mr. Edgar A. Smith, of the British Museum, without whose kind assistance in giving me free access to books and specimens I could not have compiled this list.

Group of A. perversus.

1. *A. perversus*, Linné, Syst. Nat. 10th ed.; Fér. Hist. pl. cxlviii. figs. 1–8; Homb. et Jacq. Voy. au Pôle Sud, pl. viii. fig. 9.

=*citrinus*, Brug., Chem. ed. ii. pl. ix. figs. 1, 2.
=*obesus*, Martens, Ost-Asien, p. 351; Chem. ix. figs. 934, 935.

Loc. —— ?

The type has been lost, but the uniformly yellow-coloured specimens, figured as above mentioned, are accepted as agreeing best with Linné's description. Martens's *obesus* is a small form, generally somewhat broader in proportion to its length than typical *perversus*, but agreeing perfectly with it in other respects.

A. perversus, var. *tenera*, Martens, Ost-Asien, p. 350.

A *very thin* shell, of the form of typical *perversus* and of a pale yellow colour.

A. perversus, var. *chloris*, Reeve, Con. Icon. 1848, Bul. fig. 223.

Loc. Malay Peninsula.

Typical specimens are of a narrower form than *perversus*, and have *a narrow white band below and encircling the suture*; except for the last-mentioned character there is hardly any difference sufficient to separate this from typical *perversus*—that is, when one has a series of specimens under examination.

A. perversus, var. *entobapta*, Dohrn, Nach. d. deut. Gesell. 1889, p. 21.

Loc. Paragua Island.

The greater size of aperture in proportion to the length of shell and a rather coarse oblique striation separate this variety from *perversus.* The deep yellow colour inside aperture is not always present, some specimens I have from Busuanga Island being quite white throughout.

A. perversus, var. *aurea*, Martens, Ost-Asien, p. 349, pl. xx. fig. 13.

=*H. dextra*, Chem. ix. figs. 1210, 1211.
=*H. aurea*, Fér. Hist. pl. cxlviii. figs. 1–3.

Loc. —— ?

A very unsatisfactory variety: the figure in 'Ost-Asien' is probably badly coloured, and it is difficult to say to which variety of *perversus* it belongs; the figure referred to in Fér. is a typical *perversus*; but neither agree with the *H. dextra* (Chem. ix. figs. 1210, 1211), which does agree with a specimen of mine identified by Prof. von Martens as being his var. *aurea*. This shell is a rather small *globose* form of *perversus*, of a *uniform golden-yellow colour*.

A. perversus, var. *infrapicta*, Martens, Ost-Asien, p. 344, pl. xx. figs. 1 and 9.

Differs from *perversus* in having the lower part of the last whorl covered with reddish-brown stripes and spots, which are often interrupted by a narrow yellow spiral band. Closely allied to *interruptus* of Müller, but smoother.

A. perversus, var. *interrupta*, Müller, Hist. Verm. 1774, ii. p. 94, no. 291; Chem. ix. pl. cxxxiv. figs. 1213, 1214.

=*emaciatus*, Martens, Ost-Asien, p. 347, pl. xx. fig. 7.
=*sultanus*, Lamk. Hist. Nat. Anim. s. Vert. vi. 1819; Deless. Recueil de Coq. 1841, pl. xxvii. figs. 6, 7.
=*makassariensis*, Homb. et Jacq. Voy. au Pôle Sud, pl. viii. figs. 5, 6.

Loc. Bali Island.

Müller's type, as figured in Chem. figs. 1213, 1214, is a decorticated specimen, with fewer markings than in most specimens. Lamarck's *sultanus* was founded upon specimens of this variety in good condition.

A. perversus, var. *melanomma*, Pfeiffer, Zeit. für Malak. 1852, p. 95.

=*citrinus*, Reeve (pars), Con. Icon., Bul. pl. xxxi. fig. 187 *a*.
=*flammea*, Chem. ix. p. 94, pl. c. fig. 927.

Loc. Singapore.

This variety can generally be distinguished from the foregoing by the absence of any dark colour at back of lip, its black apex (this character is not always present), its closer and finer oblique stripes, and in being somewhat smoother.

A. perversus, var. *natunensis*, Fulton.

=*perversus*, Smith, Ann. & Mag. Nat. Hist. 1894, xiii. p. 457.

Loc. Natuna Islands.

Like *interruptus*, but generally somewhat larger, *depressed at the sutural area*; coloration varies from white, with one oblique dark brown stripe, to specimens coloured like *melanomma*, except that the stripes do not extend right across the whorls, but stop short, leaving *a broad white band below the suture.*

A. perversus, var. *strigosa*, Martens, Ost-Asien, p. 346, pl. xx. fig. 6.

Very near *interruptus* and *melanomma*, but the whole shell is closely covered with oblique dark reddish-brown stripes.

A. perversus, var. *leucoxantha*, Martens, Monatsber. Berl. Akad. 1864, p. 526; Ost-Asien, p. 348, pl. xx. figs. 11, 12.

=*B. citrinus*, Reeve (pars), Con. Icon. fig. 187 *b*.

According to Martens's figures this is very variable in form, but chiefly characterized by having a broad white band below and encircling the suture. To me the figure in Reeve's 'Iconica' represents this variety; the other figures which were afterwards referred to this variety by Martens appear to me to be different.

A. perversus, var. *atricallosa*, Gould, Proc. Bost. Soc. Nat. Hist. 1843, vol. i. p. 140; Bost. Journ. iv. p. 457, pl. xxiv. fig. 3.

=*eques*, Pfeiffer, Malak. Blatt. 1857, vol. iv. p. 158.

Loc. Tavoy, Burmah.

In *typical* specimens the more globose form, the darker colour on parietal wall, and the more expanded lip separate this from *leucoxantha*; but some specimens show this variety to be closely connected with it. *B. eques*, Pf., is a decorticated specimen of *atricallosa.*

2. *A. cochinchinensis*, Pfeiffer, Proc. Zool. Soc. 1856, p. 331. (Pl. VI. fig. 6.)

A cylindrical elongated form of a uniform pale yellow colour. May possibly prove to be but a var. of *perversus.*

3. *A. inversus*, Müller, Hist. Verm. ii. p. 93. no. 290; Chem. ix. p. 93, pl. cx. figs. 925, 926.

=*jayanus*, Lea, Proc. Phil. Soc. Philad. 1841, ii. p. 31.
=*contusus*, Reeve, Con. Icon., Bul. fig. 220.
=*elongatus*, Homb. et Jacq. Voy. au Pôle Sud, 1854, pl. viii. figs. 3, 4.
=*annamiticus*, Crosse et Fischer, Journ. de Conch. 1863, p. 357, and 1864, pl. xii. fig. 8.
=*andamanensis* (Mouss. MSS.), Pfeiffer, Novit. Conch. no. 707, pl. cxvi. figs. 7–10.

Loc. Singapore, Malacca, Siam, Sarawak, and Sirhassen Island.

Variable in size and also somewhat in form, but easily distinguished by its coloration. The *andamanensis* was described by Pfeiffer from three small specimens from Mousson's collection bearing a label with the locality *Andaman Islands*; but this species has never been found there: the small form has been found at Sarawak and Sirhassen Island by Mr. Everett; it is generally of a darker colour than the larger forms, three specimens in the Geneva Museum being almost black.

Dr. Möllendorff's *annamiticus*, var. *roseotincta*, is without the usual dark brown fillet at apical whorls, the apex being uniformly rose-coloured. I find, however, that this slight character is not constant.

4. *A. alticola* (Boettger, MSS.), Fulton. (Pl. VI. figs. 5, 5 *a*.)

Loc. Java.

Dextral and sinistral, thin, obliquely striated, uniform yellow, shining, impressed with a thread-like white fillet at the suture; umbilicus almost or completely covered; lip white, somewhat reflected; columella either erect, arcuate, or somewhat distorted; whorls 6, slightly convex, last whorl equal to two thirds of whole length of shell.

Long. 37 millim., maj. diam. 20 millim.

Easily separated from all other known species of this group by its small size, narrow form, and thin substance.

Group of A. janus.

5. *A. janus*, Pfeiffer, Proc. Zool. Soc. 1852; Chem. ed. ii. pl. xlviii. figs. 1–4.

Loc. —— ? (*not* New Hebrides).

In Mousson's collection I saw two specimens quite agreeing with *janus*, except that the characteristic spiral bands were absent, the specimens being of a uniform yellow colour, with a narrow white band at the suture.

6. *A. enganoensis*, Fulton. (Pl. VI. fig. 11.)

Loc. Engano Island, W. Sumatra (*Dr. G. Modigliani*).

Shell sinistral, oblong-ovate, perforate, solid, shining, obliquely striate; ground-colour either yellow or rich brown, sometimes in the latter case with two or three darker brown spiral bands; whorls 7, convex, *suture strongly impressed with a spiral narrow white band; lip and columella broadly expanded* and slightly reflected, margins joined by a thin transparent callus, columella more or less deflected at point of insertion.

Long. 49 millim., maj. diam. 28 millim. (brown specimen n my own collection).

Long. 49 millim., maj. diam. 27 millim. (yellow specimen in my own collection).

Long. 49 millim., maj. diam. 27 millim. (banded specimen in Col. Beddome's collection).

This species is in form like a large *janus*, but easily distinguished by its broadly expanded lip and columella, its different coloration, and the absence of the dark colour on parietal wall.

7. *A. Martensi*, Boettger, Nach. malak. zool. Gesell. 1894, p. 66. (Pl. VII. fig. 10.)

Loc. Kina Balu, N. Borneo (*Everett*).

A distinct and handsome species, occurring both dextral and sinistral.

8. *A. mundus*, Zeit. für Malak. 1853, p. 57; Chem. ed. ii. pl. lxx. figs. 21, 22.

This may possibly be but a variety of *perversus*, but all the specimens I have seen appear to be different in form as well as in colour. There are two very large specimens in the British Museum, similar in size and form of aperture to typical *atricallosus*, but in other respects like *mundus*.

Group of A. comes.

9. *A. polymorphus*, Tapparone Canefri, Malac. de viaggo del Magenta, 1894, p. 82, pl. ii. figs. 4 *a* and *b*.

Loc. Cochin China.

In most collections this appears as a variety of *perversus*; but it is quite as worthy of specific rank as *inversus* and

Dohrni, its nearest allied form being rather *comes* than *perversus.*

10. *A. Dohrni*, Pfeiffer, Proc. Zool. Soc. 1863, p. 525; Novit. Conch. pl. lxxv. figs. 12, 13.

=*interruptus*, var. *infraviridis*, Martens, Ost-Asien, pl. xx. figs. 2, 5, and 8.

Loc. Cochin China.

This partakes of the characters of both *comes* and *perversus*, but is easily separated by the coloration of the last whorl and by the smaller aperture.

11. *A. comes*, Pfeiffer, Proc. Zool. Soc. 1861, p. 193; Novit. Conch. pl. lxxv. figs. 10, 11.

Loc. Annam, Cochin China.

This varies in form and coloration, and approaches very near to *polymorphus*, but can be separated by the *white tract behind lip and the greyish-brown bands below and encircling the suture of upper whorls.*

Group of A. javanicus.

12. *A. palaceus* (von d. Busch, MSS.), Mousson, Moll. Java, 1849, p. 28, pl. iii. fig. 1.

Loc. Java.

Chiefly distinguished from *perversus* by its *coarse oblique striation.*

A. palaceus, var. *subaurantia*, Martens, Ost-Asien, p. 352; Chem. ed. ii. pl. xl. figs. 7, 8.

Loc. Java.

Like typical *palaceus*, but with a dark reddish-brown band encircling the last whorl at the periphery. Martens gave this name to a specimen with a pale salmon-pink ground-colour, but sometimes it is pale yellow.

A. palaceus, var. *appressa* (Mouss. MSS.), Pfeiffer, Novit. Conch. no. 706, pl. cxvi. figs. 4, 5.

Loc. Java.

The type is a more elongated form than typical *palaceus*, of more solid growth, lighter colour, and has a smaller aperture; but with the series before me (the pick of a very large number of specimens) I am unable to separate this from *palaceus.*

A. palaceus, var. *pura*, Mousson, Moll. Java, 1849, p. 29, pl. iii. fig. 2.

Loc. Java.

A white solid form with strong rugose striation. The type specimen is the only one I have seen of this variety.

13. *A. Teynsmanni* (Mouss. MSS.), Pfeiffer, Novit. Conch. no. 704, pl. cxvii. figs. 2, 3.

Loc. Moluccas?

A very globose form of a very thin substance, allied to *palaceus*, but, judging from the type specimens (all I have seen of this species), distinct.

14. *A. Heerianus* (Mouss. MSS.), Pfeiffer, Novit. Conch. pl. cxvi. fig. 1.

= *Winteri*, var., Martens, Ost-Asien, pl. xx. fig. 10.

Loc. Java.

The colour of this species varies from yellow with only two or three reddish-brown stripes to specimens that are almost covered with variegated green and red-brown oblique markings. The spiral lines, as seen in the type specimen, are in most specimens not so distinct, but traces of them can be found in nearly all. This species has been distributed under the manuscript names of *Prillwitzi* and *pœcilus*, both of Boettger.

15. *A. robustus*, Fulton.

= *Winteri*, var., Martens, Ost-Asien, p. 353, pl. xx. fig. 4.

Loc. Java.

Shell sinistral, ovate-conic, solid, obliquely striate, almost imperforate, white, with two brown spiral bands commencing at third whorl, above and below the suture, and continued to last whorl, which has in addition one, and sometimes two, other bands on its lower half; whorls 7, convex; lip and columella white, expanded, margins joined by a white callus.

Long. 50 millim., maj. diam. 31 millim.

16. *A. javanicus*, Sowerby, Conch. Illus. 1841, Bul. pl. xxxi. fig. 35.

= *loricatus*, Pfeiffer, Proc. Zool. Soc. 1854, p. 372.

Loc. Java.

This species varies greatly in size, but is easily distinguished from its allies by its coloration.

Group of A. Winteri.

17. *A. Winteri*, Pfeiffer, Zeit. für Malak. 1849, p. 135; Chem. ed. ii. no. 177, pl. xl. figs. 3, 4.

Loc. Java.

Varies greatly in colour and degree of rugoseness; colour dirty white to reddish brown, rarely with a spiral band on last whorl. Varieties of this species have been distributed under the manuscript names of *semirugosa*, *præclara*, &c., all of Boettger.

A. Winteri, var. *inauris* (Bttg. MSS.), Fulton. (Pl. VI. figs. 12, 12 *a*.)

Loc. Java.

Like *Winteri* this variety varies in colour, but is generally somewhat less rugose; *lip broadly expanded* (especially at lower part) and reflected.

18. *A. Beccarii*, Tapparone Canefri, Annal. Mus. Civ. di Genova, 1883, vol. xx. p. 170, pl. i. figs. 10, 11.

Loc. Celebes.

Somewhat like *Winteri*, but smaller, of a narrower form, and the upper whorls are much smoother.

Group of A. maculiferus.

19. *A. maculiferus*, Sowb. & Brod. Conch. Illust. 1841, Bul. pl. cxlv. fig. 100; Proc. Zool. Soc. 1841, p. 14; Chem. ed. ii. 1846, Bul. no. 151, pl. xxxvi. figs. 1, 2.

Loc. Cottobato.

A. maculiferus, var. *multicolor*, Möllff. Bericht d. Senck. nat. Ges. 1893, p. 99.

Loc. Leyte Island.

A very pretty and distinct variety, of more slender form than typical *maculiferus*, and, instead of being ornamented with spots, is almost covered with oblique purple-brown stripes; *interior of aperture dark-coloured.*

A. maculiferus, var. *gracilior*, Pfeiffer, Hel. vol. iii. p. 319; Chem. ed. ii. pl. xl. fig. 9.

=*nigrofilosus*, Rochebrune, Bul. Soc. Philom. 1882, p. 72.

Loc. Mindanao Island.

White, with oblique semitransparent pale horn-coloured *stripes.* Apical whorls generally filleted as in *strigata* and *multicolor.* The type of *nigrofilosus*, which undoubtedly is identical with Pfeiffer's var. *gracilior*, is said to have been collected by Dr. Harmand on the "Montagnes de Chaudre," Cambodia; but I do not think it probable that this shell was found there.

A. maculiferus, var. *strigata* (Möllff. MSS.).

Loc. Mindanao Island.

Like *gracilior*, except that the ground-colour is light reddish brown, with oblique stripes of the same colour, only darker. I do not feel sure that this and the next variety are always separable.

A. maculiferus, var. *obscura*, Fulton.

=*dextrorsus*, Pf. Hel. vol. iii. p. 319.

Loc. Mindanao Island.

In form like typical *maculiferus*, but of a dirty white colour, obliquely striped and sparsely spotted with faint reddish brown. Apical whorls filleted as in *strigata*. As this occurs both dextral and sinistral, Pfeiffer's name cannot be used. It is remarkable that this is the only form of *maculiferus* of which *dextral* specimens have been found.

A. maculiferus, var. *inflata*, Fulton.

=*maculiferus*, var. γ, Hidalgo, Journ. de Con. 1888, pl. vi. fig. 1.

Loc. Baranda, Philippine Islands.

A large inflated form of a lemon-colour, with a narrow white band at the suture of lower whorls; first $2\frac{1}{2}$ whorls with a dark fillet at the suture.

Long. 66 millim., maj. diam. 38 millim.

20. *A. Roeseleri*, Möllendorff, Nach. mal. Blatt. 1894, p. 211.

=*maculiferus*, var., Smith, Ann. & Mag. Nat. Hist. 1894, vol. xiii. pl. iv. figs. 8, 8 *a*.

Loc. Bilatan Island (*Everett*), Sulu Islands (*Roeseler*).

Smaller than *maculiferus*; of a uniform cream-colour, with a very narrow golden band at suture of lower whorls, very closely and (under the lens) distinctly spirally striated.

Group of A. lævus.

21. *A. lævus*, Müller, Hist. Verm. ii. p. 95, no. 293; Chem. vol. ix. p. 103, pl. iii. figs. 940–948.

=*contrarius*, var. *subconcolor*, Martens, Ost-Asien, p. 368, pl. xxi. fig. 9.
=*Kobelti*, Rolle, Nach. mal. Gesell. 1893, p. 34.

Loc. Moluccas.

The *Kobelti* of Rolle is a pale yellow specimen without the dark purple-brown bands. Martens's *subconcolor* is near *Kobelti*, but narrower, and with two very faint yellow bands encircling last whorl, which are not shown in the figure. This species varies very much in its colour-banding; but even in the very pale varieties, where the dark-coloured bands are wanting, one can trace the characteristic *pale orange-yellow bands that encircle the whorls.*

22. *A. sinistralis*, Reeve, Con. Icon. 1849, fig. 603.

Loc. Celebes; Moluccas.

This species and its varieties may be always distinguished by the *characteristic dark spots upon the whorls*; in the light-coloured varieties the spots are semitransparent when held before the light.

A. sinistralis, var. *rosea*, Martens, Ost-Asien, p. 357, pl. xxi. fig. 2 *c*.

The same form as *sinistralis*, but of a pale rose-colour and without the dark colour inside aperture.

A. sinistralis, var. *lutea*, Martens, Ost-Asien, 1867, p. 356, pl. xxi. fig. 2 *b*.

=*sinistralis*, var. *decolor*, Tapp. Canefri, Ann. Mus. Civ. di Genova, 1884, vol. xx. p. 147.

Loc. Moluccas.

A fawn-coloured variety with white interior.

23. *A. furcillatus*, Mousson, Moll. Java, 1849, p. 32, pl. iii. fig. 3.

=*elegans*, Mouss. Moll. Java, p. 32.
=*lævus*, Reeve (pars), Con. Icon., Bul. fig. 216 *a*.
=*furcillatus*, var. *virescens*, Martens, Ost-Asien, p. 358, pl. xxi. fig. 3.

Loc. Java.

The type specimen is in rather poor condition; when fresh this species is ornamented on the last one and a half whorls with close-set oblique bright green stripes, sometimes so dark as to hide the characteristic forked markings. Martens's *virescens* is simply *furcillatus* in good condition. The narrow sutural band is yellow in most specimens, but sometimes of a pink colour.

A. furcillatus, var. *andamanica* (Thorpe, MSS.), Hanley and Theobald, Con. Ind. 1876, pl. cxlviii. fig. 10.

=*andamanicus*, var. *nicobarica*, Godwin-Austen, P. Z. S. 1895, p. 450.

Loc. Andaman Islands; Katchall, Nicobar Islands.

Near *furcillatus,* but the markings on the last whorl are *not forked,* and the narrow sutural band is reddish brown, not yellow, as in most specimens of *furcillatus.* The var. *nicobarica,* Godw.-Austen, is founded upon a light-coloured specimen; but specimens of *andamanicus* vary from very light to quite a dark colour.

Group of A. contrarius.

24. *A. pœcilochroa* (Boettger, MSS.), Fulton. (Pl. VI. fig. 7.)

Loc. Sumbawa Island.

Shell sinistral, ovate-conic, thin, obliquely striate, shining, almost or quite imperforate, lemon-colour, with oblique dark brown stripes, which are interrupted by a spiral yellow band; lower part of last whorl encircled by three dark brown bands, which are separated by two other bands, the lower broad and light red, the upper narrow and of a yellow colour; whorls 6, slightly convex; columella thin, straight; lip slightly expanded, flesh-coloured.

Long. 35 millim., maj. diam. 19 millim.

At first I thought this to be the typical *contrarius* as figured in Chemnitz, which figure (except for its thin columella) it very much resembles. After sending specimens to Copenhagen for comparison with Müller's type, I find that the generally accepted form of *contrarius* is the true one, a good figure of which appears in the 'Voy. au Pôle Sud' by Homb. & Jacq. pl. viii. fig. 1, and that *pœcilochroa* is distinct from that species.

25. *A. contrarius,* Müller, Hist. Verm. ii. p. 95. no. 292.

=*H. interrupta-sinistrorsa*, Chem. vol. ix. figs. 938, 939.
=*interruptus,* Homb. et Jacq. Voy. au Pôle Sud, pl. viii. fig. 1.

Loc. Timor Island.

This species varies greatly in form, but can be distinguished by its depressed sutural area, its coloration, and by the coarse striation at umbilical area.

A. contrarius, var. *maculata*, Fulton. (Pl. VII. fig. 4.)

Loc. Macassar.

A shorter shell than *contrarius*, somewhat thinner, and the whorls less convex; in *maculata* the interrupted markings are smaller and more distant from each other, and fade away on the last whorl, *the last half volution being quite plain* except for two basal bands; below and encircling the suture of upper whorls there is a *spiral band of equidistant small brown spots.*

A. contrarius, var. *multifasciata*, Fulton. (Pl. VII. fig. 5.)

Loc. Cambodia.

Like *maculata*, but more solid; the umbilicus almost covered, pale lemon-colour, with oblique brown stripes, *interrupted by three or four narrow yellow bands*; a narrow red band just below and encircling the suture.

26. *A. filozonatus* (Mouss. MSS.), Martens, Ost-Asien, p. 358, pl. xxi. fig. 4.

=*B. lævus*, var., Desh., Fér. Hist. pl. clxi. fig. 9.
=*contrarius*, var., Chem. ed. ii. pl. xli. figs. 5, 6.

Loc. Java.

Whorls less convex than contrarius; ground-colour either light or dark brown, with one or more narrow lighter-coloured bands encircling the whorls, sometimes with a reticulated band at the periphery, which is continued at the suture of upper whorls.

A. filozonatus, var. *jucunda*, Fulton. (Pl. VII. fig. 8.)

Loc. Macassar, Celebes.

Smaller than typical *filozonatus*, rather more solid; last whorl greyish brown, with a yellow band round lower part; upper whorls white, with oblique dark brown stripes interrupted by a narrow pale yellow band.

Alt. 28 millim., maj. diam. 14 millim.

27. *A. suspectus*, Martens, Monatsber. Berl. Akad. 1864, p. 526; Ost-Asien, p. 362, pl. xxi. fig. 8.

Loc. Timor.

Like *contrarius*, *having the sutural depression and coarse striation at umbilical area* characteristic of that species, but differs in coloration, being white above, with two dark brown and two pale yellow bands on the last whorl, the topmost yellow band being continued above; *lip and columella pink.*

A. suspectus, var. *albolabiata*, Fulton. (Pl. VI. fig. 9.)

Loc. Timor.

Differs from *suspectus* in being larger, in having *a white lip and columella*, and only two dark brown bands on last whorl, the upper being continued at the suture of the upper whorls.

28. *A. bataviæ*, Grateloup.

=*Partula bataviæ*, Grat. Actes Bordeaux, xi. p. 425, pl. ii. fig. 12.

Loc. Batavia, Java.

I do not know this species or where the type may be; but, judging from the description and poor figure, I should think it is allied to *filozonatus.*

29. *A. porcellanus*, Mousson, Moll. Java, 1849, p. 33, pl. iii. fig. 4.

Loc. Java.

A well-known and distinct species.

A. porcellanus, var. *xiengensis*, Morlet, Journ. de Con. 1891, pp. 27 and 240, pl. v. fig. 4.

Loc. Laos.

Like *porcellanus* in form, but thicker and generally larger. Coloration agrees with *porcellanus*, except that the oblique stripes are interrupted by two or three narrow spiral bands besides the central one.

30. *A. columellaris*, Möllendorff, Nach. mal. Gesell. 1892, p. 98, pl. i. fig. 9.

Loc. Sierah Island, Tenimber Islands.

A very beautiful species which varies considerably in coloration, but easily separated from its allies by its slender form and constricted aperture. I have some light-coloured specimens without the narrow red band at suture under the manuscript varietal name of *gloriosa*, Bttg.

Group of A. sylheticus.

31. *A. sylheticus*, Reeve, Con. Icon. 1849, Bul. fig. 564.

=*lepidus*, Gould, Proc. Bost. Soc. 1856, vol. vi. p. 12.

Loc. Sylhet Hills; Khasi and Garo Hills.

The types of both *sylheticus* and *lepidus* are in the British Museum, and I can see no difference sufficient to separate them.

32. *A. sinensis*, Benson, Ann. & Mag. Nat. Hist. 1851, vol. vii. p. 264; Chem. ed. ii., Bul. no. 66, pl. xx. figs. 1, 2.

Loc. S. China (*Benson*).

The ground-colour of the figure in Chemnitz is fawn; but according to the original description it should be yellow. The type does not appear to be in the Cambridge Museum, which contains Benson's collection, and I have not seen a specimen of this species; but, judging from the figure in Chemnitz (drawn from the type shell) and Benson's description, it differs from *vicaria* in being broader in form, having *a lilac-coloured lip*, with a dark-coloured stripe behind.

A. sinensis, var. *vicaria*, Fulton.

=*sinensis*, Forbes and Hanley, Con. Ind. pl. xxi. figs. 5, 6.

Loc. Pegu; Chittagong.

In most collections as *sinensis*, from which it differs in being not so broad in proportion to its length and in coloration. It is broader than *sylheticus*, and instead of being of an uniform green colour, it is yellow, with two (sometimes three) more or less distinct dark brown bands encircling lower part of last whorl. This variety varies a great deal in size and form. I give here the dimensions of two specimens out of a series in the British Museum.

Long. 33 millim., maj. diam. 17 millim.
" 21 " " 14 "

A. sinensis, var. *gracilis*, Fulton. (Pl. VI. fig. 10.)

Loc. Pegu.

A very narrow solid form; pale yellow, with two purple-brown bands at lower part of last whorl; the third and fourth whorls encircled with four rows of light brown spots; lip and columella thickened and expanded.

Type in British Museum.

33. *A. Roemeri*, Pfeiffer, Proc. Zool. Soc. 1862, p. 274, pl. xxxvi. fig. 4.

Loc. Cambodia.

Distinguished from *sinensis* by its fawn body-colour, shorter form, and its *distinct fine spiral striation.*

34. *A. Masoni*, Godwin-Austen, Journ. As. Soc. Beng. 1876, pt. 2, p. 316. (Pl. VI. fig. 2.)

=*daflaensis*, Nevill, Hand-list, 1878, p. 127.

Loc. Naga Hills.

A large and handsome species of the colour of *sylheticus*, but with a pink lip.

Group of A. flavus.

35. *A. Hosei*, Smith, Proc. Zool. Soc. 1895, p. 115, pl. iii. fig. 20.

Loc. Meri, Sarawak.

Near *flavus* in form, with a thin yellowish-green epidermis as in *sylheticus*, but easily distinguished from both by the single colour-band encircling the last whorl.

36. *A. flavus*, Pfeiffer, Proc. Zool. Soc. 1861, p. 194; Novit. Conch. no. 270, pl. xlvi. figs. 7, 8.

Loc. Siam.

Specimens of *Adamsi*, var. *inornata*, are often seen in collections under this name; but *flavus* is a more solid shell, with a *faint reddish band at lower part of last whorl.* The type specimens are all I have seen of this species.

A. flavus, var. *proxima*, Fulton. (Pl. VI. fig. 4.)

Loc. ——?

Differs from *flavus* in being more elongate, has *two* indistinct bands at basal part of last whorl, and has a spiral line of equidistant light brown spots just below suture of third and fourth whorls.

A single specimen in my own collection.

37. *A. zebrinus*, Pfeiffer, Proc. Zool. Soc. 1861, p. 194; Novit. Conch. pl. xlvii. figs. 9, 10.

Loc. Siam.

Of this distinct and pretty little species I have only seen the type specimen in the British Museum.

38. *A. areolatus*, Pfeiffer, Proc. Zool. Soc. 1861, p. 194; Novit. Conch. no. 272, pl. xlvi. figs. 11, 12.

Loc. Siam.

A thin shell somewhat like *porcellanus*, but with close forked markings on the upper whorls.

The type specimens are all I have seen.

Group of A. Adamsi.

39. *A. Adamsi*, Reeve, Moll. Voy. 'Samarang,' 1848, p. 58, pl. xv. fig. 1; Con. Icon., Bul. figs. 73 A, B.

Loc. E. Borneo.

This extremely variable species is chiefly characterized by its light substance and thin columella. The varieties appear to be tolerably distinct, so that I have ventured to name most of them.

A. Adamsi, var. *subunicolor*, Martens, Ost-Asien, p. 357. (Pl. V. fig. 5.)

=*Adamsi*, Rve. (pars), Con. Icon. figs. 73 C, D.

Loc. Banguey Island.

Yellow; lip, columella, and umbilical area pink; third and fourth whorls plain or ornamented with a reticulated band just above the suture.

A. Adamsi, var. *articulata*, Fulton. (Pl. V. fig. 7.)

Loc. Banguey Island.

Like *subunicolor*, but with a reticulated colour-band composed of square dark brown spots encircling the periphery and continued at the suture of upper whorls; ground-colour may be either yellow or reddish brown.

A. Adamsi, var. *duplocincta*, Fulton. (Pl. V. fig. 4.)

Loc. Banguey Island.

Ground-colour either yellow or reddish brown, with two purple-brown bands on last whorl, one above the pink umbilical area and the other at the periphery; lip and columella pink.

A. Adamsi, var. *luteofasciata*, Fulton. (Pl. V. figs. 2, 2 *a*.)

Loc. Banguey Island.

Ground-colour either bluish grey or white; last whorl encircled by three yellow bands situated above and below the periphery and just below the suture; the two upper bands are continued on upper whorls; sometimes there are some distant white spots or oblique white stripes at the periphery; lip, columella, and umbilical area pink.

A. Adamsi, var. *ornata*, Fulton. (Pl. V. fig. 14.)

Loc. Banguey Island.

Ground-colour either yellow or reddish brown, with a broad spiral band of short, oblique, equidistant dark brown stripes at the periphery, continued above at the suture; lip, columella, and umbilical area pink.

A. Adamsi, var. *rufocincta*, Fulton. (Pl. V. fig. 1.)

Loc. Borneo.

Ground-colour fawn or light brown, with three pink spiral bands—one immediately below the suture, and the other two above and below the periphery, the upper one being continued above.

A. Adamsi, var. *superba*, Fulton. (Pl. V. fig. 10.)

Loc. Banguey Island.

A most beautiful variety of a bluish-grey ground-colour, ornamented with three spiral colour-bands—a pink one just below the suture, one either yellow or pink at the centre of the whorls, and the third (a yellow one) at the lower part of last whorl; on the upper whorls are oblique stripes, which are interrupted by the spiral bands; lip, columella, and umbilical area pink.

A. Adamsi, var. *simplex*, Fulton. (Pl. V. fig. 12.)

Loc. Banguey Island.

Ground-colour lemon, which is sometimes suffused with orange; a pink spiral band below the suture; upper whorls either plain or with some brown spots above the suture of third and fourth whorls.

Long. 26 millim., maj. diam. 15.

A. Adamsi, var. *inornata*, Fulton. (Pl. V. fig. 6.)

Loc. N. Borneo.

Thin, pale lemon-colour, first three whorls semitransparent, and with some oblique and more or less indistinct brown stripes, *subangulate at the periphery*; suture slightly channelled; lip and columella white; umbilical area sometimes tinged with pink.

A. Adamsi, var. *aureocincta*, Fulton. (Pl. V. figs. 3, 3 *a*.)

Loc. N. Borneo.

Upper whorls dirty white, lower of a yellowish fawn-colour; *a narrow golden-yellow band just below and encircling the suture*; lip and columella white.

This variety varies greatly in size and form, as the following dimensions will show :—

Long. 41 millim.,	maj. diam.	16 millim.	
„ 36	„	„	18 „
„ 29	„	„	14 „

A. Adamsi, var. *rubiginosa*, Fulton.

= *lævus*, Fér. Hist. pl. clxi. figs. 11, 14, 15, and 18.

Loc. N. Borneo.

Last whorl rusty brown, fading to dirty white on upper whorls; lower half of last whorl is darker than the upper part, the difference being more or less sharply defined; sometimes ornamented with oblique brown-coloured stripes and a reddish-brown fillet at the suture; lip and columella white; at umbilical area is *a narrow zone of brown colour extending over the columella at point of insertion.*

40. *A. hamatus*, Fulton. (Pl. V. fig. 13.)

Loc. Labuan Island.

Shell sinistral, ovate-conic, almost imperforate, thin, obliquely striate; whorls 6 to $6\frac{1}{2}$, convex, somewhat depressed at the suture; colour either yellow or suffused with pink, with a light red-brown zone at the umbilical area and a band of the same colour just below the periphery; whorls ornamented with short hooked or zigzag markings; columella white, thin; lip white and slightly expanded.

Long. 27 millim., maj. diam. 13 millim.

41. *A. placidus*, Fulton. (Pl. V. fig. 11.)

Loc. East Borneo.

Shell sinistral, broadly conical, slightly perforate, thin, obliquely striate, somewhat angulate at the periphery; whorls 6, slightly convex, apex brown; apical whorls white, lower of a pale lemon-colour; columella straight, rather thin, slightly expanded, white at upper part; lip pale purple-brown, expanded and slightly reflected.

Long. 31 millim., maj. diam. 16 millim.

Type in British Museum.

42. *A. angulatus*, Fulton. (Pl. VI. fig. 3.)

Loc. Sarawak.

Shell sinistral, ovate-conic, thin, *more or less sharply angulate at the periphery*, obliquely striate, umbilicus almost covered; whorls $6\frac{1}{2}$ to 7, slightly convex; colour either fawn with oblique brown stripes on upper whorls or pale yellow with bluish-grey stripes, banded at lower part of last whorl;

columella white, straight, rather thin; lip somewhat expanded, white; interior of aperture dark brown.

Long. 37 millim., maj. diam. 20 millim.
" 35 " " 19 "

Chiefly distinguished by its dark coloration and angular periphery. I think it probable that *hamatus, placidus*, and *angulatus* are only varieties of *Adamsi*.

43. *A. pictus*, Fulton. (Pl. V. fig. 8.)

Loc. Kina Balu, North Borneo.

Shell sinistral, oblong-conic, almost imperforate, shining; whorls 7, convex, microscopically spirally striate, impressed at the suture; colour lemon, almost covered by oblique broad bluish-grey stripes, last whorl with two dark brown bands at the lower part; columellar area pink; columella straight, white, slightly expanded at point of insertion; lip white, expanded and reflected; interior of aperture of a purple-brown colour.

Long. 37 millim., maj. diam. 17 millim.

A. pictus, var. *concinna*, Fulton. (Pl. V. fig. 9.)

=*Adamsi*, var., Martens, Ost-Asien, p. 357, pl. xxi. fig. 5 A.

Loc. Kina Balu, N. Borneo.

Colour bluish grey, with a dark green zone encircling lower half of the upper whorls, interrupted by equidistant, short, oblique stripes; this interrupted band is continued on last whorl at the periphery; lip and columella pink. Compared with *pictus* the whorls are *more convex*, the aperture smaller; the basal bands are sometimes absent in this variety.

44. *A. Lindstedti*, Pfeiffer, Proc. Zool. Soc. 1856, p. 358. (Pl. V. figs. 15, 15 *a*.)

Loc. Malacca (*Lindstedt*), Balabac Island (*Everett*).

The type specimen of this species is in a bleached state; when in good condition it is yellow at lower whorls, fading to white above; sometimes the lower whorls are ornamented with oblique narrow pale green stripes, with a narrow orange band at the suture.

45. *A. quadrasi*, Hidalgo, Journ. de Con. 1887, p. 36, pl. ii. fig. 2.

Loc. Balabac Island.

Separated from *Lindstedti* by its different coloration, its shorter aperture, and thinner columella, which is not deflected at the point of insertion as in that species.

Some specimens of *quadrasi* are yellow, with only a trace of the bright green colour found in typical specimens, others are pale green without the pink sutural band.

A. quadrasi, var. *solida*, Fulton. (Pl. V. fig. 16.)

Loc. Palawan.

Smaller and more solid than typical *quadrasi*, subangulate at the periphery: last whorl either white, reddish brown, or yellow, with *a broad white spiral band just below the suture*; upper whorls either plain white or with narrow, oblique, interrupted light brown stripes.

46. *A. versicolor*, Fulton.

=*quadrasi*, var., Smith (pars), Ann. & Mag. Nat. Hist. 1893, vol. xi. p. 351, pl. xviii. figs. 11 & 13.

Loc. Balabac Island.

Shell sinistral, either oblong or ovate-conic, imperforate; whorls $6\frac{1}{2}$ to 7, convex, obliquely striate; apex dark brown; upper whorls either plain white or ornamented with forked dark brown markings; last whorl either yellow or cream-colour, often with a very broad flame of bright green behind the aperture; columella somewhat curved, thickened and expanded at upper part, white or (rarely) pink; lip white, expanded and slightly reflected.

Long.	43	millim., maj. diam.	22	millim.
”	47	” ”	20	”
”	44	” ”	22	”
”	40	” ”	21	”
”	35	” ”	18	” .

An extremely variable species both in form and coloration; chiefly distinguished from *Lindstedti* and *quadrasi* by its broader form in proportion to its length, being less solid, and by its coloration.

47. *A. dubius*, Fulton. (Pl. VI. figs. 1, 1 *a*.)

Loc. Balabac Island.

Shell sinistral, ovate to oblong-conic, obliquely striate, subangulate at the periphery, imperforate; whorls 6, convex, first three semitransparent, lower whorls cream, with oblique bluish-grey stripes, which are more or less branched; a spiral yellow band at lower part of last whorl, last half-whorl either bluish grey or of a greenish tint; apex dark brown; columella thin, white, slightly expanded above; lip expanded and somewhat reflected, white; interior of aperture dark brown.

Long. $31\frac{1}{2}$ millim., maj. diam. 18 millim.
„ $32\frac{1}{2}$ „ „ 17 „

Near *angulatus* in form, but of a more solid substance, and in coloration of upper whorls similar to both *pictus* and *versicolor*, but distinguished from the two latter by its subangulate periphery.

48. *A. Everetti*, Fulton.

=*quadrasi*, var., Smith (pars), Ann. & Mag. Nat. Hist. 1893, vol. xi. p. 350, pl. xviii. fig. 12.

Loc. Palawan.

Shell sinistral, ovate-conic; umbilicus almost or quite covered, obliquely striate; whorls $6\frac{1}{2}$, slightly convex, upper yellow, with oblique, forked, dark brown stripes, last whorl either almost or quite covered with greyish brown; a yellow band below the periphery; a narrow spiral band, either red or yellow, at the suture; umbilical area pink; columella erect, pale pink at upper part, somewhat expanded; *lip dark brown*, expanded and reflected.

Long. 40 millim., maj. diam. 18 millim.
„ 36 „ „ 20 „
„ 33 „ „ 18 „

A. Everetti, var. *connectens*, Fulton. (Pl. V. fig. 17.)

Loc. N. Borneo.

Differs from *Everetti* in being larger and having no basal colour-bands; body-colour of a light yellowish brown.

Like *versicolor* in size and form, but distinguished from that species by its dark-coloured lip and its narrow reddish-brown sutural band.

Group of A. semitessellatus.

49. *A. semitessellatus*, Morlet, Journ. de Con. 1884, p. 386, pl. xi. fig. 2.

Loc. Laos.

Compared by Morlet with *cruentatus*, Morelet, but is nearer *Lindstedti*, Pf., but distinguished from both by its dark brown sutural band and the spiral rows of spots on the first three or four whorls.

Group of A. annæ.

50. *A. annæ*, Martens, Reise in Niederl. Ost-Ind. 1891, p. 240, pl. xiv. figs. 19–22.

Loc. Sayler Island, Flores Islands.

A beautifully coloured shell of very thin substance, quite distinct from any known species.

Group of A. sumatranus.

51. *A. sumatranus*, Martens, Monatsber. d. Berl. Akad. 1864, p. 526; Mart. Ost-Asien, p. 366, pl. xxi. fig. 6.

Loc. Sumatra.

An elegant and distinct species of a light greenish-yellow body-colour, ornamented at lower part of last whorl with four narrow bands, and a row of spots above at the periphery.

Group of A. Begini.

52. *A. Begini*, Morlet, Journ. de Con. 1886, p. 74; id. 1889, pl. vi. fig. 4.

Loc. Cambodia.

Easily separated from all other known species of this genus by its remarkable oblique strongly costate sculpture.

Group of A. Mouhoti.

53. *A. Mouhoti*, Pfeiffer, Proc. Zool. Soc. 1861, p. 194; Novit. Conch. no. 269, pl. xlvi. figs. 5, 6. (Pl. VII. fig. 11.)

Loc. Siam.

Prof. v. Martens, in his 'Ost-Asien Moll.,' classes this species as a variety of *Schomburgki*; but I am quite unable to see the connexion between these, to me, perfectly distinct species.

54. *A. Smithii*, Fulton. (Pl. VII. figs. 12, 12 *a*.)

Loc. Annam (*Eudel*).

Shell sinistral, oblong-conic, imperforate, rather thin, white; suture impressed and slightly crenulated, last one and a half whorls covered with close-set oblique green lines, which are crossed by fine spiral lines of a darker colour; a narrow dark green band at the suture of lower whorls fading to yellow above; whorls 7, slightly convex, third whorl with two spiral rows of light brown spots; columella straight, scarcely expanded above; lip narrowly expanded and reflected; lip and columella dark brown.

Long. 35 millim., maj. diam. 16 millim. (mature specimen).
„ 39 „ „ 17 „ (lip not expanded).

This species is described from two specimens in my collection: one is evidently full-grown, except that the lip is not expanded; this specimen has its green epidermis in fine condition. The other specimen is perfect in form, but rather worn, and only shows traces of the epidermis. It chiefly differs from *Mouhoti* in its dark brown lip and columella, its longer form, and in not being subangulate at the periphery. Named after Mr. Edgar A. Smith, of the British Museum.

55. *A. cruentatus,* Morelet, Sér. Conch. de Moll. 1875, pt. 4, p. 264, pl. xiii. fig. 5.

Loc. Cambodia.

Besides the type specimen I have seen only three others of this species; all are very much worn, but agree in having the broadly expanded lip and the characteristic deep purple colour on the lip, columella, and parietal wall.

56. *A. roseolabiatus*, Fulton. (Pl. VI. fig. 8.)

Loc. Siam.

Shell sinistral, ovate-conic, moderately umbilicated, rather solid; whorls $6\frac{1}{2}$, slightly convex; obsoletely angulated at the periphery; white above, lower whorls pale lemon, with oblique *close-set light green lines; spirally striated;* lip and columella pink, expanded, lip somewhat reflected; interior of aperture white.

Long. 36 millim., maj. diam. 21 millim.

This species is described from two specimens (young and adult); they were upon a tablet with the type of *Mouhoti,* from which they can be separated by the much broader form, the more distinct spiral striæ, and by the absence of markings on the upper whorls.

Group of A. latistrigatus.

57. *A. latistrigatus,* Schepmann, Notes from Leiden Museum, 1892, vol. xiv. p. 151. (Pl. VII. fig. 1.)

Loc. Soemba Island.

A beautiful and very distinct species.

58. *A. reflexilabris,* Schepmann, Notes from Leiden Museum, 1892, vol. xiv. p. 152. (Pl. VII. fig. 2.)

Loc. Timor Island.

A species with a remarkably thickened lip, the back of which reminds one of *Bulimus labeo*; it is also beautifully coloured, the last whorl being yellow with oblique green stripes as in *furcillatus*; the lip and columella pink.

Group of A. moniliferus.

59. *A. moniliferus*, Gould, Proc. Bost. Soc. 1846, vol. ii. p. 99. (Pl. VII. fig. 9.)

= *Theobaldianus*, Benson, Ann. & Mag. Nat. Hist. 1857, vol. xix. p. 329; Conch. Ind. pl. xix. fig. 10.

Loc. Tavoy, Burmah.

Authenticated specimens of *Theobaldianus* in the British Museum are identical with specimens of *moniliferus* received from Gould himself.

60. *A. glaucolarynx*, Dohrn, Proc. Zool. Soc. 1861, p. 207, pl. xxvi. fig. 7.

Loc. Siam.

Prof. von Martens, in his 'Ost-Asien Moll.' p. 80, makes this species a variety of *Schomburgki*; he also considers the type of *glaucolarynx* to be an abnormal form, and thereupon drops Dohrn's name altogether, naming the small form of *glaucolarynx* as *Schomburgki*, var. *fasciata*, Mart. Until more material has been examined I do not think one can say that the typical *glaucolarynx* is abnormal; the type is 48 millim. in length, and there is in the British Museum a specimen 45 millim. long, only 3 millim. less. The small form which Martens considers the normal form of *glaucolarynx* I think is better classed as a variety, *but not of Schomburgki, which I consider to be quite distinct from glaucolarynx.*

A. glaucolarynx, var. *fasciata*, Martens. (Pl. VII. fig. 3.)

= *Schomburgki*, var. *fasciata*, Mart. Ost-Asien, p. 80.
= *Perrieri*, Rochebrune, Bull. Soc. Philom. 1882, p. 71.

Loc. Siam.

Like typical *glaucolarynx*, but only about 35 millim. in length, and with a spiral cream-coloured band just below the periphery. I was unable to see the type of *Perrieri* myself, but Dr. Jousseaume, to whom I sent a specimen of the above for comparison, writes that he is unable to separate *Perrieri* from this variety.

Group of A. Schomburgki.

61. *A. Schomburgki*, Pfeiffer, Proc. Zool. Soc. 1860, p. 137, pl. li. fig. 9.

= *Crossei*, Pfeiffer, Journ. de Conch. 1862, p. 43, pl. v. fig. 1.

Loc. Siam.

A stout shell, with a well-developed and thickened lip; last two whorls almost covered with oblique bright green stripes; lip, columella, and callus of a purple colour.

Pfeiffer's *Crossei* is evidently a small and decorticated specimen of *Schomburgki.*

62. *A. cambojiensis*, Reeve, Ann. & Mag. Nat. Hist. 1860, vol. vi. p. 204. (Pl. VII. fig. 7.)

Loc. Cambodia.

A fine and distinct species, the largest known of the genus.

63. *A. costifer*, Smith, Proc. Mal. Soc. 1893, vol. i. p. 12. (Pl. VII. figs. 6, 6 *a.*)

Loc. Annam.

A distinct species, remarkable for having a very prominent varix on the last whorl.

Position doubtful.

64. *A. hemicyclus*, Rochebrune, Bull. Soc. Philom. 1882, p. 117.

Loc. Bangkok.

I was unable to see this species, but Dr. Jousseaume considers it as being near *A. lævus*, Müll., but distinct from that species. If the locality is correct, I think it will prove to be allied to *janus.*

Species in the Paetel Catalogue wrongly ascribed to the Genus Amphidromus.

A. cosmandanus, Crosse, is *Cochlostyle Cossmaniana*, Crosse.

A. Crichtoni, Brod., is *Bulimus Crichtoni*, Brod.

A. imbricatus, Gass., is *Bulimus* (?) *imbricatus*, Gass.

A. tenellum, Dall, is *Buccinum tenellum*, Dall.

Alphabetical List of the Species of Amphidromus.

[Species in small capitals, varieties in Roman type, synonyms in italics.]

EXPLANATION OF THE PLATES.

PLATE V.

Fig. 1. *Amphidromus Adamsi*, var. *rufocincta.*
Figs. 2, 2 *a.* —— ——, var. *luteofasciata.*
Figs. 3, 3 *a.* —— ——, var. *aureocincta.*
Fig. 4. —— ——, var. *duplocincta.*
Fig. 5. —— ——, var. *subunicolor.*
Fig. 6. —— ——, var. *inornata.*
Fig. 7. —— ——, var. *articulata.*
Fig. 8. —— *pictus.*
Fig. 9. —— ——, var. *concinna.*
Fig. 10. —— *Adamsi*, var. *superba.*
Fig. 11. —— *placidus.* B.M.
Fig. 12. —— *Adamsi*, var. *simplex.*
Fig. 13. —— *hamatus.*
Fig. 14. —— *Adamsi*, var. *ornata.* B.M.
Figs. 15, 15 *a.* —— *Lindstedti.* 15 *a.* B.M.
Fig. 16. —— *quadrasi*, var. *solida.*
Fig. 17. —— *Everetti*, var. *connectens.*

PLATE VI.

Figs. 1, 1 *a.* *Amphidromus dubius.*
Fig. 2. —— *Masoni.*
Fig. 3. —— *angulatus.* B.M.
Fig. 4. —— *flavus*, var. *proxima.*
Figs. 5, 5 *a.* —— *alticola.*
Fig. 6. —— *cochinchinensis.* B.M.
Fig. 7. —— *pœcilochroa.*
Fig. 8. —— *roseolabiatus.* B.M.
Fig. 9. —— *suspectus*, var. *albolabiata.*
Fig. 10. —— *sinensis*, var. *gracilis.* B.M.
Fig. 11. —— *enganoensis.*
Figs. 12, 12 *a.* —— *Winteri*, var. *inauris.*

PLATE VII.

Fig. 1. *Amphidromus latistrigatus.*
Fig. 2. —— *reflexilabris.*
Fig. 3. —— *glaucolarynx*, var. *fasciata.* B.M.
Fig. 4. —— *contrarius*, var. *maculata.* B.M
Fig. 5. —— ——, var. *multifasciata.* B.M.
Figs. 6, 6 *a.* —— *costifer.* B.M.
Fig. 7. —— *cambojiensis.* B.M.

Fig. 8. *Amphidromus filozonatus*, var. *jucunda*. B.M.
Fig. 9. —— *moniliferus*. B.M.
Fig. 10. —— *Martensi*. B.M.
Fig. 11. —— *Mouhoti*. B.M.
Figs. 12, 12 *a*. —— *Smithii*.

Note.—All the specimens on Plates V.–VII. marked B.M. are in the collection of the British Museum, the remainder are in my own collection.

XII.—*Description of a new Species of* Opisthostoma. By G. B. Sowerby, F.L.S., F.Z.S.

In the 'Annals & Magazine of Natural History,' October 1894, Mr. E. A. Smith gave a list of the Bornean species of this curious and interesting little genus of terrestrial Mollusca. Including four new species then described, the total number was fifteen, of which all but two have been discovered within the last five or six years. I have now a new species to add to the list, which I propose to call

Opisthostoma Linteræ.

Testa ovato-conica, elata, rufescens vel alba, anguste perforata; spira leviter convexa; anfractus 7, convexi, apicales læves, cæteri lamellis numerosis tenuissimis pellucidis undulatis in medio plus minusve productis instructi; anfractus ultimus versus aperturam valde contortus, retrorsus et solutus, lamellis antice productis, cristam basalem formans; apertura circularis; peristoma leviter reflexum, extus lamella tenuis, expansa, antice et postice producta marginata.

Alt. 4, diam. maj. 4, min. 2.

Hab. Sarawak.

This pretty species will best be recognized by a comparison with *O. pulchellum* of Godwin-Austen, to which in many respects it is similar. It is decidedly higher in the spire, the whorls are less distinctly angular, and the contorted whorl descends much more abruptly and deeply.

XIII.—*New Genera and Species of* Pyralidæ, Thyrididæ, *and* Epiplemidæ. By W. Warren, M.A., F.E.S.

[Continued from vol. xvi. p. 477.]

Macrospectrodes, gen. nov.

Fore wings elongate; costa straight till shortly before apex, which is prominent but blunt; hind margin decidedly oblique, faintly curved. Hind wings broad, with rounded hind margin. Antennæ of male simple, filiform; labial palpi short, broad, terminal joint very minute; maxillary palpi slender, filiform; tongue well developed; forehead somewhat prominent. Neuration: fore wings, cell half as long as wing; discocellular vertical, hardly concave; first median at four fifths, second just before, third from, the lower angle of cell; lower radial just beyond the angle; upper just below the top angle; fifth subcostal from the angle; third and fourth stalked from the angle; first and second free from the cell. Hind wings with cell not half as long as wing; discocellular concave, the lower arm more oblique. Costal and first subcostal long, stalked, second subcostal from upper angle of cell; radial and third median both from lower angle of cell, second just before the angle; first at three fourths; on the abdominal margin between it and the third internal vein is a long oval semitransparent space, the edges of which are thickened.

Type *Macrospectrodes subargentalis*, Snell. (*Botys*).

Genus Opsibotys, Warr.

Opsibotys profusalis, sp. n.

Wings reddish ochreous, suffused with greyish brick-red, and with the lines dull brick-red; costa deeper brick-red; first line at at one fourth, curved outwards, then vertical; a narrow lunular discal mark; exterior line at three fourths, running at first slightly obliquely outwards, then forming a wavy outward sinus approaching the hind margin, running in basewards along first median, and again vertically wavy beneath the discal mark to the inner margin; apex and hind margin paler, less suffused; fringes concolorous, with a row of very neat black dots along their base. Hind wings like fore wings, but with the costal region broadly whitish; the basal fringe-dots larger and longer. Head, thorax, and abdomen reddish ochreous, suffused with brick-red. Underside glossy, pale, the fore wings slightly reddish.

Expanse of wings 20 millim.

One male from the Khasias.

Nearest to *rubellalis*, Snell., and also allied to *affusalis*, Guen., and *diffusalis*, Guen.

Genus Glauconoë, Warr.

Glauconoë atrigenalis, sp. n.

Fore wings dull grey, dusted with fine darker grey atoms; first line quite near base, fuscous, wavy; second line at three fourths, fuscous, wavy, and dentate, running at first outwards for a short distance, then inwards again, then forming a rounded sinus on the medians, and reaching inner margin at two thirds; a curved black discal spot and a minute dark spot between it and first line; fringe concolorous; a series of fine short dark lines at the end of the veins. Hind wings with discal spot round, and exterior line like that of fore wings; costa whitish. Head, thorax, and abdomen dark grey; palpi dark brown-black. Underside dull white, with all the markings clearly defined as blackish spots.

Expanse of wings 36 millim.

One male from Cherra Punji.

Genus Paliga, Moore.

Paliga rubicundalis, sp. n.

Fore wings yellow, with rosy markings; these markings, consisting of two stigmata in the cell, a denticulated inner, exterior, and subterminal line, are much the same as in *damastesalis*, but as the spaces between them are varied with rosy dashes and all the veins are rosy, the aspect is much gayer than in that insect; the basal and dividing line of the fringes is also rosy; costa broadly dull brown. Hind wings yellower, with the fringe-lines and the submarginal space rosy, and a rosy curved central line, containing a diffuse rosy spot within the central sinus. Head, thorax, and abdomen yellow, tinged with rosy; face brown, like the costa of fore wings. Underside dull yellowish, with the costa and hind margin brownish grey, and a similar coloured central blotch.

Expanse of wings 24 millim.

Khasia Hills.

Distinguished at once from *damastesalis*, to which it is most nearly allied, by the rosy colouring. It is probably the insect referred to by Snellen (Tr. E. S. 1890, p. 575) as *damastesalis*.

Genus Udea, Moore.

Udea nigrostigmalis, sp. n.

Fore wings luteous, with an undertone of yellowish; interior line in the single example seen obsolete; exterior line denticulate, slender, blackish, from costa at two thirds to inner margin at two thirds, curved outwards to below the middle, starting from a black costal spot; two smaller costal black spots beyond it, the costal intervals yellowish; fringe leaden grey, with a row of black dots before their base; reniform mark filled up with black. Hind wings cinereous, with a very indistinct denticulated outer line, and the row of dots before the fringe as in fore wings. Head and thorax concolorous with fore wings; abdomen dark cinereous, with the segmental divisions paler. Underside of fore wings deep cinereous, of the hind wings dull straw-colour with the markings darker; costa of fore wings yellowish from middle to apex.

Expanse of wings 18 millim.

Several from the Khasia Hills.

Genus Eurycreon, Led.

Eurycreon? rubralis, sp. n.

Fore wings reddish brown, thickly scaled, with no markings but an indistinct exterior line, slightly denticulated, which rises on the costa at three fourths, from an oblique dark pale-edged streak; fringes very wide, red-brown, with a line of darker red dots at the base, those near the apex being edged with whitish. Hind wings whitish, becoming rather reddish towards apex and hind margin. Head, thorax, and abdomen concolorous. Underside glossy pale reddish ochreous.

Expanse of wings 12 millim.

One male from the Khasias.

The forehead is much produced below, forming a shelf which is in the same plane with the top of the much prolonged and stout palpi; the antennæ are thick, lamellate. Having only one example, and that somewhat damaged, I refrain from making a new genus for the species, as will probably have to be done later on.

Genus Pachyzancla, Meyr.

Pachyzancla honestalis, sp. n.

Fore wings pale fawn-colour, tinged with rufous; the costa broadly and the hind margin diffusely darker tinted; markings fuscous; an oblique basal line, a curved sinuous exterior line, and two cell-spots; hind margin, immediately before the pale basal line of fringes, darker. Hind wings paler, semidiaphanous, with dark discal spot and central line; a dark shade along the hind margin. Head and thorax concolorous with fore wings, abdomen with hind wings. Underside paler and duller, with the markings indistinct.

Expanse of wings 20–22 millim.

Khasia Hills.

Genus Hedylepta, Meyr.

Hedylepta confusalis, sp. n.

Wings dingy fuscous, with the lines indistinct, darker; basal line at one fourth, vertical, exterior line at three fourths, vertically wavy as far as the first median, along which it runs inwards, and reaches the inner margin at two thirds; discal spot lunular, more distinct; fringes concolorous, with a narrow pale basal line, before which the extreme hind margin is darker: hind wings the same, but slightly paler; the fringe whitish in apical half. Head, thorax, and abdomen all fuscous. Underside dull greyish fuscous.

Expanse of wings 34 millim.

Two males from Japan.

A very dull-looking and inconspicuous insect, with the markings as in *tristrialis*, Bremer, with which it agrees in size.

Hedylepta ochrifuscalis, sp. n.

Nearest to *præteritalis*, Wlk., and *misera*, Butler, but rather larger, and with a strong tinge of fulvous ochreous, thereby appearing much paler than either of the above-named species; this paler tint is especially marked along the costa, hind and inner margins of the fore wings, and on the thorax and abdomen; the hind wings remain greyer. Fringe of fore wings concolorous, with a thick dark line along their base and a narrower dark line before the base along the hind margin; fringe of hind wings dull whitish, with the same lines. Underside duller, with basal two thirds of both wings rather darker but diffusely edged.

Expanse of wings 32 millim.

Several from the Khasia Hills.

Idiusia, gen. nov.

Fore wings with costa convex at the extreme base and slightly so again towards apex, which is blunt and rounded; hind margin obliquely curved, with a slight bend in the middle; anal angle obtuse. Hind wings with both angles rounded; hind margin curved and slightly bulging in middle. Antennæ (♂) lamellate, the basal joint rather swollen; ocelli not visible; tongue present; labial palpi short, straight, stout, with smooth appressed scales, the terminal joint as broad as the second, bluntly conical, distinct; maxillary palpi slender, short; hind tibiæ with the inner spurs long, *the outer* *absent.* Neuration: fore wings, cell half as long as wing; discocellular angulated, first median at two thirds, second from lower angle; third and lower radial close together shortly above the angle; upper radial from the angle of the discocellular; fifth subcostal from upper angle of cell, third and fourth stalked from before the angle, second close to and parallel to their stem, the first opposite the first median. Hind wings: cell not half the length of wing; discocellular angulated, the lower arm prolonged, oblique; medians and lower radial as in fore wings. Scaling smooth and sparse, the wings semitransparent; the general structure weak and feeble.

Type *Idiusia benepictalis*, sp. n.

Idiusia benepictalis, sp. n.

Wings pale gilded yellow, with dark brown markings. Fore wings with the whole base brown, separated by a narrow yellowish fascia, not reaching the costa, from a broad bent fascia, brown like the base, which again is succeeded by a broad brown squarish blotch, not reaching below the median vein, excepting a small curved spur along the second median nervule, and with its edges all concave; between the two blotches is a small round yellow spot; exterior line thick, curved, wavy, forming a tridentate sinus over the three median nervules, followed immediately by a much broader submarginal fascia, which touches the exterior line below the costa, on the lower radial and on the first median nervule, runs into the apex, and throws off a narrow streak just below the apex and three more in the lower half of the hind margin, all four running through into the fringe, which otherwise is wholly yellow; costa from beyond the brown basal area broadly deep yellow. Hind wings with extreme base and largish discal spot brown; the two outer lines exactly as in fore wings. Thorax, face, and abdomen brown; collar and basal joint of antennæ yellowish; palpi brown, with yellow rings. Underside paler, with only the apical markings on either wing and the discal blotch of fore wings represented, the other markings of the upperside merely showing through.

Expanse of wings 28 millim.

Several males and females from the Khasia Hills.

The insect reminds one strongly of *Hyaloplaga pulchralis*, Moore, but the markings are all much thicker; the costa of the hind wings is not bulged, as in that species, and both the shape of the palpi and the neuration are different.

The female, which I have only recently become acquainted with, is larger than the male, with *pale* brown rather dull markings, and is thus a much less striking-looking insect than the male.

Genus Pachyarches, Led.

Pachyarches punctalis, sp. n.

Like *Pachyarches imitalis*, Guen., but different; for whereas *imitalis* has a dull diffuse grey discal spot, this species has a fine black one; and while *imitalis* has at most two or three small marginal spots below the apex of fore wings, this has a minute spot at the end of the veins of both wings throughout.

One female from Jamaica, 26 millim.

Genus Caprinia, Led.

Caprinia intermedia, sp. n.

Fore wings white, with purple-brown broad costal streak and hind marginal fascia; two lustrous metallic spots in the cell, surrounded by dark brown scales; an irregular line of brown scales from base below the median vein; exterior line indicated above the inner edge of the marginal fascia by three white dots, continuing the curve towards the costa; fringe dark brown. Hind wings white, with a large apical blotch and the round cell-spot dark brown; fringe dark towards the apex along the blotch, white below it. Thorax and abdomen white; face, collar, and anal segment of abdomen brown. Underside like upper, but the dark brown markings represented by dull leaden grey ones.

Expanse of wings 24 millim.

Four examples from the Khasias.

Genus Notarcha, Meyr.

Notarcha? nigriscriptalis, sp. n.

Fore wings dark fawn-colour, with distinct black markings; first line curved, near base, followed by a small black spot in cell and a black lunule on the discocellular; second line formed of interrupted roundish wedge-shaped marks from costa at three fourths, running parallel to hind margin throughout, but with the four middle teeth nearer than the rest of the line; fringe concolorous, with dark basal and dividing line. Hind wings less thickly scaled, with the same markings as in fore wings, but without basal line and first cell-spot. Head and thorax concolorous with fore wings, abdomen with hind wings, the latter with a black spot on each side of the basal segment above. Underside paler, with all the markings reproduced.

Expanse of wings 32 millim.

One male from Queensland.

Notarcha stigmatalis, sp. n.

Fore wings ochreous, suffused with fuscous grey, most strongly fuscous in the central area and there towards the costa; lines much as in *N. imbutalis* and allied species, fuscous; first at one fourth, wavy, second at three fourths, bluntly denticulate; the three teeth on the medians hardly projecting as a sinus, the line not running far inwards up the third median, but, after curving before getting under the discocellular, running obliquely and wavy inwards to the inner margin in the middle, and so approaching the first line; a small round spot in cell beyond first line and a large reniform spot on discocellular bright pale ochreous, edged with darker; fringe pale ochreous; the two lines are edged with ochreous, the first internally, the second externally, and the inner margin is more or less broadly ochreous. Hind wings greyer, with dark fuscous cell-spot and fuscous outer line and marginal shade. Head, thorax, and abdomen concolorous. Underside the same, but duller.

Expanse of wings 28 millim.

One female from the Khasias.

Notarcha? tenebrosalis, sp. n.

♀. Fore wings dark bronzy fuscous, with the stigmata and lines indicated only by slightly paler yellowish edgings; a large subquadrate brown spot at end of cell, preceded by a roundish flattened one; the space between and on either side slightly paler, yellowish; exterior line dentate, indicated by the whitish-yellow spaces at end of each tooth; fringe concolorous, with paler dots along the base. Hind wings with the whitish markings more clear; one clear whitish spot opposite the cell, and the rest of the exterior line clearly denticulate. Head, thorax, and abdomen all dark bronzy fuscous. Underside more bronzy, with all the white markings more distinct.

Expanse of wings 40 millim.

One female, Queensland.

The terminal joint of the palpi is longer and quite acute, unlike the usual palpi of *Notarcha*.

Notarcha? tenuis, sp. n.

Fore wings straw-colour, with dark brown markings; costa dull brown, blackish at base; a brown dot on inner margin close to base and a short brown streak towards it from the costal streak beyond; first line brown, sinuous, oblique outwards; in the cell is a small squarish brown spot, and at the end on the discocellular a larger one, hourglass-shaped; beneath the starting point of the first median is a small round brown spot; second line thick, brown, from costa at three fourths, slightly dentated, at first running nearly parallel to hind margin, forming a sinus outwards over the median nervules, strongly curved inwards to beneath discal blotch, and then vertically curved to inner margin; marginal area suffused with brownish grey, except just beyond the exterior line, which is paler; a small fuscous cloud between the discal blotch and the curve of the second line; inner margin broadly suffused with yellowish, and the veins also of the same colour; fringes fuscous straw-colour, with dark brown spots at the ends of the veins. Hind wings paler, with a large cell-spot, the second line and the apex dark brownish grey; fringes paler, with a dark shade along the hind margin at their base. Head, face, thorax, and abdomen dull yellow; abdomen with a brown spot on each side of the second segment above; palpi white and brown. Underside like upper, but duller.

Expanse of wings 34 millim.

One male from Queensland.

Notarcha triparalis, sp. n.

Fore wings dark bronzy fuscous, with the usual lines and markings darker but indistinct, and indicated by the pale whitish spots that follow them; these are placed exactly as in *Idiostrophe albipunctata* from Queensland, viz. a white spot in the cell between two dark stigmata and one below it under the median vein; the upper third of the outer line is followed by three white spots, the middle one decidedly the largest, the middle third by three smaller spots, and the lower third is only just indicated. In the hind wings all three parts of the outer line are followed by three partially confluent white spots. The fore wings are broader and their hind margin not so oblique as in *I. albipunctata*, from which the palpi and male antennæ will at once separate it.

Expanse of wings 36 millim.

Two males from the Khasias.

Genus Gadessa, Moore.

Gadessa? subalbalis, sp. n.

Fore wings dull brown, with an indistinct dark basal line and a curved sinuous exterior line blackish, from three fourths of costa to beyond middle of inner margin, at first straight and oblique, distinct, describing a small sinus across the median nervules, running in to nearly beneath the discocellular, and then turning at right angles to the inner margin; discal spot large, blackish; fringes darker brown, with a fine paler line along their base, preceded by a narrow dark marginal shade. Hind wings paler, especially towards costa and inner margin; discal spot indistinct, as is the curved central line; fringes and marginal shade darker. Head, thorax, and abdomen concolorous; anal segment with a dark ring, followed by a dull whitish one, the rest dull ferruginous. Underside dull whitish, with the markings indistinctly darker.

Expanse of wings 32 millim.

Two males from the Khasia Hills.

Distinguished by the elongated fore wings with very oblique hind margin, and by the whitish underside.

Gadessa characteristica, sp. n.

Fore wings pale straw-colour, suffused with yellowish and fuscous; the costa, base, and inner margin tinged with yellow; the hind margin fuscous, fading into yellow internally; a black spot at base of costa and a small rusty one near base of inner margin; first line at one fourth, blackish, oblique outwards, thicker near costa, followed closely by a small black dot in the cell; discal mark brown-black, 8-shaped; second line at three fourths, thick and black at the costa, running straight for the anal angle as far as the lower radial, then forming three symmetrical rounded teeth in a shallow sinus outwardly, curving in along the first median to nearly beneath the discocellular, then with an inward curve to inner margin in middle; fringe pale straw-colour, with a deep black basal line between two pale ones. Hind wings with the second line more angular, the sinus straight, without teeth, and the inner angle acute and touching the dark cell-spot. Head, thorax, and abdomen shining straw-colour; abdomen with a black spot at base of last segment. Underside duller.

Expanse of wings 24–26 millim.

Several from the Khasias.

ZEBRODES, gen. nov.

Fore wings elongate; costa straight, slightly convex before apex; apex distinct, rectangular; hind margin curved, more obliquely towards anal angle. Hind wings broad, with hind margin well rounded. Antennæ of male lamellate, rising at right angles from the basal joint. Labial palpi porrect, thickly haired beneath, hardly upcurved, the terminal joint pointed, but hardly separable from second; maxillary palpi very small and short; tongue well developed; ocelli distinct. Neuration: fore wings, cell barely half the length of wing; first median shortly before lower end of cell, second and third together from end, lower radial a little above, upper radial from just below, upper angle; last subcostal from the angle, second, third, and fourth stalked from before the angle, first subcostal free. Hind wings, first subcostal anastomosing with costal for half the distance from end of cell; medials as in fore wings. Wings with broad black stripes; abdomen and anal angle of hind wings orange.

Type *Zebrodes rigidalis*, Snell. (*Zebronia*).

Genus TYLOSTEGA, Meyr.

Tylostega valvata, sp. n.

Fore wings yellow-ochreous, almost wholly suffused with smoky and blackish fuscous, the costa, inner margin, and base of fringes alone remaining of the pale ground-colour; basal and marginal areas still darker than central; the patch of scales on the cell is edged with blackish, and the origin of the first line on the costa above the beginning of the patch is likewise blackish, but its lower course is lost in the dark suffusion; second line at two thirds, curved in its upper third, interrupted in middle, and vertical to two thirds of inner margin in its lower third; marginal dark space with a concise straight oblique edge internally, with a curved row of dark spots externally before the pale fringe-line. Hind wings straw-colour, with the base, discal spot, sinuous outer line, and marginal shade dark fuscous; the spots at apex before the pale fringe-line coalescing into a broadish line; fringes of both wings fuscous. Head, thorax, and palpi dark fuscous; abdomen straw-colour, tinged with fuscous; tongue and base of palpi yellowish. Underside of wings like upper, but duller; the curl of scales in the cell glossy, leaden grey.

Expanse of wings 24 millim.

Several males from the Khasias.

Genus Synclera, Led.

Synclera fenestralis, sp. n.

Fore wings pale yellowish, with dark reddish-brown markings; a short line close to base, and a curved wavy one beyond, followed by a fine nearly vertical line; central space red-brown along costa, extending more narrowly into the disk to below the middle, with three irregularly shaped large hyaline blotches—the first on the inner edge, bounded inwardly by a fine brown line, the other two on the outer edge, one above the other, each finely brown-edged; a wavy brown line follows the central area, running parallel to hind margin and curving beneath the lower of the two hyaline blotches to inner margin at two thirds; a fourth hyaline blotch on the costa before apex, from the outside of which another fine brown line runs parallel to the last; marginal area in its apical half filled up with red-brown; a red-brown broad basal line to fringes, which are brown and white. Hind wings with a red-brown, broad, bent, central mark; two indistinct curved submarginal lines, of which the first is angulated and joins the central mark; apex brown; fringe and basal line as in fore wings. Head, thorax, and abdomen yellowish, mixed with dull brown. Underside of fore wings brownish, with the three central hyaline blotches well marked. Hind wings yellowish, with the markings brown, as on the upperside.

Expanse of wings 21 millim.

One male from the Khasias.

Chrysommatodes, gen. nov.

Fore wings elongate; costa straight, slightly convex towards apex, which is blunt; hind margin oblique, hardly curved, except just before anal angle. Hind wings narrow; both angles rounded; hind margin faintly curved. Forehead slightly prominent; antennæ (♂) thick, pubescent, the basal joint enlarged, swollen, with a hood-like crest of scales behind; thorax bluntly tufted behind; ocelli present; maxillary palpi small, filiform; labial palpi porrect, curved above, produced beyond face, but not rostriform; tongue present. Neuration normal; the first median in both wings at about four fifths. Scaling smooth and glossy.

Type *Chrysommatodes æreoflavalis*, sp. n.

Chrysommatodes æreoflavalis, sp. n.

Wings bright gilded yellow; costa of fore wings diffusely brownish, underlined with reddish brown; a reddish spot on inner margin near base; faint traces of a rusty brown inner line and wavy exterior line at five sixths; a small brown subcostal spot in middle of cell; two snow-white spots on the angles of the cell, the upper the larger, edged with brown, and lying in a small brown blotch; fringe and nervures towards hind margin faintly tinged with brown. Hind wings with discal spot and sinuous indistinct central line ferruginous; fringe and hind margin much tinged with brown; face yellow, with a narrow reddish bar at base; shoulders with a reddish line at sides; collar, patagia, thorax, and abdomen all gilded yellow; thorax with a red-brown central spot and the crest red-tinted; second segment of abdomen with two largish reddish spots; anal tuft reddish brown; palpi dark brown, the basal joint white. Underside paler yellow, with very faint markings.

Expanse of wings 24 millim.

One male, Queensland.

[To be continued.]

MISCELLANEOUS.

Contributions to the Embryogeny of Simple Ascidians. By Antoine Pizon.

Several points in the development of the Simple Ascidians are still disputed or unknown, especially the origin of the peribranchial cavity, the relations of the sensory vesicle to the neighbouring parts, and the existence of an *epicardium* analogous to that which is found in the Compound Ascidians. The species which I have had at my disposal for the purpose of studying these different points are *Cynthia morus* and *Ascidia villosa*, Giard.

The earliest phenomena of segmentation are dissimilar in these two species, and this is due to the fact that *Cynthia morus* possesses an enormous quantity of food-yolk, of which we still find a considerable portion in the larva at the moment of hatching.

I.—After the formation of the cavity of the archenteron in *Ascidia villosa*, its walls send out two lateral extroflexions which grow pretty rapidly, while each of them speedily attaches itself to the ectoderm. The latter layer on its part becomes slightly invaginated at the two points of contact and then perforated; the larva henceforth exhibits two new apertures, which are added to that of the stomodæum, and the existence of which was first demonstrated by Krohn and Kovalewsky. The enteric cavity is gradually enveloped by the dilatation of its two diverticula, which become the peribranchial cavity. The two lateral apertures are thrust more and more into the median line on the dorsal side in consequence of the development of the larva; finally they unite and form but a single orifice, which will be the cloacal aperture of the adult.

II.—The heart in *Ascidia villosa* and *Cynthia morus* is formed, as in the Compound Ascidians, by a diverticulum of the enteric cavity, which becomes isolated at an early period when the peribranchial sacs are in process of development. This diverticulum becomes a little closed sac, a certain portion of the wall of which is forthwith invaginated, thus producing a double cavity: the inner one is the *cardiac cavity*, which communicates by the cleft of invagination with the hæmal spaces; the outer chamber is the *pericardium*, which is completely closed and does not contain a drop of blood; it represents a portion of the archenteron.

III.—All along the cardiac cleft, and applied to it in the manner of an obturator, is seen another sac with very delicate epithelial walls. At the time of the appearance of the first branchial clefts in *Ascidia villosa*, this sac still has a wide opening into the enteric cavity from which it is derived, while its other extremity gradually elongates and moulds itself round the alimentary tract after the fashion of a mesentery.

In its origin, disposition, and relations to the heart this sac is absolutely identical with the *epicardium*, which hitherto was known only in the Compound Ascidians.

In *Cynthia morus* the epicardium appears as two great prolongations of the peribranchial sacs, and thus recalls with great exactness the arrangement which I have described in the Botryllidæ.

The mode of formation of this aperture is precisely as described long ago by Krohn and Kovalewsky and since observed by all ascidiologists; but the point on which I desire to insist is *the endodermal origin of the peribranchial cavity*. I therefore do not share the view of Metschnikoff and Kovalewsky, who have maintained that this cavity is due to *two ectodermal invaginations*, which gradually surround the cavity of the enteron. These two learned naturalists, whose endeavours to study the transparent embryo were evidently impeded by the egg-membranes, were unable to make out precisely the earliest processes, and observed only the stage in which the ectoderm is seen already invaginated. The examination of larvæ of all ages, still enclosed in the peribranchial cavity and cut into thin sections, is the only method that enables us to decide the question with accuracy.

It is important to determine the origin of the peribranchial cavity in Simple Ascidians, on account of the conclusions with regard to blastogenesis in the Botryllidæ which have been quite recently deduced therefrom by a Norwegian ascidiologist named Hjort *. We know that in Compound Ascidians the branchio-intestinal cavity of each bud is produced by the proliferation of the outer peribranchial wall of the parent ascidiozoid, *which is of endodermal origin* in the larva as well as in the bud, as was shown by me in a former paper †. Hjort, without making a study of the Botryllid larva, has applied to it, with regard to the origin of the

* 'Anatomischer Anzeiger,' Band x. no. 7.
† 'Annales des Sciences naturelles,' 1892.

peribranchial sacs, the results obtained by Metschnikoff and Kovalewsky in the case of Simple Ascidians, and has consequently arrived at the conclusion that *the branchio-intestinal cavity is of endodermal origin* in the larvæ of Compound Ascidians, *while it is a formation of the ectoderm* in their buds.

In this particular case, therefore, I am unable to share Hjort's opinion; the larvæ of *Amaroncium Nordmanni* and *Fragarium elegans* * had already led me to the same results as the Botryllidæ and Simple Ascidians, as to the endodermal origin of the peribranchial cavity; and herein I am in accord with Della Valle †, who studied *Ascidia mentula.*

But if the epicardium is a formation of general occurrence in Tunicates, it does not possess the property of blastogenesis in all of them. This property is non-existent in the Simple Ascidians, in which the epicardium surrounds the alimentary canal and simply plays the part of peritoneum. In the Botryllidæ the epicardium exhibits the same arrangement as in the Simple Ascidians, but *the peribranchial wall*, which, after all, is nothing but the foremost portion of the epicardiac sacs, possesses the property of budding. Finally, in the Polyclinidæ (*Amaroncium*, *Circinalium*, &c.), in *Clavellina* and *Perophora* we know that the epicardium is extended to the tip of the stolon or of the peduncle when it exists, and this it is that, by dividing or proliferating in different ways according to the particular group, gives rise to the enteric cavity of the new buds.

IV.—I have traced, in series of thin sections, the development of the nervous system of the larva as well as of the fixed Ascidian, and have succeeded in elucidating various points with reference to the sensory vesicle, as to which Kuppfer and Kovalewsky were unable to agree.

The sensory vesicle never opens on the surface of the ectoderm, as it was stated to do by Kovalewsky; but at a very early period it is brought into connexion with the anterior portion of the future branchial sac by means of a very short tube, which still exists, at the moment of fixation, in order to give rise to the *vibratile organ.* This communication between the nervous vesicle and the branchial sac is of variable duration in the different species; it no longer exists in *Ascidia villosa* at the time of hatching, any more than in the larvæ of *Amaroncium* and *Fragarium*; while in *Cynthia morus* the communication is still very wide on the second day after hatching.

The nervous system of the adult is produced by that of the larva before it commences to degenerate, and by means of a process which recalls that which I have already described in the case of *Fragarium elegans* and *Amaroncium Nordmanni* ‡.—*Comptes Rendus*, t. cxxi. no. 5 (July 29, 1895), pp. 270–273.

* 'Comptes Rendus,' February 25, 1895.
† 'Archives italiennes de Biologie,' t. ii. 1882.
‡ 'Comptes Rendus,' February 25, 1895.

On a new Lamellibranch (Scioberetia australis) *commensal with an Echinoderm.* By Félix Bernard.

In studying the collection of Echinoderms made by the Cape-Horn Expedition in the years 1882–1883 I have had occasion to examine several specimens of a Spatangid, *Tripylus excavatus*, Phil., and I discovered that this sea-urchin is viviparous. But, while the majority of individuals carry young in process of development in the depressed ambulacral zones, in two specimens the young were absent and were replaced by a Lamellibranch, the maximum size of which does not exceed 3 millimetres. I have been able to study this animal by the dissection of three examples, and by means of sections in the case of a fourth: the state of preservation of the specimens is highly satisfactory.

The shell is entirely contained in the thickness of the *mantle*; it does not cover half the breadth of the animal. The mantle, on the contrary, envelops it completely. It is prolonged in front by a groove, which recalls the siphon of Gastropods; it is united together in the median line behind, and leaves only a posterior orifice, in the centre of a circular area. The *shell*, which is very thin, equivalve, and posteriorly truncate, bears radiating striæ, and its ventral margin is slightly plicate. No muscular nor pallial impressions. In the umbonal region, which is not projecting, the embryonic shell is seen. The cardinal margins of the two valves are in contact only along the embryonic shell; further on they are separated and connected by a delicate epidermic ligament. The ligament proper is internal and occupies the whole of the embryonic hinge; on dissolving it by means of hypochlorite of soda, it is seen that the hinge has retained exactly the conformation that it possessed in the embryos, which are met with in abundance with the adults. It exhibits at its summit a little ligamentary pit interrupting the cardinal margin, and on each side parallel crenatures similar to those which exist in the embryos of a multitude of Acephala (*Nucula*, *Mytilus*, *Arca*, &c.). In the adult the ligament runs out on to all these structures, and neither cardinal plateau nor teeth, properly so-called, are formed.

As opposed to this persistence of the embryonic type of shell the internal organization exhibits an advanced specialization.

The *adductor muscles*, greatly reduced in size, are seen (in a section) in their normal position. The *foot* is but little developed and is divided into an anterior and a posterior lobe; in the retracted condition due to immersion in spirit it displays a deep longitudinal groove, which manifestly corresponds to a creeping sole. No *byssus*. *Nervous system* normal, with very large ganglia.

Alimentary canal very simple. The mouth opens on the dorsal face of the visceral mass; on each side it is joined by a deep groove, bounded by two lips which represent the rudimentary labial palps, and extend on the sides as far as the base of the gills. Œsophagus straight, dorsal; stomach spacious, with a broad opening from the digestive gland (liver), which occupies the two anterior thirds of the visceral mass and forms in three places the wall of the stomach. The latter exhibits on the right side a cæcum, which appears to secrete a hyaline style; the posterior intestine runs in a ventral direction and then towards the dorsal aspect; on issuing from the visceral mass it traverses the ventricle and terminates in a short bell-shaped rectum.

Kidneys greatly reduced, and situate at the posterior extremity of the visceral mass, at its junction with the mantle. Renal orifices behind those of the genital organs. *Genital gland* hermaphrodite, occupying the posterior third of the visceral mass.

The *gills* are the most interesting organs. On each side there exists a single branchial lamella bent round into a dihedron, of which the anterior ridge is occupied by a blood-vessel. One of the folds is united by its margin to the mantle and the other to the visceral mass, and along these lines of junction there runs a vessel (or sinus); moreover, the two gills are united together by their tips in the median line at the point where they detach themselves from the body. In this way there is produced a posterior mantle-cavity, communicating with the anterior one only by a median orifice between the visceral mass and the point of junction of the two gills. This posterior cavity is utilized as a *brood-chamber*, which appears to be of a very different nature from that which is found in *Entovalva* [so far as may be judged from the very brief description of Voeltzkow *]. Each branchial lamella is formed by a fold *continuous* with the mantle; its anterior surface bears strongly ciliated thickenings, resembling filaments, parallel to the cardinal margin, with a hæmal canal in their interior. Apertures at regular intervals, in the shape of a funnel widened posteriorly, traverse the lamella between the thickenings. It seems natural to regard this organ as a series of filaments fused together; but towards the tip of the gill, which appears to be in process of enlargement, we observe that the lamella becomes hollowed out by apertures, and exhibits fresh ciliated thickenings, while free filaments are nowhere visible.

The pallial and visceral lamellæ are united by transverse trabeculæ.

In a subsequent paper I shall discuss the interpretation that may be attached to this gill; I shall describe the anatomy of the embryos, and shall deal with the affinities of the animal, which seems to me to be allied to the Erycinids, the Galeommids, and to two forms which are still insufficiently known, *Chlamydoconcha*, Dall, and, especially, *Entovalva*, Voeltzkow †. Nevertheless the anatomical characters are, in my opinion, sufficiently distinct to justify a new generic division, and I propose for this Lamellibranch the name *Scioberetia australis* ‡.—*Comptes Rendus*, t. cxxi. no. 17 (October 21, 1895), pp. 569–571.

* Voeltzkow, *Entovalva mirabilis*, Zool. Jahrb., Abth. f. System. &c., Bd. v., 1890.

† Dall, 'Science' (New York), vol. iv. 1885; see Journal de Conchyl. t. xxxv.; Voeltzkow, *loc. cit.*

‡ This paper was prepared in the Malacological Laboratory of the Museum.

On a Chilian Example of Pterodela pedicularia, *L., with doubly abnormal Neuration.* By ALFRED GIARD, Professor at the Sorbonne.

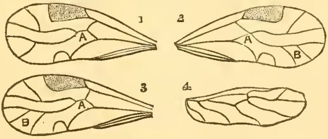
In the numerous consignments which our colleague Mr. F. Lataste has kindly sent me for the study of *Margarodes vitium* I have found at different times the larvæ, nymphs, and perfect insects of a Psocid which is common in Chili on old vine-stocks, especially at Caillihue and Santa Rita. This is *Cæcilius pedicularius*, L., which Kolbe has made the type of the subgenus *Pterodela.*

The species is widely distributed in Europe on old wood of various kinds and even in dwellings, where the imago is seen from the end of August to about the 15th of October. In Chili the perfect insect commences to appear about the month of December, and at this period there still exist many untransformed larvæ.

These Chilian examples do not differ from those of the old world. Their size is perhaps a little less and the pterostigma a little more cloudy. It seems to me evident that this Psocid has been introduced into Chili with some vegetable débris, perhaps with the vines themselves. It is not mentioned in the list of Neuroptera in C. Gay's 'Histoire Naturelle du Chili.'

By a singular coincidence the first adult example which I received from Caillihue, a male, presented an abnormal neuration, and abnormal in a different manner in each of the two anterior wings, so that I was some time in recognizing our common *Cæcilius pedicularius*, L., and my doubts only vanished later when M. Lataste sent me fresh and perfectly normal specimens.

The study of teratological cases in the neuration of insects presents considerable interest from the point of view of biological philosophy. It is important not to lose the documents which nature has furnished us with in so unusual a manner, and for this reason I have thought it advisable to describe and carefully reproduce the wings of the abnormal *Cæcilius* of Chili.



If we compare the left wing of the abnormal specimen (fig. 1) with the left wing of a normal individual (fig. 3), we see that the second posterior marginal cellule (B) is wanting, the median nervure sending only one branch to the margin of the wing instead of two. This is a simplification of the neuration which is only met with in the normal state in the inferior wing in the Psocids (*cf.* fig. 4, the inferior wing of *Cæcilius pedicularius*).

De Sélys Longchamps has described an analogous monstrosity in a *Psocus bipunctatus*, Latr., from the Rambur collection. In the genus *Psocus* there are normally four posterior marginal cellules. In the abnormal specimen the left superior wing has only three marginal cellules instead of four, the most basal being absent. The monstrosity was thus of the same nature and affected the same side as in our *C. pedicularius* *.

The right wing of our teratological example possesses, indeed, the second posterior marginal cellule, but it is abnormal from another point of view. While in the normal condition the branch of the radial nervure and the median nervure are united over a certain extent of their course (figs. 1 and 3, A), in the abnormal wing these two nervures touch at a single point (fig. 2, A), thus realizing a condition which we find normally in certain Psocids, notably in the genus *Mesopsocus*, Kolbe.

De Sélys Longchamps has already pointed out that a similar character would be insufficient to separate *Mesopsocus* from *Elipsocus*; certain examples of *Elipsocus unipunctatus*, Müll., present, in fact, a disposition of the nervures which is intermediate between the type of this species and *Elipsocus laticeps*, Kolbe †.

The teratological variations in the reticulation of the wings of insects appear to be abrupt and in discontinuity with the normal condition. If they are preserved by heredity they constitute new varieties, sometimes even new genera or species if other characters are modified in addition, so as to allow of a more complete differential diagnosis. Starting from this point, certain naturalists have maintained that all species have a similar origin, and that the action of the primary or secondary factors of evolution, Lamarkism and Darwinism, should give place to this new conception of the descent of living beings by discontinuous teratological modifications.

This, we think, is an inexact and exaggerated interpretation of facts which in themselves are highly important. The production of species by a discontinuous process remains a particular case whose importance may have been undervalued, but on which it is not advisable to found a general law.

In reality the different types of neuration represent so many stable states of equilibrium between which no continuous gradual passages can be established. The forms intermediate to these states of equilibrium are not realized, because they do not correspond to conditions of sufficient stability. To make use of a trivial comparison, *one cannot show the half or any fraction whatever of one step of the ladder.* In similar cases the progress is very discontinuous or, what comes to the same thing, only manifests itself in a discontinuous manner. But we cannot derive from these facts any argument against the formation of species by natural selection, still less can we find there the sole and complete solution of the complex problems of metamorphism.—*Actes de la Société Scientifique de Chili*, t. v. 1895, 1re livraison, pp. 19–21. (Communicated by the Author.)

March 8, 1895.

* De Sélys Longchamps, "Revision des Psocides décrites par Rambur," Ann. Soc. Entomol. de Belgique, t. xvi. p. 6 (1873).

† "Catalogue raisonné des Orthoptères et des Névroptères de Belgique," Ann. Soc. Entomol. de Belgique, t. xxxii. p. 128 (1888).

CONTENTS OF NUMBER 97.—*Sixth Series.*

*** It is requested that all Communications for this Work may be addressed, post-paid, to the Care of Messrs. Taylor and Francis, Printing Office, Red Lion Court, Fleet Street, London.

WITH EIGHT PLATES.

Vol. 17. SIXTH SERIES. No. 98.

THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY,
INCLUDING
ZOOLOGY, BOTANY, AND GEOLOGY.

CONDUCTED BY

ALBERT C. L. G. GÜNTHER, M.A., M.D., PH.D., F.R.S.,
WILLIAM CARRUTHERS, F.R.S., F.L.S., F.G.S.,
AND
WILLIAM FRANCIS, PH.D., F.L.S.

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

LONDON:
TAYLOR AND FRANCIS, RED LION COURT, FLEET STREET.
Sold by Simpkin, Marshall, Hamilton, Kent, & Co., Ld.; Whittaker & Co.: Baillière, Paris: Maclachlan and Stewart, Edinburgh: Hodges, Figgis, & Co., Dublin: and Asher, Berlin.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SIXTH SERIES.]

No. 98. FEBRUARY 1896.

XIV.—*Considerations on the Surviving Refugees in Austral Lands of Ancient Antarctic Life.* By C. Hedley, F.L.S., Assistant in Zoology to the Australian Museum *.

To ordinary readers the most desolate region imaginable is that within the Arctic Circle. Yet the intrepid explorers who have furthest penetrated into the northern wilds encountered there bears, wolves, musk-oxen, walrus, seals, and other mammals, and saw flocks of birds steering northwards beyond the utmost limit of discovery.

Infinitely more desolate is the mysterious and perhaps impenetrable Antarctic continent or archipelago. For aught we know, here may tower loftier mountains than geographers have marked in the Himalayas. From the ship's deck voyagers † have descried volcanic peaks trending into an interior which extends as an unbroken sheet of ice and snow. Beyond the beach its whole surface hardly now nourishes a single animal or plant; for the lichen reported by Borchgrevink ‡ from Possession Island and Cape Adare alone

* From an advance proof communicated by the Author, having been read before the Royal Society of New South Wales, August 7, 1895.

† M'Cormick, "A Sketch of the Antarctic Regions, embracing a few Remarks, Geographical and Ornithological," The Tasmanian Journal of Natural Science, i. p. 246.

‡ 'The Geographical Journal,' vol. v. June 1895, p. 583.

constitutes the recorded terrestrial flora. Enveloped in an atmosphere of universal death, wrapped in its closely clinging cerements of ice and snow, the one expression of the Antarctica of to-day is that of lifeless silence *.

But it was once otherwise. Not only may a naturalist assert that here stately forests once stood, streams once rippled, and green fields smiled, but he can picture what trees composed those forests, of what kind were the frogs and snails they sheltered, and of what form were the fish that swam in those streams.

Early scientific travellers † remarked that the converging continental masses of the southern world held as common stock certain forms of life. Closer enquiry elicited that these common forms were primitive, often isolated types, survivors of some ancient population overwhelmed and slaughtered by invaders from the north. South Africa was found to stand somewhat apart from the closer bond which united Tasmania and Australia to New Zealand and South America, while New Zealand is in turn poorer actually, if not comparatively, than Tasmania in South American affinities.

"Community of type," writes Dr. Gill ‡, "must be the expression of community of origin . . . . and recent palæontological finds indicate that even the Thylacinids (or, at least, forms resembling them) were formerly natives of southern America. . . . . The freshwater fishes [of New Zealand] must have been derived from the same common source as those of the isothermal portions of Australia (of course including Tasmania) and southern America. There may not have been a continuity of land at any one time between South America, Australia, and New Zealand, but at some remote period in the past it is at least possible that there was a region in which Galaxids and Haplochitonids were developed, and subsequently representatives of those families might have found their way into the regions where they now abound."

An enumeration of the genera common to South America, New Zealand, and Tasmania, and therefore probably of Antarctic origin, would exceed the limits of this paper. Forbes § quotes numerous instances; and for more ex-

* For the best physical and geographical description of Antarctica see Murray, 'The Geographical Journal,' vol. iii. pp. 1–27.

† J. D. Hooker, "On the Huon Pine &c.," London Journal of Botany, vol. iv. 1845, pp. 137–157.

‡ "A Comparison of Antipodal Faunas," National Academy of Sciences, vol. vi. p. 108.

§ "Antarctica, a supposed former Southern Continent," Natural Science, iii. pp. 54–57.

haustive data monographs of most groups of animals and plants of these countries may be consulted *.

We may compare the shattered biological monuments of Tasmania and South America to the broken columns found by Oriental travellers in the ruined and deserted cities of a vanished civilization; and as an archæologist may restore from such fragments the fallen temples or disused aqueducts, so may a naturalist trace the missing arches of life that once spanned the gap. Some of the efforts to do so may be here reviewed.

Prof. Hutton has conjectured † that such a bridge spanned the South Pacific from Chili to Samoa, and thence to New Zealand. Claiming South-American relations for the New-Zealand fauna and flora, he accounts for their entry into New Zealand by this assumed bridge. Against Prof. Hutton's arguments it may be urged that, though the relation of New Zealand to South America is indisputable, it is less than between the latter and Tasmania, and that the demand for a former union may be satisfied by supposing an approach but not a connexion with Antarctica. The sole supports of the theoretical transpacific bridge are the difficulties it is believed to explain. A biologist might object that, *had such a bridge existed, New Zealand being at the furthest extremity, ought to contain fewer South-American affinities than do intermediate Polynesian islands,* like Samoa or Tahiti, lying nearer to the source. On the contrary, these islands are devoid of such. And a geologist might say that this supposed bridge was discordant with the main orographic structure of the region.

* For fungi see Darwin, Voy. 'Beagle,' p. 236; mosses, Mueller, Trans. N. Z. Inst. xxv. p. 428; grasses, Buchanan, 'Indigenous Grasses of New Zealand;' trees, Kirk, 'The Forest Flora of New Zealand;' lichens, Shirley, Proc. Roy. Soc. Queensland, vol. x. p. 54; earthworms, Beddard, 'A Text-book of Zoogeography,' p. 60; isopods, the same, p. 173; crayfish, Parker, N. Z. Inst. xix. p. 154; fluviatile mollusca, Hedley, P. L. S. N. S. W. (2) viii. p. 507, and ix. p. 464; trematodes, Haswell, 'A Monograph of the Temnocephalæ,' Macleay Memorial Volume; ants, Emery, 'Nature,' Aug. 22, 1895, p. 400; planarians, Dendy, Trans. New Zealand Inst. 1895, p. 177; diptera, Skuse, Proc. Austr. Assoc. Adv. Science, i. pp. 526–540, and Osten Sacken, Berliner entomolog. Zeit. Bd. xxx. 1886, Heft ii. pp. 153–187; lepidoptera, Meyrick, various papers, Trans. New Zealand Institute. Mr. Skuse has drawn my attention to the interesting South-American and Australian distribution of *Stigmodera* and other genera grouped around it, as enumerated in Gemminger and Harold's 'Catalogus Coleopterorum,' tome v. pp. 1392–1405. When defects in the current classification of invertebrates are amended, the likeness between southern faunas will grow more apparent.

† "On the Origin of the Fauna and Flora of New Zealand," New Zealand Journal of Science, ii. pp. 1–249; and Ann. & Mag. Nat. Hist. (5) xiii. p. 426.

Its relics are detected by Prof. Hutton in an abyssal area two thousand fathoms deep, which only in strained language can be termed a "plateau." Of where he supposes that it lay Geikie * writes: "so abruptly does the continental plateau rise from the ocean trough, that a depression of the sea-level or an elevation of the plateau for ten thousand feet would add only a narrow belt to the Pacific coast between Alaska and Cape Horn." Much of the biological and geological data on which Prof. Hutton's paper was based have since been refuted or withdrawn.

Another answer to the question at issue is tendered by Dr. H. O. Forbes †. After a lucid summary of the kinship of austral life observed by earlier naturalists and of facts collected by himself in the Chatham Islands, he constructs an immense hypothetical Antarctic continent to explain these problems.

The impression left on my mind by a careful study of this paper is that a foundation so slender is insufficient to bear a superstructure so vast. No geological era is assigned for the map of Ancient Antarctica accompanying the article. To this area the Mascarene Islands appear to be attached chiefly upon the strength of an extinct bird of dubious lineage. The difficulties of the change from the climate of primeval Antarctica and the change in the depth of circumpolar seas are not explained, or, indeed, the changes proved. The Antarctic fauna and flora, so far as surviving fragments allow us to reconstruct them, do not suggest that wealth of forms which so wide an extent of land should have developed. A much harsher climate would have prevailed over Forbes's broad continental area than over a chain of islands or a narrow strip of land. *Had the conditions indicated by Dr. Forbes once existed, then each of the southern land-masses should have preserved an equal heritage of Antarctic life*, which is not the case. A sharing of population may not be invariably cited (as it is in this paper) as indicative of former land-passages, for it has been clearly demonstrated in the case of the Azores and Galapagos that considerable immigration may occur across wide expanses of ocean.

Mr. H. A. Pilsbry has remarked ‡ that "the presence of very similar forms in southern South America and Tasmania and New Zealand has been accounted for by the hypothesis of a former more extensive Austral continent or 'Ant-

* Address Geograph. Sect. British Association, 1892, p. 796.

† "The Chatham Islands, their relation to a former Southern Continent," vol. iii. Supplementary Papers, Royal Geographical Society, 1893.

‡ 'Guide to the Study of Helices,' p. xxxix (Philadelphia, 1895).

arctica,' which may have been supplied with these snails, as well as with certain marsupials, fishes, &c. from Australia, and subsequently became united at Cape Horn, transferring the fauna. The connexion could hardly have been in reverse order, or why should not Edentates and Hystricomorph Rodents have invaded Australia?"

The opposite view, viz. that Antarctica transferred a fauna from America to Australia, is favoured by the facts that the fossil marsupials from the Patogonian Eocene antedate * any fossil marsupials recorded from Australia, that the marsupialia dawn upon the Australian horizon as a highly differentiated group, and that Prof. Spencer has demonstrated † "that the diprotodonts had their origin in the Euronotian region," meaning that their centre of dispersal lay to the south-east of Australia. Von Ihering has suggested ‡ that a large area of South America was separated in Mesozoic times from the remainder, and maintained a distinct fauna and flora. If from this tract, which he terms Archiplata, were excluded, as he holds, placental mammals, it may have peopled Australia with marsupials, and yet not have transferred thence Edentates or Hystricomorph Rodents.

The relation of Antarctica to African lands is a subject on which an Australian student has little chance to form an opinion. Perhaps the faint though real affinity (as shown in the distribution of the mollusks Endodontidæ, Rhytididæ, and Acavinæ) would be explicable on the supposition that before either America or Australia had united with Antarctica,

* This statement is derived from the following data, for which I am chiefly indebted to the kindness of my friend Mr. W. S. Dun, Assistant Palæontologist to the Geological Survey of N. S. W., himself the author of important papers on the subject. The oldest DESCRIBED Australian mammalia are Pliocene, viz. *Ornithorhynchus maximus*, Dun, and *Echidna robusta*, Dun (Records Geol. Survey, N. S. W. iv. p. 119), from this colony. From Victoria Prof. M'Coy has claimed as Pliocene ('Prodromus,' "Palæontology of Victoria," decades i.–vii.) *Phascolomys plocenius*, M'Coy, *Diprotodon longiceps*, M'Coy, *Macropus titan*, Owen, and *Procoptodon goliah*, Owen. Some bones recognized by Johnston (Geol. Tasmania, p. 261) and Tate (Proc. Roy. Soc. N. S. W. 1893, p. 168) as *Halmaturus*, from the Eocene of Table Cape, Tasmania, can hardly be discussed till they have been studied, described, and named. Yet on *à priori* grounds the Diprotodontia can scarcely be supposed to have so far proceeded on the path of differentiation from the radical Polyprotodont stock as to have evolved into *Halmaturus* at the early date of the Eocene; further, the sea-shells of this deposit form an incongruous environment for a wallaby. For a list of the numerous marsupials extracted from the Upper Eocene beds of Santa Cruz, South America, see Zittel, Geol. Mag. x. p. 456.

† Report Austr. Assoc. Adv. Science, 1892, p. 118.

‡ Trans. New Zealand Institute, 1891, xxiv. p. 434.

Africa had already been joined to and broken from it, receiving a colony thence or leaving one there to mix with American and Australian forms when the vicissitudes of continental growth permitted.

In an inquiry * into the distribution of the pond-snail, *Gundlachia,* I lately proposed, as the simplest solution of the problem, that DURING THE MESOZOIC OR OLDER TERTIARY, A STRIP OF LAND WITH A MILD CLIMATE EXTENDED ACROSS THE SOUTH POLE FROM TASMANIA TO TIERRA DEL FUEGO, AND THAT TERTIARY NEW ZEALAND THEN REACHED SUFFICIENTLY NEAR TO THIS ANTARCTIC LAND, WITHOUT JOINING IT, TO RECEIVE BY FLIGHT OR DRIFT MANY PLANTS AND ANIMALS, as the Galapagos received their population from America or the Azores theirs from Europe.

This conclusion was built upon the following evidence. A minimum of land-extension compared with that asked for by Hutton or Forbes was demanded. A milder climate is admitted by geologists, even by those who dispute its cause, to have formerly prevailed in Arctic regions: a mild Antarctic climate should therefore be admissible. Dr. Murray remarks † of the fossils collected by Capt. Jensen close to the Antarctic Circle that they "are probably of a Lower Tertiary age, and they indicate a warmer temperature than now prevails in these high southern latitudes." A cursory survey of a collection of Eocene Mollusca from the Muddy Creek beds of Victoria suggests to me that warmer seas then prevailed. Its wealth of *Cypræa* and *Voluta* points to a tropical climate. I observe there tubes of *Kuphus*, a genus now ranging from Sumatra to the Solomons, whose evidence is corroborated by extinct allies of *Nautilus.* That New Zealand once extended very far south of its present position to or, perhaps, beyond the Macquarie Islands, is granted by all who have investigated the subject ‡. Possibly this southward extension was synchronous with the northward extension indicated § by the range of *Placostylus.* That this southward extension of New Zealand did not, during the marsupial exodus, actually touch the highway between Tasmania and South America, I infer from the fact that such passengers as the venomous snakes, extinct *Palimnarchus*, cystignathous frogs, monotremes, and marsupials failed to arrive in New Zealand. The southward

* Proc. Linn. Soc. N. S. W. (2) viii. p. 508.

† "Notes on an important Geographical Discovery in the Antarctic Regions," Scottish Geographical Magazine, vol. x. p. 195.

‡ *Vide* Blanchard, 'Comptes Rendus,' 1882, p. 386.

§ Proc. Linn. Soc. N. S. W. (2) vii. p. 335.

prolongation of Tasmania in the direction of Royal Company Island is suggested by the Tasmanian axes described * by Prof. David.

The evidence collected tends to show Antarctica as an unstable area, at one time dissolving into an archipelago, at another resolving itself into a continent.

How this would affect the marine shallow-water fauna has not been previously considered. Under the circumstances I have described, the South Pacific would stretch within a few degrees of the Pole into a deep bight or gulf extending from Tasmania to Cape Horn. Into the western extremity would open the long and narrow tongue of what is now the Tasman Sea. When the climate cooled, the fauna at the head of this Antarctic Gulf, as I propose to call it, would be driven northwards to milder zones. By diverging meridians a similar fauna would reach New Zealand, New South Wales, and Chili †. In a precisely similar manner Darwin ‡ has shown how the northern Glacial period drove the same Polar flora by radiating paths to the Alps, Himalayas, and Alleghanies, where they now survive stranded on mountain-tops.

If, when this northward migration occurred, continuous land had reached from Australia to Chili, then none of the fauna of the Antarctic Gulf could have entered either the Indian or the South Atlantic Oceans. We have, however, no warrant for believing that the Antarctic bridge long endured as continuous and contemporaneous land; and that it was pierced by channels is proved by the escape of stray members of that characteristically Antarctic genus *Struthiolaria* to Patagonian coasts (*S. ornata*, Sowerby §), on the one hand, and to Kerguelen (*S. mirabilis*, Smith) || on the other.

The destruction ¶ which the ancient fauna of the Antarctic Gulf has endured, and the length of time which has elapsed since its expulsion, deprives us of much hope of reconstructing it. Since that event, for instance, the genus *Haliotis* has probably altogether grown up as a characteristic feature of

* Presidential Addresses, Proc. Linn. Soc. N. S. W. (2) viii. p. 606, and vol. x. p. 155.

† *Cf.* "The Occurrence of *Concholepas*, recent only in South America, as a Fossil in Australia," Proc. Roy. Soc. N. S. W. 1893, p. 171.

‡ 'Origin of Species,' Chap. xi.

§ Darwin, Geol. Obs. S. America, pp. 376, 618, pl. iv. fig. 62.

|| Trans. Roy. Soc. vol. clxviii. p. 170, pl. ix. fig. 3.

¶ "We seem [in the Pliocene] to be dealing with the remains of an earlier fauna disappearing rapidly before the conquering host of the recent fauna which had invaded New Zealand some time previously." (Hutton, Macleay Memorial Vol. p. 36.)

the modern Australian molluscan fauna. A search among the more persistent of living types may produce some torn pages of its history. One such is recognized by the writer in *Lucapinella*, whose occurrence in Australian waters is noted *. But palæontology must be chiefly called on to relate the story of the decline and fall of the Antarctic marine fauna.

XV.—*The Male of* Apus cancriformis. By W. Blaxland Benham, D.Sc. (Lond.), Hon. M.A. (Oxon.), Aldrichian Demonstrator in Comparative Anatomy, Oxford.

In view of the rarity of the male individuals of this interesting Phyllopodan Crustacean, it may be worth putting on record the occurrence of one amongst the specimens of *Apus* used for examination in the ordinary course of our work in the Zoological Laboratory here in Oxford. The specimens were obtained through Fric, of Prague, from Poděbrady, a town on the Elbe.

Apus is one of the stock examples of parthenogenesis, the bulk of the individuals being females; that males do occur occasionally we know from the observations of Kozubowski, von Siebold, and others; but locality and season appear to have considerable influence on their occurrence. Thus, in 1858, out of 549 specimens of *Apus* collected at Krakau, as many as 154 were males, whereas in 1866 out of 999 collected at Breslau there were only 7 males. Von Siebold's repeated endeavours during several successive years to obtain males are matters of history.

The credit of first describing the male is due to Prof. Kozubowski, who, in 1857, gave an account of the testis, sperm-duct, and spermatozoa (Arch. f. Nat. xxiii.), and laid the foundation for the view which has since then been nearly universally adopted, viz. that *Apus* is parthenogenetic. Up to that period it had been considered hermaphrodite.

It will not be amiss to note that the only external point of difference between the two sexes is the absence in the male of that modification of the sixteenth appendage which results in the female in the formation of an egg-pouch ("oostegopod"); in fact, the sixteenth appendage of the male is precisely like its neighbours, and at its base the sperm-duct opens.

I looked carefully for any appendages which might be

* Proc. Roy. Soc. Vict. 1894, p. 197.

modified for holding the female, such as occur in its ally *Branchipus*; but none exist.

It is usually stated, on Kozubowski's authority, that the male is about one third shorter than the female, with a distinctly narrower abdomen and flatter carapace. These statements can scarcely be said to be true in the present instance. The male did not differ noticeably in size from the rest of the specimens, some of which were slightly larger, others smaller. I measured one female, taken at random, and found the trunk (excluding the head, that is) to be 36 millim. long; the trunk of the male is 33 millim.; the diameter of the female abdomen, close to the last appendage, is 5 millim., that of the male 4 millim.

Sir John Lubbock has recorded (1863) that the males of another species, *Lepidurus productus*, are larger than the female. We cannot, then, make any general statement as to proportionate size of the two sexes.

On referring to Mr. Bernard's little book, 'The Apodidæ,' I was rather surprised to find that no mention of the anatomy of the male *Apus* occurs in the body of the book; but in the appendix he quotes his letter to 'Nature,' vol. xliii. p. 843, in which he gave a brief history of the observations on the male. The name of Kozubowski does not appear in his list of references, nor that of von Siebold. Seeing that Bernard's book is the only recent English account of the anatomy of *Apus*, it is regrettable that space was not found for a reference to the sexual difference. But no doubt a description of the mere anatomy of the animal was not so much his aim as a comparison of *Apus* with an Annelid. Moreover, he wished to emphasize the hermaphrodite nature of *Apus*.

Now it is more than four years since Mr. Bernard announced, in a brief note published in the 'Jena. Zeitsch.,' the discovery of the existence of testes, or, at any rate, of "sperm-producing centres," in the female *Lepidurus*; but beyond stating that he has observed the same state of things in some other species, and has seen spermatozoa in the lower part of the duct, he has not materially added to this bare statement either in his book or elsewhere. I think it is not an exaggeration to say that zoologists have been impatiently waiting for a detailed and *illustrated* account of this phenomenon. *Apus* has for so many years been regarded as parthenogenetic, that naturalists hesitate to accept the bald statement that it is "hermaphrodite and self-fertilizing."

On p. 309 of his book Mr. Bernard writes :—"The sperm-producing centres were found scattered here and there among the rich branches of the segmental diverticula of the genital tubes. They occur either at the tips of such branches where the eggs ordinarily develop, or as slight lateral bulgings of the same." I have recently had occasion in the course of my work to examine a series of longitudinal sections through *Apus cancriformis*, and I have failed to identify any such "sperm-producing centres."

On p. 144 he gives a figure representing a portion of the ovary, and at one point the epithelium of the duct is interrupted by a group of small round granules, which is labelled "testis, as occasionally found (*e. g.* in *Apus cancriformis*)." This "testis" is neither a terminal nor a lateral bulging; this figure, too, which is the only illustration of the point in question, is so crude that we ought to have further details of these "sperm-producing centres."

I will not presume to deny the possibility of hermaphroditism in the Apodidæ, however improbable it may be; I merely repeat, we wait for further evidence.

With regard to Bernard's figure of the ovary I would say one more word. Von Siebold, in a paper accompanied by beautiful figures, showed that each terminal swelling of the ovary is formed of four cells, of which the *distal* cell becomes the egg-cell, the other three being yolk-forming cells. That this is true for *Apus* a glance at a section is sufficient to demonstrate; but Bernard, in the figure referred to (illustrating presumably *Lepidurus*), represents the *proximal* cell of the four as the egg-cell. If this is really the case, we have an extremely interesting difference between the two genera.

Oxford,
December 16, 1895.

XVI.—*Descriptions of Two new Species of* Eugaster (Hetrodidæ) *from East Africa.* By W. F. Kirby, F.L.S., F.E.S., &c., Assistant in Zoological Department, British Museum.

Eugaster suakimensis.

Long. corp. 37–40 millim.

Head brown, strongly punctured above, the lower mouth-parts, the palpi, and the base of the antennæ more or less varied with testaceous; a short conical testaceous spine between the antennæ; pronotum reddish brown or blackish, varied with testaceous in front and along the median line, and with reddish behind. It is strongly rugose, with two irregular longitudinal elevations on each side of the median line; front edge with a row of 4 black spines, placed at about equal distances apart; between these are two shorter ones between the middle ones in the males only, and another between the two outer ones on the right-hand side only in both sexes. The outer spines are at the front angles of the front lobe of the pronotum, and behind and above them are much larger spines at the hinder angles of front lobe. There is also a strong black spine on each side of the middle lobe of the pronotum. The hinder ridge of the pronotum bears a row of 6 or 7 black spines on each side, increasing in size towards the front. Legs brown, the coxæ and tarsi slightly varied with testaceous or reddish; front coxæ spined; all the tibiæ with a double row of short partly testaceous spines, least numerous on the middle tibiæ. Abdomen brown, dotted with testaceous, and inclining to testaceous towards the ends of the segments; the base, sides, and under surface more or less testaceous, especially in the males, and dotted with black.

Hab. Suakim. Presented by Dr. John Anderson.

Described from four specimens, two of each sex.

Allied to *E. spinulosus,* Linn., and *E. Woodii,* Kirb., but differs from both in the almost uniformly dark legs, and in markings &c.

Eugaster frater.

Long. corp. 33–35 millim.

Male.—Closely allied to the last species, but the head and pronotum are more uniformly dark. The front is less convex, the antennæ are testaceous, and the face and palpi are much varied with reddish. The coxæ and legs are testaceous, longitudinally striped with brown; and in the lightest specimen the hinder half of the pronotum and the base of the abdomen beneath incline towards testaceous, but there are no testaceous markings on the sides of the abdomen. On the front of the pronotum there are two spines at the angles, and two central spines, widely separated, but no intermediate ones; the middle lobe of the pronotum has a large spine on each side, and between them are two slight humps, behind which are two more elevations, forming short upright spines. The row of 14 large spines running round the hinder edge of the pronotum is regularly arranged and more or less testaceous.

Hab. Mombasa. Presented by D. J. Wilson, Esq., of the British East Africa Company.

Two male specimens.

The specimens appear to be slightly discoloured; but I hope that the above short description will be sufficient for the identification of the species.

A single female specimen of *Prionocnemis verruciferus*, Karsch, or of a closely allied species, was received from Mombasa at the same time as the specimens of *Eugaster frater*. Karsch's species was described from a single male specimen, and although the sexes of the Hetrodidæ differ little, I await further specimens before describing an insect which does not quite agree with his description, but which is of a different sex.

As the genus *Prionocnemis*, Karsch, is preoccupied, I propose to rename it *Madiga*.

The Hetrodidæ appear to be very numerous in Africa, and no doubt many species still remain to be discovered.

XVII.—*On a new Dragonfly captured by Mr. Scott Elliot in East Africa.* By W. F. Kirby, F.L.S., F.E.S., &c., Assistant in Zoological Department, British Museum.

Æschna Ellioti.

Long. corp. 58–60 millim.; exp. al. 70–75 millim.; long. pter. 3 millim.; long. app. 4 millim.

Male.—Rufous brown. Face yellowish green, vertex rugose, space around the ocelli blackish. Thorax with two broad converging green bands above and the septa green; two oblique green bands on each side under the wings, central markings of the interalary space above, and the base of the wings spotted with green; abdomen inflated at the base and constricted beyond, with a short lateral green band, bordered behind with black, at the extremity of the first segment; segments 2 to 8 of abdomen with a black transverse carina, in the middle at first, then gradually nearer the front margin; segments 3 to 10 with a large greenish spot at the extremity, on each side of the longitudinal carina; the space in front of the transverse carina is also paler on most of the hinder segments. Lateral appendages not expanded, deeply grooved above, and slightly hairy; lower appendage subtriangular, less than one third the length of the others. Legs black, reddish towards the base. Wings hyaline; pterostigma rather short, covering a little more than two cells: fore wings with 14 or 15 antenodal and 9 or 10 postnodal cross-nervures, triangle consisting of 3 cells; 2 supratriangular nervures;

4 nervures (rarely 5) in the lower basal cell: hind wings with 9 antenodal and 11 or 12 postnodal nervures; triangle consisting of 4 cells, 2 transverse at the base and the other 2 beyond; 2 supratriangular nervures; 3 to 5 cross-nervures in the lower basal cell; membranule smoky brown, white at the base.

Allied to *Æ. affinis*, Van der Lind., of Europe, and *Æ. Rileyi*, Calvert, from Kilimanjaro. Specimens were obtained at Ruwenzori (6000–8000 feet) and "Salt Lake to Wawamba Co."

Three other species of dragonflies were obtained by Mr. Scott Elliot:—*Orthetrum truncatum*, Calvert (previously known from Kilimanjaro), from Ruwenzori; *Cacergates unifasciata*, Oliv. (a species common all over Africa), from the Salt Lake; and two specimens apparently belonging to a new genus near *Agrionoptera*, but not in sufficiently good preservation to describe.

XVIII.—*Descriptions of Three new Species of Lepidoptera from East Africa.* By EMILY MARY SHARPE.

Family **Pieridæ.**

Mylothris Neumanni, sp. n.

Allied to *M. narcissus*, Butler, and *M. Jacksoni*, E. M. Sharpe.

♂. This new species differs from *M. Jacksoni* in having the fore wing nearly entirely black, the veins of the discoidal cell marked with white; while on the discal portion of the wing between each of the median nervules is a hastate mark, which combined forms a white patch in the middle of the wing.

Hind wing. Primrose-yellow, with a heavy black costal border commencing from the first subcostal nervule and extending below the discoidal nervule.

The third median nervule is indicated by a black spot at the end. The other nervules are marked by very minute black spots near the hind margin. The base of the wing has a black shading, rather stronger than in *M. Jacksoni.*

Underside. White on the fore wing, the apical portion being suffused with primrose-yellow, with a little orange on the costa at the base of the wing.

There are no black spots marking the end of the nervules as in *M. Jacksoni*.

♀. Very similar to the male, the white on the fore wing being less distinct and the hastate markings not so sharply defined.

Hind wing. Primrose-yellow, the black costal border being indicated by two black spots on the first and second median nervules. Two minute black spots at the margin mark the first and second median nervules.

The *underside* differs in the yellow on the hind wing being rather deeper in colour, with three minute black spots on the submedian nervure, the first and second median nervules, and a fourth spot on the first subcostal nervure.

Expanse, ♂ 1·9, ♀ 2·2 inches.

Hab. Near Mount Kenia. Coll. A. H. Neumann.

Family **Lycænidæ**.

Alœna picata, sp. n.

Fore wing. Black, relieved by a white transverse band nearly oval in shape from the costal margin, across the discocellular nervules, and extending to the second median nervule; about the middle of the inner margin is a second white mark extending to the first median nervule; these two white marks are distinctly separated by the black of the centre of the wing. The inner marginal white mark is coterminous with the broad white band of the hind wing.

Hind wing. Has a broad marginal border of black followed by a white band from the costa to the inner margin; the base of the wing black suffused with orange.

Underside much variegated. Fore wing black, with white and yellow markings; costa white, with two white spots in the discoidal cell, the end of the cell being marked with the white oval spot mentioned on the upperside. A submarginal row of large spots varying very much in size; these are tinged with yellow and are divided by the nervules; between these and the large oval discoidal spot is a second row of smaller spots, from the costal margin to the second discoidal nervule.

Hind wing white, with a black mark at the base and a small white spot in its centre.

Fringe of wing white; a submarginal border of black, preceded by a broad white band, across which the nervules are plainly indicated; this white band is followed by a narrow one of black, in which appear several clearly marked yellowish spots.

Head and abdomen orange.

Expanse 1·4 inch.

Hab. Between the coast and Teita, East Africa, December 1891 (*F. J. Jackson*).

Family **Nymphalidæ.**

Kallima Jacksoni, sp. n.

Nearest to *K. rumia*, Boisd.

Fore wing. The whole of the basal area bright violaceous blue, extending along the inner margin, but not quite to the external angle. This lighter blue area is bordered by a broad band of rich cobalt-blue, which separates the violet-blue base from the brown outer border; this darker blue colour decreases in size to the first median nervule, where it terminates. There are six white spots in pairs between each median nervule, three distinct ones mark the discal area of the wing, and three (more faintly indicated) are in the chestnut-brown external border; a white crescent-shaped mark is situated where the fourth and fifth subcostal nervules branch out.

A marginal border of chestnut-brown, rather more sombre in colour near the apex, has a narrow transverse black line to the third white spot of the outer series above the third median nervule.

Hind wing. Basal area violaceous blue, with a broad border of deep chestnut-brown; in this border is a distinct submarginal line of black, from the costal margin to the submedian nervure. On the discal portion from below the first median nervule are four minute black spots, giving the appearance of a second thin band.

The anal angle is greyish, extending up the submedian nervure to the base, the inner margin light brown.

Underside. Brown, like a faded leaf, with a dark transverse line of brown, and a second dark line outlining the discoidal cell and traversing both wings.

The discal spots on the fore wing are transparent, the first being ocellated. The ground-colour is sprinkled with greyish marks and indistinct wavy lines of darker brown.

Expanse 2·5 inches.

Hab. Kavirondo, March 1890 (*F. J. Jackson*).

XIX.—*Notes on some Land-Shells from Vanbu, Tonkin, with Descriptions of Two new Species.* By Edgar A. Smith.

Helicarion siamensis, Haines.

Vitrina siamensis, Haines, Pfeiffer, Mon. Hel. vol. iv. p. 158.
Helicarion Paviei, Morlet, Journ. de Conch. 1889, p. 174, pl. vi. fig. 1.

Hab. Siam (*Haines*) ; Cambodia (*Morlet*).

The specimens from Vanbu, Tonkin, are as large as those described by Haines and Morlet. The former does not mention the feeble spiral striation, but, in his brief diagnosis, he may have considered it scarcely worth noting. Specimens in the Cuming collection, obtained by Morlet in Cambodia and identified by Pfeiffer as *siamensis*, agree with the Tonquin shells.

Nanina distincta, Pfeiffer.

Helix distincta, Pfr. Conch.-Cab. ed. 2, pl. cxxxiv. figs. 1, 2; Reeve, Con. Icon. fig. 465.
Nanina distincta, Martens, Preuss. Exped. Ost-Asien, Zool. vol. ii. p. 69.
Var. = *H. Neptunus*, Pfr. Novitat. Conch. vol. ii. p. 176, pl. xlviii. figs. 1, 2; Tryon, Man. Conch. ser. 2, vol. ii. p. 34, pl. viii. fig. 27.
Var. = *H. pluto*, Pfr. Novitat. Conch. vol. ii. p. 210, pl. lv. figs. 8, 9; Tryon, Man. Conch. ser. 2, vol. ii. p. 37, pl. xii. fig. 56.

Hab. Siam, Camboja.

Two forms of this species, both smaller than the type or the variety *pluto*, are in the present collection from Tonkin. In the first (var. *funerea*) the shell is of an almost uniform purplish-black tint, redder towards the apex, the suture being sometimes indistinctly margined with yellow. The peristome is yellowish and a former lip is also visible at a considerable distance from the aperture. The body-whorl is not quite so inflated below the keel as in the var. *pluto* or the type. The largest specimen is 53 millim. in its greatest diameter, and appears to be adult.

The second variety (var. *pallidior*), of about the same size, is yellowish or olive-yellow, with a broad brownish-black band below the periphery and distinctly visible within the aperture. In both these varieties the umbilicus is rather narrower than in the typical form from Siam or the var. *pluto* from Camboja. If the form *pluto*, an intermediate link, were unknown, the two present varieties would probably be regarded as constituting a distinct species.

Camæna illustris, Pfeiffer.

Helix illustris, Pfr. Proc. Zool. Soc. 1862, p. 269, pl. xxxvi. fig. 8, var.; Novitates Conch. vol. ii. p. 208, pl. lv. figs. 1, 2 (type), fig. 3 (var.).
Camæna illustris, Pilsbry, Man. Conch. 2nd ser. vol. ix. p. 104, vol. vi. pl. xiii. figs. 57, 58.

Hab. Lao Mountains, Cambodia (*Pfr.*).

Some specimens from Vanbu, Tonkin (var. *tonkinensis*), differ from both the type and variety (var. *flava*) described by Pfeiffer. In form they are a little more ventricose, and they also differ in coloration. The general ground-tint is purplish red, interrupted at the periphery by a rather broad yellowish zone, the middle of which is traversed by a deep red line varying in width from 2 to 4 millimetres. The aperture and peristome are livid or lilac, but the columellar callus in the centre of the base is white and entirely conceals the umbilicus. Near the latter there is a distinct inflation of the surface, a feature less marked in the original specimen described by Pfeiffer.

Camæna vanbuensis.

Testa magna, solida, obtecte perforata, depresse conoidea, in medio acute carinata, saturate castanea; spira brevis, convexe conica, ad apicem obtusissima, rugis obliquis irregularibus undique sculpta; anfractus 5, celeriter sed regulariter accrescentes, ad suturam carinati, primi duo convexiusculi, sequentes duo planiusculi, ultimus ad peripheriam acute carinatus, supra valde concavus, haud descendens, infra convexus, sed prope carinam leviter excavatus vel impressus, concentrice subreticulatim rugosus; apertura paulo obliqua, livido-fusca, submargaritacea vel iridescens; peristoma incrassatum, expansum, reflexum, hepatico-fuscum, nitens, marginibus callo tenui cæruleo-albo junctis, columellari ad insertionem conspicue incrassato expanso et reflexo, umbilicum fere obtegente.

Diam. maj. 68 millim., min. 57, alt. 38; apertura intus 31 lata, 18 alta.

Var. Testa olivaceo-flavescens, carina castanea cincta.

This species differs only in form from *C. illustris*, Pfeiffer, the colour, number of whorls, sculpture, aperture, and peristome being similar in both. The flatness of the whorls and the sharp carination at the periphery, however, at once distinguish this form, which, until the connecting-links are discovered, stands as a well-marked recognizable species. That such links will eventually be found is very probable, in which case the specific name here suggested may be used in a varietal sense.

Instances in which keeled varieties of species with a normally rounded body-whorl occur might be mentioned; but I doubt if such an extreme case as the present could be shown.

Eulota rostrella, var.

Helix rostrella, Pfeiffer, Novitates Conch. vol. iii. p. 379, pl. lxxxviii. figs. 1–3; Pilsbry, Man. Con. ser. 2, vol. vii. p. 83, pl. xviii. figs. 48–50 (after Pfr.).

Hab. Lao Mountains, Cambodia.

Two specimens from Vanbu, Tonkin, differ from the typical form in being a trifle more widely umbilicated and rather less acutely carinate, the form of the peristome being consequently more regularly curved at the termination of the keel.

Pterocyclus vanbuensis.

Testa parva, discoidea, latissime umbilicata, lutea, maculis castaneis supra radiatim arcuatis picta, infra peripheriam zona angusta castanea cincta, limo undique induta; anfractus 5, convexi, incrementi lineis tenuibus striati, striis spiralibus tenuissimis obsolete sculpti; apertura circularis; peristoma duplex, margine externo leviter expanso, ad suturam haud profunde sinuato; operculum corneum, utrinque in medio concavum, multispirale, supra concentrice lamellatum, lamellis ad marginem aculeatis.

Diam. maj. 10 millim., min. $8\frac{1}{2}$, alt. 5; apertura $3\frac{1}{2}$ lata.

This species has the habit of coating its surface with mud, thus concealing the colour-markings. In form and coloration it recalls *Pt. rupestris*, Benson, the type of the genus. It is, however, smaller, the lateral notch is shallower, and the alæform expansion above it is only feebly indicated. The operculum also is more horny and flatter. The species might also be compared with the large *Pt. planorbulus* (Lamk.) as regards the general form, the character of the notch in the peristome, and the operculum.

XX.—*New Genera and Species of* Pyralidæ, Thyrididæ, *and* Epiplemidæ. By W. Warren, M.A., F.E.S.

[Continued from p. 106.]

Arthriobasis, gen. nov.

Fore wings with costa faintly concave in middle and slightly convex before apex, which is blunt; hind margin evenly curved. Hind wings round, with well-rounded hind margin. Antennæ of male filiform; the basal joint long and swollen, subdentate at the top, the shaft thickened at its base and apparently articulated to the basal joint; tongue and ocelli present; labial palpi porrect, broad, flattened, terminal joint blunt and scarcely protruding beyond the scales of the second; maxillary palpi slender, upcurved. Neuration normal.

Type *Arthriobasis lactiguttalis*, sp. n.

There is no hollowing out of the shaft of the antennæ above the basal joint, as in *Coptobasis*.

Arthriobasis lactiguttalis, sp. n.

♂. Wings greyish black, with the exterior line denoted on the costa by a large milk-white blotch, the denticulations of the same line below being more or less marked with white scales; in the cell are four small white spots, of which the third is conspicuous; the submedian fold is interruptedly white, and a whitish spot on the inner margin marks the end of the two transverse lines; base of the fringes with round white spots at end of the veins, the two above the anal angle lengthened. Hind wings with the exterior line picked out with white scales, forming three rounded teeth in the middle; fringes as in fore wings. Head, face, thorax, and abdomen blackish; basal segments of the latter varied with whitish. Underside much whiter; the cell of the fore wings white, showing two ocelloid stigmata.

Expanse of wings 26 millim.

Two males from the Khasia Hills.

Genus Charema, Moore.

Charema scabripennis, sp. n.

Wings dull fuscous, overlaid with very fine and thin long yellowish scales, which give the whole surface a scabrous appearance; the lines darker, but indistinct; first at one third, hardly distinguishable, second at two thirds, running at first parallel to hind margin, forming a slight curve over the medians, and gaining the inner margin beneath the discal spot, which is dark, like the lines; fringes concolorous with a very fine light and dark basal line. Hind wings like fore wings, with a large distinct dark cell-spot and indistinct second line. Head, thorax, and abdomen concolorous with wings. Underside much paler, the yellow scales being predominant; the exterior lines and cell-spots darker.

Expanse of wings 30 millim.

Many examples from the Khasias.

Charema longipennis, sp. n.

Fore wings dark mouse-colour, with a slight olive tinge; lines thick, black, diffuse, first at one fourth, oblique outwards, second at two thirds, forming a strong subdentate sinus in midwing, running in along the first median and finally *obliquely basewards*, approximating to first line on inner margin; fringe concolorous. Hind wings darker, with hardly a trace of lines. Head, thorax, and abdomen concolorous, the latter becoming blackish on hinder segments. Underside pale ash-colour, without markings; tufts of hind tibiæ dull ochreous fulvous.

Expanse of wings 42 millim.

One male from the Khasias.

Genus OMIODES, Guen.

Omiodes nigriscripta, sp. n.

Fore wings dark fuscous fulvous, the lines darker, indistinct; first at one fourth, straight, second at two thirds, bent outwards, but vertical in direction to second median, then incurved to below discocellular and straight to inner margin just beyond middle; a dark linear discocellular mark and a smaller one before it in the cell; fringe paler, with much darker base. Hind wings dark fuscous, slightly fulvous and paler along inner margin, with indistinct discal mark and second line. Head, thorax, and abdomen concolorous. Palpi dark fuscous. Underside of abdomen ochreous white, with a black lateral line on either side ending in a black anal tuft; legs ochreous. Underside of wing clear pale grey, with the discal spots, the exterior line (indicated as spots), the fringe, and the marginal spots all distinct and concise, dark brown.

Expanse of wings 34 millim.

One male, Tenimber.

IDIOSTROPHE, gen. nov.

Closely related to *Omiodes*, but distinguished by the palpi and the male antennæ; the palpi are thick and upcurved in front of face, with the third joint bluntly conical and well separated at its base from the second. The male antennæ are fine, filiform, with a thickened angulation near base, above which the shaft is curved and twisted; the patagia of the male are produced as in *Omiodes*.

Type *Idiostrophe albipunctata*, sp. n.

Idiostrophe albipunctata, sp. n.

Fore wings fuscous, with the lines darker; first line curved, thick, from one fourth of costa to one third of inner margin, followed below the median vein by a small pale spot; in the cell are two indistinct dark fuscous spots, separated by a round hyaline spot; underneath this spot, below the first median, is a similar hyaline spot, dark-edged at either end; second line thick, dark, vertical in its upper and lower thirds, forming a rectangular sinus outwards in the middle; it is edged with dull whitish in lower third, with three white dots between the veins opposite the sinus, and with two dots only above, the costal space being without white dots. Hind wings with a thick blackish discal blotch, with paler on each side; second line as in fore wings, the white edgings broader and plainer, the lower of the two white spots above the sinus large. Underside paler, with the markings clearer.

Expanse of wings 32 millim.

One male from Mackay.

Genus COPTOBASIS, Led.

Coptobasis? subœnescens, sp. n.

Wings wholly dull bronzy fuscous, with the lines and stigmata all a little darker, but very indistinct, the ground-colour beyond each being just a trifle paler; two stigmata in the cell; the exterior line thick at two thirds, curved inwards along the first median; fringes concolorous. Hind wings like fore wings. Head, thorax, and abdomen all dark dusky fuscous. Underside glossy, bronzy.

Expanse of wings 32 millim.

Two females from Queensland.

Probably a *Coptobasis*, but the position must remain doubtful in the absence of the male.

HYPERTHALIA, gen. nov.

Fore wings rather broad; costa slightly curved; hind margin curved obliquely; inner margin curved at base. Hind wings roundish, with rounded hind margin; the inner margin expanded, forming a lobe as long as the wing itself, with its outside edge thickened and a long curved tuft of hairs springing from its base. Abdomen slender, reaching far beyond hind wings, with upcurved lateral tufts; head hairy above; antennæ with basal joint enlarged, finely but shortly ciliated; labial palpi upturned, hairy beneath, truncate at apex, terminal joint very short; maxillary palpi slender, erect; tongue and ocelli present.

Type *Hyperthalia flavicaput*, sp. n.

Hyperthalia flavicaput, sp. n.

Fore wings fawn-colour, tinged with ochreous and dusted with darker, with no markings, but a faint dark paler-edged spot at two thirds of costa, indicating the origin of the second line; fringes concolorous. Hind wings paler, especially towards costa, silky ochreous grey, tinged with fuscous in the disk and towards inner margin; the tuft of hair from the lobe pinkish. Thorax fawn-colour; abdomen paler, more ochreous; head, face, and palpi yellowish. Underside of both wings paler and duller, without markings.

Expanse of wings 22 millim.

One male from the Khasias.

Genus REHIMENA, Wlk.

Rehimena pallidalis, sp. n.

Fore wings dull fulvous ochreous, with the markings pale dull yellow; the whole basal area, a Y-shaped central fascia, and the hind margin are all of the ground-colour; costa along the central area yellow, from which depend at one third a large pear-shaped yellow blotch, and beyond middle a smaller one, separating the arms of the Y; submarginal line indicated by a yellow subapical blotch, which is continued indistinctly to before the anal angle. Hind wings paler, towards the base whitish. Head, thorax, and abdomen fulvous ochreous. Underside the same, but much less distinct.

Expanse of wings 30 millim.

One male from Tenimber.

Gnamptorhiza, gen. nov.

Fore wings elongate; costa straight till shortly before apex; apex produced, subacute; hind margin sinuous, indented below apex, bowed outwards opposite second and third medians, very oblique below; anal angle obtuse. Hind wings with angles rounded and hind margin curved, slightly swollen in middle. Antennæ finely pubescent; the basal joint enlarged, with a small tooth and scales in front, the lower fifth of the shaft incurved; labial palpi thick, upcurved, short, the terminal joint small; maxillary palpi slender, insignificant; ocelli invisible; tongue present; legs slender; hind tibia with four spurs. Neuration normal.

Type *Gnamptorhiza multiplicalis*, sp. n.

Gnamptorhiza multiplicalis, sp. n.

Fore wings straw-colour, with the markings deep reddish brown; costa broadly brown-red to apex, in the centre finely ochreous; marginal line thick, red; all the veins rather bright red; base red-brown, angulated; first line sinuous outwards to near middle of inner margin, red-brown, swollen between the veins; an oblique red-brown spot in cell beyond it and a large oblique quadrate spot on discocellular; second line very wavy, forms a blunt angle outwards opposite the cell, three rounded teeth over the medians, runs in along the third median, making that vein doubly thick, to the median inside of the discal spot, then vertical with two blotched curves to inner margin, where it unites with first line; a wavy interrupted red subterminal line, which forms a red-brown blotch on costa before apex and another at anal angle; fringes ochreous, mottled with reddish, and altogether reddish brown near anal angle. Hind wings with a large subquadrate red-brown central spot, the inner end of which is prolonged along the submedian fold; exterior line distinct only in the middle, not reaching costa nor going beyond the submedian fold; marginal line much swollen; veins reddish in the middle of the wing towards hind margin; a longitudinal reddish blotch above the anal angle; fringe deep red-brown, except between the submedian fold and vein 1, which interval is without marks to the base. Head, thorax, and abdomen ochreous, spotted and suffused with red-brown; the patagia, which are well developed, wholly red-brown; basal one fifth of antennæ thickened, red-brown, the rest ochreous; palpi red-brown. Underside paler, suffused with rosy, with the markings much restricted, only the large discal spots, the blotches at the ends of the subterminal line, and the exterior line being distinct.

Expanse of wings 36 millim.

Three males from the Khasias.

Charitoprepes, gen. nov.

Fore wings elongate; costa straight, becoming convex towards apex; apex decidedly produced, but blunt; hind margin oblique, sinuous, slightly concave below apex and convex in lower part; anal angle obtuse. Hind wings with hind margin entire, curved, with a slight but perceptible bend at the end of the first median nervule. Antennæ (♀) filiform, five sixths of wing; forehead faintly protuberant; tongue present; ocelli invisible; labial palpi short, stout, rounded, upturned and appressed to face, third joint hardly visible; maxillary palpi invisible; legs rather long and feeble. Neuration normal. Scaling fine, glossy; no lines, but two stigmata on fore wings.

Type *Charitoprepes lubricosa*, sp. n.

It is dangerous to erect a new genus on a female type; but the insect appears so entirely different from anything hitherto described, that I venture to think the male will confirm the justice of the view I have taken.

Charitoprepes lubricosa, sp. n.

Fore wings smooth, olive-grey, becoming pearly grey along the hind margin and dusted there with fuscous scales, the veins towards the margin finely dark; the two stigmata, the first small, round, the second, larger and reniform, are darker, as is also the apex of the wing along the costa; middle third of costa pearly white, broadening towards apex. Hind wings like fore wings, with a dark discal blotch; fringes of both wings pearly grey, with a distinct dark basal line and a broken median line; abdomen olive-grey; thorax, head, and face paler, glossy; basal joint of labial palpi white, second and third fuscous olive. Underside whitish, becoming cinereous towards the hind margins of both wings; underside of abdomen and legs pearly white.

Expanse of wings 32 millim.

One female from the Khasia Hills.

Merodictya, gen. nov.

Fore wings elongate; costa straight, becoming slightly curved before apex, which is blunt, somewhat produced; hind margin decidedly oblique, curved, with a blunt elbow in middle; anal angle obtuse. Hind wings rather trapezoidal, both angles rounded, and the elbow in middle of hind margin distinct. Vertex with erect scales; antennæ (♀) filiform, almost as long as fore wings, annulated; labial palpi short, stout, squamose, the third joint very small and almost hidden in the scales of the second; maxillary palpi short, filiform; ocelli present; tongue distinct; hind tibiæ with two pairs of unequal spurs. Neuration: fore wings, cell half the length of wing; discocellular vertical, rather concave; first median at three fourths, second and third from lower angle of cell, lower radial a little above the angle; upper from the junction of the arms of the discocellular; fifth subcostal from upper angle of cell; third and fourth stalked from before the angle, fourth into apex, third starting at three fourths; second subcostal just before the common stem of third and fourth, running parallel to it, first at three fourths: hind wings, cell not half as long as wing; discocellular angulated, the lower arm oblique and prolonged; subcostal bent in the middle, where it approaches the costal; 7 and 8 short-stalked; medians and radial as in fore wings. Scaling rather feeble, reticulated; no distinct lines.

Type *Merodictya subtessellalis.*

Merodictya subtessellalis, sp. n.

Wings whitish ochreous, almost covered with dark wood-brown reticulation and suffusion, with a slight olive tint; costa spotted with white and dark brown; a faint darker oblique line or shade is visible on inner margin at one fourth, not reaching costa; marginal area suffused with dark brown except towards apex and above anal angle, where the whiter ground-colour is merely reticulated with brown; this area is bounded inwardly by an indistinct line, which leaves the costa at five sixths, runs obliquely inwards and nearly parallel to hind margin as far as the second median nervule, along which it runs inwards nearly to end of cell, and thence again parallel to hind margin to inner margin at two thirds; basal half of wing suffused with brown, central area reticulated, very narrow and nearly white on the inner margin, where the basal and hind marginal suffusions nearly meet, with an ill-defined brown cloud on the costa in the middle. Hind wings not suffused, but merely reticulated with brown except at apex; fringes whitish, irregularly mottled with brown, and with a brown basal line; thorax and abdomen olive fuscous, the latter with first a narrow white and then a broad blackish ring at base; palpi, top of face, and two dots at bottom brown; apex of palpi and centre of face whitish. Underside of both wings whitish, reticulated only with brown; legs white, mottled with brown.

Expanse of wings 36 millim.

One female from Queensland.

At first sight the insect reminds one somewhat of certain species of Thyrididæ. The length of the antennæ and the unusual character of the ornamentation will easily distinguish it. It does not appear to be nearly related to any known species.

RADIORISTA, gen. nov.

Fore wings narrow, elongate; costa straight, slightly incurved beyond middle; apex rounded; hind margin oblique, slightly curved. Hind wings broad, with both angles and the hind margin rounded. Fore wings of male with the costa at base strongly folded over and containing a tuft of hairs beneath from base. Head hairy above; antennæ of male with basal joint much swollen, the shaft slight, excurved at base, containing three or four long sharp spikes, then lamellate, thick; labial palpi stout, upcurved, terminal joint small; maxillary palpi slender, erect; forehead slightly bulging, rounded; tongue greatly developed; ocelli present, large.

Type *Radiorista venosa*, Butler (*Heterocnephes*).

The examples of this insect hitherto known were all females.

Genus CYCLARCHA, Swinh.

Cyclarcha pallidicostalis, sp. n.

Fore wings pale straw-colour, suffused with dull smoky grey, with all the veins beyond the middle dark fuscous grey; costa at base narrowly pale, with a large semioval patch before middle, the space before, beyond, and below which is diffusely grey; hind margin grey; costa before apex paler, and a narrow pale space immediately before the dark basal line of fringes; fringes themselves lustrous grey. Hind wings dull smoky grey, with hind margin and fringes as in fore wings; no distinct lines on either wing. Head, thorax, and abdomen grey; face and vertex paler. Underside pale straw-colour, with a darker cloud from costa beyond middle of the fore wings.

Expanse of wings 18 millim.

One male, Khasia Hills.

Cyclarcha paucistrialis, sp. n.

Fore wings pale straw-colour, including the fringes; a dark grey discal spot; an indistinct curved dark grey line beyond middle, not reaching the costa and ill-defined towards inner margin, containing a dark spot on the subcostal and another on the first median nervule; followed by three or four dark grey dashes, indicating a submarginal line. Hind wings with smaller discal dot and dark grey submarginal line, not reaching either costa or inner margin; basal line of fringe finely dark. Head, thorax, abdomen, and whole underside pale shining straw-colour.

Expanse of wings 20 millim.

One male from the Khasias.

It is just possible that this may be a very pale form of Snellen's *striolalis*, but I hardly think it is.

Genus Agrotera, Schrank.

Agrotera griseola, sp. n.

Fore wings with yellow basal area edged by a straight oblique line, and with three black dots near the base, one on costa, one on inner margin, the third in middle; discal mark dark grey, without orange scaling; exterior line hardly sinuous, wavy, slightly indented above inner margin; fringes whitish below apex. Hind wings greyish, deeper grey along the median area; a small black cell-spot, followed by a dark patch of scales, on the edge of the grey area, and with another towards the anal angle; fringe with a dark basal line. Head, thorax, and abdomen yellowish, spotted with orange. Underside duller and paler, the discal spot in fore wings dark and distinct.

Expanse of wings 18 millim.

Several from the Khasias.

Genus Tetracona, Meyr.

Tetracona? pictalis, sp. n.

Fore wings bright lemon-yellow, basal half with a few scattered red scales, and a small red spot in the cell; marginal space yellowish, tinged with grey; a purplish-grey fascia from costa before apex, diffuse outwards, to the inner margin beyond middle, where it is much broader; its upper part is filled in with orange-red above the lower radial, enclosing a triangular yellow costal space, and above the anal angle is an orange-red spot in the fascia; the inner edge of the fascia is vertical, edged above the inner margin with a darker curved line, which projects a little basewards about the submedian fold; fringe pale yellow. Hind wings whitish, semitransparent, more yellowish towards the inner margin, with a diffuse purplish-grey marginal fascia, which contains an orange-red spot, internally edged with dark grey about the middle of the hind margin; another orange-red blotch is at the end of the yellow patch above the anal angle; marginal area below apex briefly yellowish; fringe yellow, becoming purplish grey towards anal angle. Face and patagia yellow; centre of thorax and abdomen orange-red; sides of abdomen yellowish; hind segments of abdomen dark purplish grey; base and terminal joint of palpi yellow; middle reddish brown. Underside yellowish, with brown suffusion in the outer half of the wings; inner margin of fore wings and basal area of hind wings whitish.

Expanse of wings 32 millim.

One female from Queensland.

A very beautiful and conspicuously marked insect.

Genus Goniorhyncus, Hmpsn.

Goniorhyncus flaviguttalis, sp. n.

Fore wings dark olive fuscous, with the lines, which are indistinct and broad, still darker; first line hardly visible; second at two thirds, running at first towards anal angle to middle, then deeply incurved towards base, and again recurved, meeting inner margin about the middle; it is preceded on the costa by a large yellow drop and followed by a small yellowish spot, and both sinuses are edged externally with yellowish; in the cell is a quadrate yellowish spot between two brown ones. Hind wings olive fuscous, with a central sinuous yellow fascia edged with darker fuscous, becoming indistinct towards inner margin, and with its central angulated projection followed by a small yellowish blotch; fringes of both wings fuscous, with small pale spots at base between the veins. Head, thorax, and abdomen all dark fuscous. Underside like upper, but paler and more glossy.

Expanse of wings 24 millim.

Two males from the Khasias.

Genus Thysanodesma, Butler.

Thysanodesma discalis, sp. n.

Fore wings yellow, with the basal area, a subcostal streak, and the whole hind margin broadly fuscous; costa bright yellow; near the base are two broad brown spots, the beginnings of two lines, which are angulated on subcostal, and broadening out unite in forming the fuscous basal area; a third brown spot about the middle of costa gives rise to the first line, which runs obliquely inwards to inner margin at one third; it is followed in the cell by a roundish hyaline scaleless impression, which is in turn followed by a yellow brown-edged discocellular marking, above which is a small brown spot on costa, and beyond this a brown semiannulus; the fuscous margin is bounded inwardly by the exterior line, which runs parallel to hind margin, forms a slight but distinct angle opposite the cell, is incurved so as to touch the discocellular mark, and then runs obliquely inwards to inner margin about the middle: the dark margin contains a yellow costal lunule before apex and a yellowish blotch above anal angle; fringe yellow, with brown apex. Hind wings yellow, with base, discal spot, exterior line, and marginal band brown; fringe as in fore wings. Head, thorax, and abdomen yellowish, marked with brown. Underside the same, but duller.

Expanse of wings 16 millim.

One male from the Khasias.

Thysanodesma eximialis, sp. n.

Fore wings pale straw-colour, almost wholly suffused with purplish fuscous, the only parts unsuffused being the costa on either side of the exterior line, a small patch above anal angle on hind margin, and a squarish space in the cell between the two stigmata, and that is whitish and semitransparent; along the inner margin, especially between the two lines, the suffusion is more sparse; first line at one fourth sinuous, dark fuscous; exterior line at five sixths, starting from dark costal spot, wavy and parallel to hind margin for one third, then forming a rounded sinus, running in along the first median, thickened below the discocellular and waved to the inner margin; first discal stigma roundish, flattened, just beyond first line; second oblong, flattened, beyond the discocellular; both dark-edged; fringes dark fuscous in the middle and at the anal angle, paler between and towards apex; a fine pale line at the base, followed by a dark fuscous one and preceded by a blackish marginal line. Hind wings the same, but the discal and costal areas paler, unsuffused. Head, thorax, and abdomen dark fuscous, mottled with paler; thorax with a whitish tuft behind; abdomen with a white ring near base. Underside paler.

Expanse of wings 16 millim.

Two males from the Khasia Hills.

Thysanodesma fusalis, sp. n.

Fore wings yellowish, with brown suffusion, which is most abundant along the costa for two thirds and in the marginal area, the inner margin being only sparsely dusted with brownish; first line at one fourth, dark brown, angulated on subcostal, then vertical; stigmata with dark edges and paler centres, the first roundish, close to first line; the second kidney-shaped, beyond the discocellular; exterior line dark brown at five sixths, parallel to hind margin for one third, then forming a rounded sinus, bent in and again vertically to the inner margin; it is preceded in the subcostal space by a small brown cloud; marginal suffusion not reaching costa and interrupted above the anal angle; fringes yellowish, dusted with fuscous, with a row of small dark dots at base. Hind wings unsuffused except in marginal area; the inner marginal arm of the outer line appears disconnected from the rest and joins the discal ringlet. Head, thorax, and abdomen yellowish, mottled with fuscous. Underside duller.

Expanse of wings 16 millim.

One female from the Khasia Hills.

Thysanodesma? rosea, sp. n.

♀. Wings canary-yellow, with rosy markings; fore wings with the costa dotted with black-brown; a brownish blotch at base of costa and the two stigmata brown, both very large for the size of the wing, the first oblong, the second quadrate, the two together occupying the whole of the cell; lines rosy, first at one third, indistinct, vertical; second near hind margin, slightly bent just beneath costa, then straight to the first median, where it touches a broad rosy submarginal band, then bends inwards and upwards, touching the lower parts of both stigmata, and reaches the inner margin in the middle; between it and the inner line below the stigmata is another rosy line, which seems partially to run round the inner stigma; fringe yellow, preceded by a broad rosy band. Hind wings yellow; the basal half irregularly suffused with rosy; the second line sharply angulated in the middle of the hind margin, where it touches the rosy submarginal band, and again in the middle of the wing. Underside paler and duller.

Head, thorax, and abdomen yellow, varied with rosy; palpi externally dark blackish brown.

Expanse of wings 12 millim.

One female from the Khasia Hills.

In the absence of the male its proper placc is dubious; the labial palpi are long and sharply rostriform, the maxillary palpi also long; the antennæ thick, lamellate, slightly pubescent beneath.

Genus DIATHRAUSTA, Led.

Diathrausta profundalis, Led.

In the typical form, as depicted in Lederer's figure of this insect, the white costal blotch of the fore wings is well marked and has a blunt apex; the white spots in the fringe, two in the fore wings, and one in the hind wings are pure white and run in quite up to the hind margin, totally obliterating the dark dividing line of the fringes. In the Khasias there occur two forms which differ considerably from the typical one above noticed. In the first, which I propose to call var. *conicalis*, the ground-colour is not so black, more brownish; the costal white blotch is thinner and ends in a point, and the pale blotches in the fringe are not pure white and do not obliterate the dividing line, but only interrupt it; besides, both wings are narrower and smaller. In the other, to which the name *obliterata* may be given, and which is still smaller and as dark as the type form, the costal spot is reduced to a small white patch, and the fringes are dark throughout, besides which, in the hind wings the exterior line, which, both in the type form and in *conicalis*, is evidently twice bent, in this species runs much nearer the hind margin and nearly parallel to it all the way.

Genus DIPLOTYLA, Meyr.

Diplotyla? albilunata, sp. n.

Fore wings deep velvety blackish fuscous; first line at one third, thick, blackish, preceded by a pale fascia, which is distinct and yellow only on the costa; second line before two thirds, parallel to first, but slightly curved outwards in middle, followed by a yellow fascia, which is broadest on costa; space between lines velvety black, except costa, which is deep yellow, and semilunar spot beyond discocellular, which is white and semihyaline; fringe concolorous, but white at anal angle. Hind wings like fore wings, but without first line;

the hyaline cell-spot narrower and exterior line straighter; fringe white at apex as well as at anal angle. Head, thorax, and abdomen dark fuscous, the latter slenderly ringed with yellow and yellowish at apex; palpi and tongue yellowish. Underside duller, not velvety, with the markings more distinct; inner margin of fore wings whitish ochreous.

Expanse of wings 17 millim.

One female from the Khasias.

Diplotyla? flexiguttalis, sp. n.

Fore wings dark fuscous brown, with the lines deep velvety brown, but diffuse and indistinct; basal line oblique, straight, cell filled up with deeper brown, with a small yellow spot in the middle and two deep brown longitudinal streaks beneath it along the submedian fold and vein; costa from first line narrowly yellow, ending in a large triangular costal spot at two thirds, the apex of which is bent outwards; this blotch is bounded by the sinuous exterior line, beyond which a small additional yellow costal spot is seen. Fringe fuscous, pale at anal angle. Hind wings and fringes fuscous, the fringe paler *before* the anal angle. Head, thorax, and abdomen dark fuscous. Underside paler, duller; the hind wings with traces of paler markings.

Expanse of wings 24 millim.

One female from the Khasias.

Diplotyla vestigialis, sp. n.

Fore wings blackish fuscous, with the stigmata and lines pale; a large white semitransparent spot beyond the discocellular, a smaller round one before it in the cell, and a very minute one before the first line; first line indistinctly pale, outwardly oblique near base; second line starts as a white costal spot at three fourths, forms a wavy vertical line from the subcostal to the first median, with a slight indentation opposite the cell, runs inwards along the first median till beneath the discocellular, then obliquely sinuous to inner margin; fringes concolorous. Hind wings the same; the exterior line forms a very deep angulation, producing a pale line from anal angle to near middle of wing (which unites with the pale edge of the dark discal spot), and a pale blotch near middle of hind margin; fringes slightly paler. Head, thorax, and abdomen concolorous; abdomen of male with a white ring on second segment and white blotch on anal segment; abdomen of female yellowish at apex. Underside paler, greyish, with the markings very distinct; the dark intervals between the white cell-spots showing as square stigmata, and all the white markings well defined. In the female the disk of the fore wings is whitish.

Expanse of wings 26 millim.

One male and one female from Queensland.

Differs from other species of the genus by the distinctness of the pale lines throughout.

Genus THYSANODESMA, Butler.

Thysanodesma elongalis, sp. n.

Fore wings yellowish, but, except along the costa, overlaid with smoky black; a black spot at extreme base; first line blackish, outwardly oblique, at one fourth, followed immediately by a black-edged orbicular stigma; second line from costa at five sixths starts from a round spot, runs obliquely inwards parallel to hind margin to above anal angle, then bends and runs parallel to inner margin, and touches the base of the reniform stigma, and again runs parallel to hind margin, reaching inner margin near the first line; reniform stigma large, black-edged, with a black costal streak touching it above; a small costal streak beyond it before the second line; fringe yellowish, the extreme hind margin less suffused with smoky. Hind wings smoky black, except the hind margin, which remains yellowish, as well as the fringe. Head, thorax, and apex of abdomen yellowish, rest of abdomen smoky brown. Underside dull smoky grey, except costa of fore wings and hind margin of hind wings.

Expanse of wings 22 millim.

One male from the Khasias.

METOECA, gen. nov.

Fore wings elongate, narrow; costa straight, only faintly curved just at apex; apex blunt; hind margin oblique, hardly curved. Hind wings triangular, with slightly curved hind margin. Antennæ of male lamellate; palpi stout and short, upright before face; top of second joint truncate and raised behind, the terminal joint very short and scarcely projecting beyond top of second; maxillary palpi invisible; tongue and ocelli present. Neuration normal.

Type *Metoeca fœdalis*, Guen. (*Isopteryx*).

Metoeca amplificata, sp. n.

Fore wing stone-colour, dusted and suffused with fuscous; the lines blackish; the space on either side of the exterior line of the clear ground-colour, without fuscous atoms; first line at one fourth, starting from a dark costal spot, curved and bent outwards on subcostal; exterior line at three fourths, starting from a large black costal spot, straight and vertical to the lower radial, curving outwards, finely denticulate over the median nervures, then running in basewards, and finishing as a wavy line beneath the discal spot, which is distinct, blackish; marginal area suffused with fuscous, the median and basal areas more dusted with it; fringe paler stone-colour, with two indistinct darker lines, and a black line at base, preceded by a narrow patch of pale ground-colour. Hind wings the same. Head and thorax ochreous mixed with fuscous. Abdomen yellowish; anal segment with first a black, then a broader whitish ring. Underside dull cinereous, with the markings faint.

Expanse of wings 22 millim.

One male from the Khasias.

Preneopogon, gen. nov.

♂. Fore wings narrow, elongate; costa straight, slightly convex before apex; apex produced, subacute; hind margin curved, very oblique. Hind wings narrow, with hind margin curved. Antennæ simple, annulated, three fourths of the length of wing; the basal joint much swollen; vertex hairy; tongue prominent; palpi much enlarged, dependent vertically, clothed with dense hair, which projects laterally from the basal joint. (In the female the palpi are globose below the face, with rough hair-like scales sticking out on all sides, and the maxillary palpi, which are completely hidden in the male, are broadly truncate at their ends.) Fore legs with tibia and first joint of tarsus, which is greatly enlarged, hairy, the tibia with a tuft of long hairs from the base; other legs slender, the hind tibiæ with four slender spurs. Anal segment with a very large expansible tuft from beneath base of claspers, which are themselves greatly enlarged and ear-shaped.

Type *Preneopogon barbata*, sp. n.

Preneopogon barbata, sp. n.

Fore wings stone-colour, suffused in parts with fine fuscous atoms and shading; basal area and subcostal streak darkest; first line quite close to base, blackish, angulated in middle, and bent outwards before inner margin, followed immediately in the cell by a small dark-edged ocellus similar to that which stands on the discocellular; above and beyond this second ocellus is a costal half-ring, followed by a smaller one, and some black subapical markings; second line at two thirds forms an irregularly waved sinus outwards, then is curved inwards to beneath the discocellular, and ends on inner margin nearly in middle; hind marginal area, except just beyond this line, suffused with fuscous; a row of small black dots along hind margin; cilia pale, with two dark lines. Hind wings like fore wings, but without first line and ocellus. Head, thorax, and abdomen ochreous mixed with fuscous; basal segments of abdomen paler, the second with a blackish ring. Palpi dark fuscous; legs pale ochreous. Underside like upper, but somewhat duller; hind wings with an additional line from inner margin within the submarginal. The female is paler, more smoothly scaled, the suffusion being ochreous rather than fuscous, and the ocelli and lines are darker and more distinct.

Expanse of wings 22 millim.

One male, one female, from the Khasias.

Genus Pleonectusa, Led.

Pleonectusa pallidalis, sp. n.

Fore wings pale silky ochreous, finely dusted with sandy; costa brown close to base; lines pale fuscous, first near base, very obscure, followed by a minute dark dot in cell; discocellular spot oblong, brown, edged outwardly with paler; exterior line curved outwards from three fourths of costa to three fourths of inner margin; a fine dark marginal line and a thicker basal line to the fringes, which are quite pale ochreous. Hind wing the same, with exterior line only. Head, thorax, and abdomen all sandy ochreous. Underside paler and duller.

Expanse of wings 24 millim.

One male from the Khasias.

This species is very decidedly paler, more ochreous, than *admixtalis*, Wlk. There are in the British Museum collection four specimens from North-west India placed under *admixtalis* which approach the present species in coloration, and may belong to it; but these have the two marginal lines and the costa of fore wings more strongly marked.

Pleonectusa subpurpurescens, sp. n.

Fore wings dull dark brown, with a slight purple tint; a darker discal spot and slightly curved exterior line at three fourths; fringe unicolorous. Hind wings rather paler, bronzy tinted. Head, thorax, and abdomen bronzy brown, the latter becoming dull whitish towards the anal segments. Underside dark purplish brown; costal region of hind wings pale straw-colour.

Expanse of wings 26 millim.

One male from the Khasias.

Distinguished by the deep purplish brown of the underside.

Genus Stenia, Guen.

Stenia carbonalis, sp. n.

Fore wings glossy, deep brown-black, without any markings: hind wings the same. Head, thorax, and abdomen concolorous; antennæ pale, with dark rings. Underside greyish black.

Expanse of wings 16 millim.

One male from the Khasias.

I leave this at present in *Stenia*. Only the third and fourth subcostals of the fore wings are stalked, the first, second, and fifth being free; the last from below the end of cell; the palpi are slender, porrect, and the terminal joint plain.

Genus Metasiodes, Meyr.

Metasiodes indecisalis, sp. n.

Fore wings ochreous, almost entirely overrun with purplish fuscous; the lines black, thick and somewhat obscure; first line thick on costa, oblique inwards, parallel to hind margin, preceded by a paler line, which is yellow on costa, basal area within it purplish fuscous; a small spot in the cell just beyond the first line and a large black one at end of cell with a black costal spot above it; second line at two thirds much curved outwards, and then inwards to below discal mark, whence it runs straight to inner margin; marginal area purplish fuscous; fringe-line broad, black; fringe itself glossy, pale ochreous, except in the middle, where it is dark. Hind wings smoky fuscous, somewhat paler towards base, with a black discal spot, and a much curved and sinuous black outer line; fringes wholly fuscous. Head, thorax, and abdomen ochreous, much mottled with fuscous. Underside paler and duller.

Expanse of wings 18 millim.

One female from the Khasias.

Genus CANGETTA, Moore.

Cangetta albocarnea, sp. n.

Fore wings dull greyish pink; first line at one fourth darker, vertical, followed on inner margin by a small white blotch; second line at three fourths vertical, but slightly and irregularly wavy, preceded on costa by a whitish space, which forms a tooth reaching to mid-wing; a slight dark discal spot; fringes paler, preceded along the hind margin by a rather concise deeper-tinted brownish-pink narrow fascia. Hind wings like fore wings, with no first line, and the second line curved, and towards the anal angle incurved and angulated. Head, thorax, and abdomen dull flesh-colour; face and palpi paler, almost white; antennæ annulated. Underside duller, otherwise like upperside, except that the outer line on fore wing is differently situated, being oblique for the first two thirds, then bent in slightly and angulated.

Expanse of wings 16 millim.

One male from the Khasias.

Genus CALLINAÏAS, Swinh.

Callinaïas nigripalpis, sp. n.

Fore wings glossy pale ochreous, becoming deeper ochreous beyond the second line; first line curved just before the middle; second line also curved and parallel to first and to hind margin beyond the middle; the central space palest; fringes paler, with a darker rather thick basal shade. Hind wings like fore wings. Head, thorax, and abdomen concolorous with wings; face and outside of palpi almost black. Underside glossy ochreous, with no inner line to either wing, and the outer from two thirds of costa, curved outward to inner margin just before anal angle.

Expanse of wings 16 millim.

One male from the Khasias.

This probably is not a true *Callinaïas*, but the palpi are so much distorted and damaged that it is difficult to say what their original position and direction was.

ERISTENA, gen. nov.

Fore wings very narrow and elongate; costa straight; apex produced, but blunt; hind margin oblique, rounded off at anal angle. Hind wings long and narrow, the inner margin short; hind margin hardly curved, with two bends, one at end of third median, the other at end of submedian fold; a slight indentation below apex, which is prominent and bluntly rounded; legs long and slender. Antennæ lamellate, the edges of the joints slightly projecting, long, but curled round towards tips. Labial palpi upcurved in front of face; second joint with long hairs beneath, terminal acute; maxillary palpi distinct; tongue present. Cell of fore wings quite two thirds, first median some distance before end; second and third medians and lower radial close together from lower end of cell; upper radial well below the upper end of cell; last subcostal from the end; second, third, and fourth stalked from shortly before end; first subcostal free. Hind wings: second subcostal from the angle of cell; first anastomosing with costal till just before hind margin; discocellular very oblique; radial and third median on longish stalk; second median from lower angle, first considerably before angle. Scaling smooth and glossy, with few and indistinct markings.

Type *Eristena murinalis*, sp. n.

Eristena murinalis, sp. n.

Fore wings pale mouse-colour, in the male with no markings but the slightly darker cell-spot and an ill-defined exterior line just beyond it; fringe concolorous, with a fine pale basal line, followed by a thick darker one. Hind wings whitish for two thirds; like fore wings in the marginal area, beyond a curved, slightly wavy, subterminal line. In the female the fore wings are shorter, slightly tinged with ochreous; the exterior line is distinct, being edged with paler, and forming a slight sinus outward in the middle, and the discal dot is preceded by an indistinct vertical darker shade; the hind wings are paler, with discal dot and subterminal line more distinct. Head, thorax, and abdomen all concolorous, paler in female than in male. Underside glossy, with hardly any markings; the fore wings darker than the hind ones.

Expanse of wings, ♂ 20, ♀ 18 millim.

A long series from the Khasias.

[To be continued.]

XXI.—*A Revision of the British Jurassic Bryozoa.*—Part IV. *The Genera* Reptomultisparsa *and* Diastopora. By J. W. GREGORY, D.Sc., F.G.S.

[Continued from p. 48.]

Family **Tubuliporidæ** (concluded).

Genus REPTOMULTISPARSA, d'Orbigny, 1852.

Diagnosis.—Tubuliporidæ in which the zoarium is encrusting and consists of thick multilamellar sheets. The zoœcia are cylindrical and parallel to the surface upon which the zoarium has grown. The peristome is flush or slightly raised.

Type species: *R. microstoma* (Mich.), syn. *R. diluviana*, Edw. & Mich. (non Lamx.).

Affinities.—This genus was founded by d'Orbigny for thick multilamellar species allied to *Berenicea.* The division seems to me convenient. The first of the five species referred to the genus by d'Orbigny, which is accordingly here taken as the type, is the *Diastopora diluviana*, Edw. & Mich. (non Lamx.). This, however, I regard as the same as Michelin's *Diastopora microstoma.*

1. *Reptomultisparsa undulata* (Michelin), 1846.

Diastopora undulata, Michelin, 1846, Icon. Zooph. p. 242, pl. lvi. fig. 15.
Berenicea undulata, d'Orbigny, 1852, Pal. franç., Terr. crét. t. v. p. 860.
Berenicea microstoma (non Mich.), Haime, 1854, Bry. Jur., Mém. Soc. géol. France, sér. 2, t. v. p. 178, pl. vii. fig. 3.
Diastopora microstoma, var. *connectens*, Vine, 1884, Polyz. Rich. Bor., Quart. Journ. Geol. Soc. vol. xl. p. 789.

Diagnosis.—*Zoarium* in large, thick, irregular encrusting sheets, which in the adult completely bury the shell they encrust. Young forms are flabelliform.

Zoœcia long or medium in length. Young zoœcia are seen throughout. The more adult peripheral zoœcia are crowded, and thus not wholly seen. Surface traversed by sinuous raised ridges.

Peristomes slightly raised, irregularly distributed.

Formula.—1/1″ 0 2 *i* 0.

Distribution.—England: Great Oolite, Richmond boring, Bradford Clay, Bradford. Foreign: Bajocian and Bathonian, France and Germany.

Genus Diastopora, Lamouroux, 1821 (emended).

Diagnosis.—Tubuliporidæ in which the zoarium is erect and foliaceous. (The zoarium consists of simple fronds or may be split up into multifid segments, or may grow in hemispherical masses by the crumpling of the fronds, or may be cylindrical, or may be reteporiform.) The zoarium is unilaminate or bilaminate. The zoœcia are tubular. The peristomes are flush or raised only a small proportion of the length of the zoœcia. The oœcia are closed, slightly enlarged zoœcia.

Type species: *D. foliacea*, Lamouroux.

1. *Diastopora foliacea*, Lamouroux, 1821.

Diastopora foliacea (pars), Lamouroux, 1821, Expos. méth. p. 42, pl. lxxiii. figs. 1, 2 (non figs. 3, 4).
Eschara foliacea, Bronn, 1835, Leth. Geogn. Bd. i. p. 241.
Elea foliacea, Brauns, 1879, Bry. mitt. Jura, Metz, Zeit. deut. geol. Ges. Bd. xxxi. p. 313, pl. vi.
Berenicea foliacea, Vine, 1880, Review Diastoporidæ, Quart. Journ. Geol. Soc. vol. xxxvi. p. 357.
Diastopora Eudesiana, M.-Edwards, 1838, *op. cit.* p. 225, pl. xiv. fig. 1.
Bidiastopora Eudesia, d'Orbigny, 1849, Prod. Pal. t. i. p. 317.
Mesenteripora Eudesia, d'Orbigny, 1852, Pal. franç., Terr. crét. t. v. p. 808.
Berenicea Eudesiana, Vine, 1880, Review Diastoporidæ, Quart. Journ. Geol. Soc. vol. xxxvi. p. 357.
Bidiastopora mæandrina, d'Orbigny, 1849, Prod. Pal. t. i. p. 289.
Diastopora mettensis, Haime, 1854, Bry. Jur., Mém. Soc. géol. France, sér. 2, t. v. p. 190, pl. viii. fig. 10.
Bidiastopora macropora, d'Orbigny, 1852, Pal. franç., Terr. crét. t. v. p. 799.
Diastopora macropora, Haime, 1854, *op. cit.* p. 191.
Diastopora petaloides, Waagen, Zone *Amm. Sowerbyi*, Geogn. Pal. Beitr. Bd. i. Heft 3, p. 645.

Diagnosis.—Zoarium loose and open, the fronds being generally broad, thin, and only slightly contorted; bilaminate.

Zoœcia visible throughout, the zoœcia being long and the apertures distant from one another and irregular in arrangement; the zoœcia are regularly cylindrical.

Peristomes well raised, giving a rough aspect to the zoarium.

Gonœcia simple closed zoœcia.

Formula.—2 0 3 *fr i* 0.

Distribution. — British: Inferior Oolite — Cornbrash. Foreign: Bajocian, Germany; Bathonian, France.

2. *Diastopora Davidsoni*, Haime, 1854.

Diastopora Davidsoni, Haime, 1854, Bry. Jur., Mém. Soc. géol. France, sér. 2, t. v. p. 185, pl. viii. fig. 9.
Diastopora Wrighti, Haime, 1854, *op. cit.* p. 186, pl. viii. fig. 5.
Diastopora foliacea (non Lamx.), Morris, 1843, Cat. Brit. Foss. p. 35 (*fide* Haime).
Diastopora Terquemi, Haime, 1854, *op. cit.* p. 187, pl. viii. figs. 7 *a–d*.
Diastopora scobinula (non Mich.), Haime, *op. cit.* p. 186, pl. viii. fig. 6.
Mesenteripora scobinula (non Mich.), Sauvage, 1889, Bry. Jur. Boul., Bull. Soc. géol. France, sér. 3, t. xvii. p. 49.

Diagnosis.—Zoarium loose, composed of broad and fairly flat fronds; bilaminate.

Zoœcia visible throughout their length or almost so; their length is medium, and in shape they are regularly cylindrical.

Peristomes slightly raised, but not reflexed; they are mostly arranged in fairly regular oblique lines.

Formula.—1 0 2 *r* 0.

Distribution.—England: Inferior Oolite and Great Oolite. Foreign: Bajocian, France and Germany; Bathonian, France.

3. *Diastopora Michelini* (Blainville), 1830.

Mesenteripora Michelini, Blainville, 1830, Dict. Sci. nat. t. lx. p. 397.
Diastopora Michelini, M.-Edwards, 1838, Mém. Cris., Ann. Sci. nat. Zool. sér. 2, t. ix. p. 226, pl. xiii. fig. 1.
Bidiastopora Michelini, d'Orbigny, 1849, Prod. Pal. t. i. p. 317.
Mesenteripora dædulea, Blainville, 1830, Dict. Sci. Nat. t. lx. p. 397.
Diastopora foliacea (non Lamx.), Michelin, 1846, *op. cit.* p. 239, pl. lvi. fig. 8.
Bidiastopora microphylla, d'Orbigny, 1849, Prod. Pal. t. i. p. 317.
Mesenteripora microphylla, d'Orbigny, 1852, Pal. franç., Terr. crét. t. v. p. 808.
Diastopora microphylla?, Haime, 1854, Bry. Jur., Mém. Soc. géol. France, sér. 2, t. v. p. 191.
Bidiastopora latifolia, d'Orbigny, 1852, Pal. franç., Terr. crét. t. v. p. 799.
Diastopora latifolia, Haime, 1854, *op. cit.* p. 191.
? *Diastopora conferta*, Reuss, 1867, Bry. braun. Jura Balin, Denks. k. Akad. Wiss. Wien, Bd. cxxvii. p. 10, pl. ii. fig. 6.

Diagnosis.—Zoarium hemispherical, formed of interlocking contorted bilaminate fronds. The surface appears cerebriform, as the sinuous edges of the fronds are separated by narrow depressions.

Zoœcia short and very crowded, only visible at the distal end.

Peristomes well raised ; zoœcia fusiform. The distribution of the peristomes is along irregular curved lines; but in some places the linear arrangement is not apparent.

Formula.—2 1 1″ (*r*) 2.

Distribution.—England : Inferior Oolite—Forest Marble. Foreign : Bajocian, Germany ; Bathonian, France and Austria.

4. *Diastopora lamellosa*, Mich., 1846.

Diastopora lamellosa, Michelin, 1846, Icon. Zooph. p. 241, pl. lvi. fig. 11.
Mesenteripora lamellosa, Sauvage, 1889, Bry. Jur. Boul., Bull. Soc. géol. France, sér. 3, t. xvii. p. 50.
Non *Bidiastopora lamellosa,* d'Orbigny, 1850, Prod. Pal. t. ii. p. 266.
Eschara Ranvilliana, Michelin, 1846, *op. cit.* p. 243, pl. lvii. fig. 12.
Elea Ranvilliana, d'Orbigny, 1852, Pal. franç., Terr. crét. t. v. p. 628.
Lateromultelea Ranvilliana, d'Orbigny, 1852, *op. cit.* p. 629.
Diastopora cervicornis, Michelin, 1846, *op. cit.* p. 241, pl. lvi. fig. 12.
Bidiastopora cervicornis, d'Orbigny, 1849, Prod. Pal. t. i. p. 317.
Elea cervicornis, d'Orbigny, 1852, Pal. franç., Terr. crét. t. v. p. 628.
Bidiastopora ramosissima, d'Orbigny, 1849, Prod. Pal. t. i. p. 317.
Diastopora ramosissima, Haime, 1854, *op. cit.* p. 190, pl. ix. fig. 3.
Elea ramosissima, d'Orbigny, 1852, Pal. franç., Terr. crét. t. v. p. 628.
Bidiastopora luciana, d'Orbigny, 1849, Prod. Pal. t. i. p. 317.
Multisparsa luciana, d'Orbigny, 1852, *op. cit.* p. 870, pl. 761. figs. 1–3.
Diastopora luciana ?, Haime, 1854, *op. cit.* p. 191.
Diastopora fenestrata, Reuss, 1867, Bry. braun. Jura Balin, Denks. k. Akad. Wiss. Wien, Bd. cxxvii. p. 11, pl. ii. fig. 5.

Diagnosis. — *Zoarium* bilaminate, forming either thin, broad, crumpled fronds or thick narrow branches.

Zoœcia short and broad, fusiform.

Peristomes slightly raised, not crowded, quincuncially arranged.

Formula.—1 2 1 *r* 0.

Distribution.—England : Inferior Oolite—Bradford Clay. Foreign : Bajocian, Germany ; Bathonian, France and Austria.

5. *Diastopora calloviensis* (d'Orbigny), 1852.

Elea calloviensis, d'Orbigny, 1852, Pal. franç., Terr. crét. t. v. p. 629.
Diastopora calloviensis, Haime, 1854, Bry. Jur., Mém. Soc. géol. France, sér. 2, t. v. p. 191.
? *Diastopora subramosa,* Waagen, 1868, Zone *Amm. Sowerbyi,* Geogn. Pal. Beitr. Bd. i. Heft 3, p. 645, pl. xxxiii. figs. 9, 10.

Diagnosis.—*Zoarium* of loose tufts, composed of bands which branch irregularly ; bilaminate.

Zoœcia long, broad, and regular in shape.

Peristomes distant and well raised, irregularly distributed ; zoœcia visible throughout their length.

Formula.—1″ 0 2″ *i* 0.

Distribution.—England : Inferior Oolite, near Leckhampton. Foreign : Bathonian and Callovian, France.

6. *Diastopora Lamourouxi*, M.-Edw.

Diastopora Lamourouxi, M.-Edwards, 1838, Mém. Cris., Ann. Sci. nat. Zool. sér. 2, t. ix. p. 225, pl. xv. fig. 2.

Diastopora foliacea, pars, Lamouroux, 1821, Expos. méth. pl. lxxiii. fig. 3.

Diastopora Waltoni, Haime, 1854, Bry. Jur., Mém. Soc. géol. France, sér. 2, t. v. p. 184, pl. viii. figs. 2 *a*, *b*.

Diagnosis.—*Zoarium* unilaminate, growing in irregular tubes, which may branch repeatedly or broaden into funnel-shaped expansions.

Zoœcia usually visible throughout, the zoœcia being long and the apertures usually distant.

Peristomes (in well-preserved specimens) highly raised and irregular in distribution, though occasionally there is a tendency towards a quincuncial system. Zoœcia regularly cylindrical.

Formula.—3 0 2 *i* 0.

Distribution.—England: Inferior Oolite. Foreign: Bajocian, Germany; Bathonian, France and Austria.

Synopsis of Species.

I. Zoœcia cylindrical.
  A. Zoarium bilaminate.
    a. Zoœcia visible throughout.
      Zoarium frondose :
        peristomes well raised and their distribution irregular .... *foliacea.*
        peristomes slightly raised and their distribution subregular.......... *Davidsoni.*
      Zoarium ribbon-shaped :
        peristomes raised and their distribution irregular .... *calloviensis.*
    b. Zoœcia visible at ends .... *Michelini.*
  B. Zoarium unilaminate.......... *Lamourouxi.*

II. Zoœcia lozenge-shaped .... *lamellosa.*

XXII.—*On the Isopod Genus* Leptochelia.

By the Rev. Thomas R. R. Stebbing, M.A., F.L.S.

While recently exploring Dana's great Atlas of Crustacea for certain objects, I found my attention arrested in passing by the figures of his *Leptochelia minuta*. These drawings and the text relating to them, as well as a still earlier account in the 'American Journal of Science,' produced the painful impression that, so long ago as 1849, the famous American naturalist must have taken advantage of my inexperience in such matters at that period to predescribe on his own account *my Dolichochelia Forresti*. As he is unhappily beyond the reach of any personal expostulations, I will only suggest that the two points in which his account differs from mine may safely be ignored. He draws a line by which the head is marked off both dorsally and laterally from the large first segment of the peræon. But both the West-Indian specimens described in the Ann. & Mag. Nat. Hist. last month and the general character of the family Tanaidæ warrant the inference that no such line existed, though, while the family character was insufficiently known, its presence might well have been thought necessary. In the next place, the first antennæ are said by Dana to have the "base" or peduncle four-jointed, with the second joint the longest, from which it is clear that he has taken the dilatation of the proximal end of the long first joint as a separate joint. Kröyer, before him, had done the same thing in a parallel case, and probably misled his successor. There is good reason to know that, with specimens only a tenth of an inch long, it was not difficult forty or fifty years back to make such mistakes as these.

Dana reports his specimen as coming "from among seaweed and small corals, Feejees, Island of Ovalau," and further remarks:—"This species is Caprelloid in habit. It was observed by the author attached by its hinder legs to seaweed, and reaching out the long arms in different directions as if in search of prey."

That a minute shallow-water organism like this *Leptochelia* should as yet be recorded only from two localities so extremely remote from one another as the Leeward Islands and the Fijis is at first sight rather striking. But, however the distribution may have been effected, probably the species will be found to occur at many intermediate stations whenever research is more generally directed than it has been hitherto to the inconspicuous occupants of the coast-lines of the globe.

The exact character of Dana's genus has long remained misunderstood. This is partly to be explained by the circumstance that Dana's writings are often almost as inaccessible as they are celebrated. *Leptochelia*, with its type species *minuta*, was first described in the 'American Journal of Science,' vol. viii. p. 425, 1849. A fuller account was given in the 'Crustacea of the U.S. Exploring Expedition, 1852–53,' wherein the remark is made that "*Tanais Edwardsii* of Kröyer (Tids. iv. 1842) is of this genus." Figures of the type species were published in the Atlas in 1855.

It must be borne in mind that, besides the extremely slender and elongate first gnathopods, the type species has very long upper antennæ, in which the second joint is unusually elongate as well as the first, and biramous uropods, in which the small outer branch has two joints. Dana says :—"Caudal stylets as long as abdomen, longer branch six-jointed, shorter minute, two- or three-jointed." The appearance of a third joint may have been produced by the crossing or apical meeting of two setules. In the *Tanais Edwardsii* of Kröyer, to which Dana refers, the gnathopods are stouter, the second joint of the upper antennæ is by Kröyer's account not more than a quarter as long as the first, and the outer branch of the uropod is distinctly one-jointed. When Bate and Westwood in 1866 adopt the genus *Leptochelia* for Kröyer's species, they declare that the uropods are "unibranched," distinguishing the genus from *Paratanais* by the fact that the pleon "has only a single branch to the caudal pair of pleopoda attached to the sixth segment;" and again, in their specific description, they repeat that "the posterior or caudal pair of pleopoda consist of a single multiarticulate branch." They give not the slightest intimation that both the authors to whom they refer had described the appendages in question as double-branched. In 1878 the late Oscar Harger, in his 'Report on the Marine Isopoda of New England and adjacent waters,' makes Dana's *Paratanais* a synonym of *Leptochelia*, supposing the former genus merely to represent the females of the latter, but at the same time being well aware of the structure of the uropods in the various species which he groups under the same generic name; so that he says in regard to the uropods, "the outer ramus may also consist of more than one segment." He remarks, too, that the type species, "*L. minuta*, possesses all the characters of *Paratanais* that could occur in the male." This way of putting it was not sufficiently direct to warn other writers of the differences between Dana's species and the *Tanais Edwardsii* of Kröyer, with which Dana had himself compared it. Accordingly in 1880, and again in 1886, Professor G. O.

Sars (followed in the latter year by Norman and Stebbing) assigns to *Leptochelia* two characters which are not appropriate to the type—one, that the upper antennæ in the male have the flagellum adorned with bundles of sensitive cilia; the other, that the outer branch of the uropods is uniarticulate. He mentions also that the immobile finger of the gnathopods is strongly tuberculate within, whereas in *L. minuta* it is very weakly tuberculate. Beddard also, in 1886, in his Report on the 'Challenger' Isopoda, when describing his genus *Neotanais*, says that, "as in *Heterotanais*, the exopodite of the uropoda is distinctly two-jointed, and this character distinguishes both genera from *Leptochelia*, Dana." Lastly Hansen *, in 1895, figures the uropods of his *Leptochelia affinis* with the outer branch one-jointed.

Thus we find, according to the various accounts of the genus *Leptochelia*, that the uropods have no outer branch and that they have an outer branch, and in the latter case that the branch is one-jointed, that it is one- or two-jointed, that it is two- or three-jointed, or that it is two-jointed. The last view I believe to be the correct one, so far as the type species is concerned.

The following list shows the species which have been referred to *Leptochelia*, and distinguishes the character of the uropods:—

	Inner branch.	Outer branch.
Leptochelia minuta, Dana, ♂	6-jointed.	2-jointed.
—— *limicola*, Harger, ♀	4-5-jointed.	2-jointed.
(This species and *Paratanais tenuis*, G. M. Thomson, are considered by Sars to belong to his *Heterotanais*, although Thomson says of his species that the outer branch is 1-jointed.)		
—— *cæca*, Harger	2-jointed.	2-jointed.
(This is referred by Sars to his genus *Leptognathia*.)		
—— *filum* (Stimpson)................	4-5-jointed.	Nothing known.
—— *rapax*, Harger, ♂ ♀	5-jointed.	1-jointed.
(The gnathopods of the male and, to a less extent, its first antennæ are remarkably like those of *L. minuta*.)		
—— *Edwardsii* (Kröyer), ♂	8-6-jointed.	1-jointed.
(This is recognized as a synonym of the next species.)		

* In the Ann. & Mag. Nat. Hist. for last month, p. 52, line 13, for "Dr. H. J. Hansen gives," I should have said "Dr. Hansen refers to."

	Inner branch.	Outer branch.
Leptochelia Savignyi (Kröyer), ♀	7-jointed.	1-jointed.
—— *dubia* (Kröyer), ♂ ♀	6-jointed.	1-jointed.
—— *algicola*, Harger, ♂ ♀	6-jointed	1-jointed.
(This species is supposed by Sars to correspond partly to *L. dubia* (Kröyer) and partly to *L. Savignyi* (Kröyer).)		
—— *brasiliensis* (Dana), ♀	6-jointed.	Nothing known.
—— *neapolitana*, Sars, ♂ ♀	6-jointed.	1-jointed.
—— *affinis*, Hansen, ♀	4-jointed.	1-jointed.

Of these twelve specific names *Edwardsii* and *algicola* may be dismissed as synonyms, *filum* and *brasiliensis* as having no certainty of position, *cœca* as obviously belonging elsewhere. The reasons for referring *limicola* to *Heterotanais* are somewhat hypothetical, since *limicola* is known only in the female, while the principal distinction of *Heterotanais* consists in the gnathopods of the male, which, instead of being strongly chelate, are very imperfectly so. The group formed by *Savignyi*, *dubia*, and *neapolitana* presents no difficulty in itself, and might very well be separated under a new generic name from *Leptochelia minuta*. But to this *Leptochelia rapax* interposes an obstacle, for this species agrees with the group just mentioned in having the one-jointed outer ramus of the uropods, but agrees very closely with *L. minuta* in the elongate gnathopods of the male, with feebly tuberculate immobile finger, and in the considerable elongation of the first antennæ.

For the present, therefore, it seems advisable to leave the five species last-named as constituents of the genus *Leptochelia*, making the definition of it more comprehensive by recognizing that the outer ramus of the uropods may be either one- or two-jointed, and by omitting such details in regard to the antennæ and gnathopods as have been found to be unsuitable to some of the species. *L. dubia* seems to be rather doubtfully distinguishable from *L. Savignyi*.

Hansen's species, published last year, was described from a single female specimen taken at St. Vincent, Cape Verde Islands. Hansen considers that, on the whole, it makes a near approach to *Leptochelia dubia* (Kröyer), but he remarks that it differs from all hitherto described species of the genus in having only four joints on the inner branch of the uropods. In this respect it will be observed that it makes an approach to *Leptochelia rapax*, and, by accepting *affinis* as a sixth species of *Leptochelia*, we permit the inner ramus of the uropods to consist of either four, five, six, seven, or eight joints. Bate and Westwood, by their description of *Leptochelia Edwardsii*, would carry the number up even to nine; but in their figure, with unexplained inconsistency, they represent only six.

"*Tanais* (*Paratanais*?) *brasiliensis*" is described by Dana as having the caudal stylets simple, six-jointed. But he recognizes the chance of his having overlooked the outer branch of the uropods and the likeness of the species to Kröyer's *Tanais dubius.* Sars accepts it as *Leptochelia brasiliensis.* Yet, though it is probably the female of some *Leptochelia*, specifically it remains indeterminate.

The only other *Paratanais* described by Dana is *Paratanais elongatus* from "the Sooloo Archipelago." This, therefore, is the type, and it has the inner branch of the uropods two-jointed, the outer one-jointed, whereas in this genus, as redefined by Sars, each branch of the uropods has two joints. Here also, perhaps, a slight modification of the definition will suffice.

XXIII.—Atta (Œcodoma) cephalotes, *Latr.: "The Soldier."* By J. H. Hart, F.L.S.

In studying the various forms of the inhabitants contained in a nest of the "Sauba" or "Parasol-Ant" I have observed:—(1) males, (2) queens, (3) soldiers, (4) large workers, (5) smaller workers, and (6) nurses.

Lubbock gives only five classes—1, 2, 3, 4, and 5—the fourth and fifth of which he calls large workers, and states:—"Bates never saw either of the last two kinds do any work at all, and was not able to satisfy himself as to their functions. They have also been called Soldiers, but this is obviously a misnomer—at least they are said never to fight. Bates suggests that they may serve in some sort as passive instruments of protection to real workers. Their enormously large, hard, and indestructible heads may be of use in protecting them against the attacks of insectivorous animals. They would be on this view *pièces de resistance*, serving as a foil against onslaughts made on the main body of the workers."

Lubbock then states * that he is not satisfied with this solution, and thinks the true function of these large-headed forms is not yet satisfactorily explained.

I have personally had the advantage of studying the insect both in Nicaragua and in Trinidad, and I must agree with

* 'Ants, Bees, and Wasps.'

him, for the observations I have made clearly show the "Soldier," or no. 3 of my set, to be actually a "soldier," and a most resolute defender of the nest in which *he* (?) resides.

If a nest of *Atta cephalotes* is visited and the slightest disturbance made, the first members which appear are the "soldiers," who will seize any and every thing presented to them or that comes in their way. I have suffered myself to be bitten on the hand by one of them, and have watched the process.

The mandibles are first fully extended and the skin is firmly grasped by the points, but as the pressure is continued the mandibles meet below the skin to a depth of 3 to 4 millim., causing a neatly incised wound sometimes as much as 5 to 6 millim. in length, and resembling a cut from a small knife. The grip of the animal is so tenacious that it will allow its head to be pulled from its body before it will quit its hold, and will fix to iron, flesh, or cloth with equal facility.

Mr. Lunt, my assistant, when visiting a large nest had thick woollen socks so cut through by the "soldier" of this species that they were useless for further wear.

If a nest is visited and an alarm caused by putting a piece of iron, stick, or other instrument into their holes, it is sure, when removed, to be covered with the "soldier" ants hanging to it by their mandibles.

In addition to these facts I have seen in my artificial nests, which I have had under observation for some three years, many fights with the "soldier."

The workers of *Atta octospinosa*, Reich., among which there are no "soldiers," can easily kill the "soldier" of *A. cephalotes*: they proceed as follows:—The "soldier" is attacked in regular order by *six* or *eight* of the *octospinosa*, who completely surround their victim, and watch their opportunity to seize the outer joint of his (?) legs. This is cut off, and gradually the creature is deprived of these appendages joint by joint, and ultimately is left to move on mere stumps, when it dies in a few hours. In doing this, the smaller insects take particular care not to approach within the reach of the "soldier's" mandibles, as to do so is certain destruction to the individual who has such temerity; they seldom do so, but, on the contrary, the object appears to be to keep as far away as possible and to hold the legs fully extended while effecting their object of cutting them off piece by piece.

"Soldiers," again, when placed together fight among themselves, and a bodiless head and thorax is frequently seen stalking about after such meetings. When placed together in spirit they at once seize one another and form themselves up into a complete mass, which is tightly held together by the mandibles.

The "soldier" of *Atta cephalotes* is the same in form in Nicaragua as in Trinidad, and possesses the same powers of defence and offence.

Trinidad,
January 9, 1896.

XXIV.—*The Sense of Sight: Sketch of a new Theory.* By H. M. Bernard, M.A. Cantab., F.L.S., F.Z.S.

For nearly ten years I have been engaged in endeavouring to find an explanation of light sensations. I have at last worked out a theory capable of connecting and explaining most of the phenomena, and, what is still more important, apparently capable of demonstration. I am now engaged in arranging the evidence; but in the meantime I am urged to publish a short abstract of the conclusions arrived at, because, in the first place, the duties which I have undertaken at the Natural History Museum must necessarily retard the publication of a fuller treatise, and, in the second place, because, the subject being one of wide interest, physiologists and zoologists will have an opportunity of recording observations either for or against the theory, which will be useful towards the ultimate solution of this important problem.

In the following pages I propose to confine myself solely to a statement of my own theory, abstaining entirely from all criticism, and even from all mention of existing theories, except when the subject requires it.

A long series of observations on different Metazoa, ranging from the Platodes to the Vertebrates *, have convinced me not only that wandering-cells, apparently acting as scavengers among the tissues, collect granules discharged from other cells or matter to be afterwards formed into granules, but that the importance of this process is not exclusively physiological. These granules are conveyed by the wandering-cells to organs which lead out of the body, where they may be put to secondary uses. The granules themselves not only differ greatly in different animals, but may also differ in one and the same animal. The secondary utilization of these granules takes place, in many cases at least, by their transference from

* Not including, however, the Echinoderms; and on these *cf.* Mr. H. Durham's paper in the 'Quarterly Journal of Microscopical Science,' vol. xxxiii. p. 81.

the wandering-cells into those of other tissues to which they have been brought. Just as the cells of the tissue where they originated passed them on to the wandering-cells, these can again pass them on to other cells. I may, perhaps, recall the collections of pigment-cells within the ovaries of frogs, which appear to be passing their coloured granules into the eggs.

Chief among the tissues receiving the loads brought to them by the wandering-cells is the outer skin. Here they can be seen discharging their granules to the epidermal cells, which utilize them in various ways. They take part—probably a very important part—in the formation of epidermal protective structures, chitinous and horny cuticles, &c. Slime-glands appear to use them in the formation of their secretions. Or, again, they are stored up, altered or unaltered, as the colouring-matters of the skin and of its derivatives.

Remarkable among skins coloured by these granules are those endowed with what is known as the chromatic function. In these cases the wandering-cells have either been arrested in the connective tissue just beneath the skin, or have given up their granules to connective-tissue cells, the resultant "chromatophores" coming under partial control of the nervous system. The highest specialization of this is seen when, in two or more layers of cells containing differently coloured granules, these granules change their positions in the bodies of the cells, spreading out or crowding together at different times and in different degrees, so as to produce an astonishing play of colour. But even in such cases it is probable that individual granules escape from these secondary detentions and reach the outer cells of the skin, where they may be needed for various more primary functions.

Leaving out of account those cases which are complicated by secondary association with the nervous system, we have abundant evidence to show that, although the wandering-cells under discussion somehow travel to their respective destinations in the dark, they are very sensitive to light, towards the source of which they move. This is a common phenomenon among unicellular organisms both animal and vegetable, and it is specially marked when the contents of the cells are coloured. It is in large measure to this attraction that the great abundance of the granule-bearing cells or of transported granules in or under the skin is due.

The theory which I desire to propound is, that it is to this constant striving of wandering-cells to travel towards the light, and, if possible, to escape altogether from the cell-complex of the body in which they originated (or, perhaps, only to discharge their contents at the surface), that the animal kingdom owes its many visual organs. It is legitimate to assume that the laden wandering-cells would flock in excess towards the source of the brightest light. At such points complications would arise between these invaders and the more stationary tissues which bar the way. Out of such complications, I believe, eyes have arisen. The sensory nerves in those parts of the skin most strongly and frequently illuminated become associated in different ways with these complications, either with the struggling crowd of wandering-cells collected in excess at such bright spots, and set in commotion whenever light falls on them, or with other cells into which these wandering-cells have discharged their contents to overcrowding, and which, on this account, practically become equally restive whenever subjected to light-stimulus. For it is important to note that these granules appear to make the same endeavours under light-stimulus to leave the cells in which they find themselves and travel towards the light, as do the wandering-cells themselves to escape from the Metazoan body.

We may enumerate some of the different types of eye which can be thus accounted for.

1. Simple epidermal cells associated with epithelial sensory (tactile) cells become filled with granules to overcrowding. The escape of these granules at the exterior is hindered by the excess of slime to which they themselves have contributed. These granules, crowding forward whenever stimulated by light, but unable to escape fast enough, exert a lateral pressure upon the adjacent sensory cells. The excess of slime produced by the continual crowding forward of the granules may result in the formation of vitreous bodies or lenses. Eyes arising in this way occur, for instance, in some Mollusks.

2. The wandering-cells may be arrested by, or collect in excess round, epithelial glands which have sunk below the surface. This would be especially the case round gland-cells or glands which contained glassy or refractive contents in the line of light, such bright points having, according to the theory, an especial attraction for the wandering-cells. The striving of the wandering-cells either to push on through, or to pass on their contents to, these cells would again be appreciated by sensory nerves. Further, assuming, and there is ground for the assumption, that the granules in many cases contribute to the formation of the slimy or refractive secretions in such glands, these secretions would, owing to the excessive supply of granules, tend to develop abnormally, and thus help to form a more efficient dioptric apparatus than the simple gland

afforded. The eyes in certain Platodes, and apparently also in Leeches, are essentially of this type.

3. In cases where a rigid chitinous cuticle is present, the different ways in which the cells containing the granules become associated with the sensory nerves are very numerous. These cells may belong either to the skin or to the connective tissue, or are, perhaps, collections of the wandering-cells themselves. Leaving these differences on one side, we may roughly divide the eyes arising under chitinous cuticles into two groups—those in which the sensory nerves running close under the cuticle turn round and face the advancing crowds of granule-bearing cells or granules, and the other in which the sensory nerves run with the stream towards the light. In both these divisions we have many specializations of the different cells composing the ultimate complex or organ, while in all cases the excess of the advancing granules, which normally contribute an important constituent to the hard cuticle, leads to the formation of rods, rhabdomeres, crystalline cones, and lenses. We have, then, here to assume that individual granules, though evidently impeded by the structure of the complex, continually succeed in their efforts to advance and in some way end by fulfilling their normal destiny of helping to build up chitin.

The secondary character of visual organs seems to follow from the fact that eyes showing both the positions of the sensory (retinal) cells described under this heading occur in one and the same animal class, *e. g.* in the Arachnida and in the Mollusca.

Before passing on to the typical complicated vertebrate eye I may refer to the persistent remains of a far simpler kind of eye which are still to be found among lower vertebrates. I refer to the ancient pineal eye, which is still recognizable as an eye in the Lizards. This pineal eye, if its present condition, say in *Hatteria*, gives any evidence of its original morphology, and it would be difficult to prove the contrary, is of the first and simplest of the types above described *, and thus morphologically, as well as phylogenetically, is a very primitive structure. The pigment-granules or granule-bearing cells which, in the functional eyes of that type, contribute to the formation of the cuticular or gelatinous dioptric apparatus, in

* I have to thank my friend, Mr. Martin Woodward, of the Royal College of Science, for the loan of sections of the pineal eye of *Hatteria*, which leave no doubt in my mind on this point. I may add that I am greatly indebted to other fine preparations made and kindly lent me by Mr. Woodward; they have confirmed in a striking manner many points in my theory.

these degenerate eyes appear usually to escape into the cavity of the eye, in some cases at least, unaltered *.

Turning to the vertebrate eye proper, we are justified in affirming that, however highly specialized, it is a product of the same activities as have given rise to the simpler eyes above described. With regard to its structure, what chiefly concerns us is the fact that the sensory cells are turned towards the advancing streams of granules. I feel justified in speaking of the streams of granules, because, as is known, not only are these granules carried about in cells, but they are apparently capable, under the action of stimulus, of independent movements within cells, and, further, can pass from cell to cell. Amœboid movements have been claimed for the individual granules from the eye of vertebrates when floating free in a suitable medium. That the granules in many eyes are highly complex bodies (perhaps secondarily specialized), and not simple concretions, follows from the fact that they seem to contain a staining kernel of chromatin, and in the eye of the crustacean *Apus* they are invested in a fine hyaline layer of matter and can be found dividing †.

Passing by cornea, iris, lens, and other accessory structures, we may say that the vertebrate eye, as a sense-organ, consists essentially of a thick layer of nerve and sensory tissue effectually opposing, or only greatly impeding, the advance of granules contained in the cells of an epithelium which is in contact with this sensory layer over its whole extent. These granules should normally reach the surface of the body and take part in the formation of the external protective structures. They are, however, kept back, but are stimulated to renewed efforts every time the light falls on them. This attack on the nervous-tissue layer, to try and force a way through whenever attracted by the light, I believe to be the secret of our light sensations.

We may point out here that albinism, which has hitherto prevented physiologists from seeing in the movements of the pigmented granules any essential factor in the production of light sensation, is no difficulty to this theory ‡. The granules themselves are doubtless there in some form or other, only they lack the colour. This deficiency may be quantitative or

* *Cf.* W. Baldwin Spencer, "On the Presence and Structure of the Pineal Eye of the Lacertilians" (Q. J. M. S. xxvii. 1887).

† In conjunction with the normal granules others of such purely excretory matter as guanin are found in some eyes. This phenomenon is quite in accordance with our theory.

‡ The seductive analogy between the eye and a photographic camera with its sensitive films has also had something to do with drawing a tention away from the pigmented granules.

merely qualitative *. That these granules, in spite of this deficiency, seek the light, we gather from the fact that the outer skin of albinos is, but for the absence of colour, apparently normal. The connexion between the granules and integumentary protective structures has already been referred to, and need not here be repeated. I may merely remark that we have almost every gradation between dark-skinned people with coal-black eyes, through fair-skinned people with less deeply pigmented eyes, to albinos with so little pigment in their skins and eyes that, if present at all, it is not at first sight apparent. Perhaps faint traces might be found if the granules of the eyes were specially examined for that purpose. My own, all too limited, observations on this point have so far left me undecided.

We may conclude, however, that the colour of the granules is not essential, for, without it, they strive to reach, and in the skin succeed in reaching, the surface. Nevertheless the fact that the granules collected in visual organs are, as a rule, deeply coloured, shows that the colour is very useful. Its absorption of the light prevents a diffusion injurious to clear vision, and, perhaps, also increases the vigour of the movements of the granule by slightly raising its temperature.

We have, then, these two tissues to consider :—

(1) The layer of cells (choroidal or pigment epithelium) containing the usually pigmented granules, which seek to force a way towards the source of the light that stimulates them to action.

(2) The thick layer of tissue, chiefly nervous and sensory, which blocks the way, *i. e.* the retina.

We will, for convenience, take the latter first.

The Retina.—It will be freely admitted that it is not easy to give a simple morphological definition or description of this complicated structure. While certain of its elements are fairly well understood, we are still far from a complete comprehension of it as a whole. In fact, the application of the most recent and approved methods of staining tend, it seems to me, to make it more enigmatical than ever. What follows is therefore put forward purely tentatively. The retina is a many-layered sensory epithelium, in which originally, *i. e.* when less highly developed, the cells stretched as fine thread-like strands between its limiting membranes, the nuclei being suspended on these threads at different levels. This is a

* Pigmented granules lose their colour in the process of being transformed into cuticle or slime within epidermal cells. This fact largely explains why the two have not hitherto been associated in the manner suggested above.

common type of sensory epithelium, and, as far as the retina is concerned, describes fairly well the undifferentiated portion of that structure as seen in the eyes of tadpoles round the rim of the retinal cup, although the layers of nuclei are even here already numerous. For some little distance round the outside of this rim the granule-bearing cells of the choroidal epithelium are in close contact with the external limiting membrane of the retina—that is to say, there are no rods or cones keeping them at a distance. As we go further from the rim these begin to appear, and the manner of their appearance seems to me to be very significant.

What first strikes one is that they are far less numerous than the nuclei, which at this point have still further increased in number without any very marked signs of differentiation among them. So many nerve-cells with so few terminal structures involuntarily suggest that these end-structures, the "rods and cones," must contain many separate nerve-fibrils. This suggestion finds support in the irregular thickness of the rods and cones. Some receive far more nerve-fibrils than others. There would thus be no morphological difference between these structures, *i. e.* between rods and cones, whatever difference there might be among them as to length or thickness. The rod-like structures, however, are not composed wholly of nerve-fibrils; they may be described as cuticular outgrowths from the sensory layer projecting into the granule-cells lying in contact with it. The cuticular outgrowths appear to rise from that layer of the sensory cells which lies just within the external limiting membrane, while from the crowd of undifferentiated sensory cells in the deeper layers (lying nearer the centre of the eye) fine nerve-fibrils descend from all sides and run out along (? within) the supporting cuticular rods prepared for them. This will explain the fibrous character of the protoplasm ascending from each rod and surrounding its own special nucleus, which can be clearly seen under the microscope in sections of the retina of the frog. It might also be associated with the longitudinal striation which has long been attributed to these structures.

From all that has been said above as to the connexion between the granules in the wandering-cells and integumentary protective structures, the development of cuticular rods is not surprising even in such a place. We have but to assume that a certain number of granules succeed in forcing their way into the outer layer of cells in the opposing sensory tissue-layer, and that these cells work them up into protective structures. The structures take the form of rods projecting into and still further impeding the advancing stream of the granules.

Microscopic evidence can be adduced which leaves little doubt that the pigment-granules do actually yield at least some portion of the material out of which the rods are built up. If this is indeed the case, it would go far towards establishing the theory here set out, that the granules endeavour to force their way forward towards the source of light and into the opposing layer, which layer, being composed mainly of sensory cells, is in consequence stimulated.

In the highest vertebrate eyes these cuticular rods may be of great length, forcing the granule-bearing cells back from the external limiting membrane, while, again, the great thickness of the retinal tissue necessitates considerable differentiation of its elements for support and, perhaps, on the one hand, for nourishment, and on the other for the removal of waste.

The Choroidal Epithelium.—Having thus briefly sketched the opposing sensory tissue, we turn to the layer of cells containing the granules which seek to reach the surface of the body whenever stimulated by light. The bodies of these cells are forced back from the external membrane of the sensory layer by the cuticular outgrowths just described, but they remain attached to it by fine protoplasmic processes. These protoplasmic strands thus run up among the cuticular rods; or, to describe it in another way, just as the granule-bearing cells, on being arrested by dense epidermal tissue on their way to the surface of other parts of the body, penetrate as far as they can between the cells composing this tissue by means of pseudopodia, so here the pigment-bearing cells penetrate with their pseudopodia between the rods protecting the retina until they are stopped by its limiting membrane. In the case of the eye for certain, and from the darkening of the skin by exposure to sunlight probably in this case also, the granules are stimulated to escape along these pseudopodia by the action of light. In the case of the eye very few apparently succeed in getting away at the tips of these cell-processes through the membrana limitans externa, and, baffled, they have to return to the cells in which they are imprisoned. In the case of the skin, however, their escape in considerable numbers into its outer cell-layers seems not only probable in itself, being quite in accordance with what the microscopic study of skins teaches us, but seems also to be required by the dark colour familiar to us under the name of sun-burning, which persists for some days, or even weeks, after the exposure has ceased *.

* Dark people, as a rule, burn darkest; in fair people the granules invading the skin are apparently not coloured, but local immigrations of coloured granules, perhaps from blood-vessels, give rise to freckles. If

Returning to the eye, the granules may be described as advancing and retreating according as they are stimulated by light or as the stimulus is withdrawn. It may also be that, like the kindred chromatophores of the skin of animals endowed with the chromatic function, they are susceptible to nerve-stimulation, inasmuch as it is said that the granules advance in a darkened eye if the companion eye is stimulated by light. But this "sympathetic" advance might perhaps be explained in another way.

While the advance is apparently due to the stimulus of the light, the retreat may be due to lateral pressure on the part of the cuticular rods. That such a pressure exists we may perhaps conclude from the fusiform shape assumed by those granules which, being on the outer portions of the cells, slide up and down most frequently between the rods. The pointed ends of these fusiform bodies lead one at first naturally to see in them the instruments for stimulating the nerves. It has been pointed out that they might, for all we know, vibrate as rapidly as cilia. It was long before I became convinced that this shape was chiefly useful in enabling the granules to force their way up and down rapidly between the closely packed rods, and also in enabling them to form compact masses, the fresh arrivals wedging themselves in between those in front. The pointed ends have, I am convinced, no other function than that of facilitating their alternate advancing and retreating movements, for rapid crowding at special points and equally rapid dispersal.

The actual cause of Light Sensation.—At first sight it must appear that no theory can be simple which seeks to explain how the eye can accurately register (as it does, say, in the process of reading) several hundreds of distinct words, each composed of many letters, per minute, each letter forming an image which remains but the fraction of a second. My theory, however, claims to be, comparatively speaking, a simple one. It assumes the existence of no forces or substances which we do not know to exist, not only in the body, but even in the eye itself; and it is, moreover, applicable to every eye, known for certain to be such, in the animal kingdom.

Just as the play of colour in the skins of animals endowed with the chromatic function is due to the constant shifting of the variously coloured granules within the chromatophores, so

---

these granules really contain excretory matter which should be discharged at the surface of the body, we should be justified in concluding that the exposure of the skin to light must be generally beneficial to health.

the rapid changes in our sensation of sight are, I believe, due to slight shiftings, in obedience to the changing play of the light, of the granules between the highly sensitive rods of the retina. The distances through which the granules have to move individually can be shown to be infinitesimal. This fact is of importance, because one of the difficulties against any such hypothesis has been stated to be the great distance the granules would have to travel from the pigment-cells all the way up between the rods, and the consequent slowness of the reaction, which we know from experience to be practically instantaneous. Closer inspection shows that this difficulty does not exist. No eye is fit for vision in which the granules are contracted into the body of the pigment-cells, as any one may prove for himself who suddenly opens the shutters of a really dark room in which he has passed the night. The eye, indeed, has to be prepared for, or, in other words, to "get accustomed to," the light. The general sensation of light must precede the sensation of any distinct image, and this general sensation is brought about by the pressing forward of the granules between the sensitive rods. Before we have any distinct vision, therefore, the granules are already in position, actually causing the general sensation, Not until this is the case are we conscious of any definite images.

Leaving colour-sensation for the moment out of the question, these definite images are really only variations in the intensity of the light. These will be felt in the following way. Where a bright light falls, more granules push forward from the back; where a shadow falls, the push from behind is relieved. The movements of the individual granules in order to effect these changes of pressure need only be infinitesimal. In a crowded gangway it is often difficult to see, by any actual movement, who is pushing and who is not. We all, however, feel instantaneously both when the pressure is put on and when it is taken off. No one who has watched the movements of minute organisms under the microscope can doubt that they would supply us with far greater rapidity than that required by this theory, for the instantaneous application or withdrawal of pressure, the distances to be traversed being, as already stated, infinitesimal.

We may, then, describe our ordinary vision (apart from colour) as due to constantly varying degrees of relief from, or increase in intensity in, the general sensation of light which, during all vision, floods the eye, this general sensation being caused by the granules pressing forward between the rods and cones, and varying in numbers according to the brilliance of the light. Every shadow, every shade of a shadow, every dark moving object, every black line of the book we are reading represents so many reliefs, so many degrees, so many shiftings, and so many durations of relief from the pressure which the granules are exerting laterally upon the sensory nerve-fibrils in some way incorporated with the retinal rods.

Colour-Sensation.—No theory of colour-sensation can be satisfactory unless it can be shown to be a natural development—that is, a development, without sudden break or sudden addition of new factors, of ordinary light-sensation. It is satisfactory, therefore, to find that colour-sensation almost naturally follows from the foregoing description of general light-sensation.

That there exists some connexion between the granules and the formation of the cuticular rods is not only probable itself, but can even, I believe, be demonstrated under the microscope. We need not now discuss the details: it is enough for our purpose if this cuticular structure, the rod, varies slightly in texture in such a way as to be almost glassy near the external limiting membrane, and from this point to consist of zones in which corpuscles of increasing size (though always microscopic) are suspended. That the rod has some definite texture tending to cause it to break transversely into short lengths, histologists are agreed. We are further justified in assuming some heterogeneity in order to avoid the total internal reflection of the light down to its tip, which would take place if the rod were a homogeneous glassy structure. In addition to this specialization into zones, with different-sized corpuscles suspended in the substance of the rods, we have only to assume that, of the sensory nerve-fibrils embodied in each rod, one or more terminate among the finest corpuscles, one or more among the next coarser, and so on to the tip, where the coarsest are found. Colour-sensation would, it seems to me, naturally result from such an arrangement. We require no more movement among the pigment-granules than we required for the appreciation of the ordinary variations in light and shade. The red rays, according to the law illustrated daily in the sky, passing through all zones containing the smaller corpuscles, would be caught and dispersed on all sides by the largest granules at the tips of the rods. The pressure of the granules already crowded in the "gangways" would be immediately directed both from above and below to the point where the red light is breaking in from the side. Again, rays of shorter wave-lengths would be caught by the smaller suspended corpuscles and scattered laterally among the crowds higher up the gangways between the rods, when the pressure would at once be increased in the region of these smaller corpuscles by infinitesimal movements of the pigment-granules from both directions. In this way it would be possible to have rods dispersing laterally each colour of the solar spectrum in succession, beginning from the top with the violet. How many different zones there actually are in the longest tapering rods (" cones ") in the human eye can only perhaps be ascertained by a careful analysis of our sensations. It was long ago shown (Young-Helmholtz theory) that three elementary sensations—red, green, and violet—would be sufficient to explain the rest; but, according to our theory, there appears to be no reason why there might not be more.

According to this theory white and black would not be colours, but merely stimulation or absence of stimulation of the rods as wholes.

The curious phenomenon of colour-blindness in individuals, and perhaps also the assumed existence of racial deficiencies in the matter of colour-sensation *, might be explained as due to a failure to develop the necessary specialized gradations in the sizes of the corpuscles suspended in and composing the retinal rods. It is, on the other hand, possible that we have not ourselves reached the limit of perfection attainable in this direction.

It may perhaps be added that, while the active force causing the stimulation of the nerve-endings for the different colours would in all cases be the same, namely pressure on the sides of the rod by the crowded granules in the gangways, the actual stimulus on the nerve-fibrils would be different for each colour—in one zone of the rod the nerve-ends would be nipped between larger, in another zone between smaller, corpuscles, which also might perhaps differ in shape.

We have, then, briefly traced a theory of light-sensation and of vision which embraces all known eyes, from the simplest to the most complex, and which accounts for the most perplexing phenomena by an appeal to known factors alone. But, however connected and plausible a theory may be, the question of most importance always is, can it be proved? Is it anything more than a mere working hypothesis? While admitting that this theory is, and may perhaps long remain, only a working hypothesis, I think that it is something more. A great part of it, dealing with the elemen-

* The ancient Greeks, judging from the very limited colour vocabulary of their poets, are thought not to have been so specialized in this respect as we are to-day.

tary stages in the development of the sense of vision, is capable of actual demonstration, and on this solid foundation the rest is built. The truth of this most important "rest," which includes the phenomena of clear vision such as we know it, can only perhaps be finally established by degrees. Facts are, however, not wanting which make me believe that a rigid demonstration of it is not far off.

I will point first of all to those observations which tend to show that, in cases of frogs killed after their eyes had been exposed to different coloured lights, the pigment is found massed in a manner not unlike that in which, according to this theory, it should be massed. A chromatic scale, somewhat like that which I have sketched theoretically, is actually claimed to exist. The red light is found to mass the pigment round the tips of the rods, and so on in regular order upward. It is hardly to be expected that the records of actual discoveries in connexion with this chromatic scale would tally exactly with the requirements of the theory. The extreme mobility of the pigmented granules would render their persistence in any position, after the conditions which induced it were changed, highly improbable. It is, in fact, a matter of surprise to me that they show as much of the theoretical chromatic scale as they are said to do *.

Again, evidence in favour of the theory, to some minds perhaps of even greater weight than that already adduced, may be found in the fact that it enables us to explain such collateral phenomena as irradiation, contrasts, after-images.

Irradiation would be due to the increase in size of any bundle of strongly illuminated rods owing to the great crush and continued pressure of granules into the gangways between them. This increase in size of the area occupied by the illuminated rods would press upon the adjacent rods all round for a short distance, the pressure being soon neutralized by the emptying of the gangways (by the squeezing out of the granules) between these adjacent rods.

On the withdrawal of the light the crush in the gangways, if it has been very great owing to the brilliancy of the illumination, takes some time to relieve, during which time we have a positive after-image. As soon as it is sufficiently relieved, the granules which had been forcibly squeezed out from between the adjoining gangways force their way back again, and in doing so seem to assist in squeezing the recently congested passages empty. The positive after-image then changes, as in a moment, into a negative after-image with a

* *Cf.* Angellucci, Molleschott's 'Untersuchungen,' xiv. 1890, p. 231.

corona. Only slowly is the state of equilibrium reached; we apparently have, indeed, a veritable "oscillation" of pressure, alternately within the originally stimulated area and the region immediately surrounding it.

If, again, the congestion in the gangways between the rods of an illuminated area is not equally distributed throughout their whole length, but is localized, say, at their distal ends, which is, according to the theory, the result when the illuminating rays are red, the pressure on the surrounding region will be different. It will not affect the whole length of the adjacent rods, but only their distal ends. The pressure exerted on the distal ends of adjacent rods will squeeze the granules which were arranged here both up and down. It is probable that more will be squeezed up than down, as the downward attraction of the red rays would tend to relieve the pressure at the upper ends of the rods in the illuminated area, and render this the direction of least resistance within the gangways of the adjoining rods. While, then, the red light is massing the granules *between* the distal ends of the rods in the illuminated area, the pressure caused by these localized assemblages of granules leads to a slight massing of granules *above* the distal ends of the rods in the surrounding region. Here it should give rise to a different colour-sensation from red. Indeed, it is a necessary corollary of the theory of colour-sensation here proposed that the irradiation from any coloured image must be of a different colour. Daily experience shows this to be actually the case. According to this theory, then, the difficult phenomena known as "colour-contrasts" have hardly to be accounted for; they take a natural and necessary place in the scheme *.

One more point in evidence as to the truth of this theory. It is true that it is again indirect evidence, but its weight cannot be ignored. There has never yet, so far as I know, been any satisfactory explanation of the curious deception presented by what are known as Zöllner's parallels. If, however, irradiation is due to a real mechanical pressure, the apparent divergence of these lines admits of very simple explanation.

We may therefore briefly describe the development of visual organs in the animal kingdom as follows:—

Under the influence of light certain organisms travelling toward the light seek either to leave the Metazoan body altogether or else to discharge their contents at the surface. Such

* The whiter edge of a white image surrounded by a black border is usually also classed under the head of contrasts; but this admits of a very different interpretation.

emigration cannot take place without the cognizance of the nervous system, and where it is most pronounced, *i. e.* in the most frequently illuminated parts of the body, complications arise between the fugitives and the other tissues, notably the peripheral nerves. My suggestion is that out of these complications all the known eyes of the animal kingdom, the most complicated as well as the most simple, have in one way or another arisen.

If this theory can be established, a fascinating field of investigation will be opened out to zoologists. If such specialized structures as eyes have arisen simply by the crowding to excess of pigmented granules in the most frequently illuminated parts of the integument, may not other less specialized integumentary structures in the animal kingdom be also explained by variations in the numbers of the granules received by their formative cells? Leaving out of account the circulatory system, the tissues among which the wandering-cells have to travel towards the surface are not all equally dense, and even if soft may for one reason or another be impenetrable. Hence the migrating swarms of wandering-cells would tend to divide up into streams which would reach the surface as such, causing cuticular thickenings or prominences at such spots. We might expect to find specializations of the integumentary cuticular formations showing some slight correspondence with the sizes and importance of these streams. In investigating the movements of wandering-cells, which, avoiding the canal-system supplied by the blood-vessels, may be described as travelling across country, gravitation and the active movements of the body, as well as light, must certainly be taken into account. It is not improbable that a slowly cumulative selective action is taking place, those cells containing the most deeply pigmented granules better overcoming the attraction of the earth under the light-stimulus than those carrying less- or non-pigmented granules.

In the fuller treatise containing a detailed account of the evidence, direct and indirect, on which this theory is based, I propose to give simple diagrams to illustrate more fully the explanations, here thus briefly sketched, of colour-sensation, irradiation, colour-contrasts, and other kindred phenomena. I propose also to include an account of some of the subjective phenomena, attention to which first drew me on to seek an explanation of vision in general.

Streatham, S.W.,
January 10, 1896.

XXV.—*On the Presence of Wood-Mason's Stridulating-Organ in* Trechona zebrata (*Walck.*). By R. I. Pocock.

Mr. Thomas Workman of Belfast has recently kindly drawn my attention to the paper entitled "Remarks on the Falces and Maxillæ of Spiders," published in the Annals & Mag. Nat. Hist. (3) xix. pp. 258–259, pl. x. fig. 3 (1867), in which Mr. John Blackwall describes and figures part of the stridulating-organ of one of the Theraphosidæ, which he called *Mygale zebra*. On p. 259, after discussing the inappropriateness of the term teeth as applied to the abbreviated spines which stud the base of the maxilla and the apex of the labium in the spiders of the family "Mygalidæ," he observes: "but to a remarkable group of spines, situated on the superior surface of the maxillæ of *Mygale zebra*, and clearly indicating, by its position and structure, that the principal function it performs must be that of mastication, the appellation of teeth appears to be more appropriate. The spines composing this group, which are of a dark-brown colour, and have their pointed extremity directed towards the inner margin of the maxillæ, are fewer in number, enlarged at the extremity, and much longer and more distinct near the posterior end of each group than the closely compacted ones that form its anterior part. These spines, by their figure and arrangement, present a highly interesting subject for inspection under the microscope." This description and the figure that accompanies it leave no room for doubt that the author had before him the cluster of modified hairs constituting the notes or keys of the stridulating-organ that was subsequently described by Wood-Mason. That he failed to discover the true significance of the organ is perhaps not surprising, seeing that he had never been previously informed, as had Wood-Mason, that these spiders are able to emit sounds.

The chief interest, however, of the discovery lies in the fact that *Mygale zebra*, or rather *Trechona zebrata*, as it should be called, is a South-American species; and no other member of the family from this country, which is perhaps, so far as the Theraphosidæ are concerned, the richest in the world, is known to possess this stridulating-organ. In fact, in connection with this subject, I remarked, on p. 168 of the 'Annals' for February last, "no organ resembling either of those [the two types of stridulators occurring in the oriental genera*] mentioned above is found in any genus that I have

* See also 'Natural Science,' vi. pp. 44–50.

examined of the following Neotropical groups :—Aviculariœæ, Eurypelmateæ, Theraphoseæ, and Homœommateæ."

The genus *Trechona*, however, belonging to a distinct subfamily—namely, that of the Diplurinæ,—and represented in the National Collection by a single dried example, which will very possibly prove to be Walckenaer's type, I did not examine for this organ, for fear of causing needless damage to a valuable and unique specimen. But upon reading Mr. Blackwall's article, I immediately took the necessary steps to verify his statement, and was rewarded by finding the organ almost exactly as he described it. The set of notes on the maxilla is of large size, and occupies nearly the whole length of the inner surface of this segment. The notes composing the distal two-thirds of the group are black and thickly clustered together; they are not, however, short and spicular as Blackwall's figure represents, but long and straight. Those, on the contrary, that compose the proximal third of the cluster are thicker, more separated from each other, curved, and arranged in a single line, the individual notes gradually decreasing in length as they pass from the centre of the cluster to its proximal end. The modified hairs on the opposable surface of the mandible, which Blackwall does not mention, are constructed on very much the same plan as the corresponding hairs that I have described in *Psalmopœus Cambridgii* *—that is to say, they consist of a small number of long, thick, but apically filiform setæ set on the posterior portion of the lower edge of the jaw, and these pass into a set of rigid setæ, which ultimately blend with the hairs at the base of the fang.

A point to be noticed in connection with the occurrence of this remarkable organ in a Neotropical genus belonging to a subfamily with which the Oriental stridulating Selenocosmiidæ seem to have no special affinity, is the unavoidable conclusion that substantially the same structure has been developed twice over. Moreover, as I have pointed out †, the instrument is also found in another spider, *Idiommata Blackwallii*, Camb., which belongs to yet a third subfamily. So that apparently we have evidence that the organ has been independently acquired three times within the limits of a single group of spiders.

This conclusion at once raises the question as to the value of the character in uniting the genera that I have grouped together as Selenocosmiidæ. For it may well be asked what reasons there are for regarding it as a sign of affinity in the

* Ann. Mag. Nat. Hist. (6) xv. p. 178, pl. x. fig. 3 *a*.

† Ann. Mag. Nat. Hist. (6) xvi. p. 225.

case of the Selenocosmiidæ, when we do not claim it to be a sign of affinity between the Selenocosmiidæ and *Idiommata* and *Trechona*. To this it must be replied that *Idiommata* and *Trechona* are separated from each other and from the Selenocosmiidæ by certain other characters which do not admit of the genera presenting them being grouped in the same category. But the genera of Selenocosmiidæ are, apart from the presence of Wood-Mason's organ, much alike in all structural points; and this, coupled with the fact that they inhabit the same geographical area, lends great weight to the supposition that the mutual possession of Wood-Mason's organ may be regarded as an indication of relationship between them.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

December 4, 1895.—Dr. Henry Woodward, F.R.S., President, in the Chair.

The following communication was read:—

'The Mollusca of the Chalk Rock.—Part I.' By Henry Woods, Esq., M.A., F.G.S.

In the introductory part of the paper the Author gives an account of the characters, distribution, and literature of the Chalk Rock. He points out that the Chalk Rock fauna may be recognized at the same level in Northern France, N.W. Germany, Saxony, Silesia, and Bohemia; and on account of the wide distribution and distinctive features of this fauna, he suggests that the Chalk Rock merits a palæontological rather than a lithological designation, and proposes for it the term 'zone of *Heteroceras reussianum*.'

The main part of the paper is devoted to the consideration of the cephalopoda, gasteropoda, and scaphopoda; and is based largely on the collection from Cuckhamsley (B rks) made by the late Mr. Montagu Smith; but for the loan of many specimens the Author is indebted to Mr. R. M. Brydone, Mr. C. Griffith, Mr. W. Hill, Dr. J. Morison, and Mr. James Saunders. In addition to some genera, of which sufficiently good examples for exact determination have not yet been obtained, the following are represented:—*Nautilus*, *Ptychoceras*, *Heteroceras*, *Baculites*, *Prionocyclus*, *Pachydiscus*, *Scaphites*, *Crioceras*, *Emarginula*, *Pleurotomaria*, *Trochus*, *Turbo*, *Crepidula*, *Natica*, *Cerithium*, *Aporrhais*, *Avellana*, and *Dentalium*. Some new species are described, and the synonymy and distribution of the others treated in detail, figures and descriptions being given of the forms not previously well known. The account of the lamellibranchs and the general conclusions are reserved for Part II.

December 18, 1895.—Dr. Henry Woodward, F.R.S., President, in the Chair.

The following communication was read:—

'The British Silurian Species of *Acidaspis*.' By Philip Lake, Esq., M.A., F.G.S.

In this paper descriptions are given of those species of *Acidaspis* in the Silurian of Britain which have hitherto been incompletely described. The British forms are compared with those from the same system in Sweden and Bohemia. Five, out of nine, are represented by the same or very closely allied species in Sweden; two in Bohemia. All the Swedish forms except one are represented in Britain, and one in Bohemia as well as in Britain.

MISCELLANEOUS.

Numbers of Zoological Species known in the Years 1830 *and* 1881. By Dr. A. Günther.

Some years ago I made a computation of the approximate numbers of species of animals known in the years 1830 and 1881 respectively, with the following result:—

	1830.	1881.
Mammals	1,200	2,300
Birds	3,600	11,000
Reptiles	443	2,600
Amphibians	100	800
Fishes	3,500	11,000
Crustacea (year 1840)	(1,290)	7,500
Pycnogonida	8	70
Arachnida	1,400	8,000
Myriopoda	450	1,300
Insecta:—		
Coleoptera	17,000	93,000
Orthoptera	800	6,500
Neuroptera	400	4,000
Hymenoptera	2,400	30,750
Lepidoptera	14,500	44,500
Diptera	11,000	24,400
Rhynchota	3,000	17,000
Annulata (Lamarck in 1838)	(130)	3,100
Turbellaria and Nemertida (ditto)	(20)	170
Entozoa (ditto)	(222)	2,800
Rotatoria (ditto)	(40)	120
Mollusca	11,000	33,000
Echinoderms (ditto)	(230)	1,843
Cœlenterata (year 1834)	500	2,200
Radiolaria (Ehrenberg, 1844)	(5)	2,000 (Hæckel)
Foraminifera	(say) 100	900
Infusoria (year 1838)	(200)	(say) 400
Spongiida (Blainville, 1835)	(50)	(say) 400
	73,588	311,653

On the Reproduction of Wasps. By M. Paul Marchal *.

The results of my researches on the earth-burrowing wasps (*Vespa germanica, V. vulgaris*) are as follows :—

Their nests, when they are fully formed, contain two sorts of cells, the *small* and the *large*. The latter always constitute the lower part of the wasp's nest, for example the two lowest combs, while the others make up the rest of the nest, namely the six to ten combs superposed.

The *large cells*, which are only built by the workers during the first fortnight of August, may, at an early period, receive indifferently either females or males, the former being either queens or very large workers, the latter always in small proportion ; afterwards, at the beginning of September, these cells are entirely set apart for the queens to such an extent that in October only queens are to be found in them, the males being entirely excluded.

The *small cells*, on the contrary, from the time that the laying of males has begun, contain indifferently up to the end of the season either workers or males.

The proportion of males in the combs of small cells decreases from below upwards, with this remarkable exception—that if there be a mixed comb containing at one and the same time large and small cells, the small cells of the mixed comb are influenced by the proximity of the large cells, and contain but a very small quantity of males.

The commencement of the period for laying males coincides very nearly with the period of the appearance of the large cells and takes place in the first fortnight of August. The curve which represents their production rises suddenly in an almost vertical manner to reach its maximum ; it then descends gradually, with or without oscillations, to the end of the reproduction.

The queen takes a prominent part in this great production of males, because the laying workers have already long since disappeared, whilst the young male larvæ are still to be found in great numbers in the nests.

The queen has then (at least after the early days of September) the power to determine with certainty the female sex of the eggs which she lays in the large cells ; on the other hand, she lays indifferently either female or male eggs in the small cells.

One can only admit, in order to explain this remarkable fact, the principle of the theory of Dzierzon, based upon the fecundation, because if the production of males were due, for example, to some influence of season, it is evident that the eggs laid *at the same epoch* in the large cells would become male just as much as the others.

In order to interpret all the facts, this theory ought nevertheless, in my opinion, to be modified, by allowing the intervention of another factor than the will of the queen. We will admit, then,

* This work was carried out partly at the Entomological Station at Paris. The experiments and observations on which the conclusions arrived at are based will be published in detail later.

that after her first deposit (of eggs), exclusively those of workers, which lasts uninterruptedly up to the end of July or the beginning of August, the reflex which brings about the contraction of the seminal receptacle at the moment of the laying of each egg is no longer produced with the same energy, and that therefore the eggs can be laid without being fecundated; thence the almost sudden appearance of males corresponding to the relative state of inertia of the receptacle. Then it is that the workers building the large cells give the queen a choice between two distinct classes of alveoli; and she, stimulated by the presence of the large alveoli, which seem to possess the power of rendering her reflexes more energetic *, will concentrate from that time all her energies upon them, and will only lay fecundated eggs and females. The modification thus introduced into the theory is important, because it replaces the voluntary act of the queen by a passive one. The queen does not deposit males and females at will; but there comes a time when she cannot do otherwise than deposit males, because of the relative inertia of her receptacle. Among the bees the queen appears to be always conscious † of this state of inertia, and when she is subjected to it she will never lay in any other cell but that of a male, unless there are none of them at her disposal (observations of Drory). It is not the same among the wasps, which mark a less perfect stage in the evolution of the phenomena relating to reproduction. With them the queen lays haphazard when she finds herself over the small cells, and then, according as her receptacle reacts or remains inactive, the deposit (of eggs) gives rise to patches and streaks of workers or to patches and streaks of males, set irregularly and without order one beside the other. If, on the other hand, the queen finds herself over the large cells, stimulated by their presence, she will only lay fecundated and female eggs.

It is very remarkable that, among the wasps, the large cells (queen cells) are adapted to the state of activity of the receptacle, whilst among the bees the large cells (male cells) are adapted to her state of inertia.

Possibly further observations may bring into line other factors not at present suspected, and will modify the theory which has just been laid down. Its only value consists in its giving an acceptable explanation of facts hitherto known and of those which I have just set forth.

Laying of Workers.—This deposit is normal in August in the nests which have their queens; it exists, however, in a relatively small degree, and is not sufficient to account for the great rise in (the number of) males; then it diminishes and ceases completely in normal nests in September and in October. The laying of workers is exaggerated in an extraordinary degree by the simple fact of the suppression of the queen or by her ceasing to lay.

* The queen in captivity shows a marked preference for the large cells.

† The term *conscious* is not altogether correct, but it saves a periphrasis; it is rather a matter of adaptation, of pre-established harmony, than of consciousness.

It can be then provoked in workers in captivity to the extent of obtaining one third fertile, whilst the workers of the same nest in the company of the queen remain sterile. A nest of *Vespa vulgaris*, in which the laying of eggs by the queen had been completely interrupted, yielded more than one half fertile workers, whilst other normal nests, taken at the same time, yielded only sterile workers.

It is evident that in these different cases the fecundity of the workers can only be provoked by the absence of the young brood in the nest and by the upsetting of the equilibrium of nutrition in favour of the adults which results from it.

The production of fertile workers is independent of the bringing up of the queens, contrary to the state of things which, according to Huber, exists among bees. Their fecundity depends upon the nutrition of the imago, and has so much the more chance to develop itself because the worker is hatched after a shorter lapse of time and is nourished in a manner much more intense.

The fecundity of the workers can only establish itself in a nest when the food-collecting section of the community greatly exceeds the larval, or, in other words, when the nutritive condition of the colony reaches its climax, that is to say, in normal nests in the month of August.—*Comptes Rendus*, t. cxxi. pp. 731–734.

Researches on the Structure, Organization, and Classification of the Fossil Reptilia.—Part X. *On the complete Skeleton of an Anomodont Reptile* (Aristodesmus Rütimeyeri, *Wiedersheim*), *from the Bunter Sandstone of Reihen, near Basel, giving new Evidence of the Relation of the Anomodontia to the Monotremata.* By H. G. Seeley, F.R.S.

With the co-operation of the Trustees of the University Museum of Basel and Professor Rütimeyer the author has examined the fossil described by Dr. Robert Wiedershiem in 1878 as *Labyrinthodon Rütimeyeri*. The bones are differently interpreted:—

The reputed humerus is the interclavicle.
The reputed scapula is the humerus.
The reputed supra-scapula is the left coracoid.
The reputed supra-scapula is the right scapula.
The reputed right and left coracoids are the pre-coracoid and coracoid of the right side.
The reputed clavicles are the ribs.

Five digits are identified in place of four in 1878.

These osteological identifications are inconsistent with reference of the type to the Labyrinthodontia. The author also examines the relation of the Labyrinthodont type to existing Amphibia, and regards the Labyrinthodont osteology as demonstrating closer relationship with Ichthyosauria and Anomodontia. The group is therefore regarded as reptilian, forming a branchiate division of the class.

The fossil is referred to a new genus—*Aristodesmus.* It is identified as an Anomodont reptile chiefly on the basis of resemblances to *Procolophon* and *Pareiasaurus.* It is shown not to be a mammal by the large parietal foramen, the composite structure of the lower jaw, and presence of the prefrontal bone. It, however, differs from known Anomodonts in making a somewhat closer approximation to Monotreme mammals than has hitherto been evident, and this correspondence extends to successive segments of both the fore and hind limbs.

The teeth are in sockets placed obliquely, with conical crowns compressed to sharp lateral margins, and curved inward. The proportions of the vertebral column are those of *Echidna*, though the transverse processes are longer, as in *Pareiasaurus.* The ribs are like those of a Monotreme, though the sacral ribs are longer. The shoulder-girdle resembles that of *Procolophon*, and differs from all other Anomodonts in the constituent bones being unanchylosed, and in the precoracoid having a large anterior extension in advance of the scapula. The sternum appears to have been unossified, as in Crocodilia. The humerus is widely expanded at both extremities and twisted, but does not show the peculiar lateral curvature seen in Monotremes. The ulna gives no evidence of an olecranon process; it is larger than the radius, and appears to articulate with the humerus. The pelvic bones are without acetabular or obturator perforations, are not anchylosed together, and the ilium is not expanded transversely. The hind limb is no longer than the fore limb. The femur is more slender than the bone in *Echidna.* The fibula is prolonged proximally beyond the stout tibia, round which it may rotate. The proximal row of the tarsus is one large bone, formed of the blended astragalus and os calcis.

In conclusion, the author argues that the points of structure are so few in which Monotreme mammals make a closer approximation to the higher mammals than is seen in this fossil and other Anomodontia, that the Monotreme resemblances to fossil reptiles become increased in importance. He believes that a group *Theropsida* might be made to include Monotremata and Anomodontia, the principal differences (other than those of the skull) being that Monotremes preserve the marsupial bones, the atlas vertebra, and certain cranial sutures. *Ornithorhynchus* shows prefrontal and postfrontal bones, and has the malar arch formed as in Anomodonts.

Aristodesmus, which suggests this link, is at present placed in the Procolophonia, a group separated from its recent association with *Pareiasaurus*, and restored to its original independence because it has two occipital condyles, with the occipital plate vertical, and without lateral vacuities, and has the shoulder-girdle distinct from Pareiasauria in the separate precoracoid extending in advance of the scapula.—*From the Proceedings of the Royal Society.* (Communicated by the Author.)

CONTENTS OF NUMBER 98.—*Sixth Series.*

⁂ It is requested that all Communications for this Work may be addressed, post-paid, to the Care of Messrs. Taylor and Francis, Printing Office, Red Lion Court, Fleet Street, London.

Vol. 17. **SIXTH SERIES.** No. 99.

THE ANNALS AND MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

CONDUCTED BY

ALBERT C. L. G. GÜNTHER, M.A., M.D., Ph.D., F.R.S.,
WILLIAM CARRUTHERS, F.R.S., F.L.S., F.G.S.,
AND
WILLIAM FRANCIS, Ph.D., F.L.S.

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

WITH TWO PLATES.

Illustrative of Dr. M. Laurie's Paper on the Anatomy of some Scorpions, and Mr. R. I. Pocock's on the Species of *Opisthophthalmus* in the British Museum.

LONDON:
TAYLOR AND FRANCIS, RED LION COURT, FLEET STREET.

Sold by Simpkin, Marshall, Hamilton, Kent, & Co., Ld.; Whittaker & Co.: Baillière, Paris: Maclachlan and Stewart, Edinburgh: Hodges, Figgis, & Co., Dublin: and Asher, Berlin.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SIXTH SERIES.]

No. 99. MARCH 1896.

XXVI.—*Notes on the Anatomy of some Scorpions, and its bearing on the Classification of the Order.* By MALCOLM LAURIE, D.Sc., B.A., F.R.S.E., F.L.S., Professor of Zoology in St. Mungo's College, Glasgow.

[Plate IX.]

THE classification of the Scorpions has been based hitherto entirely on external characters. While this method of procedure is the most convenient for museum purposes, where the preservation of the specimens intact is of importance, it is very apt to lead to a system of classification which does not express the true relationship of the forms. That the results are not wholly satisfactory may be seen by comparing the schemes proposed by Peters, Thorell, Simon, Kraepelin, and Pocock. To cite a single example, the members of section B of Thorell's subfamily Pandinini are distributed under two families by Simon, while Pocock arranges them under two families which do not correspond with those of Simon, and one of which contains two subfamilies. So far as I am aware the only attempt to apply the internal structure of this group to their classification is that of Ray Lankester *. He based his classification on two sets of organs—the abdominal nerve-ganglia and the lamellæ of the lung-books. Owing to the small number of forms which he examined, his scheme, which divides the group into

* Trans. Zool. Soc. vol. xi. p. 372.

two subfamilies and only three genera, is not altogether satisfactory; nevertheless, it was an attempt in the right direction, and one of his subfamilies agrees with the family of the Buthidæ.

Having a considerable number of Scorpions in my possession, it seemed worth while to investigate further on the lines laid down by Professor Lankester, and see whether more definite and satisfactory results could be attained. The number of species at my command has, however, proved too small to base any final conclusions on, though some points of interest have come out.

While I have examined every point which seemed in the smallest degree likely to yield any information, I only deal with three in the present paper. This is due to the other points, such as the entosternite, having given purely negative results. Two of the points I discuss are those dealt with by Ray Lankester, and, in addition, I have taken the female reproductive organs. My material having been collected originally with a view to embryological work, the number of males was too small to give any results.

For my material I am indebted to Professor E. L. Mark, of Harvard University, Mr. S. F. Harmer, Cambridge, Mr. Peringuey, of the Cape Town Museum, Professor Thomson, of Stellenbosch, and Mr. R. I. Pocock, of the British Museum. I gladly take this opportunity of tendering my sincerest thanks to all these gentlemen. For the correct identification of my specimens—a point of importance for this work—I am further indebted to Mr. Pocock.

In so far as any classificatory terms are used without specifying in whose sense, they are taken from Mr. Pocock's classification *.

In conclusion, I may say that I would be very grateful for further specimens to enable me to continue this research.

I. *The Nervous System.*

The nerve-cord in the meso- and metasomatic segments, with which alone we have to do, consists of a pair of longitudinal cords bearing ganglia at intervals. These ganglia (Pl. IX. fig. 1) are seven in number and give off nerves on each side to the segments to which they belong. A median nerve has been described by Dufour † and Lankester ‡ passing

* Ann. & Mag. Nat. Hist. ser. 6, vol. xii. p. 303.

† Dufour, "Hist. Anat. et Physiologique de Scorpions," Mém. prés. à l'Acad. d. Sci. vol. xiv. (1856).

‡ Lankester, "Position of Ganglia &c. in Scorpions," Proc. Roy. Soc. 1882.

in a ventral direction from each ganglion. I have not found this nerve in any of the forms I have dissected, and it seems to me probable that previous observers have been misled by a blood-vessel which passes ventrally between the two cords close to each ganglion from the longitudinal vessel overlying the nerve-cord. It is not easy to separate this vessel from the ganglion, but microscopic examination makes its nature evident.

The most important part of the nerve-cord is that lying in the mesosomatic and first metasomatic segments. Three pairs of ganglia are present on this portion, and, according to Lankester, their arrangement differs markedly in different forms. In *Androctonus* (*Prionurus*) *funestus* *, *Androctonus occitanus* †, *Androctonus americanus* ‡, and *Androctonus hottentotus* § the first two of these ganglia supply respectively the third and fourth pairs of lung-books (eleventh and twelfth segments), the third ganglion supplying the first metasomatic segment. The segments anterior to the eleventh are innervated from the prosomatic ganglion-mass. In *Scorpio italicus* ‖, *Scorpio cyaneus* ¶, *Brotheas subnitens* **, and two species of Telegonini ††, on the other hand, the first two ganglia supply the second and third lung-books respectively, while the fourth pair is supplied by the third ganglion. In these, therefore, the prosomatic ganglion supplies only the segments as far back as the first pair of lung-books (segment 9).

In view of the great morphological importance of these differences, I have devoted special attention to the point, and have carefully dissected the nervous system in the following forms:—*Scorpio fulvipes*, *Opisthophthalmus capensis*, *Palamnæus Thorellii*, *Opisthocentrus madagascariensis*, *Opisthocentrus validus*, *Hormurus australasiæ*, *Vejovis* sp., *Euscorpius italicus*, *Broteochactas delicatus*, *Bothriurus bonariensis*, *Buthus nigrolineatus*, *Parabuthus capensis*, *Uroplectes triangulifer*, and *Centrurus*, sp.

The conclusion I have arrived at is as follows:—The first ganglion may vary in position between the level of the second

* *Prionurus hector* (Koch).
† *Buthus europæus* (Linn.).
‡ Probably *Centrurus gracilis* (Latr.).
§ *Parabuthus*, sp.
‖ *Euscorpius italicus* (Herbst).
¶ *Scorpio megacephalus* (Koch).
** *Teuthraustes atramentarius* (Sim.).
†† *Caraboctonus Keyserlingii* (Poc.), from Coquimbo, and *Cercophonius squama* (Gerv.), from Tasmania. For these synonyms I am indebted to Mr. Pocock.

pair of lung-books (tenth segment), as in *Parabuthus* (fig. 1), and a position forward in the second free segment, as in *Scorpio fulvipes* (fig. 3). In *Vejovis* it is even further forward.

The nerve from it, however, passes always behind the dorso-ventral muscle of the fourth mesosomatic (tenth) segment. About the level of this muscle it divides into two branches, of which the anterior runs out to the body-wall, while the posterior runs back to the lung-book in the fifth mesosomatic (eleventh) segment.

The second ganglion may lie in the sixth mesosomatic (twelfth) segment, as in *Parabuthus* (fig. 1), or it may lie forward towards the front of the fifth mesosomatic (eleventh) segment, as in *Palamnæus* (fig. 2) and *Vejovis*. The nerve from it runs behind the dorso-ventral muscle of the fifth mesosomatic (eleventh) segment, and in front of that of the twelfth segment, divides into two, and the posterior branch goes to the last lung-book.

The third ganglion may lie well back in the first metasomatic (thirteenth) segment, as in *Scorpio* (fig. 3), or forward in the last mesosomatic (twelfth) segment, as in *Palamnæus* (fig. 2). The nerve from it runs either backward or forward, according to the position of the ganglion and of the dorso-ventral muscle of this segment, in front of which it passes. I have never been able to trace it to the last pair of lung-books, but it always goes to the muscles of the segment (thirteenth) to which it belongs. It does not divide into two branches as those in front of it do.

The four ganglia behind this supply each one of the metasomatic segments except the last ganglion, which innervates the last two segments and the telson.

The nerves from the prosomatic ganglion to the first and second lung-books have a course much like the nerves from the first two ganglia. They pass respectively behind the dorso-ventral muscles of the second mesosomatic (eighth) and third mesosomatic (ninth) segments. Each divides into two branches—an anterior body-wall branch and a posterior branch to the lung-books.

In *Opisthophthalmus* and probably in others, a fine nerve runs longitudinally down the mesosoma on each side (fig. 4, *l.n.*). It passes in each case under the body-wall branch of the nerve and over the lung-book branch. It is connected with each of the segmental nerves by a fine branch arising from the nerve before it divides into two branches (segment 10), from the body-wall branch after the division (segment 11), or from the point of division of the nerve (segment 12). I have as yet failed to trace this longitudinal nerve to its termination at either end.

Examination of the nerve-cord shows, then, that we can get no aid from it in classifying the Scorpions. The position of the ganglia seems to vary quite independently of the relations of the species to one another, as may be seen by comparison of the figures, such unquestionably nearly allied forms as *Scorpio* (fig. 3) and *Palamnæus* (fig. 2) showing great differences. On the other hand, the segments supplied by each ganglion remain the same throughout. The position of the ganglia might serve as a generic character, but is of no greater value.

The varying position of the dorso-ventral muscle of the first metasomatic (thirteenth) segment might also be useful as a generic character, but here also we get considerable differences in closely allied forms.

II. *The Reproductive Organs.*

As nearly all my material was procured with the idea of further elucidating the embryology of these forms, I have not had much opportunity of examining the male organs, and will therefore postpone any account of them to some future time. The general anatomy of the female organs is sufficiently well known, and the only point of importance in which the various forms differ is that of the structure of the egg, and, in relation to this, the mode of formation of the embryo. The two types of development have been described in detail elsewhere, and seem to me to constitute a difference of very considerable morphological importance.

In the first type of development * the egg is of considerable size, and contains a large quantity of yolk (fig. 7). It passes at an early stage out of the follicle in which it is formed and fertilized into the ovarian tube (fig. 8), in the cavity of which it undergoes the greater part of its development. Two embryonic membranes are formed round the embryo, and it appears to depend entirely on the yolk for nourishment. This type occurs in all the Buthidæ (*Buthus*, *Parabuthus*, *Uroplectes*, *Centrurus*, *Androctonus*) which I have examined, and also in *Broteochactas*, *Bothriurus*, *Euscorpius*, and *Vejovis*. It is probably the more primitive mode of development, agreeing as it does in many respects with other Arachnids. The egg of *Vejovis* is much smaller in

* V. Brauer, Zeitschr. wiss. Zool. vol. lvii.; Laurie, Quart. Journ. Micr. Sci. vol. xxxi., &c.

proportion than that of the other forms. In the one specimen in my possession which contains partially developed embryos there appears to be very little, if any, yolk. The embryos develop in the ovarian tube, however, as in *Euscorpius*.

In the other type of development * the egg is very minute and contains no yolk. It is placed (fig. 6) at the distal end of a large diverticulum of the ovarian tube, and the embryo as it grows extends down and occupies the cavity of the diverticulum. There appear to be no embryonic membranes, and the embryo is nourished by consuming a solid cord of cells which terminates the diverticulum. This type of development I have found in *Scorpio*, *Heterometrus*, *Palamnœus*, *Opisthophthalmus*, *Opisthocentrus*, and *Hormurus*. Thus, so far as my observations go, it is characteristic of the family Scorpionidæ, but I have not had specimens from the subfamilies Diplocentrini, Hemiscorpiini, or Urodacini. This is the more to be regretted as we shall see that there is some reason to doubt the close alliance of, at all events, the Diplocentrini with the other Scorpionidæ.

An additional mode of nourishment of the embryo in the form of two outgrowths from the head, which probably absorb fluid from the surrounding tissues, occurs in *Opisthophthalmus* †.

A structure which I have not seen fully described, and the function of which is unknown to me, occurs in all the Scorpionidæ and Ischnuridæ which I have examined, but seems to be wanting in the Buthidæ. It consists of a pair of hollow cylindrical processes projecting back into the abdomen from the posterior side of the diaphragm between the prosoma and the mesosoma. In sections it is seen to be composed of two layers of cells separated by a thick non-cellular layer. The outer cell-layer appears to be continuous with the diaphragm, while the inner one comes into close connexion with the capsule of flattened cells surrounding the coxal gland. It is possible that the cavity of this diverticulum is in communication with the lumen of the coxal gland, in which case it is a portion of the cœlome. I have not been able to satisfy myself on this point, however.

III. *The Lung-books.*

These are more available for systematic purposes than the preceding structures, as it is possible, by making an incision

* Laurie, "Development of *Scorpio fulvipes*," Quart. Journ. Micr. Sci. vol. xxxii.

† Laurie, Proc. Roy. Phys. Soc. Edinburgh, 1895–96.

between two of the sternites, to extract the lung-book without injury to the external appearance of the specimen. Treatment for fifteen minutes with hot dilute caustic soda makes the structure more distinct by removing the organic matter. The anatomy of these structures is sufficiently well known, and, as it seems to be constant throughout the group, need not concern us here. The shape of the lamellæ varies too much in the different parts of the lung-book to be of any service. Lankester * used the surface-markings of the lamellæ in his classification, and distinguishes two types. In one of these the whole of the upper surface of each lamella is covered with small pillar-like structures, which serve to maintain a space for the air between each pair of lamellæ. Berteaux † has shown that these rods or pillars are in *Scorpio indicus* of two kinds. Those round the margin of attachment are smaller than the others, and their upper ends fuse to the lower surface of the lamella above. The larger pillars which occupy the centre and free border of the lamellæ do not fuse to the superjacent lamella, but frequently divide at the top, and may form arcades by uniting with adjoining pillars. These two regions of the lamella are usually quite distinct from each other and easily made out.

In *Euscorpius flavicaudis* according to Berteaux the rods nowhere unite with the adjoining lamellæ. The two areas on the surface of the lamella are nevertheless quite distinct, at all events, in *Euscorpius italicus*.

In the second type of lamella the area occupied in the first type by the larger pillars is covered by a network of chitinous ridges, the meshes of which are subdivided by smaller ridges. Pillars are entirely wanting over this region, but towards the sides they begin to appear among the ridges, and finally replace the ridges entirely.

Berteaux has described a further difference in various forms in the structure of the free edge of the lamella. In lamellæ of the first type the edge may be furnished with sharp spines (fig. 9), a condition which he describes in *Scorpio*, or the spines may divide at their free ends, and, uniting with each other, form a regular arcade (fig. 10), an arrangement which occurs in *Euscorpius*.

In the second type the network of ridges is present on both surfaces of the lamella, the larger ridges being continuous over the edge, and the edges are devoid of spines (fig. 11).

* *Loc. cit.* p. 378.

† Berteaux, 'Le Poumon d. Arachnides,' "La Cellule," vol. v.

We have thus three types of structure for the lamella, which we may term the spinous, arcade, and reticulate forms.

The spinous type occurs in *Scorpio*, *Heterometrus*, *Opisthophthalmus*, *Palamnæus*, *Opisthocentrus*, *Hormurus*, and *Urodacus* among the Scorpionidæ; in *Scorpiops*, *Vejovis*, *Hadrurus*, and *Broteochactas* among the Iuridæ; and in the only member of the Bothriuridæ which I have seen, namely *Bothriurus*. From its wide range this type of lamella is probably the most primitive.

The arcade type occurs in *Diplocentrus* and *Nebo* among the Scorpionidæ, and in *Iurus*, *Caraboctonus*, and *Euscorpius* among the Iuridæ.

The reticulate type occurs in *Buthus*, *Parabuthus*, *Uroplectes*, and *Centrurus*, all belonging to the Buthidæ.

The morphological value of the lamellæ is probably less than that of the development.

The following table summarizes the two sets of facts and gives a list of the species I have examined :—

	Development.	Lung-books.
Scorpio fulvipes (C. Koch)	*Scorpio* type.	Spinous.
Heterometrus, sp.	,, ,,	,,
Opisthophthalmus capensis (Herbst)	,, ,,	,,
Palamnæus Thorellii (Poc.)	,, ,,	,,
Opisthocentrus madagascariensis (Kraep.)	,, ,,	,,
Opisthocentrus validus (Thor.)	?	,,
Hormurus australasiæ (Fabr.)	*Scorpio* type.	,,
Urodacus novæ-hollandiæ (Pet.)	?	,,
Scorpiops Hardwickii (Gerv.)	?	,,
Vejovis, sp. ined.	*Euscorpius* type.	,,
Hadrurus hirsutus (Wood)	,, ,,	,,
Broteochactas delicatus (Karsch)	,, ,,	,,
Bothriurus bonariensis (Koch)	,, ,,	,,
Diplocentrus Whitei (Gerv.)	?	Arcade.
Nebo flavipes (Sim.)	?	,,
Iurus Dufoureius (Brullé)	?	,,
Caraboctonus Keyserlingii (Poc.)	?	,,
Euscorpius italicus (Herbst)	*Euscorpius* type.	,,
Buthus nigrolineatus (Dufour)	,, ,,	Reticulate.
Parabuthus capensis (Gerv.)	,, ,,	,,
Uroplectes triangulifer (Thor.)	,, ,,	,,
Centrurus gracilis (Latr.)	,, ,,	,

The number of forms examined is far too small to base deductions on with any certainty, and to classify on the ground of these two structures alone would be almost certain to lead to a wrong conclusion. The results seem, however, to *suggest* the following rearrangement :—

(1) *Scorpio*, *Heterometrus*, *Opisthophthalmus*, *Palamnæus*, *Opisthocentrus*, and *Hormurus* remain associated as one group on the ground of their embryology.

All the rest have the *Euscorpius* type of development, and can be divided by their lung-books.

(2) A second group is formed by *Scorpiops*, *Vejovis*, *Hadrurus*, *Broteochactas*, and *Bothriurus*, which have "spinous" lung-books. *Vejovis* may have to be isolated on account of the difference in development.

(3) *Diplocentrus*, *Nebo*, *Iurus*, and *Euscorpius* agree in having the arcade type of lung-book.

(4) *Buthus*, *Parabuthus*, *Uroplectes*, and *Centrurus* have the reticulate type.

The first and last of these groups are in perfect accord, so far as they go, with Pocock's classification; the others agree less perfectly. The separation of *Euscorpius* from *Broteochactas* is not improbable, and gets over the difficulty of the geographical distribution of the Chactini; but the association of it with *Iurus*, and still more with *Diplocentrus* and *Nebo*, is less plausible, and it is much to be regretted that I have had no opportunity of examining the ovaries of these last two genera.

The bringing together of *Bothriurus* and *Hadrurus* is not unnatural. Pocock says of the Bothriuridæ:—"The Scorpions of this group seem to be little more than an exaggeration of some of the American members of the Iurini, for some of them show many points of resemblance to *Caraboctonus* and *Hadrurus*." Unfortunately the two forms here named do not, according to the lung-books, seem to be closely related.

Kraepelin's * classification needs less alteration, inasmuch as he unites the Iuridæ and Scorpionidæ of Pocock as one family. His subfamilies are practically the same.

How far these internal characters will agree with the external ones when these last are re-examined is a question which I think it better to leave to those who have had experience in discriminating the minute points of external difference.

EXPLANATION OF PLATE IX.

Figs. 1–5. The abdominal nervous system.
Fig. 1. *Parabuthus capensis*, $\times \frac{2}{1}$.
Fig. 2. *Palamnæus Thorellii*, nat. size.

---

* Jahrb. Hamb. Wissen. Anstalten, xi. 1.

Fig. 3. *Scorpio fulvipes*, nat. size.
Fig. 4. *Opisthophthalmus capensis*, × $\frac{3}{1}$. *l.n.*, longitudinal nerve.
Fig. 5. *Uroplectes triangulifer*, × $\frac{4}{1}$.
Fig. 6. Portion of ovary of *Scorpio fulvipes*.
Fig. 7. Portion of ovary of *Euscorpius italicus*, with unfertilized eggs.
Fig. 8. Portion of the same, with embryos in the ovarian tube.
Fig. 9. Portion of edge of lung-book lamella of *Vejovis*, sp. (spinous type).
Fig. 10. The same of *Euscorpius italicus* (arcade type).
Fig. 11. The same of *Buthus nigrolineatus* (reticulate type).

XXVII.—*A Revision of the British Jurassic Bryozoa.*—Part V. *The Families* Idmoniidæ *and* Entalophoridæ. By J. W. Gregory, D.Sc., F.G.S.

[Continued from p. 155.]

Family **Idmoniidæ.**

Diagnosis.—Cyclostomata Tubulata in which the zoœcia are simple open tubes and grow into adnate or erect branching zoaria. The zoarium is branched and the zoœcia open only on one side of it. The apertures are arranged in regular transverse series, usually alternately arranged.

Genus Idmonea, Lamouroux, 1821.

Diagnosis.—Zoarium adnate or erect. Branches ridged or triangular in section. Zoœcia in regular, transverse, and usually alternate series. The zoarium is branched and the branches usually radiate from a centre. The branches sometimes anastomose.

Type species: *Idmonea triquetra*, Lamx. 1821.

1. *Idmonea triquetra*, Lamouroux, 1821.

Idmonea triquetra, Lamouroux, 1821, Expos. méth. p. 80, pl. lxxix. figs. 13–15.
Non *Idmonea triquetra*, Walford, 1889, Bry. Shipton, Part I., Quart. Journ. Geol. Soc. vol. xlv. pp. 568, 569, pl. xviii. fig. 13, pl. xix. figs. 3, 4.
Reptotubigera triquetra, d'Orbigny, 1852, Pal. franç., Terr. crét. t. v. p. 751.
Idmonea gracilis, d'Orbigny, 1849, Prod. Pal. t. i. p. 317.

Diagnosis.—*Zoarium* composed of triangular branches, beside each of which is a thin flat selvage. The branches dichotomize repeatedly.

Zoœcia from 4 to 7 in each series.

Peristomes open along the summit of a low ridge.

Zoœcia slender and cylindrical in adult, short, thick, and angular in young stages. Walls punctate.

Distribution.—England: Great Oolite and Bradford Clay. Foreign: Bathonian, France.

Family **Entalophoridæ.**

Diagnosis.—Cyclostomata Tubulata in which the zoarium is erect and dendroid; the branches consist of solid bundles of zoœcia. The zoœcia are monomorphic and open on all sides of the stems.

Genus 1. Entalophora, Lamouroux, 1821.

Diagnosis.—Entalophoridæ in which the zoarium consists of thin stems, each of which is composed of a small number of zoœcia. The peristomes are scattered irregularly. The œcia are cylindrical.

Type species: *E. cellarioides*, Lamouroux, 1821.

1. *Entalophora cellarioides*, Lamouroux, 1821.

Entalophora cellarioides, Lamouroux, 1821, Expos. méth. p. 81, pl. lxxx. figs. 9–11.

Entalophora laxipora, d'Orbigny, 1849, Prod. Pal. t. i. p. 318.

Entalophora subgracilis, d'Orb., var. *corrugata*, Walford, 1889, Bry. Shipton, Part I., Quart. Journ. Geol. Soc. vol. xlv. p. 573, pl. xviii. fig. 14.

Diagnosis.—Zoarium cæspitose, composed of thin fragile branches about 1 millim. in diameter.

Zoœcia long; the free distal portion is often very long.

Peristomes irregularly quincuncial in arrangement.

Distribution.—England: Inferior Oolite, Great Oolite. Foreign: Bathonian, France.

2. *Entalophora magnipora*, Walford, 1889.

Entalophora magnipora, Walford, 1889, Bry. Shipton, Part I., Quart. Journ. Geol. Soc. vol. xlv. p. 572, pl. xix. figs. 11, 12.

? *Entalophora subirregularis*, d'Orbigny, 1849, Prod. Pal. t. i. p. 289.

Entalophora raripora, non d'Orb., Walford, 1889, *op. cit.* p. 572, pl. xix. fig. 10.

Entalophora raripora, Walf., var. *anomala*, Reuss, Walford, 1889, ibid. p. 573.

Cisternifera clausa, Walford, 1894, ibid. Part II., vol. l. p. 82, pl. vii. figs. 11, 17.

Cisternifera inconstans, pars, Walford, 1889, ibid. Part II., vol. l. p. 80, pl. vii. fig. 16.

Diagnosis.—*Zoarium* of thin regularly cylindrical branches, composed of about twelve zoœcia. Branches 1 to 2 millim. in diameter.

Zoœcia long, cylindrical, with only a small portion free. Apertures irregular in distribution, distant. Surface wrinkled.

Distribution.—England: Mid Lias—Great Oolite. Foreign: Bajocian, France?

3. *Entalophora nidulata* (Walford), 1894.

Pergensia nidulata, Walford, 1889, Bry. Shipton, Part II., Quart. Journ. Geol. Soc. vol. l. p. 73, pl. ii. figs. 1, 2.
Pergensia major, Walford, 1894, ibid. p. 74, pl. ii. figs. 3, 4.
Pergensia porifera, id. ibid. p. 75, pl. ii. fig. 6.
Pergensia galeata, id. ibid. p. 76, pl. iii. fig. 27.
Pergensia minima, id. ibid. p. 74, pl. ii. fig. 12.
Entalophora richmondiensis, var. *pustulopora*, Vine, 1884, Polyz. Richmond Boring, Quart. Journ. Geol. Soc. vol. xl. p. 792.

Diagnosis.—*Zoarium* short, clavate, cylindrical in section.

Zoœcia cylindrical, partly immersed, but a free distal portion, the extent of which varies greatly. The apertures are irregularly arranged, but a tendency to a spiniform arrangement occurs in the proximal portion of the zoarium.

Oœcia large, spherical.

Distribution.—England: Inferior Oolite and Great Oolite.

Genus 2. Spiropora, Lamouroux, 1821.

Diagnosis.—Entalophoridæ in which the apertures in most parts of the zoarium occur in regular annular or spiral lines. The zoœcia are regularly cylindrical.

Type species: *Spiropora elegans*, Lamouroux, 1821.

1. *Spiropora elegans*, Lamouroux, 1821.

Spiropora elegans, Lamx. 1821, Expos. méth. p. 47, pl. lxxiii. figs. 19-22.
Cricopora elegans, Blainville, 1830, Dict. Sci. nat. t. lx. p. 385.

Diagnosis.—*Zoarium* formed of loose tufts; branches dichotomize repeatedly, rather stout.

Zoœcia long, regularly tubular.

Peristomes slightly elevated, arranged in regular horizontal rows; from 5 to 7 peristomes are seen on each side of a branch; the rows of peristomes are distant, the zoœcia being long.

Distribution.—British: Great Oolite. Foreign: Bathonian, France.

2. *Spiropora annulosa* (Michelin), 1847.

Cricopora annulosa, Michelin, 1847, Icon. Zooph. p. 339, pl. lvi. fig. 3.
Cricopora verticillata, non Goldf., Michelin, 1846, *op. cit.* p. 236, pl. lvi. fig. 3.
Laterotubigera verticillata, d'Orbigny, 1852, Pal. franç., Terr. crét. t. v. p. 715.
Cricopora tessonis, Michelin, 1846, Icon. Zooph. p. 236, pl. lvi. fig. 6.
Entalophora tessonis, d'Orbigny, 1849, Prod. Pal. t. i. p. 318.
Spiropora tessonis, Haime, 1854, Bry. jur., Mém. Soc. géol. France, sér. 2, t. v. p. 195.
Cricopora subverticillata, d'Orbigny, 1849, Prod. Pal. t. i. p. 318.
Spiropora straminea (non Phill.), Haime, 1854, *op. cit.* sér. 2, t. v. p. 196, pl. ix. fig. 6.
Entalophora straminea (non Phill.), Brauns, 1879, Bry. mittl. Jura, Metz, Zeit. deut. geol. Ges. Bd. xxxi. p. 331.
Spiropora cæspitosa (non Lamx.), Haime, 1854, *op. cit.* p. 195 (excl. syn.), pl. ix. fig. 7.
Spiropora compressa, Haime, 1854, *op. cit.* p. 197, pl. ix. fig. 5.
Entalophora compressa, Vine, 1888, Polyz. Caen, Journ. Northampton Nat. Hist. Soc. vol. v. p. 10.
Cricopora acutimargo, Waagen, 1868, Zone *Amm. Sowerbyi*, Geogn. Pal. Beitr. Bd. i. Heft 3, p. 641, pl. xxxiii. fig. 7.

Diagnosis.—*Zoarium* forming very loose tufts; branches dichotomize irregularly, of medium thickness; section of branches circular, oval, or compressed.

Zoœcia regularly cylindrical, rather short.

Peristomes raised and arranged in regular rows; these are horizontal or slightly oblique; from 5 to 7 peristomes can be seen on one side of a branch; the distance between the rows of peristomes is short.

Distribution.—England: Inferior Oolite and Great Oolite. Foreign: Bajocian, France and Germany. Bathonian: France.

3. *Spiropora cæspitosa*, Lamouroux, 1821.

Spiropora cæspitosa, Lamouroux, 1821, Expos. méth. p. 86, pl. lxxxii. figs. 11, 12.
Non *Spiropora cæspitosa*, Haime, Bry. jur., Mém. Soc. géol. France, sér. 2, t. v. p. 195, pl. ix. fig. 7.
Cricopora cæspitosa, Blainville, 1830, Dict. Sci. nat. t. lx. p. 386.
Entalophora cæspitosa, d'Orbigny, 1849, Prod. Pal. t. i. p. 318.
? *Spiropora capillaris*, Lamouroux, 1821, *op. cit.* p. 47.
Cricopora capillaris, Blainville, 1830, *op. cit.* p. 386.
Intricaria bajocensis, Defrance, 1822, Dict. Sci. nat. t. xxiii. p. 546, pl. xlvi. fig. 1.
Spiropora bajocensis, Haime, 1854, *op. cit.* p. 196.
Laterotubigera bajocensis, d'Orbigny, 1852, Pal. franç., Terr. crét. t. v. p. 715.
Entalophora bajocensis, d'Orbigny, 1852, *op. cit.* t. v. p. 779.
Pustulopora tenuis, Waagen, Zone *Amm. Sowerbyi*, Geogn. Pal. Beitr. Bd. i. Heft 3, p. 641.

Diagnosis.—Zoarium growing in dense tufts of long slender cylindrical branches; these dichotomize repeatedly and occasionally anastomose.

Zoœcia regularly cylindrical.

Peristomes slightly raised; three or four apertures seen on each side of a branch; peristomial rows very oblique and crowded, and therefore giving the orifices an apparently quincuncial arrangement. At the ends of branches the peristomes are irregular and low (form *cæspitosa*, Lamx. & Mich., non Haime).

Distribution.—England: Great Oolite and Forest Marble. Foreign: Bajocian, France and Germany; Bathonian, France.

4. *Spiropora richmondiensis* (Vine), 1884.

Entalophora richmondiensis, Vine, 1884, Polyz. Richmond Boring, Quart. Journ. Geol. Soc. vol. xl. p. 791, fig. 3.
Terebellaria? increscens, Vine, 1884, ibid. p. 79.

Diagnosis.—Zoarium of thin bifurcating stems, from 1 to 2 millim. in diameter.

Zoœcia numerous, in regular spirals; below the points of bifurcation the rows of peristomes become less oblique and increase to ten in number; elsewhere 7 or 8 zoœcia can be seen in a single row across one face of the stem; zoœcia are short and cylindrical.

Peristomes well raised.

Distribution.—England: Great Oolite.

5. *Spiropora tetragona*, Lamouroux, 1821.

Spiropora tetragona, Lamouroux, 1821, Expos. méth. p. 85, pl. lxxxii. figs. 9, 10.
Cricopora tetragona, Blainville, 1830, Dict. Sci. nat. t. lx. p. 386.
Entalophora tetragona, d'Orbigny, 1849, Prod. Pal. t. i. p. 318.
Bisidmonea tetragona (non Lamx.), Walford, 1889, Bry. Shipton, Part I., Quart. Journ. Geol. Soc. vol. xlv. p. 571, pl. xix. figs. 7–9.
Spiropora tetraquetra, Lamouroux, 1821, *op. cit.* p. 47.
Cricopora tetraquetra, Bronn, 1835, Leth. Geogn. p. 247.
Bisidmonea antiqua, d'Orbigny, 1852, Pal. franç., Terr. crét. p. 720, pl. 762. figs. 10–12.

Diagnosis.—Zoarium composed of thick tetragonal stems, which dichotomize repeatedly but irregularly; they form a loose tuft.

Zoœcia short.

Peristomes slightly raised, arranged in alternate horizontal series (as in *Idmonea*). On each face of a stem there occur two rows of apertures placed alternately on the left and right sides of the face; the distance between two rows on the same side is of medium length.

Distribution. — British: Inferior Oolite. Foreign: Bathonian, France.

Genus 3. HAPLOŒCIA, gen. nov.

Diagnosis.—Entalophoridæ in which the zoœcia are short and angular in form. The peristomes are never greatly raised; the apertures are small and they are arranged either lineally or quincuncially.

Type species: *Haploœcia straminea* (Phillips), 1829.

Affinities.—This genus is proposed for some species which differ from *Entalophora* and *Spiropora* by having short hexagonal zoœcia instead of long regularly tubular ones. As the aperture is not truly terminal and is somewhat contracted, the zoœcia show a certain resemblance to those of the Cheilostomata; if the ordinarily accepted definitions of Cheilostomata and Cyclostomata be rigidly applied the members of this genus ought to enter the former order. Some of the species have been included in *Melicertites*, a genus of which the type species is very uncertain. These forms cannot, however, enter *Melicertites*, as accepted by Pergens, whose use of this name may be conveniently accepted.

1. *Haploœcia straminea* (Phillips), 1829.

Millepora straminea, Phillips, 1829, Geol. Yorks., Part I., Yorks. Coast, p. 143, pl. vii. fig. 8.
Cricopora straminea, Morris, 1843, Cat. Brit. Foss. p. 34.
Intricaria straminea, d'Orbigny, 1849, Prod. Pal. t. i. p. 289.
Non *Laterotubigera straminea*, d'Orbigny, 1852, Pal. franç., Terr. crét. t. v. p. 715.
Entalophora straminea, id. ibid. p. 779.
Non *Spiropora straminea*, Haime, 1854, Bry. jur., Mém. Soc. géol. France, sér. 2, t. v. p. 196, pl. ix. fig. 6.
Non *Spiropora straminea*, Vine, 1883, Rep. Brit. Assoc. 1882, p. 262.
Pustulopora straminea, Gregory, 1893, Cat. Jur. Bry. York Museum, Rep. Yorks. Phil. Soc. 1893, p. 60, fig. 2.
Pustulopora Quenstedti, Waagen, 1868, Zone *Amm. Sowerbyi*, Geogn. Pal. Beitr. Bd. i. Heft 3, p. 641, pl. xxxii. fig. 10.

Diagnosis.—*Zoarium* tufted, loose, and irregular; branches of medium thickness.

Zoœcia in regular, horizontal, closely adjoining series, usually hexagonal and bisymmetrical, but variations in growth-pressure render some irregularly polygonal. Aperture transversely elliptical. Peristomes slightly raised. Front wall punctate.

Distribution. — England: Inferior Oolite — Cornbrash. Foreign: Bajocian, Germany; Bathonian, France.

2. *Haplœcia irregularis*, sp. n.

Diagnosis.—Zoarium composed of small cylindrical stems, which dichotomize irregularly and usually at short intervals.

Zoœcia usually hexagonal, but occasionally heptagonal or pentagonal, often irregular, irregularly quincuncial in arrangement. Apertures large, circular, or, when worn, transversely elongate. Front wall coarsely punctate.

Distribution.—British: Great Oolite, Ancliff, near Bath; Lincolnshire Limestone, Stamford. Foreign: Bathonian, Normandy.

Affinities.—This species is separated from the former one by the irregularly quincuncial arrangement of the zoœcia.

Genus 4. Ceriocava.

Diagnosis.—Entalophoridæ in which the zoarium consists of thick massive stems, each of which is composed of a large number of zoœcia. The zoœcia are funnel-shaped. The apertures crowded. The peristomes flush. The axis of the zoarium consists of fine zoœcia, densely packed. The outer zone consists of zoœcia which are usually reflexed and of much greater diameter.

Type species: *Ceriocava corymbosa* (Lamouroux), 1821.

1. *Ceriocava corymbosa* (Lamouroux), 1821.

Millepora corymbosa, Lamouroux, 1821, Expos. méth. p. 87, pl. lxxxiii. figs. 8, 9.
Non *Ceriopora corymbosa,* Michelin, 1846, Icon. Zooph. p. 246, pl. lvii. fig. 9.
Ceriocava corymbosa, d'Orbigny, 1852, Pal. franç., Terr. crét. t. v. p. 1016.
Heteropora corymbosa, Haime, 1854, Bry. Jur., Mém. Soc. géol. France, sér. 2, t. v. p. 212.
Ceriopora Neptuni, d'Orbigny, 1849, *op. cit.* p. 324.
Ceriocava Neptuni, d'Orbigny, 1852, *op. cit.* p. 1016.
Ceriopora conifera (non Lamx.), Michelin, 1846, *op. cit.* p. 245, pl. lvii. fig. 8.
Ceriopora dumetosa, Michelin, 1846, *op. cit.* p. 245, pl. lvii. fig. 7.
Cava dumetosa, d'Orbigny, 1852, *op. cit.* t. v. p. 1019.
Cava pustulosa, Michelin, 1846, *op. cit.* p. 245, pl. lvii. fig. 6.
Monticulipora pustulosa, d'Orbigny, 1849, Prod. Pal. t. i. p. 323.
Nodicava pustulosa, d'Orbigny, 1852, *op. cit.* t. v. p. 1014.
Heteropora pustulosa, pars, Brauns, 1879, Bry. mittl. Jura, Metz, Zeit. deut. geol. Ges. Bd. xxxi. p. 336.

Diagnosis.—*Zoarium* dendroid, erect, growing in thick, solid branches, which anastomose occasionally. The branches are regularly cylindrical, or compressed (form *dumetosa*). The surface is level, or raised into pustules (var. *pustulata*).

Zoœcia thin-walled; diaphragms numerous. Aborted zoœcia scattered irregularly through the zoarium.

Distribution.—England: Great Oolite and Cornbrash. Foreign: Bathonian, France.

2. *Ceriocava laxata*, sp. n.

Diagnosis.—Zoarium with branches fairly regularly cylindrical.

Peristomes irregular in shape, size, and arrangement. Number of zoœcia in a branch comparatively limited. The central axis consists of few zoœcia, irregularly and loosely arranged.

Distribution.—Inferior Oolite, Leckhampton.

Affinities.—This species is most nearly allied to *Ceriocava corymbosa* (Lamx.). The differences can be clearly seen in a longitudinal section. The central axis has far fewer zoœcia, and these are not so tightly packed. It is not easy to separate the specimens of the two species by the external characters; but the apertures in *C. corymbosa* are more regular than in *C. laxata.*

Synopsis of Species of Entalophoridæ.

A. Zoœcia long and tubular; apertures equal in diameter to zoœcia.
- I. Branches slender; structure simple.
  - a. Apertures never in linear series. =*Entalophora.*
    - *a.* Zoarium of long thin cylindrical branches:
      - (1) free distal end long .... *E. cellarioides.*
      - (2) free distal end short .... *E. magnipora.*
    - *b.* Zoarium short, clavate .... *E. nidulata.*
  - b. Apertures mostly in linear series. =*Spiropora.*
    - *a.* Apertures in regular horizontal rows:
      - (1) series of apertures distant .... *S. elegans.*
      - (2) series of apertures close .... *S. annulosa.*
    - *b.* Apertures in oblique spiral series:
      - (1) peristomes slightly raised .... *S. cæspitosa.*
      - (2) peristomes well raised .... *S. richmondiensis.*
    - *c.* Apertures in short alternate series .... *S. tetragona.*
- II. Branches stout, with a central dense axis. =*Ceriocava.*
  - (1) Axis thick .... *C. corymbosa.*
  - (2) Axis loose and irregular .... *C. laxata.*

B. Zoœcia short and hexagonal; apertures contracted. =*Haploœcia.*
- (1) Apertures regularly arranged................ *H. straminea.*
- (2) Apertures irregularly arranged .... *H. irregularis.*

XXVIII.—*New Genera and Species of* Pyralidæ, Thyrididæ, *and* Epiplemidæ. By W. Warren, M.A., F.E.S.

[Concluded from p. 150.]

Subfamily *Hydrocampinæ.*

Genus Ambia, Wlk.

Ambia conspurcatalis, sp. n.

Fore wings greyish fuscous, peppered with dark grey, and towards the hind margin slightly suffused with ferruginous; basal line dark grey, angulated at one third; exterior line at four fifths, sinuous, parallel to hind margin, blackish; costa whitish beyond first and before and beyond second line; a narrow white discal lunule; a ferruginous broad marginal band finely edged internally with black and preceded by a sinuous, swollen, white, curved fascia; fringes ? pale. Hind wings wholly grey, dusted with dark grey atoms, with the two dark lines of the fore wings; a series of small round black dots at ends of all the veins; the hind margin finely ferruginous, but without the broad ferruginous band of the fore wings. Head, thorax, and abdomen grey. Underside paler and duller.

Expanse of wings 14 millim.

One female from the Khasias, without abdomen and the fringes worn.

Ambia albipunctalis, sp. n.

Fore wings dingy cinereous; first line blackish, edged with paler close to base; second line before middle parallel to first; a small silvery-white costal triangle in the centre, the apex touching the linear blackish discal spot, which is edged internally with silvery white; subterminal line shortly before hind margin finely silvery white, edged internally with black, becoming obsolescent below cell, but faintly discernible, curved inwards below middle, and reaching inner margin at two thirds, slightly wavy and blackish; apex of wing with a black spot edged with white; fringe concolorous. Hind wings the same, with a double blackish inner line, dark cell-spot, and slightly waved blackish submarginal line, which is double only on inner margin; fringe preceded by a darker line. Head, thorax, and abdomen concolorous. Underside the same; the white markings distinct, the dark ones hardly visible.

Expanse of wings 12 millim.

One female, Cherrapunji.

Genus PARACYMORIZA, Warr.

Paracymoriza semialbida, sp. n.

Fore wings with the two lines and submarginal row of white spots as in *P. stellata*, but the whole wing suffused with smoky black, beneath which the course of the two lines can be traced; the submarginal white spots remaining clear; fringes and fringe-line as in *stellata*, but all much darker. Hind wings pure white; basal patch black, edged with a white black-margined line; a round black discal spot; apical region occupied by a large oval black blotch, nearly touching on the outside a submarginal streak of dull bronzy scales edged with black, and preceded by an oblique black line from the costa, which forms part of the dark submarginal line, which is only distinct again on inner margin above anal angle; fringes dark bronzy in the apical half, whitish beyond; the hind margin of the hind wings is not crenulated as in *stellata*. Head and thorax blackish; abdomen silky whitish. Underside with all the markings duller.

Expanse of wings 18 millim.

One female from the Khasias.

Paracymoriza stellata, sp. n.

Ground-colour sandy ochreous; basal patch blackish fuscous, edged by a subangulated, whitish, dark-margined line, and traversed by an indistinct whitish line; exterior line at three fourths, whitish from the costa and parallel to hind margin to below middle, then turning rectangularly basewards, curved upwards and basewards again, then again bent at right angles, running to inner margin in middle; except for the costal arm it is sandy ochreous, like the ground-colour, with slightly darker edges; the middle space is whitish towards costa and suffused with dark grey on the inner margin; apical three fourths of hind margin occupied by a brown-black patch, through which there runs parallel to the hind margin and near it a row of snow-white dots, of which the third from the top is much the largest; fringes white, with a dark spot at apex and a dark blotch in the lower part, with a blackish basal line, preceded by a fine pale one. Hind wings with dark basal patch as in fore wings;

central area narrow on inner margin and broadening towards costa, also clouded with dark brownish and containing a large roundish discal spot, and edged with a fine, irregularly sinuous, dark-edged pale line; marginal space sandy yellow, except at anal angle, which is occupied by a brown-black blotch; the row of white spots is bounded externally by a fine brown line, and the spots are lunular and almost contiguous; hind margin distinctly crenulate; fringes white, with pale and dark basal lines as in fore wings, and with long dark pencils at the end of all the veins. Head, face, and thorax brown-black, mottled with white; abdomen blackish, with pale segmental rings, becoming yellowish towards its apex. Underside with all the markings repeated, but duller and blurred.

Expanse of wings 18 millim.

Both sexes from the Khasias.

Genus Nymphula, Schrank.

Nymphula? inconsequens, sp. n.

Fore wings white, almost wholly suffused with yellowish, the white ground-colour being restricted to the costa and the course of the subterminal line; first line at one third vertically sinuous, blackish, rising beyond a large blackish costal spot; a blackish costal annulus lies close to the base, and a black spot near the middle of the basal area; second line from one half, running rather obliquely outward, bluntly angulated in mid-wing, and attaining inner margin at two thirds, where it is thickened; the costal space between the two lines is broadly white and the linear black cell-spot is edged with white; subterminal line near to and parallel to the hind margin, formed of black spots and edged rather broadly on the inner side with white; costa between second line and subterminal line marked with three black white-edged spots; fringe dark leaden-grey. Hind wings dingy ochreous grey, with very faint indications of a submarginal line. Head, thorax, and abdomen yellow. Underside like upper, without the yellow suffusion; hind wings with basal patch, central line, and two curved submarginal lines dark.

Expanse of wings 18 millim.

A long series from the Khasias.

Nymphula pygmæalis, sp. n.

Fore wings pale ochreous, suffused with pale tawny; basal line pale, curved, dark-edged, preceded by a blackish blotch on costal half; the whole base narrowly blackish; second line whitish, dark-edged, is parallel and near to first on inner margin, then forms two large dentations outwardly, and reaches the costa just beyond middle as a pure white line; space between lines on inner margin blackish; subterminal line whitish, finely denticulated, edged finely with blackish below costa, preceded by a dark grey blotch opposite the sinus of the second line, and followed by a blackish blotch in the middle of the wing; fringe white, with a fine dark basal line and a dark cloud in the middle of wing. Hind wings with two white, finely denticulated, parallel, curved, dark-edged lines; the intermediate space also black, except a quadrate white spot in the middle; no dark markings in submarginal and marginal areas. Head, thorax, and abdomen ochreous, the latter blackish, level with the black band of hind wings. Underside like upper.

Expanse of wings 12–14 millim.

Several from the Khasias.

Genus Cataclysta, Hübn.

Cataclysta repetitalis, sp. n.

Ground-colour white; costa broadly yellow to middle, joining an oblique triangular central costal blotch, yellowish, but almost overrun with dark brown; a curved dark-edged yellow fascia from costa before apex, with its costal margin brown-black, costa narrowly yellowish between the fasciæ and on to apex; marginal band yellow, internally edged by a dark line, and externally containing a series of small black dots between the veins, the lower part of the white space between it and the last fascia suffused with dull grey-brown; the yellow marginal band is continued past the anal angle and throws off a curved spur, dark-edged above, touching the apices of the two costal fasciæ; base of inner margin yellowish, bounded by an oblique black oval mark; the space along inner margin between this mark and the yellow projection from the marginal band is white rippled with black; a blackish spot in the middle of the base; fringe lustrous grey. Hind wings white, with an indeterminate blackish central line; hind margin yellowish, containing in the middle four subquadrate black spots, edged with metallic blue and surmounted by a curved wavy black line, that is itself topped by a pale yellow dark-edged line, which, towards the apex of the wing, touches the tawny grey blotch that forms the extremity of the central line; fringe lustrous grey. Head, thorax, and abdomen dull yellow, the latter with dark dull grey segmental rings. Underside pale lustrous yellow, with the markings slightly apparent. The inner margin of the fore wings of the male beneath contains a tuft of yellow hairs.

Expanse of wings 18 millim.

One male from Queensland.

Genus Oligostigma, Guen.

Oligostigma siennata, sp. n.

Fore wings pearly white, with dark chocolate-brown markings; these consist of a costal streak from base to middle connected with a broader oblique fascia from middle of costa to near anal angle, its base continued narrowly along costa to another broad slightly sinuous fascia, which connects with the oblique fascia above the anal angle; an isolated oblique blotch on inner margin near base and the extreme base of the inner margin narrowly yellow; marginal band orange, edged internally by a fine black line, and containing externally a series of small black dots between the veins; it is continued more narrowly a short way along the inner margin till it touches a small projection from the chocolate-brown fasciæ; fringes lustrous grey. Hind wings pearly white, with a broad orange, dark-edged, submarginal fascia, and an orange lustrous-edged marginal fascia containing four metallic spots, the first indistinct, the second round, black; the top two smaller, black, with lustrous grey heads; opposite the cell the submarginal orange fascia is broadened out, so as to intrude upon the marginal, and at the wider part is suffused with darker; fringes lustrous grey; vertex, face, collar, and thorax pearly white; hind segment of thorax and basal segments of abdomen chocolate-brown; middle segments of abdomen white, anal segments orange-yellow. Underside with all the markings duller; legs and underside of abdomen yellowish white; legs brown at all the joints.

Expanse of wings 22 millim.

One male from Queensland.

Genus Parapoynx, Hübn.

Parapoynx? lævalis, sp. n.

Fore wings fuscous, dusted and suffused with darker; basal area filled up with darker and bounded at one fourth by the dark first line; second line at three fourths, thick, blackish, parallel to hind margin; median area brownish fuscous, becoming paler between the small dark cell-dot and the outer line; marginal area dark smoky fuscous, with a diffuse submarginal shade beyond the outer line; fringe and extreme hind margin slightly paler. Hind wings with the three lines reproduced, but less distinct, as the ground-colour is thickened with dense blackish dots. Head, thorax, and abdomen fuscous; apical segments of abdomen fulvous; face and antennæ fulvous ochreous. Underside dull dark cinereous, with only the outer line shown on both wings.

Expanse of wings 16 millim.

One male from the Khasias.

Subfamily *Scopariinæ*.

Genus Scoparia, Haw.

Scoparia planilinealis, sp. n.

Fore wings whitish, with dark grey dusting and blackish markings and suffusion; a black spot close to base in midwing; first line black, straight, preceded by a whitish line, and contiguous to two black stigmata externally; second line black, externally white-edged, straight at first and vertical from costa, then with scarcely a sinus running obliquely inward parallel to hind margin; the reniform stigma 8-shaped, oblique, with pale centre and costal blotch above it; marginal space blackish grey, with traces of a pale submarginal line; a series of black spots before hind margin, which is finely pale; fringe grey, with two fine grey basal lines. Hind wings dull greyish, darker towards hind margin. Thorax and abdomen whitish, peppered with grey. Underside of fore wings dull greyish fuscous, of hind wings paler.

Expanse of wings 18 millim.

One male from the Khasias.

An ordinary looking insect, distinguished by the nearly straight exterior line.

Family **Thyrididæ**.

Genus Hypolamprus, Hmpsn.

Hypolamprus fimbriata, sp. n.

Fore wings ochreous, washed with pale reddish cupreous, with brown lines and faint reddish reticulations; costa pale, with minute dark dots; a subcostal grey-brown streak, becoming reddish cupreous before apex, this space being edged beneath with brown and with a broad red-brown subapical streak from it to the end of the third median; from the end of the cell a slightly bent red-brown line descends as far as submedian vein, where it is thickest; another irregularly bent brown line ends at the anal angle, and beyond the cell is joined by a fine horizontal line to the median line; several interrupted vertical reticulations towards the base along inner margin; fringes concolorous, with the lower half red-brown towards the base. Hind wings with a brown-red basal streak, an angulated central one of same colour, preceded in cell by a squarish red blotch; a fine line from anal angle, which divides rectangularly into two, with a small brown dot between them; a fine subapical streak; fringe as in fore wings. Head, face, and front of thorax bronzy grey-brown; thorax and abdomen concolorous with wings. Underside like upper, with some black and white linear scales along the cell of fore wings; the costa of fore wings grey-brown, with a subcostal reddish cupreous streak, and the disc washed with the same tint; a pale whitish subapical space beneath the dark brown costal line.

Expanse of wings 26 millim.

One female from the Khasias.

Akin to *H. lobulata*, Moore.

Genus Pharambara, Wlk.

Pharambara compunctalis, sp. n.

Fore wings ochreous, almost entirely suffused with pale reddish brown and with reddish-brown markings, or with dark brown and brownish-black markings. The markings consist of broadish solid fasciæ on the costa, which, however, soon become broken up into lines and spots; two near the base antemedian, a third in the middle, a fourth (triangular and broad) at three fourths, and two smaller ones before apex; on the costa each of these patches is finely edged with black; the intervals between them are pale ground-colour, on the extreme costa almost white; a vertical, oblong, more or less annular blackish discal spot beyond the central fascia. Fringes concolorous, mottled with darker below the middle. Hind wings quite pale along costa, becoming gradually more coloured and with a red-brown or brown-black fasciaform blotch at anal angle, and on inner margin to centre, where there is a black distinct discal spot; fringes as in fore wings. Underside straw-colour, with bright reddish-brown or dark brown tessellated markings, darker on costa, where the large triangular spot is nearly black; both wings with an elliptical black discal spot, with silvery centre.

Expanse of wings 22 millim.

A good series from the Khasias.

Pharambara costiscripta, sp. n.

Fore wings dull yellowish ochreous, with dull red-brown markings, which are restricted to the costal half; costa more yellowish in the intervals and minutely spotted with brown; a brown blotch along costa near base, a subquadrate one before middle, separated by a distinctly paler rather glossy pear-shaped space from the outer blotch, which is irregularly quadrate, and contains a pale rectangular mark from the costa; a smaller blotch before the apex throws off a fine curved brown line, which runs near and parallel to hind margin as far as the anal angle; in the inner half of the wing only dull reticulations can be traced; fringes concolorous. Hind wings with the costal area pale whitish; the rest of the wing with red-brown broken fasciæ and reticulations, which more or less run into each other. Underside brighter, with darker tessellations; subcostal nervure and nervules of fore wings with glistening black metallic scales.

Expanse of wings 24 millim.

One female, Queensland.

The species can be distinguished by the pale pear-shaped space depending from the costa between the two central fasciæ. The fore wings are long and narrow, with bluntly rounded apex and simply curved hind margin, and the hind wings are comparatively small.

Pharambara decoratalis, sp. n.

Fore wings along inner margin pale whitish ochreous, towards the hind margin becoming smoky fawn-colour; costa in its apical half bright tawny, from the base outwards purplish fuscous, with numerous small coalescent blotches; the tawny exterior half of costa contains four pearly-grey blotches, each with a central dark spot, and gradually decreasing in size towards apex, much as in many *Tortrices*; along the middle of the marginal fawn-coloured space are a few dark spots and one prominent black one close to margin; this fawn-coloured space throws out a short fascia to inner margin before anal angle, the angle itself remaining pale, with a small triangular grey spot; fringe tawny yellow, with two black spots about the middle. Hind wings ochreous, much suffused with fawn-colour towards apex, with an ill-defined tawny central fascia and indistinct reticulations in parts; fringe dark fulvous, with paler apices. Head, face, and thorax purple-grey; abdomen paler, more ochreous. Underside of fore wings with costa marked with bright tawny; a dark fasciaform spot from inner margin at two thirds and a curved dark narrow streak below apex running into hind margin; hind wings ochreous, mottled and suffused with fulvous and fawn-colour.

Expanse of wings 19 millim.

One male from the Khasias.

Pharambara obliquistrigalis, sp. n.

Fore wings pale straw-colour, suffused and reticulated with fulvous; an ill-defined fulvous streak from apex to middle of inner margin, basewards of which the whole wing is washed with fulvous, except the outer half of costa, which is broadly pale ochreous; apical region fulvous, with a small pure white dark-edged spot, which merges below in the fringe-line; from inner margin before anal angle two parallel oblique tawny lines run as far as the lower radial, and are followed by a small black dot; beyond them externally are some irregular tawny strigæ. Hind wings straw-colour, crossed by about fifteen slightly wavy lines parallel to hind margin, which is nearly straight; two in the middle are darker and have the intervening space filled up with tawny, and two more towards the margin are slightly darker and contain a small black dot corresponding to that in the fore wings. Head, thorax, and abdomen tawny. Underside of fore wings with costa finely spotted and streaked with black, with yellow and black strigulæ below, and three brownish vertical fasciæ; hind wings as above.

Expanse of wings 25 millim.

One male from the Khasias.

Pharambara parcipunctalis, sp. n.

Fore wings pale greyish ochreous, glossy, covered with short strigulations of fuscous tint, which in many cases are confluent, and with a few more prominent blackish markings, of which the most conspicuous are two horizontal streaks, one obliquely over the other, on the submedian fold just beyond the middle, two or three shorter ones obliquely above them beyond the cell, and three irregularly-shaped markings towards the hind margin; a grey slightly sinuous subcostal streak and some costal grey blotches; the submedian vein is also grey towards the base; fringe concolorous, with blackish mottling at end of the veins. Hind wings rather paler, not so grey, with a blackish mark on the discocellular and a small dark one above the anal angle. Head and abdomen ochreous; thorax greyer. Underside like upper.

Expanse of wings 28 millim.

One male from the Khasias.

Not unlike *P. subcostalis*, Hmpsn., but quite distinct.

Pharambara semiperforata, sp. n.

Fore wings nearly three times as long as wide, whitish ochreous, semihyaline, overlaid with bright red-brown, and with red-brown reticulations; costa finely dotted with dark; the basal two thirds is more or less wholly suffused with red-brown, the marginal third remaining pale, with red-brown reticulations; a small yellowish costal patch at one fourth and a larger more oblique one just before the middle, the latter divided by a reddish line extending into the cell, and there becoming hyaline, the costal margin on both sides of them from base to apex being deep red-brown; beneath the median vein are four small round semihyaline spots in a row; the long costal blotch beyond the second yellowish interval itself contains two small yellowish spots; before the apex a curved dark red-brown streak runs from the costal margin to the hind margin, and the reticulations in the marginal area form another red streak running vertically to the anal angle; fringe reddish brown. Hind wings with a broad dark red-brown fascia in the middle, separated by the paler ground-colour from a shorter and narrower one nearer the base; marginal space beyond it semihyaline, reticulated with red-brown; fringe reddish, preceded by a thick red-brown line. Face, palpi, and abdomen red-brown; thorax and vertex duller, more fuscous. Underside yellowish, with reddish-fuscous reticulation and blotches; costa of fore wings with seven dark blotches, of which the last five are triangular, and with the intervals straw-colour; all alike neatly marked and strigulated with black; a subcostal streak reddish orange, with some long black and yellow streaks beneath; beyond the cell is a large irregular velvety black-brown blotch, the inner edge of which is curved and the outer with two prominences and a sinus between them; all the markings semi-obsolete below the submedian fold; hind wings much as the upperside.

Expanse of wings 32 millim.

One male from the Khasias.

Pharambara ulterior, sp. n.

Fore wings very pale ochreous, with pale fulvous markings; a subcostal fulvous streak; three small pale fuscous costal spots near base, one just beyond the middle and a larger one shortly before apex; hind marginal area and fringes fulvous; an oblique fulvous fascia from inner margin beyond middle to middle of the wing, where it approaches a projection from the marginal fascia, and has a small dark spot on its inner edge; the pale ground-colour is throughout very finely reticulated with fulvous and the intervals on the costa between the spots are paler. Hind wings the same, without the costal spots, except one dark fuscous one *beyond* the middle, obliquely below which is a smaller fuscous spot lying on the inner angle of the oblique fascia. Head, thorax, and abdomen pale ochreous, spotted with fulvous. Underside with all the markings very distinct, the last two costal blotches and the oblique fascia on the fore wings being brown-black.

Expanse of wings 16 millim.

One male, Khasias.

In *emblicalis*, Moore, the *large* costal blotch is much nearer the middle of the costa as well as the oblique fascia; and the subapical blotch is darker and runs obliquely outwards into the fringe.

Genus Siculodes, H.-S.

Siculodes argentalis, Wlk., var. *tuberosalis*, nov.

Differs from typical *argentalis* in the shape of the marginal brown blotch, which, instead of being sinuous on the inner edge, is concave and well defined and irregularly oval in shape; the oval apical blotch, instead of being filled up with black, is shining white, with the upper edge alone black. The brown blotch probably varies locally; Mr. Meyrick (Trans. Ent. Soc. 1894, p. 479) remarks that the Sambawa examples have it narrower than the Bornean, but he does not refer to any difference in the shape and contour.

This present variety is from the Khasias.

Family **Epiplemidæ.**

Genus Epiplema, H.-S.

Epiplema albipunctata, sp. n.

Fore wings leaden cinereous; at one third and two thirds two black curved transverse lines, finely edged with ochreous, the exterior again edged finely with black. This is strongly outcurved in mid-wing towards the subapical sinus in the hind margin, then curved inwards more or less parallel to hind margin; on the first and second median it is immediately preceded by a small oval white spot; two black linear dashes accompanied by ochreous scales along the upper part of the subapical sinus; fringe rather darker, with ochreous base. Hind wings with one or two indistinctly expressed black-edged round marks at end of cell; an exterior ochreous line, strongly angled outwards on vein 4, and edged with black on both sides, more thickly on the outside above the angle and on the inside below it; four round white spots in the intraneural interspaces before the hind margin in the upper half of the wing. Head, thorax, and abdomen, and underside of fore wings concolorous. Underside of hind wings mottled ochreous, with broad dark hind margin, in which the four white spots are prominent.

Expanse of wings 20 millim.

One male from the Khasias.

Akin to *sreapa*, Swinhoe, and probably to *incertaria*, Wlk., from Borneo.

Epiplema cœruleotincta, sp. n.

Fore wings dull greyish brown, speckled with darker, with a paler brown space in the middle from the inner margin, not reaching the costa, followed by a broad smoky-brown shade from inner margin, which also does not attain the costa; the whole of the marginal area beyond smoky brown and grey; extreme hind margin dark brown-black, edged internally by a wavy line from costa just before apex to the angle on the second median vein; on the costa at two thirds is a black-brown triangular blotch, followed by three smaller ones before apex; fringe dark brown-black, with a paler line at base. Hind wings with the costal half deep brown, with numerous bright bluish-white freckles and two pale yellowish-white blotches in the middle; inner half dull paler brown; hind margin and fringe as in fore wings, preceded by a pale wavy fascia, which is dark-edged internally and itself preceded by a darker shade. Head, thorax, and abdomen dark brown, dusted with darker; collar paler. Underside dull brownish grey in the fore wings; more or less tinged with whitish in the hind wings, and with the discal markings white.

Expanse of wings 28 millim.

A few from Queensland.

The ground-colour is variable, some examples being very much paler.

Epiplema inhians, sp. n.

Of the same size and wing-outline as *E. irrorata*, Moore, but with very different distinct markings. Fore wings ochreous, with numerous transverse fuscous striæ; first line at one fourth, oblique, wavy, dark, with tawny edging, followed by a dark blotch on costa; second line from another dark blotch in the middle of costa runs obliquely outwards to below the middle of wing, then is curved inwards to inner margin just beyond middle, describing a very prominent acute projection in the middle; the whole wing basewards of this line suffused with dark grey, mottled with lighter and with tawny; marginal space from apex to second angle filled in with olive tawny, edged inwardly by a wavy blackish line, followed above the anal angle by two lunate marks, the upper one smaller and surrounded by whitish scaling, the lower larger and darker; between these and the exterior line is a narrow shade from the costa, angulated opposite the angulation of the exterior line and incurved below parallel to it; fringes tawny, mottled with blackish at the three angular projections; cell-spot linear, whitish. Hind wings darker, more mottled, with the exterior line reproduced; a long white scaleless mark in the cell; marginal space irregularly mottled, with a narrow dark wavy margin, which towards anal angle is edged with white; fringe tawny. Head, thorax, and abdomen mottled dark grey. Underside of fore wings brownish grey, with indistinct frecklings; of hind wings whitish, with blackish frecklings.

Expanse of wings 16 millim.

One female from the Khasias.

Epiplema lituralis, sp. n.

Fore wings chalk-white, flushed with ochreous; basal patch ill-defined, mottled with fuscous atoms; central fascia dark grey, edged with blackish and tawny; the inner edge irregular and strongly inangulated in middle; the outer vertical and only slightly wavy; a small tawny spot at the extreme apex, below which are four black spots, the second horizontal, forming a line to another tawny less distinct patch in middle of hind margin. Hind wings white, more or less suffused with ochreous, with a broad dull central fascia with wavy darker edges and some tawny patches along the upper part of hind margin, edged inwardly with black curves. Head, thorax, and abdomen white. Underside white; the fore wings with reddish-fuscous transverse striæ.

Expanse of wings 18 millim.

One female from the Khasias.

Epiplema ochreofumosa, sp. n.

Fore wings pale straw-colour, entirely suffused except along hind margin and narrowly along inner margin with smoky blackish, mixed with fulvous; first line very indistinct, slender, angulated on subcostal, then vertical and wavy; second line from costa just beyond the middle makes a rectangular curve in mid-wing, and forms a small concise angle inwards on the submedian vein; it is bounded inwardly by a broadish fulvous shade, and followed by a smoky vertical shade that descends from the smoky costa, and is itself followed by a more diffuse fulvous one; submarginal line represented by three dark vertical dashes between the veins in the upper half of the wing; the smoky cinereous tint embraces the whole of the basal area and the costa to the apex, before which it becomes broader, and mixed with fulvous scales extends more or less over the central area, leaving only two straw-coloured patches on inner margin, one before, the other (paler) beyond the exterior line; discal spot annular, fulvous, edged with dark; fringes straw-colour. Hind wings with the extreme base blackish, the rest of the wing pale straw-colour, with some transverse fuscous speckles in the disk and a fulvous exterior line, which starts from the middle of the costa and ends on inner margin shortly before anal angle, forming a narrow projecting sinus on vein 4; it is preceded and followed by some bright fulvous streaks; a fine dark submarginal line; fringes concolorous with ground-colour. Face, thorax, and basal segments of abdomen cinereous; rest of abdomen straw-colour; vertex white; antennæ ochreous. Underside dull straw, without markings; the fore wings with the smoky area reproduced, but duller.

Expanse of wings 30 millim.

Khasias.

Genus Gathynia, Wlk.

Gathynia fumicosta, sp. n.

Fore wing smooth, greyish ochreous, with the costa broadly purple-grey and the hind margin suffused with grey; a fulvous streak beneath the grey costal streak, as broad as that, and running to the exterior line; a fulvous streak along the inner margin from base; a fulvous apical spot, with two small black dots in it; lines fuscous, first from one fourth of costa to one fourth of inner margin, forming an acute angle in mid-wing, the two arms both straight; second line at five sixths, outwardly curved and forming a large sinus, and reaching inner margin not far before the anal angle; fringe fulvous, with darker tint below apex and above anal angle. Hind wing very pale straw-colour, with three fulvous lines, the first like the first on fore wing, the second similar but approaching the first towards the angle, and so forming a blunter, more rounded angle, the third marginal containing four small blackish dots opposite the cell, the uppermost the largest; a broad ferruginous streak, concisely edged, from base to fringe between the radial and the second median nervule, which beyond the exterior line becomes leaden-coloured; fold on inner margin grey. Head, face, and collar dark purplish brown; antennæ, thorax, and abdomen fulvous, the latter mixed with cinereous and becoming paler at the apex. Underside: fore wings dark cinereous, shot with fulvous towards apex; hind wings whitish straw-colour, the costal tufts yellowish.

Expanse of wings 24 millim.

One male from the Khasias.

XXIX.—*Descriptions of Five new Species of* Castnia *from Tropical South America.* By Herbert Druce, F.L.S. &c.

Castnia, Fabr.

1. *Castnia laura*, sp. n.

Primaries brown, crossed from about the middle of the costal margin to the anal angle by a wide white band, which becomes narrower near the anal angle; six round white spots nearest the apex, the first three in a straight line, the second three beyond slightly curved outwards; the fringe brown and white: underside as above, excepting that the white band and spots are more distinct, and, in addition, a marginal row of large orange-yellow spots extending from the apex to the anal angle, those nearest the apex being the smallest. Secondaries brown, crossed below the middle from the costal margin nearly to the anal angle by a row of large pure white spots and a marginal row of large orange-yellow spots extending from the apex to the anal angle; the fringe brown: the underside very similar to the upperside, but paler in colour. Head, antennæ, thorax, abdomen, and legs dark brown, the anus orange.

Expanse 4 inches.

Hab. Brazil, Chapada (*Mus. Druce*).

2. *Castnia ahala*, sp. n.

Primaries pale brownish fawn-colour, crossed beyond the middle by a curved brown line; a large round darker brown spot at the end of the cell, and a small white spot close to the apex; the veins blackish; the fringe pale brown: underside bright orange. Secondaries deep orange-yellow, the veins black, the outer margin edged with black; a row of small black dots extends from the anal angle partly across the wing: underside very similar to the upperside. Head, antennæ, thorax, and upperside of the abdomen pale brown; anus yellow; underside of the head and front of thorax white; underside of abdomen pale yellow.

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

Hab. Amazons (*Mus. Druce*).

3. *Castnia sora*, sp. n.

♂ ♀. Primaries dark brown, marked somewhat as those of *C. mygdon*, but considerably darker; the fringe brown. Secondaries black; a large dark orange-yellow spot at the end of the cell and two wide bands of large dark orange-yellow spots extending from the costal margin to the anal angle; the first band just below the cell, the second round the outer margin; the fringe yellow. Head, antennæ, thorax, abdomen, and legs dark brown, the anus yellow.

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

Hab. Paraguay, San José (*Mus. Druce*).

4. *Castnia micha*, sp. n.

Primaries and secondaries hyaline, slightly irrorated with black scales; the veins all black; the costal, outer, and inner margin edged with black: primaries very broad; a black band crosses the wing beyond the cell from the costal margin to the anal angle, and on the inner margin near the anal angle is a large round black spot; a black band crosses the cell about the middle; two white elongated spots about the middle of the outer margin. Secondaries crossed below the middle from the costal margin to the anal angle by a wide curved black band, the outer margin black. Head, antennæ, abdomen, and legs black; sides of the abdomen greyish, with a white spot on the last three segments; thorax spotted with white.

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

Hab. Paraguay (*Mus. Druce*).

5. *Castnia dodona*, sp. n.

Primaries long and narrow, hyaline, the veins all black; the apical band oval and very wide; a black band crossing the middle of the cell. Secondaries with the middle hyaline space very small, and a wide black band crossing the wing from the costal margin to the anal angle; the outer margin black, with some small white spots at the anal angle. Head, thorax, and abdomen black; antennæ black, the tips yellow; the sides of the abdomen pale yellow.

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

Hab. Ecuador, Sarayacu (*Buckley*, *Mus. Druce*).

This species is allied to *Castnia linus*, Cram., and was included with it by Westwood, who also sank *Castnia heliconioides*, Herr.-Sch. I now have four species of this group, which are easily separated from each other and are geographically quite distinct; they are as follows:—

Castnia linus, Cram.

Hab. Guiana, Surinam, Cayenne.

Castnia dodona, sp. n.

Hab. Amazons, Ecuador.

Castnia heliconioides, Herr.-Schäff.

Hab. North-west and South-east Brazil.

Castnia micha, sp. n.

Hab. Paraguay.

The resemblance between these species of *Castnia* and the following species of Perecopidæ from the same localities is very remarkable:—

Anthomyza brotes, Druce, resembles *Castnia linus*, Cr.

Anthomyza Buckleyi, Druce, resembles *Castnia dodona*, Druce.

Anthomyza Swainsoni, Druce, resembles *Castnia heliconioides*, Herr.-Schäff.

From Paraguay I have not yet received any species of *Anthomyza*.

XXX.—*Microscopic and Systematic Study of Madreporarian Types of Corals.* By Maria M. Ogilvie, D.Sc.*

In the first part of this paper the author gives the results of her microscopic investigations on the structure of the skeleton in a number of typical Madreporaria.

Detailed microscopic study of the surface of the septum showed small scales lying above and against one another, somewhat like the slates of a roof, and consisting solely of fine, parallel-placed, or diverging aragonite fibres. Besides these calcareous scales, ectodermal cells (calicoblasts) could still be observed in several cases attached to the surfaces of septa in fresh specimens. Heider and one or two other authors have already mentioned the frequent occurrence of organic polypal remnants on skeletal surfaces.

The scales observed by the author were found to agree precisely in shape and size with the calicoblasts, and to show various transitional stages from the organic cell to the calcified. It follows from this that the skeleton of Madreporaria takes its origin from an actual calcification of the calicoblasts, and not, as Koch thought, by a secretion laid down outside the cells. The author found further that the calcareous scales were arranged in extremely thin lamellæ, and that the fibro-crystalline deposit was similarly oriented in successive lamellæ.

The stages in the process of skeleton-building may be thus generally stated :—

(1) Calcareous deposit is laid down within individual calicoblasts of the ectoderm. At the same time new ectodermal cells are formed next the mesoglœa, and these which are undergoing calcification become loose external layers of partly calcareous, partly organic tissue.

(2) Fibro-crystalline groups of aragonite are built up in the individual cells, and the cell-walls shrivel. Thus a connected calcareous lamella is formed, which is ultimately incorporated with the skeleton.

(3) Changes of disintegration and crystallization still continue after the cell-lamella has severed living contact with the polyp. The disintegration of organic cell-remnants produces various flecks and bands, usually carbonaceous, in the midst of the crystalline deposit. These afford the

* From the 'Proceedings of the Royal Society,' vol. lix. no. 353, pp. 9-18; being an abstract of a communication received July 24, 1895.

explanation of the so-called "dark streaks" and other appearances in the skeleton.

The finer structure of the septa will be readily understood when it is remembered that the septa are formed within radial invaginations of the aboral body-wall of the polyp. The septal surfaces are practically casts of the two flaps of a septal invagination. When the flaps are smooth the calcareous lamellæ are also smooth; but, according to the author's observations, that is seldom the case in recent Madreporaria. Usually the septal flaps are pitted and goffered, resembling the pleated muscular flaps of the mesenteries, and the septal surfaces are correspondingly granulated and fluted. The author has found that in all cases the calcified calicoblasts of successive lamellæ are grouped around definite *centres of deposit* situated in the median plane—corresponding to the growing edge—of the septum. Subsequently the individual groups of calicoblasts assume the form of radiating bunches of fibro-crystalline aragonite, passing outwards from the original centre of deposit in the median plane to the surface of the septum. The author has given the name of "fascicles" to these fibro-crystalline "bunches," and has demonstrated the relation which they bear to the external sculpturing observed on lateral septal surfaces. *The emergence of a fascicle at the surface gives rise to a granulation.* The fascicles are, however, of varied size; if large, one fascicle usually corresponds to one granulation, if small, a number of fascicles may, in the course of septal thickening, coalesce to form a broad nodular granulation. The size of individual fascicles depends on the original closeness of the "centres of calcification" at the septal edges.

The trabecula (="poutrelle," Edw. & H.) of a "perforate" septum is composed of *symmetrical groups of fascicles* placed in vertical series. The author has further found that those septa described by Edwards and Haime as "imperforate and leaf-like" are also composed of trabeculæ. But the individual parts of these trabeculæ have an opposite *pair of fascicles*, instead of an indefinite number. The majority of Astræid genera have septa in which both kinds of trabeculæ occur. The author applies the term "simple trabecula" to a trabecula made up of successive *pairs* of fascicles, as the axis of deposit is in part or wholly common to the opposite fascicles, and the term "compound trabecula" to one made up of successive *groups* of fascicles. In the former case the fibro-crystalline deposit may be said to be bilaterally symmetrical in the opposite halves of a septum; in the latter the fibro-crystalline deposit is radially symmetrical around ideal trabecular axes in the median septal plane. Each member of a successive series of fascicle "pairs" or "groups" in a trabecula is called by the author a *trabecular part* (*Trabekelglied*). *The "fascicle" may be regarded as the structural unit of the coral-skeleton. Two or more fascicles combine to build up a "trabecular part." And the differences in the relative arrangement of trabecular parts determine the endless varieties of skeletal form within the Madreporaria.*

The author has subjected the following typical genera to a detailed microscopic investigation:—*Galaxea, Mussa, Heliastræa, Goniastræa, Montlivaltia, Thecosmilia*; then *Fungia, Siderastræa, Lophoseris*; further, *Eupsammia, Haplaræa*; and, lastly, *Turbinaria, Actinacis, Madrepora*, and *Porites*. This research enables the author to state that different types of septal structure are characteristic of different groups of Madreporaria. The differences relate to the microscopic structure of the trabeculæ and to the arrangement of trabeculæ in the plane of a septum. It is impossible here to do more than indicate the line of research. *Turbinaria* is an example of an extremely simple structural type. The component trabeculæ are small, uniform in size, and directed all in the same way, obliquely or almost horizontally inwards from the periphery of the septum to the inner edge. The fascicles are paired, and their axes never bend out of the median septal plane. *Galaxea* has a septum whose trabeculæ bend right and left from a definite area of divergence in the septal plane. The individual trabeculæ are large, vary in size, and the axes of the paired fascicles bend out of the median plane towards the opposite surfaces of a septum. The septum of *Mussa* is composed of a number of broad ridges, elliptical in section and ending at the upper edge of the septum in broad "spiniform teeth." The author shows that each "spiniform tooth" is itself finely serrated, and that the serræ represent apices of trabeculæ. In short, *a single broad ridge of the* Mussa *septum is the precise homologue of the complete* Galaxea *septum*, being built up of fan-shaped groups of trabeculæ diverging right and left from the middle area of a ridge. Again, *Fungia* has, like *Mussa*, a septum composed of a number of ridges; but the trabeculæ in each ridge have a course almost parallel with one another. The emergent fascicles are thus so close that coalescence inevitably takes place; the soft parts of the polyp clothing the ridge are pushed outwards at the prominent middle part of the ridge, and readily give rise to synapticular union between septa. Further reference to this part of the work must be omitted here.

The author observed in sections of recent types that a larger amount of organic cell-material was usually present near the median plane of the septum than towards the lateral surfaces. This she believes may be attributed to the greater rapidity of the calcareous secretion and the less complete calcification of the calicoblasts present at the doubled upper edges of septal invaginations. In fossil material secondary changes render this central part of the septum more or less conspicuous on account of the breaking down of organic products, or sometimes the complete replacement by infiltrated salts. The author strongly contends that there is no basis for the assumption of a "*primary septum*" in the middle plane of a septum in the sense at present accepted by most palæontologists. On the contrary, the author's sections show that the *fibro-crystalline structure of the septum is the same throughout its whole thickness, essentially that of a double system of thin calcareous lamellæ*, either smooth or fluted, and corresponding to a deposit from opposite flaps of an invagination.

The author's investigations afford many new microscopic facts of structure, testifying that the growth in height of the polyp is accomplished at certain growth-periods, between which pauses ensue. During each growth-period a varying number of the calcareous lamellæ, "growth-lamellæ," are laid down, and these always appear in intimate union with one another. Again, regular curves or lines of growth are evident on the septal surfaces, marking the intervals between successive growth-periods. The space between two growth-curves or lines on the septal surface represents the part of the septum built up in one growth-period, and it has been called by the author a septal *growth-segment*. An important observation is that the extra length added to a single trabecula in one growth-period is *invariably one trabecular part*; this length varies in the trabeculæ of one and the same septum, being greatest at the exsert portions near the wall.

Granulations mark the surfaces of trabecular parts. Edwards and Haime applied the term "synapticula" to the interseptal bars in *Fungia* and its allies, and described the synapticula as formed by coalescence of granulations from opposite surfaces of neighbouring septa. The author demonstrates that in *Fungia* the granulations *seldom* meet across interseptal loculi; but a continuous calcareous deposit is formed in a special invagination of the interseptal parts of the aboral body-wall. Together with a number of observations on other synapticulate types, this has led the author to accept a distinction made by Pratz, and hitherto discredited in the literature. Pratz proved that the fossil Fungid subfamily of Thamnastræinæ had synapticulæ formed by coalescence of granulations, and these he called "*pseudo*-synapticulæ." The name of "*true* synapticulæ" he limited to such as were formed around new centres of deposit out of the septal plane; these he found in Siderastræa, but did not farther examine typical genera belonging to the families Funginæ and Lophoserinæ. The author's results are that *pseudo-synapticulæ* occur not only in Thamnastræinæ, but also in the Funginæ, Lophoserinæ, and occasionally in Astræidæ and Eupsammidæ; while *true synapticulæ* occur chiefly in Funginæ and Eupsammidæ, rarely in Lophoserinæ, and never in Astræidæ. The author regards true synapticulæ as *basal* structures representing modified dissepiments. The advantage of synapticulæ to the polyp is that they afford a basal support over which the fleshy parts and mesenterial loculi may bend and be continued to some depth. The author, in pointing this out, refers to the analogy of the internal canaliculate visceral system thus produced with the external canaliculate system attained by a porous cœnenchyme in "Perforate" colonies. At the same time she thoroughly disagrees with the prevailing opinion that the synapticulate types have any nearer relationship with *Madrepora*, *Porites*, &c., since the skeletal parts show many important differences of structure; neither is the "porous cœnenchyme" in any way homologous with the synapticulate calyx.

No essential difference is presented between septa, costæ, and wall in respect of their microscopic structure; and the author found it also for other reasons practical to distinguish in her work the septa and costæ under the inclusive name of *radial* structures, the wall, on the other hand, as a *tangential* structure. Dissepiments, tabulæ, true synapticulæ, and certain kinds of columella are regarded as *basal* structures.

The microscopic structure of dissepiments and tabulæ is demonstrated by the author to be the same. Both are composed of a series of calcareous growth-lamellæ laid down from one surface only of the aboral body-wall of the polyp. The fibro-crystalline deposit is therefore perpendicular to the plane of contact between polyp and skeleton. The distance from one platform of dissepiments to the next above coincides in all typical Astræids with the interval between two growth-lines on the septal surface. It may be deduced from this that the polyp lays down a new basal support for itself at the close of each growth-period. The solid calcareous deposit (usually called "stereoplasm" or "endotheca") at the base of the short simple calyces of most Turbinolids has the same microscopic structure as tabulæ or dissepiments, differing from them only in the fact that the new groups of growth-lamellæ are always closely opposed to the foregoing.

The "columellar" or "pseudocolumellar" area of recent Madreporaria is explained by the author as the morphological equivalent of the "tabulate" area in most Palæozoic Madreporaria. The styliform or fasciculate "true" columella of *Turbinolia* and its allies proves itself to be, structurally considered, a basal deposit, and is merely an upwardly arched or entwined modification of the tabulæ. The "pseudocolumella" is, as already known, a mixed structure in which septal teeth or outgrowths unite with irregularly distributed basal deposit. It finds its antetype readily in the occasional warping of the septal spines or inner ends *within* the tabulate area of certain Palæozoic genera. The "lamellar" columella is of especial interest; the author looks upon it as the remnant of a retrograde "*main septum*," affording therefore an important phylogenetic link between so-called "tetrameral" and "radial" symmetry of the septa wherever it occurs.

Considerable differences are at present found in Madreporarian literature in the use of the terms "theca" and "epitheca." The author accepts Heider and Ortmann's terms "*pseudotheca*" for a wall formed by lateral thickening of the septa, and "*eutheca*," or simply *theca*, for a wall in which independent centres of deposit are developed. Ortmann's suborders of Madreporaria, Euthecalia, Pseudothecalia, Athecalia are, however, believed by the author to be based on an erroneous principle, since all types with a porous wall are placed among Athecalia. Porosity is looked upon by the author as a secondary feature, the porous wall can be demonstrated to be the morphological equivalent either of pseudotheca or of eutheca. A still more serious objection to these suborders is the fact that not all Turbinolids possess an eutheca; neither do all Astræids possess a pseudotheca as Ortmann means, but cases occur in both those families where the only peripheral support is afforded by the epitheca. The author is inclined to think this was the primitive form of the Madreporarian calyx, and to look upon both theca and pseudotheca as later modifications associated with retrogression of the epitheca, greater prominence and rapid growth of the septa, and very often with the processes of vegetative budding.

Certain cœnenchymatous colonies, *Madrepora*, *Turbinaria*, &c., have been shown by the author to have thecal and septal structure like the Turbinolids; further absence of basal structures in the calyx other than columella. This throws a new light on the relationship of these types, and brings them along with the Oculinidæ and Pocilloporidæ into a very natural affinity with the Turbinolidæ. The cœnenchyme of these colonies is treated by the author as an elaboration of a primitive *extra-calycinal* deposit around individual polyps. Bourne, in one of his papers, suggests the possibility of cœnenchyme being epithecate in certain of these types.

In order to elucidate the "costate" portions of Astræid and Fungid colonies the author demonstrates the exact homology of skeletal parts in the calyces of ancient Cyathophyllids and of recent Astræids and Fungids. The pseudotheca which appeared in *Acervularia* and other Cyathophyllid types marked out an inner from an outer area of the calyx and septa. The exact counterpart of this is found in the type-genus of the Astræidæ, *Heliastræa*. In it, however, only the inner part is called *calyx*, while the outer area is spoken of as a "costate"—*extra-calicinal*—area. It is on this outer area that the so-called "Randplatte" (which the author translates as "edge-zone") is supported in the living polyp, and the author takes it that the typical edge-zone has mesenteries and mesenterial loculi simply because it was originally an inherent part of the polyp. It is clear that such costate parts in Astræid colonies have an entirely different evolutionary history from the cœnenchyme in the Pocilloporidæ &c., where no edge-zone surrounds the polyp. The author traces back this difference in recent colonial types to a difference already well-marked in Silurian Madreporaria—viz. the difference between the calyces of a typical Cyathophyllid and a typical Zaphrentid respectively. In the former a broad calycinal outer zone with dissepimental base surrounds an inner tabulate area; in the latter there is no such outer zone or the very slightest indication of it.

The author found that the families of Edwards and Haime's classification must undergo considerable changes; she limits herself here to one or two of the most important changes suggested by her on the basis of microscopic septal structure and generally of the morphology of the skeleton. The family of Astræidæ, E. & H., hitherto included two main subfamilies, the Astræinæ and Eusmilinæ. The former is made by the author the sole representative of Astræidæ, while the latter is entirely broken up. The genera *Trochosmilia*, *Placosmilia*, and their allies are referred to the family of Turbinolidæ; the genera *Rhipidogyra*, *Pectinia*, *Dendrogyra*, *Euphyllia*, and a large number of fossil genera are placed in a new family, Amphiastræidæ, erected by the author. The Mesozoic representatives of this new family are proved to be direct colony-building descendants of Palæozoic Zaphrentids, while the

Turbinolidæ are looked upon as simple corals descended from the same Palæozoic family. The *Stylina* group of Eusmilinæ, E. & H., are placed in the neighbourhood of the Astræidæ and Amphiastræidæ as an intermediate family, Stylinidæ. *Galaxea* is regarded as a near ally of the Stylinidæ; in spite of its somewhat aberrant features the author ranks it provisionally within this family.

Edwards and Haime's group of Madreporaria Perforata is also broken up by the author. The Eupsammidæ show undoubted affinity with the Fungidæ, and both these families, together with the Astræidæ and Stylinidæ, are shown to have derived their structural features from leading Palæozoic types belonging to the family of Cyathophyllidæ. In all of them the septum reaches a high degree of differentiation in its trabecular structure on lines already introduced in various of the more advanced Palæozoic types. The Madreporidæ (Turbinarinæ, E. & H., and Madreporinæ, E. & H.) are placed in the neighbourhood of Pocilloporidæ and Oculinidæ; their simple septal structure agrees with the primitive types of septum presented by Palæozoic Zaphrentids and their allies. The Poritidæ, although having certain features in common with the Madreporidæ, differ essentially in septal structure, and are regarded as a group of Madreporaria which branched off at a very early age from the main ancestral stem of Zaphrentidæ, and followed an independent line of development.

The author's results bear inevitably to the conclusion that the suborder Madreporaria Rugosa erected by Edwards and Haime draws an entirely artificial barrier between Palæozoic Madreporaria and the younger suborders Madreporaria Aporosa and Perforata, Ed. & H. In the second part of the present paper the author annuls all three suborders, and follows out the evolution of Madreporaria in the light of the general morphological results arrived at in the first part of the paper. Hæckel's terms of "Tetracoralla" for the Madreporaria Rugosa and "Hexacoralla" for the Madreporaria Aporosa and Perforata only gave a stronger expression to Edwards and Haime's convention of tetrameral and hexameral symmetry of the septa. And although several authors have from time to time pointed out the inappropriateness of erecting subdivisions on the feature of septal symmetry, nothing farther has been done. Even now in current literature one may find the term *Rugosa*=Tetracoralla set in contradistinction to *Madreporaria*=Hexacoralla!

From the standpoint attained by her own investigations the author then traces the series of changes which appeared within the group of Madreporaria during the course of the geologic ages. Some of the more important and general of these evolutionary changes may be shortly enumerated :—

(1) *Tabulæ became modified centrally* as columella and pseudocolumella, more seldom became vesicular.

(2) Instead of one to four basal pits (fossulæ) for the reception of specialized reproductive mesenterial filaments, *the whole base of the calyx became deepened*, usually around the axial columella or pseudocolumella.

(3) Septa became more prominent and exsert in growth; their structure became more elaborate, their surfaces fluted and richly granulated, their edges knobbed, toothed, serrated, spined.

(4) The "rugose epitheca" became tardy in growth, and was replaced functionally by a theca or pseudotheca.

(5) Vegetative increase was facilitated by the specialization of an "edge-zone" around the polyp (represented by the "costate" portion of a calyx, or its ancient homologue, the peripheral "dissepimental zone" of Cyathophyllids).

(6) The "*pinnate insertion*" of septa demonstrated by Kunth in primitive corals became gradually a feature of embryonic calyces, and then vanished; but the embryonic mesenteries appear in recent types in the same "tetrameral" order as the septa did in the mature calyces of primitive types. The disappearance of "pinnate insertion" as a generic feature did not necessarily entail the abandonment of a tetrameral, more properly said bilateral, arrangement of the septa. It induced mainly the *hastening of septal insertion, the relative position being often retained, even in adult forms* *. Again, many recent types said to have radial symmetry of septa in adult calyces have well-marked bilateral symmetry in the young individual.

All the above changes indicate, in the author's opinion, merely various lines of adaptivity, correlative with one great leading change in the living polyp—*an increase in the number of gonad-bearing mesenteries and in the musculature of the mesenteries, resulting in improved powers of self-preservation and of reproduction.*

The evolution of recent Madreporarian families from primitive types hinges round the gradual incoming of that main change. The general law of the hastening of the developmental stages in the individual worked with this change, and

* Various observations bearing out this statement have been made by the author on Mesozoic corals. These are fully described in the author's "Monograph of the Upper Jurassic Stramberg Corals," at present being published in the 'Paläontologische Mittheilungen' (Koch, Stuttgart).

the pinnate insertion of septal pairs became more and more modified to a cyclical system of insertion. The author points out in favour of this view how the untoward circumstances for coral existence which prevailed in Europe during the Upper Carboniferous, Permian, Triassic, and Liassic ages may have given a widespread impulse towards the carrying out and confirmation of the main evolutionary change as above stated. The change, however, has been ever since in progress. The author traces its constant working within the family of Astræidæ, its influence on Eupsammidæ and Oculinidæ, and so on.

There is therefore, in the author's opinion, no greater fallacy than the idea that some universal change took place amongst Madreporaria at the end of Palæozoic time and before the mid-Triassic era. One and the same line of evolution may be detected making its way in the group of Madreporaria. Precocity in advance was shown by the Palæozoic Cyathophyllids; hence the high differentiation of Astræids, Eupsammids, and Fungids as early as Mesozoic ages. On the other hand, the Palæozoic Zaphrentids and their descendants in Mesozoic times were remarkably backward in advance, and it is among their recent representatives that primitive structures and forms are chiefly upheld. Naturally retrogression and atavism is shown in various degree in all families, in none more so than in the Turbinolids, the family most closely allied with the ancient Zaphrentids.

The author draws up a new classificatory system of Madreporaria into a number of independent families of equal rank. These are based on the study of skeletal structures, known facts of anatomy, and phylogenetic relationships. She arranges the families, according to the lines of descent demonstrated in the present paper, as follows:—

Zaphrentoidean Families: Zaphrentidæ, Amphiastræidæ, Turbinolidæ, Stylinidæ, Oculinidæ, Pocilloporidæ, Madreporidæ, Poritidæ.

Cyathophylloidean Families: Cyathophyllidæ, Astræidæ, Fungidæ, Eupsammidæ.

XXXI.—*Descriptions of Two new Species of Snakes from Sarawak.* By Dr. A. Günther.

In a collection of Snakes which I received recently from Mr. C. Hose there were two species which appear to be undescribed.

Calamaria Hosei, sp. n.

Moderately slender in habit; head broad, depressed; eye very small. Scales in 13 rows; ventrals 138; subcaudals 19. Upper labials 5. A minute præocular in the antero-inferior corner of the orbit, and a very small postocular. The vertical shield is very broad, at least four times as broad as the supra-ocular. The symphysial is in direct contact with the mentalia. Two transverse rows of scales before the first ventral scute. Upper parts pinkish, with black cross-bars, which are narrower than the interspaces between them and contracted on the sides; there are eighteen of these cross-bars on the trunk and three on the tail. The scales within the pink parts of the body are bordered and speckled with blackish. Head brownish above, this colour extending downwards on the sides in the form of two ill-defined oblique bands. Tail with a blackish longitudinal stripe along each series of scales. Lower parts white, with a few scattered blackish spots; subcaudals blackish.

One specimen, 14 inches long (of which the tail takes $1\frac{1}{2}$ inch), was discovered by Mr. Hose on the Entoyut River.

Geophis albonuchalis, sp. n.

Head narrow, snout pointed, body moderately stout, tail tapered; eye very small. Scales in 15 rows, without apical groove. Ventrals 141; anal entire; subcaudals 43. Anterior frontals triangular, small, only one fourth the size of posterior, which enter the orbit. Vertical very large and broad, broader than long, reaching from one orbital margin across to the other, and pressing back the supraocular to the postero-superior angle of the orbit. Occipitals as long as the anterior shields together, and forming a long suture with the fifth upper labial. Two nasals. Loreal and anteocular confluent into one long shield. A minute postocular. Upper labials six, of which the third and fourth enter the orbit. Symphysial in direct contact with the mentalia, which are considerably longer than the post-mentalia. Six lower labials, the fifth long and narrow.

Deep black, with a broad pure white collar, which covers half of the occipitals and the neck.

One specimen, $9\frac{1}{2}$ inches long (of which the tail takes $1\frac{5}{8}$ inch), was discovered by Mr. Hose at Baram.

XXXII.—*Note on* Tenebrio ferrugineus, *Fabr.*, *in the Banksian Collection of Coleoptera.* By CHARLES O. WATERHOUSE.

I HAVE had occasion to examine the type specimen of *Tenebrio ferrugineus*, F. (Sp. Ins. i. p. 324), and think the following notes may be useful.

The following is the Fabrician description:—"Corpus præcedenti [*Antherophagus pallens*] adhuc minus, magis depressum ferrugineum. Elytra striata, testacea. Habitat in Africa æquinoctiali."

The general appearance is something between *Pediacus* and *Lœmophlœus*; the antennæ, however, resemble those of *Gnathocerus*, but with longer terminal joint. I cannot call to mind any insect with a similar thorax. This is flat, slightly dull, except the smooth median line and fine smooth line inside the lateral finely reflexed margin; it is only slightly narrowed towards the base, and the almost rectilinear sides are peculiar. I can only distinguish four joints to all the tarsi.

I think the species must be placed in the Cucujidæ, near *Xenoscelis*, Woll., which it resembles in many respects, but has quite different antennæ.

The following additional characters will help to identify the species. Of course the insect so long known in our collections as *Tribolium* "*ferrugineum*, Fab.," will have to bear a different specific name.

Prosternum without process, flat between the coxæ, impressed behind them. Mesosternum lightly impressed, with a slight oblique swelling next the intermediate coxæ, which are moderately separated; the line dividing the mesosternum from metasternum curved. Metasternum with a deep longitudinal median impression behind. [Abdomen wanting.] Apical joint of the maxillary palpi elongate-ovate, very obliquely truncate at the apex.

Anterior tarsus four-jointed, four fifths the length of the tibia. The basal joint about one third of the tarsus; the second and third joints shorter, subequal, slightly produced beneath; claw-joint a very little longer than the basal joint.

Posterior tarsus with four joints, the basal one long; the second with its basal part about one third the length of the basal joint, produced below into a long rather broad lamina, extending beneath to about the middle of the claw-joint; the third joint about as long as the second; the claw-joint about as long as the basal joint. The eyes are rather large and very coarsely faceted. The antennæ are as long as the head and thorax together, slightly flattened. The basal joint a little longer than broad; second joint very short; third joint about one third longer than broad, narrowed towards its base; the fourth to tenth joints subequal, shorter than the third, very slightly increasing in width; the terminal joint as long as the two preceding joints taken together, elongate-ovate, rather narrowed towards the apex. Head somewhat as in *Pediacus*, but flatter, less narrowed in front, narrowed behind the eyes, but with a distinct portion behind the eye; surface rather strongly and rather closely punctured. Thorax broader than the head, about as long as broad, rather flat, irregularly and rather strongly punctured (with a fine smooth median line), broadest just before the front angles, gradually but not very much narrowed to the base; the sides almost rectilinear, finely margined; the posterior angles slightly projecting and acute; the base with two widely separated sharply marked foveæ. Elytra somewhat as in *Pediacus*, each with the suture and three fine costæ slightly raised; the intervals flat and appearing smooth, but there are a few fine obscure punctures.

XXXIII.—*Note on the Synonymy of* Huphina lanassa, *a common Australian Butterfly of the Subfamily* Pierinæ. By ARTHUR G. BUTLER, Ph.D. &c.

So much confusion has arisen in the synonymy of this species that, after carefully working it out, I feel no time should be lost in putting it straight.

The species was described by M. Boisduval in his 'Species Général' (1836), evidently from an old female example from New Holland in which the under surface of the secondaries had darkened to ochreous with age, and in which there chanced to be no submarginal spots (we have a specimen in which the secondaries show only one spot on the under surface).

M. Boisduval considered his specimen to be a male; but he so often blundered in sexing his species, that no reliance can be placed upon the statement "Nous n'avons pas vu la femelle." The description "la bordure des supérieures assez large" can hardly apply to a male, unless it be assumed that his method of description was loose, because an equally broad border to that of males of this species is (in other descriptions) regarded by M. Boisduval as "de largeur moyenne."

In 1852 M. Lucas described a species, also from New Holland, under the name of *Pieris nabis*, the male of which was of the variety having only two subapical spots on the border of the primaries, the female only differing from typical "*Pieris lanassa*," Boisd., in having several yellow spots on the border of the secondaries below.

In 1865 Felder described the female again, but from Fiji, under the name of "*Pieris perithea*," and compared it with the *P. perimale* of Donovan.

At the same time and on the same page he described a male from Australia, characterized by having the apical area of the primaries and the entire basal area of the secondaries on the under surface whity brown, under the name of *P. periclea.*

Lastly, in 1867 Wallace described a male from Moreton Bay in which the apical area of the primaries and entire basal area of the secondaries on the under surface were "earthy brown with an orange tinge."

Wallace compared his new species with the *Pieris nabis* of Lucas and *Papilio perimale* of Donovan, but he failed to recognize the latter owing to the fact that the type was evidently a female. The male of Donovan's species is, I have no doubt, the species in Hewitson's collection which Wallace incorrectly identified as Felder's *P. periclea.* There are two examples from New Caledonia, differing from each other exactly as *P. narses* and *P. nabis* differ; but, curiously enough, Wallace does not consider them distinct, as he logically should do, but observes:—"These two specimens indicate a variable species."

It is absolutely certain that Felder's "*P. periclea*" cannot be the species from New Caledonia, which in form of wing corresponds with its presumed female "*P. perimale*," for Felder states that it agrees with his *P. perithea*:—"die vorbeschriebene Art, mit welcher die Flügelform übereinstimmt."

In 1869 Herrich-Schäffer described and figured a *Huphina* as *P. periclea*, and, later, he reproduced the plate coloured as part of an Appendix to his 'Aussereuropäische Schmetterlinge.' The coloured figure is at once seen to be identical with Wallace's *P. narses*, the colouring below not being whity brown, but earthy brown.

When a large series of *Huphina lanassa* is examined, it becomes evident that the species is tetramorphic; the under surface cf the secondaries and apex of primaries may be white, yellow, whity brown, or earthy brown, but the upper surface only varies in the number of white spots on the black border. From what we now know of the seasonal dimorphism of white butterflies, it is almost certain that the earthy-brown and whity-brown types are dry-season forms and the yellow and white types are wet-season forms.

In like manner the two males of *P. perimale*, which Wallace regarded as an aberrantly variable species, represent the ordinary dry- and wet-season forms, of the first of which Donovan's type is typical. *P. perimale*, however, is more nearly allied to my *Huphina terranea*, of which we now possess both types from Lifu, than to *Huphina lanassa*.

The synonymy of *H. lanassa* corrected to date will be as follows:—

Huphina lanassa.

♀. *Pieris lanassa*, Boisduval, Sp. Gén. Lép. i. p. 477 (1836).
♂ ♀. *Pieris nabis*, Lucas, Rev. et Mag. de Zool. 1852, p. 326.
♀. *Pieris perithea*, Felder, Reise der Nov., Lep. ii. p. 169 (1865).

Australia, Baudin Island, Fiji.

Dry-season form.

♂. *Pieris periclea*, Felder, Reise der Nov., Lep. ii. p. 169 (1865).
♂. *Pieris narses*, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 333, pl. vi. fig. 3 (1867); Herrich-Schäffer, Stett. ent. Zeit. 1869, p. 76, pl. i. fig. 4; Auss. Schmett., App. p. 3, pl. i. fig. 103 (1869), as *P. periclea*.

Australia, Baudin Island.

In the wet-season form there are all gradations between the extremes of yellow and white, whilst *P. periclea* is a transitional form between the latter and *P. narses*; therefore, if the facts proved as regards the seasonal changes in colouring in other genera of Pierinæ should be found not to be true of *Huphina*, the above forms would still have to be regarded as variations of one species.

XXXIV.—*On the Species of the South-African Scorpion* Opisthophthalmus *contained in the Collection of the British Museum.* By R. I. Pocock.

[Plate X.]

Thanks to Prof. Kraepelin's recent examination and comparison of most of the types of *Opisthophthalmus* and his determination of their age, sex, and specific identity *, I have found it possible, with some degree, I hope, of exactness, to identify the rich material of this genus contained in the collection of the British Museum. I have added some notes respecting the various species, which, I trust, may be of service in their determination; but especially do I wish to draw attention to the fact that many of the specimens have been obtained of late years, and are consequently furnished with trustworthy and *exact localities*—an item of information which has been so much ignored in connexion with these animals, but which will ultimately prove, I think, to be of the first importance. For instance, when discussing *O. capensis*, apparently the commonest species of all in most collections, Kraepelin says that its distribution seems to be exclusively Cape Colony (Capland). This, no doubt, is perfectly true; but I cannot lay my hands upon a particle of evidence that the species ranges *throughout* Cape Colony. It appears, in fact, so far as I can determine at present, to be restricted to a relatively narrow but undetermined area around Cape Town and the Cape of Good Hope; and there is no evidence known to me that any other species inhabits the same spot. That many more species than at present are known from specimens ticketed vaguely "S. Africa or Cape Colony" will be found also to have a restricted range is, I think, probable, though, on the other hand, there are some—*O. carinatus*, for example—that cover a wide area in distribution.

Opisthophthalmus capensis (Herbst).

Scorpio capensis, Herbst, Naturg. d. Scorpione, p. 62, pl. v. fig. 2 (1800), ♀.
Opisthophthalmus pilosus, C. Koch, Die Arachn. iv. p. 91, fig. 309 (1838), ♂.
Opisthophthalmus maxillosus, id. ibid. (young, teste Kraep.).

Of this species the British Museum has twenty-three examples of all ages and both sexes. It is evident that Cape Town is the head-quarters of this species. How far it extends to the north and east of this point I have no means of judging. Of the above-mentioned examples no fewer than fourteen are ticketed Cape Town, received from R. Trimen, R. C. Wroughton, Rev. G. H. R. Fiske, and H. A. Spencer; while all the rest that are labelled came from the Cape of Good Hope. I cannot understand Kraepelin's reasons for

* See "Revision der Scorpione.—II. Scorpionidæ und Bothriuridæ," Jahrb Hamb. Anstalten, xi. 1, pp. 77–108.

separating this species from what he calls *pilosus*, for the characters he assigns to the latter are merely those of the male of *capensis*, in which usually all the abdominal sterna with the exception sometimes of the first are granular, while the palpi are very richly hairy; yet Kraepelin speaks of the two sexes, both of *pilosus* and *capensis*, as if he were familiar with them. I cannot, however, avoid the conclusion that he has in some way confused the sexual characters; and this opinion is strengthened by the fact that he considers the figure of the type published by Herbst to represent a male. It appears, however, to me to be without doubt a female, as both Thorell and Simon have affirmed. The male of *capensis* has a slender hand, and the first and second caudal segments taken together are equal to the length of the carapace; while Herbst's figure, with its broad hands and short tail, agrees exactly with all the adult females in this collection.

Opisthophthalmus palli[di]pes, C. Koch.

Opisthophthalmus pallipes, C. Koch, Die Arachniden, x. p. 3, fig. 757, ♂; Thorell, Etudes Scorpiol. p. 227.

A single female from the Concordia Copper Mine, Ookiep, about 70 miles from the coast in Little Namaqualand, to the south of the Orange River (collected by W. H. Clark), gives the following measurements in millimetres:—Total length 115; length of carapace 16·5, of tail 59, of hand-back 10·5, of movable digit 17·5; width of hand 13·7.

The accompanying figure of this species (p. 236) is taken from a photograph by Dr. Howard of a female specimen procured near the copper mines, Namaqualand, and sent to Mr. Lydekker, by whose kind permission I here reproduce it. The interocular area of the carapace and the hand, which are blackish in the photograph, are reddish yellow in the actual specimen.

Opisthophthalmus carinatus (Peters).

Scorpio carinatus, Peters, Mon. Ak. Wiss. Berl. 1861, p. 515.

Two male examples, Otjimbinque (Keyserling collection) and Umfuli River, Mashunaland (*G. A. K. Marshall*). The one from Otjimbinque presents the discoloration and softness of exoskeleton characteristic of recently moulted Arthropods; the one from Umfuli, on the contrary, is full-coloured, the extremity of the tail, the legs, and hands being pale yellow, while the upper surface of the trunk is greenish brown, the humerus and brachium of the chelæ pale yellowish red, with strong deep green crests, and the fingers deep green. This

Opisthophthalmus palli[di]pes, C. Koch.

example presents one of those types of coloration which is so rare in this genus, namely, although there is a strong contrast in colour between the legs (and hands) and the trunk, the tint of the interocular area of the carapace resembles that of the trunk. In almost every other case it is the same pale colour as the hands and legs.

This specimen gives the following measurements in millimetres :—Total length 98 ; length of tail 53, of carapace 14·5 ; distance of eyes from front border 8·6. There are 23 pectinal teeth on each side, and the sterna of the abdomen are strongly corrugated with deep transverse grooves, which are much more strongly marked than in the specimen from Otjimbinque.

Another interesting point about this species is that in the subcentral position of its median eyes and the deepness of the notch in the anterior border of the carapace it approaches the genus *Scorpio*—the so-called Black or Rock Scorpion, which ranges in Africa from Senegambia to the Congo on the west, and from Abyssinia and Somaliland to Lake Nyasa (Zomba) on the east, but is replaced in S. Africa by *Opisthophthalmus*. On account of these features this species was by Karsch regarded as a distinct genus, which he named *Petrooicus* (a preoccupied name, which was changed by myself into *Œcopetrus*). But since the exact position of the eyes is a character liable to considerable specific variation, it is, perhaps, better to hold with Kraepelin that *carinatus* is merely a well-marked species of *Opisthophthalmus*.

Opisthophthalmus Wahlbergi (Thor.).

Miæphonus Wahlbergi, Thorell, *op. cit.* p. 222.

One female example in Keyserling's collection from Otjimbinque, about 100 miles up the river inland from Walfisch Bay, in Damaraland, gives the following measurements in millimetres :—Total length 103 ; length of tail 46, of carapace 14 ; distance of eyes from posterior border 6 ; length of hand-back 6, of movable digit 13 ; width of hand 9·6. Pectinal teeth 17.

Opisthophthalmus austerus, Karsch. (Pl. X. fig. 4.)

Opisthophthalmus austerus, Karsch, Mitth. Münch. ent. Ver. 1879; Kraepelin, *loc. cit.* p. 94.

Two male examples ticketed " S. Africa, near the Tropic of Capricorn " (Methuen's Expedition). Recorded by Kraepelin from Cape Colony and Griqualand.

One of them gives the following measurements in millimetres:—Total length 87; length of carapace 13, of tail 52, of hand-back 9·5, of movable digit 21; width of hand 8. Both specimens have 22 pectinal teeth on each side, and the colour is a uniform reddish brown, the crest on the chelæ being black.

Opisthophthalmus macer, Thorell. (Pl. X. fig. 5.)

Opisthophthalmus macer, Thorell, *op. cit.* p. 236.

A single male example from Zulu country, S. Africa (*G. F. Angas*), giving the following measurements:—Total length 86; length of carapace 12, of tail 51; width of hand 9; length of hand-back 6·5, of movable digit 16·5. There are 16 pectinal teeth on each side. The chelæ are testaceous, except for the black crests and granules and digits, and the maxillary processes of the first and second legs are deep black.

Opisthophthalmus latimanus, C. Koch.

Opisthophthalmus latimanus, C. Koch, Die Arachn. viii. p. 65.

Two female examples from Murchison Range, Transvaal (*C. R. Jones*). The largest of these measures in millimetres as follows:—Total length 99; length of carapace 16·5, of eyes from posterior margin 5; length of tail 48·5, of hand-back 9, of movable digit 16; width of hand 13.

Both specimens possess 15 pectinal teeth on each side, and the colour, like that of *O. austerus*, is a reddish brown, paler on the legs, hands, and anterior region of carapace.

Opisthophthalmus calvus, L. Koch.

Opisthophthalmus calvus, L. Koch, Verh. z.-b. Wien, xvii. p. 233 (1867).

The single female example that I have seen of this species is ticketed "S. Africa, Dr. Smith." No nearer locality is known for it.

The measurements in millimetres of this specimen are as follows:—Total length 66; length of tail 35, of carapace 12·5, of hand-back 6·5, of movable finger 11·5; width of hand 10.

Opisthophthalmus glabrifrons, Pet.

Opisthophthalmus glabrifrons, Pet. Mon. Berl. Ak. 1861, p. 514.
Opisthophthalmus læviceps, Thorell, *op. cit.* p. 228 (teste Kraepelin).

The localities so far known for this species are Tette on the Zambesi and Caffraria (!) (*Wahlberg Coll.*). The British Museum has examples from Tette (*Keyserling Coll.*), Lake Nyasa, ? southern shore (*Universities Mission, Capt. Maclear* and *Mr. Bellingham*), and from Mashunaland (Salisbury, 5000 feet, Umfuli River, 1200 feet: *G. A. K. Marshall*), making a total of ten specimens (males, females, and young). The pectinal teeth vary in number as follows:—

Specimens from Nyasa: ♀, 10–10, 11–11; ♂, 12–12, 13–13, 13–13.
Specimens from Tette: ? young ♀, 11–11.
Specimens from Salisbury: ♀, 10–12, 13–13; ♂ (young), 16.
Specimens from Umfuli: ♂ (adult), 16–18.

According to Kraepelin the pectinal teeth in the males that he saw were 18–19, while Peters gives 23 for this sex, a number which is nearly double that of one of the males from Nyasa.

Another feature which is, according to Kraepelin, characteristic of this species is the distinctness in the female of the upper crest on the anterior surface of the humerus; but it is not distinctly defined in any of the females examined by me except in the one from Tette. Moreover, it is only in the young example from Tette and in one from Salisbury that the interocular area of the carapace is perfectly smooth. In all the other specimens it is in both sexes distinctly though finely granular in front; and in one of the females from Umfuli the first dorsal plate is finely granular at the sides. I have very little doubt, however, that all the specimens under discussion are cospecific.

Opisthophthalmus pugnax, Thorell.

Opisthophthalmus pugnax, Thorell, *op. cit.* p. 232, ♂.
Opisthophthalmus curtus, id. ibid. p. 234, ♀ (teste Kraepelin).

Of this species, the synonymy of which I adopt from Kraepelin, the Museum has only four examples in alcohol, *i. e.* one adult female from Durban (*Capt. Munn*), two young males from Basutoland (*R. C Wroughton*), and one adult male from King William's Town. The pectinal teeth in these examples are as follows:— ♀ from Durban, 13–14; ♂ from King William's Town, 17–18; ♂ from Basutoland, 12–12, 13–13—whereas, according to Kraepelin, they are 15–15 in a male and 10-12 in the females.

Although this species is nearly allied to *O. glabrifrons*, it may be distinguished, as Kraepelin has pointed out, by its more coarsely and thickly granular terga, by the ornamentation of the hand, which is less granular and composed rather of low anastomosing tubercles, by the constancy of the occurrence of either one or two spines external to the series running along the lower surface of the third and fourth tarsi. In the male, too, the interocular area of the carapace is finely granular throughout and the keels on the hand are stronger. The colour, too, is on the whole darker, and in the specimens that I have seen the maxillary processes of the first and second pairs of legs, as well as the tip of the sternum, are black, while these same skeletal pieces in *glabrifrons* are uniformly pale.

Opisthophthalmus granifrons, sp. n.
(Pl. X. figs. 1–1 *b*.)

No. 1, type (♀, dry specimen).—*Colour* mostly ochre-yellow; postero-lateral portion of carapace darker than the interocular area; mandibles black, granules forming the crests on the chelæ also black; maxillæ of the first and second legs lightly infuscate at the tips.

Carapace considerably longer than wide, as long as the first and second caudal segment and half the third; its interocular area coarsely granular in its anterior half, nearly smooth behind; sides of the carapace coarsely granular, especially on the edge bordering the interocular area; the median eyes very far back, less than a quarter of the length of the carapace from the posterior border; the median groove distinctly forked in front.

Terga granular at the sides, the posterior ones becoming gradually more and more granular along the hind border, the seventh granular throughout; the third to the sixth with a smooth longitudinal ridge, the seventh with a low median elevation, but showing scarcely a trace of lateral crests.

Sterna smooth and polished, the last with a few low granules in the middle of its area.

Tail of medium length, slender; the upper crests of segments 2 to 4 ending in an enlarged spiniform granule; the inferior median keels practically obsolete upon segments 1 to 3, though just visible on 2 and 3, weakly granular on the fourth; the infero-lateral keels obsolete on the first, which is polished and scarcely granular below; these keels distinct on the third and fourth and marked with black pigment. Vesicle and fifth segment as in *O. capensis*.

Chelæ.—All the crests on the humerus coarsely granular, the upperside of the segment sparsely granular, its anterior edge strong and granular; the upper ridge on the brachium coarsely granular; hands convex above and thickly covered with low round granules; the keels weak, the finger-keel consisting merely of a row of black granules, the secondary keels also weak, though defined with black lines; the upper keel of the hand-back distinctly granular; hands wide, with strongly convex denticulated inner edge.

Legs with lower edge of anterior femora denticulate; tarsi of fourth leg with a single row of spines below, of third with a single anterior or external spine as well; the side-lobes longer than the superior median process.

Genital operculum heart-shaped, as long as broad.

Pectines with 14 teeth; the basal intermediate lamella long, as in *O. Wahlbergi.* (Pl. X. fig. 1 *a.*)

Measurements in millimetres.—Total length (abdomen contracted) 79; length of carapace 13·5; distance of eyes from anterior edge 10·5; width of carapace 12; length of tail 42; width of hand 10; length of hand-back 8, of movable finger 11·5.

Loc. "The Cape" (*Keyserling Collection*).

No. 2, ♂.—A specimen (also dry) that I believe to be the male of this species presents the following differential characters:—

The *carapace* only slightly exceeds the first two caudal segments in length; the side-edges of the interocular area defined by strong granules.

Terga more thickly covered with granules.

The first *abdominal sternite* is smooth, the second granular posteriorly and laterally, the third more granular than the second and the fourth than the third, the fifth entirely covered with squamiform granules, as also is the lower surface of the first caudal segment. Lower surface of second and third caudal segments sparsely granular and weakly keeled.

Hands much narrower than in female (*cf.* measurements), but the granular crests rather more strongly expressed.

(*Pectines* absent.)

Two external spines on lower surface of tarsus of third leg.

Measurements in millimetres.—Total length 108; length of carapace 15, width 13; distance of eyes from front margin 11; length of tail 62; width of hand 9; length of hand-back 8·5, of movable digit 15·5.

Loc. S. Africa (*Dr. Smith*).

No. 3 (young ♂ in alcohol).—The *interocular area* smoother than in the other two, especially in its posterior half, where it is not granular.

Terga nearly smooth, only finely granular at the sides and posteriorly.

Sterna and *tail* as in the female.

Palpi as in the female, but hand much narrower (*cf.* measurements).

Pectines as in the female, with 16–18 teeth.

Genital operculum as in male, *i. e.* normal and completely divided.

Tarsi not furnished below with an anterior spine.

Measurements in millimetres.—Total length 73; length of carapace 11·2, width 9·8; distance of eyes from anterior border 8; length of tail 36; width of hand 7; length of hand-back 6, of movable digit 8·5.

Loc. Concordia Copper Mine, Ookiep, in Little Namaqualand (*W. H. Clark*).

I believe the three examples that I have described above are referable to the same species, since they agree sufficiently well to permit the supposition that their differential characters are merely due to differences of age and sex.

According to Prof. Kraepelin's recent revision of the species of *Opisthophthalmus*, this new form falls into the same section as that containing *capensis*, *pilosus*, and *pictus*. From the latter, which is unknown to me, *granifrons* certainly differs in colouring as well as in having the interocular area of the carapace granular instead of smooth. From *capensis* and *pilosus*, *granifrons* may be recognized by having the interocular area more granular, the hands more granular, and the inner half of the upper surface much more strongly convex, the finger-keel weaker and strongly granular, and the crest bounding the upperside of the hand-back and the one on the upperside of the brachium also strongly granular instead of smooth. Moreover, in the female of *capensis* the proximal intermediate lamella of the pectines is not elongated. Some points connected with colour are also noticeable. In *capensis* the crests on the chelæ, especially those on the humerus, are much more strongly blackened and the maxillary processes of the first and second pairs of walking-legs are wholly fuscous.

O. granifrons also seems to be readily distinguishable from the two forms characterized by Thorell and Simon respectively as *latro* and *Chaperi*, which Prof. Kraepelin assigns to *pilosus.* In *O. Chaperi*, for example, the *humerus* and *brachium* of the chela are black, the interocular area is smooth and punctured and only sparsely granular, and the hand is flat and nearly smooth above.

Opisthophthalmus nitidiceps, sp. n.
(Pl. X. figs. 2, 2 *a*.)

♀ (in alcohol).—*Colour.* Carapace dark at the sides, pale on the interocular area; abdomen olive-brown, darker above than below; mandibles brown at the base, deep olive-green distally; chelæ, legs, coxæ, and tail clear reddish yellow, the fingers of the chelæ and the crests on the hand being dark brown.

Carapace as long as wide, as long as the first two caudal segments and half the third; median eyes two thirds of the length of the carapace from the anterior end; interocular area entirely smooth, sparsely punctured, the median sulcus deep in front, but not bifurcating; sides of the carapace weakly granular, with no oblique ridge of granules running forward from the median to the lateral eyes.

Tergites smooth in the middle, finely granular at the sides, the posterior edge rugose; the last granular throughout.

Sterna smooth and polished, the last feebly granular.

Tail with the lower surface of the first segment weakly granular; the inferior keels on all the segments distinct, but not coarsely granular; the superior keels on the second, third, and fourth posteriorly strongly denticulate.

Vesicle distinctly granular.

Chelæ large, humerus with its four crests strong and granular, the front surface coarsely granular, the upper with only a few large granules; brachium with its upper crest crenulate; hand large, its upper surface convex and closely covered with smooth, low, irregular-shaped, sometimes anastomosing tubercles, its inner edge weakly denticulate, the secondary keels obsolete, the finger-keel moderately large and entire, the keel defining the hand-back above finely crenulate.

Tarsi of third and fourth legs with two anterior spines in addition to the four on the lobe; lobes much longer than upper process; second protarsal segment of first three pairs of legs externally spined, as in *O. opinatus.*

Genital operculum much wider than long.

Pectines with long internal basal sclerite armed with 12 or 13 teeth. (Pl. X. fig. 2 *a*.)

Measurements in millimetres. — Total length 81; length and width of carapace 13; distance of eyes from front border 8·5; width of hand 12·2; length of hand-back 7·5, of movable finger 13·5.

Loc. Port Elizabeth, Algoa Bay (*J. M. Leslie*).

Resembling *O. opinatus*, Sim., and *Wahlbergi*, Thor., in having the vesicle granular, but certainly differing from both in having the eyes some distance behind the middle of the carapace, the last abdominal sternite granular, a smaller number of pectinal teeth, &c.; but of the two it appears to be much nearer to *O. opinatus*, which it resembles in the armature of its feet.

Opisthophthalmus breviceps, sp. n.
(Pl. X. figs. 3, 3 *a*.)

Colour of trunk above a uniform deep reddish brown; carapace the same colour, the interocular area being only a little lighter in the middle and not sharply contrasted with the colour of the rest of the plate; tail and under surface a little paler than the upper surface of trunk; legs pale reddish brown; chelæ yellowish red, with the crests heavily blackened; fingers black; the upper surface of the hand entirely yellowish red, the colour showing up rather strongly against the generally dingy tint of the trunk; coxæ uniformly reddish brown.

Carapace short, as wide as long, distinctly shorter than the first two segments of the tail, equalling in length the fifth segment of the tail; ocular tubercle one third of the length of the carapace from the posterior border; finely granular at the sides, without any crests of coarse granules defining laterally the interocular area, which is shining and finely punctured, but also, at least in one specimen, very finely and sparsely granular; median sulcus undivided.

Terga exceedingly finely granular (shagreened) throughout, the median crest almost absent, but defined by a depression on each side; the seventh coarsely granular, with two abbreviated crests on each side.

Sterna, including the first (Pl. X. fig. 3 *a*), thickly and coarsely granular throughout, except just upon the antero-lateral angle between the muscular groove and the stigma; the granules mostly transversely elongate.

Tail four and a half times the length of the carapace; upper surface of segments 1 to 3 granular, upper keels of segments 2 to 4 denticulate, the denticulation rather stronger posteriorly; lateral surface granular, infero-lateral keels weak, weakly granular; inferior median keels obsolete on the first and almost so on the second, very weak on the third and fourth; lower surface of the first thickly granular like the last abdominal sternite, the second also similarly though less strongly granular below, the third and fourth still more weakly; the median keel on the fifth formed of a single row of denticles.

Chelæ.—Humerus with strong and coarsely granular crests, its upper surface rather smooth, with only a few small granules behind; upper crest on the brachium crenulate; hand furnished with a very strong, complete, and continuous finger-keel, vertical area external to this granular, the horizontal area internal to it nearly flat, flatter than in *O. capensis*, only finely granular, with scarcely a trace of supernumerary crests; the inner edge denticulate distally, thickly furnished with long setæ; hand-back equal to the width of the hand from the inner edge to the finger-keel, and half the length of the movable digit; lower surface of hand nearly smooth, only very finely granular.

Femora of *legs* finely granular externally; distal protarsal segment of first, second, and third pairs spiny on the external edge; lower surface of tarsi of third and fourth with two external spines in addition to the four on the external tarsal lobe; lobes longer than superior process.

Pectines with proximal angle of the shaft rectangular, 17 to 18 teeth.

Measurements in millimetres.—Total length 94; length of carapace 12, width 12; distance of eyes from anterior border 8; length of tail 54; length of hand-back 7·3, of movable digit 15; width of hand 8·5.

Loc. S. Africa (*Dr. Quain*). A couple of male examples.

According to Kraepelin's table this species, with its granular sterna and undivided cephalic sulcus, falls into the same category as *glabrifrons*, *pugnax*, and *prædo.* The granulation of the upper surface of the hand is rather finer than in male specimens of *glabrifrons* from Mashunaland and Nyasa, and the finger-keel is much stronger, while the inner keel is even less well developed. The carapace, too, is longer in *glabrifrons*, excelling the first and second caudal segments in length and also the fifth, as well as being longer than the upper surface of the hand. Moreover, the first and second abdominal sterna in *glabrifrons* are smooth.

From *pugnax*, *breviceps* differs in the finer granulation of the hand and the obsoleteness of the internal keels, in the smoother interocular area and shorter carapace as compared with the uppersurface of the hand and with the first and second and fifth caudal segments, the relative length between these parts being about the same in *pugnax* as in *glabrifrons*, in having all the abdominal sterna thickly and uniformly granular, and the inferior median keels quite obsolete on the first caudal segment, instead of coarsely granular as in *pugnax*.

From *prædo*, which is unknown to me, *breviceps* seems to differ in much the same way that it does from *pugnax*, though possibly approaching it more nearly in the granulation of the hands.

Synopsis of the Species contained in the Collection of the British Museum.

a. Carapace furnished in front with a small but distinct triangular area, defined by two grooves which run obliquely inwards and backwards from the anterior edge and meet in a point in the middle line.

- *a*¹. Ocular tubercle only a little behind the middle of the carapace; interocular area not granular; lower surface of abdomen wrinkled in the male, but not grannlar .. *carinatus*, Pet.
- *b*¹. Ocular tubercle far behind the middle of the carapace.
  - *a*². Interocular area of carapace, lower surface of abdomen and of tail smooth, not granular .... *palli[di]pes*, C. Koch.
  - *b*². Interocular area distinctly granular; sterna also granular (the last only very feebly so in ♀ of *granifrons*).
    - *a*³. Hand more convex and coarsely granular; keel on upperside of brachium and finger-keel of hand coarsely granular; last abdominal sternum of ♀ nearly smooth, of ♂ like the first caudal segment below, and some of the other sterna granular; paler in colour, crests on chelæ and carapace not heavily blackened; maxillary processes of first and second legs slightly infuscate apically.................. *granifrons*, sp. n.
    - *b*³. Hand flatter and more finely granular; crest on brachium and hand strong, but almost smooth; fifth (and fourth in part) sternite in ♀ thickly granular, all of them in ♂ usually granular, principally behind; crest on chelæ and maxillary processes of first and second legs deeply black.................. *capensis* (Herbst).

b. Carapace not furnished with a distinct triangular piece, the two grooves mentioned under *a* being obsolete.

*a*⁴. Ocular tubercle just behind the middle of the carapace; penultimate segment of the first three pairs of legs not spined externally; vesicle granular .... *Wahlbergi* (Thor.).

*b*⁴. Ocular tubercle far behind the middle of the carapace; penultimate segment of legs of first three pairs spiny externally.

*a*⁵. Vesicle distinctly granular below (interocular area of carapace smooth, last abdominal sternite weakly granular in ♀).. *nitidiceps*, sp. n.

*b*⁵. Vesicle smooth below, at most granular quite at the base.

*a*⁶. (♀.) Tail short, 3 or $3\frac{1}{2}$ times as long as the carapace, which is about as long as the first, second, and third caudal segments; hand of chela thicker, heavier, and less hairy; genital operculum not divided.

*a*⁷. Last abdominal sternite roughened, at least mesially, with irregular granulation; inferior surface of the first caudal segment with roughened keels.

*a*⁸. All the terga distinctly granular; interocular area finely so; last abdominal sternite granular throughout; colour darker, maxillæ of first and second legs deep black .... *pugnax*, Thor., ♀.

*b*⁸. Terga and interocular area entirely smooth, or, at most, finely granular; last sternite mesially roughened; colour paler, maxillary processes not blackened .... *glabrifrons*, Pet., ♀.

*b*⁷. Last abdominal sternite not granular, at most punctured; inferior keels of first caudal segment smooth (each marked with two punctures).

*a*⁹. Interocular area rugose inferior median keels of first caudal segment strong; colour entirely blackish .... *calvus*, L. Koch, ♀.

*b*⁹. Interocular area polished, smooth; inferior median keels of first caudal segment weak; colour reddish brown .... *latimanus*, C. Koch, ♀.

*b*⁶. (♂.) Tail from 4 to $4\frac{1}{2}$ times the length of the carapace; hand much thinner and more hairy.

*a*¹⁰. Sterna of abdomen smooth, the last, at most, granular laterally.

*a*¹¹. Tail narrow, compressed; denticles of upper keels on segments

2 to 4 much enlarged posteriorly; interocular area smooth; hands narrow, width less than length of hand-back; fingers very long, the movable more than twice the width of the hand .... *austerus*, Karsch, ♂.

b^{11}. Tail robust; denticles of upper keels hardly enlarged posteriorly; interocular area granular; hand stouter, its width much excelling the length of the hand-back, and more than half the length of the movable digit .... *macer*, Thor., ♂.

b^{10}. Sterna of abdomen rugose, the last granular; palpi and tail proportioned almost as in *macer*.

a^{12}. All the abdominal sterna thickly granular; first and second segments of tail longer than carapace, which equals the fifth segment in length .... *breviceps*, sp. n., ♂.

b^{12}. Not all the sterna evenly granular, the anterior at most slightly wrinkled.

a^{13}. Interocular area nearly or quite smooth; hand much more finely granular; anterior sterna smooth; inferior median keels on first caudal segment nearly obsolete .... *glabrifrons*, Pet., ♂.

b^{13}. Interocular area entirely granular; hand strongly crested and tubercular; first caudal segment strongly and granularly keeled below .... *pugnax*, Thor., ♂.

EXPLANATION OF PLATE X.

Fig. 1. *Opisthophthalmus granifrons*, sp. n. Carapace and chela, ♀.
Fig. 1 *a*. Ditto. Genital operculum and comb of one side.
Fig. 1 *b*. Ditto. Carapace and chela, ♂.
Fig. 2. *Opisthophthalmus nitidiceps*, sp. n. Carapace and chela, ♀.
Fig. 2 *a*. Ditto. Genital operculum and comb of one side.
Fig. 3. *Opisthophthalmus breviceps*, sp. n., ♂. Nat. size.
Fig. 3 *a*. Ditto. First abdominal sternum.
Fig. 4. *Opisthophthalmus austerus*, Karsch. Brachium and manus of chela, ♂.
Fig. 5. *Opisthophthalmus macer*, Thorell. Brachium and manus of chela, ♂.

XXXV.—*Notes on the Study of the Cross-Fertilization of Flowers by Insects.* By Ida A. Keller, Ph.D.*

One of the most remarkable discoveries in plant-physiology was certainly that of the cross-fertilization of plants by the aid of insect visitors. That this discovery, made toward the end of the last century, was founded upon actual fact has been verified by almost every one who has become interested in this most remarkable phenomenon. Apparent as it is in many cases, in more instances cross-fertilization by means of insects is simply a conjecture. There is no more fruitful source of error perhaps in the experience of all scientific knowledge than a sudden brilliant discovery, which is founded upon careful observations in a limited number of cases, and the wholesale application of its results without the exercise of sufficient caution. Again and again the organic world has been shown to be so complex that no one simple formula can be found to express adequately the exact situation in each of a great variety of cases. Experience is constantly showing that each particular case must be carefully studied by itself before we can with any degree of certainty gain a thorough understanding of any general phenomenon in plant or animal life.

In my attempts to obtain an impartial view of the subject of cross-fertilization, so far as the actual observations made in this field up to the present day will permit, I was struck with a number of curious facts in connexion with the development of our knowledge in this direction. I must, however, apologize for the rather meagre presentation of the subject. I have had neither the time nor the opportunity to acquaint myself thoroughly with its entire literature, and the original observations which I have made in this line are limited in number.

Conrad Sprengel, as we all know, discovered "The Secret of Nature Revealed in the Formation and Fertilization of Flowers." Over one hundred years have passed since this was recorded, and yet the plant-world offers in this respect one puzzle after another. Instead of having exhausted the study of the subject by this time, it seems to be gaining in interest.

Naturally enough, it was not the tendency of scientists to try to disprove what was evidently true from the observations

* From the 'Proceedings of the Academy of Natural Sciences of Philadelphia,' 1895, pp. 555–561.

of Sprengel, but rather to develop more fully our knowledge of cross-fertilization. I need only refer to the famous work of Darwin, to that of the well-known German botanists Hildebrand, H. Müller, Kerner, and to that of the many close observers of our own day.

The fact that cross-fertilization is of utmost value to the individual species has been emphasized by Darwin. In fact this great discoverer contends repeatedly that pollen applied to the pistil of the same flower is a positive injury to the species. It is curious to note how this idea has influenced the authors of botanical text-books. As one instance in many I need only refer to Gray's 'Structural Botany.' To the rather long chapter devoted to the description of the adaptation of flowers to insure intercrossing a few paragraphs are added in which the writer, it seems to me rather unwillingly, admits that there are also special adaptations to insure close fertilization—in fact, that there are cases which positively exclude all chances of a cross. Of cleistogamous flowers Gray says:—"Here the intention and the accomplishment of self-fertilization are unmistakable. This peculiar dimorphism consists in the production of very small or inconspicuous and closed flowers, necessarily self-fertilized and fully fertile, in addition to ordinary, conspicuous, and much less fertile, though perfect flowers" *. He then continues:—"It has been said that the ordinary flowers in such plants are sterile, and perhaps they always are so, except when cross-fertilized; in most cases they are habitually infertile or sparingly fertile. *Probably* they suffice to secure in every few generations such benefit as a cross may give, while the principal increase is by cleistogamous self-fertilization, which thus offsets the incidental disadvantage of the former mode." I have quoted the writer verbatim, because the extract shows so plainly his mental attitude in regard to the significance of this phenomenon. Here we have a concession in regard to the extreme fertility of cleistogamous flowers, followed by a suggestion in regard to the few mostly infertile conspicuous flowers which accompany the former, and from these and the statement that no species is altogether cleistogamous, taken as a premise, the following conclusion is drawn:—"Thus, cleistogamy, with all its special advantage, testifies to the value of intercrossing." The same bias, looking favourably upon cross-fertilization, may be observed in most writers on the subject. The prevailing impression seems to be that close fertilization is, as a rule, only resorted to when all the chances for cross-fertilization are at an end.

* Gray's 'Structural Botany,' p. 241.

It appears that the problem permits of a wholly different solution. Among the few writers who admit this there is, perhaps, none who speaks with as much decision and who adduces as many facts to prove his assertions as does Mr. Meehan. In his interesting paper entitled "Are Insects any Material Aid to Plants in Fertilization?" the conclusions are as follows :—

First, the great bulk of coloured flowering-plants are self-fertilizers.

Secondly, only to a limited extent do insects aid fertilization.

Thirdly, self-fertilizers are every way as healthy and vigorous, and immensely more productive, than those dependent on insect-aid.

Fourthly, that where plants are so dependent they are the worse fitted to engage in the struggle for life, the great underlying principle in natural selection.

These views are directly opposed to the impression one would naturally receive from text-books on botany. It is evident that it is of the utmost importance to study the significance, and, if possible, the cause of each of the various factors with which we have to deal as pointing either towards cross- or towards close-fertilization. As already suggested, it is always a critical matter to generalize where thousands of species are concerned which have developed under a variety of circumstances.

Let us now consider the chief adaptations which point towards cross-fertilization :—

I. Distinct sexes.
II. Specially adapted or conspicuous corolla.
III. Peculiar position of stamens and pistils.
IV. Difference in the time of maturity of stamens and pistils.

I. *Distinct sexes.*—The male and female flowers being separated, it is a matter of necessity that the pollen of one flower finds its way to the stigma of another flower. From a teleological point of view the intention is clearly shown. We cannot, however, speak with certainty of cross-fertilization even in all these cases, except in wholly diœcious plants, at least not in Darwin's understanding of the term, which is that "cross-fertilization always means a cross between distinct plants raised from seeds." We must therefore be careful not to include too hastily in this category monœcious plants, where the male and female organs are borne on distinct flowers but on the *same plant.*

II. *A specially adapted or conspicuous corolla.*—It is these showy, irregular, or peculiarly shaped corollas that insects may readily be observed to visit. The questions which here arise are numerous. The first one to present itself is this: Has the corolla been developed for the purpose of attracting insects, and is it the proof which nature gives us that cross-fertilization is a necessity, or that it is at least favourable to the preservation of the species? This seems to have been definitely answered in the affirmative. The number of cases where the insect has actually been seen to transport the pollen from one plant to another, however, are few compared with the great number of species whose flowers would come under this head. In this connexion it must be remembered how very often the insect is simply a robber. This past summer I observed, *e. g.*, a very large patch of *Gerardia pedicularia*, the flowers almost all being pierced at the base of the corolla by bees perching on the outside and never touching stamens or pistil. Now, wherever it is more convenient for the insect to reach the desired substance without boring a hole, it is apt to be taken for a benefactor, even if it simply takes from the flower without rendering any service in return. There is another suggestion I would offer in regard to insect visitors. In observing bees travelling to and from flowers of *Kalmia latifolia*, I noticed that very frequently pollen is thrown upon the pistil of the same flower when the stamens are unfastened by the insect. I am not prepared to assert, however, that such flowers proved fertile. I simply throw this out as a suggestion, and it should be taken for what it is worth. Professor Willis made somewhat similar observations on the flowers of *Phacelia tanacetifolia.* He describes the crawling of insects over the dense cymes, touching stamens and styles indiscriminately, and probably knocking the pollen on the stigmas from the surrounding anthers *. Further, he says in regard to *Phacelia campanularia*:—"Bees alight sometimes on the corolla, touching styles and stamens, crushing them all up together with the styles, and probably causing self- as much as cross-fertilization" †. This in spite of the fact that the flower of this plant is to all appearance well adapted to secure cross-fertilization. I should not be surprised if, sooner or later, upon close examination it should be found

* "Contributions to the Natural History of the Flower," Journ. Linn. Soc. Lond., Botany, vol. xxx. p. 55.

† *Ibid.* p. 57.

that in many cases where this adaptation to insects seems so perfect the insect visitors aid in securing self-fertilization, as these observations seem to indicate.

III. *Peculiar position of stamens and pistils.*—In the preceding paragraph I have already briefly referred to the flowers of *Kalmia latifolia,* perhaps the best illustration of such an arrangement. The wheel-shaped corolla, with the ten pockets in which the anthers are held, is sufficiently familiar to require no further description. Stamens and pistil mature at the same time. The anthers are held in the pockets of the corolla ; when visited by insects they are set free, and the pollen is thrown with considerable force from the anther-sacs through the orifices. As I have remarked before, I have observed repeatedly that pollen was thrown upon the stigma of the same flower. Careful observations should decide the question how far in such cases, where there is such a peculiar arrangement in the position of stamens and pistils in regard to each other, close-fertilization is possible.

Even should it be impossible in any case that autogamy, or close-fertilization, is effected, it must be remembered that whenever a plant bears many or clusters of flowers the chances of cross-fertilization are reduced. Insects in such cases may visit many flowers of the same plant ; but this is not cross-fertilization in Darwin's sense of the term.

IV. *Dichogamy, or difference in the time of maturity of stamens and pistils.*—This appears to me the most suggestive and interesting phase of this intricate problem. From a teleological point of view, *i. e.* if we look for a purpose, we must agree with Darwin and his followers that this is one of the most remarkable adaptations favouring cross-fertilization. Modern science insists, however, that we must use inductive methods, and it is the tendency of the present day to search rather for the causes than for an underlying purpose. If, on the one hand, we affirm that every organ is modified to serve some particular use, we cannot believe, on the other hand, that such modifications are directly due to external factors over which the plant has no control. I am aware that the principle of natural selection may find its application in the most subtle cases ; at the same time it requires, in this particular instance, a considerable strain to make it fit. In reference to dichogamy, Mr. Meehan says positively that the difference between the time of maturity of stamen and pistil is caused by varying degrees of temperature, and that dichogamy has its origin in this circumstance, " that whatever its significance, it arises from no effort innate to the plant itself, but from an outside force that can have but little interest in cross-fertilization" *. It is peculiarly characteristic of the present day to seek for the effect of external conditions and to experiment with the modifications that can be brought about by changing these. For example, Prof. Goebel says, in reference to cleistogamic flowers, "We do not yet know the conditions necessary for the production of cleistogamic flowers, but it may be assumed even now that this production is influenced by external factors wherever a plant has the power to produce such flowers" †. He then cites experiments made with *Impatiens fulva*, where cleistogamic flowers are the result of poor nutrition. Accordingly it appears at least possible that experiments might give similar results in reference to dichogamy.

Attention has often been called to the fact that in plants especially adapted to insure cross-fertilization there exists in almost every case a possibility of self-fertilization. The above statements in regard to dichogamy, if of any value, point to a different conclusion concerning the final or at least possible autogamy from that which is generally accepted. It is assumed that the flower is so constructed that there is every chance of a cross provided the insect appears to do the work. This failing, the arrangement is such as to allow pollen to come in contact with the stigma of the same flower. It is evident that in every case which seems to point towards cross-fertilization it is always to a great extent a matter of chance whether the visitor arrives or not, even when the adaptation seems most perfect. It should be decided if cross-fertilization or autogamy is the rule with every species which seems constructed so as to attract insects, and this work should be done in as many different localities and at different times of the year as possible, since there is no doubt there are great variations possible in the fertilization of flowers in the same species caused by different conditions of heat, moisture, &c.

If autogamy should in any case prove the rule, we must regard fertilization by aid of an insect as an exception, not to call it an accident. Dichogamy probably is then in a measure due to external conditions. If this is true, it is simply the result of a "lagging behind" in the ripening time of either stamens or pistils, and the final autogamy is the result of a subsequent "catching-up" in this respect. This is, as I have said before, probably the most interesting side of the question, and the one which will no doubt prove the most satisfactory for experimental investigation.

* Proc. Acad. Nat. Sci. Philad. Nov. 27, 1888, p. 394.

† Goebel, 'Pflanzen-biologische Schilderungen,' Marburg, 1893, ii. Theil, 2 Lief. p. 363.

In conclusion, I desire to make the following suggestions:—

First. It is evident that the study of the phenomenon of cross-fertilization of flowers by means of insects is still a profitable field for observation and discovery.

Second. The effect of external conditions in reference to dichogamy should be the subject of critical experiments.

Third. Teleological explanations should be avoided as much as possible, here as elsewhere, according to the spirit of modern investigation.

Finally. The relative number of cases of cross- and close-fertilization should be compared, and it should be determined if cross-fertilization actually takes place in all cases where this is assumed.

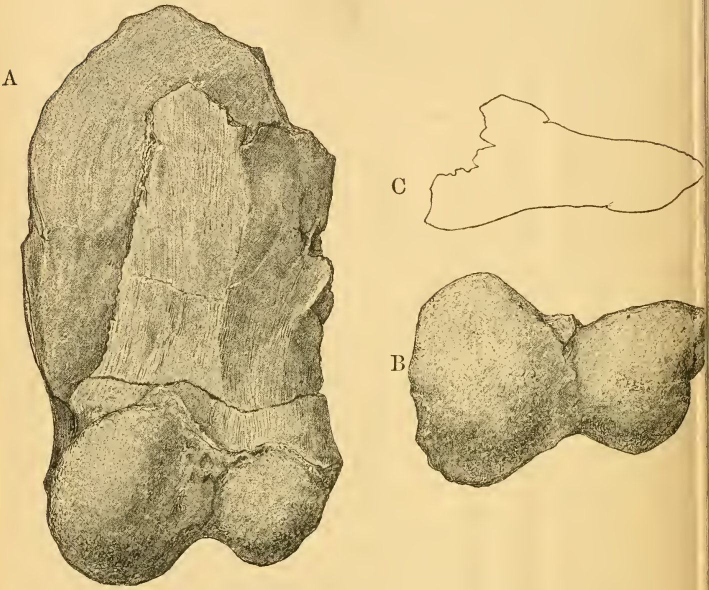
XXXVI.—*On the Quadrate Bone of a Gigantic Pterodactyl discovered by Joseph Mawson, Esq., F.G.S., in the Cretaceous of Bahia, Brazil.* By A. Smith Woodward, F.L.S., F.G.S.

Nearly five years ago Mr. Joseph Mawson discovered the first evidence of Pterodactyls in the rocks of the Southern Hemisphere, consisting of two fragmentary quadrate bones from the Cretaceous of Bahia, Brazil *. Quite recently he has returned from a further examination of the cliffs and shore-reefs in the same district, and now he has obtained another example of the same bone, interesting not only on account of the locality, but also as belonging probably to the most gigantic Pterodactyl hitherto recorded.

The new specimen, shown from the posterior and articular aspects and in transverse section in the accompanying figures, belongs to the right side of the head. A little more of its proximal portion is preserved than in the previous example, but the pterygoid plate is similarly broken away, the facette for its articulation alone being indicated. The bone is much compressed antero-posteriorly, its outer margin being a sharp edge, and a transverse fracture immediately above the condyles (fig. C) shows that its lower portion is solid. The

* A. S. Woodward, "Evidence of the Occurrence of Pterosaurians and Plesiosaurians in the Cretaceous of Brazil, discovered by Joseph Mawson, Esq., F.G.S.," Ann. & Mag. Nat. Hist. [6] vol. viii. (1891), p. 314, fig. 2.

upper portion may have been hollow, but there is no pneumatic foramen such as often occurs on the hinder face of this element. Both faces are flattened, but the anterior one is slightly concave from side to side above, and the posterior one (fig. A) is remarkable for its relatively great width in the upper part. The facette for the pterygoid lamina extends downwards almost as far as the inner articular condyle and is obscured by adherent matrix; but its boundaries are clear,



Right quadrate bone of a Pterodactyl, natural size, from the posterior (A) and articular (B) aspects, and in transverse section (C). Cretaceous, Plataforma, Bahia, Brazil. [Mawson Collection, British Museum.]

and the transverse fracture shows that it was coarsely rugose and ridged as in the previous small specimen from Brazil. The articular end of the bone (fig. B) exhibits the usual lack of bilateral symmetry. The condyles are a little abraded, though apparently not much damaged, and are particularly remarkable both for their inequality in size and their tumid form. The inner is very much larger than the outer condyle, and the valley between the two is sharply angulated.

Compared with the Pterodactylian quadrates already discovered by Mr. Mawson in the same formation and locality, the new specimen is about three times as large, and differs in the marked inequality of the articular condyles, as also in their less oblique disposition. The new fossil, however, agrees with the others in having these condyles remarkably tumid and separated by a narrow sharp valley, thus resembling the corresponding bones of the Jurassic * rather than those of Cretaceous age †. So far as yet known, indeed, the articular end of the quadrate in Cretaceous Pterosaurian genera is almost saddle-shaped, with acute lateral borders.

Not being able to determine the genus of the Brazilian Cretaceous Pterodactyl, it is equally impossible to estimate the size of the skull or the animal itself from a single bone. There is too much variation in the proportions of the snout and the relative dimensions of the head among Pterodactyls to admit of any such induction. To judge by Marsh's figure of the skull of *Pteranodon*, however, the Brazilian form must have even exceeded in size the gigantic species of this North-American genus, of which the head sometimes attains a length of 4 feet.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

January 22, 1896.—Dr. Henry Woodward, F.R.S., President, in the Chair.

The following communications were read :—

1. 'On some Podophthalmous Crustaceans from the Cretaceous Formation of Vancouver and Queen Charlotte Islands.' By Henry Woodward, LL.D., F.R.S., P.G.S.

This paper contains descriptions of several crustaceans from the Cretaceous coal-bearing strata of Vancouver and Queen Charlotte Islands, sent to the Author by J. F. Whiteaves, Esq., F.G.S.,

* R. Lydekker, "On certain Ornithosaurian and Dinosaurian Remains," Quart. Journ. Geol. Soc. vol. xlvii. (1891), p. 41, pl. v. figs. 3, 4.

† H. G. Seeley, 'The Ornithosauria' (1870), p. 90, pl. xi. figs. 16, 17. See also figure of quadrate of *Pteranodon* (no description) by O. C. Marsh, Amer. Journ. Sci. [3] vol. xxvii. (1884), pl. xv.

Palæontologist to the Geological Survey of Canada, and two from the Museum of the Geological Society of London.

After giving a brief notice of the deposits from which the nodules containing these crustacean fossils have been derived, and the authors who have written upon them, Dr. Woodward describes (1) a new *Callianassa*, which he names *Callianassa Whiteavesii*; (2) an anomalous Brachyuran, which he names *Homolopsis Richardsoni*; (3) a new Corystid, named *Palæocorystes Harveyi*; and (4) a new Cancer, named *Plagiolophus vancouverensis.*

2. 'On a Fossil Octopus, *Calais Newboldi* (J. de C. Sby., MS.), from the Cretaceous of the Lebanon.' By Henry Woodward, LL.D., F.R.S., P.G.S.

The specimen to which the Author's attention was obligingly drawn by Mr. C. Davies Sherborn, F.G.S., is in the Museum of the Geological Society; it was obtained by Major T. J. Newbold, and named in 1846 in MS. by the late Mr. J. de Carle Sowerby, *Calais Newboldii*, who added on the label:—'Ceph. Octopoda. Genus ineditum. Abdomen alis triangularibus instructum. E strato calcareo *tertiario* Montis Libani a D. Newbould effossum.—1846. J. de Carle Sowerby.'

The Author describes the specimen in detail, and retains for it the genus and species proposed by Mr. Sowerby, only correcting the spelling of the discoverer's name and the age of the bed, which is Cretaceous, not Tertiary.

MISCELLANEOUS.

The imputed Jealousy of European Workers on Australasian Faunas by Local Writers. By C. Hedley, F.L.S.

Referring to the controversy in the last August and October numbers of this Magazine, touching the synonymy of *Rhysota Armiti*, I can readily accept the decision of Mr. Smith, since he has the advantage over me of consulting a figure. While the identity of a species may be held a trifling matter, his concluding remark that American and Australian naturalists jealously resent the interference of European writers with their respective local fauna, touches on a topic so large and important that I would crave space to discuss it further.

When such interference takes the shape of the splendid 'Challenger' monographs it is received most thankfully; but when it comes to us, as it often does—I am, of course, not now alluding to Mr. Smith—in papers ignoring Australian or American literature, without, or with mistaken, reference to geographical, geological, and other environment necessary to the proper appreciation of the subject, and presenting data insufficient for the recognition of the species dealt with, then we may be ungrateful without being jealous. Even resentment may be provoked by the flippant manner in which Australian and some American work is received, no matter how honestly attempted, by the disregard of our scientific literature and by the shameful ignorance that pervades all classes in matters concerned with Australian geography.

An apt parable is the story of two children dividing a piece of bread and jam, of whom the elder licked off the sweets and handed to the younger the dry bread for his share. What credit may attach to the naming of species is appropriated by some Europeans, who leave the drier crust of classification, anatomy, distribution, &c. to be laboriously worked out by others.

To support these charges by particulars, I will wander no further than the source whence this discussion arose. Some years ago I prepared an account of the Land-Molluscan Fauna of British New Guinea, in studying which I encountered several unfigured descriptions by Mr. Smith. A London writer, who has at his command the ablest men, the wealthiest museums, and most complete libraries in the world, cannot appreciate the difficulties under which an American, and still more an Australian, student pursues his work in a city far from civilization's centre, poorly equipped with books, specimens, or apparatus, and alone from fellow-workers. If Mr. Smith, who can identify almost any known shell by a glance at an authentic specimen in his official custody, could realize how the head of one student of his writings has ached in reading and re-reading one of his brief unfigured diagnoses and in endeavouring to match it with a specimen in hand, he would never, I believe, again issue an unfigured description. Chance, however, later threw in my path authentic examples of Mr. Smith's unfigured Papuan species; and, though I consider it unfair for one writer to cast upon another the burden of completing his work, I published drawings of each of them.

My satisfaction in reducing this fauna to order was short-lived, for Mr. Smith then produced a series of papers in which a considerable number of New-Guinea species were named and described without figures or precise localities. Now I do not regard the publication of these descriptions as a mere formal rite whose celebration invests British-Museum specimens with the rank of type; but I receive them as an intended aid to Australian students in the study of their local fauna. Yet a perusal of them does not enable me to project a distinct image of any of the forms dealt with; nor am I alone in this infirmity, for one of the most striking of these shells has since been renamed, described, and figured as an unpublished species by a German author, Dr. Kobelt. Several of the species are relegated to the genus *Helix*, which, in the sense Mr. Smith employed it, contains about three thousand species; he also draws specific limits narrower than do some other writers. For the purpose of this argument it is granted that, in adopting broad genera and narrow species, the best course is followed; but it will then be obvious that he who contrasts a novelty with thousands instead of scores of co-generic forms, and he who sees five species where another distinguishes three, is under the greater necessity of giving full details than he who adopts the alternative course. Conchelogists have especial reasons for figuring every shell described, inasmuch as that shell is not a complete organism, such as usually represents a species to an entomologist or an ichthyologist. If a carcinologist were required to name and describe a new crab from an empty carapace shorn of its appendages, or a botanist to publish a new tree from a handful of leaves, each would probably decline on the ground of insufficient material; and if he yielded, say to the importunity of a palæontologist who could furnish nothing else, he would endeavour to make amends for his fragmentary material by figuring and describing it in the minutest detail.

To conclude: in the army of science there is no room between an honoured veteran like Mr. Smith and a tyro like myself for that green-eyed monster to whom he somewhat harshly alludes. The object of these remarks will have been attained if I can but induce European writers to read a little more Australian scientific literature, to study the geography of this continent with a little more care, and especially to figure every Australasian shell they describe as new.

Sydney, New South Wales,
November 30, 1895.

Reply.

I do not propose in any way to modify or withdraw the opinion expressed in the paragraph of my paper complained of by Mr. Hedley, who has, however, both *misunderstood* and *misrepresented* it. I make no general imputation against *all* Americans, as he infers, but, from my own experience and from the testimony of others, I have reason to know that a jealous feeling has been entertained by "*some.*"

With regard to the title of Mr. Hedley's above remarks, I would observe that I have made no accusation at all against Australian writers, and my observation, "it seems almost as if the 'green-eyed monster' were tripping in the Antipodes," was a playful reference to Mr. Hedley alone, and was prompted by the general tone of his paper, which I thought might have been withheld until he had again occasion to deal with the fauna of New Guinea. I may add that if he had been a little less precipitate he would have been saved the trouble of writing his comments, for figures have since been published of the species complained of.

I may also say, in conclusion, that I do not think it would be edifying to further encroach upon the valuable space of these 'Annals' with a detailed criticism of the rest of Mr. Hedley's prolix remarks. A deal might be said with regard to the relative value of a good description and a bad figure, of the cost of illustration, of priority of publication, &c., but *cui bono*? E. A. Smith.

P.S.—Since penning the above reply specimens of Mr. Hedley's *Rhysota flyensis* (a synonym of which he complained of my creation in *R. Armiti*) have been added to the Museum collection. In my opinion it is *merely a variety* of his own *R. hercules*, described at the same time!—E. A. S.

CONTENTS OF NUMBER 99.—*Sixth Series.*

PROCEEDINGS OF LEARNED SOCIETIES.

MISCELLANEOUS.

*** It is requested that all Communications for this Work may be addressed, post-paid, to the Care of Messrs. Taylor and Francis, Printing Office, Red Lion Court, Fleet Street, London.

Vol. 17. **SIXTH SERIES.** No. 100.

THE ANNALS AND MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

CONDUCTED BY

ALBERT C. L. G. GÜNTHER, M.A., M.D., PH.D., F.R.S.,
WILLIAM CARRUTHERS, F.R.S., F.L.S., F.G.S.,
AND
WILLIAM FRANCIS, PH.D., F.L.S.

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

WITH FIVE PLATES.

Illustrative of Mr. H. M. Bernard's Paper on Hermaphroditism among the *Apodidæ*, and Dr. A. Günther's on Reptiles and Fishes from the Ogowe River and Old Calabar.

LONDON:
TAYLOR AND FRANCIS, RED LION COURT, FLEET STREET.
Sold by Simpkin, Marshall, Hamilton, Kent, & Co., Ld.; Whittaker & Co.: Baillière, Paris: Maclachlan and Stewart, Edinburgh: Hodges, Figgis, & Co., Dublin: and Asher, Berlin.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SIXTH SERIES.]

No. 100. APRIL 1896.

XXXVII.—*Report on a Collection of Reptiles and Fishes made by Miss M. H. Kingsley during her Travels on the Ogowe River and in Old Calabar.* By Dr. A. Günther, F.R.S.

[Plates XIII.-XV.]

Miss Mary H. Kingsley, on returning from her first visit to the West Coast of Africa in 1894, brought with her a small miscellaneous collection of zoological specimens, sufficiently large to show the interest she took in the fauna of the countries visited by her. Last year she started again from England, with the object of extending her travels in the interior of the Gaboon country; and as she intended to follow during a part of this expedition the course of the Ogowe River, she readily fell in with my view that an opportunity of collecting the fishes of this mighty river should not be lost. The means of preserving and transporting the specimens were naturally limited, as Miss Kingsley travelled alone with a native crew; besides, whilst traversing the region of the rapids, which extends over some hundred of miles, the upsetting of her canoe was a matter of frequent occurrence. Nevertheless she succeeded in bringing home in excellent condition a collection of eighteen species of Reptiles and about sixty-five species of Fishes, which will be enumerated or described in this paper, besides a number of other, especially entomological, specimens.

During a temporary stay at Old Calabar and a visit to the island of Corisco some freshwater fishes were added to the main collection from the Ogowe River. These will be also embodied in the present paper, whilst the marine species, being all well known, are omitted. A case containing the fishes of Lake Aznigo, which Miss Kingsley visited with the special object of obtaining its fishes, was unfortunately lost by the upsetting of a boat.

Thirty years ago scarcely anything but the name was known of the Ogowe River; but between 1860 and 1870 French officials and traders began to trace its course inland, discovering a long stretch of rapids in its middle course which render navigation dangerous and, at places, impossible to any vessel larger than a boat. Among those earlier explorers an Englishman, the late Mr. R. B. N. Walker, took a prominent part *, making two expeditions in 1866 and 1873, and penetrating to Lopé, in the Okanda country. The survey of the upper parts of the river was completed by Messrs. de Brazza and Balay.

All that was known before the year 1860 of the reptiles and fishes of the Gaboon country has been collected by Aug. Duméril in his memoir "Reptiles et Poissons de l'Afrique occidentale," in Arch. Mus. vol. x. I find that in the list at the end of his memoir he mentions eight freshwater fishes from Gaboon, all being from the littoral portion of the country. In 1867 † I described the collection made by Walker on the Ogowe, adding seventeen species to its fauna, ten of which were new. This list was increased by six others found by Buchholz and determined by Peters (MB. Berlin. Akad. 1876, p. 244). Two years later M. Sauvage commenced to publish the results of his examination of the materials that had accumulated in the Paris Museum (Bull. Soc. Philom. 1878, pp. 90–103), giving a complete account of the then knowledge of this fish-fauna in his memoir "Étude sur la Faune ichthyologique de l'Ogôoué," in N. Arch. Mus. iii. 1880. In it he enumerates thirty-seven species, a part of which, however, he knew only from the papers of his predecessors. This number has been increased by him in a last supplementary list to forty-six (Bull. Soc. Zool. France, ix. 1884).

In the present paper I have added to the Gaboon fauna from Miss Kingsley's collection the following sixteen species:—

Gobius æneofuscus, Gthr.
Eleotris senegalensis, Stdchr.

* Bull. Soc. géogr. Paris, 1879, p. 114.

† Ann. & Mag. Nat. Hist. 1867, xx. p. 109. In this paper the name of the river is misspelt Ogome.

Ophiocephalus obscurus, Gthr.
Ctenopoma gabonense, sp. n. (? = *Ct. multispine*, Sauv., nec Ptrs.).
—— *nanum*, sp. n.
—— *Kingsleyæ*, sp. n. (? = *Ct. Petherici*, Sauv., nec Gthr.).
Chromis ogowensis, sp. n. (? = *Ch. microcephalus*, Sauv., nec Blkr.).
Cynoglossus senegalensis, Kaup.
Clarias Walkeri, sp. n.
Eutropius liberiensis, Hubrecht.
Chrysichthys Büttikoferi, Stdchr. (= *Ch. macrops*, Sauv., nec Gthr.).
Barilius bibie, Joannis.
Alestes longipinnis, Gthr.
—— *Kingsleyæ*, sp. n.
Mormyrus amblystoma, sp. n.
Notopterus nigri, Gthr.

Deducting from M. Sauvage's list three species which I consider merely synonyms, and allowing for four others which I believe to figure in my and M. Sauvage's lists under different names, I compute the total number of species known at present from this river to be fifty-one, a number which may be expected to be doubled by future investigations. The fish-fauna of the Nile consists of about ninety species.

The localities which will be mentioned in this report are the following:—

Warri, on the Forcados River (mouth of the Niger).
Azuminé Creek, freshwater, running into the Opobo River, with a swift current, 25 miles from the sea (Niger delta).
Egwanga, on the Opobo River (Niger delta).
Corisco Island, off the Gaboon Coast.
Lambarene, Ogowe River.
Talagouga, about 180 miles from the mouth of the Ogowe.
Kondo-Kondo, an island in the Alemba Rapids of the Ogowe.

Reptiles and Batrachians.

The Reptiles were collected at Lambarene, and belong to the following species:—

1. *Cycloderma Aubryi*, D. B.—A young specimen well agreeing with one figured by Peters (MB. Berl. Akad. 1876, p. 117).

2. *Monitor niloticus*, L.
3. *Poromera Fordii*, Hallow.
4. *Mabouia Raddonii*, Gray.
5. *Gymnodactylus fasciatus*, D. B.
6. *Polemon Barthii*, Jan.
7. *Coronella fuliginoides*, Gthr.
8. *Grayia Smythii*, Leach.
9. *Hydræthiops melanogaster*, Gthr.
10. *Hapsidophrys lineatus*, Fisch.
11. *Philothamnus nitidus*, Gthr.
12. *Lycophidium irroratum*, Leach.
13. *Dipsadoboa assimilis*, Matschie.
14. *Naja melanoleuca*, Hallow.
15. *Vipera nasicornis*, Shaw.
16. *Atheris anisolepis*, Mocq.
17. *Cornufer Johnstonii*, Blgr.
18. *Rana crassipes*, Ptrs.

Before passing on to the Fishes I offer remarks on a few of these species.

Poromera.

Poromera, Boul. Liz. iii. p. 6.

Nostril between two nasals and the suture between rostral and first labial. Lower eyelid scaly. Collar present. Back covered with scales larger than those of the tail, and strongly keeled, the keels forming continuous longitudinal ridges; sides with much smaller scales; ventral scales rather large, imbricate, keeled, the keels again forming continuous series. Fingers and toes slender, with a double series of smooth, very small scutes beneath. Femoral pores; no inguinal pores. Tail long, cylindrical.

Poromera Fordii.

Tachydromus Fordii, Hallow. Proc. Ac. Nat. Sci. Philad. 1857, p. 48.
Poromera Fordii, Boul. *l. c.*

General aspect of a *Tachydromus*.

The scutes on the upperside of the head show longitudinal ridges either along the middle or concentric with their margins. The anterior nasal meets its fellow in the median line behind the rostral. Anterior frontal longer than broad; an unpaired small scute between the posterior frontals. Vertical bell-shaped, twice as long as broad; a pair of anterior occipitals, half the size of the posterior, between which a central occipital. The posterior occipitals are fringed by some smaller marginal scutes. Two large supraoculars on each side. Seven or eight narrow upper labials, of which the penultimate is the largest. Four chin-shields on one side, five on the other. Temporal scales small, strongly keeled.

Ear very open, vertically long. Collar more distinct in front of the shoulder-joint, and nearly obsolete across the chest. Dorsal scales in eight, ventral in ten, longitudinal series. Præanal region covered by keeled scales, in size and shape scarcely differing from those preceding them. About twelve femoral pores. All the caudal scales strongly keeled.

The fore limb pressed backwards does not reach the groin; the hind limb carried forwards extends to the ear. Thigh finely granular behind.

The upper parts are brown, or, after the removal of the epidermis, green iridescent. Back anteriorly with a black longitudinal band on each side of the median line, the two bands coalescent further behind. An indistinct greenish band along each side of the neck. Lower parts whitish.

	millim.
Distance of snout from vent	45
Length of tail	110
Distance of snout from ear	12
Length of fore limb	20
Length of hind limb	30
Length of fourth toe (measured from its junction with the fifth)	12

I have given a full description of this lizard, as the specimen found by Miss Kingsley at Lambarene seems to be only the second known to exist in collections. Its specific identity with *Tachydromus Fordii* of Hallowell might be questioned, as this author has described the specimen in the museum of the Philadelphia Academy as possessing only six rows of ventral scales; also the scutellation of the præanal region is differently described. However, as there is a great agreement in other respects between the two specimens, and the locality (Gaboon) as given by Hallowell points likewise to a specific identity, I adopt the name given by the latter author.

Dipsadoboa assimilis.

Dipsadoboa assimilis, Matschie, SB. Ges. naturf. Fr. Berl. 1893, p. 173 (Togoland); Bocage, Jorn. Sc. Lisb. iv. 1895, p. 17.

The specimen obtained at Lambarene agrees better with *D. assimilis* than with *D. unicolor* with regard to the number and disposition of the labial shields.

Professor Bocage refers his specimens from Fernando Po also to *D. assimilis*, whilst, singularly enough, I have now some evidence that the type of *D. unicolor* came from the same island, as I received some years ago a specimen from Fernando Po which is identical with *D. unicolor*. Therefore, as far as our present experience goes, both *D. unicolor* and *assimilis* (if they are really distinct) would seem to occur in Fernando Po, while the former does not extend on to the mainland.

Atheris anisolepis.

Atheris anisolepis, Mocquard, Bull. Soc. Philom. 1887, p. 90.
Atheris læviceps, Boettger, Zool. Anz. x. p. 651; Ber. Senckenb. Ges. 1888, p. 92, tab. ii. fig. 7 (head).

An adult specimen from Lambarene. The specimens from which Boettger took his description came from Banana (Congo delta). The principal distinctive characters of this species are, in my opinion, the number and size of scales and the two series of suboculars, rather than the degree of carination of some of the scales on the crown of the head, which depends on age.

Thanks to the kindness of Professor L. Vaillant and Dr. Jentink I have been able, by a re-examination of the typical specimens described by Schlegel and Mocquard, to form a definite opinion as to the species of *Atheris* which deserve recognition. They are the following:—

1. *A. squamigera*, Hallowell, = *A. subocularis*, Fisch., probably = *A. Burtonii*, Gthr. With 17 (in *A. Burtonii* with 19) series of scales; only one row of minute subocular scales (exceptionally partly confluent with upper labials).
2. *A. anisolepis*, Mocquard (1887), = *A. læviceps*, Boettger (1887), = *A. chloroechis*, Boettg., part. With 22–25 series of scales; two rows of minute suboculars, the lower row sometimes incomplete, but always indicated by several scales.
3. *A. chloroechis*, Schleg., = *A. polylepis*, Ptrs. With 31–36 series of scales and with a double row of suboculars.
4. *A. ceratophora*, Werner.

Rana crassipes, Buchh. & Ptrs.

One young specimen from Glass, Gaboon estuary.

This specimen, as well as an adult in the British Museum, has no vomerine teeth, whilst two short groups are present in the second of the British Museum specimens, which is intermediate in size between the two former.

Freshwater Fishes.

Gobius æneofuscus.

Gobius æneofuscus, Peters, MB. Berl. Akad. 1852, p. 681, and Reise n. Mossamb., Flussf. p. 18, Taf. iii. fig. 1; Günth. Fish. iii. p. 61.
Gobius æneofuscus, var. *guineensis*, Peters, MB. Berlin. Akad. 1876, p. 248.
Gobius tajasica, Steind. Not. Leyd. Mus. xvi. p. 25 (not synon.).

A Goby which seems to be very common in the freshwaters of Liberia and the Cameroon River, and is abundant in the Ogowe River, where numerous examples were obtained by Miss Kingsley at Kondo-Kondo, is identical with the species discovered by Peters in the Zambeze, but not, as Dr. Steindachner thinks, with the West-Indian *G. banana*, which has considerably smaller scales on the tail. *G. æneofuscus*, therefore, belongs to the freshwater fauna of Tropical Africa, extending right across the continent.

Gobius lateristriga, A. Dum. Arch. Mus. x. p. 247, pl. xxi. fig. 1, if not identical with this species, is, at any rate, closely allied to it; unfortunately the author has omitted to describe the scales, dentition, and other important characters.

Periophthalmus Koelreuteri, var. *papilio*, Bl. Schn.

Common on the West Coast, and attracting the notice of every traveller by its semiterrestrial habits and by the astonishing rapidity with which it leaps, frog-like, over the mud-flats of the littoral.

Island of Corisco (Steindachner, SB. Wien. Akad. 1869, lx. p. 945).

Eleotris senegalensis.

Eleotris (*Culius*) *senegalensis*, Steind. SB. Wien. Akad. 1869, lx. p. 949, Taf. ii. figs. 1, 2.

Ascends the Ogowe River, specimens having been obtained at Kondo-Kondo.

Mastacembelus cryptacanthus.

Mastacembelus cryptacanthus, Günth. P. Z. S. 1867, p. 102; Ann. & Mag. Nat. Hist. 1867, xx. p. 110.
Mastacembelus Marchei, Sauv. Bull. Soc. Philom. 1876, p. 94, and N.

Arch. Mus. iii. 1880, p. 36, pl. i. fig. 1; Steind. Not. Leyd. Mus. xvi. p. 31; Denkschr. Wien. Ak. 1879, xli., "Ueber einige neue . . . Fisch.," p. 16.

Lambarene.

Mugil falcipinnis, C. V.

Warri (Niger delta).

Ophiocephalus obscurus, Gthr.

Lambarene and Kondo-Kondo.
Figured in Petherick's 'Travels,' 1869, ii. pl. ii. fig. B.

CTENOPOMA, Ptrs.

From an examination of a much greater number of specimens than were at my disposal some years ago I have come to the conclusion that the variation in the characters of the species is of a limited extent, and that a greater number of species exist than I was formerly inclined to admit. Neither is the distinction of this genus from *Spirobranchus* so sharp as was supposed, the armature of the opercles not being equally developed in all species, and very young Ctenopomas apparently lacking it. At present I divide the specimens before me under the following specific names:—

I. A very distinct space between anal and caudal fins.
  A. Large scales on the back, above the lateral line.
    1. Maxillary extending beyond the centre of the eye.
      D. $\frac{17-18}{9}$. A. $\frac{9}{9}$. Subopercular armature strong .... 1. *multispine*, Ptrs.
    2. Maxillary extending to below the centre of the eye.
      D. $\frac{20}{9-10}$. A. $\frac{9-11}{9}$. Subopercular armature strong .... 2. *gabonense*, sp. n.
    3. Maxillary not extending to below centre of the eye.
      a. D. $\frac{15-16}{9}$. A. $\frac{8}{9-10}$. Suboperculum not serrated .... 3. *nanum*, sp. n.
      b. D. $\frac{17}{8}$. A. $\frac{11}{10}$. Suboperculum serrated .... 4. *congicum*, Blgr.*
  B. Small scales on the back, above the lateral line .... 5. *microlepidotum*, Gthr.

* Ann. & Mag. Nat. Hist. 1887, xix. p. 148.

II. Anal and caudal fins nearly continuous.

A. D. $\frac{15-17\ (18)}{7-10}$. A. $\frac{10\ (9)}{9-11}$. Depth of body $\frac{2}{5}$ of length in adult, $\frac{1}{3}$ in young........ 6. *Petherici*, Gthr.

B. D. $\frac{16-17}{9}$. A. $\frac{9-10}{9-10}$. Depth of body $\frac{1}{2}$ of length in adult, $\frac{2}{7}$ in young .... 7. *Kingsleyæ*, Gthr.

Ctenopoma gabonense, sp. n. (Pl. XIII. fig. C.)

Ctenopoma multispine, var., Günth. Ann. & Mag. Nat. Hist. 1867, xx. p. 110.

D. $\frac{20}{9-10}$. A. $\frac{9-11}{9}$. L. lat. 32. L. transv. $2\frac{1}{2}/9$.

Body almost as oblong as in *Ct. multispine*, to which this species is closely allied. The height of the body is two sevenths, or less than one third, of the total length (without caudal), the length of the head two sevenths or rather more than two sevenths. The snout equals the diameter of the eye, which is one fifth of the length of the head; interorbital space nearly flat, much wider than the orbit. Mouth moderately wide, the maxillary not extending beyond the vertical from the centre of the eye. The entire margin of the suboperculum is armed with prominent spines; also part of the interopercular margin is spiny. The space between anal and caudal fins is equal to, or even longer than, the diameter of the eye. Ventral fin not reaching the vent. Pores on the head rather small, inconspicuous. Coloration uniform.

Of this species there are two specimens in the British Museum, 140 and 153 millim. long, both from the Gaboon. One was obtained by the late Mr. R. B. N. Walker, and therefore most probably came from the Ogowe River. Both have twenty dorsal spines, which number does not seem to have been ever observed in *Ct. multispine*; from the latter species the present differs besides in a rather smaller mouth and much stronger subopercular armature. Vomerine and palatine teeth present.

Ctenopoma nanum, sp. n. (Pl. XIII. fig. B.)

D. $\frac{15-16}{9}$. A. $\frac{8}{9-10}$. L. lat. 27. L. transv. $2\frac{1}{2}/9$.

Body stouter than in *Ct. multispine* or *Ct. gabonense*, its greatest depth being contained $2\frac{3}{4}$ in the total length (without caudal) and nearly equal to the length of the head. The snout equals the diameter of the eye, which is contained $4\frac{3}{4}$ in the length of the head; interorbital space rather convex, not wider than the orbit. Mouth rather narrow, the maxillary not extending to the vertical from the centre of the eye.

Opercular armature weak; there are only a few spinous teeth above and below the opercular notch, and none at all on the sub- and interoperculum. The space between anal and caudal fins is equal to a diameter of the eye. Pores on the head entirely covered by scales. Five series of scales on the cheek, the lowermost covering the præopercular margin. Ventral fins reaching beyond the origin of the anal, the two outer rays being prolonged into filaments. Body with darker cross-bands; an indistinct oblique irregular dark band from the eye towards the root of the pectoral.

Two specimens from the Gaboon, 67 millim. long, are in the British Museum; they were collected with specimens of *Ct. Petherici.*

This species does not possess palatine teeth, and I am unable to see any teeth on the vomer, the head of which, however, is visible and not covered by the mucous membrane. Of course the possibility of these specimens being the young of one of the other species has been considered; but beside agreeing among themselves and differing from the other species in the number of spines, the comparative size of the eye and width of the interorbital space clearly point to their being either mature or not far removed from maturity.

Ctenopoma Petherici.

Ctenopoma Petherici, Günth. Ann. & Mag. Nat. Hist. 1864, xiii. p. 211, and 1867, xx. p. 110 (part.); and in Petherick's Travels, ii. 1869, p. 208, pl. i. fig. A.

The British Museum contains a specimen the exact habitat of which is not known, but which was bought with other West-African fishes. Although this specimen differs from typical *Ct. Petherici* in the fin-formula, which is D. $\frac{18}{10}$, A. $\frac{9}{11}$, I refer it for the present to the Nilotic species.

In young specimens, 60 millim. long, the opercular armature and the vomerine and palatine teeth are well developed; but these specimens have the body still lower than the adult, viz. one third of the total (without caudal); in the adult it is a little less than two fifths. The ornamental colours are prettier than in the adult, the diffuse blackish spot on the tail of the latter being a complete white-edged ocellus in the young.

Ctenopoma Kingsleyæ, sp. n. (Pl. XIII. fig. A.)

Ctenopoma Petherici, part., Günth. Ann. & Mag. Nat. Hist. 1867, xx. p. 110 (part.).

This species is allied to *Ct. Petherici*, but has a deeper body, and especially the young differs much from that of the Nilotic species.

D. $\frac{16-17}{9}$. A. $\frac{9-10}{9-10}$. L. lat. 25. L. transv. $2\frac{1}{2}/9$.

The depth of the body is scarcely less than one half of the total length (without caudal), the length of the head a little less than one third. The snout is nearly equal to the diameter of the eye, which is two ninths of the length of the head; interorbital space rather convex, wider than the orbit. Mouth narrow, the maxillary extending somewhat beyond the front margin of the orbit. Vomerine teeth; palatine teeth in a very narrow linear band. A series of short spinous teeth above and below the opercular notch; subopercular and part of the interopercular margin finely and equally serrated. Tail very short, the anal terminating immediately before, or subcontinuous with, the caudal. Pores on the head entirely covered by scales. Five or six rows of scales on the cheek, the scales near the eye being much smaller than the others. Ventral fins not prolonged, reaching the vent. Soft parts of the vertical fins scaly. Blackish, a diffuse large black spot on the end of the tail, in front of the root of the caudal.

This diagnosis is taken from an adult specimen 150 millim. long; two young ones, 60 millim. long, differ in the following points:—

Their body is somewhat less elevated (though much more than in young *Ct. Petherici*), its depth being contained $2\frac{1}{3}$ times in the total length (without caudal). Interorbital space as wide as the diameter of the eye, which is one fourth of the length of the head. Two or three spines above and one below the opercular notch; suboperculum partly and indistinctly, interoperculum not serrated. Vomerine teeth developed, only traces of palatine teeth in front of the bone. Coloration as in the adult.

All three specimens from Kondo-Kondo.

Chromis latus, Gthr.

Warri.

The typical specimen was most likely from the same locality, the late Mr. Fraser being known to have collected in, or to have received collections from, the Niger delta.

Chromis ogowensis, sp. n.

? *Chromis microcephalus*, Sauvage, Bull. Soc. Zool. France, ix. 1884, p. 196 (nec Bleek.).

D. $\frac{15}{11}$. A. $\frac{3}{9}$. P. 13. L. lat. 27. L. transv. 3/11.

Scales on the cheek in three series. Twenty-eight notched teeth on each side of the upper jaw. The maxillary terminates some distance in advance of the vertical from the eye. The depth of the body is a little less than one half of the total length (without caudal), the length of the head a little less than one third. Eye two ninths of the length of the head, much less than the length of the snout and than the width of the interorbital space. Pectoral fin with the third and fourth rays produced and extending to the first anal spine. Caudal fin truncated, scaly. Body with indistinct cross-bands. Vertical fins blackish, the dorsal with black longitudinal stripes, longitudinal on the spinous portion, oblique on the soft; a large oval black spot behind the last dorsal spine. Ventrals black. A black opercular spot.

	millim.
Total length	170
" " without caudal	143
Length of the head	47
Diameter of the eye	10
Length of the eighth dorsal spine	19

Ogowe River (Lambarene).

Hemichromis fasciatus, Ptrs.

Azuminé Creek; Ogowe River.

Hemichromis bimaculatus.

Hemichromis bimaculatus, Gill, Proc. Philad. Ac. 1862, p. 137; Steind. Notes Leyd. Mus. xvi. p. 49.
Hemichromis auritus, Gill, *l. c.* p. 135.

Allied to *H. guttatus* and *H. subocellatus*, but with the body deeper and the spinous dorsal higher.

D. $\frac{14}{10}$. A. $\frac{3}{8}$. L. lat. 24. L. transv. 3/10.

The height of the body is contained $2\frac{1}{2}$ in the total length (without caudal), the length of the head $2\frac{3}{4}$. Length of the snout equal to the diameter of the eye, which is one fourth of the length of the head and equal to the width of the interorbital space. Teeth conical, brown, equal in size. Four series of scales on the cheek. Cleft of the mouth rather narrow, slightly oblique, with the lower jaw slightly projecting and with the maxillary not quite reaching the vertical from the front margin of the orbit. The length of the eighth dorsal spine is two fifths of that of the head. In the adult the soft dorsal and anal and the ventral fin are produced into points. Brownish above, a deep black spot on the end of the operculum and another in the middle of the body; three or four series of round bluish spots on the cheek and gill-cover. Fins without spots.

	millim.
Total length	78
„ „ without caudal	60
Depth of the body	25
Length of the head	22
Diameter of the eye	6

From the middle course of the Ogowe River.

Hemichromis Schwebischi.

? *Hemichromis Schwebischi*, Sauvage, Bull. Soc. Zool. France, ix. 1884, p. 198, pl. v. fig. 2.

D. $\frac{15-16}{11}$. A. $\frac{3}{8}$. L. lat. 28. L. transv. 3/10.

The height of the body is contained $2\frac{3}{5}$ times in the total length (without caudal), the length of the head $2\frac{2}{3}$ times. Snout produced, with the upper jaw slightly the longer, longer than the postorbital portion of the head. Mouth of moderate width, very slightly oblique, the maxillary reaching but little beyond the vertical from the nostril. Teeth small, subequal, with brown pointed tips. The eye is a little less than one half of the length of the snout and contained $4\frac{2}{3}$ times in that of the head; its diameter does not equal the width of the interorbital space in the largest specimen. Præorbital as wide as the eye. Præoperculum with a broad scaleless inferior limb, but its width is much narrower than the cheek, on which the scales are arranged in four series. The dorsal fin commences above the root of the pectoral fin; its spines are of moderate strength, the middle ones being much longer than the eye. Caudal fin slightly emarginate.

Specimens from Azuminé Creek have sixteen dorsal spines and the pectoral fin reaches nearly the vent. Two faint broad longitudinal bands on the upper half of the body are crossed by five or six transverse bands, equally faint, the parts crossed being of a darker tint. These markings are more distinct in young examples than in the adult. An opercular spot.

Specimens from Kondo-Kondo have fifteen dorsal spines and a rather shorter pectoral. None of the markings are present beside the opercular spot.

	millim.
Total length	148
„ „ without caudal	125
Length of the head	45
Diameter of the eye	10
Length of the ninth dorsal spine	15

The specimen described by Sauvage was considerably larger than ours; to this circumstance I am inclined to ascribe the discrepancies between the two descriptions.

Cynoglossus senegalensis, Kaup.

Lambarene.

Clarias Walkeri, sp. n. (Pl. XIV. fig. B.)

D. 77. A. 56. P. 1/8.

Vomerine teeth villiform, forming a rather narrow band, without posterior projection, and as broad as the intermaxillary band; each half of the latter is twice as wide as broad, and both the intermaxillary and vomerine bands have the same lateral extent. Head covered above with smooth thin skin, scarcely any granulation being visible. The occipital process projects as an isosceles triangle, the hind margin of the head forming an open crescent on each side of the process. The fontanelle is elongate, slightly encroaching upon the base of the triangular process. The length of the head (measured to the end of the process) is two ninths of the total (without caudal); the width of the interorbital space is one half of the length of the head. Barbels moderately long, that of the nostril not reaching the gill-opening, and that of the maxillary extending to the origin of the dorsal fin, which is opposite to the end of the pectoral. Anal fin not low. Vertical fins separated from each other by a small interspace. Coloration uniform blackish brown.

	millim.
Total length	171
„ „ without caudal	150
Length of upperside of head	35
Width of interorbital space	18
Diameter of the eye	2·7

Ogowe River.

Clarias gabonensis.

Clarias gabonensis, Günth. Ann. & Mag. Nat. Hist. 1867, xx. p. 110.

D. 76–78. A. 56–60. P. 1/10.

Vomerine teeth villiform, forming a band which is a little broader than the intermaxillary band, without posterior projection; each half of the intermaxillary band is twice as wide as it is broad, and laterally scarcely extends so far as the vomerine band. Head naked above, finely granular and striated. The occipital process triangular, with rounded end, its base being a little longer than its sides. The fontanelle is ovate, and does not encroach upon the base of the triangular process. Length of the head one fourth of the total (without caudal); snout contracted, the width of the interorbital space being less than one half of the length of the head. Barbels moderately long, that of the nostril reaching to the root of the pectoral fin and that of the maxillary to the origin of the dorsal, which is nearly opposite to the end of the pectoral. Anal fin not low. Vertical fins separated from each other by a small interspace. Coloration uniform blackish brown.

	millim.
Total length	168
„ „ without caudal	148
Length of upperside of the head	38
Width of interorbital space	15
Diameter of the eye	3

This species inhabits also the Ogowe River. To facilitate comparison with the other species here described, I have given a fuller diagnosis than my former one.

Clarias buthupogon.

? *Clarias læviceps*, Gill, Proc. Ac. Nat. Sci. Philad. 1862, p. 139.
Clarias buthupogon, Sauvage, Bull. Soc. Philom. 1878, p. 96.
Clarias gabonensis (*Clarias megapogon*), Sauvage, N. Arch. Mus. iii. 1880, p. 39, pl. i. fig. 2 (not Günth.).

D. 84–87. A. 65–67. P. 1/8.

Vomerine teeth villiform, forming a rather broad band, without posterior projection, and as broad as the intermaxillary band; each half of the latter is twice as wide as broad, and both the intermaxillary and vomerine bands have the same lateral extent. Head covered above with a very thin skin and finely and rather sparsely granular. The occipital process projects as an isosceles triangle, the hind margin of the head being deeply notched on each side of the process. The fontanelle is of an oval shape, its greater portion lying in advance of the base of the process. The length of the head (measured to the end of the process) is two sevenths or one fourth of the total (without caudal); the width of the interobital space is somewhat less than one half of the length of the head. All the barbels very long, the nasal reaching beyond the head and the maxillary beyond the origin of the anal. Pectoral fin extending to the vertical from the first dorsal ray. Anal fin low; both the dorsal and anal extend to the root of the caudal. Sides of the head and neck with whitish specks.

	millim.
Total length	225
" " without caudal	195
Length of upperside of head	48
Width of interorbital space	21
Diameter of the eye	4·5

The specimens were obtained at Kondo-Kondo and in Corisco Island. The original description of *C. læviceps* runs as follows:—"Height at anus a tenth of length; head (laterally) a sixth, its breadth an eighth; the surface smooth; maxillary barbels twice as long as head. D. 86, A. 61,"—and is quite insufficient for exact determination of specimens. The typical specimen came probably from Liberia.

Schilbe mystus, Cuv. Val.

Old Calabar.

Schilbe dispila, Gthr.

Azuminé Creek (Opobo River).

I believe that the specimens so named should be reunited with *Schilbe mystus*.

Eutropius liberiensis.

Eutropius liberiensis, Hubrecht, Notes Leyd. Mus. iii. p. 69; Steind. ibid. xvi. p. 59.

D. 47–50.

Lambarene.

Eutropius congensis, Gthr.

Warri.

Chrysichthys Büttikoferi.

Chrysichthys Büttikoferi, Steindachner, Notes Leyd. Mus. xvi. p. 60.

This is a species clearly distinct from *Ch. macrops*, having the adipose fin much shorter and further distant from the dorsal fin. In this respect it agrees with *Ch. nigrodigitatus*, which, as a rule, has a more contracted snout and narrower mouth. However, I have examined large specimens which it is difficult to refer to either of these two species with certainty. And the difficulty is increased, as I find that there are specimens with eleven and with thirteen anal rays in both the narrow-snouted form (*Ch. nigrodigitatus*) and the broad-snouted (*Ch. Büttikoferi*). Possibly more than these two species should be distinguished. Miss Kingsley found *Ch. Büttikoferi* at Kondo-Kondo and in Corisco Island.

Synodontis serratus, Rüpp.

Old Calabar.

Malapterurus beninensis, Murr.

Old Calabar; Ogowe River.

Labeo coubie, Rüpp.

Old Calabar.

Barbus Kessleri, Steind.

Specimens from the Ogowe River have the barbels rather longer and the base of the dorsal fin at a steeper slope than specimens from Angola.

Barilius bibie. (Pl. XV. fig. C.)

? *Leuciscus bibie*, De Joannis, Guérin, Mag. Zool. 1835, Pisc. pl. iv.; Günth. Fish. vii. p. 293.

D. 10. A. 18. V. 9. L. lat. 54. L. transv. 8/4.

Body compressed, its depth being two ninths, the length of the head one fourth, of the total length (without caudal). Head oblong, with pointed snout, which is equal to the diameter of the eye or two sevenths of the length of the head. Width of the interorbital space equal to the diameter of the eye. Mouth wide, oblique, the narrow maxillary extending to below the middle of the eye, its extremity being hidden below the suborbital, when the mouth is shut. Præorbital about half the area of the orbit; the first suborbital is narrow, much narrower than the second and third, which nearly entirely cover the cheek, leaving only a space uncovered about equal to the size of the first suborbital. The origin of the dorsal fin is rather nearer to the caudal than to the occiput; origin of the anal fin below the middle of the dorsal. Caudal fin deeply forked. Pectoral fin shorter than the head, not reaching the much shorter ventral. Scales thin, with very distinct radiating striæ; lateral line sweeping down in a curve towards the abdomen, and, following the lower profile, terminates below the centre of the caudal fin. Silvery, with twelve bluish vertical bars along the middle of the side, and with a large blackish spot at the root of the caudal.

	millim.
Total length	110
„ „ without caudal	95
Length of the head	22
Diameter of the eye	6

Ogowe River.

This is one of the most interesting fishes in the collection. Originally described and figured in a very rude manner from a small specimen from the Nile, *L. bibie* has remained undiscovered in that river up to the present time. De Joannis does not mention the bluish cross-bars, which, however, are very faint. It is most desirable that specimens from the Nile should be directly compared with West-African ones.

I am unable to arrive at a definite conclusion as to whether *Barilius senegalensis*, Steindachner (SB. Wien. Akad. 1870, lxi. p. 564, Taf. v. fig. 2), from the Senegal, should be referred to this species. Lat. l. 59–63; maxillary extending to behind the centre of the eye.

I am equally uncertain with regard to *Opsaridium Buchholzi*, Peters (MB. Berl. Akad. 1876, p. 251, fig. 4). It also comes from the Ogowe River; but, to judge from the diagnosis and figure, Peters's fish has fewer scales in the lateral line (46), a smaller eye and longer snout (the specimens are of about the same size), and a longer maxillary, which reaches behind the middle of the eye. Peters represents his fish without any colour-markings.

Assuming that there are two distinct species of *Barilius* in West Africa, from a geographical point of view *B. senegalensis* would probably prove to be identical with the Nile fish, whilst the Ogowe specimens described by Peters and myself might prove to be the second species; but this assumption is not confirmed by the description of the various authors. Thus, as not one of the descriptions extant fully agrees with our specimen, I apply at present the oldest name to it.

Alestes macrophthalmus.

Alestes macrophthalmus, Günth. Ann. & Mag. Nat. Hist. 1867, xx. p. 112.

Talagouga.

Alestes macrolepidotus, C. V.

Old Calabar.

Alestes leuciscus.

Alestes leuciscus, Günth. Ann. & Mag. Nat. Hist. 1867, xx. p. 113.

Egwanga, on the Opobo River.

Alestes longipinnis.

Brachyalestes longipinnis, Günth. Fish. v. p. 315.

Azuminé Creek and Ogowe River.

Alestes Kingsleyæ, sp. n. (Pl. XV. fig. B.)

D. 10. A. 15–16. L. lat. 23–24. L. transv. $4/3\frac{1}{2}$.

The height of the body is one third of the total length (without caudal), the length of the head one fourth. Eye two sevenths of the length of the head, equal to that of the snout, but less than the width of the interorbital space. Origin of the dorsal fin a little behind that of the ventrals. None of the fin-rays elongate. A deep black band commences abruptly in the middle of the tail, opposite to the origin of the anal fin, and runs to the end of the central caudal rays; it is broader at its commencement than at its end. A more or less distinct dark spot above the commencement of the lateral line.

	millim.
Total length	115
„ „ without caudal	95
Length of the head	26
Diameter of the eye	8

Ogowe River.

Sarcodaces odoë, Bl.

Old Calabar; Ogowe River.

Distichodus notospilus.

Distichodus notospilus, Günth. Ann. & Mag. Nat. Hist. 1867, xx. p. 114.

Lambarene.

Xenocharax spilurus.

Xenocharax spilurus, Günth. Ann. & Mag. Nat. Hist. 1867, xx. p. 113, pl. iii. fig. B.

Talagouga.

Mormyrus zanclirostris.

Mormyrus zanclirostris, Günth. Ann. & Mag. Nat. Hist. 1867, xx. p. 114, pl. ii. fig. B.

Common at Talagouga.

Mormyrus microcephalus.

Mormyrus microcephalus, Günth. Ann. & Mag. Nat. Hist. 1867, xx. p. 114.

Common at Talagouga.

Mormyrus lepturus.

Mormyrus lepturus, Günth. P. Z. S. 1871, p. 670, pl. lxix. fig. B.
? *Mormyrus grandisquamis*, Peters, MB. Berl. Akad. 1876, p. 250.

I described this species from two young specimens 3 inches long. Miss Kingsley has rediscovered it at Talagouga, and collected specimens apparently adult and up to 190 millim. in length. Thus I am enabled to amend my original diagnosis in several points.

D. 20–24. A. 25–29. L. lat. 42–44.

Snout obtuse, with the mouth terminal and, with age, with the lower lip thickened into a short adipose protuberance. The upper profile is somewhat more curved than the lower. Eye small, shorter than (in adult specimens only half as long as) the snout, situated in the anterior half of the head. Teeth of moderate size, notched, few in number. The height of the body is two sevenths of the total length (without caudal), the length of the head two ninths. The caudal peduncle is slender, about as long as the head, its depth being one third of its length. Origin of the dorsal fin a little behind that of the anal, midway between the root of the caudal and the head. Pectoral a little shorter than the head, extending to the middle of the ventral, which is only half as long and terminates a long way from the vent. The scales on the anterior part of the trunk are of moderate size; they gradually increase in size towards behind, and are largest on the hinder part of the tail and on the caudal peduncle, on the side of which they stand in three series. Brownish or silvery, darker on the head. Two black vertical bands descend from the anterior and hindmost dorsal rays to the anal, spreading more or less over that fin.

Mormyrus sphecodes.

Mormyrops sphekodes, Sauvage, Bull. Soc. Philom. 1878, p. 101; N. Arch. Mus. iii. 1880, p. 55, pl. ii. fig. 4.

D. 22. A. 26. L. lat. 65.

The teeth on the palate and tongue are well developed. Sauvage's description is fairly applicable to a specimen from

Talagouga, 138 millim. long, but I count only 65 transverse series of scales, whilst Sauvage states 82. The diameter of the eye is only one eighth of the length of the head in our specimen. These differences could be accounted for by a somewhat less perfect state of preservation of Sauvage's specimen.

Mormyrus Kingsleyæ, sp. n. (Pl. XV. fig. A.)

D. 17. A. 22. L. lat. 56.

Snout short, rounded, parabolic, with the small mouth antero-inferior. Five notched teeth above and six below. The eye is small, half the length of the snout and scarcely one seventh of that of the head. Body rather elongate, its greatest depth being contained $4\frac{1}{3}$ times, the length of the head $4\frac{4}{5}$ times in the total (without caudal). Caudal peduncle compressed, moderately long, shorter than the head, its depth being one half of its length. Origin of the dorsal fin behind that of the anal and twice as distant from the end of the snout as from the root of the caudal. The length of the base of the anal equals that of the head. Pectoral fin shorter than the head, nearly reaching the ventral. Ventral fin more than half as long as the pectoral, and half as long as the distance of its root from the vent. Scales rather small; there are eight in an oblique series running from the first anal ray to the lateral line, and five longitudinal series on the side of the caudal peduncle. Uniform brown.

	millim.
Total length	106
,, ,, without caudal	93
Length of the head	19
Diameter of the eye	2·4
Height of the body	20
Length of the caudal peduncle	15

A single specimen was obtained in Old Calabar. This species is nearest to *M. liberiensis* (Steind.), but readily distinguished by a shorter anal fin, with a smaller number of rays.

Mormyrus amblystoma, sp. n. (Pl. XIV. fig. A.)

D. 24. A. 30. L. lat. 40.

Snout short, obtuse, as long as the eye, with the mouth at the lower side. The mouth is very broad, twice as broad as the eye, armed above with twenty-two and below with thirty notched teeth; its corner is beyond the vertical from the front margin of the eye. The upper profile of the head is somewhat more curved than the lower and steadily ascends to the dorsal fin. Eye small, one fifth of the length of the head. The height of the body is contained $2\frac{3}{5}$ times in the total length (without caudal), the length of the head $3\frac{3}{4}$ times; the caudal peduncle is slender, much shorter than the head, its depth being two fifths of its length. The origin of the dorsal fin is behind that of the anal and nearer to the root of the caudal than to the head. The anal extends also further backwards than the dorsal. Pectoral shorter than the head, reaching to the middle of the ventral. Ventral very short, only half as long as the pectoral or as the distance of its root from the vent. Scales rather large; there are eight in an oblique series running from the first anal ray to the lateral line, and three and two half longitudinal series on the side of the peduncle of the tail. Silvery brownish above; a deep black spot on the root of the caudal, and another high up on the side below the origin of the dorsal fin.

	millim.
Total length	155
„ „ without caudal	133
Length of the head	35
Diameter of the eye	7
Width of the mouth	14
Length of the pectoral fin	25
„ „ ventral fin	12
„ „ caudal peduncle	23
Height of the body	49

One specimen from Talagouga.

Mormyrus simus.

Mormyrus (*Petrocephalus*) *simus*, Sauvage, Bull. Soc. Philom. 1878, p. 100; Nouv. Arch. Mus. iii. 1880, p. 51, pl. ii. fig. 3 (fig. mediocr.).
Mormyrus tenuicauda, Steind. Notes Leyd. Mus. xvi. 1894, p. 69, pl. iv. fig. 1.

D. 26–28. A. 31–33. L. lat. 48 *.

Snout short, obtuse, a little shorter than the eye, with the mouth at its lower side. The mouth is narrow, not wider than the eye, armed above with twelve and below with twenty-two teeth; its corner lies beyond the vertical from the front margin of the eye. The upper profile of the head is a little more curved than the lower, and steadily ascends to

* This is the number of transverse series above the lateral line, which is composed of larger scales, only forty in number.

the origin of the dorsal fin. Eye one fourth of the length of the head. The height of the body is contained $2\frac{3}{5}$ times in the total length (without caudal), the length of the head four times. Caudal peduncle slender, much shorter than the head (measured from the last anal ray), its depth being contained $2\frac{3}{5}$ times in its length. The origin of the dorsal fin is behind that of the anal and midway between the root of the caudal and end of the opercle. The anal extends also further backwards than the dorsal. Pectoral fin shorter than the head, reaching rather beyond the middle of the ventral. Ventral fin only half as long as the pectoral or as the distance of its root from the vent. Scales of moderate size; there are twelve or thirteen in an oblique series running from the first anal ray to the lateral line, and three and two half longitudinal series on the side of the caudal peduncle. Silvery, brownish above; anterior part of the dorsal blackish.

	millim.
Total length	130
„ „ without caudal	106
Length of the head	25
Diameter of the eye	6
Width of the mouth	5·5
Height of the body	41
Length of the caudal peduncle	20

There are some slight discrepancies between this and Sauvage's descriptions, which are quite within the limits of individual variation. Besides, our specimens from Talagouga belong to the same district as Sauvage's, which came from Doumé (Ogowe). Steindachner's description is more precise and his figure more accurate; he compared the species with *M. Sauvagii* (Blgr.), which, however, has a much wider mouth. The specimens described by Steindachner came from Liberia. Thanks to Dr. Jentink's kindness I have been able to compare the latter with those collected by Miss Kingsley.

Mormyrus Sauvagii.

Mormyrus (*Petrocephalus*) *Sauvagii*, Boulenger, Ann. & Mag. Nat. Hist. 1887, xix. p. 149.

Warri.

Mormyrus affinis.

Petrocephalus affinis, Sauvage, Bull. Soc. Philom. 1878, p. 101.
Mormyrus (*Petrocephalus*) *affinis*, Sauvage, N. Arch. Mus. iii. 1880, p. 52, pl. ii. fig. 2.

I refer a young specimen, 86 millim. long, from Talagouga to this species, although it shows some discrepancies from the typical specimen (from Doumé); it has D. 20, A. 25, L. lat. 58; there are eight notched teeth in the upper as well as lower jaw. Five longitudinal series of scales along each side of the caudal peduncle.

Mormyrus Marchei.

? *Petrocephalus Marchei*, Sauvage, Bull. Soc. Philom. 1878, p. 100.
? *Mormyrus* (*Petrocephalus*) *Marchei*, Sauvage, N. Arch. Mus. iii. 1880, p. 50, pl. ii. fig. 5.

D. 22. A. 30. L. lat. 63.

Snout short, obtuse, but rather longer than the eye, with the mouth at its lower side. Mouth narrow, a little wider than the eye, armed above and below with six notched teeth; its corner lies a little in advance of the vertical from the front margin of the orbit. The upper profile of the head is somewhat more convex than the lower and ascends slightly towards the origin of the dorsal. Eye one fifth of the length of the head. The height of the body is contained $3\frac{3}{4}$ times in the total length (without caudal), the length of the head $5\frac{1}{2}$ times. Caudal peduncle extremely slender, longer than the head (measured from the last anal ray), its depth being only two ninths of its length. The origin of the dorsal fin is behind that of the anal and midway between the root of the caudal and the end of the opercle. The anal extends also further backwards than the dorsal. Pectoral fin as long as the head, reaching beyond the middle of the ventral; ventral fin half as long as the pectoral or as the distance of its root from the vent. Abdomen behind the ventral fin compressed into a ridge. Scales of moderate size; there are nine in an oblique series running from the vent to the lateral line and three and two half longitudinal series cover the side of the caudal peduncle. Silvery, light brownish above.

	millim.
Total length	175
,, ,, without caudal	150
Length of the head	27
Diameter of the eye	5
Width of the mouth	5·5
Height of the body	38
Length of caudal peduncle	33

One specimen from Talagouga.

Pellonula vorax, Gthr.

Old Calabar.

Notopterus afer, Gthr.

Old Calabar.

Notopterus nigri, Gthr.

Kondo-Kondo.

Tetrodon pustulatus, Murr.

Old Calabar.

EXPLANATION OF THE PLATES.

PLATE XIII.

Fig. A. *Ctenopoma Kingsleyæ.*
Fig. B. —— *nanum.*
Fig. C. —— *gabonense.*

PLATE XIV.

Fig. A. *Mormyrus amblystoma.*
Fig. B. *Clarias Walkeri.*

PLATE XV.

Fig. A. *Mormyrus Kingsleyæ.*
Fig. B. *Alestes Kingsleyæ.*
Fig. C. *Barilius bibie.*

XXXVIII.—*Descriptions of some East-African* Lycænidæ. By HAMILTON H. DRUCE, F.Z.S., F.E.S.

COLONEL SWINHOE has lately received a collection of Lepidoptera from Dar-es-Salaam, and has placed the Lycænidæ in my hands for examination. Amongst them are specimens of *Chrysorychia amanga*, Westw., and also of *C. punicea*, Grose Smith, with which the recently described *C. cruenta*, Trimen (P. Z. S. 1894, p. 55, pl. vi. fig. 13, ♂), is identical. This figure is a very bad one, and the conspicuous white marking which is really on the fore wing below the first median nervule is here shown on the costal margin of the hind wing.

There is also a male *Hypolycæna Buxtoni*, Hew., which is much larger and deeper in colour on the upperside than the typical form.

Col. Swinhoe has kindly presented us with the types.

Epamera mermis, sp. n.

♂. Upperside allied to *E. iasis*, Hew., the blue paler in shade and in the fore wing less extensive, but half occupying the cell and not reaching beyond the first median nervule; the inner margin is not white-edged, and in the hind wing the shining patch is darker in colour and rather less extensive. Underside differs from that of *E. iasis* by the fore wing having a distinct black line closing the end of the cell, and beyond this two distinct transverse black lines—the first, which corresponds with that in *E. iasis*, thin and dark; the second, which is placed halfway between this line and the outer margin, paler and broader.

Hind wing as in *E. iasis*, but the spots and metallic patches larger and the black lines more distinct. Thorax and abdomen greyish above, white below. Legs white, with black spots. Palpi white, with black tips; frons deep orange. Antennæ black, with white rings.

Expanse $1\frac{3}{5}$ inch.

Hab. Dar-es-Salaam. Type Mus. Druce.

The tuft of hair on inner margin of fore wings below, which in *E. iasis* and *iaspis*, mihi, is black, is in *E. mermis* white, and the hind wing is of a different shape, not being so produced at the anal angle, and consequently less triangular. It is also much like *Iolaus silanus*, Grose Smith, from Mombasa, the type of which Mr. Grose Smith has kindly shown me, on the underside, but on the upperside it is distinguished at once by its much paler blue, by the less extensive colour on the fore wing, and by the entire absence of the black spots at the anal angle of the hind wing. I think it probable that on a close examination *I. silanus* will be found to belong to the genus *Epamera*.

Argiolaus silas, Westw.

Local race *lalos*, nov.

♂. Upperside differs from typical *A. silas* by the black outer margins being narrower and by the almost entire absence of the black and red spots between the nervules at the anal angle of the hind wing.

♀. Differs on the upperside from that sex of typical *silas* by having large pure white discal areas to both wings and by the orange band being confined to the two lower interspaces, the pale blue dusting being restricted to the bases of both wings. Underside as in *A. silas*.

Expanse, ♂ ♀ $1\frac{7}{10}$–2 inches.

Dar-es-Salaam. Type Mus. Druce.

XXXIX.—*A Revision of the British Jurassic Bryozoa.*—Part VI. *The* Fascigeridæ, Theonoidæ, Dactylethrata, *and* Trepostomata. By J. W. GREGORY, D.Sc., F.G.S.

[Concluded from p. 201.]

Family **Fascigeridæ**, d'Orbigny.

Diagnosis.—Cyclostomata Tubulata in which the zoœcia are simple open tubes. These arise from a small cupuliform or discoid base (the *Pelagia* or *Defrancia* stage). The zoœcia are monomorphic and greatly elongate. The zoarium consists of tufts, and the apertures all occur at the ends of the tufts.

Genus 1. FASCICULIPORA, d'Orbigny, 1846.

Fasciculipora, d'Orbigny, Voyage dans l'Amérique méridionale, t. v. pt. 4, Zooph., plates 1839, text 1846, p. 20.

Diagnosis.—Fascigeridæ in which the zoarium consists of long tubular zoœcia grouped into bundles which branch irregularly; these form a loose, open, tufted zoarium, for the bundles are not connected by platforms nor do they anastomose. The apertures are at the ends of the branches, and never on the sides, and occur in isolated groups.

Type species: *F. ramosa*, d'Orbigny, 1839 and 1846.

1. *Fasciculipora Waltoni*, Haime.

Fasciculipora Waltoni, Haime, 1854, Bry. Jur., Mém. Soc. géol. France, sér. 2, t. v. p. 200, pl. x. fig. 4.

Diagnosis.—The branches of the zoarium each contain about thirty zoœcia; the branches are marked externally by longitudinal ridges; the branching is irregular.

Distribution.—Great Oolite, Hampton, near Bath.

Genus 2. APSENDESIA, Lamouroux, 1821 *.

Diagnosis.—Fascigeridæ in which the zoarium rises from a cup-shaped disk. The bundles of zoœcia in the adult are long and are grouped in long irregularly sinuous series. There are no platforms. The zoœcia all open upon the

* Lamouroux, Expos. méth. p. 81. The name is spelt *Apseudesia* by some authors.

summits of the ridges and never upon their sides. The underside of the zoarium is covered by epitheca.

Type species: *A. cristata*, Lamouroux, 1821.

1. *Apsendesia cristata*, Lamouroux, 1821.

Apsendesia cristata, Lamouroux, 1821, Expos. méth. p. 82, pl. lxxx. figs. 12–14.
Discotubigera cristata, Vine, 1888, Polyz. Caen, Journ. Northampton. Nat. Hist. Soc. vol. v. p. 19.
Pelagia clypeata, d'Orbigny, 1849, Prod. Pal. t. i. p. 317.
Defrancia clypeata, Bronn & Rœmer, 1851, Leth. Geogn. ed. iii. Bd. ii. Th. 4, p. 94, pl. xvi. fig. 18.
Apsendesia clypeata, E. E. Deslongchamps, 1865, Jura. inf. Norm., Mém. Soc. linn. Norm. t. xiv. p. 151.
Discotubigera clypeata, Vine, 1888, *op. cit.* p. 19.

Diagnosis.—*Zoarium* small, dense, and hemispherical; it grows from a low funnel-shaped central disk; from this arise the radiating bundles which unite into irregular twisted laminæ. The apertures occur in series or in isolated teeth.

Distribution.—England: Inferior Oolite—Forest Marble. Foreign: Bajocian, Germany; Bathonian, France.

Family Theonoidæ, Busk.

Diagnosis.—Cyclostomata Tubulata in which the zoœcia are simple, short, open tubes; they pass through a *Defrancia* stage (? always). The zoœcia are monomorphic.

The apertures occur along raised ridges.

Genus 1. ACTINOPORA, d'Orbigny, 1852.

Diagnosis.—Theonoidæ in which the zoarium is a flat, simple, adnate disk. The zoarium consists of a central depression, of a rim crossed by radiating ridges, and usually also of a flat peripheral selvage.

Type species: *A. regularis*, d'Orbigny, 1852.

1. *Actinopora Phillipsi* (Haime).

Lichenopora Phillipsi, Haime, 1854, Bry. Jur., Mém. Soc. géol. France, sér. 2, t. v. p. 206, pl. x. fig. 10.

Diagnosis.—*Zoarium* regular, circular; radial ridges about 22 in number, straight, regular, unbranched. The apertures are biserial. New ridges arise from the interradial valleys. A broad expansion surrounds the zoarium; this is low and flat, and is not crossed by the radial ridges.

Distribution.—Great Oolite, Hampton, near Bath, and Richmond boring.

2. *Actinopora diplopora* (Branco), 1879.

Defrancia diplopora, Branco, 1879, Unt. Dogg. deut. Lothr., Abh. geol. Specialk. Els.-Lothr. Bd. ii. Heft i. p. 131, pl. vi. fig 9.
Actinopora diplopora, Friren, 1893, Bry. ool. inf. Metz, Bull. Soc. hist. nat. Metz, sér. 2, t. vi. p. 57.

Diagnosis.—Zoarium large and thin; several zoaria often grow together into a semiconfluent incrustation: the ridges are from 35 to 50 in number; they are very thin, irregular, and high, and extend to the margin of the zoarium; they sometimes branch. No peripheral selvage. In some zoaria (var. *alta*) the ridges are almost as high as the zoarium is broad, and the central depressions are accordingly very deep.

Distribution.—England: Inferior Oolite—Great Oolite. Foreign: Bajocian, Germany.

Genus 2. KOLOLOPHOS, gen. nov.

Constellaria, Haime, 1854 (non Dana, 1848).
Radiopora, pars, Pictet, 1857 (non d'Orbigny, 1852).

Diagnosis.—Theonoidæ in which the zoarium consists of flat encrusting sheets formed of numerous radial groups of zoœcia. The radial ridges are broken up into groups, the arrangement of which is irregularly linear.

Type species: *Kololophos Terquemi* (Haime).

Affinities.—The type species of this genus was referred by Haime to Dana's genus *Constellaria*, which at that time was misunderstood. The American fossil has recently been redescribed by Ulrich *; it is quite different from this species. There is a certain superficial resemblance, due to the prominence of radial non-poriferous lines; but in *Constellaria* these lines are solid ("maculæ" of Ulrich) and in *Kololophos* they are depressions between zoœcial ridges.

The nearest ally of this genus is *Actinopora*; from this it differs by the confluence of several radial groups into one sheet and the broken interrupted character of the ridges.

1. *Kololophos Terquemi* (Haime), 1854.

Constellaria Terquemi, Haime, 1854, Bry. Jur., Mém. Soc. géol. France, sér. 2, t. v. p. 207, pl. x. fig. 6.
Radiopora Terquemi, Pictet, 1857, Traité Pal. ed. 2, t. iv. p. 153.

Diagnosis.—Zoarium formed of several confluent disks.

* E. O. Ulrich, "Palæont. Illinois.—Palæozoic Bryozoa," Geol. Surv. Ill. vol. viii. pt. ii. sect. vi. 1890, p. 374.

Radial ridges broad and compact, broken up into short groups or bands. The bands have from 2 to 4 zooecia in breadth.

Distribution.—England: Inferior Oolite. Foreign: Bajocian, Germany and France.

Genus 3. Theonoa, Lamouroux, 1821.

Diagnosis.—Theonoidæ in which the zoarium is massive and consists either of dense rounded masses of thick incrustations or erect thick fronds. The surface is crossed by the broad well-marked ridges; the ridges may expand in some species into broad tubular elevations.

Type species: *T. clathrata*, Lamouroux, 1821.

1. *Theonoa clathrata*, Lamouroux, 1821.

Theonoa clathrata, Lamouroux, 1821, Expos. méth. p. 82, pl. lxxx. figs. 17, 18.

Diagnosis.—*Zoarium* dense, massive, roughly spherical; the surface of the zoarium is broken into ridges, which are short, broad, and blunt; they never rise into high bilaminate sheets. Four or five apertures occur together in one width of a ridge.

Distribution. — England: Great Oolite (*fide* Morris). Foreign: Bajocian, France and Germany; Bathonian, France.

2. *Theonoa Bowerbanki*, Haime.

Theonoa Bowerbanki, Haime, 1854, Bry. Jur., Mém. Soc. géol. France, sér. 2, t. v. p. 205, pl. x. fig. 3.

Diagnosis.—*Zoarium* composed of many erect irregular sheets; the sheets are tall, irregularly sinuous, and branched, leaving loose funnel-shaped cavities between them. The zoarium is roughly hemispherical in form.

The radial ridges are long and fairly continuous; the summits are flat and contain generally 3 or 4 apertures in the width, but in places they expand and contain 6 or 7 in the width; the ridges occur on both sides of the sheets.

Distribution.—Inferior Oolite, England.

3. *Theonoa distorta* (Lamouroux), 1821.

Tilesia distorta, Lamouroux, 1821, Expos. méth. p. 42, pl. lxxiv. fig. 6 (non fig. 5).

Theonoa distorta, Vine, 1883, 3rd Rep. Foss. Polyz., Rep. Brit. Assoc. 1882, p. 267.

Diagnosis.—A thick incrustation; the surface is covered by numerous irregular ridges, the width of which usually contains two or three apertures. The depressions between the ridges are deep and usually as wide or a little wider than the ridges.

Distribution.—England: Inferior Oolite. Foreign: Bathonian, France.

Suborder DACTYLETHRATA.

Diagnosis.—Cyclostomata in which the normal zoœcia are elongate simple tubes of the same general character as those of the Tubuliporidæ. Dimorphism occurs, and the zoarium consists of normal zoœcia separated by numerous dactylethræ, which often form the major part of the zoarium.

Zoarium usually large and complex.

Fam. **Clausidæ**, d'Orbigny (emended).

Diagnosis. — Cyclostomata Dactylethrata in which the zoarium is arborescent. The zoœcia open on all sides of the zoarium. The dactylethræ are collected into zones or are scattered regularly or irregularly among the zoœcia.

Genus 1. MULTICLAUSA, d'Orbigny, 1852.

Diagnosis.—Clausidæ in which the zoarium consists of stout branches, cylindrical or pyriform, and in which the zoœcia are distributed throughout the zoarium, and not collected into zones or groups. The apertures occur either regularly or irregularly.

Type species: *M. compressa*, d'Orbigny, 1852.

1. *Multiclausa Haimei*, nom. nov.

Berenicea lucensis, Haime, 1854, Bry. Jur., Mém. Soc. géol. France, sér. 2, t. v. p. 180, pl. vii. fig. 4.

Berenicea (Multisparsa) lucensis, pars (Haime, non d'Orb.), Brauns, 1879, Bry. mitt. Jura, Metz, Zeit. deut. geol. Ges. Bd. xxxi. p. 328.

Diastopora lucensis, pars (Haime, non d'Orb.), Reuss, 1867, Bry. braun. Jura Balin, Denks. k. Akad. Wiss. Wien, Bd. cxxvii. p. 9.

Non *Bidiastopora luciana*, d'Orbigny, 1849, Prod. Pal. t. i. p. 317.

Non *Multisparsa luceana*, d'Orbigny, 1852, Pal. franç., Terr. crét. t. v. p. 870, pl. 761. figs. 1–3.

Diastopora diluviana, pars, M.-Edwards, 1838, Mém. Cris., Ann. Sci. nat. Zool. sér. 2, t. ix. p. 228, pl. xiv. fig. 4.

Diagnosis. — *Zoarium* branching repeatedly and irregularly, and sometimes anastomosing; branches stout.

Zoœcia long, cylindrical; apertures distant and irregularly placed.

Peristomes low. Walls with thin sinuous ridges.

Distribution.—England: Great Oolite—Cornbrash. Foreign: Bajocian, Germany; Bathonian, France and Austria.

2. *Multiclausa Jellyœ*, sp. n.

Diagnosis.—*Zoarium* growing in large dense tufts of thick irregular branches.

Zoœcia cylindrical, long.

Peristomes raised; surface punctate; apertures arranged irregularly, not very distant and often in irregular lines.

Distribution.—England: Inferior Oolite—Cornbrash. Foreign: Bathonian, France.

Affinities.—This species is allied to *M. Haimei*, Greg., but differs from it by the greater elevation of the peristomes and by having the zoœcia more crowded and the apertures closer and often in irregular lines.

Genus 2. Terebellaria, Lamouroux, 1821.

Diagnosis.—Clausidæ in which the zoarium is arborescent and thick. Zoarial growth is by the addition of Berenicoid colonies on to the ends of the branches; each colony sends an expansion downward around the stem (hence growth is acropetal and exogenous). The zoœcia are reflexed. The apertures occur in zones separated by interzones of dactylethræ.

Type species: *T. ramosissima*, Lamouroux, 1821.

1. *Terebellaria ramosissima*, Lamouroux, 1821.

Terebellaria ramosissima, Lamouroux, 1821, Expos. méth. p. 84, pl. lxxxii. fig. 1.
Terebellaria antilope, Lamouroux, 1821, *op. cit.* p. 84, pl. lxxxii. figs. 2, 3.
Terebellaria tenuis, d'Orbigny, 1849, Prod. Pal. t. i. p. 318.

Diagnosis. — *Zoarium* massive, branching irregularly. Apertures in rows of from 3 to 5; the lower limit is straight, but the upper is very irregular. Apertures in these bands crowded and quincuncial.

Peristomes slightly raised.

Distribution. — England: Inferior Oolite — Cornbrash. Foreign: Bathonian, France.

Order TREPOSTOMATA.

Bryozoa in which the zoarium consists of prismatic or cylindrical zoœcia which are arranged parallel to one another. The zoarium is either massive or composed of encrusting or erect lamina.

The zoœcia are either closely packed or separated by mesopores or by inter-zoœcial vesicles. The zoœcia begin as thin, simple, immature Cyclostomatoid tubes. Diaphragms are generally present. Generally dimorphic.

Family Amplexoporidæ.

Diagnosis.—Trepostomata in which the zoœcia are simple, prismatic, or subcylindrical, with a well-marked divisional line between the walls of adjoining cells. Mesopores absent. (Aborted zoœcia occur and sometimes resemble mesopores.) Diaphragms horizontal.

Genus Ceriopora, Blainville, 1834.

Diagnosis.—Amplexoporidæ with prismatic or subcylindrical zoœcia. Mesopores absent. Acanthopores absent. Walls of zoœcia thin. Diaphragms horizontal, numerous. Zoarium branching or massive.

Type species: *C. micropora*, Goldfuss, 1829.

1. *Ceriopora globosa*, Michelin, 1846.

Ceriopora globosa, Michelin, 1846, Icon. Zooph. p. 246, pl. lvii. fig. 5.
Monticulipora globosa, d'Orbigny, 1849, Prod. Pal. t. i. p. 323.
Reptonodicava globosa, d'Orbigny, 1852, Pal. franç., Terr. crét. t. v. p. 1015.

Diagnosis.—*Zoarium* massive, either spherical or of irregular lobed masses, generally with a broad base protected by epitheca. The surface is level and ornamented with irregularly scattered tubercles.

Diaphragms abundant.

Young zoœcia are fairly abundant, and being smaller in size resemble mesopores.

Distribution.—England: Inferior Oolite—Bradford Clay. Foreign: Bajocian and Bathonian, France and Germany.

2. *Ceriopora arborescens*, Waagen, 1868.

Ceriopora arborescens, Waagen, 1868, Zone *Amm. Sowerbyi*, Geogn. Pal. Beitr. Bd. i. Heft 3, p. 644, pl. xxxiii. fig. 2.

Diagnosis.—Zoarium of thick massive branches or irregularly lobed masses.

Zoœcia very long; walls thin.

Diaphragms numerous near distal end. Apertures irregular. No acanthopores.

Distribution.—England: Inferior Oolite and Great Oolite. Foreign: Bajocian, Germany; Bathonian, France.

Family **Heterotrypidæ**, Ulrich.

Diagnosis.—Trepostomata in which the zoœcia are simple, prismatic, or cylindrical, with a well-marked divisional line between the walls of adjacent zoœcia. Mesopores present. Diaphragms numerous and horizontal. Neither cystiphragms nor inter-zoœcial vesicles present.

Genus Heteropora, Blainville, 1834.

Diagnosis.—Heterotrypidæ with prismatic or subcylindrical zoœcia. Mesopores numerous. Acanthopores absent. Walls of zoœcia thin. Diaphragms horizontal, numerous. Zoarium branching or massive.

Type species: *H. cryptopora* (Goldfuss), 1829.

1. *Heteropora conifera* (Lamouroux), 1821.

Millepora conifera, Lamouroux, 1821, Expos. méth. p. 87, pl. lxxxiii. figs. 6, 7.
Heteropora conifera, M.-Edwards, 1836, in Lamarck, Hist. Nat. Anim. ed. 2, t. ii. p. 308.
Ceriopora conifera, Michelin, 1846, Icon. Zooph. p. 245, pl. lvii. fig. 8.
Multicrescis conifera, d'Orbigny, 1852, Pal. franç., Terr. crét. t. v. p. 1074.
Millepora dumetosa, Lamouroux, 1821, *op. cit.* p. 87, pl. lxxxii. figs. 7, 8.
Spiropora dumetosa, Defrance, 1827, Dict. Sci. nat. t. l. p. 300.
Cricopora dumetosa, Blainville, 1830, *ibid.* t. lx. p. 386.
Heteropora dumetosa, M.-Edwards, 1836, *op. cit.* t. ii. p. 308.
Ceriopora dumetosa, Michelin, 1846, *op. cit.* p. 245, pl. lvii. fig. 7.
Crescis dumetosa, d'Orbigny, 1852, *op. cit.* t. v. p. 1072.
Millepora pyriformis, Lamouroux, 1821, *op. cit.* p. 87, pl. lxxxiii. fig. 5.
Heteropora pyriformis, Michelin, 1846, *op. cit.* p. 244, pl. lvii. fig. 3.
Polytrema pyriformis, d'Orbigny, 1849, Prod. Pal. t. i. p. 323.
Multicrescis pyriformis, d'Orbigny, 1852, *op. cit.* t. v. p. 1074.
Heteropora ramosa (non *M. ramosa*, Fleming), Michelin, 1846, *op. cit.* p. 244, pl. lvii. fig. 4.
Ceriopora ramosa, d'Orbigny, 1849, *op. cit.* t. i. p. 323.
Millepora ramosa, Fleming, 1828, Brit. Anim. p. 529.
Heteropora reticulata, Haime, 1854, Mém. Soc. géol. France, sér. 2, t. v. p. 211, pl. ix. fig. 9.

Heteropora calycina, Bruder, 1881, Jurabl. Sternberg, Sitz. k. Akad. Wiss. Wien, Bd. lxxxiii. Abl. i. p. 89, pl. ii. fig. 6.
Heteropora ficulina, Michelin, 1846, *op. cit.* p. 244, pl. lvii. fig. 2.
Polytrema ficulina, d'Orbigny, 1849, Prod. Pal. t. i. p. 323.
Reptomulticrescis ficulina, d'Orbigny, 1852, *op. cit.* t. v. p. 1079.

Diagnosis.—*Zoarium* of erect branches, which are generally cylindrical and either grow in irregular stumpy branches (typical form), or expand into thick pyriform masses (form *pyriformis*), or into lobed *Alcyonium*-shaped masses (var. *ficulina*), or regular cylindrical branches (var. *ramosa*). The branches dichotomose and may sometimes anastomose (form *reticulata*). The surface is level.

Zoœcia crowded. Diaphragms numerous. Mesopores irregular in distribution. Frequently only at the angles between *zoœcia*, but sometimes completely surrounding them.

Distribution. — England: Inferior Oolite and Great Oolite. Foreign: Bajocian and Bathonian, France and Germany; Callovian, France and Austria.

2. *Heteropora laminata*, sp. n.

Diagnosis.—*Zoarium* encrusting, growing in layers superposed into thick masses. The surface of the zoarium is level.

Mesopores irregular in distribution, generally numerous.

Distribution. — Inferior Oolite, Dorset; Bradford Clay, Wiltshire.

Affinities.—This species differs from *H. conifera* mainly by zoarial characters, though the mesopores are generally more numerous. The fact that the mesopores are useless as specific guides is shown by their great variation in different parts of the same specimen of species of this genus. This shows that Haime was correct as to the variability in the number of these structures, though, by his refusal to admit any value to their complete absence, he underrated their significance.

3. *Heteropora oviformis*, sp. n.

Diagnosis.—*Zoarium* small, free, ovate masses.

Zoœcia short. Surface of zoarium covered with large scattered pustules.

Distribution.—Bradford Clay, Bradford, Wiltshire.

XL.—*Hermaphroditism among the* Apodidæ. By H. M. Bernard, M.A. Cantab., F.L.S., F.Z.S.

[Plates XI. & XII.]

In 1890 I published a preliminary notice in the 'Jenaische Zeitschrift' * announcing that in several specimens of a small species or variety of *Lepidurus* from East Spitzbergen the posterior tip of the genital gland on each side was filled with sperm-cells, and that that representative of the family was therefore hermaphrodite.

By the kindness of Canon Norman and Prof. Möbius I was then enabled to examine representatives of three other species, viz. *Lepidurus glacialis*, *Lepidurus productus*, and *Apus cancriformis*. One of each of these was sectioned with the sole object of ascertaining whether they were also hermaphrodites. In each case the specimens examined showed in some part or other the same conversion of epithelial cells of the genital gland into the minute clear cells which I believed and still believe to be sperm-cells †. That representatives of four different types of Apodidæ from different parts of the world should show hermaphrodite conditions would be almost too marvellous a coincidence, unless hermaphroditism were under certain circumstances the rule, at least in those members of the family.

Dr. Benham, in his note on a male of *Apus cancriformis* in the February issue of this Magazine, takes me somewhat severely to task for having let four years go by without having published any detailed account of these hermaphrodite specimens. Most people will, however, readily admit that this delay was justifiable, nay, almost necessary, under the circumstances; indeed, I should hesitate before publishing this paper if I had not become convinced that the hermaphrodite condition is, after all, not that most commonly found in these animals.

In the first place, none of the specimens show clearly the method of formation of the assumed sperm-cells; it was therefore necessary to obtain better preserved material. It was some time before, through the kindness of Prof. Biedermann, I obtained well-preserved specimens of *Apus cancriformis*, *Lepidurus productus*, and *Branchipus stagnalis*. The new material, however, when examined showed none of

* Band xxv. p. 337.
† 'Nature,' vol. xliii. 1891, p. 343.

the "sperm-forming centres"; had the latter been found, the results would doubtless have ere now been published. In the meantime I have been continually hoping that someone, more fortunate in obtaining material, would publish a full account, giving the details which were not to be found in my own slides. I did not myself feel justified in publishing a detailed account based upon indifferently preserved material.

I have now, however, waited four years, and not only has no one rediscovered the hermaphrodite condition of *Apus*, but those who have actually looked for it have not succeeded in finding any traces of it. After all, then, it appears that my experience must have been a marvellous one. Three specimens belonging to separate species collected in different regions are examined in rapid succession, in order to look for a condition already ascertained to be normal in another member of the same family, and in each case the same condition is found, and since then it has never been found again! Under these circumstances I feel that any further hesitation to make the best of my slides and to give the results of my observations for what they are worth would be inadvisable. The bare facts, however lacking in finer detail, are evidently worth recording. After reading Dr. Benham's paper, therefore, I resolved to examine my slides, some of which had never been looked at again since they were prepared, and record all that the best microscopic objectives could show in them.

Before giving these results I may mention two circumstances connected with the case which will help further to justify my delay, if any more justification is needed.

While I found in Germany no hesitation in pronouncing the minute cells to be sperm-cells, in England there has been much difference of opinion. This naturally made it all the more incumbent on me to wait until I had material which showed the process of formation of the cells in question. In this I was further confirmed when, some three years ago, I asked my friend Mr. J. E. S. Moore, at that time working in the Huxley Research Laboratory of the Royal College of Science, if he would take over the whole subject and work it out. I handed him the slides and all my remaining material, including the *Branchipus*. Unfortunately the slides which I most wished him to investigate, not showing the finer processes of cell-division which at that time monopolized his thoughts, received but scant attention. In his paper "On the Origin of the Reproductive Elements in *Apus* and *Branchipus*" * he

* Quart. Journ. Micr. Sci. vol. xxxv. 1894, p. 277.

dismissed the question of hermaphroditism with the words "certainly the appearances which have come under my notice favour this view." The efforts kindly made at the time by Prof. Howes to obtain specially preserved specimens of *Apus* were unsuccessful.

On returning once more to the slides which show the hermaphrodite condition of the genital glands, I have been somewhat surprised to find how much *en evidence* the sperm-centres are. In each case the first section, passing well through the genital gland, shows almost immediately what is wanted. It is quite impossible that they could have been overlooked had they occurred in any of the specimens in which they are reported to be absent. They show, however, certain variations which make it highly probable that in each species the phenomenon is a normal one under certain life-conditions, the nature of which we can only surmise.

In what follows, in order to avoid circumlocution, I shall always speak of the cells which I believe to be sperm-cells under this name, while admitting that some different interpretation may perhaps have to be put upon them.

The Spitzbergen Variety of Lepidurus glacialis.

In all the specimens examined the epithelium of the posterior portion of the genital tube is modified to a varying extent in the manner illustrated. Fig. 1 (Pl. XI.) is a longitudinal section through this portion of the genital gland in a specimen measuring about 1 centim. long. The genital tube is seen resting on the ventral longitudinal muscle-strand, separated from it, however, by the membrane (*m*) which encircles the intestinal tube and the genital glands *. The segmental bulgings of the tube gradually diminish posteriorly, but are indicated even to the tip. This tip appears in the section as if separated from the rest, but this is simply because the section here passes somewhat tangentially. The drawing represents the appearance of the section when only a low power is used. The most anterior swelling shown in the figure occurs in about the thirteenth trunk-segment, *i. e.* two behind the one which opens externally at the base of the eleventh leg. The two descending muscles run into the twenty-third and twenty-fourth appendages.

Figure 2 shows a portion of the same section as seen under a 3 millim. apochromatic oil imm. (1·40 n. a.) of Zeiss. The

* 'The Apodidæ,' pp. 120 and 297; also fig. 14, p. 59.

epithelium appears to have been dissolved into minute, clear, round or oval cells each with a single chromosome. The cells are from 4 to 5 μ in diameter. In addition to these cells there is a great quantity of slime. Near the basal membrane these sperm-cells appear as if embedded in slime (fig. 2 *a*), while the lumen of the tube is filled up with a fine reticulum of hardened slime, the meshes of which appear as if they were round loculi from each of which one of the sperm-cells has escaped. A few normal epithelial cells are seen standing up among the sperm-cells; I cannot make out that any of them are in the act of breaking down. In all cases the masses of sperm-cells abut directly against apparently normal epithelial cells.

Lepidurus glacialis.

I have only one series of sections (longitudinal) through a specimen from Greenland about 23 millim. long. Fig. 3 is drawn from a section passing through one of the genital tubes. The membrane (*m*) above mentioned is seen dorsally held up by the dorso-ventral muscles (*dv*) and ventrally under the genital tube. The figure shows the section as seen under a low power. The genital epithelium up to about the twenty-fifth appendage (or twentieth leg) is completely disorganized, but after this point apparently perfectly normal. The lumen of the tube contains drops of slime, some large and clear with a few black lumps in the centre, others small, all of them highly refractive. The transition between the normal and the disorganized epithelium is again quite sudden, but it is in this case specially interesting. The disorganization seems to be undermining the normal epithelium; definite clear-cut arches run under the epithelial cells, and these arched spaces are filled with sperm-cells.

Fig. 4 shows the ventral point of transition as seen under the oil immersion lens. The cells again measure from 4 to 5 μ in diameter. The distal ends of the epithelial cells seem to be breaking down into slime. The free ends shown in the figure are not necessarily detached, although appearing so in the section. The arch running under these epithelial cells is very clear, as it is also dorsally even with a low power (fig. 3). There is but one interpretation of this arching, viz. that which is gathered from observations of the egg-formation. The cell or cells near the basement membrane, on dividing to form the four egg-cells, force apart the adjacent club-shaped epithelial cells, which then arch over the developing elements on all sides. We have in the figures now under discussion clear indications of these sperm-cells having originated from a cell or cells close to the basement membrane, which were arched over by the adjoining epithelial cells. Further, Moore (*loc. cit. suprà*) has pointed out that in the egg-formation the eggs develop very irregularly out of ordinary epithelial cells. It is obvious that we have the same indifference in the formation of the sperm-cells, for in the completely disorganized portion of the tube every single epithelial cell, whether arched over or not, must have divided into exactly similar sperm-cells. It looks as if the distal ends of the cells break down into slime, and the proximal ends divide up into sperm-cells. This, it seems to me, would necessarily involve the arching over of those which start the process first.

Lepidurus productus.

I have only one complete series of longitudinal sections of *Lepidurus productus.* The section is 23 millim. long; but as the animal was slightly bent, it probably measured 25 to 26 millim.

Fig. 5 is one of four or five pocket-like outgrowths found in a section passing well through the genital gland. This one was selected because it happened to be cut through longitudinally. It is situated quite anteriorly in the body and dorsally. The rest are scattered about without any apparent order on the section. There is no marked localization of the sperm-forming area at the posterior tip of the gland, as in *L. glacialis* and its minute Spitzbergen variety. Indeed, in this animal and in *Apus cancriformis* the branching of the tube is so pronounced that it is not easy to ascertain which is the posterior tip of the gland. Two pockets, however, were found opening into the axial canal in the region of the eighteenth appendage, *i. e.* very near the duct which discharges the eggs into the egg-pouch.

The figure speaks for itself; there is no special arching of epithelial cells over the aperture, but in the same section three low cells or groups of cells (*e*) close down on the basement membrane are seen arched over by the adjoining cells and apparently about to develop into eggs or perhaps into masses of sperm-cells.

Figure 5 *a* is a very small pocket, which looks as if it might have been produced by the division of one, or at the most of two, cells over which the adjoining epithelial cells had arched. The proliferation of the sperm-cells, instead of forcing up the arched epithelial cells, bulges out the basement membrane. This figure is given because it again shows that the production of these minute cells is a parallel phenomenon with that accompanying the production of the eggs. This, it seems to me, goes far to justify the assumption that these cells are the male reproductive elements.

In contrast to this minute pocket, in another section I have noticed one or two very large irregularly shaped sacs in which the epithelium was divided up into sperm-cells; one occurs, for instance, at the extreme anterior end of the gland dorsally.

I stated in my letter to 'Nature,' above cited, that these sperm-cells could be seen lurking in the folds of the genital duct, apparently for the purpose of fertilizing the eggs in their downward passage into the egg-pouch. The duct in the longitudinal sections of the Spitzbergen *Lepidurus* is contracted and is filled with a solid strand of slime resting on the round ends of the club-like epithelium, which runs far down the duct almost to its aperture. In the sections of *Lepidurus productus* the ducts must have been recently stretched. The following structural details can be made out (Pl. XI. fig. 5 *b*). Externally is a thin layer of irregularly branching or crossing muscle-fibres (*mf*). Upon these rests the basement membrane (*bm*), which is finely wrinkled. Upon this membrane small clear nuclei, each with a single chromosome and exactly resembling the cells above described, occur irregularly, here thickly, there very sparsely. Over the whole is an irregular reticulum of slime with slime-granules. These clear cells are evidently the cells which I referred to as the lurking sperm-cells. Re-examination of them has not shown that they are not; but beyond their close resemblance to the sperm-cells, taken in conjunction with the fact that pockets of such cells occur in the main genital tube quite close to the duct, there is nothing to show for certain that they are. It is possible that they may be the nuclei of the cells lining the duct, which, in its contracted state, are long and club-like, but in its stretched state must be flat and extended. They may be perhaps a trifle larger than the sperm-cells, which range from 4 to 5 μ, these from 5 to 6 μ. On the other hand, they occur very irregularly, often in groups, whereas we should rather expect the nuclei of the epithelial cells to be uniformly and rather sparsely spread over the surface.

Most of the unripe eggs in this specimen appear to be degenerating.

Apus cancriformis.

Of the three series of sections of this species, as above stated, only one, and that the very first examined five years ago, shows the sperm-forming centres. The original specimen is just under 3 centim. long, and is peculiar in one point, which from the first attracted my attention: the alimentary canal is distended with fine grit. In this very little can be found which looks like organic matter from which nourishment could be obtained. The animal had apparently sought to allay the pangs of hunger by swallowing enormous quantities of fine mud *. This mud shows as a broad black or brown streak along the section, and the particles of it have unfortunately escaped in the process of cutting and mounting and have spoiled many of the slides. The alimentary canal, thus heavily weighted with inorganic matter, has changed its position. It runs along close under the dorsal surface, having displaced all the branching tubules of the genital gland which normally arch over it dorsally. The whole genital gland now lies below the intestinal canal and probably partially at its sides. This dorsal position of the weighted alimentary canal is doubtless due to the habit of the animal of swimming always on its back.

Fig. 6 (Pl. XII.) shows portions of four branches of the genital tube and a ripe egg (*e*) cut through. One branch contains a ripe egg in its passage along the tube (only partially shown), while two of them (*dt*) show portions of the epithelium dissolved into sperm-cells. One of these is cut transversely and the other longitudinally. The part drawn is in the region of the eighteenth to nineteenth appendage, *i. e.* not far from the genital duct. Fig. 7 is a magnification of part of the longitudinally-cut branch shown in fig. 6, as seen under the oil immersion objective. The transition between the normal epithelial cells and the masses of sperm-cells is quite sudden, and the reduction of the cells has given rise to the usual slime-globules. The sperm-cells again measure from 4 to 5 μ.

Fig. 8 shows a portion of the main or axial tube of the genital gland some way behind the duct leading to the exterior. A small pocket is seen on the ventral side, bulging down the basal membrane. In the next section in one direction this pocket is nearly flattened out. I did not come across it again in any other section. In the centre of the tube is a large egg (*e*) squeezed out lengthways and perhaps cut tangentially; the slimy covering of the egg, hardened by the alcohol, has been broken up by the microtome-razor. In this case the egg is certainly ripe, and, if the sperm-cells are

* It is worth remarking that the Trilobites had, under certain circumstances, the same habit. Strands of argillaceous matter have been found running through the fossils (Barrande).

ripe, it is difficult to see why the eggs should not be fertilized by the sperm-cells. The only hindrance would be the coating of slime. There is no reason to believe that this, which in the living state would be quite soft, would be sufficient to prevent one or more sperm-cells from finding their way into the egg. They may perhaps be mechanically squeezed through the slimy covering in the process of stretching the duct on their passage to the egg-pouch.

Fig. 9 shows two tubules lying across one another, in both of which a portion of the epithelium has broken down into sperm-cells. One of these alone need engage our attention. An egg, which has all the appearance of degenerating, occurs at the tip, while the epithelium of the neck of the tubule which carries the egg has broken up into sperm-cells and slime. On one side the proliferation of the cells has caused the neck to bulge out greatly.

Figure 10 shows the same phenomenon. A couple of eggs developing at the tip of a tubule dorsally in the region of the fourth leg or ninth appendage appear to be rapidly degenerating. On the other hand, the neck of the stalk-like tubule is swelling up (from *a* to *b*) by the rapid division of the epithelial cells into masses of sperm-cells.

In the foregoing, in order to avoid needless circumlocution, it has been assumed that these minute cells are sperm-cells. The question, then, is—Are they or are they not? The evidence here adduced leaves little doubt that they are. Until, therefore, it is shown, by direct comparison with the undoubted sperm-cells of a male, that they do not resemble such cells in any way, differing entirely in size, shape *, and mode of origin as far as the last has here been sketched, it seems to me that we are justified in asserting that the Apodidæ are hermaphrodite under certain conditions of existence.

Before endeavouring to ascertain what the necessary conditions are which lead to this hermaphroditism, one point raised by Dr. Benham's paper calls for brief comment. He speaks of hermaphroditism in *Apus* as improbable. Nearly all who have worked comparatively at ovigenesis or spermatogenesis have emphasized the already admitted fact that both ova and sperm develop from the same elements, and that the

* Very little can be made out of Kozubowski's figures and account (Arch. f. Naturg. xxiii.) of the sperm-cells of a male *Apus*. It is very doubtful whether he saw the ultimate sperm-cells. His figures show what appear to be spherical packets of cells resembling somewhat those found in the sperm-forming centres of the hermaphrodite specimens.

causes which result in different ultimate products are mainly physiological.

Confining our attention entirely to Crustacea, eggs and sperm have been frequently found developing in the same gland. Nebeski * found that in *Orchestia* the sperm develops in the posterior end of the gland, eggs in the anterior. In a Decapod—*Gebia major*—all the males examined by Ishikawa † had eggs developing in the posterior end of the gland. Rudimentary eggs have been found in the testis of a Crayfish, and the process of the formation of these eggs out of the same cells, which elsewhere normally form sperm, has been followed out in detail ‡. This is also insisted upon by Moore in the paper above quoted with reference to *Branchipus*. Hermaphrodite individuals are said not to be uncommon among the parthenogenetic Cladocera, appearing about the same time as the males. To this I shall have to refer again §. In the face of these records it is difficult to see why there should be any special improbability in sperm-cells occasionally appearing along with eggs in the long, branched, and apparently but little differentiated genital glands of the Apodidæ, a family, be it remembered, in which the males, in several species at least, are very rare.

My experience, however, shows more than this. The specimens from high latitudes, containing a rather large *L. glacialis* from Greenland and several specimens of the minute *L. spitzbergensis*, show one particular portion of the reproductive gland apparently normally transformed into a sperm-forming region, while the rest produces eggs. These arctic dwellers are perhaps arrested rather early in their development ‖. The posterior end of the genital gland does not grow out into rich branchings, but tapers off

* "Beiträge zur Kenntniss der Amphipoden der Adria," Arb. Zool. Inst. Wien, vol. iii. 1880, p. 24.

† Zool. Anz. xiv. 1891, p. 70.

‡ La Valette St. George, "Innere Zwitterbildung beim Flusskrebs," Arch. mikr. Anat. Bd. xxxix. 1892, p. 504.

§ In addition to these, the well-known cases of the Cirripedes and of certain Isopods may be cited. With regard to the latter, *cf.* Bullar, Journ. of Anat. and Physiol. xi. 1876, p. 118; Mayer, Mitth. aus der zool. Stat. Neapel, Bd. i. 1879, p. 165; Leichman, Bibliotheca Zool. Bd. iii. Heft x. 1891.

‖ As they were caught in large numbers by Prof. Kükenthal and the late Dr. Alfred Walter a week or two before the arctic winter set in, it is impossible to consider the specimens as immature. According to Dr. A. S. Packard ("North-American Phyllopod Crustacea," U.S. Geol. and Geogr. Surv. 12th Ann. Rep. 1883) 14 millim. was the average size of his specimens of *L. glacialis*, which were nevertheless adults—that is, if we may judge from the size of their tail-plates.

gradually with mere periodical swellings. May we not assume that the failure to form the typical branchings indicates a lack of nutrition, one result of which is that the cells which here, under more favourable conditions, might have produced eggs, divide up into sperm-cells? The evidence, therefore, certainly points to a normal hermaphroditism among the arctic Apodidæ. With regard to the more central European species, both the hermaphrodite specimens of *L. productus* and of *Apus cancriformis* above described were apparently suffering some privation in the way of nourishment, if we may judge from the generally collapsed condition of the immature eggs; while, further, the condition of the alimentary canal of the specimen of *Apus cancriformis* clearly indicates a state of semi-starvation.

In these facts, then, it seems that we have some indications of the conditions which induce hermaphroditism. It appears that the Apodidæ which, under favourable circumstances, produce parthenogenetically, may become hermaphrodites when food is scarce. This hermaphroditism is thus superimposed upon the parthenogenetic females.

On comparing this with observations which have been made on kindred forms, interesting speculations are suggested as to the relations of these hermaphrodites to true males. The males of different families of Cladocera begin to appear when the year is waning and food is getting scarce. Kurz * found that the males of *Daphnia* always appeared whenever the puddles began to dry up, and he even succeeded in some cases in producing males artificially by slowly draining off the water in which the animals lived. This observer, on accidentally finding hermaphrodite specimens of four distinct species just about the time when the males begin to appear, suggested that such were probably of frequent occurrence and that this might be a sort of provisional arrangement. The needed males were not immediately forthcoming, and hermaphroditism tided over the interval.

Kerhervé's observations led to the same conclusion; not only do males appear on the advent of "hard times," but the females undergo a change. "Quelques jours suffisent pour transformer une Daphnie parthénogénétique, indifférente aux mâles en femelle éphippiale douée d'affection sexuelle, en pondeuse d'œufs destinés à être fécondés. Le facteur principal de cette modification, ici je le répète, est la pénurie des vivres" †.

* Kurz, "Ueber Androgyne Missbildung bei Cladoceren," SB. Akad. Wien, lxix. Abth. i. 1874, p. 40.

† Mém. Soc. Zool. de France, v. p. 227 (1892).

In this latter case the transformation takes place in the same individuals, parthenogenetic females becoming sexual females. Where do the males, which this rapid transformation in the females implies, come from? Kurz speaks of the interval of time which must necessarily elapse before any of the young can develop into males, and during such an interval, he suggests, hermaphroditism may occur. Are these hermaphrodites transformed parthenogenetic females, as the hermephrodite Apodidæ appear to be? If so, is it absolutely necessary to suppose that they stop at hermaphroditism?

With regard to the Apodidæ, the records of "finds" do not show that the males begin to appear in the fall of the year. The rain-pools in which *Apus* lives are most likely to dry up and render life difficult in midsummer. Hence males may occur at any time of the year, whenever, in fact, the rain-pools threaten to dry up; that is, if the law is the same for *Apus* as for Cladocera—that males appear when the conditions of life are unfavourable.

If this be the case, where do these much-needed males of *Apus* come from? Do they develop from eggs specially laid under the influence of the adverse conditions, or do a certain number of developing young ones become males instead of becoming parthenogenetic females, as, under favourable circumstances, would have been the case? These are questions which cannot be finally answered for want of data. A few points, however, are worth considering.

Claus * found that a developing *Apus cancriformis* at the twelfth ecdysis showed clear signs of the transformation of the eleventh leg into the egg-pouch, but that at this stage its dorsal shield measured only 2½ millim.—that is, the animal was still very small. How long it took to grow to this size is apparently not stated. Brauer † found that *Lepidurus productus* was 7 millim. long after the seventh ecdysis and sexually mature after the twelfth, which took place thirty-seven days after hatching. Here are certainly remarkable differences between the courses of development in these two forms, but they appear to agree in showing that the process is a slow one. It appears certain, then, that males could not be produced from eggs for an emergency. It would take too long. The eggs laid when the pools were in process of drying up would certainly take more than a month to hatch out and develop into sexually mature animals. Indeed, the assumed unfavourable conditions under which they would be growing would still further retard their development. It seems more

* Abh. k. Ges. Wiss. Göttingen, Phys. Class. xviii. (1873).

† SB. Akad. Wiss. Wien, Bd. lxix. Abth. i. 1874, p. 130.

probable, therefore, that the genital glands of developing young, instead of producing exclusively eggs, might produce exclusively sperm, and that the needed males might be more quickly obtained in this way. As far as I can see, there is only one difficulty in believing that this takes place. The male and female glands have, according to Kozubowski, the same shape, and we know from the hermaphrodite specimens above described that the epithelium may produce sperm or eggs. The difficulty, however, lies in the early modification of the eleventh pair of legs into egg-pouches. This occurs apparently much earlier in *Apus cancriformis* than in *Lepidurus productus.* If this modification has already set in, when the direction of development is changed from parthenogenetic female into male—if, indeed, this change ever takes place—then we should have to assume that these legs, during subsequent ecdyses, revert to the normal type.

There is one feature in my hermaphrodite specimens of *Lepidurus productus* and *Apus cancriformis* which appears to me of significance in this connexion. The unripe eggs in both specimens were, as stated, in process of degeneration. Those which were quite ripe, *i. e.* were filled with well-developed yolk-granules, beyond being somewhat small, seemed to be unaffected and to be escaping through the gland towards the egg-pouch. Nearly all the rest, *i. e.* the unripe eggs, showed signs of shrinking, as if they were being resorbed, the material being probably needed for nourishment. In one or two cases it appears as if there had been a struggle between the yolk-forming tendency of the egg-cells and the rest of the animal organization seeking to resorb the egg-protoplasm. The nuclei were embedded in small compact masses of yolk-disks, while the rest of the staining protoplasm of the egg-cells was full of vacuoles and irregular spaces from which the material had been drawn. It seems obvious that in these two hermaphrodites an egg-producing stage was coming to an end.

On the other hand, indications are not wanting that a sperm-producing stage is in process of development. The following can be gathered from the figures. The sperm-masses have been in most cases but very slightly drawn upon; fresh pockets completely filled with sperm-cells appear to be forming (figs. 5 *a* and 8); and, lastly, at the tips of certain branches where eggs are degenerating, the cells just below such eggs appear to be actively producing sperm-cells (figs. 9 and 10). The appearances therefore all tend to suggest that a sperm-forming phase was about to succeed an egg-producing phase. It looks, therefore, as if the hermaphrodite specimens were parthenogenetic females in process of becoming males!

I do not assert that this *is* the case. Much more evidence, if possible based upon direct experiment, is needed before such a transformation could be admittedly established. Appearances, however, point so decidedly that way that I feel justified in hazarding the suggestion.

I may, perhaps, add that, startling as is even the suggestion of such a transformation, there is in this particular case hardly any serious morphological difficulty to be overcome—so far as I know, none more serious than the reversion of a single pair of modified limbs to the normal type. In view of the marvellous transformations which occur in other members of the Arthropod phylum at times of ecdysis, such a reversion can hardly be claimed as a difficulty. It seems to me that the most serious objection lies in the extreme improbability of an egg-producing gland changing completely into a sperm-producing gland. If the possibility of such a change is granted, other difficulties appear trifles in comparison. But it is just this change which appears to be so clearly indicated by my slides.

A propos of the fact that these transformations take place in the parthenogenetic females, it will be remembered that Pelseneer, in a valuable paper on "Hermaphroditism in Mollusca," endeavoured to show that here also this condition has been superimposed upon the female *. He suggests the following stages:—production of spermatozoa in parts of the ovaries; reduction in size and number of the males; complete replacement of females by hermaphrodites; final disappearance of the degraded males. Viewing the Apodidæ in the same manner, we may suggest the following account of the reproductive arrangements of the family:—Parthenogenetic reproduction with suppression of males was brought about by the superabundance of food in the early summer, *i. e.* during the season of growth and most rapid multiplication. When the pools dry up and food becomes scarce it is necessary to produce resting eggs, for which fertilization is necessary.

* Quart. Journ. Micr. Sci. vol. xxxvii. 1895. Pelseneer, following Brock (Zeitschr. wiss. Zool. xliv. 1886), claims that the same is also true of the fishes. The recent announcement by Schneider (Mém. Acad. Imp. Sci. St. Pétersb. (8) t. ii. no. 2) that in *Cobitis* and *Phoxinus* the genital ducts of the opposite sexes are homologous with each other and with the Müllerian duct appears to support this. Pelseneer, however, makes no mention of the recent papers by Howes (Journ. Linn. Soc., Zool. vol. xxiii. p. 539) and Stewart (*ibid.* vol. xxiv. pp. 69, 70), nor of others dealing with the subject, therein cited; this is the more unfortunate, as Stewart's description of a hermaphrodite trout with fully developed genital ducts and "fundamentally a male," tells directly against Brock's hypothesis.

A certain number of parthenogenetic females become hermaphrodites by the production of sperm in parts of the ovaries. It is possible that their transformation may continue until in some cases, the developing eggs being completely resorbed, the whole gland becomes a testis, and adult males are thus rapidly produced. At the same time, it is more probable that the true males are developed, under the influence of the same unfavourable conditions, out of younger specimens not yet sexually ripe.

The whole subject of hermaphroditism in the animal kingdom is one of vast interest and deserves a special study. The Apodidæ promise to yield useful results, inasmuch as they could be experimented upon as Kurz (*loc. cit.*) experimented with Cladocera. Indeed, the experiments of Kurz with Cladocera might themselves be profitably repeated, and individual specimens be carefully examined by the most recent methods of fixing and staining. Much welcome light might be thrown in this way upon the whole subject. In the meantime, in view of the fact that the majority of Apodidæ which come into the hands of students are parthenogenetic females and that the hermaphrodite specimens here described are as yet unique, Professor Howes has kindly consented to my depositing the slides in the Huxley Research Laboratory at the Royal College of Science, South Kensington, where they can be examined by any one interested in the subject.

EXPLANATION OF PLATES XI. & XII.

[The detailed explanation of the figures will be found in the text.]

Figs. 1, 2. The sperm-forming portion of the genital gland of *Lepidurus glacialis*, var. *spitzbergensis* (see pp. 298–299).
Figs. 3, 4. Ditto of *Lepidurus glacialis* (see pp. 299–300).
Figs. 5, 5 *a*. Sperm-formation in the genital gland of a specimen of *Lepidurus productus* (see pp. 300–301).
Fig. 5 *b*. Portion of duct of same.
Figs. 6–10. Sperm-formation in a specimen of *Apus cancriformis* (see pp. 301–303).

XLI.—*Descriptions of new Fishes from the Upper Congo.* By G. A. Boulenger, F.R.S.

The new fishes here described were contained in a small collection made some 50 miles south of Mangala by Mr. J. H. Weeks and presented by him to the British Museum. The known species are the following:—*Hemichromis fasciatus*, Ptrs.; *H. bimaculatus*, Gill; *Lamprologus congoensis*, Schilth.; *Channalabes apus*, Gthr.; *Schilbe mystus*, C. & V.; *Alestes leuciscus*, Gthr.; *Pellonula vorax*, Gthr.; *Notopterus nigri*, Gthr.; *Tetrodon fahaka*, Forsk.; *Polypterus palmas*, Ayres*. The specimens (three young, one with external gills) of *Polypterus palmas*, a species which I have previously recorded from the Congo, are interesting for the number of dorsal finlets, which varies from five to seven.

Ctenopoma Weeksii, sp. n.

D. XVI 8. A. IX 9. Sc. 28 $\frac{3}{8}$; l. l. $\frac{15}{10}$.

No palatine teeth. Depth of body equal to length of head, $2\frac{2}{3}$ in total length. Snout $\frac{3}{4}$ diameter of eye, which is $3\frac{2}{3}$ in length of head and equals interorbital width; lower jaw projecting; maxillary extending to below anterior fifth of eye; opercle notched, with four small spines above and two below. Dorsal originating above base of pectoral and extending to caudal; spines subequal, as long as the eye. Brown, with irregular whitish spots and a large black blotch in the middle of the side; two oblique dark brown streaks behind the eye, the upper ascending to the upper border of the opercle, the lower descending to the angle of the præopercle; ventrals black; lower surface of head and breast silvery, with brown spots.

Total length 60 millim.

A single specimen.

Pelmatochromis Guentheri, sp. n.

D. XVI 12. A. III 7. Sc. 32 $\frac{4}{\frac{2}{8}}$; l. l. $\frac{23-24}{28-29}$.

Three series of minute teeth in the jaws, the outer series largest. Depth of body $2\frac{2}{5}$ in total length, length of head 3 times. Snout $1\frac{1}{3}$ diameter of eye, which is $3\frac{1}{3}$ in length of head and equals interorbital width; maxillary extending to below the nostril; four series of scales on the cheek. Dorsal originating above opercular cleft; spines subequal, half as long as the head. Third anal spine longest, longer than dorsals. Pectoral falciform, as long as the head. Ventral reaching anal. Upper lateral line ending below the last dorsal rays; lower extending from the shoulder to the

* Also a turtle not previously recorded from the Congo: *Cycloderma frenatum*, Ptrs.

caudal, on which it is produced in three branches. Uniform pale brownish; dorsal membrane checkered with brown and white spots.

Total length 107 millim.

A single specimen.

Mastacembelus congicus, sp. n.

Depth of body 9 times in total length, length of head 6 times. Snout thrice as long as diameter of eye, ending in a dermal appendage which is twice as long as the eye; cleft of mouth extending hardly to below nostril; two strong spines at angle of præopercle. Vertical fins united with the rounded caudal. Dorsal XXVII 45, its distance from the head nearly equal to the length of the latter. Anal I 45. Pectoral $\frac{1}{3}$ length of head. 25 scales between origin of soft dorsal and lateral line. Brown, marbled with darker, with a lateral series of black blotches; soft dorsal with oblique dark and light lines; anal dark brown, with a white edge and a series of 11 large round white spots at the base.

Total length 250 millim.

A single specimen.

The four species hitherto recorded from the Congo differ abundantly in the number of dorsal and anal rays:—

M. cryptacanthus, Gthr.	D. XXIV 100, A. II 100
M. Marchii, Sauv.	D. XXIII 75, A. II 76
M. niger, Sauv.	D. XXVII 82, A. II 65
M. marmoratus, Perugia	D. XXX 85, A. II 70

Clarias Dolloi, sp. n.

Vomerine band of villiform teeth as broad as the præmaxillary band. Head smooth, finely granulate behind, about once and a half as long as broad, $3\frac{1}{2}$ to 4 times in total length; occipital process angular; diameter of eye 3 times in length of snout, 5 or 6 times in interorbital width; nasal barbels as long as the head, maxillary once and a half. Dorsal 70–75. Anal 55–60. Caudal free. Uniform dark brown. The largest specimen is a pied albino, yellowish white spotted with dark brown.

Total length 250 millim.

Three specimens.

Allied to *C. macromystax*, Gthr., but vomerine teeth forming a narrower band.

Named in honour of my distinguished colleague and friend M. Dollo, of the Brussels Museum.

XLII.—*Notes on some Ethiopian Species of* Ischnurinæ *contained in the Collection of the British Museum.* By R. I. Pocock.

Since I published some notes upon the African Ischnurinæ contained in the collection of the British Museum *, a considerable number of accessions to this group have been made, and amongst them are some examples, apparently representing species, which not only are new, but are of additional interest inasmuch as they bridge over the differences between the genera *Opisthacanthus*, *Opisthocentrus*, and *Cheloctonus*. Thus the two species from Madagascar, with their deeply excised frontal border, large brachial process, and (especially in *madagascariensis*) large and prominent lateral eyes, falls between the South-American *Opisthacanthus* and the South-African *Opisthocentrus*, but may further be recognized from both by the presence of a well-developed median row of spicules upon the lower surface of the tarsi. Since, however, traces of this row are visible in some of the South-African specimens examined by me, it is, perhaps, not wise at present to regard it as a character of generic value. Nevertheless the same character is perhaps the only distinctive feature between the genera *Hormurus* and *Iomachus*. So, too, with regard to *Cheloctonus*. The examination of the specimen described as *crassimanus* shows that two of the characters relied upon, namely the absence of upper anterior crest on the humerus and the marginal position of the lateral eyes, can scarcely be regarded as of more than specific importance. The shape of the hand, too, though striking enough, is shown by analogy to be hardly of generic value; so that I am now of opinion that the three genera under discussion may be looked upon as identical. Consequently the African genera of Ischnurinæ † may be recognized as follows:—

a. Feet thickly clothed below with two rows of long stout bristles .... *Ischnurus*, Koch.
b. Feet sparsely clothed below with paired spines or bristles.

* Ann. & Mag. Nat. Hist. (6) xii. pp. 316–320 (1893).

† Collectors in South Africa who are not acquainted with the genera of Scorpions may readily recognize the Ischnurinæ from the Scorpioninæ (*Scorpio* and *Opisthophthalmus*), to which they are most nearly allied, by the flatness of the body and claws and the weaker compressed tail. The group ranges from Gaboon and Mombasa southwards over the whole of the continent.

a^1. Feet furnished below with paired bristles and along the middle line with a series of delicate spinules .... *Iomachus*, Poc.

b^1. Feet furnished below with paired spines; without a distinct median row of spinules (at least in the South-African species).

a^2. Tail very strongly compressed; body and claws flatter; many pores on the outer border of the lower surface of the hand and forearm .... *Hadogenes*, Kraep.

b^2. Tail stouter; body less flat; only a few pores on the outer border of lower side of the hand and forearm .... *Opisthacanthus*, Pet.

Genus Opisthacanthus, Peters.

Opisthacanthus crassimanus, sp. n.

Closely allied to *O. Jonesii* (Poc.), from Murchison Range, Transvaal, but very much smaller (*cf.* measurements) and possessing a distinct ridge of granules on the humerus, separating its anterior from its upper surface, and also in having the crests upon the last abdominal sternite and on the lower surface of the first caudal segment smooth instead of granular.

Measurements in millimetres.—Total length 48; length of carapace 6·5, of tail 22·5, of hand-back 4·8, of movable digit 6; width of hand 6·5.

Loc. East London (*H. A. Spencer*). A single male example.

This example has been selected as the type; but the Museum has two others of apparently the same species, one from Caffraria and the other from Natal, from the collection of the late F. P. Pascoe; also three young examples from Basutoland (*R. C. Wroughton*), which are provisionally referred to this species.

It is possible that these examples will prove to be the young of *C. Jonesii*, but the only sign of immaturity shown by the type is the absence of lobes on the digits. Moreover, analogy lends no support to the view that the distinctive features of this form are due to immaturity. The interest attaching to the species lies in the fact that the presence of the anterior crest on the humerus bridges over one of the distinctions between the genus *Cheloctonus* and *Opisthocentrus*.

It may be added that the spine-armature of the tarsi in these two species resembles that of the West-African species *O. africanus*, Sim., there being three posterior and two anterior spines, with the distal inferior angle of the tarsus tipped with a bristle, and not with a spine as in *O. validus*, Thor., and *O. asper* (Pet.).

Opisthacanthus rugulosus, sp. n.

Colour of trunk, tail, and chelæ a deep blackish green above, a little paler below; legs deep brown, paler distally; coxal areas brown, sometimes mottled, the maxillary processes of first and second legs deeper tinted; vesicle pale yellowish brown.

Allied to *O. validus*, Thorell.

Upper surface of *trunk* finely and closely granular throughout; the median eyes small, the space between them about equal to or greater than a diameter; the three lateral eyes evenly spaced. *Sterna* smooth, polished, and finely punctured throughout, the last obsoletely crested.

Tail three and a half times the length of the carapace; the lower side distinctly carinate, as in *validus*, the upperside laterally more coarsely granular than in that species; vesicle compressed, granular below.

Chelæ more thickly and coarsely granular than in *validus*, both hand and brachium being closely and distinctly granular above; so also are the crests on the upper and lower edges of the inner surface of the hand more coarsely granular; hand thicker and more convex above, its width being very nearly equal to the length of the keel along the hand-back; the two digits lobate in the adult.

Legs punctured; femora externally feebly granular; tarsi armed below with 4 inner and 3 outer spines, but there is no spine on the lower angle.

Genital operculum in male transversely oval, much wider than long.

Pectinal teeth 6.

Length 72 millim., of carapace 9·3, of tail 33; width of hand 7·5; length of keel of hand-back 8, of movable digit 9·3.

Loc. Ishiromo, Nyasaland (*Sir H. H. Johnston*).

Easily recognizable from *O. validus* by its coarser granulation, especially of the upper surface of the hand and brachium, these areas being almost smooth in *validus*, with the hand furnished with a reticulated pattern of smooth low ridges. In *validus*, too, though the number of spines on the lower tarsi is the same, there is one upon the inferior angle of this segment.

The African species of this genus may be recognized by the following key:—

a. Hand not so flat; very wide, the width exceeding the length of the hand-back; less of the carapace showing below the lateral eyes; anterior crest on humerus (upper arm) of pincers absent or

weak; (lower surface of tail strongly crested, vesicle smooth).
- a^1. Anterior upper crest of humerus absent; keels on last abdominal sternite and those on lower surface of first caudal segment finely granular. *Jonesii* (Poc.).
- b^1. Crest on humerus distinct; keels on lower surface of first caudal segment and on last abdominal sternite smooth .... *crassimanus*, sp. n.

b. Hand flatter, narrower, width less than length of hand-back; more of the carapace showing below the lateral eyes; crest on humerus very strong.
- a^2. Lower side of tail much less strongly crested; its upper surface with shallower median groove.
  - a^3. Carapace deeply excised in front; abdomen and tail not thickly punctured; vesicle smooth; pectinal teeth 9–13 .... *Lecontei* (Luc.).
  - b^3. Carapace less deeply excised; abdomen and tail thickly punctured; vesicle granular below; pectinal teeth 5–7 .... *africanus*, Sim.
- b^2. Lower side of tail strongly keeled; groove on its upper surface deeper.
  - a^4. Hand coarsely granular above; a bristle on the inferior distal angle of the tarsi ...... *rugulosus*, sp. n.
  - b^4. Hand not granular above; a spine on the inferior distal angle of the tarsi.
    - a^5. Femora externally finely punctured, not granular; hand less coarsely sculptured; pectinal teeth 8–10 .... *asper* (Pet.).
    - b^5. Femora externally granular; upperside of hand with a coarsely reticulated pattern; pectinal teeth 5–7 .... *validus*, Thor.

Opisthacanthus punctulatus, sp. n.

Colour a uniform dull brown; legs the same tint as the trunk, and not brownish red as in most species of the genus.

Carapace densely punctured, anteriorly finely granular; the median lateral eye a little nearer the posterior than the anterior of the series.

Terga finely and closely punctured; *sterna* smooth, polished, finely punctured.

Tail as in *O. madagascariensis*, Kraepelin.

Chelæ long and slender, densely punctured; humerus and brachium very finely granular above, humerus with just a few minute granules below at the base; humerus furnished with a very large internal basal process; *hand* not granular above, except towards the inner edge; inner surface armed with two crests of strong granules; flat and depressed, the two areas of the upper surface meeting at right angles; width of the hand about two thirds the length of the hand-back, which exceeds that of the movable digit.

Legs with femora finely granular externally; tarsal spine-armature the same as in *O. madagascariensis*, except that there is a spine on the lower angle of the tarsus instead of a stout bristle.

Genital operculum wider than long, without median suture.

Pectinal teeth 8.

Length 70 millim., of carapace 11, of tail 28, of hand-back 10, of movable digit 9·5; width of hand 7·6.

A single female example from South Central Madagascar (*J. L. Last*).

Genus Hadogenes, Kraepelin.

(=*Ischnurus* of all authors, except C. Koch.)

Hadogenes paucidens, sp. n.

It is needless to describe this species at length, since it seems to differ from the South-African forms that Kraepelin has described under the name *trichiurus* in the spine-armature of the fifth caudal segment. In *trichiurus* the inferior keels of this segment are furnished with a considerable number of small teeth, there being upwards of 15 or more smallish teeth on the median keel and upwards of 9 or 10 similar teeth on the lateral keels; but in *paucidens* there are only 5 much larger teeth on the median keel and 4 or 5 large ones on the lateral keels. The teeth on the lower surface of the second caudal segment also larger and fewer.

Number of pectinal teeth 14 or 15.

Measurements in millimetres of type.—Total length 119, of tail 56, of carapace 15; width of hand 10; length of hand-back 16, of movable digit 14.

Loc. West Africa (*type Keyserling Coll.*).

In addition to the example described above the Museum has a couple of dried specimens from the Congo (*A. Currer, Esq., R.N.*) which appear to belong to this species, since they present the same armature of the caudal segments. One of these is very young, measuring only 39 millim., and possesses 19 pectinal teeth; the other, which appears to be a not quite adult male 86 millim. in length, has 24 or 25 pectinal teeth.

The following are the distinctive features of the remaining specimens of this genus contained in the British Museum:—

Firstly, a male 101 millim. long, of which the tail is 60 and the carapace 10 (pectinal teeth 16 and 17); and a female 84 millim. long, of which the carapace is 11 and the tail 44 (pectinal teeth 14). These two examples, which have no locality, are evidently sexes of the same species, and by the strong lobation of their digits appear to be adult. There is little doubt that they are specifically identical with the type of *trichiurus* described by Gervais, as is shown by the strong terminal spine-armature of the superior keels of the second and third caudal segments. In both the vesicle is smooth and the carapace distinctly excised in front.

Secondly, a female from Tette measuring 147 millim., of which the tail is 68 and the carapace 18 (pectinal teeth 18 or 19); a second specimen of the same sex from Umfuli River, Mashunaland, 1200 feet alt. (*G. A. K. Marshall*), which measures 140 millim., the carapace being 16 and the tail 68 (pectinal teeth 16). These two specimens, which appear specifically identical, are doubtless referable to the form recorded by Peters from Tette as *troglodytes*. According to Kraepelin this species of Peters is identical with *trichiurus* of Gervais; and the former would recognize only one species of this genus. According, however, to the material available to me for examination, there may be two South-African species in addition to the new one here described as *paucidens*; these may be recognized as follows:—

a. Keels on the lower surface of the fifth caudal segment furnished each with about five strong spiniform teeth; the rest of the characters as cited under b^2. Congo .... *paucidens*, sp. n.

b. Keels on lower surface of fifth caudal segment furnished much more thickly, though less strongly, with teeth, there being upwards of 12 teeth on the median keel and 8 or 9 on the lateral. S. Africa.

- a^2. Anterior border of carapace angularly excavated, the triangular sclerite small; first caudal segment with distinctly crenulate upper crests; the second and third, especially the second, with the terminal granule of the upper crests much enlarged; vesicle smooth .... *trichiurus*, (Gerv.).
- b^2. Anterior border of carapace shallowly emarginate; first caudal segment smooth and not crested above; the terminal granule of the upper crests on the second and third segments only very slightly enlarged .... *troglodytes*, Pet.

Genus Iomachus, Poc.

Iomachus politus, sp. n.

Colour blackish brown above; tail entirely dark; legs pale at the base; lower surface of trunk fulvous; maxillary processes of first and second legs infuscate.

Upperside of *trunk* entirely smooth and polished; *sterna* of abdomen also quite smooth; *carapace* a little longer than the first three segments of the tail.

Tail slender and very short, only a little more than twice the length of the carapace; none of the segments distinctly keeled, marked below with series of pores; the inferior surface of the fifth segment scarcely granular; the upper surface of the tail mesially excavated, the sides a little uneven, hardly granular; vesicle smooth below.

Chelæ nearly smooth above; humerus only minutely granular above, its anterior surface and the upper and lower crests which define it distinctly granular; smooth below; brachium smooth above, but reticulated, its anterior crests granular, the basal anterior tooth prominent; hand flat, long and narrow, nearly parallel-sided, its width only a little more than half the length of the hand-back; upper surface reticulated, inner surface distinctly granular or denticulate, outer surface more than three times as long as high, granular and traversed by a long crest; lower surface smooth, reticulated; digits short, movable about two thirds the length of the hand-back, with a sharp basal tooth.

Legs with femora finely granular externally; *tarsi* with a median row of spicules and lateral rows of four setæ.

Pectinal teeth 9.

Measurements in millimetres.—Total length 38; length of carapace 6, of tail 13·5, of hand-back 6·5; width of hand 3·5; length of movable digit 4·2.

Loc. Mombasa (*D. J. Wilson*).

This species is of peculiar interest, inasmuch as the only other species of the genus, *Iomachus læviceps* (Poc.) *, is an inhabitant of Southern India. The two species may be readily recognized by the following features:—

a. Cuticle densely and finely punctured; tail longer, its first three segments exceeding the length of the carapace even in the female; vesicle yellow and higher; hand wider, its inner surface less strongly granular, outer surface without a median granular crest, two pores above at base of immovable finger; movable digit longer, almost as long as the hand-back; with basal lobe; pectines with 3–6 teeth .... *læviceps*, Poc. S. India.

b. Cuticle not densely punctured; tail shorter, its first three segments in the male less than the length of the carapace; vesicle fuscous, thinner; manus longer, more coarsely granular internally, with a median granular crest on the outer surface; movable digit only about two thirds the length of the hand-back and armed with sharp basal denticle; three pores at the base of the immovable digit above; pectinal teeth 9.. *politus*, sp. n. Mombasa.

---

* Ann. & Mag. Nat. Hist. 1890, vol. v. p. 242, pl. xii. fig. 1 (*Hormurus*).

XLIII.—*Two new Subspecies of Zebra from Central and East Africa.* By W. E. de Winton.

By the kind permission of Sir William Flower I have been allowed to look through the zebras in the collection of the British Museum, some skins having lately been received which hardly seemed to me to agree with any of the recognized forms; and I now give a preliminary description of two well-marked local forms of Burchell's zebra.

Equus Burchelli Granti, subsp. nov.

General pattern of the stripes as in *E. Burchelli Chapmanni*, but having far narrower light spaces between the broader dark stripes of the haunches, with no intermediate shadow-stripes. The spots above the nostrils are of much the same colour, but rather lighter than the stripes of the face and body, which are brown or chocolate-colour, varying somewhat in intensity.

Hab. Masailand.

Type no. 94. i. 2. 1 in Brit. Mus. Presented by Dr. J. W. Gregory.

Equus Burchelli Crawshaii, subsp. nov.

General pattern of the stripes as in *E. Burchelli Chapmanni*, but having the dark stripes upon the haunches of about the same width, or slightly broader than the intervening spaces, with no intermediate shadow-stripes whatever. The spot over the nostrils bright tan-coloured. Stripes of the body almost pure black; ground-colour varying from nearly pure white to pale fawn.

Hab. Highlands of Nyasaland west of Lake Nyasa.

Type no. 95. xii. 12. 1 in Brit. Mus. Presented by R. Crawshay, Esq.

XLIV.—*On the Genus* Dactylipalpus, *Chapuis, and Two new Genera of* Scolytidæ *from Africa.* By W. F. H. Blandford, M.A., F.Z.S.

The purport of this paper is to describe three distinct and remarkable species of Scolytidæ from Africa, of which the types are in my collection. They are referred to two new but not related genera; and as one of these is very nearly allied to *Dactylipalpus*, Chap., it has been necessary carefully to examine the structural characters of that genus, hitherto imperfectly known.

Dactylipalpus.

Dactylipalpus, Chapuis, Syn. Scol. p. 12 (Mém. Soc. Liége, 1873, p. 220).
Dactylopselaphus (emend.), Gemminger and Von Harold, Cat. Col. p. 2678.

Head shortly rostrate; eyes oblong, not approximated above or below; antennæ very short, the scape scarcely longer than the basal joint of the 7-articulate funiculus, the club subcompressed, subpyriform, not sharply pointed at the tip, closely pubescent and solid, the sutures being untraceable even in a balsam-mounted specimen. Gular region deeply inflexed, the buccal orifice hidden by the base of the mandibles; mentum small, sublinear and rod-like, widened at the tip to receive the long two-jointed labial palpi, of which the apical joint is fusiform, pointed, and twice as long as the basal joint; ligula indistinguishable. Maxillæ weak, the inner border sinuate, very shortly lobed at the tip, and set with hairs not stouter than those on the outer border and face; maxillary palpi two-jointed, the basal joint nodular, the second elongate, slightly curved, and tumescent before the obtusely pointed apex. Prothorax transversely rectangular, scarcely declivous in front, without propleural foveæ, but in the female with a deep incised transverse striga before the middle of the dorsum. Tibiæ widened from the base to the truncate apex, their upper border straight, rather weakly serrate, their outer face scabrous. Tarsi short, stout, the first three joints subequal, the third bilobed. Underskeleton and elytra as in *Phlœoborus*, but with the prosternum more depressed before the coxæ, and the antecoxal ridges very strong; abdomen relatively shorter.

The genus differs from *Phlœoborus* essentially in the solid antennal club and two-jointed palpi; the appearance and sculpture are quite those of a *Phlœoborus*. As yet it contains a single Oriental species. The etymological alteration of the generic name by Gemminger and Von Harold is too great to be substituted justifiably for Chapuis's hybrid compound.

Dactylipalpus transversus.

♀. *Dactylipalpus transversus*, Chap. Syn. Scol. p. 12 (Mém. Soc. Liége, 1873, p. 220).
♂. *Dactylipalpus quadratocollis*, Chap. *l. c.*

Hab. Celebes, Gilolo, Malacca, Nicobar Islands.

The two species here conjoined differ in nothing but size and sexual characters, and are clearly sexes; I possess both from Ternate. In the Nicobar Islands there is a form which appears to be identical with the typical one, though some specimens show slight differences in the tuberculation and punctuation of the elytral apex. However, the curious disparity in size between the sexes, which appears to be constant in the Ternate and Celebes examples, is not maintained, as the one male and ten females I possess all range from about 8 to 9·5 millim.

ETHADOPSELAPHUS, gen. nov.*

Dactylipalpo affinis; discedens palpis maxillaribus brevibus, triarticulatis.

This genus differs from the preceding in the fact that the maxillary palpi are short and three-jointed, the two basal joints being cylindrical, the first transverse, the second rather longer, the apical joint shorter and conical. The labial palpi are not quite so elongate as in *Dactylipalpus*, but are two-jointed, and the structural characters are in other respects identical, the characteristic thoracic striga being present in the females.

Inconvenient as it is to separate a genus on such a point of structure, it is one too important to be disregarded, and fortunately, owing to the large size of the species, the maxillary palpi can, with a little trouble, be examined without dissection. The two-jointed condition of one or both pairs separates this and the preceding genus from other Scolytinæ; and it is noticeable that, though in the three-jointed maxillary palpus *Ethadopselaphus* forms a link between *Phlœoborus* and *Dactylipalpus*, its two species, both African, have a peculiar elytral sculpture, and do not resemble each other or any species of the allied genera.

E. cicatricosus, which I have more thoroughly examined, may be regarded as the type.

1. *Ethadopselaphus cicatricosus*, sp. n.

Oblongus, opacus, niger, pilis brevibus, appressis, cinereo-flavis ornatus; elytris irregulariter punctato-sulcatis, sulcis sinuatis, ad apicem solum profundis, 4° cum 5°, dein cum 3° connexo, interstitiis rugosis, flavo-pilosis, 3° ter, 5° bis, 7° semel in disco callose ampliatis.

Long. 8–11 mm.

♂. Fronte subimpressa; prothorace absque striga transversali.

Oblong, dull black, pilose, with short decumbent brownish-yellow hairs. Head shining, strongly punctured in front, with

* ἠθὰς, ψήλαφος.

an impunctate median space and a slight transverse impression at the base of the rostrum; the latter narrower in the male, with the side-margins more elevated and frontal surface flatter, pubescence short in both sexes; antennal club acuminate-oval, compressed. Prothorax nearly twice as broad as long, rather narrower at the apex than at the base, the sides gently curved, the anterior angles nearly rectangular, the base deeply impressed on either side for the reception of the elytra; surface (♂) gently convex longitudinally, with a slight transverse impression behind the apex, covered with moderately close decumbent hairs, and scabrous with close, elevated, confluent rugæ, stronger at the sides, which are submuricate, and absent over a shining central line, more or less abbreviated behind and widened in front; surface (♀) flatter, muricate at anterior angles, the transverse striga of variable length, situate before the middle, margined by a shining rugosely punctured area. Scutellum very small, shining, oblong. Elytra strongly rounded at the base, with irregular sulci, coarsely and rugosely punctured, shallow before the middle, deepened and shining posteriorly; the first straight, approximated to the second before the apex; the third confluent with the second just before the middle and immediately behind with the fourth; the fifth confluent with the fourth just after the base; outer sulci subangulate inwards after the base; interstices convex, especially towards the apex, rugose, granulate at the base, covered with short, rather coarse, decumbent hairs, and divided by the confluent sulci, so that the third interval has three, the fifth two, the seventh one, subcallose enlargements on the disk.

Underside and legs black, shortly hairy.

Hab. Natal.

My collection contains several specimens, and there are others in that of the British Museum. The elaborate elytral pattern gives the insect an appearance quite peculiar among the Scolytidæ.

2. *Ethadopselaphus Grouvellei*, sp. n.

♀. Nigra, opaca, pilis brevibus cinereo-flavis sparsim aspersa; prothorace valde transverso, margine antico concavo, granulato, circa strigam sublævi, lateraliter fortius muricato; elytris pilis appressis e punctis muricatis confusis ornatis, striis obsoletis ad basin apicemque solum vix decernendis.

Long. 11 mm.

♀. Black, dull, rather thinly covered with very short cinereous-yellow decumbent hairs. Front shining, strongly and simply punctured, with a median impression from the vertex to near the mouth, its pubescence short, mouth ciliate; antennal club ovate, with the apex subtruncate, closely and finely pubescent, without trace of superficial sutures. Prothorax strongly transverse, much wider in front than the head, its anterior margin concave, the sides gently curved; surface covered with small granular asperities, stronger at the sides and apical angles, the transverse striga conspicuous, its margins wide, somewhat shelving, nearly smooth and hairless; between the anterior margin and the apical border is a fringe of upright hairs. Scutellum minute. Elytra one fourth longer than broad, very strongly rounded at the base, the shoulders obliquely rounded; covered with decumbent hairs arising from small asperate points, irregularly placed and stronger at the base and sides, the striæ completely obsolete except at the base and extreme apex, where they are very feebly impressed, and have a just discernible row of minute punctures.

Underside and legs with short yellow pubescence.

Hab. Begoro in Ashanti.

I dedicate this species, curious in the obsolescence of the elytral striæ, to M. Grouvelle, from whom I have received it.

The following genus belongs to the Tomicides:—

STYRACOPTERUS, gen. nov.*

Caput globosum, receptum; oculi ovales, emarginati; antennarum funiculus brevissimus, 3-articulatus; clava magna, compressa, latitudine longior, oblique subovalis, margine inferiore minus, superiore fortius curvato, suturis tribus notata. Prothorax transversus, fere semiglobosus. Elytrorum margo basalis elevatus, crenatus. Coxæ anticæ subcontiguæ. Pedes fere ut in *Liparthro* constructi, tarsorum articulis 1, 2 perbrevibus.

Head globose, large, concealed above by the prothorax. Eyes broad-oval, emarginate. Antennæ situated in the ocular emargination, the scape rather long, slender basally, strongly clavate at the apex; funiculus very short, three-jointed, the second joint conical, the third transverse; club large, flattened, much longer than broad, its inferior border nearly straight, the superior rounded, the tip subacuminate and situate below the middle line; surface shining, with three fringed sutures, the first transverse, near the base, the second transverse on the outer face, obliquely curved on the inner

* στύραξ, πτερόν.

face, the third near the tip, obliquely curved on both faces and concentric with the apical margin. Prothorax transverse, nearly semiglobose, with no side-margin. Elytra raised and crenate at the base, overlapping the prothorax, strongly spinous in the single species. Anterior coxæ subcontiguous, separated by a narrow prosternal process; middle coxæ widely separated; abdomen short, the first four segments successively decreasing in length. Anterior tibiæ slender, narrowed at the apex, feebly asperate above, and terminating in a recurved uncus; middle and posterior tibiæ flattened, not wide, the upper border rounded and finely dentate towards the apex, of which the lower angle is spinous; tarsi short, the first two joints very small and difficult to observe, the third longer, the apical joint as long as all the preceding.

The genus appears to be related to *Liparthrum* and *Hypoborus*, differing in antennal structure. I have not been able to dissect the mouth-parts, owing to the small number of available specimens and their already mutilated condition.

Styracopterus murex, sp. n.

Breviter ovatus, opacus, squamis brevibus cinereis quasi crusta opertus, obscure ferrugineus, capite, prothoracis apice, elytris ad basin nigricantibus, antennis pedibusque testaceis; prothorace rugoso, medio rarius elevato-granulato; elytris punctato-striatis, ad basin interstitii 2^{i} carinula trispinata, cum crista fortissime 4-spinata post medium interstitii 3^{i} connexa, interstitiis 5° a basin ad medium, 7° mox pone basin ad apicem spinis erectis cristatis, margine apicali serrato.

Long. 1·4–2 mm.

Short-oval, convex, dull, covered thinly with very small cinereous scales, which give it a dirty appearance. Head black, front with a transverse impression, crossed by a fine elevated longitudinal line, pilose above; mouth densely fringed with fulvous hairs; antennæ yellow-testaceous, the scape fringed with a pencil of very long hairs. Prothorax much broader than long, narrowed in front, the sides rounded throughout, the apex somewhat obtuse, the base bisinuate; strongly convex above, somewhat gibbous in the middle, and declivous in front, obscure ferruginous, with the apex blackish, rugosely punctured, the punctures containing appressed scales, the sides with a few longer scales; median portion of disk with small scattered elevated granules. Scutellum absent. Elytra about as wide as the thorax and more than a half longer, their basal margins elevated and serrate, overlapping the prothorax, the sides straight to the middle, thence broadly rounded to the apex; surface obscure ferruginous, blackish at the base, squamous, punctate-striate, the punctures large, quadrate, the rows somewhat interrupted and deflected by the interstitial armature; second interstice elevated at base and furnished with three strong teeth, the hinder one the largest, the elevation connected behind by a ridge with one on the apical half of the third interstice, which carries four very large erect acute teeth; fifth interstice (from the base to the middle) with a crest of seven acute teeth, increasing in size posteriorly; seventh with a toothed crest from near the base to the apex, which helps to form an acutely serrate margin to the elytra when seen from above.

Underside fusco-piceous, pilose and thinly scaled. Legs testaceous.

Hab. British Bechuanaland (*F. Whitworth Jones*).

The extraordinary development of the elytral armature in this species has no parallel among any described Scolytidæ, though it is feebly approached by some species of *Phlœosinus*. Of the teeth which compose it by far the largest are those on the third interstice. I possess three examples, of which one is much smaller than the other two and has this armature less developed. The frontal and antennal characters, however, correspond, and it is likely that all three are males, the small specimen being depauperized.

XLV.—*On the Seasonal Changes in the Plumage of* Zosterops cærulescens. By Alfred J. North, F.L.S., Ornithologist to the Australian Museum *.

In describing *Zosterops westernensis* of Quoy and Gaimard in the 'Catalogue of Birds in the British Museum' †, Dr. R. Bowdler Sharpe makes the following observations:—"An Australian specimen has been described, and it is extraordinary that a bird which seems to be widely distributed on that continent should so much have escaped notice, the only allusion to the species that I can find in Mr. Gould's work being a passage where he mentions that some specimens of *Z. cærulescens* have the 'throat wax-yellow.' It seems to be the *Z. westernensis* (Q. & G.), a species re-instated in the system by Dr. Hartlaub (J. f. O. 1865) p. 20."

With a view of solving the mystery why so common a species should have been overlooked by most writers, I have given this subject my attention for the past two years, by

* From the 'Records of the Australian Museum,' vol. ii. no. 7, pp. 98–100.

† Gadow, Cat. Birds Brit. Mus. ix. p. 156 (1884).

careful observation and the collecting of a number of specimens of *Zosterops* found in the neighbourhood of Sydney. For a liberal supply of these birds every month, from January until the end of August, the thanks of the Trustees are chiefly due to Mr. H. J. Acland, of Greendale, and for a small series of Tasmanian skins to Mr. E. Leefe Atkinson, of Table Cape. Mr. J. A. Thorpe, the taxidermist, too, has assisted at various times, and from the specimens collected or sent me for examination has prepared a series of nearly fifty skins in every stage of plumage. The results of my observations conclusively prove that the *Z. westernensis* of Quoy and Gaimard, the type of which was obtained by them at Western Port, Victoria, is only the spring and summer attire of *Z. cærulescens* of Latham. Taking the two extreme phases of winter and summer plumage exhibited in *Z. cærulescens*, it can be easily understood why each phase should be thought to belong to a distinct species; and it is only where one has these birds under daily observation and obtains specimens during every month of the year that the intermediate stage or the gradual transition of one phase of plumage to the other is observed. These changes in the plumage of *Z. cærulescens* have already been pointed out by me in a series of skins exhibited in August last at a meeting of the Linnean Society of New South Wales. Typical examples of Latham's *Z. cærulescens** with the deep tawny-buff flanks and grey throat, the autumn and winter attire of this species, may be obtained in the neighbourhood of Sydney from the middle of April until the end of August. Some specimens, however, are to be found during April that have not quite lost their summer plumage, and in August others that have already began to attain their spring livery; these birds have the yellow throat more or less clearly defined. Usually the first indications of losing the deep tawny-buff flanks and acquiring the yellow throat are seen, during a normal winter, about the second week in August, in some seasons a fortnight earlier; but in two specimens examined the grey throat was retained as late as 19th September. During August and September, however, the gradual transition from the winter to the spring attire (the *Z. westernensis* of Quoy and Gaimard) † is slowly taking place, and by the middle of October not a bird is to be seen with the deep tawny-buff flanks and the grey throat. Specimens shot in November have the throats of a brighter olive-yellow than at any other period of the year, the flanks at that time being of a very pale tawny brown. At midsummer,

* *Z. dorsalis* (Gould), Birds of Austr. iv. p. 81.

† Voy. de l'Astrolabe, pl. xi. fig. 4.

when the breeding-season with the species is virtually over, the throat is slightly paler than in the spring, and this livery is retained until the beginning of March. The flanks then become darker, increasing in intensity of colour from that time forward, the yellow feathers on the throat also disappearing and passing into grey until the autumn livery is again fully assumed by the end of April.

Of six specimens obtained at Table Cape, Tasmania, during April 1894, three have the throat grey, the remainder faintly washed with yellow, and in all of them the flanks are of a deeper tawny buff than in Australian examples.

The distinguishing characters in the seasonal changes of the plumage of the under surface of *Z. cærulescens* may be briefly summarized as follows:—

Spring plumage.—Throat bright olive-yellow; chest and breast ashy grey, passing into dull white on the abdomen; flanks very pale tawny brown; under tail-coverts dull white, in some specimens washed with yellow.

Summer plumage.—Similar to the spring, but the throat slightly duller in colour.

Autumn plumage.—Throat faintly washed with olive-yellow or gradually passing into grey; flanks tawny buff.

Winter plumage.—Chin and sides of the throat dull olive-yellow; centre of the throat, the chest, and breast ashy; flanks deep tawny buff; abdomen and under tail-coverts dull white, the latter in some specimens washed with yellow.

Transition from winter to spring plumage. — Throat greyish white, faintly washed with olive-yellow; flanks pale tawny buff; under tail-coverts dull white, slightly tinged with yellow.

Obs.—The average measurements of examples obtained during winter and in summer are alike. All through the year some specimens are found with the under tail-coverts tinged or washed with yellow. This does not appear to be a sexual character, although from the specimens examined the yellowish wash on the under tail-coverts predominates among the males. As a rule, however, the dull white or white under tail-coverts are found in birds obtained during the winter.

Under the synonymy of *Z. westernensis* Dr. Sharpe includes

Z. tephropleura of Gould, from Lord Howe Island, but the latter species can be readily distinguished from the spring plumage of *Z. cærulescens* by its bright yellow under tail-coverts and by its larger and more robust bill. At the Macleay Museum I have examined the type of *Z. Ramsayi*, described by Mr. George Masters from specimens obtained by him on one of the Palm Islands lying north of Halifax Bay, N.E. Queensland. It is a good and distinct species, with olive-yellow under tail-coverts and a broad zone of white feathers round the eye. Dr. Sharpe, from the description of this species given in the 'Proceedings of the Linnean Society of New South Wales' *, considers it probably identical with *Z. westernensis*; but there is no question that the specific character pointed out by Mr. Masters and the olive-yellow under tail-coverts will prevent one when examining this species from confounding it with the spring or summer plumage of *Z. cærulescens* or with any other Australian member of this genus.

MISCELLANEOUS.

On the Coloration of certain Insects of the Order Lepidoptera. By Émile Blanchard.

I have made numerous experiments with a view to modifying the colour of certain Lepidoptera; these experiments have been made more particularly on the butterfly commonly known as the Peacock (*Vanessa io*), the most richly coloured of all our Lepidoptera. Taking young caterpillars on the point of hatching from the egg, I placed them in boxes under red, green or blue, and violet-coloured glass. On the day of hatching no colour had undergone the slightest modification. Individuals reared in complete obscurity were hatched as brilliantly adorned as those reared in the full light. As the larvæ of the Peacock feed on nettles, the stalks of nettles, passing through small holes in the bottom of well-closed boxes, were received in vessels of water, so as not to need renewing very often; when changing became necessary, this was done in a darkened chamber. Notwithstanding every care no alteration took place in any shade of the wing of the butterfly.

There is, however, one point of difference which appears well indicated—the action of light. A small species of the genus *Vanessa*, known by the popular name of Carte géographique, from the pattern of its wings, has two annual generations. In the individuals the whole of whose metamorphoses take place in the summer the wings are black: this is *Vanessa prorsa*. In the individuals which pass the winter in the pupa state the wings are fawn: this is the variety *levana*.—*Comptes Rendus*, Dec. 16, 1895.

* Vol. i. p. 50.

CONTENTS OF NUMBER 100.—*Sixth Series.*

*** It is requested that all Communications for this Work may be addressed, post-paid, to the Care of Messrs. Taylor and Francis, Printing Office, Red Lion Court, Fleet Street, London.

Vol. 17. SIXTH SERIES. No. 101.

THE ANNALS
AND
MAGAZINE OF NATURAL HISTORY,
INCLUDING
ZOOLOGY, BOTANY, AND GEOLOGY.

CONDUCTED BY

ALBERT C. L. G. GÜNTHER, M.A., M.D., PH.D., F.R.S.,
WILLIAM CARRUTHERS, F.R.S., F.L.S., F.G.S.,
AND
WILLIAM FRANCIS, PH.D., F.L.S.

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

WITH TWO PLATES.

Illustrative of Mr. A. O. Walker's Paper on Two new Species of Amphipoda Gammarina, and Mr. G. A. Boulenger's on new Batrachians in the British Museum.

LONDON:
TAYLOR AND FRANCIS, RED LION COURT, FLEET STREET.
Sold by Simpkin, Marshall, Hamilton, Kent, & Co., Ld.; Whittaker & Co.: Baillière, Paris: Maclachlan and Stewart, Edinburgh: Hodges, Figgis, & Co., Dublin: and Asher, Berlin.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SIXTH SERIES.]

No. 101. MAY 1896.

XLVI.—*On new Species of Coleoptera from Japan, and Notices of others.* By G. Lewis, F.L.S.

Towards the close of last year Monsieur René Oberthür sent me some Coleoptera from Oshima, and on examination I find the species generally are of a decidedly more tropical character than those of the most southern parts of Kiushiu. I once spent three or four days in Oshima in February; the diurnal Lepidoptera were then flying freely, and the temperature and climatal conditions generally seemed to me to harmonize with those of May in Nagasaki. Oshima lies in lat. 28°, and Nagasaki is close to lat. 33°, and the warmth of the ocean, as well as the more direct rays from the sun, has a very marked effect on the vegetation of the small oceanic islands to which Oshima belongs. Near Yokohama the warmth of the Kurosuwo, or Japanese Gulf-stream, is distinctly felt on the Idzu peninsula, while in the bay of Tokio the water is of a lower temperature; this and similar agents in various parts of Japan have without doubt a localizing effect on peculiar species, and until almost every valley and mountain-side have been searched at various seasons of the year, the Coleopterous wealth of the Empire will continue to yield sufficient novelties to reward one whose care it may be to seek them.

Eustra Batesi, sp. n.

Rufo-testacea, nitida, subdepressa; thorace minus transverso, subcordato; elytris perspicue imbricato-punctatis, disco post medium infuscato; antennis pedibusque rufo-testaceis.

L. $2\frac{3}{4}$ mill.

Reddish testaceous, shining, somewhat depressed; the thorax feebly explanate laterally, with very minute projections (but clearly seen under the microscope) at intervals along the edges, and somewhat wide at the base (fig. 1); the elytra clearly punctate, punctures shallow and being sometimes transversely confluent have an imbricate appearance; on the disk of each elytron just behind the middle is an infuscate blotch, more or less defined in different specimens; the pygidium also has a somewhat similar shallow imbricate surface-sculpture.

Fig. 1.

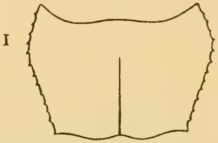
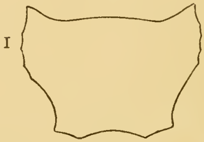


Fig. 2.



Bates formerly (Trans. Ent. Soc. Lond. p. 237, 1873), before he saw a Burmese specimen, considered this species to be *E. biplagiata*, Schmidt-Goebel, but latterly (Ann. Mus. Civ. Gen. ser. 2, vol. xii. p. 270, 1892) he called it *Eustra biplagiata*, var. *japonica*. But it is, without doubt, a distinct species. *Eustra biplagiata*, judging from an example from Burmah so named by Bates and now in the Genoa Museum, has the thorax very much narrowed behind (fig. 2), without conspicuous lateral projecticns, and the elytra are also much less wide, and only "vage imbricato-punctatis," as Schmidt-Goebel described them. The pygidium also is smooth. In the Genoa Museum there is a third species from Teinzò in Burmah, in which the head is less elongate, the eyes more prominent, and the colour and general sculpture different.

Hab. Common in Kiushiu under stones and bark of decaying trees, and it is often gregarious. Also taken at Kashiwagi and on Maiyasan near Kobé. Some notes on its habits are given in the Ent. M. M. p. 39 (1881).

Trechus ovipennis, sp. n.

Gracile ovatus, supra depressus, piceo-brunneus, palpis, antennis pedibusque pallidioribus; capite sat lato, post oculos parum angustato; thorace ante basin conspicue constricto, angulis posticis acutis; elytris ovatis, depressis, striis tenuiter impressis, interstitiis haud convexis, lævibus.

L. 6 mill.

This species is similar in size to *T. oreas*, Bates, in the Japanese series, but it is darker in colour, much more depressed, head wider, thorax broader behind the anterior angles, and at and before the base the thorax is conspicuously constricted. The elytra are precisely oval, being rounded off anteriorly and posteriorly in exactly the same measure, are very feebly convex, with the striæ fine and interspaces nearly flat and smooth.

Hab. Ontake, August 1881. I obtained only one example.

Pheropsophus agnatus, Chaudoir.

Pheropsophus agnatus, Chaud. Ann. Soc. Ent. Belg. xix. p. 43 (1876); Bates, Ann. Soc. Ent. Fr. (6) ix. p. 281.

I believe this species is now recorded from Japan for the first time. Chaudoir described it on a Chinese specimen; Bates's notice refers to varieties.

Hab. Oshima (*Oberthür*).

Styphromerus Batesi, Chaudoir.

Styphromerus Batesi, Chaud. Ann. Soc. Ent. Belg. xix. p. 87 (1876).
Crepidogaster bicolor, Bohm., Bates, Trans. Ent. Soc. Lond. p. 307 (1873).

Chaudoir in 1876 corrected the nomenclature of this species.

Hab. Nagasaki. Only seen once; this species crepitates more loudly than any species of *Brachinus* I have ever met with alive.

Atritomus Reitteri, sp. n.

Oblongo-ovalis, piceus vel nigro-piceus, nitidus; capite, thorace antennisque nigris; elytris brunneis vel disco infuscato, punctato-striatis; pedibus piceis.

L. $2\frac{1}{2}$–$2\frac{3}{4}$ mill.

Oblong-oval, piceous or nearly black, shining; the head punctate, punctures irregular and not very thickly set; the thorax transverse, more thickly punctured than the head, but the punctures are somewhat sparse before the scutellum, lateral rim arched and distinctly reflexed; the elytra are usually wholly brown, but sometimes the dorsal disk is infuscate as well as a band along the outer margin, punctate-striate; the antennæ are somewhat long and nearly black; the legs infuscate, with the joints and tarsi rather paler.

This species differs from *A. Lewisi*, Reitt., in being less parallel and with shorter elytra. The antennæ are one quarter of their length longer, the thorax is more transverse and more arched laterally, with the rim conspicuously raised; the punctures of the elytra are also clearly separate from each other, and not close and sometimes confused as in *A. Lewisi*. The hind tarsi also are distinctly longer.

Hab. Suyama in Sagami, and Ichiuchi and other places in Higo.

Phæochrous asiaticus, sp. n.

Piceo-brunneus, nitidus, supra parum convexus; clypeo margine utrinque reflexo in medio inciso; thorace sparse punctato; elytris dense striato-punctatis; tibiis anticis 3-dentatis.

L. 9–9½ mill.

Pitchy brown, shining, somewhat convex above; the head with rather small punctures, not closely set, and a small area between the eyes smooth, anterior portion and cheeks finely strigose, clypeus deeply incised in the middle, with the edges on either side markedly reflexed; the thorax with scattered punctures variable in size on the disk, larger and closer on the lateral margin, along the edges is a fine stria, complete on all sides, but leaving a somewhat wide smooth margin behind the head; the scutellum somewhat acuminate, hinder part smooth; the elytra has rows of punctures, about twenty-one, more or less regular, with three vague costæ on the median area; each costa is separated by three or four rows of punctures; the anterior tibiæ have three large teeth on the outer edge well separated from each other and projecting beyond the regularly arranged smaller ones.

This species differs from a Ceylonese species I have in the clypeus being more widely incised, the thorax more convex, the marginal stria leaves a wide margin behind the head, and the scutellum is longer and more acuminate posteriorly. In the Ceylonese species the anterior tibiæ are only furnished with two conspicuous teeth.

Hab. Okinawa. I have seen three examples from the collection of Colonel Schönfeldt.

Apogonia amida, sp. n.

Breviter ovata, convexa, nitida; capite thoraceque supra æneo-nigris; antennis brunneo-testaceis; clypeo antice arcuato, dense et paullo rugose punctato, inter oculos parum sparse punctato; thorace sparse punctato, angulis anticis depressis, lateribus arcuatis.

L. $7\frac{1}{2}$–8 mill.

In 1874 Waterhouse considered that this species belonged to *A. splendida*, Bohm., but a larger series of specimens now available for examination proves it to be distinct. The form of the clypeus is shorter and relatively broader, and it is more widely arched and consequently wider before the eyes; the thorax is more transversely convex, and the anterior angles are more obtuse and depressed and the lateral margin more arcuate. The punctuation also of the ventral segments is larger and the pygidium less wide and *not carinate in the middle.* The tarsi are longer and more slender. The scutellum is almost impunctate. In some examples the elytra, metasternum, and ventral segments are brownish, with an æneous tinge.

Hab. Nagasaki and other places in Kiushiu. There are examples from my collection in the British Museum and in the Museum at Brussels.

Apogonia bicarinata, sp. n.

Oblongo-ovata, nigra, nitida, capite thoraceque sat dense et grosse punctatis; clypeo arcuato, antice vix sinuato; scutello sparse sed distincte punctato; elytris punctatis, singulo in medio bicostato; propygidio pygidioque in mediis conspicue carinatis.

L. 10 mill.

Oblong-oval, black, shining, with a very faint cupreous tint; the head closely but not densely punctate; clypeus widely arched, with the outline very feebly sinuous or nearly straight, narrowly and not markedly reflexed at the edge; the thorax punctured like the head, anterior angles obtuse, not produced; the elytra punctate, punctures chiefly in rows, with two median and one sutural costæ on each smooth; the propygidium and pygidium rugosely punctate, each with a median carina occupying their whole length; the palpi and antennæ brown or testaceous. The anterior tibiæ are prolonged beyond the tarsi (except in Schönfeldt's example, which is malformed), but they are not conspicuously dentate like others of this genus.

This species differs from *A. splendida*, Bohm., in colour, being concolorous throughout, in the form of the clypeus, in the scutellum being punctured, and, above all, in the propygidium and pygidium both having a carina.

Hab. Japan (*Ritsema*), Oshima (*Schönfeldt*). The type specimen belongs to the Museum of Brussels.

Apogonia cupreoviridis, Kolbe.

Apogonia cupreoviridis, Kolbe, Arch. f. Nat. i. p. 193 (1886).
Apogonia fusana, Kolbe, *l. c.* p. 193.

I find I have an example of this species from the Goto Islands; it should therefore be included in the Japanese fauna. It is much larger than *A. niponica*, Lew., anterior angles less acute, and the punctuation of the thorax is larger and not dense.

Hab. Gotoshima and Korea (*Kolbe*).

Anomala Gottschei, Kolbe, 1886, = *Anomala geniculata*, Motschulsky, 1866.

I inadvertently omitted Kolbe's name in the synonymic list of last year.

Chalcophora satzumæ, sp. n.

Æneo-nigra, nitida; capite in medio canaliculato; thorace post angulos paullo prominulo; elytris obscure 4-maculatis, apicibus conspicue incisis.

L. 32–34 mill.

There are several good characters to separate this species from *C. japonica*, Gory, which it resembles closely. It is broader, less parallel at the sides, and darker in colour. The thorax bulges out somewhat behind the anterior angles and the apices of the elytra are sharply incised; the eyes are more oval and less convex, and the dorsal area flatter, with the smooth elytral spaces less elevated. There is an example of a species very similar to *C. satzumæ* in the British Museum from Chinkiang on the Yangtsze River; the apices of the elytra are incised and the thorax bulges out in a similar manner, but the Chinese species has the elytral convex spaces more like those of *C. japonica*.

Hab. Satzuma. I am much indebted to Mons. René Oberthür for the sexes of this species.

Chalcophora amabilis, Vollen.

Chalcophora amabilis, Snell. v. Vollen. Tijdschr. Ent. vii. p. 163, t. ii. fig. 5 (1864).

This name must be added to the list of Japanese Buprestidæ. Whether it is the same species as *C. querceti*, Saund., or not Saunders could not decide, and it cannot be determined until the type is examined.

Hab. "Japan."

Chrysodema oshimana, Nonfried, 1895, = *C. Lewisii*, Saund. 1873.

Nonfried's description appears in Berl. ent. Zeitschr. xl. p. 297 (1895). In the Journ. Linn. Soc., Zool. xxiv. p. 328 (1892) I recorded this species from Oshima. Nonfried also (*l. c.*) redescribes *Cetonia Pryeri*, Jan, as *C. oshimana*.

Corœbus Oberthüri, sp. n.

Capite aureo-viridi; thorace disco cyaneo, lateribus viridissimis; elytris albo-fasciatis, apice utrinque bispinosis, basi et apice aureo-viridibus, in medio aureo-cupreis; subtus antennis pedibusque obscure æneis et griseo-pubescentibus.

L. $10\frac{1}{2}$ mill.

The head rich golden green, frontal channel deep, not angulate behind, punctate, punctures deep and elongate, especially lengthening (almost furrow-like) before the neck, where they are generally transverse; the thorax coarsely and transversely sculptured, feebly arched in outline from the anterior angle to the base, edges crenulate, sides somewhat explanate at and before the bases, rich blue on the disk and base, golden green laterally and blue-green behind the neck; the scutellum, anterior portion transverse, with sharply defined truncate sides, and an acuminate triangular area behind, median space rugosely punctate; the elytra, sculpture distinctly transverse and somewhat coarse, golden green at the base, narrowly only near the suture, but at the humeral angle the green colour stretches out broadly along the sides almost to the middle of the wing-case, at the apex about one fourth of the elytral length is golden green, the central area coppery red, and this colour extends along the suture nearly to the base; across the coppery dorsum is a rather wide white pubescent fascia, with a white patch in front of it near the suture, the apex is 4-spinose, two on each elytron, the outline of the elytral edge between the spines is narrow and semicircular (in *C. niponicus* this outline is wide and nearly straight); the ventral segments above are of a deep rich blue, beneath the whole body is obscurely æneous and pubescent, and the antennæ and legs concolorous.

This species is the size of *C. niponicus*, Lew., and should be placed next to it in the Catalogue.

Hab. Oshima.

It gives me much pleasure to name this species after Mons. René Oberthür, from whom I received it.

Lacon, Castelnau.

A sexual character in the males of certain species of this genus has been noticed by Champion (Biol. Centr.-Amer. vol. iii. pt. 1, p. 263, 1894). In some species the males have an almost smooth space on the fifth ventral segment, varying in size in different species. I find this character in two Japanese species: in *L. cordicollis*, Cand., the male has a smooth disk equal to nearly one third of the ventral area; the space leaves a narrow margin only at the apex and anteriorly it does not reach beyond the middle. In *L. binodulus*, Motsch., the smooth space is further from the apex, is somewhat triangular, and extends to the base. I have not found any corresponding character in *L. fuliginosus*, Cand., nor in *L.* 4-*nodatus*, Lew., and I believe my single example of the latter is a male. The golden hair which forms the clothing of *L.* 4-*nodatus* is very short and curved, and under the microscope is seen to be cirriform.

Lacon scutellaris, Candèze.

Lacon scutellaris, Cand. Mém. Acad. Belg., Elat. Nouv. v. (publication pending).

"Fuscus, confertissime squamulosus, squamulis fulvis, brunneis, albicantibusque marmoratim intermixtis; prothorace latitudine haud longiore, dorso æquali, angulis posticis obtusis, oblique carinatis; scutello albo squamuloso; elytris seriatim punctatis; sulcis tarsalibus nullis.

"L. 15–18 mill., lat. 5–6 mill.

"*Hab.* Japon méridional; Oshima."

I found this species at Yokohama and other places, but until I saw Candèze's description in a separate copy circulated in advance of publication I did not consider my specimens differed from those of *L. fuliginosus*, Cand.

Melanotopsis, Lew. Ann. & Mag. Nat. Hist. xiii. p. 192 (1894), = *Sphenicosomus*, Schwarz, Wien. ent. Zeit. xi. p. 132 (1892).

Schwarz's genus I find is established on the same species as mine and has priority. Schwarz considers *Melanotus* to be a Palæarctic genus; but the Palæarctic zone is limited to lat. 40° N., and *Melanotus* occurs in the tropics. I have taken more than one species between lat. 6° and 7°.

Aphanobius fuscomarginatus, sp. n.

Brunneo-testaceus, nitidus, pubescens; capite thoraceque grosse et dense punctatis; thorace elytrisque mediis et lateralibus infuscatis; antennis parte infuscatis; pedibus brunneo-testaceis.
L. 12 mill.

Brownish yellow, shining, with dense pubescence of the same colour; the head coarsely and densely punctured; the thorax with similar sculpture, with a broad longitudinal infuscate marking from the anterior edge to the base, lateral margin also infuscate, the latter band reaching the posterior angle, but does not quite touch the anterior edge; the scutellum punctate, black; the elytra evenly and markedly striate, interstices rather convex and rugosely punctured, sutural borders infuscate, at the bases to the width of two interstices, the infuscate border gradually lessening to one interstice at the apex, outer margin more widely infuscate, occupying four interstices; the epipleural fold is distinctly testaceous and broad near the humeral angle; antennæ brownish at the base, gradually becoming infuscate; the legs and under surface reddish testaceous. The claws in this genus are simple.

Hab. Oshima (*Ferrie*).

Silesis crocatus, Candèze.

Silesis crocatus, Cand. Mém. Acad. Belg., Elat. Nouv. v. (publication pending).

Candèze's description refers to a form which I consider a variety of *S. musculus*, Cand. (Ann. & Mag. Nat. Hist. ser. 6, xiii. p. 315, 1894). In my series of twenty-seven examples, ten have pale elytra, and in the others the elytra are dark. I took both forms together. *Glyphonyx bicolor*, Cand. (Elat. Nouv. v.), I also consider a variety of *G. illepidus*, Cand., and I referred to it as such (*l. c.* p. 315).

Pyrocœlia atripennis, sp. n.

Elongata, subparallela, rufo-aurantiaca; capite, palpis, antennis, elytris pedibusque atratis.
L. 17 mill.

Elongate, somewhat parallel, bright reddish orange, with the head, mouth-organs, antennæ, elytra, and legs densely black; the head in this genus is concealed under the thorax, which has over each eye a transparent space; in this species this space is semicircular in outline on the outer edge and straight on the inner side; the thorax is closely sculptured, with a median but not strong carina from the base to the anterior edge, anterior outline semicircular; the scutellum obtusely acuminate behind; the elytra densely sculptured, sculpture granulate, each wing-case has four vague costæ, the second one from the suture being the most conspicuous.

This species appears to be closely similar to *P. rufa*, E. Oliv., but it differs in the colour of the palpi and legs.

Hab. Oshima (*Schönfeldt*).

Callimerus prasinatus, sp. n.

Elongatus, parallelus, læte æneo-viridis, griseo-hirtus, nitidus; elytris apice rugosis; antennis pedibusque flavis, tibiis inermis.
L. 7 mill.

Rather pale brassy green; the head sparsely and feebly punctulate, face thickly clothed with a greyish scale-like pubescence; the thorax, punctuation coarser and more dense, with the surface distinctly rugose, on each side before the middle in a line behind the eye is a convex tumour-like swelling, which is more conspicuous than in some other species of the genus; the elytra are sculptured very similarly to the thorax, but the rugosity is best marked at and near the apices; the sides of the metasternum are densely clothed with white pubescence; the mouth-organs, antennæ, and legs are flavous, the hair on the legs is much longer than that on the body; unlike some of the species of *Callimerus*, the tibiæ are without spines or denticulations and are long and slender.

Hab. Oshima (*Ferrie*).

Apate carinipennis, sp. n.

Elongata, parallela, brunneo-nigra, subnitida; capite dense rugoso; thorace in medio obscure carinato; scutello minuto, elevato; elytris ante basin bicarinatis; antennis piceis.
L. 13 mill.

Elongate, parallel, nearly black, somewhat shining; the head rugosely and densely sculptured; the thorax nodulose and very roughly sculptured, anteriorly with a lateral ridge of tubercles which terminate in a rough pointed process, which projects over the forehead (the eyes viewed from above are seen outside of them), the base is narrowly constricted, with a somewhat large nodule on either side just before the base, in the middle is a somewhat ill-defined furrow with a small carina in its centre; the scutellum is small, clothed with golden-grey pubescence and distinctly elevated; the elytra are densely and roughly punctate, marked with small patches of brownish setæ; on either side of the scutellum the basal edges of the elytra are a little projecting, and behind the scutellum, but well away from the suture, are two short polished carinæ, apices blunt.

Hab. Kawatchi.

The two curious elytral carinæ distinguish this species from most, if not all, of the described species of *Apate*; but Mr. Gorham has a species from the Andaman Islands which closely resembles it. Its chief differences are, the antennæ are shorter and stouter, the thorax parallel at the sides, rectangular at the base, the scutellum not elevated, and the two elytral carinæ are half as long again; both species measure L. 13 mill. In the Andaman species the tarsi are also shorter and the terminal joint of the antenna is conical. In *A. carinipennis* the terminal joint is distinctly oval *.

Apate niponensis, sp. n.

Elongata, parallela, nigra, nitida: capite rugoso, in medio obscure lævi; thorace dense imbricato-rugoso; scutello elevato; elytris profunde seriatim punctatis, ante apicem valde bituberculatis.

L. 15 mill.

Elongate, parallel, black, shining; the head rugose, with a small smooth median space between the eyes which is connected with the base of the head by an ill-defined polished line; the thorax rugosely sculptured, the rugosities assume an imbricate form, especially on the disk; the anterior thoracic processes are bent downwards towards the head, are hamate at the tips, and are based on two tuberculate ridges, the outer row of tubercles being the strongest; the small scutellum is distinctly elevated; the elytra are deeply punctate, the punctures are set in somewhat irregular rows, the sutural margin is elevated, and there are two median rather vague costæ separated from each other by three rows of punctures, and well before the apices at an equidistance from the suture and outer edge are two large tubercles, one on each elytron, they are polished and bent towards each other; the apical rim of the elytra is elevated rather more strongly than the sutural margin; the antennæ and thighs are piceous.

Hab. Okinawa (*Schönfeldt*).

* Mr. Gorham wishes me to name his insect; I propose, therefore, to call it *Apate carinata*, sp. n.

Gnesis helopioides, Pascoe.

Gnesis helopioides, Pasc. Journ. Ent. p. 477 (1866).
Tromosternus Haagi, Har. Abh. Brem. p. 131 (1876).

This species is figured in 'Aid to Identification of Insects,' pl. xxiv. p. 158.

Hab. South and Central Japan. Not very common.

Helops araneiformis, Allard.

Helops araneiformis, All. Rev. Helop. vrais, L'Abeille, xiv. p. 67 (1876).

This species was omitted in my list of Japanese Tenebrionidæ (Ann. & Mag. Nat. Hist. ser. 6, vol. xiii. p. 484, 1894), nor does the name appear in the 'Zoological Record' of 1876. The species only measures 7 mill., and is described doubtfully as belonging to *Helops*.

Plesiophthalmus brevipennis, sp. n.

Subelongatus, niger, nitidus, leviter convexus; capite rugose punctato; thorace subtilissime punctulato; elytris subtilissime striato-punctatis; antennis pedibusque obscure rufis.
L. $13\frac{1}{2}$ mill.

Black, shining, with a slight bluish tint, antennæ and legs dull red; the head rugosely punctate, lateral ridges, under which the antennæ are inserted, distinctly elevated; the thorax rather wider than broad, anteriorly rectangular, anterior and lateral margins finely but clearly raised, surface polished, with a very fine sparse punctuation, most sparse on the disk; the elytra relatively short as compared with *P. nigrocyaneus*, Motsch., highly polished and very finely striate-punctate, interstices very feebly (almost obsoletely) convex, with a punctuation sparse and very fine. The male has the last ventral segment emarginate.

The type of this species is much smaller than any example of *P. nigrocyaneus* I have seen, and possibly the sculpture and colour of the body and legs may vary as much as in that species; but still there are three good characters by which it may be recognized, viz. the greater elevation of the antennal ridges, the feeble surface-sculpture, and the shorter elytra.

Hab. Oshima (*Ferrie*). I have only seen one male example.

Lagria notabilis, sp. n.

Nigra, nitida, nigro-hirta; capite thoraceque grosse punctatis; elytris dense punctatis et transversim rugosis, apice angulo suturali valde mucronatis.
L. $11\frac{1}{2}$ mill.

Black, shining, clothed with long black hairs not closely set; the head and thorax relatively narrow, elytra at the bases as wide again as the thorax, widest behind the middle; the head rather coarsely and rugosely punctate, with a transverse impression between the antennæ; the thorax sculptured like the head, with a longitudinal impression, free of large punctures, on the disk; the scutellum somewhat roughly punctulate, obtuse behind; the elytra more densely and more coarsely sculptured than the thorax, with the interstices of the punctures more raised and generally distinctly transverse; on the apex of each elytron there is a large triangular process, the base of the triangle being parallel to the suture, so that when the wing-cases are closed only one of the processes is visible; the antennæ and legs are black, joints 7 to 11 of the first are opaque.

Hab. Oshima (*Ferrie*).

Macrolagria rugipennis, sp. n.

Elongata, subparallela, nigra, nitida; elytris grosse et rugose punctatis, nigris vel rufo-brunneis.
L. 11–12 mill.

Elongate, rather parallel at the sides, black, shining; the elytra black or wholly reddish brown; the head smooth, with a very few scattered punctures and an oblong impression between the eyes (not always well defined); the thorax, punctures larger and much more numerous than those of the head and somewhat irregularly set, posterior rim distinctly elevated; the elytra with coarse punctures arranged roughly in double rows, with costæ running between them; the costæ are encroached upon by the punctures, apices somewhat acute; the legs and antennæ black.

This species is about the size of and similar to *M. rufobrunnea*, Mars., but the eyes are nearer together in both sexes and the rough and coarse sculpture of the elytra is very different.

Hab. Oshima (*Ferrie*). Apparently common.

Balaninus Hilgendorfi, Har. 1878, = *B. dentipes*, Roel. 1874.

Hispa higoniæ, sp. n.

Oblongo-quadrata; capite rufo; thorace transverso, 5-spinoso; elytris multispinosis, abdominis pedibusque rufis.
L. 4 mill.

The head red, microscopically rugose before the eyes; the antennæ filiform, basal joint rather long, first two and the last blackish; the thorax transverse, margins reddish, with a red median line, two spines on the edge behind each eye having a common base and are nearly erect, on the lateral margin are three spines having also a common base, surface punctate, but less coarsely than that of *H. japonica*, Baly; the scutellum blackish, with a red median mark; the elytra, each furnished with about twenty spines, those on the dorsum are erect, surface with rows of large punctures evenly set, colour pitchy, with the posterior edge rather broadly, lateral edge indistinctly reddish testaceous, and marks of the same colour on the wing-cases; the legs and abdominal segments reddish.

The facies of this insect resembles *H. japonica*, but the basal joint of the antenna is half as long again, the eyes are wider apart, and instead of tuberosities on the dorsum it has long spines, and the anterior tibiæ are less swollen.

Hab. Yuyama in Higo. I only obtained one specimen.

AMIDA, Lewis.

This genus should be placed near *Ortalia*, Mulsant.

List of Species, with some new Synonymy.

CARABIDÆ.

Eustra Batesi.
Trechus ovipennis.
Pheropsophus agnatus, *Chaud.*
Styphromerus Batesi, *Chaud.*
Crepidogaster bicolor, *Bohm.* (*Bates*, 1873).

MYCETOPHAGIDÆ.

Atritomus Reitteri.

SCARABIDÆ.

Phæochrous asiaticus.
Apogonia amida.
—— bicarinata.
—— cupreoviridis, *Kolbe.*
Anomala geniculata, *Motsch.* 1866.
Gottschei, Kolbe, 1886.

BUPRESTIDÆ.

Chalcophora satzumæ.
—— amabilis, *Vollen.*
Chrysodema Lewisii, *Saund.* 1873.
oshimana, Nonfried, 1895.
Coræbus Oberthüri.

ELATERIDÆ.

Lacon scutellaris, *Cand.*
Sphenicosomus, *Schwarz*, 1892.
Melanotopsis, *Lewis*, 1894.
Aphanobius fuscomarginatus.
Glyphonyx illepidus, *Cand.* 1873.
bicolor, Cand.
Silesis musculus, *Cand.* 1873.
crocatus, Cand.

LYCIDÆ.

Pyrocœlia atripennis.

CLERIDÆ.

Callimerus prasinatus.

BOSTRICHIDÆ.

Apate carinipennis.
—— niponensis.

TENEBRIONIDÆ.

Gnesis helopioides, *Pasc.*
Helops? araneiformis, *All.*
Plesiophthalmus brevipennis.

LAGRIDÆ.

Lagria notabilis.
Macrolagria rugipennis.

CURCULIONIDÆ.

Balaninus dentipes, *Roel.* 1874.
Hilgendorfi, Har. 1878.

CHRYSOMELIDÆ.

Hispa higoniæ.

COCCINELLIDÆ.

Amida tricolor, *Har.*

XLVII.—*On Two new Species of Amphipoda Gammarina.* By ALFRED O. WALKER.

[Plate XVI.]

Fam. **Phoxocephalidæ**, G. O. Sars.

Phoxocephalus pectinatus, sp. n. (Pl. XVI. figs. 1–6.)

Epimeres of the peræon rather deeper than their segments; third pleon-segment with the lower margin straight, the hinder slightly convex, and the hinder angle with the point rounded.

Head with the hood slightly curved downwards; eyes round, dark, and large, especially in the male.

Upper antennæ with the first joint longer than the two next, its upper margin produced and the lower furred in the male; flagellum 4-jointed, terminated in the male by a stiff seta as long as the whole antenna; accessory appendage 4-jointed, reaching nearly to the third joint of the flagellum.

Lower antennæ in the male as in *P. Holbölli*, in the female with the second joint of the peduncle nearly as long as the first and third together; flagellum 4-jointed, as long as the second joint of the peduncle.

First gnathopoda rather smaller than the second; epimeres distally expanded; propodos distally contracted; second gnathopoda with the epimeres rounded-oblong; margins of propodos parallel; in both pair the propodos is almost as long as the four preceding joints, the second, third, and fourth joints being very short.

First and second peræopoda much as in *P. Holbölli*, but with the dactylus about three fourths of the length of the propodos.

Third and fourth peræopoda as in *P. Holbölli*, except that the latter is rather longer.

Last peræopoda with three shallow teeth on the hind margin of the first joint; second and third joints in the female with long plumose setæ, remaining joints gradually decreasing in length. In the male the fourth joint has four curved and blunt spines in an equidistant comb-like row on the distal half of the anterior margin; the third joint has no plumose setæ.

Uropoda and telson nearly as in *P. Holbölli*, but there are no spines on the longer ramus of the third uropoda.

Length 3 millim.

This species may be at once distinguished from *Phoxocephalus Holbölli*, *Leptophoxus falcatus*, and the genus *Harpinia* by the conspicuous eyes, while the shortness of the first four joints and the form of the hand in the gnathopods, as also the characters of the last pair of peræopoda, distinguishes it from *Paraphoxus oculatus* and *Phoxocephalus Fultoni*. A male and female were dredged by me off St. Peter's Port, Guernsey, in 7 fathoms, on a bottom of coarse gravel, clinkers, and broken shells, on April 4, 1892. I have also received a male from Mr. J. T. Calman, University College, Dundee, who informs me that it was found with a few others among a number of male *P. Fultoni*, Scott, received from Mr. D. Robertson, of Cumbrae, some years ago.

Fam. **Pardaliscidæ**, Boeck.

HALICOIDES, gen. nov.

Head with a rostrum equal to half the entire head; eyes obsolete.

Upper antennæ with no accessory appendage at the base of the flagellum, but with a small one at the base of the last (third) joint of the peduncle.

Mandibles nearly as in *Halice*, but with the last joint of the palp about two thirds the length of the second joint and more slender.

Gnathopods simple.

First and second peræopods with the third and fourth joints expanded.

Remaining characters as in *Halice*.

Halicoides anomala, sp. n. (♂). (Pl. XVI. figs. 7–18.)

Epimeres of peræon small; first three pleon-segments with a small tooth at the hinder angle, fourth and fifth injured, but with no appearance of dorsal teeth.

Head longer than the first two body-segments; eyes indicated by a clear almost circular space on the top of the head.

Upper antennæ with the first joint very large, expanding distally, and completely filling the space between the rostrum and the anterior margin of the head, exceeding in length the next two joints, which are less than half as wide; the distal margin of the second joint has a sinus on the upperside, from which a scale-like appendage reaches to the end of the upper margin of the third joint, which is much shorter than the lower margin. First joint of flagellum as long as the last two of the peduncle, furred, and provided with long setæ on the upperside; next eight or nine joints very short, setose, tapering gradually into longer and thinner joints, about twenty-eight in all.

Lower antennæ:—Penultimate joint of peduncle reaching to the end of the first joint of the flagellum of the upper antennæ, constricted at the proximal end; last joint longer than the preceding, both with setules along the upper margin; flagellum very slender, with the third joint longer than the preceding and succeeding joints, about twenty-eight in all.

First gnathopod:—First joint thicker than any of the following, about as long as the next three; carpus rather more than half as long as the propodos, which tapers gradually to the base of the dactylus, and has three setæ and six setules on the lower margin; the dactylus is expanded at the base, not deflexed, and fully half as long as the propodos. Epimere subtriangular.

Second gnathopod:—Like the first in general form, but the lower margins of the carpus and propodos are furred and densely clothed with setæ, which lengthen distally; many of those on the carpus are greatly curved. Epimere rounded-oblong.

First and second peræopoda:—First joint as long as the third and fourth together, third obcordate, the distal end as wide as the shorter diameter of the broadly oval fourth joint; fifth joint as long as, but much narrower than the fourth; dactylus about two thirds the length of the fifth joint; hind margins of third, fourth, and fifth joints fringed with long setæ, which are most numerous on the fourth.

Third peræopoda:—First joint twice as wide and not so long as the third, which is about equal to the fourth and fifth, but twice as wide. Dactylus more than half as long as the propodos.

Fourth and fifth peræopoda subequal, of the same form as the third, but much longer.

Branchial vesicles and pleopoda large.

Uropoda injured, the first with peduncles as long as the rami, which are narrow, equal, and spinous; the second shorter than the first, with subfoliaceous (?) rami; the third foliaceous and probably setose, the inner ramus rather shorter than the outer, which is coarsely serrate on the inner side and is terminated by a short strong spine. The peduncle is short, widening distally, with a median and terminal spine.

Telson longer than the peduncle of the last uropoda, cleft to the base, with a notch at the tip of each division.

Length 7 millim.

A single male specimen was found in a very interesting collection of Crustacea made by Mr. R. L. Ascroft in the steam trawler 'Britannic,' off the Isle de Yen, in the north of the Bay of Biscay, the depth being 17 to 32 fathoms, bottom sand and mud. This species approaches the genus *Halice*, Boeck, very closely in general form, structure of the mouth-organs, antennæ (with the exception of the accessory appendage), gnathopoda, last three pair of peræopoda, uropoda, and telson; but it differs from that genus in having no accessory appendage at the base of the first joint of the flagellum of the upper antennæ, and from every known Amphipod, so far as I am aware, in having a small but distinct scale-like accessory appendage at the base of the last (third) joint of the peduncle. Both the upper antennæ are exactly alike in this respect. The first and second pairs of peræopoda resemble those of the genus *Synopia*, Dana, in the dilated third and fourth joints, and thus connect this genus with the Pardaliscidæ in this respect, just as *Synopioides*, Stebbing, does in the shape of the head. There remains, therefore, nothing to justify Bovallius's establishment of the subtribe of Amphipoda Synopidea,—Claus, Stebbing, and G. O. Sars having already pointed out the relationship of the titular genus to the Gammarina, and the remaining genera having been referred to other families, viz. *Trischizostoma* to the Lysianassidæ and *Hyperiopsis* to the Hyperiidea.

EXPLANATION OF PLATE XVI.

Figs. 1–6. *Phoxocephalus pectinatus.* 1. Upper antenna, ♂. 2. Lower antenna, ♀. 3. First gnathopod, ♀. 4. Second gnathopod, ♀. 5. Last peræopod, ♀. 6. Last peræopod, ♂.

Figs. 7–18. *Halicoides anomala.* 7. Head. 8. Peduncle and first joint of flagellum of upper antenna. 9. First gnathopod. 10. Second gnathopod. 11. First peræopod. 12. Third peræopod. 13. Fifth peræopod. 14. Telson and last uropod. 15. Mandibles. 16. First maxilla. 17. Second maxilla. 18. Maxillipede.

Figs. 1–6, 8, and 15–18 are drawn with a $\frac{1}{2}$-inch objective, the rest with a 1-inch.]

XLVIII.—*Notes on the Pierine Butterflies of the Genus* Daptonura, *with Descriptions of new Species.* By A. G. Butler, Ph.D., Senior Assistant-Keeper, Zoological Department, British Museum.

In carefully supervising the synonymy of *Daptonura* I noted that the outline of the wings, the width of the outer borders, and the inner edging of the latter appeared to be constant and reliable characters; but the mere tint of the wing-surface varied from white to brimstone and from brimstone to saffron, these modifications being best illustrated by such species as *D. florinda* and *D. isandra.*

In *D. limnoria*, Godt. (*limnobia*, Swains.), the secondaries of the male vary in tint from pale brimstone to canary-yellow, but the orange on the border is invariably represented by a series of saffron or orange spots. Hübner's figures (Samml. exot. Schmett. ii. pl. ccxxxii.) represent a very distinct species, for which, years ago, I proposed the name *D. Hübneri*, writing it upon a label and pinning it into the collection; but if I published the correction it has never been quoted, and consequently I cannot refer to it.

Hübner's insect differs in both sexes from *D. limnoria*, as will be at once seen by comparing Swainson's admirable illustration of the latter with the plate in the 'Sammlung.'

Daptonura Hübneri.

♂. Decidedly smaller than *D. limnoria*, the black apical border narrower, with regularly dentate-sinuate inner edge; the secondaries bright sulphur-yellow, with broad orange outer border and linear black edging.

♀. Smaller than that sex of *D. limnoria*, the black cuneiform bar across end of cell connected by a streak (which passes along the third median branch) with the black outer border; the latter narrower on the costa than in the common species and gradually decreasing in width to inner margin; the secondaries as in the male, excepting that the orange external area and black edging are wider.

♂, "Rio R." In coll. Hewitson.

The female I know only from Hübner's illustration; it is said to come from Brazil. The locality is probably Rio Real in Northern Bahia.

Daptonura inæqualis, sp. n.

Allied to *D. leucanthe*; decidedly smaller, the outer margin of primaries straighter, the black apical border decidedly narrower, with zigzag dentated inner edge; only the fringe of secondaries (not the margin also) blackish; male above white, female bright orange washed with canary-yellow on costa and in cell of primaries: the male below nearly resembles *D. leucanthe*, but the blackish line on the end of the discoidal cell of primaries is either ill-defined or wanting; the apical border also is only indicated through the wing and the veins crossing it are barely or not at all blackened; the apical area of these wings and the whole surface of secondaries are far more buff in tint, and the veins of the latter wings are black to the base; the wings themselves are more rounded, less produced at anal angle than in *D. leucanthe*: the female below is paler (more golden crocus-yellow) than above, in veining it corresponds with the male.

Expanse of wings, ♂ 63, ♀ 66 millim.

♂ ♀, E. Peru (*Whitely*); ♂, Bolivia, N. side of the Cordillera de Cochabamba (*Bridges*). B.M.

Var. ?—Black, veining obsolete on both surfaces; outer margin of primaries slightly more inarched; inner edge of apical border sinuated.

♂, Bolivia (*Bridges*); ♂, Cuenca, Ecuador (*Fraser*). B.M.

Daptonura latilimbata, sp. n.

♂. Allied to *D. peruviana*; basal two thirds of primaries milk-white; costal margin and apical third black-brown, the inner edge of the latter zigzag, commencing almost parallel to the end of the cell and continued obliquely to near the extremity of the first median branch, whence it tapers more abruptly to the extremity of the submedian vein; fringe towards external angle white: secondaries milk-white, with black-brown outer border as wide as in the female of *D. eurymnia*, but not spotted: body normal. Wings below with the black-brown borders broader, shining dark copper-brown; a black-brown cuneiform streak from costa closing the discoidal cell of primaries; basal lobe of secondaries orange, and sides of pectus washed with the same colour as in *D. peruviana*.

Expanse of wings 76 millim.

Ecuador (*Buckley*). Coll. Hewitson.

Daptonura Harti, sp. n.

Commonly confounded in collections with the New Granadian *D. eurymnia*, usually a little smaller, and invariably with the outer margin of primaries more concave; the external border of these wings in the male slightly narrower, especially below the second median branch, the inner edge of this border widely sinuous, but not regularly sinuated as in the New Granadian species: the secondaries tinted with sulphur-yellow; the dark brown outer border much narrower, tapering to a point at each extremity, so that only three out of the usual five squamose whitish submarginal spots are clearly emphasized: on the under surface the brown borders differ as above, and the yellow is a clear brilliant canary instead of gamboge; the basal lobe of secondaries is barely tinted with saffron, instead of being deep orange. In the female the differences are less marked, but the primaries above are pale brimstone and the secondaries bright brimstone-yellow, far brighter than in *D. eurymnia*: on the under surface the borders are slightly narrower than in the female of the latter species, the primaries are brimstone-yellow, with the costal area deepening to canary; the secondaries are very deep canary-yellow, with a slight tint of saffron on the costal edge of the basal lobe, whereas in *D. eurymnia* these wings are much darker, cadmium-yellow, with deep saffron basal lobe.

Expanse of wings, ♂ 58–70, ♀ 59 millim.

Trinidad (*Hart, Broadway, and Caracciolo*). B.M.

Judging by the female differences alone, I should never have supposed this to be a distinct species; but the male characters are much more markedly dissimilar from the form of the mainland; the latter ranges from Bogota to Venezuela, but whether to the coast I do not know.

The true *D. eurymnia* is like a white edition of *D. polyhymnia*, and I am satisfied that the two are only forms of one species; in like manner I still believe that *D. monstrosa* is only a form of *D. florinda*, inasmuch as the fact that Dr. Staudinger has described four types, all differing, clearly indicates inconstancy in the ground-colouring of the wings. The Hewitson collection contains a male and two females, none of which agree with the figures in the 'Biologia'—they are all what botanists know as "selfs." Then, again, the *D. panamensis* of Staudinger is represented by the opposite sexes of the two forms *D. florinda* and *D. monstrosa*, as figured in the 'Biologia,' the male being described as having the primaries white and the secondaries citron-yellow, the female as having the primaries citron and the secondaries ochre-yellow.

Staudinger's *D. anceps* is said to be smaller, the secondaries white, like the primaries, but with a yellowish suffusion at the anal angle; the female more opaque than in *D. panamensis*, not ochre-yellow on the secondaries; therefore this female would answer to the female of "*D. panamensis*" figured in the 'Biologia.'

Staudinger's *D. chagris* is said to resemble his *D. panamensis* in both sexes, excepting that it has a somewhat broader black apical border and the under surface of the primaries is white with yellow costal border.

Staudinger's *D. chiricana* is a "self," the male citron and the female ochre-yellow; it corresponds exactly with a pair so-named in the Hewitson collection *, which I am satisfied are conspecific with *D. florinda*; whilst Hewitson's third example is gamboge-yellow, and therefore is intermediate between *D. anceps* ♀ and *D. chiricana* ♀.

As another instance of variation in ground-colour in this genus I may mention that I have no doubt of *P. pedrosina* being a mere form of *P. palæstra*, differing in having the secondaries and costa of primaries on the under surface white instead of yellow; there is no other difference by which to separate them.

My *D. pedrosina*, therefore, will sink as a seasonal form or a sport of *D. palæstra*, Hopffer.

XLIX.—*Descriptions of some new Species of Heterocera from Tropical Africa.* By Herbert Druce, F.L.S. &c.

Zygænidæ.

Saliunca, Walk.

Saliunca ostia, sp. n.

Male.—Primaries and secondaries uniform bright purplish black; primaries with a round white spot at the end of the cell and one on the secondaries about the middle of the costal margin; the fringe of both wings black. Antennæ, head, thorax, and abdomen bluish black; legs black; the thorax has two small white spots at the base.—*Female* very similar to the male, but larger and without any white spot on the secondaries.

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

Hab. East Africa, Dar-es-Salaam (*Mus. Druce*).

* Staudinger's "ochre-yellow" I should call bright orange.

BRACHARTONA, Hamps.

Brachartona unxia, sp. n.

Primaries and secondaries purplish brown. Head and antennæ black; thorax brown; abdomen and legs blackish brown.

Expanse $\frac{6}{10}$ inch.

Hab. West Africa, Lagos (*Mus. Druce*).

Brachartona (?) *titæa*, sp. n.

Primaries and secondaries semihyaline smoky brown, the veins and the fringe darker. Head, antennæ, and thorax black; abdomen golden yellow on the upperside, the sides and underside and legs black.

Expanse $\frac{6}{10}$ inch.

Hab. South Africa, Transvaal (*Mus. Druce*).

Nyctemeridæ.

ALETIS, Hübn.

Aletis alba, sp. n.

Primaries and secondaries semihyaline white; primaries, the costal margin broadly bordered with black, the apical half of the wing greyish black; a large white spot slightly beyond the end of the cell, below which, on the outer margin near the anal angle, are two white spots; the base of the primaries pale orange: secondaries with a dentated black margin. Underside the same as the upperside. Head, antennæ, and thorax black; collar spotted with white; abdomen yellow; legs greyish black.

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

Hab. West Africa, Sierra Leone (*Mus. Druce*).

Aletis kedar, sp. n.

Primaries white, the apical half and the veins black; a large oval-shaped white spot close to the apex; the costal margin black: secondaries white, the veins black; the apex and outer margin bordered with black; the black margin is dentated near the anal angle. Head, collar, and underside of thorax pale yellow; antennæ, thorax, and abdomen above black, banded with white; the underside of the abdomen white; the anus yellow; legs greyish black.

Expanse 2 inches.

Hab. East Africa, Dar-es-Salaam (*Mus. Druce*).

NEUROPHANA, Herr.-Schäff.

Neurophana charax, sp. n.

Primaries and secondaries deep chrome-yellow; primaries with the apex and outer margin broadly bordered with brownish black; a small black dot at the end of the cell and two black spots close to the base: secondaries edged with brownish black from the apex to the anal angle; a small black spot at the end of the cell. Underside as above, but with the spots more distinct. Head, thorax, and abdomen chrome-yellow; antennæ black; abdomen with a dorsal row of black spots; legs yellow, with the tarsus black.

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

Hab. East Africa, Zanzibar and Dar-es-Salaam (*Mus. Druce*).

Liparidæ.

SOLOE, Walk.

Soloe tripunctata, sp. n.

Male.—Primaries and secondaries uniformly pale chrome-yellow, slightly hyaline near the base of the secondaries; the fringes of both wings yellow; primaries with the costal margin black near the base; an oval black spot at the end of the cell and a round black spot in the cell nearest the base: secondaries with a black spot at the end of the cell. Head, thorax, and abdomen yellow; antennæ and legs yellow; palpi yellow, with the terminal joint black.

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

Hab. East Africa, Dar-es-Salaam (*Mus. Druce*).

AROA, Walker.

Aroa libyra, sp. n.

Male.—Primaries smoky brown, shaded with grey along the outer margin and crossed from the costal to the inner margin by two waved black lines; the anal angle shaded with white; a fine submarginal black line extends from the apex to the anal angle: secondaries deep black, the fringe greyish white. Underside of both wings black; the primaries with a large white patch at the anal angle. The head and thorax greyish brown; antennæ brown; abdomen black; the anus bright yellow; legs yellowish.—*Female.* Primaries greyish fawn-colour, shaded with brown at the apex and along the inner margin near the base, whitish at the anal angle, the waved lines crossing the wing almost identical with those on the wing of the male: secondaries pale chrome-yellow, the fringe yellowish white. The head, antennæ, and thorax dark greyish brown; abdomen chrome-yellow, with a line of black spots from the base to the anus; legs yellow, the tarsus black.

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

Hab. East Africa, Dar-es-Salaam (*Mus. Druce*).

Aroa tomisa, sp. n.

Female.—Primaries and secondaries pale yellow; primaries shaded with brown along the outer margin from the apex to the anal angle: secondaries with some indistinct brown marks on the apex and outer margin near the anal angle. The head, thorax, and abdomen chrome-yellow; antennæ and legs black The underside of both wings pale yellow, entirely without markings.

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

Hab. East Africa, Dar-es-Salaam (*Mus. Druce*).

Aroa (?) *enos*, sp. n.

Female.—Primaries dark reddish brown, darkest from the end of the cell to the anal angle: secondaries yellow, broadly bordered with reddish brown from the apex to the anal angle. The head, antennæ, thorax, and legs reddish brown; abdomen yellow, with a row of black spots from the base to the anus.

Expanse 2 inches.

Hab. West Africa, Old Calabar (*Mus. Druce*).

MELANOTHRIS, Feld.

Melanothris mœonia, sp. n.

Primaries and secondaries reddish brown; primaries crossed from the costal margin nearly to the anal angle by a wide semihyaline yellowish-white band, which is thickly irrorated with brown scales near the anal angle; a small white dot close to the apex, and a very fine submarginal zigzag white line extends from the apex partly along the outer margin; the fringe yellowish brown: secondaries without markings; the fringe yellowish brown. Underside of both wings very similar to the upperside. The head, antennæ, thorax, abdomen, and legs dark reddish brown; the collar yellow.

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

Hab. West Africa, Old Calabar (*Mus. Druce*).

Saturniidæ.

ANTHERÆA, Hübn.

Antherœa osiris, sp. n.

Male.—Primaries yellowish fawn-colour; a small hyaline spot at the end of the cell; two white lines cross the wing from the costal to the inner margin, the first nearest the base, slightly waved; on the outer side of this line the wing is thickly powdered with white scales; the second line is considerably beyond the cell and is edged with black on the outer side: secondaries pale brownish pink, the outer margin broadly bordered with fawn-colour; a small hyaline spot at the end of the cell broadly surrounded with orange, black, pale yellow, and white rings; a white line edged with black crosses the wing from the apex to the inner margin above the anal angle; the fringes of both wings fawn-colour. Underside, both wings with the outer lines as above, but very indistinct; the primaries very pink, the secondaries very thickly powdered with white scales. The head, antennæ, thorax, and abdomen fawn-colour; the collar white; legs brown.—*Female* very similar to the male, but with the white lines crossing the wings slightly wider and more distinct; the antennæ are black; the underside is also darker in colour than the male.

Expanse, ♂ $5\frac{1}{4}$, ♀ $5\frac{3}{4}$ inches.

Hab. East Africa, Dar-es-Salaam (*Mus. Druce*).

Lasiocampidæ.

STENOGLENE, Feld.

Stenoglene pira, sp. n.

Female.—Primaries pinkish brown, palest near the outer margin, crossed from the costal to the inner margin with two rows of indistinct black spots, the outer margin shaded with dark brown: secondaries pale fawn-colour, with a few black hairs along the inner margin. Head, thorax, and abdomen pale brown; antennæ dark brown; legs yellowish brown.

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

Hab. East Africa, Dar-es-Salaam (*Mus. Druce*).

Stenoglene nahor, sp. n.

Male.—Primaries dark smoky brown, palest along the outer margin, crossed beyond the middle from the costal to the inner margin by two fine waved dark brown lines; three small angular-shaped black spots close to the apex: secondaries pale brownish fawn-colour, darkest at the base and along the inner margin; two fine brown lines cross the wing below the middle, extending from the apex to the inner margin; the fringes of both wings yellowish brown. Head, antennæ, thorax, and abdomen brown.

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

Hab. South-east Africa, Umtata, Pondoland (*Mus. Druce*).

Stenoglene velutonia, sp. n.

Male.—Primaries reddish brown, crossed from the costal margin close to the apex by a dark brown rather wide line, edged with pinkish white on the outer side, extending to the inner margin near the base; the fringe pinkish brown: secondaries chrome-yellow, crossed about the middle from the apex to the inner margin by a reddish-brown line; the fringe on the inner margin, the anal angle, and part of the outer margin pinkish brown. Underside of both wings yellow. Head, thorax, and upperside of abdomen brown; the underside of the abdomen and legs yellow.

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

Hab. West Africa, Cameroons (*Mus. Druce*).

Viana, Walk.

Viana tristis, sp. n.

Male.—Primaries and secondaries uniformly pale brown; both wings with a dark brown submarginal line extending from the costa to the inner margin. Head, antennæ, thorax, and abdomen pale brown. Underside of the thorax and abdomen pale yellow; legs yellow.

Expanse 2 inches.

Hab. West Africa, Gambia (*Mus. Druce*).

This species is allied to *Viana velutina*, Walker.

Eutricha, Steph.

Eutricha sophax, sp. n.

Female.—Primaries dark smoky brown, slightly paler on the outer margin; an indistinct brown line crosses the wing from the apex to the middle of the inner margin: secondaries very dark brown, with the basal third of the wing white, the fringe of both wings yellowish brown. Head, antennæ, thorax, abdomen, and legs dark brown; the anal segments of the abdomen and a line on each side bright yellow.

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

Hab. East Africa, Dar-es-Salaam (*Mus. Druce*).

Bombycidæ.

Ctenogyna, Feld.

Ctenogyna lytæa, sp. n.

Primaries and secondaries pale greyish fawn-colour; primaries crossed from the apex to the inner margin by a pale yellowish-brown line: secondaries crossed at the middle with a line, the same as on the primaries; a small black dot at the end of the cell. Head, antennæ, thorax, and abdomen pale fawn-colour; legs fawn-colour.

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

Hab. West Africa, Lagos, Gambia, Fantee (*Mus. Druce*).

Notodontidæ.

Phalera, Hübn.

Phalera imitata, sp. n.

Male.—Primaries silvery grey, very similar to those of *P. bucephala*, Linn.; the general coloration almost the same, but crossed by four waved rather indistinct brownish-black lines; the buff tip very similar to that of *P. bucephala*, but clearer: secondaries creamy white, thickly clothed with yellow hairs on the inner margin from the base to the anal angle; the marginal line black; the fringe cream-colour. Underside of both wings pure white, the veins black. Head and thorax dark reddish brown; tegulæ silvery grey; abdomen dark orange-yellow, pale at the anus; antennæ yellowish brown, only pectinated to the middle, the outer half simple; legs smoky brown.

Expanse 2 inches.

Hab. East Africa, Dar-es-Salaam (*Mus. Druce*).

L.—*New Species of Lepidoptera from the Khasia Hills.* By Col. C. Swinhoe, M.A., F.L.S.

Nymphalinæ.

Neptis nashona, sp. n.

♂ ♀. Like *N. vikasi*, Horsf., in the coloration on the upperside, bands a little whiter. Fore wings with the cell-streak very similar; the subapical streaks narrow and well separated; the submarginal band rather broad and continuous, not sinuated; three spots near the hinder angle round and small, decreasing in size to the hinder margin, on which the spot is often very small and does not expand on the margin: on the hind wing the antemedial transverse band is narrow and expands somewhat on the abdominal margin; the outer band is broad, well away from the margin, and is not broken up by the veins; the submarginal band complete and not sinuous; cilia of both wings white at the apices and opposite the veins. Underside with the ground-colour of the wings chestnut-brown, as bright as in *N. cartica*, Moore, with the bands nearly as white, corresponding to the bands above, but broader.

Expanse of wings $2\frac{6}{10}$ inches.

Cherra Punji. Fourteen males and one female.

Lycænidæ.

Deudorix diara, subsp. n.

♂ ♀. Above similar to *D. epijarbas*, Moore. Underside differs from that species in having the upper and outer areas of both wings silvery grey (nearly pure white), making the square patches at the ends of the cells and the discal bands stand out very prominently.

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

Jaintia Hills. Five males and two females.

Like a melanistic form of *D. epijarbas*; but my seven examples are all exactly similar to each other.

Lehera Skinneri, Wood-Mason and de Nicéville.

Lehera Skinneri, Wood-Mason and de Nicéville, Journ. As. Soc. Beng. 1886, p. 369, pl. xv. fig. 3.

Cherra Punji.

Two males and one female of this very rare species. It is much smaller than *L. eryx*, Linn., in both sexes; the male is only $1\frac{4}{10}$ inch in expanse of wings, whereas the expanse of *eryx* is $1\frac{9}{10}$; the upperside is duller in colour, the blue sheen more restricted on the hind wings; on the underside the markings are similar, but the ground-colour is dull pale ochreous yellow, instead of dark bright green, as in *eryx*. The type specimen (a female), which is in the Indian Museum, Calcutta, came from Cachar.

Tajuria valentia, sp. n.

♂. Upperside blue, resembling *Camena cleobis*, Godt., but slightly paler: fore wing with the costal and apical black band very similar, but extending to the hinder angle; in some examples the band is as broad here as in *T. thyia*, de Nicé., covering all the wing except the cell and space below the first median veinlet; in other examples there is some blue in the outer interspace above: hind wing with the costal border black, fining downwards round the apex to a fine line on the outer margin; abdominal space nearly pure white; tails black, with white tips; anal lobe small, with a blackish outer patch and a fine white thread running up a short distance on the outer margin; cilia black, with white tips; the veins black on both wings. Underside: both wings French grey, exactly as in *T. thyia*, both wings crossed by a broken, somewhat sinuous, reddish-brown line with pale outer margin, much further away from the margin than in *thyia*, extending on the fore wing from the subcostal to the submedian nervure, recurved posteriorly on the hind wing to the abdominal margin; both wings with a pale indistinct lunular line close to the margin, the lunules more distinct on the hind wing; an oval deep black spot near the outer margin in the first median interspace surrounded by an ochreous square space; a small black spot on the anal lobe, margined inwardly with blue scales, followed by a small ochreous patch; between these two patches are some greyish-blue scales.

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

Cherra Punji. Many examples.

Identified heretofore as *T. mantra*, Felder, from Celebes and Borneo, the type of which is in coll. Rothschild; differs from that species in its smaller size, in the blue area of the upperside being much darker and rather less extensive; the ground-colour of the underside is paler and the linear band differently placed, being much further in, colour different, being reddish brown, whereas in *mantra* it is merely of a darker shade of the ground-colour. *T. mantra* has also an indistinct marginal band, which in this species is absent. Mr. Hamilton H. Druce tells me that this species is nearer *T. isœus*, Hew., from Borneo, but I have not that species to compare it with.

Tajuria nela, sp. n.

♂. Upperside bright cærulean blue, paler than in *T. diœus*, Hew.; costal and apical band black and very deep, limited by the median vein, and then broadly down the outer margin to just below the first median veinlet, where it is rounded off in some examples, leaving the remainder of the margin with a fine black line; in others it reaches the hinder angle and curves a little on to the hinder margin. Hind wing with a broad blackish-brown costal margin, limited by the subcostal vein; the costal space pale and in some examples nearly white; outer marginal line black, with three submarginal blackish spots in the interspaces near the anal angle; tails black, fringed with white, as is also the cilia of both wings; anal lobe with a black spot crowned with orange; abdominal space whitish, the white hairs often hiding the orange on the anal lobe. Underside grey, paler than in *T. longinus*, Fabr., but not so white as in *T. diœus*; very similar to *longinus* in its markings; the discal transverse line is, however, more flexuous and curves in on to the costa in both wings at a greater distance from the apex than in *longinus*; there is also on both wings an indistinct grey submarginal line and an indistinct grey band between this line and the margin; a black spot on an orange ground in the first submedian interspace near the margin, another crowned with orange on the anal lobe, with a pale lunular mark on a grey ground between them.

♀. Pale slaty grey above, with some blue scales at the base; otherwise it is similar to the male.

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

Jaintia Hills. Ten males and two females.

Above, this species has the appearance of a large bright-looking *T. jehana*, Moore; the costal band is, however, much broader, the underside is different, and the female lacks the discal flexuous black line above which is such a conspicuous feature in the females of both *jehana* and *longinus*.

Sesiidæ.

Adixoa cruentata, sp. n.

♀. Palpi brown above, white below, and crimson at the tips; antennæ orange-red, black above, and with black bands;

head, thorax, and abdomen above black, streaked with crimson on the sides of the collar, sides of the abdomen, and anal tuft. Wings hyaline, with black veinlets; costa of fore wings black, as is also the outer third of the costa of hind wings; both wings with the cilia black; a black patch at the ends of the cells; base and chief veins crimson: hind wings with a crimson patch on the inner side of the black patch, and the entire abdominal area crimson: on the underside the thorax is marked with white, the abdomen with white bands; fore legs black, with broad pale yellow bands on the tarsi; hind legs crimson, with thin black bands at the tarsal joints; anal tuft below black.

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

Cherra Punji. One example of this very distinct species.

Notodontidæ.

Pydna aroides, sp. n.

♂. Pale ochreous; fore wings irrorated with red and brown atoms, thickened on the costal and hinder borders, and in a streak from the apex to the centre of the wings, where there is a cluster of irrorations between two transverse brown lines, which are dentated and much bent outwards—one is before and the other beyond the middle; the dentations on these lines are marked with brown spots, and there is another similarly spotted line before the margin which curves in on to the hinder margin one fourth from the angle: hind wings tinged with pale pink. Underside of a uniform pale dull ochreous grey, without markings except on the costal borders, which are irrorated with brown, and the cilia of the fore wings is ochreous, with black streaks opposite the veins.

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

Cherra Punji. Two examples.

Antennæ pectinated to the tips, as in the *P. testacea* group.

Pydna essa, sp. n.

♂ ♀. Pale ochraceous, the female with the fore wings darker ochraceous than the male: fore wings with many transverse bands of small ochreous-brown spots, curving inwards on to the hinder margin, and with some ochreous-brown suffusions beyond the end of the cell, at the apex, and on the hinder marginal area, also a black spot in each interspace close to the outer margin: hind wings suffused with brown except on the costal area and cilia. Underside uniform, much paler than on the upperside, with the inner areas of both wings suffused with brown.

Expanse of wings, ♂ 2, ♀ $2\frac{4}{10}$ inches.

Shillong. One pair.

♂. Antennæ with short bristles, as in *P. pallida*, Butler, from Japan, to which this species is allied, but from which it is perfectly distinct. I have a fine series of the Japanese species, which is uniformly much smaller, differently coloured, and almost free from any markings.

The *Pydna notata*, Swinh., which Hampson has sunk as a synonym of *P. pallida* ('Moths,' i. p. 140), Mr. Warren has pointed out to me, though superficially like a *Pydna*, is a Crambite, and not a Notodont.

Pydna crenelata, sp. n.

♂. Pale brownish ochreous: fore wings suffused with brownish on the lower half; a darker brown shade from the cell to the outer margin, with a short brown streak at the apex; black spots on the upper portions of the wings, three or four at the base, a group before the middle, with a large spot below the median vein, a largish spot at end of cell, and a group in the upper discal portion; some marginal black points: hind wings uniform pale brown, unmarked; cilia greyish ochreous. Underside pale greyish ochreous; both wings suffused with brown in their inner portions and some black marginal dots on fore wings below the apex; legs marked with black stripes.

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

Cherra Punji. One example.

Antennæ with short bristles.

Lymantriidæ.

Pantana luteiceps, sp. n.

♂. Antennæ, body, and wings above dull black: fore wings with a whitish spot at the upper end of the cell, crowning a large whitish space on the lower half of the wing, including the lower half of the cell, leaving the outer and hinder margins of the ground-colour of the wings: hind wings uniformly black, without markings. Frons, palpi, thorax, and abdomen beneath luteous; legs also luteous; wings beneath coloured as above.

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

Cherra Punji. Two examples.

Of the same dull black colour as *P. albifascia*, Walker, but much smaller and very distinct.

Lithosiidæ.

Æmene diffusifascia, sp. n.

♂. Grey; fore wing covered with diffused bands of blackish brown; a short band from the costa near the base; a broad central pale band, very diffuse and narrowing on to the hinder margin, followed by two discal sinuous thin bands; two large black subapical spots, the larger one on the costa and the other immediately below it, and an irregular band close to the margin; also a marginal black line broken by the veins: hind wings grey, unmarked.

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

Shillong. One example.

Sarothripidæ.

Argyrothripa olivana, sp. n.

♂. Dark olive-brown; palpi white beneath: fore wings with a greenish tinge; an indistinct brown band from costa close to base to hinder margin one third from base; a large pink-brown oval patch occupying nearly the whole of the outer portion of the wing, edged with brown, with a brown patch on its inner side; some black marks at the apex and indistinct short brown streaks on the veins on the outer margin, which are continued on to the dark olive-grey cilia, which is interlined with reddish brown: hind wings nearly black, uniformly coloured and without markings; cilia grey, with a fine antecilial white thread. Underside uniformly blackish brown, with the costal portion of fore wings and apical portion of hind wings luteous.

Expanse of wings 1 inch.

Shillong. One example.

Quadrifidæ.

Nyctipao jaintiana, sp. n.

♂ ♀. Black-brown: fore wing with an indistinct curved dark antemedial line; the discocellular whorl shaped as in *N. glaucopis*, Walker, margined with ochreous grey, edged with black, and with blue metallic scales on the head of the whorl; the outer black line of the whorl attached to the costa at its centre, and joins below a curved dark line which runs parallel with the antemedial line; a prominent pure white discal curved band, broad at the costa, which it does not quite touch, sinuous, with several long dentations towards the outer margin, and fines down gradually to the hinder margin near the angle, which it does not quite reach; the second and fourth dentations the longest: hind wings with a thin white and very sinuous discal line; cilia of both wings white. Underside dull black-brown, not glossed as in *albicincta* and *glaucopis*; fore wing with a short white band on each side of the discoidal vein; the white toothed discal band broken up and macular; the white line of the hind wing broken up into thin lunules.

Expanse of wings $3\frac{8}{10}$ inches.

Jaintia Hills. Two pairs.

Allied to *N. glaucopis*, but lacks the beautiful blue sheen of that species.

Nyctipao ophristigmaris, Hampson (Trans. Ent. Soc. 1895, p. 305), is the male of *N. gemmans*, Guen.; I have received many of both sexes from Cherra Punji. There is often a similar difference between the sexes in the species *N. glaucopis*, Walker.

Hypenidæ.

Hypena nocturnalis, sp. n.

♂ ♀. Olive-brown; fore wing with an outwardly curved indistinct subbasal line; a postmedial erect and nearly straight line, outwardly edged with ochreous; halfway between this and the margin is a sinuous dark line with pale outer edge, and marked inwardly with black spots; in some examples there are also two large black spots on the inner side of the postmedial line, and in one example the line runs through these black spots, and there are black diffused streaks between the lines; a black spot at the end of each vein on the outer margin: hind wings darker brown, unmarked; cilia of both wings brown, interlined with ochreous.

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

Cherra Punji. Many examples.

Allied to *H. ophiusoides*, Moore, and *H. uniformis*, Hampson; from the former it can be distinguished by the postmedial line being straight: in *ophiusoides* there are two acute outer dentations; in *uniformis* this line inclines outwards and is not erect.

LI.—*On Odonata from the Province of Szechuen, in Western China, and from Moupin, in Eastern Thibet.* By Robert M'Lachlan, F.R.S. &c.

In the Ann. & Mag. Nat. Hist. for May 1894 I published (pp. 421–436) a notice of Neuroptera from Ta-chien-lu, in Szechuen, received from my friend Mons. René Oberthür. Since then the same kind friend has sent me a further collection from other neighbouring localities in the same province and also from Eastern Thibet. They are principally Odonata, and I do not here propose to notice the few insects of other groups of Neuroptera, neither do I intend to include some few species present in both consignments where there is nothing of interest in connexion with them. In the following pages several new species are described and previously unknown sexes of others, also notes of local and general interest. As previously noticed, the affinities are with Japan and North China.

Subfam. *Libellulina.*

Thecadiplax ardens, M'Lach.

A series of individuals of both sexes from Moupin agree with those previously described from Ta-chien-lu. Furthermore, several specimens taken by my friend Mr. J. J. Walker in the Chusan Archipelago and on the neighbouring coast of China seem also to belong here, independent of the question of specific right or as representing a race of *Th. erotica*, Selys.

[N.B.—This appears a fitting opportunity for a short statement with regard to *Thecadiplax infuscata*, Selys, and *Th. erotica*, var. *fastigiata*, Selys.

Th. infuscata was originally described by my friend Baron de Selys (Ann. Soc. Ent. Belg. xxvii. p. 90, 1883) from a pair (♂ ♀) in my collection, the female of which had lost the end of the abdomen. *Th. erotica*, var. ♀ *fastigiata*, was noticed at p. 91 of the same volume of the 'Annales.' In both of these the apical portion of the wings is smoky or blackish.

In the same 'Annales' for 1884, p. 40, Baron de Selys doubts whether the individuals described as a variety of the female of *erotica* under the name *fastigiata* should not more properly be considered *infuscata*, and he expresses some doubts as to whether the abdomen and head of the original male type of *infuscata* might not have been accidentally broken off and replaced by that of some other species. It appears to me practically certain that *Th. infuscata* and the var. *fastigiata* are *specifically identical* and distinct from *erotica.* I can state positively that the head and abdomen of the original male of *infuscata* have never been detached and also that the two small steel-blue spots are *present* (contrary to what is stated in the original description) and less rudimentary than those in the original female type. Furthermore, I have since received another male agreeing perfectly with the original in wings, genitalia, and appendages, but in this individual the two steel-blue spots *are* absent.

Thecadiplax is made up of incongruous materials, and it is probable that the large and ponderous *Th. baccha*, Selys, may form a group by itself; of this the female is at present not known to me, but I possess three males taken by Mr. J. J. Walker in the Chusan Archipelago and vicinity.

Here, also, I allude to the solitary male insect from Ta-chien-lu mentioned in my former paper (p. 432) as "*Agrionoptera* (?), sp." In this insect there are symmetrically *two* nervules in the median area ot the posterior wings (one forming the inner triangle and one other), and in the same wings the arculus is symmetrically not coincident with the base of the triangle, but placed distinctly (though not distantly) more towards the base. These characters induced me to think of *Agrionoptera* as a possible, though doubtful, location. Further examination causes me to think its position is near *Thecadiplax infuscata*, although the characters just alluded to are foreign to such a connexion. The general form is not opposed to such a position: there are only ten antenodals (the last not continuous); the extreme apex (after the *end* of the pterostigma) of all the wings is infuscated, and the genitalia and appendages do not apparently differ from those of *Th. infuscata.* The top of the face is unspotted (the form of the prothorax it is not now possible to define). Whether this be a case of individual aberration, or whether it is indicative of a group in which there is plasticity of neuration as well as of other characters usually considered essential, further materials can alone decide.]

Orthetrum internum, M'Lach.

Orthetrum japonicum, var. *internum*, M'Lach. Ann. & Mag. Nat. Hist. May 1894, p. 431.

In my former paper I gave certain characters separating this from typical *O. japonicum*, Uhler. The only one of any importance was that the triangle of the posterior wing appeared to be constantly traversed by a nervule in *internum* and constantly free from such nervule in *japonicum*. Having examined more examples, the same rule appears to hold good, and as such a character when constant is regarded as of specific importance, I here quote *internum* as a species. In some females of *japonicum* the middle lobe of the labium is dusky. As before, it is difficult to define any differences in the genitalia.

O. internum occurs also in the Khasia Hills and in other localities of the North Indian side of the Himalayas.

Orthetrum melania, Selys.

A series of examples from Siao-Lou and also from Moupin, the latter showing a still further western extension of the species. The male previously noticed from Ta-chien-lu was highly adult and pulverulent; those now before me are mostly immature, allowing a comparison as to colours and markings with the Japanese types. No differences are apparent in the colouring of the body; it is, however, probable that the dark space at the base of the wings often remains yellowish (not dark brown) in continental examples.

Crocothemis servilia, Drury.

A series of males from Moupin are remarkable for the very dark, almost brownish, base of the wings, the colour being also sharply delimitated on the posterior wings; the neuration is dark and the apical margin is usually narrowly dusky. I have similar examples from the coast of North China. These examples induced me to go through, probably for the sixth time, a series of about one hundred specimens of *Crocothemis*. They were attacked primarily with the idea of finding specific, or strongly racial, characters in the specimens above referred to, and secondly to test the possibility of separating *C. servilia* and *C. erythræa*. Neuration and the genitalia of the second segment were especially examined.

It is easy to say that large examples from Hong Kong or Japan are *servilia*, and that smaller ones from Europe, Africa, India, &c. are *erythræa*, and it is tolerably easy to isolate examples intermediate as to size, such as those from Moupin &c.; but once again have I failed to find any certain *structural* characters. There are slight neural differences, but only such as are either individual or correlated with size, and there are slight differences in the genitalia even in individuals from the same locality, but in the majority of cases of a nature more illusory than real. Some other investigator may be more fortunate.

Subfam. *Gomphina.*

Gomphus scissus, sp. n.

♀. Head shining black; a spot on each side of the face at the corners of the mouth, a rather broad transverse band at the top of the front, and a small triangular spot at the back of the middle of the occiput yellow; occiput strongly ciliated, produced in its middle into an erect flattened tooth, which is broad and triangular at its base, but afterwards strongly acuminate, *the apical portion narrow, the apex itself obtuse and slightly bifid.* Prothorax black, with a transverse nearly interrupted median spot, followed by a short line. Thorax black above, with grey pilosity, anteriorly with two transverse yellow lines (forming the collar), separated by the dorsal crest; behind these is an oblique *isolated* short yellow band on either side of the dorsal crest, and a small isolated yellow spot below each band placed more outwardly; two small yellow dots in the sinus; in the interalar area are three yellow spots: sides yellow, a black line on the interalar suture, connected anteriorly with a much angulated black line which extends nearly across the pectus, which latter is otherwise yellow. Legs short, wholly black. Abdomen dilated at the base, but afterwards slender, black, marked with yellow as follows:—above, a transverse spot on the first segment, followed by a median longitudinal band on the second; a fine interrupted dorsal line on the third, continued as a short basal line on the fourth to seventh, and a narrow ring at the apex of the ninth. Sides marked as follows:—a broad band on the first and second segments, continued as a narrower band on the third (interrupted in the middle by the false suture), a small basal and postmedian spot on the fourth to eighth, and the lateral margins of the eighth and ninth. Appendages about as long as the tenth segment, cylindrical, acute, yellow, tipped with black, a rounded black protuberance between them ciliated with black. Vulvar scale two thirds the length of the ninth segment, black, *divided almost to the base into two long slender parallel spines*, the apices of which are slightly upcurved.

Wings hyaline, strongly tinged with yellow to beyond the triangles in the anterior, and nearly up to the nodus in the costal portion of the posterior; neuration black; pterostigma long ($3\frac{1}{2}$ millim.), yellowish brown; 14 antenodal and 13 postnodal nervules in the anterior wings.

Length of abdomen, ♀ 40 millim.; length of posterior wing, ♀ 35 millim.

Siao-Lou (Szechuen), one female.

Notwithstanding that the male remains unknown, there can be little doubt that this species is allied to *G. melænops*, Selys, and *G. Pryeri*, Selys, both from Japan. Both of these show an analogous conformation of the occiput, but in a much less pronounced manner, and are of the same general aspect but larger. The condition of the vulvar scale in *G. scissus* is remarkable.

Subfam. CORDULEGASTRINA.

Anotogaster Sieboldii, Selys.

Moupin, one male, two females.

These seem to possess some slight differences when compared with numerous examples from Japan and North China. The two yellow spots at the base of the labrum are apparently smaller; the yellow in the excavated portion of the top of the front is reduced to a mere marginal thread (virtually obsolete in one very adult female), and the wings of the female seem more strongly washed with yellow up to the triangles, almost as in *A. nipalensis* and *A. basalis*. Possibly the stature is slightly less robust. It would be necessary to see more materials before deciding if the differences alluded to are constant and worthy of the imposition of a varietal name.

Cordulegaster luniferus, Selys, and var. *pekinensis*, Selys.

Four males and two females from Siao-Lou, Mo-si-mien, and other localities in Szechuen. Of these I should be inclined to refer three males to *luniferus* and one male and two females to *pekinensis*, irrespective of locality, according to description. Having now so much more material before me, the distinctness of *luniferus* and *pekinensis* seems very doubtful. I have seen no male so large as is indicated for *pekinensis*.

Subfam. ÆSCHNINA.

Æschna ornithocephala, sp. n.

♂. Head: labium and palpi brownish; labrum and face uniformly pale greenish yellow, margined with blackish at the summit; top of the front excavated, its margin broadly blackish, which colour descends in the middle, forming a very ill-defined T-spot, the blackish colour blending with somewhat livid side-spots; vesicle black; eyes connected in a long space, occiput forming a small black triangle. Thorax black, above with two broad greenish-yellow bands, interrupted posteriorly by the sinus; the sides with two broad oblique greenish-yellow bands, one under each wing; probably some pectoral yellowish spots. Legs black. Abdomen with the first and second segments considerably dilated; oreilettes not prominent, flattened, yellow, with about three blackish marginal teeth; general colour dull blackish, becoming deeper black towards the apex, with indications of livid (blue or green during life?) markings as follows:—a broad lateral band and an indistinct dorsal band on first and second segments, a narrow margin posteriorly to the second to sixth, a broader submedian band (or semi-annulus) on the third to eighth placed just below the false suture; tenth segment above with a rather strong longitudinal median carina, *dilated posteriorly into a very strong laterally flattened triangular tooth* directed slightly towards the apex. Superior appendages scarcely so long as the ninth and tenth segments united, black; viewed from above they are narrow at the base, afterwards gradually dilated internally to the apex, which is very obtuse and slightly excavated, the opposing apices touching; the median longitudinal carina only faintly indicated, merging into the thickened apical portion; the inner edge fringed with long blackish hairs in the median portion: viewed laterally these appendages are straight, narrow at the base; subsequently the upper and lower edges form carinæ, the upper just before the apex becoming suddenly dilated and rounded (excavated above), and the lower ends in a short beak-like process, slightly upcurved, causing the entire apex to have a striking resemblance to the profile of the head of some kind of bird (*e. g. Regulus*, with the crest not erected). Inferior appendage fully two thirds the length of the superior, gradually acuminate, its apex apparently entire, slightly upcurved if viewed laterally; above deeply concave and brownish black, beneath black.

Wings hyaline; membranule white; pterostigma black, small ($3\frac{1}{2}$ millim. in anterior, shorter in posterior wings), surmounting $2\frac{1}{2}$ cellules; neuration black; anterior wings with 18 antenodal and 12 postnodal nervules, 2 supra-trigonal, 2 in the triangle; post-trigonal cellules commencing singly, then two rows, followed by three, and increasing; subnodal sector furcating on a level with the pterostigma (slightly before in the posterior); posterior wings with 12 ante- and postnodal nervules; 2 supra-trigonal and 2 in the principal triangle; anal triangle with 3 cellules.

Length of abdomen (*cum append.*) 54 millim.; length of posterior wing 48 millim.

Moupin, one male.

It is probable that the nearest ally of this well-marked species is the Japanese *Æ. melanictera*, Selys, which it resembles in the possession of the strong tooth on the tenth segment, and there is some amount of affinity in the structure of the apex of the superior appendages; but the small size, very small pterostigma, much shorter appendages &c. of the present insect are opposed to any very close relationship. The remarkable bird's-head-like profile of the end of the superior appendages is reproduced to some extent in the European *Æ. cyanea* and the North-American *Æ. constricta*, but neither of these has the tooth on the tenth segment.

N.B.—The female from Ta-chien-lu referred doubtfully to *Æ. juncea* in my former paper has no relationship to the present species, and was probably correctly referred.

Subfam. *Calopterygina.*

Calopteryx Oberthüri, M'Lach.

One female is from Siao-Lou, in the same district as Ta-chien-lu.

Matrona basilaris, Selys.

Nearly thirty examples of both sexes from Siao-Lou, Mo-si-mien, Moupin, and other places in the district, all pertain to the type form and not to the race *nigripectus*, Selys.

Archineura incarnata, Karsch.

One adult female from Siao-Lou. As this sex has not been described, I append a description, omitting points common to both sexes:—

♀. Labrum pale yellow, with a narrow black border and a black line at the base, emitting a central prolongation not extending across. Colour of the body brighter green; a small yellow spot or line on the sides of the thorax above the insertion of each coxa, and a similar spot or line on each coxa itself externally; some small yellow spots under the insertion of the wings. Ninth and tenth abdominal segments slightly pulverulent; a median yellowish line on the dorsum of the ninth not reaching the extremities, and on this segment slightly before its apex there is a small median, nearly acute, conical tubercle, a slight median carina on the tenth; appendages shorter than the tenth segment, black, slightly divergent; vulvar lamina of the ninth ventral segment strong, broadly keel-shaped, its appendages black, filiform.

Wings hyaline, pale fuliginous, slightly tinged with olivaceous at the extreme base and along the costal margin to the nodus; neuration mostly reddish, the marginal nervures black, the costal nervure whitish pruinose externally; the nodal sector takes its origin slightly *before* the continuation of the nodal vein (in the male in my possession this sector arises distinctly *after* the nodal vein); pterostigma dull yellow between strong black veins (length 4 millim., broader than in the male); about 45 antenodal nervules in the anterior wings.

Length of abdomen 60 millim.; length of posterior wing 53 millim.

Considerably larger than the male, with no trace of the red base of the wings so conspicuous in that sex. The colour of the neuration and of the pterostigma resembles that seen in the very immature male described by Kirby as *A. basilactea.*

Vestalis smaragdina, Selys.

One very adult female from Moupin. It differs somewhat from the description and from specimens from the Khasia Hills in my collection. The size is larger (abdomen 43 millim., posterior wing 40 millim.). The abdomen above is metallic blue rather than green, with the ninth and tenth segments conspicuously whitish-pulverulent. The legs (excepting at base) nearly blackish, with the femora brown internally. Wings hyaline, with scarcely any trace of reddish tinge, but slightly olivaceous at base and along costal margin; neuration almost blackish, dark brown in certain lights. It is probable that most of the differences above noticed (excepting that of size) are due to the individual being highly mature.

Caliphæa consimilis, M'Lach.

Four females, two from Siao-Lou and two from Moupin.

These offer no peculiarities other than in abdominal sexual characters. In less highly mature examples the terminal segments of the abdomen are not pruinose above and the wings are simply hyaline, with no olivaceous tinge. Possibly the pterostigma is slightly shorter than in the male. The point of insertion of the nodal sector is slightly variable in different individuals, and there is sometimes only one nervule in the quadrilateral of the hind wings (in one individual there is only one such nervule in the right anterior and left posterior wing and two in the other wings).

Length of abdomen 33–35 millim.; length of posterior wing 31–33 millim.

Subfam. *Agrionina.*

Mesopodagrion, g. n. (légion *Podagrion*).

Nodus placed at one third the distance from base to pterostigma. Pterostigma short-oblong, dilated, surmounting three cellules. Quadrilateral with its upper edge two thirds the length of the lower, so that the outer edge is strongly oblique. Wings ceasing to be petiolated *before the basal postcostal nervule,* which is near the level of the second antenodal. Arculus coincident with the second antenodal. *Postcostal area with one row of cellules.* Subnodal sector commencing from the prolongation of the nodal vein, the median markedly before. Two supplementary sectors between the ultranodal and nodal sectors and between the nodal and subnodal, one between the median and short sectors.

Labium deeply divided, the lobes distant, subacute at apex. Second joint of antennæ somewhat longer than first. Abdomen moderately stout, cylindrical. Superior appendages of male longer than tenth segment, forcipate. Legs moderate, stout, spines long, claws minutely toothed below apex.

Having the facies of *Argiolestes*, but with a single row of postcostal cellules, and distinct from all Old-World forms of the légion in consequence of the wings ceasing to be petiolated before the basal postcostal nervule.

Mesopodagrion tibetanum, sp. n.

♂. Black; head clothed with rather long greyish hairs; labrum, a spot on each side of it, and another spot on each side below the base of the antennæ greenish yellow; two minute oblique lines (one on each side of the ocelli) and a short line on the middle of the occiput yellowish; a large yellow spot behind each eye. Prothorax with a yellow line on each side (continuous with the humeral lines). Thorax with a slightly curved, rather broad, humeral yellow line; sides and pectus yellow, divided by a nearly straight black line, broadest anteriorly. Legs black; coxæ and trochanters spotted with yellow. Abdomen clothed with rather long black hairs at its base, somewhat shining; first segment broadly yellow at sides, second with two yellow lateral lines, third and fourth with one yellow lateral line (not reaching the apex on the fourth), and with a yellow lateral basal spot; ninth and tenth segments probably sometimes pulverulent above, tenth broadly produced into a triangle on its posterior margin, deeply cleft in its middle, yellow on its sides. Superior appendages longer than the tenth segment, subcylindrical, gradually forcipate, the incurved apices acute, not toothed; inferior appendages indicated by a brown swollen base, divided by a line in its middle, filling in the wide excision in the tenth ventral segment.

Wings vitreous, slightly tinged with smoky yellowish; pterostigma (3 millim.) dark reddish brown, between strong black nervures; neuration black; 21 postnodal nervules in the anterior wings, 20 in the posterior.

♀ as in the male, but the labrum and the spots on the front are livid or brownish and the spot behind the eyes is absent or obsolete. Abdomen more shining; a single yellow lateral line on the second segment, continued on the third and fourth, and an apical yellow lateral spot on the third to seventh; ninth with a very large yellow lateral spot, and the tenth largely yellowish on the sides. Appendages as long as the tenth, slightly curved laterally, acuminate, pointed, yellowish at the base; viewed in front there is a large swollen yellow sulcate mass between their base; appendages of vulvar lamina cylindrical, black, strongly curved.

Wings scarcely tinged; pterostigma (slightly immature) whitish yellow; neuration brownish in certain lights; 21 postnodal nervules in anterior wings, 19 in posterior.

Length of abdomen, ♂ 33, ♀ 35 millim.; length of posterior wing, ♂ 30, ♀ 34 millim.

Moupin, one male; Siao-Lou, one female.

Pyrrhosoma tinctipenne, M'Lach.

Erythromma tinctipennis, M'Lach. Ann. & Mag. Nat. Hist. ser. 6, vol. xiii. (May 1894) p. 436.

The discovery of the male renders it certain that this insect is a *Pyrrhosoma* rather than an *Erythromma* (the two genera being defined by scarcely more than colour differences). The single example is from Siao-Lou, in the same district as the locality whence came the females.

♂. Head and thorax as in the female, the pale lines on the thorax more reddish. Abdomen much more slender, bright red; first and second segments yellowish at sides and beneath; a large black subquadrate mark on the first segment above, and the posterior margin of this segment and also of the third is narrowly black; an isolated line on the sides of the seventh not reaching the margins, a thicker and shorter line on the eighth reaching the anterior margin only, and a quadrate spot on the ninth (also reaching the anterior margin) all black; an indication of a paler (yellowish ?) dorsal spot at the base of the seventh, and the ninth and tenth also paler; margin of the tenth shallowly excised in its middle. Appendages reddish yellow, longer than the tenth segment; superior appendages subcylindrical, inserted distantly, somewhat divergent, broader at base, the apices somewhat suddenly incurved and blackish; inwardly at the base is a short slender branch or tooth inserted at nearly a right angle; inferior appendages broader and slightly shorter, their tips incurved and obtuse if viewed laterally.

Wings tinged as in the female; pterostigma somewhat more reddish; 4 antenodal cellules, 15–16 postnodal nervules in the anterior wings.

Length of abdomen $27\frac{1}{2}$ millim.; length of posterior wing 21 millim.

This is the analogue of the European *P. minium* rather than of *P. tenellum*. Both these species have a form of the female in which the abdomen is nearly wholly black or blackish; and it seems quite possible that a form of that of *P. tinctipenne* may be discovered in which the abdomen is in part red.

Ceriagrion melanurum, Selys.

Moupin, three males, one female.

LII.—*Descriptions of Two new Species of Butterflies from New Britain.* By H. Grose Smith, F.E.S., F.Z.S., &c.

Tachyris maculata.

Male.—Upperside. Both wings white: anterior wings with costal and outer margins black, the latter rather broadly and indented between the veins; the apical region crossed by an irregular band of contiguous greyish-black curved bars from the costa at one fourth from the apex to the middle median nervule, the veins between the band and the outer margin being rather broadly black. Posterior wings with a narrow greyish-black band on the margin from the apex to about the lowest median nervule; across the disk is a row of blackish dots representing the row of dark spots on the underside.

Underside. Anterior wings white, tinged with yellow towards the apex; outer margin with a blackish band indented between the veins and terminating on the lowest median nervule; the subapical black band as on the upperside, the bar nearest the costa being nearly obsolete and the others wider than on the upperside. Posterior wings greenish yellow, with a brownish-grey narrow border; the disk is crossed by a row of five brownish-grey spots, of which the uppermost is confluent with the dark marginal band, the third is out of line towards the margin, and the fifth spot is nearly obsolete.

Expanse of wings $2\frac{1}{8}$ inches.

In the collection of Mr. Grose Smith. It is not near any described species. On the upperside the anterior wings somewhat resemble *T. agave*, Feld.

Mycalesis xanthias.

Male.—*Upperside* rufous brown. Anterior wings with two ocelli as in *M. phidon*, Hew., but the ocellus between the two lowest median nervules is larger and rounder than in that species, and its iris is fulvous, becoming brighter fulvous externally. Posterior wings with four discal ocelli, each with a bright orange-fulvous iris, the space beyond the ocelli to the outer margin being also bright orange-fulvous traversed by two submarginal sinuate dark lines.

Underside as in *M. phidon*, but on the anterior wings the lower ocellus is larger and the transverse tawny band across the disk is more curved outwardly at its upper end and is straighter at its lower end towards the inner margin; the space between the transverse bands and the outer margin on both wings is more yellowish than the basal portion of the wings. The row of six discal spots on the posterior wings closely resembles that on *M. phidon*, but the pupils of the third and fourth spots are more strongly marked with black.

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

In the collection of the Hon. Walter Rothschild.

LIII.—*Description of a new Chameleon from Uganda.* By G. A. Boulenger, F.R.S.

Chamæleon Jacksonii.

Casque feebly raised, obtusely angular behind, with strong tubercular parietal crest bifurcating in front; the distance between the commissure of the mouth and the extremity of the occiput equals the length of the mouth; postfronto-squamosal crest strong, tubercular; no canthus rostralis; interorbital region deeply concave; male with three long, conical, smooth horny processes, with circular striæ, directed forwards, one in front of each orbit and the third on the snout; the rostral horn much thicker, but not longer than the orbitals; no occipital lobes; scales on the head unequal, largest on the parietal region. Body and limbs covered with granules of unequal size intermixed with small tubercles; a dorsal crest of large, distant, triangular, compressed tubercles; no gular or ventral crest. Limbs stout, rather short; no tarsal process. Tail as long as head and body. Dark olive, with a whitish lateral streak.

	millim.
Total length	122
From end of snout to extremity of mandible	15
" " " casque	20
Rostral horn	7
Præorbital horn	7
Depth of skull (mandible included)	12
Width of head	10
Body	44
Fore limb	27
Hind limb	28
Tibia	10
Tail	60

A single half-grown male specimen, presented by Mr. F. J. Jackson to the British Museum.

This chameleon agrees in its cephalic horns with the West-African *Ch. Owenii*, Gray, and the East-African *Ch. deremensis*, Matschie. It differs from the former in the heterogeneous lepidosis, the posteriorly pointed casque with strong crests, the absence of occipital lobes, the presence of a dorsal crest, and the shorter tail; from the latter in the presence of a parietal crest, the absence of occipital lobes, of a dorsal crest supported by produced neural spines, and of a ventral crest.

LIV.—*A Further Revision of the Species of Scorpions belonging to the South-African Genera* Uroplectes, Lepreus, *and* Tityolepreus *. By R. I. POCOCK, of the British Museum of Natural History.

THE distinctions between the genera *Lepreus*, *Uroplectes*, and *Tityolepreus*, based upon the dentition of the digits of the chelæ, depends, firstly, upon the number of enlarged teeth (whether 0, 1, or 2) at the apex of the median rows; secondly, upon the position taken up by the teeth of the internal row with regard to the apices of the median series †.

Perhaps the simplest form of dentition is found in such species of *Lepreus* as *planimanus*, Karsch, *carinatus*, Poc., and *variegatus*, C. Koch, where none of the apical teeth of the median rows are enlarged and the teeth of the inner series are throughout the dental area only separated by a small space from the extremities of the median rows and form transverse series with the two enlarged teeth, constituting the posterior termination of the median rows. But the position varies a little in the species named, the inner teeth being further forward in *planimanus* and *carinatus*, so that the short transverse rows are oblique, and a little further back in *variegatus*, the transverse rows being more angular. To this section belongs, in all probability, the type of the genus *Lepreus*, *L. pilosus*, Thor., which is unfortunately unknown to me in nature.

The second type of dental formula to be noticed occurs in such species as *vittatus* and *Fischeri*, which were also referred to *Lepreus*; but the formula here is very different, the teeth of the inner set being separated by a wider space from the middle rows than in *L. planimanus*, and in the posterior five sixths of the digit the individual teeth of the inner series lie well behind the apex of the corresponding median row, so that they alternate with the pair of enlarged teeth of the outer set, instead of forming short oblique transverse rows with them. Considerable difference, however, in the position taken up by the inner teeth is observable, the teeth lying much

* Collectors and others in South Africa who are not acquainted with the generic characters of Scorpions may usually readily recognize the species belonging to this group by their small or medium size, tolerably slender build, thin claws, and bright colouring, most of the species being variegated with black and yellow spots or stripes, though sometimes the body approaches a uniform bright green or even black.

† For the sake of clearness I am considering in this instance that the teeth of the inner series have arisen independently from those forming the median series.

further back in a Transvaal example of *L. vittatus* than in the Somaliland form *L. Fischeri*. A variation of this formula is seen in *occidentalis*, where the inner teeth occupy almost the same position as in *Fischeri*, but in the distal third of the digit the apical tooth of the median series becomes a little enlarged and slightly separated from the rest, and forms with the adjacent tooth of the inner set a pair of teeth. It is upon this character in this species that Kraepelin has based his genus *Tityolepreus*.

A fourth arrangement is found in such species as *chlorodermus* and *triangulifer*, Thor., which are usually referred to the genus *Uroplectes*. In these the disposition of the teeth is only a little different from what is seen in *occidentalis* (*chinchoxensis*), the inner teeth at the proximal end of the digit being isolated and removed to some distance from the apices of the median rows, though in the distal two thirds of the digit they approach the median series and are paired with the slightly enlarged and separated apical teeth. The disposition, however, in the two species named is not identical, and in the closely allied species *U. olivaceus*, here described as new, yet a third variation is presented, the internal teeth being much closer to the ends of the median rows at the proximal end of the digit than in the other two.

And, lastly, there is a fifth arrangement exhibited by such species as *lineatus*, Koch, and *formosus*, Poc., in which the inner teeth are close to the apices of the median rows, forming with the two enlarged and separated terminal teeth of these rows a recurved series.

Trusting to these data, it seems to me to be logical to follow Kraepelin, refusing to recognize the three genera *Lepreus*, *Tityolepreus*, and *Uroplectes*, as established, since there are no fewer than *five* dental formulæ presented by the known species of this section, and the formula varies in closely allied species.

It seems, therefore, that if we adopt the system of splitting the species into several genera according to dentition of the digits, consistency will compel us to recognize no fewer than *five*. I prefer, however, to adopt the alternative hypothesis of referring all the species to a single genus *Uroplectes*, since, in the first place, in addition to the considerations mentioned above, we do not know the dental formula of *U. ornatus*, Pet., the type of the genus *Uroplectes*, whether it be like that of *lineatus* or like that of *triangulifer*, and consequently cannot say to which section of the species the name should be applied; nor do we know with exactness that of the species named *pilosus*, Thor., *otjimbinguensis*, Karsch, *lunulifer*, Sim., and *tricolor*, Sim., for although all these forms were referred to *Lepreus*, their dentition may be of the type presented by *planimanus*, or by *vittatus*, or by *occidentalis*. And, lastly, since all these forms inhabit a single geographical area, it is in the highest degree probable that when the described forms have been re-examined and others discovered still more intermediate links than now exist will be found between the various types of dental formula. Prof. Kraepelin has, however, attempted to maintain the genera *Lepreus* and *Uroplectes* on other grounds (Jahrb. Hamb. Anstalten, xii. p. 7, 1895), referring to the former the two species *pilosus* and *planimanus*, in which there are small lateral keels on the terga, a long basal pectinal tooth in the female, and no tooth beneath the aculeus on the poison-vesicle; and to the latter the species in which there is only one crest on the terga, the basal pectinal tooth is not elongate, and there is a tooth beneath the aculeus. But as regards the armature of the vesicle, it may be said that *variegatus* of Koch, which resembles *pilosus* and *planimanus* in having the lateral tergal crests, has a large tooth on the aculeus; and concerning the structure of the basal pectinal tooth in the female, it may be added that in the female of *U. triangulifer* and of *U. Marshalli* this tooth is unmodified, and that in *variegatus* it is also of the same form as in *lineatus*, and is not elongate as in *pilosus* and *planimanus*; so that this feature cannot at present be looked upon as of generic importance. And, finally, I doubt if the genus *Lepreus* can be maintained on the presence of the lateral tergal keels; such keels, at all events, are not accorded this importance in the case of *Archisometrus tricarinatus* and *Buthus quinquestriatus*.

Uroplectes planimanus (Karsch).

Lepreus planimanus, Karsch, Mitth. Münch. ent. Ver. 1879, p. 125; Kraepelin, Jahrb. Hamb. Wissen. Anst. viii. p. 94, pl. ii. fig. 24 (1891).

The British Museum has recently received three adult examples (two males, one female) of this species from the Umfuli River, 4200 feet, in Mashunaland (*G. A. K. Marshall*). The male differs from the female in having the tail much longer (carapace 4 millim., tail 29 millim.), whereas in the female a specimen with carapace 4·3 millim. has the tail only 22 millim.

Uroplectes carinatus (Poc.).

Lepreus carinatus, Pocock, Proc. Zool. Soc., March 1890, pp. 129, 130, pl. xiv. fig. 3.

Prof. Kraepelin * has recently asserted that this species is identical with *planimanus*, Karsch; but the examination of examples of the latter species has shown me that the two, as I originally supposed, are distinct. In *carinatus* the tail is more strongly keeled, the median keel being quite strong on the third segment and distinctly traceable on the fourth, and the inferior keels on all the caudal segments and the vesicle are distinctly granular. In *planimanus* the inferior keels are smooth on at least the first and second caudal segments, weakly granular on the rest, vesicle punctured basally, the median lateral crest absent on the fourth caudal and exceedingly short on the third; and, lastly, in *planimanus*, as the name indicates, the hand, especially in the male, is flat above, broad, and with its inner edge compressed, whereas in *carinatus* it is thinner and of the normal spherical form. The small disparity in size between the type of *carinatus* and the smallest male of *planimanus* lends no support to the supposition that these distinctions are due to differences of age.

Unfortunately we have no nearer locality for this species than S. Africa, near the Tropic of Capricorn. It agrees with my examples of *planimanus* in having nine distinct median rows of teeth on the digits, without counting the exceedingly short apical set. According to Karsch there are only eight rows of these teeth.

Uroplectes variegatus (C. Koch).

Tityus variegatus, C. Koch, Die Arachniden, xi. p. 9, fig. 855 (1845).

Colour pale yellow, variegated with black; the interocular area black, mesially flavous in front, the area of the carapace behind the tubercle with a black edge, irregularly fuscous laterally and fuscous in the middle. The tergites adorned with seven black lines, the three keels on each and the lateral edges being black, with a large black patch between the edge and the lateral keel; the tail black-lined, the pigment marking the keels; there is also a black line in the middle of the dorsal surface and one in front in the middle of the inferior surface; the fifth segment fuscous throughout, only obscurely fulvo-lineate; vesicle entirely pale, aculeus posteriorly black. Cheliceræ entirely pale. Chelæ with trochanter,

* Jahrb. Hamb. Wissen. Anst. xii. p. 16 (1895).

humerus, brachium, and manus variegated with black, the last two especially so posteriorly, digits pale. Legs with femora and patella variegated with fuscous; lower surface of the trunk quite pale, the last sternite only being obscurely lined with black.

Carapace coarsely granular but not carinate, the ocular tubercle granular. *Terga* coarsely granular, each of the first six marked with three granular keels, the lateral keels on the anterior segments only represented by a single tubercle, the keels on the seventh tergite strong and denticulate. Three anterior *sternites* smooth but punctured, the fourth slightly granular in the middle, more thickly at the sides, the fifth closely granular throughout, the normal keels only marked by a few larger granules.

Tail slender, a little narrowed posteriorly, about 4½ times the length of the carapace; its intercarinal spaces finely granular; the keels well developed and granular or denticulate, the first three segments with 10 keels, with a trace of the median lateral on the fourth; the superior keels denticulate, the terminal denticle being larger; the superior borders of the fifth not carinate, the inferior strongly denticulate; the vesicle granular, with a distinct triangular tooth beneath the aculeus, the whole tail beset with strong setæ.

Palpi granular, humerus carinate, brachium not carinate, manus not carinate and not granular, hairy, rounded, about as wide as the brachium; the digits in contact, the movable about twice the length of the hand-back and furnished with 8 rows of teeth along the middle line; the basal row long; teeth of the inner series a little behind the apices of the corresponding median rows.

Legs granular; the feet not thickly hairy beneath.

Pectines short, furnished with 15 teeth, of which the basal is enormously enlarged but not elongate.

Total length 28 millim., of tail 16·5, of carapace 2·8.

Loc. Cape Town (*H. A. Spencer and G. H. R. Fisk*) and Simon's Town (*De la Garde*).

A single female example taken by each of the above collectors.

This species resembles *pilosus*, Thorell, *planimanus*, Karsch, *lunulifer*, Simon, and *carinatus*, Pocock, in possessing three keels upon the tergites; in these other species, however, the pectinal teeth are over 20 in number, varying from 23 to 31, and there is no tooth beneath the vesicle on the tail.

I have published a full description of this species, because, so far as I am aware, no examples of it have been examined or described since 1845, when C. Koch first established it; and it was under the guidance of this description that Prof. Kraepelin was led to locate the species in close proximity with *U. lineatus.* Its true position amongst the South-African species may be seen by referring to the synoptical table.

Uroplectes lineatus (C. Koch).

Tityus lineatus, C. Koch, Die Arachniden, xi. p. 7, fig. 854 (1845); Kraepelin, Jahrb. Hamb. Wissen. Anst. viii. p. 89 (1891).

During recent years the British Museum has received a large number of specimens of this species from Cape Town and from Wynberg, Hoet's Bay, and Kalk Bay in the neighbourhood (*H. A. Spencer*), also one from Simon's Town (*De la Garde*), making a total of 17 specimens of different sizes and sexes. The males differ from the females in having the tail longer, the hand thicker, and the basal pectinal tooth not enlarged.

The colour is very fairly constant, that of the upperside of the trunk consisting, roughly speaking, of three yellow bands alternating with four black ones; but the yellow bands are not continuous, the median one being broken up by a pigment patch on the keel and the lateral ones being in reality extensions of the > <-shaped markings so characteristic of many species of this genus. The tail is banded with black, the bands mostly marking the keels, but at the sides, especially of the posterior segments, they show a tendency to broaden and fuse; the lower side of the first three segments is pale, with a fine median black line; the vesicle is always yellow.

Uroplectes insignis, Poc.

Uroplectes insignis, Poc. Proc. Zool. Soc. 1890, p. 131, pl. xiii. fig. 4.

This species was based upon a couple of examples obtained by Dr. Dobson on Table Mountain, and at the time, owing to scarcity of material of this form and of *U. lineatus*, I was unable to compare the two in any detail. But, thanks to the acquisition of a large number of examples from Table Mountain (*H. A. Spencer*), I am now able to point out that it resembles *U. lineatus* in almost all structural characters, although differing considerably and, apparently, constantly in being far more strongly pigmented. For instance, the banding of the trunk observable in *lineatus* does not appear here, the two lateral yellow bands of the former being reduced to the > <-shaped markings; the vesicle, moreover, is black below and at the sides, with four fine yellow lines, and the median black stripe on the lower surface of the tail is broad and divided by a fine yellow line. The only other distinctive feature that I notice in this form is the smaller size of the tubercle beneath the aculeus.

From the constancy of these characters it seems to me that *U. lineatus* must at all events be looked upon as a distinct subspecies, a melanistic mountain form, of *U. lineatus*. It is a significant and interesting fact that Mr. H. A. Spencer, who, while acting as medical officer on board the U.S.S. 'Mexican,' was collecting on and off for some years in S. Africa, never took the typical *U. lineatus* upon Table Mountain nor *U. insignis* on the lower ground in the neighbourhood of Cape Town, and he himself was struck by the darker tint of the mountain form.

Uroplectes formosus, Pocock.

Uroplectes formosus, Pocock, Proc. Zool. Soc. 1890, p. 134, pl. xiii. fig. 3.

Principal form.—With a single small fuscous spot upon the upper surface of the trochanter of the palp; two spots upon the femur, one at its distal and the other at its proximal end; two spots upon the tibia, one small, distal, the other larger but irregularly defined and median; the hand blacker; a fuscous spot upon the maxillary lobes of the first and second pairs of legs. The >-shaped spot very indistinctly defined; the last tergite almost entirely black at the sides, with only a very narrow yellow stripe just above the black margin; the lower surface of this last segment also almost entirely fuscous, with a posterior median triangular yellow spot. The upper surface of the first four tail-segments entirely orange-red, not black; the lower surface of these segments with a thin inferior median black band and adorned with irregular black patches at the side. The vesicle of the tail with scarcely a trace of yellow lines.

Loc. Port Natal (*E. Howlett*).

Uroplectes formosus, Poc., subsp. *Spenceri*, nov.

Coxæ and maxillary lobes of the anterior appendages without fuscous spots; a single large fuscous patch covering the proximal end of the humerus above; the proximal patch upon the brachium larger and better defined; the hand paler and distinctly black-lined. The flavous >-shaped mark on the tergites well defined, the seventh tergite largely flavous at the sides; the sternite flavous, with three black bands, one slender median and one on each side wider and less well defined. The anterior four segments furnished with seven well-defined black longitudinal lines, one inferior and median and three on each side, the upper marking the superior keels; the vesicle distinctly yellow-lined.

Loc. East London (*H. A. Spencer*).

In addition to the large number of examples obtained at the above locality Mr. Spencer brought back others from Port Elizabeth which, while agreeing in the main with the typical East London examples, differ from them in being rather more deeply pigmented. For example, the ><-shaped marks on the terga are less distinct, almost the entire upper surface of the brachium and humerus is fuscous, and the black lines on the tail are wider, so that sometimes they anastomose.

Uroplectes triangulifer, Thor.

Uroplectes triangulifer, Thor., Actes Soc. Ital. Sci. Nat. xix. pp. 123–126 (1876).

On pl. xiii. fig. 5 of my paper (Proc. Zool. Soc. 1890) upon South-African Buthidæ I give a figure of the male of this species taken from an example collected at Pietersberg (Transvaal) by Mr. C. R. Jones, this being the only example contained at that time in the Museum collection; but since then we have received fresh examples from Port Elizabeth (*H. A. Spencer*) and Basutoland (*R. C. Wroughton*).

The differential characters of this form and its allies are pointed out in the synopsis of the species.

Uroplectes chlorodermus, sp. n.

Uroplectes flavoviridis, Peters, Pocock, P. Z. S. 1890, p. 135, pl. xiv. fig. 5; not *U. flavoviridis*, Peters, Mon. Ak. Wiss. Berlin, 1862, p. 516.

This species, of which I have given a full description of both sexes in the Proc. Zool. Soc. for 1890, I formerly regarded as identical with *U. flavoviridis* of Peters, from Tette; but I am now of opinion that the two must be regarded as distinct, on the grounds that Peters describes the underside of the tail of his species as shining and finely granular, whereas in my specimens its first three segments are quite smooth and studded with coarse punctures, which can scarcely have been overlooked by Peters and, still less, described by him as fine granules. Moreover, this author states that the basal pectinal tooth is of striking size and falciform ("sichelförmig") in shape, from which I infer that he had before him a scorpion with the sickle-shaped basal pectinal tooth of *U. planimanus* or *U. lunulifer*, and not an example with this tooth merely expanded, as is the case in *U. chlorodermus*.

In addition to the examples of this species from E. Africa and Lake Nyassa that I have previously recorded, the Museum has received it from Fort Salisbury, Mashunaland, 5000 feet (*G. A. K. Marshall* *). *U. chlorodermus* resembles *triangulifer* in many characters—for instance, in the thin spine-armed hand of the male, approximately in the arrangement of the teeth on the digits of the chelæ; it may, however, be recognized by being of a uniformly deep green colour, and having the anterior caudal segments smooth, punctured, and not carinate below, the basal pectinal tooth expanded in the female, and the sides of the upper surface of the fifth caudal segment straight and abruptly sloped posteriorly. In the three last-named respects it approaches the Somaliland and East-African *U. Fischeri*, Karsch.

Uroplectes olivaceus, sp. n.

Colour somewhat the same as in *U. flavoviridis*, Peters, but the green paler, more emerald on the upper surface of the trunk and chelæ, yellower on the tail; fingers and trochanter of chelæ yellow; legs yellow and green, a broad band of the latter colour occupying the whole of the middle of the femur and patella; lower surface of trunk yellow or greenish yellow.

Carapace as long as the second caudal segment, finely and closely granular throughout; ocular tubercle smooth. *Terga* also finely granular, more coarsely so posteriorly, the median keel smooth, but the keels on the last granular.

Sterna smooth and polished, the last very weakly granular at the sides.

Tail about $6\frac{1}{2}$ times the length of the carapace, robust, parallel-sided; the inferior median keels weak, obsolete on segments 4 and 5; a weak median lateral keel on segments 1 to 3; all the keels and the intercarinal spaces granular except the median area on the lower surface of the first segment and the upper surface of all the segments, which are at most feebly granular; the upper keels of segments 1 to 3 ending in an enlarged denticle; upper edges of the fifth segment high and strongly convex; the hinder half of the upper surface very deeply impressed for the reception of the

* Mr. Marshall has recently sent me the following species of Scorpions from Mashunaland:—*Opisthophthalmus carinatus*, Pet., Umfuli River; *O. glabrifrons*, Pet., Salisbury and Umfuli River; *Hadogenes troglodytes*, Pet., Umfuli River; *Uroplectes chlorodesmus*, Poc., Salisbury; *U. planimanus* (Karsch), Umfuli River. It is interesting to note that, with the exception of the last-named, the species are identical with those that Peters has recorded from Tette on the Zambesi.

vesicle; vesicle coarsely granular below, a small denticle some distance below the root of the aculeus, its upper surface depressed at the base, strongly convex on its distal half, the curvature of which is continuous with that of the vesicle.

Chela long and slender; humerus and brachium finely and closely granular above, more coarsely granular in front; manus slender, about as wide as the brachium, smooth, but punctured and hairy; a distinct tubercle on its inner surface at the base of the digits; width of hand a little more than half the length of the hand-back; hand-back less than half the length of the movable digit; digits long, rather strongly curved at the end; 11 rows of teeth along the median series, the basal row long, with an enlarged denticle on each side of it near the middle of its length; the teeth of the inner series lying close up to and a little behind the apical tooth of the median rows, which is scarcely larger than the rest and not separated from them by a larger space than that which separates the rest of the teeth of the median rows from each other.

Legs weakly granular externally.

Pectines long, with 23–24 teeth.

Measurements in millimetres.—Total length 60; length of tail 38, of carapace 5·7; width of hand 1·5; length of hand-back 3, of movable digit 6·5.

Loc. Murchison Range, Transvaal (*C. R. Jones*).

Belonging to the same category as *U. chlorodermus* and *U. triangulifer*, but recognizable from both in the characters pointed out in the synopsis.

Uroplectes vittatus (Thor.).

Lepreus vittatus, Thorell, Act. Soc. Ital. Sci. Nat. xix. p. 121.

A single female example of this species recently received from the Murchison Range, Transvaal (*C. R. Jones*), presents the following type of coloration:—

Carapace ornamented in front with a triangular black patch lying between the eyes; the posterior apex of this patch extends beyond the ocular tubercle halfway towards the posterior margin, the posterior edge with two transverse black lines and the lateral edge black nearly up to the lateral eyes. The anterior four *terga* with black or partly black edges, all of them except the last, which is almost of a uniform yellow, furnished with two large conspicuous black spots, which constitute together a double dorsal band, but each of these black spots is distinctly divided by a >-shaped yellow mark; the yellow bands which lie between the black bands are subequal in width and much more brightly coloured posteriorly. *Tail* yellow, passing into a redder tint posteriorly; the lower surface of the first segment is furnished behind with two abbreviated black lines, that of the third has the corresponding lines better developed and a slender median line which takes its origin from a conspicuous black spot on the anterior portion of the segment; ornamentation of the same kind is noticeable upon the lower surface of the two following segments, but it is less clearly defined on the fourth.

Legs and *palpi* yellow; digits infuscate.

Thorell's type from Caffraria was doubtless a male, since no reference is made to the enlargement of the basal pectinal tooth observable in my example, in which there are 18–19 teeth, the basal being modified as in *U. occidentalis* and *lineatus*, and not elongate as in *U. planimanus* and *lunulifer*. This specimen also differs in two other respects from Thorell's description, since it possesses twelve rows of teeth along the middle line of the digits, instead of eleven as stated by Thorell, and the movable digit is nearly twice the length of the hand-back ($5\frac{3}{4}:3$), whereas in the type of *vittatus* the difference is much less, being only $5\frac{1}{2}:4$. But without more specimens for examination it is not possible to say whether a specific or subspecific value is to be attached to these features.

Uroplectes Fischeri, Karsch.

Uroplectes Fischeri, Karsch, Mitth. Münch. ent. Ver. 1879, p. 124.

Recorded from Barawa in Somaliland; the British Museum has recently received examples of apparently the same species from Mombasa (*D. J. Wilson*) and East Africa (*Imperial British East Africa Company*). According to Kraepelin this species is identical with the foregoing *U. vittatus*, but the three above-mentioned examples referred to *Fischeri* may be distinguished from the Transvaal example of *vittatus* in the features pointed out in the diagnosis. Kraepelin's description is apparently based upon specimens from unstated localities, one only being mentioned as coming from Somaliland, and this is probably identical with *Fischeri*. According to this author the variation in colour presented by the "species" is very great, specimens even having the segments of the legs ringed with black. The examples seen by me agree with Karsch's description, except that they seem to approach my example of *U. vittatus* more nearly in colour and have the hands pale, whereas in the type of *Fischeri* these organs are said to be marked with longitudinal blackish lines. The specimen that I described as *nigrimanus* seems to represent a melanistic form of the same species and may provisionally, at all events, rank as a subspecies.

Uroplectes occidentalis, Simon.

Uroplectes occidentalis, Simon, Bull. Soc. Zool. France, 1876, p. 219.
Tityus chinchoxensis, Karsch, Zeits. Naturw. lii. p. 370 (1879).

The British Museum has examples of this species from the Congo (whence the type was obtained), Angola, and Cette Cama (Gaboon); but, according to Kraepelin, it spreads as far to the north as Sierra Leone and eastwards and southwards into Somaliland, Masailand, and Natal. If these localities are trustworthy, the species has a wider range in Africa than any indigenous scorpion with which I am acquainted. Furthermore, this author also affirms that he has examined specimens from Sumatra, Java, Borneo, and Celebes.

As stated above, this species, of which I have published a coloured figure in the Proc. Zool. Soc. 1890, pl. xiv. fig. 4, is the type of Kraepelin's genus *Tityolepreus*; but I feel satisfied of the impossibility of separating it generically from such forms as *vittatus* and *Fischeri.*

Synopsis of the South-African Species contained in the Collection of the British Museum.

1. Abdominal terga with a lateral abbreviated keel on each side as well as the median; teeth of the inner set close to and not behind the apices of the adjacent median rows; crests on the lower surface of the tail well developed.
   - *a.* Vesicle of tail without a distinct tooth beneath the aculeus; a large number of pectinal teeth (up to 30): female with the basal pectinal tooth long and falciform (? in *carinatus*).
     - *a*¹. The crests of the tail weakly granular, the inferior ones on at least the first and second segments smooth; median lateral keel weak on the third segment, absent on the fourth; hand, especially in the male, broad, flat, with compressed inner edge .... *planimanus* (Karsch).
     - *b*¹. The crests on the tail, including the lower ones on the first and second segments, strongly granular; the median lateral crest strong on the third segment and distinct on the fourth; hand in the male normally rounded............................. *carinatus* (Poc.).
   - *b.* A distinct triangular tooth beneath the aculeus; pectines with 15 teeth in ♀, basal tooth expanded but not elongate; tail crested and granular as in *carinatus* .... *variegatus* (Koch).
2. Abdominal terga without lateral crests; tail coarsely punctured below, almost entirely

smooth, and without crests, the superior keels represented by a terminal granule, and sometimes on the first and second segments by a few smaller granules; inner set of teeth on digits isolated and, except at the distal end, lying far from the apices of the adjacent median rows; hand of male not internally spined; basal pectinal tooth in female expanded but not elongate; (prevailing colour mostly yellow, with a black patch on each side of the terga 1 to 6; tail posteriorly infuscate and basal half of digits also darker).

a^2. Apical teeth of the median rows at the distal end of the digits enlarged and slightly separated from the rest, and pairing with the adjacent teeth of the inner set; (hand internally granular; vesicle smooth below; a small tooth beneath the aculeus; fifth caudal segment almost as in *Fischeri*) .... *occidentalis* (Sim.).

b^2. Apical teeth of the median rows scarcely enlarged and hardly separated from the rest, so as to pair with the adjacent teeth of the inner set.

a^3. Vesicle rugose below, with only a small tuberculiform tooth beneath the aculeus; upper edges of the fifth caudal segment evenly convex from end to end; hand internally granular; internal teeth of digits further back, the ninth from the base on a level with the apex of the adjacent median row .... *vittatus* (Thor.).

b^3. Vesicle smooth, coarsely punctured below, with a distinct triangular tooth; superior edges of the fifth caudal segment elevated behind and terminating in a nearly vertical margin; internal teeth of the digits further forward, the sixth or seventh from the base on a level with the apex of the adjacent median row .... *Fischeri* (Karsch).

3. Terga with a single crest as in section 2, the superior and superior lateral crests of the tail well developed and granular; at least the lower surface of the vesicle and of the fifth segment granular below; hand in the ♂ slender and armed internally with a denticle, which is visible as a tubercle in the ♀; more of the basal teeth of the internal series isolated, but, at least in the distal two thirds of the digit, they are paired with the enlarged and separated apical tooth of the adjacent median rows.

a^4. Anterior four caudal segments smooth below, not carinate, but punctured as in section 2; sides of the fifth segment of the tail as described under b^3; a distinct tooth beneath the aculeus of the tail; basal pectinal tooth enlarged as in section 2; colour uniform deep green, with paler flavous markings .... *chlorodermus*, sp. n.

b^4. All the normal caudal keels at least visible, the lower surface of at least the second, third, and fourth segments granular, not punctured; uppersides of the fifth caudal segment convex from end to end, not posteriorly elevated; basal pectinal tooth in the ♀ (? *olivaceus*) not enlarged.

a^5. The inferior caudal crests weak, nearly obsolete, and lost amongst the granules of the lower surface; those on the first segment smooth; the superior and superior lateral keels of segments 1, 2, and 3 with terminal denticle much enlarged; vesicle in the ♂ but little modified; colour greenish, approaching what is seen in *chlorodermus* .. *olivaceus*, sp. n.

b^5. All the crests of the tail strong and well defined, those on the lower surface of the first segment granular; vesicle strongly compressed in its basal half, with an angular prominence beneath the aculeus; prevailing colour yellow, with two black patches on the terga, each marked with a >. (*triangulifer*, Thor.)

4. Terga as in 2 and 3; tail almost as in a^4, with smooth unkeeled lower surface; the fourth and fifth segments and vesicle granular, superior keels distinct, with enlarged terminal tooth; hand in the male enlarged, without an inner tubercle in either sex; in the distal two thirds of the digit *two* of the teeth of the median rows are enlarged and separated to form a trio with the adjacent teeth of the inner set.

a^6. The lower surface of the vesicle and of the fifth caudal segment more coarsely and sparsely granular; superior keels stronger; middle keel of the terga wholly or partly black.

a^7. Vesicle clear yellow; terga marked with alternating black and yellow bands. (Typical form.) .... *lineatus* (Koch).

b^7. Vesicle fuscous, with fine yellow lines; terga darker, not distinctly banded, ornamented with well-defined ><-shaped stripes. (Melanistic subspecies.) .... *insignis*, Poc.

b^6. The lower surface of the vesicle and of the fifth caudal segments finely and closely granular; superior keels weaker; a continuous median flavous band on the terga.

a^8. Chelæ, with the exception of the black bands and a few small fuscous spots, orange-yellow; a conspicuous spot on the base of the maxilla above; the apices of the maxillary processes of the first and second pairs of legs fuscous; last abdominal sternite almost wholly black, a flavous spot in the middle; terga almost entirely smooth and polished. (Typical form from Natal.) .... *formosus*, Poc.

b^8. Hands of chelæ paler, with deep black bands; brachium and humerus with large fuscous patches; without fuscous tips to the maxillary lobes of the first and second pairs of legs and scarcely a trace of a black patch on the maxillary (basal) segment of the chela; last abdominal sternite flavous, with a black patch on each side of it; terga more distinctly granular. (Subspecific form from East London.) .... *Spenceri*, nov.

The sections indicated in this table by the numbers 1, 2, 3, 4 represent, I believe, the natural groups into which the species fall; but at present, for reasons stated above, I do not consider it advisable to adopt generic titles for these sections. Probably, however, the name *Lepreus* applies to no. 1 and *Tityolepreus* to no. 2; but it appears to me by no means certain whether *Uroplectes*, the oldest name for the group, is applicable to 2, 3, or 4.

The following species, unknown to me in nature, also fall into this genus:—

1. *Scorpio* (*Atreus*) *spinicaudus*, Gervais (Arch. Mus. iv. p. 222, pl. xi. figs. 22–25, 1844), from Caffraria, will probably be found to belong to no. 4, and will perhaps prove identical with *U. formosus Spenceri*.

2. *Tityus fallax*, C. Koch ('Die Arachniden,' xi. p. 1, fig. 850), from Africa, also apparently falls under no. 4. If adult, the type probably represents a species distinct from those enumerated, but if immature may prove to be the young of *U. insignis*.

3. *Tityus striatus*, C. Koch (*t. c.* p. 6, fig. 853), from Africa.—The same remarks apply to this form as to *T. fallax*. On the strength of the figures of these species it is impossible to say for certain that they are synonymous with any of those recognized in the above table; for it is unjustifiable to ascribe inaccuracy to these figures, seeing how accurate on the whole are those of *U. lineatus* and *U. variegatus*.

4. *Uroplectes ornatus*, Peters (Mon. Ak. Wiss. Berlin, 1862, p. 516), from Tette, was said by Karsch to fall into "*Tityus*" of C. Koch, a statement which means presumably that it belongs to the same category of species as *U. triangulifer*, Thor. It is a pity that we cannot locate this species more satisfactorily, for since it is the type of the genus *Uroplectes*, its exact systematic position is of the greatest importance to those who would more finely divide the genus.

5. *Uroplectes flavoviridis*, Peters (Mon. Ak. Wiss. Berlin, 1861, p. 516), from Tette.—The position of this species is also one of perplexity. The only other species, so far as I know, that have been accredited with a falciform basal pectinal tooth are *U. planimanus* and *U. lunulifer*; but these certainly differ from *flavoviridis* in having the lower side of the tail distinctly carinate.

6. *Lepreus pilosus*, Thorell (Act. Soc. Ital. xix. p. 118, 1876), from Caffraria, the type of the genus *Lepreus*, without much doubt falls in section 1 of the table, but certainly differs from the forms enumerated there in having the median inferior keels obsolete on the first, second, third, and fourth segments of the tail.

7. *Lepreus otjimbinguensis*, Karsch (Mittl. Münch. ent. Ver. 1879, p. 125), from Otjimbingue, near Walfisch Bay.—Judging from the description I should say that this species belongs to section 2 of the table; but it certainly differs from the species there mentioned in having the median part of the terga black and not yellow.

8. *Lepreus lunulifer*, Simon (Ann. Soc. Ent. Fr. 1887, p. 375), from Namaqua or Damaraland, is evidently very nearly allied to *L. planimanus*, Karsch. Kraepelin, indeed, holds the two to be identical. At all events, it is not possible without a comparison of the types to express the differential characters from the description alone.

9. *Tityus tricolor*, Simon (Bull. Soc. Ent. Belg. xxvi. p. lix, 1882), from the area lying between Zanzibar and the lake region, almost certainly falls into section 2. From the fact that Simon refers it to *Tityus* I am inclined to think the dentition of the digits will be found to resemble that of *occidentalis*, Sim., to which, as well as to *vittatus* and *Fischeri*, the species is evidently nearly allied.

Supplement.

Whilst this paper has been in the printer's hands I have received from Mr. G. A. K. Marshall a couple of species of this genus from Durban. One of these proves to be *U. planimanus* of Karsch, identical in almost all respects with the Mashunaland example mentioned above; but the other appears to be an undescribed form, which I propose to dedicate to its discoverer and diagnose briefly in the following terms:—

Uroplectes Marshalli, sp. n.

Closely related to *U. triangulifer*, Thor., in all essential points of structure, and falling under section b^5 of the above table, but easily recognizable from this species in the following features :—

Colour of trunk and tail a deep and uniform black, the appendages deep green; the three basal segments of the chelæ paler green than the brachium and manus; fingers yellowish green; femora and patellæ of the legs also deeper than the rest, the adjacent ends of these segments, as well as the opposite end of the patella, conspicuously red; the maxillary lobes of the first and second legs deeper green than the rest of the coxæ.

Granulation of the trunk and tail and keels on the latter developed as in *triangulifer*; area of the vesicle below the aculeus prominent, but only furnished with a tubercle, which is considerably smaller than that of *triangulifer*.

Pectinal teeth 18–18, 20–21 in ♀, 18–20 in ♂; the teeth longer in the latter, but the basal tooth not enlarged in the former.

Vesicle of male modified as in *U. triangulifer*, and, as in that species and in *chlorodermus*, the spike on the hand is larger in this sex than in the female.

Measurements in millimetres.—♀, total length 40, carapace 4, tail 22·5; ♂, total length 35, carapace 3·5, tail 22.

Loc. Durban.

A male and two females with many young were taken. It is interesting to note that the young specimens, 8 millim. in length, present the colouring of the adults with the exception of being a little paler.

Note.—In two papers upon African Scorpions recently published (in the March and April issues of the 'Annals') I have recorded certain species from the Umfuli River, Mashunaland; but, owing to the partial obliteration of the label, the altitude was given as 1200 feet. It is, in reality, as Mr. Marshall informs me, 4200 feet, the exact spot being known as Gadzima.

LV.—*Descriptions of new Reptiles and Batrachians collected in Celebes by Drs. P. and F. Sarasin.* By G. A. Boulenger, F.R.S.

Tropidonotus Sarasinorum.

Maxillary teeth 25, the posterior very feebly enlarged. Snout rather prominent, obtusely truncate; eye moderate. Rostral much broader than deep, not visible from above;

internasals as long as broad, as long as the præfrontals; frontal twice as long as broad, longer than its distance from the end of the snout, shorter than the parietals; loreal as long as deep; one præ- and three postoculars; temporals 1+2 or 3; eight upper labials, third, fourth, and fifth entering the eye; four lower labials in contact with the anterior chin-shields, which are shorter than the posterior. Scales in 15 rows, all strongly keeled. Ventrals 137–141; anal divided; subcaudals 65–75. Reddish brown anteriorly, with more or less distinct blackish cross-bands and a dark nuchal blotch, connected with a dark streak on each side of the head along the upper border of the labials; latter whitish, speckled or vermiculate with brown; body olive or dark grey posteriorly; belly yellow, reddish on the sides, dotted with blackish; posterior ventrals and subcaudals, in the male, dark grey.

Total length 530 millim.; tail 150.

Two specimens, male (V. 141; C. 75) and young (V. 137; C. 65), from Loka, Bonthain Peak, about 3500 feet.

Intermediate between *T. celebicus*, Peters and Doria, and *T. picturatus*, Schleg.

Calamaria acutirostris.

Snout pointed. Rostral small, as deep as broad, just visible from above; frontal pentagonal, as long as broad or slightly longer than broad, as long as its distance from the end of the snout, much shorter than the parietals, four times as broad as the supraocular; one præ- and one postocular; the diameter of the eye hardly equals its distance from the mouth; five upper labials, third and fourth entering the eye; a pair of large anterior chin-shields, in contact with the symphysial; posterior chin-shields small and separated by a scale. Scales in 13 rows. Ventrals 156–179; anal entire; subcaudals 14–24. Tail ending in a point. Uniform blackish brown above, white beneath.

Total length 250 millim.; tail 43.

Several specimens from Loka, Bonthain Peak, about 3500 feet.

This species connects *Calamaria* with *Pseudorhabdium*.

Calamaria Muelleri.

Rostral large, as deep as broad, the portion visible from above as long as or a little longer than its distance from the frontal; frontal hexagonal, much longer than broad, much longer than its distance from the end of the snout, as long as or a little shorter than the parietals, twice as broad as the supraocular; one præ- and one postocular; diameter of the eye exceeding its distance from the mouth; five upper labials, third and fourth entering the eye; anterior chin-shields in contact with the symphysial; posterior chin-shields shorter and in contact with each other. Scales in 13 rows. Ventrals 153–187; anal entire; subcaudals 12–21. Tail ending in a point. Coloration very variable. Dark brown above, uniform or spotted with black, reddish brown, or brick-red, the scales speckled and edged with black; a black streak on each side of the head, passing through the eye; upper lip white; white beneath, the ventrals edged or spotted with black, or edged with vermilion; a black or red band between two white ones along the lower surface of the tail.

Total length 1900 millim.; tail 16.

Several specimens from Loka, Bonthain Peak, about 3500 feet.

This species is named in memory of my late friend Dr. F. Müller, of Basle, who had undertaken the working out of the Drs. Sarasin's herpetological collections.

Rhacophorus monticola.

Vomerine teeth in two oblique series between the choanæ. Snout more or less pointed, as long as the diameter of the orbit; canthus rostralis distinct, loreal region slightly concave; nostril equally distant from the eye and the end of the snout; interorbital space as broad as the upper eyelid; tympanum moderately distinct, half the diameter of the eye. Outer fingers two-thirds webbed; disks of fingers large, as large as or a little larger than the tympanum; toes webbed to the disks of the third and fifth, penultimate phalanx of fourth free; subarticular tubercles feeble; a very small inner metatarsal tubercle; no tarsal fold. The tibio-tarsal articulation reaches the eye or the anterior border of the orbit. Skin finely shagreened above, granulate on the belly and under the thighs; a fold from the eye to the shoulder. Coloration very variable. Greyish, bluish, or purplish above, uniform or dotted, spotted or vermiculate with darker, or with large symmetrical markings, viz. a cross-band between the eyes, an hourglass- or X-shaped blotch on the anterior part of the back, and a cross-band on the sacrum; limbs with more or less distinct dark cross-bands; flanks white, or purple with large white spots; lower parts white. Male without vocal sacs.

From snout to vent 48 millim.

Several specimens from Loka, about 3500 feet, and one from the north slope of the Bonthain Peak, 2600 feet.

LVI.—*Description of a new Nymphaline Butterfly from Burma.* By LIONEL DE NICÉVILLE, F.E.S., C.M.Z.S., &c.

MR. H. J. ELWES has kindly sent me a specimen of a species of the Nymphaline genus *Neurosigma* from the Karenni country, lying to the north-east of the Burmese province of Pegu, which, as it undoubtedly represents a new species distinct from *Neurosigma Doubledaii*, Westwood, the hitherto unique species in the genus, I describe as follows:—

Neurosigma nonius, sp. n.

Hab. Karenni, Burma.

Expanse, ♂ 3·2 inches.

Description.—Male. Upperside: fore wing differs from the same sex of *N. Doubledaii*, Westwood, from Nepal, Sikkim, Assam, and Upper Burma, in having the fulvous coloration of the ground confined to the basal third of the wing, the ground-colour of the rest of the wing being creamy white. Hind wing has the ground-colour everywhere creamy white, in *N. Doubledaii* the discal area of the wing occupying half the surface is fulvous. Underside: both wings present the same differences as on the upperside, in addition to which all the black markings are of a deeper and richer shade and larger.

Female unknown.

Mr. W. Doherty, who captured numerous male specimens of this species in March and April, 1890, recognized it as a new species, as he wrote to Mr. Elwes:—"I send many males of *Neurosigma Doubledayi*. It seems to me distinct from the Sikkim form, of which I took dozens in the Chittagong hill-tracts, all black and fulvous above." Mr. Elwes, however, in Proc. Zool. Soc. Lond. 1891, p. 277, did not describe it as new, but refers to it as *Neurosigma Doubledayi*, var.?, and figured it on pl. xxvii. fig. 7, as he thought it might be "a case of male dimorphism in which the male and female are different in some localities and resemble each other in others." As, however, both sexes of *N. Doubledaii* are known and have been figured, and both are represented in my collection, I do not think that Mr. Elwes's suggestion is likely to prove correct, although we know only one sex of the Karenni local race. It will be most probably found, when the female of *N. nonius* is discovered, that it closely resembles its male and has no fulvous coloration whatever on the hind wing, while the female of *N. Doubledaii* has a small patch of that colour in the middle of that wing on both surfaces.

LVII.—*Description of Two new Species of Fishes* (Mastacembelus *and* Barbus). By Dr. A. GÜNTHER.

Mastacembelus shiranus.

D. 27 or 29 | 66. A. 2/68. C. 14.

Trunk and tail compressed, of moderate length, its greatest depth being three fifths of the length of the head. Length of the head without appendage about one third of its distance from the vent. Tail equal in length to the rest of the body. Rostral appendage a little longer than the eye, which is small. Præoperculum without spines. Dorsal spines short, the distance of the foremost from the operculum being scarcely half of the length of the head.

Greyish olive, finely marbled and reticulated with brown; a black longitudinal band on the side of the head, through the eye, another similar band along the middle of the crown of the head.

Two specimens, of which the larger is 10 inches long, were sent by Mr. H. H. Johnston, from the Upper Shiré River, to the Natural History Museum.

The genus *Mastacembelus*, and probably this species, occurs also in the Victoria Nyanza; at least, I am unable to discover distinctive characters in a specimen 6½ in. long found by Mr. E. J. Baxter in that Lake. So far as I can make out from its somewhat desiccated condition, the fin-formula would be :—D. 30 | 60. A. 2/60.

In my description of *Mastacembelus tanganicæ* Prroc. Zool. Soc. 1893, p. 629) the length of the tail should have been described as being but little more than two fifths *of the total length.*

Barbus faoensis.

D. 11. A. 8. L. lat. 28. L. transv. $\frac{5}{4}$.

Osseous dorsal ray strong, not denticulated; two and a half series of longitudinal scales between the lateral line and the root of the ventral. Body oblong, compressed, its height being contained thrice and one fourth in the length (without caudal), the length of the head four times. Eye rather small, two fifths of the width of the interorbital space and one half of the length of the snout. Mouth anterior, without barbels. The dorsal fin is scarcely half as high as the body, its origin being opposite to that of the ventral and midway between the root of the caudal and the eye. Caudal fin deeply forked. The pectoral fin terminates a long way from the ventral.

Coloration uniform.

One specimen from Fao (Persian Gulf), 16 inches long, is in the Natural History Museum.

LVIII.—*On the Relations of the Myrmecophile* Lepismidæ *to Ants.* By M. Charles Janet *.

The numerous species of animals which live in ant-hills, and which for this reason have been called "Myrmecophile," have very varied relations with the ants †.

A certain number of Staphylinidæ, such as *Myrmedonia funesta*, which have been especially studied by Wasmann, capture the ants at the entrance to their galleries or the larvæ in the deeper parts of the nest and devour them (*myrmecophagy*).

Certain Nematodes plant themselves in the pharyngeal glands of the Camponotidæ, in order there to pass through a larval stage (*internal parasitism*) ('Comptes Rendus,' t. cxvii. p. 700, 1893).

Certain Acarids attach themselves to different parts of the bodies of the ants, and especially to the head and feet (*external parasitism*).

A considerable number of Arthropods enter the ants' nest for hardly any other purpose than to seek the detritus, of which they are able to make some use, or to find there favourable conditions for their existence, and they are treated with indifference by their hosts. This is the case with a little Isopod Crustacean, *Platyarthrus Hoffmanseggi*, which is so common in ant-hills all over Europe. This cohabitation in the same nest of a myrmecophile species with ants has been called *synœketism* when there is no direct relation between them.

Many of the Staphylinidæ and Pselaphidæ live normally in ants' nests. They bear on the dorsal region tufts of hair, corresponding with certain glands the secretion of which is much sought after by the ants, who, in exchange for it, pour out for them voluntarily before their mouths a liquid food. There is in this case between the ants and their guests a symbiosis with reciprocal advantages, constituting the *myrmecoxeny* of Emery. Wasmann has shown that among the myrmecophile Staphylinidæ the reduction, more or less pronounced, of the palps was, so to speak, the expression of the degree of dependence of these insects upon the ants who housed them.

* From the 'Comptes Rendus,' tome cxxii. 1896, pp. 799–802.

† A classified list of myrmecophile animals will be found in a recent book, exceedingly useful to naturalists engaged in the study of ants, Wasmann, Erich, 'Kritisches Verzeichniss der myrmekophilen und termitophilen Arthropoden' (Berlin, 1894).

This dependence is pushed to the last degree in the case of *Claviger testaceus*, which is to be found often enough on the ant-hills near Paris. Although in artificial nests one can see these Coleoptera attach themselves from time to time to the dead larvæ, which they appear to suck for a moment, it may be said that their true food is only that provided for them by their hosts, because they die rapidly when they are separated from them.

As for the Aphides, they are not truly myrmecophile: it is true that they are greatly sought after by ants, who obtain from them an abundant supply of food, and who, in exchange, can extend to them a more or less real protection; but they neither ask nor obtain from the ants anything, and even in general do without them.

The Lepismidæ have for a long time been classed as myrmecophile, but their relations to ants have up to the present been but imperfectly understood. I have had occasion to notice in my artificial nests specimens of *Lepismina polypoda*, Grassi, taken with a colony of *Lasius umbratus*, Nyl., genus *mixtus*, Nyl.

In the first nest I placed some *Lepismina* without ants, in a second *Lepismina* with the ants with which they had been taken.

The *Lepismina* which had been brought up without ants received as food a mixture of honey, sugar, flour, and yolk of egg. They numbered at the beginning of the observations twenty-one; at the expiration of two years and six months there were still nine of them remaining in good condition, and these readily ate the liquid honey which was given to them on the point of a pair of very fine forceps.

The *Lepismina* brought up with the ants with which they had been captured were much more lively than those from the other nest. They were in a state of constant movement, and ran about among the ants, but took great care never to remain stationary in their neighbourhood.

Occasionally I saw the ants threaten the *Lepismina*, and even throw themselves upon them; but in the latter case they were so agile that they invariably escaped. Nevertheless, in my artificial nest, in which they could not so easily reach a place of safety as in a natural nest, they were sooner or later caught. Two days after setting up the nest I found five dead bodies, which the ants seized in their mandibles and carried about the nest. In order to save the survivors I began their training in a new nest, only certain portions of which were accessible to the ants, or, at least, but little frequented by them. There the *Lepismina* remained for a long time in a state of repose, completely motionless; but when an individual ant passed near to one of them it never failed to make a sharp movement in order to push it out of the way.

If the food smeared with honey, which was placed in the empty chamber of the nest, was withheld for several days and then replaced, a number of ants would be seen to come and make a lengthy meal on it, and when, after filling themselves as full as they could hold, they went back to the living chambers of the nest, they were assailed by their companions, who came to ask, with their antennæ, a share of the food.

The division began immediately. The one with the food and the one requiring it arranged themselves one slightly in advance of the other; the former drew aside its mandibles and protruded its proboscis, which its companion seized with its maxillæ, and disgorged some small drops, which were immediately absorbed.

From the moment that the first food-bearers entered the living chambers of the nest the *Lepismina* showed by their agitation that they had perceived the odour of honey.

Soon quite a number of ants were gathered in pairs for the business of disgorging. The bodies slightly drawn back, and often with the anterior feet raised, they left a certain interval between them below their heads. As soon as a *Lepismina* arrived near such a pair it would throw itself into this space, raise its head sharply, snap up the droplet which fell before it, and then get away as quickly as possible, as if to escape a pursuit which was deserved. But the ants, propped up one against the other, are not sufficiently free to move, and cannot even threaten the audacious thief, who runs off at once to put another pair under contribution; and this manœuvre is continued until hunger is satisfied.

One must conclude from these observations that *Lepismina polypoda* can do without the ants well enough when there is proper food at their disposal; that they are tolerated in the ants' nest for the simple reason that their agility saves them from pursuit by the ants; that they are attracted to the ants' nest by the bait of the nutritious liquid which the ants store in their crops; and that, contrary to what takes place in the case of myrmecoxeny, the ants do not give this liquid of their own free will to the *Lepismina*, but that these latter know how to take advantage of circumstances to possess themselves of it by stealth (*myrmecoclepty*).

LIX.—*Descriptions of new Batrachians in the British Museum.* By G. A. Boulenger, F.R.S.

[Plate XVII.]

Rana luzonensis.

Vomerine teeth in two oblique groups between, and extending beyond, the posterior borders of the choanæ. Snout much depressed, acutely pointed, projecting, longer than the diameter of the orbit; canthus rostralis strong; loreal region feebly oblique, grooved; nostril nearer the end of the snout than the eye; interorbital space as broad as the upper eyelid; tympanum very distinct, two thirds to three fourths the diameter of the eye. Fingers long and slender, first a little shorter than second, dilated into large disks. Toes webbed to the disks of the third and fifth, to the penultimate phalanx of the fourth; disks smaller than those of the fingers; subarticular tubercles strong; a small oval inner metatarsal tubercle. The tibio-tarsal articulation reaches far beyond the tip of the snout. Skin smooth; a feeble narrow dorso-lateral glandular fold. Greyish or olive above, with or without a light vertebral line; a blackish canthal streak and temporal spot; tympanum reddish brown; upper lip with a light, dark-edged streak; limbs with dark cross-bands; whitish beneath, throat and breast sometimes brown.

From snout to vent 58 millim.

Four specimens (female and half-grown) from the Highlands of Lepauto, N. Luzon, collected by Mr. Whitehead. Presented by the Subscribers to the Whitehead Expedition Fund.

Oreobatrachus, gen. nov. (*Ranidarum*).

Pupil horizontal. Tongue small, oval, free and very slightly notched behind. Vomerine teeth none. A strong transverse dermal fold between the choanæ. Tympanum hidden; eustachian tubes large. Fingers free, toes webbed, the tips dilated into small disks; outer metatarsals separated by web. Omosternum and sternum with a bony style. Distal phalanx T-shaped; no intercalary ossification between the latter and the penultimate.

Allied to *Phrynobatrachus*, Gthr.

Oreobatrachus baluensis. (Pl. XVII. figs. 1, 1 *a.*)

Head small; snout obtusely pointed, shorter than the diameter of the orbit; no canthus rostralis; nostril equally distant from the eye and the tip of the snout; interorbital space as broad as the upper eyelid. Fingers short, first and second equal. Hind limb stout; toes moderate, three-fourths webbed; subarticular tubercles very feebly developed; a feebly prominent elliptical inner metatarsal tubercle. The tibio-tarsal articulation reaches the tip of the snout. Skin smooth. Dark brown above, limbs with darker cross-bars; a yellowish vertical streak on the tip of the snout and an oblique one from the eye to the angle of the mouth; white (in spirit) beneath, largely marbled with black.

From snout to vent 33 millim.

A single specimen from Mount Kina Balu, North Borneo, collected by Mr. A. Everett.

Rhacophorus Mocquardii.

Allied to *R. depressiceps*, Blgr., with which it agrees in the shape of the head and the disposition of the vomerine teeth, but distinguished by the much shorter digits. Fingers free or with a very indistinct rudimentary web, the disks a little smaller than the tympanum. Foot not half as long as head and body; toes two-thirds webbed; two metatarsal tubercles, inner elliptical, outer round and flat. Tibio-tarsal articulation reaching halfway between the eye and the end of the snout. Pale brown above; a dark brown canthal and temporal streak; a dark cross-band between the eyes; flanks brown, with three white spots; limbs with dark cross-bands; hind side of thighs with light spots in a dark brown network; whitish beneath, speckled with brown.

From snout to vent 34 millim.

A single specimen from Sahambendrana, C. Madagascar, collected by M. Majastre.

Rhacophorus Majori.

Closely allied to *R. rhodoscelis*, Blgr., from which it differs in the more developed web of the manus, the outer fingers being half-webbed. The tibio-tarsal articulation reaches halfway between the eye and the end of the snout. Crimson above, sometimes with scattered blackish dots on the back, with or without a large brown symmetrical marking extending from the head to the sacrum, giving off six oblique branches, the anterior pair directed forwards, the others backwards; limbs with greyish-brown or blackish cross-bars; throat and belly white, lower surface of limbs wholly or partially crimson. Male with an external gular vocal sac.

From snout to vent 28 millim.

Four specimens from the Ambohimitombo forest, Madagascar. Collected by Dr. Forsyth Major.

Rhacophorus macroscelis.

Allied to *R. Hosii*, Blgr. Vomerine teeth in two small oblique groups close to the inner borders of the choanæ. Head large, as long as broad; snout rounded, shorter than the diameter of the orbit; canthus rostralis strong; loreal region deeply concave; nostrils near the end of the snout; interorbital space as broad as the upper eyelid; tympanum distinct, half the diameter of the eye. Fingers webbed at the base; toes webbed to the disks of the third and fifth, penultimate phalanx of fourth free; a very small inner metatarsal tubercle. The femoro-tibial articulation reaches the shoulder, the tibio-tarsal far beyond the tip of the snout. Above with small scattered warts; heel with a conical tubercle; throat and belly granulate. Olive above, marbled with darker; a yellow cross-line between the eyes and a large W-shaped yellow marking on the occiput; upper lip white, with vertical blackish blotches; flanks white, with large black spots; limbs with dark cross-bars; dirty white beneath, belly and hind limbs dotted with brown.

From snout to vent 31 millim.

A single specimen from Mount Kina Balu, N. Borneo, collected by Mr. A. Everett.

Megalixalus brachycnemis. (Pl. XVII. fig. 2.)

Tongue oval, rather deeply notched. Head rather small; snout rounded, shorter than the diameter of the orbit; tympanum hidden. Fingers with a slight rudiment of web; toes half-webbed. The tibio-tarsal articulation reaches the shoulder; tibia one third to two fifths the length of head and body. Skin smooth, coarsely granulate on the belly and under the thighs. Greyish above, with two dark brown lines along the back; sides of head dark brown; brownish beneath.

From snout to vent 25 millim.

Three specimens from Chiradzulu, British Central Africa. Presented by Sir H. H. Johnston.

Calophrynus brevis.

Allied to *C. calcaratus*, Mocq.*, with which it agrees in the very large shovel-shaped metatarsal tubercle and the large flat tarsal tubercle, but distinguished by a shorter

* Of which adult specimens are in the British Museum, the largest measuring 40 millim. from snout to vent.

snout, shorter limbs, and extremely short and very obtuse digits. Occiput swollen; interorbital space as broad as the upper eyelid. First finger shorter than second, fourth shortest; three strong palmar tubercles. Foot not longer than the head; inner toe with a subarticular tubercle, others without; metatarsal tubercle much longer than the inner toe. Tarso-metatarsal articulation reaching the shoulder. Pale greyish olive above, with pink and olive blotches; a chevron-shaped dark cross-band between the eyes; a pair of large dark blotches on the scapular region; tarsal and metatarsal tubercles yellowish white; white beneath, with a few olive dots and vermiculations.

From snout to vent 26 millim.

A single specimen from S.W. Madagascar, collected by Mr. Last.

Dyscophus Grandidieri.

Palatine teeth in a long, nearly straight, transverse series, narrowly interrupted in the middle. Head once and a half as broad as long; snout rounded, narrower than in *D. Antongilii* and *D. Guineti*; nostril equally distant from the eye and the end of the snout; interorbital space a little broader than the upper eyelid; tympanum indistinct. First and second fingers equal. Toes webbed at the base; inner metatarsal tubercle very large, compressed, shovel-shaped, quite as long as the inner toe. The tarso-metatarsal articulation reaches the eye. Skin thick and finely shagreened above; a glandular dorso-lateral fold; a strong fold from the eye to the arm. Olive above, lighter on the sides of the back; a broad triangular dark marking between the eyes; a short dark canthal streak in front of the eye; a dark club-shaped streak behind the eye; a dark light-edged streak on the lateral fold; dirty white beneath, mottled with brown on the throat and breast; metatarsal tubercle whitish.

From snout to vent 33 millim.

A single specimen from S.W. Madagascar, collected by Mr. Last.

Leptodactylus maculilabris.

Tongue oval, slightly nicked behind. Vomerine teeth in two slightly curved series behind the choanæ, narrowly separated in the middle and extending outwards as far as the outer border of the choanæ. Snout rounded, scarcely prominent, as long as the diameter of the orbit; nostril nearer the tip of the snout than the eye; interorbital space as broad as the upper eyelid; tympanum very distinct, nearly two thirds the diameter of the eye. Fingers moderate, first much longer than second; toes slender, not fringed; subarticular tubercles strong; sole smooth, with a small oval inner metatarsal tubercle; a tarsal fold. The tibio-tarsal articulation reaches midway between the eye and the end of the snout. Skin smooth; a glandular fold on each side of the back from eye to groin; another from the eye to the shoulder; a ventral discoidal fold. Pale brown above; glandular folds black-edged; a dark brown triangular blotch on the back of the head, the base between the eyes, the apex between the shoulder; sides of head whitish, with a black canthal streak and three dark brown spots on the lip, the second extending to the eye; sides of limbs with large dark brown spots; a white dark-edged streak along the back of the thighs; uniform white beneath.

From snout to vent 43 millim.

A single specimen from Bebedero, Costa Rica, collected by Mr. C. F. Underwood.

CORYTHOMANTIS, gen. nov. (*Hylidarum*).

Pupil rhomboidal. Tongue subcircular, scarcely free behind, entire. Vomerine teeth. Head a bony casque, with projecting labial borders, formed as in *Triprion* and *Diaglena* Tympanum distinct. Fingers free, toes webbed, the tips dilated into regular disks. Outer metatarsals united.

Agrees with *Triprion* and *Diaglena* in the curious shape of the head, but differs in the absence of teeth on the parasphenoid.

Corythomantis Greeningi. (Pl. XVII. figs. 3–3 *b*.)

Vomerine teeth forming a transverse series on two strong triangular bony prominences between the posterior borders of the choanæ. Head extremely depressed, entirely bony, rough, its posterior border slightly raised and notched in the middle; forehead concave; canthus rostralis raised, curved; snout projecting far beyond the mouth, flat beneath; tympanum half the diameter of the eye. Fingers rather short, disks as large as the tympanum; toes two-thirds webbed, the disks a little smaller than those of the fingers; subarticular tubercles strong. The tibio-tarsal articulation reaches the posterior border of the eye. Sides of body with closely-set small round tubercles; belly and lower surface of thighs granulate. Greyish olive above, freckled with darker; tubercles whitish; lower parts whitish. No vocal sacs.

From snout to vent 78 millim.

A single male specimen from Brazil (exact locality unknown), presented by Mr. L. Greening.

Pelodytes caucasicus.

Vomerine teeth in two transverse groups between the choanæ. Snout subacuminate, with moderately distinct canthus; tympanum feebly distinct, two thirds the diameter of the eye. First finger as long as second; toes webbed at the base and fringed; subarticular tubercles strong; a very small inner metatarsal tubercle. The tibio-tarsal articulation reaches the tip of the snout. Body covered with strong warts, some of which are confluent into longitudinal folds; a paratoid-like fold above the tympanum. Olive above, white beneath, all the warts covered with a black horny layer in the male. Male with an internal vocal sac, the fore limbs very strong, with rugose black plates as in *P. punctatus*; similarly with black rugosities round the lower jaw, on the breast, belly, and under the hind limbs, especially on the subarticular tubercles.

From snout to vent 47 millim.

A single specimen from Mount Lomis, Caucasus, 7000 feet, received from the Tiflis Museum.

This Batrachian is of particular interest as adding a second species to the genus *Pelodytes*, the range of which was believed to be confined to France, the Spanish peninsula, and North-west Italy. Not long ago but three species of Pelobatoids were known from the Palæarctic Region. The number is now raised to five, viz.:—

1. *Pelobates fuscus*, Laur. (Central Europe and Northern Italy.)
2. *Pelobates cultripes*, Cuv. (France, Spain, Portugal.)
3. *Pelobates syriacus*, Bttgr. (Asia Minor, Syria.)
4. *Pelodytes punctatus*, Fitz. (France, Spain, Portugal, N.W. Italy.)
5. *Pelodytes caucasicus*, Blgr. (Caucasus.)

EXPLANATION OF PLATE XVII.

Fig. 1. *Oreobatrachus baluensis.*
Fig. 1 *a.* Ditto. Open mouth.
Fig. 2. *Megalixalus brachycnemis.*
Fig. 3. *Corythomantis Greeningi.*
Fig. 3 *a.* Ditto. Side view of head.
Fig. 3 *b.* Ditto. Open mouth.

BIBLIOGRAPHICAL NOTICE.

On supposed Remains of Organisms from the Pre-Cambrian Strata of Brittany. By HERMANN RAUFF, of Bonn. With illustrative cuts.

Ueber angebliche Organismenreste u. s. w. From the 'Neues Jahrbuch für Mineralogie,' &c., 1896, Bd. i.

THE Author reviews the results arrived at by M. Cayeux in his microscopic researches in these old rocks. After examining specimens himself, Herr Rauff thinks that the so-called Sponge-spicules are inorganic—merely microscopic threads and granules of some decomposed metallic mineral, most likely pyrites.

He notices the extremely minute size and relatively enormous number of the so-called Radiolarians. He observes that M. Cayeux regards the matrix as having been crystallized from an original state of Radiolarian earth; and Rauff asks if any one could determine optically the isotropic nature of the delicate and thin shells and skeletons in the anisotropic enveloping material. He also asks why M. Cayeux holds it possible that the Radiolarian skeletons, in spite of the crystallizing of the quartzose medium in which they lie, could keep their original colloidal silica, whilst for his Sponge-spicules he does not allow of its possible preservation. Rauff concludes that these so-called Radiolarians and Sponge-spicules are minute spherical granules of some modified metallic mineral, probably pyrites, in touch or coalescence one with another. Independent corroboration of his views he finds in Dr. Hinde's remarks on some similar minute bodies in the 'Quarterly Journal of the Geological Society,' vol. li. p. 631.

MISCELLANEOUS.

Modifications produced in the Organs of Sense and of Nutrition in certain Arthropods by confinement in Caves.* By M. ARMAND VIRÉ.

NOWHERE does the influence of environment show itself more markedly or in a more striking manner than in caverns: the absence of light and the scarcity of prey produce in animals which are drawn into them, and succeed in acclimatizing themselves therein, modifications of various kinds.

The eye, *always atrophied*, is more or less so according to the species and the individuals of the same species. In certain Amphipod Crustaceans (*Gammarus*, nov. species) it presents varying intermediate states between the almost normal eye, of a blood-red colour and apparently still capable of perceiving certain luminous sensations, and the completely depigmented eye, in which nothing is preserved beyond the *external* primitive form. Some individuals exhibit varying degrees of atrophy in one eye and the other.

* Researches made in the Jura in 1894-95 and in the physiological laboratory of the Sorbonne.

Among the Thysanura (Campodeæ and Poduridæ) the evolution is more accentuated, inasmuch as the Poduridæ have still at the base of the antennæ some globules of a reddish colour, whilst the Campodeæ have no trace whatever of a visual organ.

Certain sense-organs supply the place of the eye. Thus the antennæ of the Campodeæ, which in certain individuals are still almost normal, reach in others a length more than double (the normal) and become longer than the body. The same takes place with the anal fork. The tactile hairs which cover the body take on an exaggerated development, and appear in the Crustacea to go so far as sometimes to invade the eyeball.

The sense of hearing, on the other hand, does not appear to be proportionately increased, and a great noise may be made near a subterranean lake without startling the animals (in it).

The sense of smell seems to be very acute, and putrid food left in the water or on the ground is in a few minutes attacked by a large number of creatures.

The *digestive organs* are considerably modified, as the result of a mode of life which sometimes extends to the complete absence of animal food in species normally carnivorous. Thus two (specimens of) *Staphylius* caught in June last in the grotto of Baume-les-Messieurs (Jura) had their mandibles atrophied.

The digestive tube of the Crustacea is found to be almost always full of clay from the bottom of the lakes, which contains nothing beyond the mineral matter except great quantities of microphytes (algæ, moulds, spores, &c.). Under the influence of this regime, the digestive tube appears to have enlarged, sometimes it presents knots and a certain tendency to twisting.

All the animals are *depigmented* more or less completely. Some specimens still possess, however, a slight rosy coloration or minute irregular patches of black pigment in contrast with the colourless ground of the tissues. With regard to this point, it appeared to me to be of interest to replace certain individuals in the light and observe what would happen. The experiment, interrupted by accident at the end of about a month, was nevertheless even then conclusive; the individuals were carefully taken from amongst the most etiolated, as exhibiting no trace whatever of pigmentation. In this short space of time, one could watch the appearance of quantities of small black specks, scattered over the whole body, and especially abundant on organs accidentally amputated and in course of repair, such as the antennæ and feet. It appears, then, that this phenomenon occurs fairly rapidly. Later observations on this head will be reported.

The animals found may be classed as follows :—6 species of Crustacea (Amphipoda and Isopoda), 2 species of Thysanura, 1 Acarid, 2 Arachnids, 1 Gasteropod, &c. They were taken principally from the grottoes of Sainte-Catherine, at Consolation, Commune of Maisonnettes (Doubs), Baume-les-Messieurs (Jura), Les Planches, near Arbois, and Les Nans, near Nozeroy.—*Comptes Rendus*, t. cxxii. pp. 486–487.

CONTENTS OF NUMBER 101.—*Sixth Series.*

BIBLIOGRAPHICAL NOTICE.

MISCELLANEOUS.

*** It is requested that all Communications for this Work may be addressed, post-paid, to the Care of Messrs. Taylor and Francis, Printing Office, Red Lion Court, Fleet Street, London.

Vol. 17. **SIXTH SERIES.** No. 102.

THE ANNALS AND MAGAZINE OF NATURAL HISTORY,

INCLUDING

ZOOLOGY, BOTANY, AND GEOLOGY.

CONDUCTED BY

ALBERT C. L. G. GÜNTHER, M.A., M.D., PH.D., F.R.S.,
WILLIAM CARRUTHERS, F.R.S., F.L.S., F.G.S.,
AND
WILLIAM FRANCIS, PH.D., F.L.S.

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

WITH ONE PLATE.

Illustrative of Mr. R. I. Pocock's Paper on East-African Scorpions, Centipedes, and Millipedes.

LONDON:
TAYLOR AND FRANCIS, RED LION COURT, FLEET STREET.
Sold by Simpkin, Marshall, Hamilton, Kent, & Co., Ld.; Whittaker & Co.: Baillière, Paris: Maclachlan and Stewart, Edinburgh: Hodges, Figgis, & Co., Dublin: and Asher, Berlin.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SIXTH SERIES.]

No. 102. JUNE 1896.

LX.—*On some Odonata of the Subfamily* Æschnina. By Robert M'Lachlan, F.R.S. &c.

The new species here noticed form a portion of the undescribed material I possess in the subfamily. The sequence adopted is that of Dr. Karsch (1891), which in several respects seems an improvement on that of Baron de Selys (1883), especially in the discovery of important neural characters. But I am of opinion that the formation of the tenth ventral segment in the female will prove of more importance than the later system allows to it, more especially as the condition seen in *Gynacantha* is repeated in a North-Indian genus (not here characterized) allied to *Cephalæschna** and *Calliæschna* by neuration.

In the descriptions that follow I have adopted the minute details of neural characters used by Dr. Karsch. It is probable that eventually a plan of grouping species will obviate the necessity for such exactitude. A certain amount of latitude must be accorded to the interpretation of these details, for at present they are often drawn up from very limited material.

Anaciæschna triangulifera, sp. n.

♂. Face dingy whitish or yellowish; top of front clothed

* Cf. *Cephalæschna sikkima*, Karsch.

with blackish hairs, with a black T-spot, the top of which is thickened in the middle, the tail dilated into a *broad, nearly equilateral triangle*, the base of which extends nearly to the outer angles of the front; vesicle with two yellowish or bluish spots; eyes connected in a long space; occiput very small, yellowish or brownish; back of head black. Thorax green above, brown on the sides, interalar area spotted with greenish white; no antehumeral or humeral bands, but on the sides there is a rather narrow oblique greenish-yellow band under each wing, not extending to the legs. Legs black; the coxæ and trochanters and the anterior femora beneath at the base reddish. Abdomen slender, inflated at base and constricted afterwards; oreilettes small, acute, the apex incurved; when adult the general colour is blackish brown, paler at the base; on the sides the apex of segment 1 and base of segment 2 are occupied by a greenish-yellow transverse band divided by the black suture; there are indications of pale apical and subapical spots on segments 4 to 7; above there is a large and nearly round median pale spot on each side of 10 and an apical spot on 7 to 9 (a less mature male shows a whitish lateral band on segments 1 and 2 and half of 3, and a small dorsal spot on each side of the false suture on segments 2 to 7, the apical spots less distinct); tenth segment with a median dorsal carina, which near its base is *elevated into a strong triangular black tooth, with a tubercle placed in a fovea on either side of it*; superior appendages (5 millim.) as long as the ninth and tenth segments united, black, slightly curved and narrowed at the base internally, the inner edge forming a gradual curve to the apex, which is narrower than the base, acute, and curved downward; there is a strong median carina from base to apex, dilating almost suddenly at the commencement of the apical third, the internal edge fringed with long hairs; inferior appendages more than one half shorter, elongately triangular, slightly notched at tip, curved upward, brownish above.

Wings hyaline; pterostigma very small (3 millim.), ochreous, surmounting $2\frac{1}{2}$ cellules; membranule conspicuous, smoky black, with whitish base; nodal sector suddenly elevated under the pterostigma; subnodal sector furcating before the level of the pterostigma, 3 rows and 5 marginal cellules between its branches; 3 or 4 rows of cellules between the subnodal and the interposed sector at the widest part; one row of cellules between the sectors of the triangle (more towards the apex) in the anterior, two rows and afterwards one in the posterior; no basal subcostal nervule; 15 to 17 antenodals and 7 to 9 postnodals in the anterior and 10 or 11 and 8 to 10 in the posterior; 5 (rarely 6) cellules in the principal triangle in anterior and 4 (rarely 5) in posterior, 2 (rarely 1) in the inner triangle; 2 to 4 supra-trigonals, 3 or 4 in the median area; anal triangle 3-celled.

Length of abdomen (*cum append.*) 49 millim.; length of posterior wing 44 millim., greatest breadth 14 millim.

Hab. Delagoa Bay, two males.

This insect is clearly an *Anaciæschna* (distinct from *A. jaspidea*), but the lateral impressions on the sides of the abdomen are very faintly indicated *.

Gynacantha † *khasiaca*, sp. n.

♂. Face dingy yellowish, almost fumose, a strongly defined black T-spot on the top of the front, which is otherwise conspicuously pale (yellowish); occiput minute, blackish, its margin raised; back of head yellowish, eye-margins blackish. Thorax dark greenish above, dorsal crest black; sides somewhat more yellowish, with indications of two narrow blackish bands, one on the humeral suture, the other on the interalar suture. Legs *pitchy black*; anterior coxæ and trochanters and anterior femora internally brownish. Abdomen moderate, the basal portion short and much inflated, considerably constricted at the third segment; oreilettes large, rounded, black, the edge with five or six coarse teeth; general colour black above, venter brownish on a portion of the third to seventh segments, the sides of segments 1 and 2 varied with greenish; tenth segment with a fine, slightly raised, longitudinal dorsal carina not quite reaching the apical margin, which is finely denticulate and slightly notched in the middle, the apical portion of the segment transversely excavated, and at the

* As a modification of Dr. Karsch's system I think it will prove preferable to cause *Anaciæschna* to follow instead of precede *Gynacantha* &c. Probably undue importance has been placed on the presence of lateral impressions on the abdomen, and I show that in the species above described they are virtually absent.

† *Gynacantha* is here applied in the sense indicated by de Selys in 1883. Mr. Kirby, in his Catalogue, retains the term for species placed in *Triacanthagyna* by de Selys, and substitutes *Acanthagyna* for *Gynacantha*. Dr. Karsch has objected to this on the ground that, according to him, there was no necessity for de Selys's subdivisions. I think, however, that these subdivisions will be maintained (and others probably be found necessary). My objection to the change made by Kirby is that the type or types of *Gynacantha* and *Triacanthygina* were *first* indicated by de Selys when he subdivided the former in 1883 (Kirby's catalogue was published in 1890); he indicated no type of *Gynacantha* in 1857, as Kirby seems to imply.

base on either side of the carina there is a strong tubercle; superior appendages comparatively short and thick (6 millim.), about as long as the eighth and ninth segments united, black, externally nearly straight, slightly sinuate before the apex; internally they are thick at the base and scarcely excised on the edge, but triangularly dilated before the apical portion (at a point where a carina extending from the base finishes), which latter is very oblique, ending externally in an incurved sharp tooth; viewed laterally these appendages are gently curved, the inner edge ciliated; inferior appendages fully *two thirds the length of the superior*, very elongately triangular, strongly curved if viewed laterally, the apex slightly inturned (doubtfully emarginate).

Wings broad and obtuse, hyaline, tinged with yellow at the base in the subcostal and median areas, brownish in the former, extending nearly to the arculus in the posterior; pterostigma brownish yellow ($4\frac{1}{2}$ millim.), surmounting 4 or 5 cellules; membranule small, whitish; neuration moderately dense, black; subnodal sector furcating much before the level of the pterostigma, with 3 or 4 rows of cellules between the branches (9 on the margin); 4 cellules between the subnodal and interposed sector at the widest part, 2 on the margin; one row between the sectors of the triangle; no basal subcostal nervule; 24 antenodals and 24 postnodals in the anterior, and 18 to 22 in the posterior; 6 cellules in the principal triangle in the anterior and 5 in the posterior, 2 in the inner triangle, 6 supra-trigonals and 5 or 6 in the median area; 3 cellules in the anal triangle.

♀. As in the male, but the abdomen only slightly constricted at the third segment; appendages very slender and acute, as long as the ninth segment; tenth ventral segment with two long curved teeth.

Wings becoming fumose, especially at base and apex, in very adult individuals; the yellow of the base more strongly defined than in the male, extending nearly up to the triangles, and the brown much more evident, extending up to and beyond the arculus; 25–28 antenodals and 19 or 20 postnodals in the anterior, and 21–23 and 20–22 in the posterior.

Length of abdomen, ♂ (*cum append.*) 54 millim., ♀ 52–54 millim.; length of posterior wing, ♂ 45 millim., ♀ 46–50 millim.; greatest breadth 15–$16\frac{1}{2}$ millim.

Hab. Khasia Hills, two males, three females; Annam, one female.

Quite distinct from *G. subinterrupta* and *basiguttata* (which also have the wings marked with brown at the base) by the black legs and the appendages, the long inferior appendages of *G. khasiaca* being remarkable.

De Selys (Ann. Soc. Ent. Belg. xxvii. p. 128, 1883) alludes to a *G. nigripes* from Thibet as having very acute appendages and *no* markings at the base of the wings, but with no further indication of characters.

Gynacantha bullata, Karsch.

Of this I possess two males and two females from "Cameroons" (*Rutherford*), one male from "Mahambé" (*Rutherford*), one male from Cape Coast Castle, and one male from "West Africa," without further indication of locality. They vary considerably in size, but the characters remain very distinct. In very mature examples the wings are strongly brownish fumose. The oreilettes are usually wholly black, but yellow margined with black in less mature individuals. (A very immature male and female from Sierra Leone are slightly doubtful.)

N.B.—*Æshna africana*, Pal. de Beauv. (Ins. Afr. &c. p. 67, pl. iii. fig. 1). The figure indicates a somewhat large *Gynacantha* (probably female), larger than *G. bullata*; what it really is will probably remain problematical, for I am not aware that the type is extant.

Gynacantha sextans, sp. n.

♂. Face dingy yellowish; a strongly defined black T-spot on the top of the front; eyes connected in a long space; occiput very small, yellowish; back of head yellowish. Thorax above dingy fuliginous, paler in front, with cinereous pilosity; sides and first segment of abdomen dingy yellowish, with conspicuous black mesothoracic spiracle. Legs reddish yellow. Abdomen slender, much inflated at the base and very strongly and flatly constricted at the third segment; oreilettes large, yellowish, with three or four coarse blackish teeth; general colour fuscescent, darker towards the apex, with no defined markings; first segment as above noticed, second more dingy but yellowish at the sides, which colour is continued conspicuously on the sides of the third (but not reaching the apex) and slightly at the sides of the base of fourth to sixth; tenth with a strong median longitudinal carina its whole length, the margin slightly rounded. Superior appendages long (7 millim.), longer than the eighth segment, slender, the outer margin nearly straight, the inner narrow at the base, then gradually dilated, followed by a long excision and again gradually dilated to the apex, which is somewhat rounded, ending externally in a sharp tooth or spine; a dense fringe of long hairs nearly from base to apex internally. Inferior appendage less than one third the length of the superior, elongately triangular, obtuse and scarcely emarginate at apex, concave and yellowish above.

Wings hyaline, slightly fumose, more or less uniformly tinged with brownish when very adult; a brownish mark at extreme base, extending a short distance along the subcostal and median areas; pterostigma reddish brown (5 millim.), surmounting $5\frac{1}{2}$ to $6\frac{1}{2}$ cellules; membranule rudimentary, whitish; neuration very dense, blackish, costal edge dark purplish externally; subnodal sector furcating before the level of the pterostigma, the cellules between the branches commencing as one, then two, followed by three, five on the margin; 7 cellules between the subnodal and interposed sector in the broadest part, ending in two marginal cellules; one row between the sectors of the triangle in both pairs; no basal subcostal nervule (exceptionally one in a posterior wing); 28 to 30 antenodals and 24 postnodals in the anterior and 25 to 27 and 24 to 26 in the posterior; 6 to 9 cellules in the principal triangle, 2 in the inner; 8 to 10 supra-trigonals; 6 nervules in median area; 6 (exceptionally 5) cellules in anal triangle (two above, three in the middle, and one below).

Length of abdomen (*cum append.*) 59–60 millim.; length of posterior wing 50–53 millim., greatest breadth of same 16–17 millim.

Hab. Mongo-ma-Lobah, Cameroons (*Rutherford*), two males.

Quite distinct from other West-African species by the form of the appendages, the 6-celled anal triangle (which is perfectly constant in internal arrangement in three of the four wings examined), and the brown markings at the base of the wings.

Gynacantha quadrina, sp. n.

♂. Face dingy yellowish, margin of labrum and the nasus somewhat fuliginous; a black T-spot on the top of the front, the tail of which is very distinct and the top ill-defined, the whole placed in a deep sulcus (longitudinal and transverse); eyes connected in a long space, occiput rather elongate, dingy yellowish, its margin elevated; back of head dingy yellowish. Thorax brownish fuliginous above, paler anteriorly, with cinereous pilosity; sides dingy ochraceous, together with the first and second abdominal segments; mesothoracic spiracle encircled with black. Legs purplish red, with concolorous spines. Abdomen slender, inflated at base, constricted at the third segment; oreilettes large, yellow, subquadrate, with 3 or 4 blackish teeth on the lower edge; colour brown, with ill-defined paler markings, sutures on all the segments narrowly black, and there is a fine black dorsal crest from the third to eighth, sides of the third broadly pale yellowish, venter paler; tenth segment with a much elevated longitudinal carina, highest at the apical margin, where it is cut off obliquely if viewed laterally, causing the apical margin of the segment to be angulated in its middle; a deep depression on either side of the apical portion of the carina. Superior appendages (7 millim.) about as long as the ninth and tenth segments united, dingy ochreous or slightly reddish, flattened above, with raised edges; externally straight, gradually curved inwards towards the apex; internally densely ciliated for the whole length, narrow at the base, then very slightly dilated for a short space, then excised to end of basal third, again dilated and regularly excised in a curved manner to the apex, which is inturned, dilated, and the broadest part of the whole length, *the apex itself truncated and very slightly excised*, the inner angle rounded, the outer ending in a short sharp tooth. Inferior appendages elongately triangular, reddish, the inturned apex blackish and sulcate, the sides slightly constricted from about the middle, one third the length of the superior, extending to the end of the inframedian excision.

Wings hyaline, slightly fumose, *strongly tinged with yellow* (scarcely brownish) *at the base*, which colour extends nearly to the triangles, and occupies the anal triangle in the posterior; pterostigma small, yellowish ($5\frac{1}{2}$ millim.), surmounting 5 or 6 cellules; membranule small, whitish; neuration dense, dark brownish, almost black, the costal margin brown externally; subnodal sector furcating much before the commencement of the pterostigma, the area between the branches with 4 rows of cellules for the greater part, 6 marginal cellules; 6 irregular cellules between the subnodal sector and the interposed one below it at the widest part, ending in two marginal cellules; a single row of cellules between the sectors of the triangle except towards the apex; no basal subcostal nervule; 33 antenodals and 20 postnodals in the superior, 24 and 25 in the posterior; 9 or 10 cellules in the principal triangles, 2 in the inner; 12 or 13 supra-trigonals in the anterior, 9 in the posterior; 6 in the median area in the anterior and 5 in the posterior; anal triangle with *four* cellules, one next the anal margin above and two placed against it on the other side, the fourth below.

Length of abdomen (*cum append.*) 66 millim.; length of posterior wing 56 millim., greatest breadth of same $16\frac{1}{2}$ millim.

Hab. Mahambé, West Africa (*Rutherford*), one male.

This species agrees with the description of *G. vesiculata*, Karsch, in the 4-celled anal triangle, and tolerably well in the form of the anal appendages (there is no mention of the strong elevated carina on the tenth dorsal segment), but its much larger size, darker colour of the body, yellow base of the wings, and apparently more constricted third segment seem opposed to specific identity. It is the largest African species known to me.

Assuming that *G. quadrina* is distinct and *G. africana* uncertain, *G. vesiculata* is the only described West-African species I do not possess.

Gynacantha membranalis, Karsch.

This fine species is distributed from the Amazons to Panama. As an item in the identification of the numerous American species unfortunately quoted with names in MS. or with "no description," it is well to point out that *G. membranalis* = "*G. falco*, Bates, Selys, MS."

Gynacantha tibiata, Karsch.

Described from a male from Ecuador. A pair (♂ ♀) in my collection from Chiriqui (Panama) agree with the description in all essential points; the very short and broad inferior appendage of the male is, however, very slightly notched in the middle of the rounded apex. There can scarcely be any doubt as to the identity.

Gynacantha chelifera (Selys, MS.), sp. n.

♂. Face dingy yellowish, with cinereous pilosity; seen from above the top of the front is much elevated and almost angulate at its summit; T-spot ill-defined, the top evident only as a dingy margining of the edge, the tail distinct, dingy blackish; eyes connected in a very long space, the occiput flat, very small; back of head yellowish. Thorax yellowish fuliginous above, paler beneath and on the sides. Legs pale yellowish, with concolorous spines. Abdomen slender, cylindrical, scarcely thicker at the base, and *not constricted* afterwards, smoky brown; venter yellowish, the incisions of the segments scarcely darker; oreilettes of the second segment triangular, yellow, acute, with 3 or 4 tuberculiform black teeth on the lower edge; tenth segment transversely elevated at its base, the margin regular. Superior appendages very long (6 millim.), nearly as long as the eighth and ninth segments united, brownish, inserted distantly at the base, narrow for nearly three fourths of their length (the inner edge slightly sinuous), then *suddenly enlarged into a flattened, obtuse, spoon-shaped concave apex*, the opposing apices contiguous; viewed laterally these appendages are regularly but slightly curved; viewed from beneath the dilated apical portion is convex, but with a circular terminal concave space, margined by a fringe of cinereous hairs. Inferior appendages rudimentary (not more than 2 millim.), triangular, whitish yellow, the apex notched, and produced into a small black tooth on either side.

Wings hyaline, *short, broad, and obtuse*; pterostigma brown, surmounting 3½ cellules in the anterior, 2½ in the posterior; membranule very rudimentary, whitish; neuration moderately dense, dark brown (blackish in certain lights); subnodal sector furcating considerably before the level of the pterostigma, with three rows of cellules between its branches for the greater part, 4 marginal cellules; 4 cellules between the subnodal and interposed sector beneath it at the widest part, but for only one row, three on either side of it, ending in only one marginal cellule; one row of cellules between the sectors of the triangle in the anterior, one or two cellules sometimes transversely connected in the posterior; no basal subcostal nervule; 19 antenodals and 13 postnodals in the anterior, 14 and 16 in the posterior; 4 or 5 supra-trigonals, 5 in the median area in the anterior and 4 in the posterior; 5 or 6 cellules in the principal triangle, 2 cellules in the inner triangle in the posterior, 1 in the anterior; 3 cellules in anal triangle.

Length of abdomen (*cum append.*) 43 millim.; length of posterior wing 37 millim., greatest breadth of same 13 millim.

Hab. Brazil, Rio Janeiro (*Fry*). One male has been in my collection for about twenty years with the MS. name here adopted.

A singular species in its general form, in the appendages, and in the not constricted base of the abdomen in the male, possibly pertaining to the group of species placed in *Triacanthagyna*, Selys.

Heliæschna fuliginosa (Selys), Karsch.

I have before me five males and three females (collected by the late D. G. Rutherford), as follows:—

(1) One very mature male from Cameroons.—The wings entirely brownish fuliginous; 25 ante- and 18 postnodals in the anterior, and 22 and 20 in the posterior. Length of posterior wing 41 millim., greatest breadth 12 millim.

(2) One less mature male (wings not tinged) and one highly mature male and similar female (wings darkly tinged) from "Cameroons," and two highly mature and tinged males from "Mahambé."—In these there are about 31 or 32 ante- and 21 or 22 postnodals in anterior wings, and about 24–26 and 23 in the posterior. Length of posterior wing 51–54 millim., greatest breadth 15–16 millim.

(3) Two transitional (?) females (one from Old Calabar, and the other from Cameroons), in which the wings are strongly marked with blackish fuscous in the costal and subcostal areas nearly up to the arculus, and with a large smoky-yellowish space from the nodus to the pterostigma, extending half across the wing (somewhat as in *Amphiæschna ampla*). —There are 31 or 32 ante- and 23–25 postnodals in the anterior wing, and 24–26 and 26–28 in the posterior. Length of posterior wing 56 millim., greatest breadth 16 millim. In these examples the abdomen has conspicuous pale markings (almost obliterated in the others); the sides of the third segment are broadly whitish yellow; a like-coloured geminate spot at the base of segments 4 and 5 and a half-ring at the apex of segments 3 to 6. In these also the appendages are present (broken in the other), very long (11 millim.), somewhat similar in form to the superior pair in the male, but more slender at the base and less widened afterwards.

It will be seen from the foregoing that the range of size is almost as given by Dr. Karsch (Ent. Nachr. xix. p. 194) from a single pair only, and the neural details practically agree also; but the size is not dependent upon sex, as my statement proves. The two females (3) with parti-coloured wings have a different appearance, but I think are not specifically distinct.

It seems to me that the oreilettes in the male are 5- (not 4-) toothed. On the tenth abdominal segment in the male there is a slight raised longitudinal median carina, at the base of which on either side is a transverse elongate fovea with raised edge externally, and the apical margin is slightly notched in its middle. The legs have piceous-red femora and black tibiæ and tarsi. In one of the large females there are *two* basal costal nervules before the first thickened nervule in one anterior wing.

Heliæschna ugandica, sp. n.

General characters as in *H. fuliginosa*, and apparently not differing in anal structure. Colour (excepting the face, which is dingy) black, paler beneath, the abdomen showing traces of paler markings (more evident in the female). Legs *wholly reddish piceous*, or the tarsi sometimes blackish.

♂. Wings hyaline, not tinged; pterostigma black (3 millim.), surmounting nearly 4 cellules; neuration less dense, black; two rows of cellules between the branches of the sector, 4 cellules on the margin; 4 cellules between the subnodal and the interposed sector at the widest part; a single row between the sectors of the triangle for the whole length; 22 ante- and 13 postnodals in the anterior and 15 and 13 in the posterior wings; 5 cellules in the principal triangle, 2 in the inner; 5 supra-trigonals; 3 or 4 nervules in the basal area; anal triangle 3-celled.

♀. Wings as in male, but slightly tinged with yellow at the extreme base; pterostigma brownish yellow ($2\frac{1}{4}$ millim.); 23 ante- and 15 postnodals in the anterior and 17 ante- and postnodals in the posterior; two rows of cellules between the sectors of the triangle for a short distance on the margin in the anterior only; (other neural details mainly as in the male).

Length of abdomen, ♂ (*cum append.*) 49 millim., ♀ (*append. excl.*) 42 millim.; length of posterior wing, ♂ 42, ♀ 43 millim., greatest breadth, ♂ 14, ♀ $14\frac{1}{2}$ millim.

Hab. Uganda, East Central Africa (*R. P. Denoït*, received from M. René Oberthür), one male and one female, slightly immature.

The pair above noticed appear to be specifically distinct by the very small pterostigma, less dense neuration *, and appreciably broader wings (especially the posterior) when compared with an example of *H. fuliginosa* of practically the same size; also in the nearly wholly reddish legs. In the right posterior wing of the female the first postnodal cellule is divided longitudinally, but exceptionally and not as a continuation of the subcosta.

Æschna erythromelas, sp. n.

♀. Face elongate, olive-green, labium and palpi brownish; crest of top of the front dusky posteriorly, ciliated with

* Compare the details given for *H. fuliginosa* by Dr. Karsch, *loc. cit.*

blackish, with no defined T-spot; vesicle olive-green; eyes connected in a long space, occiput very small, slightly excised on its margin, black; back of head shining black. Thorax dark blackish brown, with black villosity and green markings as follows:—a broad band on either side of the dorsal crest interrupted posteriorly by the crest of the antealar sinus; two large interalar spots; on each side two large oval bands or spots, one under each wing, not extending to the legs; pectus brown. Legs black; coxæ, anterior and intermediate trochanters, and anterior femora at base beneath brownish; claws red, tipped with black. Abdomen orange-red; a very distinct ring at the base of segments 2 to 7, segments 8 to 10 wholly (excepting some red spots on 8) and a ventral line black; at the apex of each segment from 1 to 7 is a greenish ring with indications of a narrower one on the transverse false sutures; margin of tenth segment above slightly excised in the middle and with a fovea at the insertion of each appendage. Appendages black (broken); tenth ventral segment rounded, denticulate, with 4 or 5 of the teeth much more prominent than, and twice the length of, the others; vulvar lamina with black side-sheaths and strong reddish spine.

Wings hyaline, very shining; pterostigma small (4 millim.), black; membranule whitish; neuration open, black; subnodal sector furcating on a level with the pterostigma (slightly before in posterior), the space between the branches commencing by a single cellule, followed by two rows, and ending in 4 or 5 marginal cellules; 5 or 6 cellules in the space between the subnodal and the underlying interposed sector in its broadest part; no basal subcostal nervule; 19 ante- and 15 postnodals in the anterior wings, 13 and 16 in the posterior; 4 supra-trigonals in the anterior and 3 in the posterior; 5 cellules in principal triangle in anterior and 4 in posterior; 5 nervules in the median area in the anterior and 3 or 4 in the posterior (excluding the nervule forming the inner triangle).

Length of abdomen (*excl. append.*) 59 millim.; length of posterior wing 55 millim., greatest breadth of same 17 millim.

Hab. Sabathu, near Simla (N.W. India), July 1888, one female.

It will be necessary to see the male before attempting to define the nearest allies of this magnificent insect; the inequality of the teeth on the tenth ventral segment may be significant.

In this individual the abdomen had been "prepared" when fresh by the extraction of the contents and the substitution of cotton-wool, so that the colours are no doubt more vivid than in examples not prepared; but at the same time they probably fall far short of the brilliancy in the living insect.

Æschna minuscula, sp. n.

♂. Face and top of the front yellow, the latter with a black T-spot, the top of which is broad and crescentic; the tail somewhat conical, connected with the top only at a point; a fringe of black hairs on either side; vesicle yellow above, in front with a narrow black line, which descends along the margins of the eyes to the base of the front; eyes connected in a rather short space; occiput yellow; back of head blackish. Thorax brown, clothed with fine concolorous pilosity, and darker dorsal crest and antealar sinus; each side above with a straight, rather narrow, greenish-yellow antehumeral band extending into the sinus, but scarcely reaching the anterior margin; sides with two broad oblique greenish-yellow bands, one under each wing, not reaching the legs; interalar space and wing-roots spotted with yellow. Legs black; coxæ, trochanters, and femora (except at apex) reddish brown. Abdomen somewhat slender, inflated at base and constricted afterwards; oreilettes small, prominent, triangular; colour brown, with black sutures; a broad yellow band on the sides of segments 1 and 2, an elongate cuneate dorsal yellow spot on 2; lateral spots on the base of segments 4 to 8; the apex becomes gradually nearly black, with a large yellow spot above on each side of the apex of segments 4 to 10, vague on 4 to 6, afterwards very distinct, the spots on 10 being nearly quadrate, with a black margin anteriorly and posteriorly, and separated by a longitudinal black band in which is the dorsal carina, slightly elevated near its base (with a deep fovea on either side), but not forming a tooth if viewed laterally. Superior appendages (6 millim.) about as long as the ninth and tenth segments united, blackish brown, straight, contiguous, narrowest at the base, the inner edge gradually widening to end of inferior appendage and continued as a gentle curve almost from base to apex, which latter is about the same width as base, with the inner margin gently curved, the outer acute and slightly turned outward; above there is a slight median carina from base to apex. Inferior appendage more than one half shorter, elongately triangular, the apex notched; colour above reddish yellow with black margins.

Wings hyaline, very slightly fumose; pterostigma (3 millim.) narrow, dark brown, surmounting $2\frac{1}{2}$ cellules; membranule conspicuous, whitish above, blackish below; neuration moderate, blackish, the costa and nodal vein conspicuously yellowish, and most of the ante- and postnodals, and the nervules in the basal portion of the wing are yellowish if seen in certain lights; subnodal sector furcating before the level of the pterostigma, with 3 or 4 rows of cellules between its branches and 6 cellules on the margin; 3 cellules between the subnodal and interposed sector at the widest part, ending in one for some distance; a single row between the sectors of the triangle in the anterior, ending with 4 on the margin; two rows for the space of three cellules near the base in the posterior, then one, ending with two on the margin; no basal subcostal nervules; 13 antenodals and 9 postnodals in the anterior and 9 ante- and postnodals in the posterior; 3 (rarely 4) cellules in the principal triangles, 1 in the inner; 2 or 3 supra-trigonals; 2 or 3 nervules in the median area; anal triangle 3-celled.

♀. Similar to male; the abdomen not becoming darker towards the apex, and the spots above are found only on segments 8 to 10, occupying the whole of 10 excepting a narrow median line; the lateral spots are conspicuous on segments 6 to 8. Appendages black, formed nearly as the anterior in the male, but very short (2 millim.); tenth ventral segment with numerous minute black teeth nearly all over its surface.

Wings as in male, but the costal portion appears yellowish owing to the more decided pale coloration of the costal nervules; pterostigma yellowish; 13 ante- and 8 postnodals in anterior, 10 ante- and postnodals in posterior.

[An immature female has a semilunate pale spot on each side of the second segment on the false suture; the dorsal apical spots are visible only on 9 and 10 and the basal lateral only on 8; the wings are much tinged with yellowish. Possibly a distinct species.]

Length of body, ♂ (*cum append.*) 40, ♀ 44–47 millim.; length of posterior wing, ♂ 37, ♀ 38–39 millim., greatest breadth, ♂ 12, ♀ 13 millim.

Hab. Cape of Good Hope, one male and one female; Knysna (Cape Colony), one female.

Æschna subpupillata, sp. n.

♂. Face dingy yellow; top of the front with a fuliginous margin which expands on the sides above, forming a segment of an arc in which is enclosed a large black spot, the base of which is seated on the vesicle, and the apex acute but not reaching the margin (hence there is no **T**-spot); vesicle yellow, black in front, which colour descends as a fine line along the eye-margins; eyes connected in a moderately long space; occiput yellow; back of head black. Thorax greyish ochreous, with cinereous villosity; dorsal crest and the crests of the antealar sinus blackish; a faint vestige (scarcely definable) of an antehumeral paler line anteriorly, sides with two broad whitish bands not reaching the legs, one under each wing. Legs: tibiæ and tarsi and the underside of posterior femora black; otherwise reddish. Abdomen moderately slender, somewhat inflated at the base and slightly constricted afterwards; oreilettes prominent, subtriangular, obsoletely toothed; lateral genital valves on second segment much elongated, truncate at the apex, enclosing a slightly longer laterally flattened piece (penis?), the apex of which is also truncate; general colour dark brown, with indications of paler markings consisting of basal, subbasal, and apical spots; tenth segment nearly wholly pale, with a blackish median tooth near the base, on either side of which are two subobsolete tubercles and a short well-defined longitudinal sulcus; the carina is continued from the tooth to the apical margin, which is slightly notched in the middle. Superior appendages longer ($5\frac{1}{2}$ millim.) than the ninth and tenth segments united, strong, blackish brown, the outer edge nearly straight, the inner slightly dilated immediately after the base, then gradually excised to before the end of the inferior appendage, then considerably dilated, and finally gradually excised to the apex, which is very obliquely truncate and acute externally; viewed laterally the apices are downturned; a carina extends from base to apex, dilated and elevated in the apical fourth; internal edges with a dense fringe of long hairs in the apical half. Inferior appendage nearly half the length of the superior, elongately triangular, slightly curved, brown and concave above, with black margins and apex.

Wings hyaline; pterostigma small ($3\frac{1}{4}$ millim.), brown, surmounting $2\frac{1}{2}$–$2\frac{3}{4}$ cellules; membranule grey, whitish at base; neuration black, costal edge conspicuously yellow externally, and most of the nervules in the costal portion of the wing and in the triangles &c. are yellowish in certain lights; subnodal sector furcating before the level of the pterostigma, with mostly three rows of cellules between the branches, 4 cellules on the margins; 3 cellules between the subnodal and interposed sector at the widest part, 1 marginal cellule; a single row of cellules in the basal portion of the space between the sectors of the triangle in the anterior, two rows in the posterior, followed by one; 16 antenodals and 9 or 10 postnodals in the anterior, 11 and 10 or 11 in the posterior;

4 cellules in principal triangle, 1 in inner; 2 (rarely 1) supra-trigonals; no basal subcostal, 3 or 4 in median area; 3 (abnormally 2) cellules in anal triangle.

♀ (slightly immature). As in male; abdomen much varied with whitish at the sides of segments 1 to 3 and at the base of segments 4 to 9 (mostly in the form of a spot on each segment), a whitish lunule above on each side of the dorsal crest on segment 2. Appendages long ($5\frac{1}{2}$ millim.), brownish, in the form of flattened blades, narrowed internally at the base and rounded at the apex; tenth ventral segment apically covered with rather dense blackish teeth; there are mostly four rows of cellules between the branches of the sector, with 4 cellules on the margin, the neural details otherwise varying little.

Length of abdomen, ♂ (*cum append.*) 45, ♀ 45 millim.; length of posterior wing, ♂ 42, ♀ 45 millim., greatest breadth, ♂ 14, ♀ 15 millim.

Hab. British Caffraria (S.E. Africa), one male; Transvaal, one female.

Remarkable for the subpupillate markings of the top of the front and for the greatly produced genital parts of the second segment of the male.

I have examined the types of *Æ. Ellioti*, Kirby, from Central Africa, which species is perhaps allied to *Æ. minuscula*, but differs in the appendages &c.; it is not possible to define the form of the spot on the top of the front on account of the condition.

Æ. Rileyi, Calvert, should belong to another group, being much larger and with humeral as well as antehumeral bands.

Boyeria (new name).

= *Fonscolombia*, Selys (1883), preoccupied by Lichtenstein in Hemiptera (1877).

The genus remains named in honour of E. L. J. H. Boyer de Fonscolombe.

Planæschna, gen. nov.

♀. Face short, subglobose. Eyes connected in a rather long space; occiput very small. Thorax short. Abdomen moderate, inflated at the base and afterwards constricted; tenth ventral segment rounded, minutely denticulate.

Wings rather broad, reticulation moderately dense; membranule large; pterostigma moderate; subcosta not continued beyond the nodus; basal area not reticulated; supra-trigonal area reticulated; triangles moderate in the anterior, *short in the posterior*; *subnodal sector furcated* midway between the nodus and pterostigma; *a single row of cellules in the area between the subnodal sector and the interposed sector below it.*

Type *Æschna Milnei*, Selys (Japan).

The type of *Æ. Milnei* is in my collection and is obviously not a true *Æschna*, differing in its subglobose face, and especially in the single row of cellules between the subnodal sector and the interposed sector below it.

According to the system of Karsch (Entom. Nachr. xvii.) *Planæschna* seems (in the absence of the male) nearest to the American *Epiæschna*, which differs from it mainly in the abdomen not being constricted near the base, in the much longer triangles, and in the presence of two rows of cellules in the space between the subnodal sector and that interposed.

LXI.—*On the Scorpions, Centipedes, and Millipedes obtained by Dr. Gregory on his Expedition to Mount Kenia, East Africa.* By R. I. Pocock.

[Plate XVIII.]

Part I.—Scorpions.

Family **Buthidæ**.

Buthus Eminii, Poc.

Buthus Eminii, Pocock, Ann. & Mag. Nat. Hist., July 1890, pp. 98-100, pl. i. fig. 2.

Loc. Ndara and Athi Plains. A female example obtained at each locality. The male example was procured by Emin Pasha on the shores of Lake Victoria Nyanza.

I suspect this species will prove to be identical with *Centrurus trilineatus*, Pet., from Tete.

Parabuthus pallidus, Poc.

Parabuthus pallidus, Poc. Journ. Linn. Soc., Zool. xxv. p. 312.

Loc. Giriama, near Fuladoya. A single very young specimen.

The types of the species were from Mombasa.

Babycurus pictus, sp. n. (Pl. XVIII. fig. 1.)

? *Babycurus centrurimorphus*, Karsch, Berl. ent. Zeitschr. xxx. p. 78, pl. iii. fig. 2 (1886).

♀.—*Colour.* Carapace yellow, variegated with five longitudinal black bands, one median extending from the anterior border across the tubercle almost to the hinder border, one on each side passing backwards from the lateral eyes, and one on each lateral margin, whence patches of the same colour pass inwards, near the side of the posterior border there is on each side a distinct patch; terga yellow, with three longitudinal black bands, one in the middle and one on each side; these do not spread on to the seventh tergite; tail pale yellow, except for three rather indistinct fuscous spots on the lower surface of the second, third, and fourth segments, one in the middle and a pair at the posterior end; chelæ yellow, digits alone black in their basal half; legs yellow, faintly spotted with black, one spot in the middle of the femur, another on the patella, and one at the base of the two tibial segments.

Carapace as long as the first and half the second caudal segments, finely granular throughout, but not crested; ocular tubercle low, with smooth ridges.

Terga finely granular, the median crests distinct, granular, the lateral crests on the last strong and granular.

Sterna smooth, punctured, the last with neither granules nor crests.

Tail nearly five times as long as the carapace, the fourth segment a little wider than the fifth, third, and second, and equal to the first; segments almost smooth, only minutely granular when examined with a high power; keels all weak and scarcely to be called granular, the lower surface of the third, fourth, and fifth segments without visible keels.

Chelæ almost smooth, the crests very weakly granular; hand without crests, smooth, wide, a little wider than the brachium, the width equal to nearly half the length of the movable digit, which is only one third greater than the length of the hand-back; digits short, unmodified, the movable with 7 median rows of teeth (including the small apical set and regarding the long basal row as single), 7 larger external teeth, and 7 larger internal ones.

Legs weakly granular.

Pectines with 19 teeth.

Measurements in millimetres.—Total length 51; carapace 5·5, tail 28, of movable digit 5.

Loc. Athi Plains. A single female example. Also two examples of a closely allied though not quite identical form, from Niomkolo, Lake Tanganyika (*A. Carson*), which are not sufficiently well preserved to be satisfactorily identifiable.

The genus *Babycurus* is of considerable interest from a taxonomic point of view, on account of the position it occupies with regard to the other genera of the Buthidæ and the stumbling-block that it constitutes in the way of the adoption of the two classifications of the family that have been proposed by Dr. Thorell and by Prof. Kraepelin. The former divided the genera into two subfamilies, the Androctonini and the Centrurini—the former being characterized by the presence of two lower teeth on the immovable mandibular fang, while in the latter there is only one such tooth or none. In my paper on "A Revision of the Genera of Buthidæ" * I ventured to suggest that such a classification was untenable †, in view of the discovery of many genera of Buthidæ since 1876, when Thorell wrote; and I further ventured upon the statement that, in my opinion, the family was not susceptible of division into groups of the value of subfamilies.

The first opinion is, I think, borne out by the classification proposed in 1891 by Kraepelin, who attributed only a subsidiary importance in his scheme to the dentition of the mandible, but regarded the so-called tibial spurs and the dentition of the fingers of the chelæ as being of primary value. Taking these two characters into consideration, he split up the Buthidæ (Androctonidæ ‡) into three subfamilies:—(1) Androctonini, with a tibial spur on the fourth and usually on the third leg as well; (2) Isometrini, and (3) Centrurini, the latter differing from the former in having the additional external teeth on the fingers of the chelæ. This use of the tibial spurs was, to my mind, a great advance in our knowledge; but I do not consider that the difference in the dentition between *Centrurus* and *Tityus* is sufficient warrant for referring them to distinct subfamilies. An exactly analogous

* Proc. Zool. Soc. 1890, pp. 114 &c.

† To be logically consistent Thorell should, I think, have referred his genera to *three* categories, namely:—(1) those with two of these teeth; (2) those with but one; and (3) those with none. For it is difficult to see the grounds for uniting 2 with 3 rather than with 1, since, according to the character cited, it holds an intermediate position between the other two.

‡ Thorell, and following him Kraepelin, calls the family Androctonidæ. I prefer Simon's name Buthidæ, on the ground that *Androctonus* is a synonym of *Buthus*.

difference obtains between the genera *Hadruroides*, Poc., and *Caraboctonus*, Poc., as I have already pointed out *, yet no one regards the character in this case as of more than generic value. I submit, therefore, that we are logically compelled to fuse the Isometrini and the Centrurini into one group, and if a name be required for it the latter, as the older, must be retained. This reduces Kraepelin's subfamilies to two; but the further question to be discussed concerns the value that he attributes to the tibial spurs. According to his table the genera fall into two groups, namely those possessing tibial spurs (Androctonini) and those without them (Centrurini in the wider sense defined above). At first sight this looks reasonable enough, but, when critically examined, it seems to me to fail in consistency in just the same way that Thorell's system did; for the genus *Babycurus* occupies an intermediate position between the two sections. In fact, if classified according to the pedal spurs, the genera must be referred to *three* sections, namely:—(1) those with these spurs on the third and fourth legs; (2) those, or rather the one, with them only on the fourth leg; and (3) those with them on neither leg. I confess that, in my opinion, if the Buthidæ are to be divided into subfamilies upon the presence or absence of the pedal spur, it will have to be into the following three:—(1) Buthini, with the third and fourth pairs of legs spurred; (2) Babycurini, with the third pair not spurred; and (3) Centrurini, with the third and fourth pairs not spurred. But if exception be taken to this partition of the genera (and it is certainly, I think, open to criticism), I see no escape from the conclusion expressed by myself in 1890, that the character or characters which justify the splitting of the family into subfamilies have yet to be found.

Since 1890, when I wrote an account of the South-African Buthidæ contained in the collection of the British Museum (P. Z. S. 1890, pp. 114–141), several additions have been made to our series of *Babycurus*. The first and most important is a series of six examples from Cette Cama (or Sette Camma), south of the Gaboon. These are of especial interest, inasmuch as Karsch's types of *B. Büttneri* (Berl. ent. Zeit. xxx. p. 78, 1886) also came from the Gaboon, though from a spot called Sibangefarm, which I have so far failed to discover on the atlases. These specimens, moreover, agree more closely with the description of *B. Büttneri* than any others examined by me. To the colour-characters mentioned below it may be added that the lower surface of the tail is

* Ann. & Mag. Nat. Hist. (6) xii. p. 329.

deeply infuscate, especially towards its extremity, though the upper surface and the vesicle is reddish. The sexes are easily distinguishable; in the female the hand is barely as wide as the brachium, its width being about one third the length of the movable digit *; the two digits are straight and in contact; the first segment of the tail is the widest, but the second, third, fourth, and fifth are equal in width; the pectines are short and furnished with 18 or 19 teeth. The largest female measures 66 millim., the carapace being almost 7 and the tail 37. In the male, on the contrary, the hand is much wider than the brachium (3 : 2), its width being nearly half the length of the movable digit, which is slightly lobate at the base, while the immovable is somewhat strongly sinuate; the tail is wider than in the female, being almost parallel-sided, the fourth and fifth segments equalling the width of the first and slightly exceeding that of the second. In both sexes the tails are perfectly smooth to the touch, though in reality they are exceedingly finely granular, with very weak keels. The pectines are longer, with 19 or 20 teeth. Length of largest male 54 millim., of which the carapace is 5·8 and the tail 33.

The examination of these forms has shown me that *B. Kirkii*, Poc., the type of which, though decolorized, shows the dark-tinted brachium characteristic of the West-African species, is closely allied to *B. Büttneri*, from which it apparently differs merely in the greater exaggeration of its sexual features, as evidenced by the greater width and smoothness of the tail. If such characters increase with age I could well believe the type of *B. Kirkii* to be nothing but an aged individual of *B. Büttneri*.

In the footnote to my description of *B. Kirkii* mention is made of a couple of examples of a scorpion from Rio del Rey, near the Old Calabar River, which were referred to *B. Büttneri*; but since seeing the examples mentioned above from Cette Cama I am compelled to change my opinion about the identity of the Rio del Rey examples; and since they are both readily distinguishable either as subspecies or species from the Cette Cama form which apparently comes nearest to the typical *B. Büttneri*, I propose to describe the former as a new species under the name *Babycurus Johnstonii*. As stated in the synopsis below, this form is much darker coloured than *Büttneri*, the legs, hand, humerus, and upper surface of

* On this digit there are eight median rows of teeth, the basal one being long and undivided; the outer row consists also of eight, but the inner of nine, owing to the presence of one near the middle of the basal row of the median series.

the basal segments of the tail being an exceedingly deep red-brown, while the trunk is nearly black above. In addition to this the granulation is everywhere coarser, and the keels on the tergites, tail, and chelæ much stronger, the finger-keel on the hand standing up as a very conspicuous crest. Total length 62 millim., of carapace 7, of tail 37. Tail moderately robust, slightly attenuate posteriorly.

Two female examples from Rio del Rey (*H. H. Johnston*).

The British Museum also has an example of a *Babycurus*, resembling, though not quite identical with, the Cette Cama form, from the mouth of the Loango, north of the Congo (*H. L. Duggan*).

Synopsis of the Species contained in the British Museum *.

a. The brachium of the chela strongly infuscate, contrasting forcibly with the paler red or yellow colour of the manus; the finger-keel on the hand visible in the ♀ (though sometimes absent in the ♂, as, for instance, in the type of *B. Kirkii*); median eyes very large; an enlarged tooth on the middle of the inner side of the long basal series of the middle row on the digit.

- a^1. Colour of trunk a uniform deep brownish black; brachium the same deep colour as the terga; hands, humerus, and legs a uniform deep red; keel on the hand strong and finely granular; granulation and keeling of the trunk, limbs, and tail coarser .... *Johnstonii*, sp. n.
- b^1. Colour of trunk paler, variegated; terga blackish at the sides and along the median keel, pale yellowish red elsewhere; brachium (and sometimes humerus also) infuscate; legs yellow, variegated with blackish spots; lower surface and hand pale yellow; granulation and keels finer .... *Büttneri*, Karsch.

b. Chelæ (with the exception of the black digits) of a uniform yellow colour; hand without a finger-keel; median eyes smaller; no large tooth in the middle of the inner side of the long basal series of the median row on the digit.

- a^2. Eight median rows of teeth on movable digit; the sides and lower surface of the tail thickly and somewhat coarsely granular; all the normal keels well defined and coarsely granular; upper surface of tail also granular, but more finely; last abdominal sternite finely granular and marked with four abbreviated crests; coloration uniform .... *Jacksoni*, Poc., ♀.

* I have failed to unravel to my satisfaction the specific characters of the remaining species of the genus as set forth by Prof. K. Kraepeliu.

b^2. Seven median rows of teeth on movable digit; tail entirely smooth; the keels exceedingly feeble, only minutely crenulate; last abdominal sternite smooth, without crests; trunk yellow, ornamented above with longitudinal black bands; legs also slightly variegated .. *pictus*, sp. n.

Family Scorpionidæ.

Scorpio cavimanus, Poc. (Pl. XVIII. figs. 2, 2 *a*.)

Scorpio cavimanus, Poc. Ann. & Mag. Nat. Hist. ii. p. 247 (1888).

When I described this species about eight years ago I had but a couple of specimens for examination—one obtained by Mr. F. J. Jackson near Kilima Njaro, and the other by Capt. Speke near Umyamuezi. Since then the British Museum has been enriched by the receipt of several more specimens, and amongst them two mutilated males obtained by Dr. Gregory at Kinani and a place 4 miles to the south of it. These specimens agree with the types, so far as can be judged from their condition, except that the hands of the chelæ are not so wide as the length of the carapace, the measurements being in one case 17·5 : 16·5 and in the other 16·5 : 15·5. The pectinal teeth are 14—14 and 15—16.

What I regarded originally as one of the most distinguishing characteristics of this species is the curious depression on the upperside of the hand at the base of the immovable finger. This feature I now believe to be a mark of the adult male; at least it is conspicuous in all the six males that I have seen (examples varying in length from 76–110 millim.), but is absent in the one specimen of the female sex that the Museum possesses. The latter was obtained, together with a couple of males, at Ugogo, halfway between Zanzibar and Tanganyika, by Mr. E. J. Baxter; she measures 92 millim. in length, has 13 pectinal teeth on each side, the hand more coarsely punctured than in the male, but without a depression. The tail is less than three times the length of the carapace, whereas in the males it is more.

Prof. Kraepelin (JB. Hamburg. Anst. xi. pp. 67 and 69) regards *Scorpio cavimanus* as a "form" of the Abyssinian *Sc. bellicosus* of L. Koch from Habab, which, in its turn, is but a subspecies of the great West-African *Sc. africanus*, Linn. For myself, however, I prefer to consider even *cavimanus* and *bellicosus* as distinct until accurately sexed specimens of the latter are brought to light. From the number of its pectinal teeth (19 or 20) I should be inclined to think the type of *bellicosus* must be a male; but, if so, there is no evidence that the upperside of the hand is excavated in the manner characteristic of *cavimanus*, and the tail is evidently very much shorter.

In all the examples that I have examined the spine-armature of the feet is very constant, consisting of but 7 spines, 4 on the posterior border and 3 on the anterior, in both cases there being 2 on each lobe, one in its middle, the other on its inferior angle, while the apex of the lobe is furnished with stout spiniform bristles, which, when fractured, resemble small spines. The same spine-armature is found in the other East-African species known to me, namely *Scorpio viatoris*, Poc. (Ann. & Mag. Nat. Hist. 1890, vi. p. 100), which was described from a specimen obtained by Emin Pasha, ticketed merely East Africa. Since then the Museum has received a couple of adult examples (male and female) from Zomba, Lake Nyassa (*H. H. Johnston*). These two show that the sexual characters of this species are very different as regards the chelæ from those of *Sc. cavimanus*, the chelæ of the male, instead of being larger than those of the female, are longer and lighter, with the hand only as wide as the length of the hand-back. The female has the sculpturing of the hands stronger and the tail shorter, the first and second segments being shorter than the carapace, whereas in the male they are rather longer. The male has 13—14 pectinal teeth, the female 13—13; whereas a young female (77 millim.) from Fwambo (*A. Carson*) has 14. The adult male measures 105 millim., the female 100, the carapace in both cases being 16, the tail in the male 60, in the female 52. The terga are much more coarsely granular than in *cavimanus*, and the crests which are so conspicuous on the lower surface of the anterior caudal segments and of the last abdominal sternite in *cavimanus* are weak or obsolete in *Sc. viatoris*.

Scorpio Gregorii, sp. n. (Pl. XVIII. figs. 3, 3*a*.)

Colour a uniform olive-brown; legs dark reddish brown, hand of chelæ paler reddish, fingers deep blackish green.

Carapace about equalling the first and second caudal segments in length; the median eyes well behind the middle; the anterior border with a median semicircular excision; carapace smooth towards the middle, sparsely punctured, distinctly granular at the sides; a row of setiform punctures along the anterior and posterior borders.

Terga smooth, somewhat coarsely but very sparsely punctured, the last coarsely granular at the sides, with traces of two crests.

Sterna smooth and polished, the last coarsely punctured on each side of the middle line.

Tail about $3\frac{1}{2}$ times the length of the carapace, narrowed posteriorly, somewhat compressed, the upper surface smooth, its side-keels high and strongly denticulated on the second, third, and fourth; lateral surface of segments granular; inferior keels on first and second smooth, punctured, on third weakly granular, on fourth and fifth almost denticulate; supero-lateral keel coarsely granular on all the segments. Vesicle large, granular below, its width equal to the width of the third segment, its height equal to the width of the fifth segment; aculeus stout, strongly curved.

Mandibles with the penultimate tooth of the movable fang enlarged and nearly as prominent as the apical.

Chelæ of normal length; humerus tubercular or denticulate above and in front, smooth behind and below; brachium weakly granular and subcostate behind and above, armed with a few granules below in front, smooth below and coarsely punctured behind; hand thick and large, with the lobe strongly produced internally; very convex above, not keeled, furnished externally and at the base of the fingers with smooth, rounded, irregular-shaped low tubercles, which towards the inner edge of the hand posteriorly fuse into a reticulated pattern and entirely disappear upon the posterior part of the lobe, which, as a consequence, is quite smooth; the distal half of the inner surface of the hand denticulate; hand-back smooth, punctured; lower surface not crested or keeled, coarsely granular in its distal half.

Legs of first and second pairs with proximal and distal tibial segments, each armed behind with two spicules; femora of fourth very feebly granular; tarsus of fourth with its lower surface armed behind with 8 spines, 2 of which are on the lobe, 1 on its inferior angle and 1 halfway up, with a bristle between them, the angle of the lobe being tipped with bristles; the distal spine on the lower edge of the foot is close to the lower one on the lobe; the spine-armature on the front (or outside) of the tarsus is the same, except that there are only 3 or 4 spines on the lower edge. The tarsi of the other feet present much the same armature.

Pectines with 17 teeth.

Measurements in millimetres.—Total length 117; length of tail 58, of carapace 16·2; distance of eyes from hinder edge 6·2; length of hand-back 10·8, of movable digit 16; width of hand 15·3, height of hand 7·5.

Loc. Kinani, a single female (type); Tanganyko (confluence of the Athi), a single female; Tzavo, one male obtained by Mr. George Wilson; sandy steppes south of Tzavo, five more or less mutilated specimens—an adult male, three females, and a young.

The females vary but little in structure, except that the legs and palpi are darker in colour and the sides of the carapace distinctly yellowish in the smaller examples; a very young specimen measuring only 46 millim. has the bands much narrower and the upper caudal crests smooth. The pectinal teeth are usually 18.

The males, on the contrary, differ considerably from the females. The tail is a little longer; the chelæ, however, are neither longer nor thinner, but the movable digit is furnished with a large lobe-like tooth, which fits into a corresponding notch on the immovable digit. The terga also are very distinctly though finely granular, and the carapace is not so smooth above; the pectines, though larger, do not appear to be furnished with a greater number of teeth, one specimen possessing 17 on each side and the other 18.

This interesting new Scorpion is allied to *Scorpio exitialis*, Pocock *, from Shoa, in Abyssinia: but in *exitialis* the hand is entirely covered with tubercles, which are more granuliform than in *Gregorii*; the lower surface of the hand is furnished with two strong granuliferous crests; the lower surface of the humerus is coarsely granular, the upper caudal keels are not strongly denticulate, and, lastly, on the tarsal lobes there are 3 spines, one above on the extremity of the lobe, and the others below in the same position as those on the tarsi of *Gregorii*. There seem, moreover, to be fewer spines on the lower surface of the foot, since on the inner side of the last tarsus there are only 4 spines, the distal of these being further from the inferior one on the lobe than in *Gregorii*. In the adult male of *exitialis*, moreover, the vesicle is enormously enlarged, as I have previously stated. Since writing the description, however, I have had the opportunity of examining two additional examples of *exitialis* from Shoa. These are both young, the larger measuring 95 millim. and the smaller 80. In both the vesicle is small and there is a tendency on the part of the granules on the hand to run into crests on the external side, and there are 22—23 pectinal teeth.

The two species now under discussion are strikingly nearly allied to *Sc. arabicus* and *Sc. pallidus* of Kraepelin; the former, indeed, recorded from Homrau, in Arabia, is very difficult to distinguish from *Sc. exitialis*, of which it might

* Ann. & Mag. Nat. Hist. 1888, ii. p. 249, ♂.

well be the female, and *pallidus* in many of the points mentioned in the description seems to resemble *Sc. Gregorii.* But the locality "Baravez," in Sumatra *, if accurate, forbids such an identification, quite apart from the fact that Kraepelin says *pallidus* resembles *fulvipes* in the structure of its tail &c.

Part II.—Centipedes.

Scutigera rugosa (Newp.).

Scutigera rugosa (Newp.), Ann. & Mag. Nat. Hist. xiii. p. 95 (1844); Tr. Linn. Soc. xix. p. 353 (1845); Cat. of Myriopoda in the Collection of the British Museum, p. 8 (1856).

A single example obtained at Merifano.

In addition to this specimen and the type of the species, which was obtained by Capt. Speke in East Africa, the British Museum possesses but one other example, received from the British East African Company in 1892.

Scolopendra morsitans, Linn.

Athi Plains.

A single specimen presenting the following type of coloration:—head, antennæ, first tergite, legs, and anal somite reddish yellow; tergites 2 to 20 greenish yellow, with a dark green stripe along the hinder border.

Dacetum trigonopoda (Leach).

Mkonumbi.

One specimen. Colour brownish olive-green; legs yellow, apices of anal legs greenish.

Otostigmus tæniatus, sp. n.

Colour green or almost ochre-yellow, with the head-plate and maxillipedes castaneous; the terga marked with four fine deeper green lines, one on each margin and one on each sulcus; antennæ greenish or ochre-yellow; legs pale green or yellow, or yellow obscurely banded with green.

Head smooth, finely punctured, narrow, elliptical in shape. Antennæ elongate, with 17 longish cylindrical segments, the basal three of which are naked or nearly so and the rest pubescent. Maxillæ largely overlapping the head at the

* I venture to suggest that this so-called "locality" may be due to the wrong interpretation of a partially illegible label upon which was originally inscribed the words "Barawa in Somali."

sides, finely punctured; precoxal plates longish, narrow, parallel or diverging, armed with four teeth, the inner fused; femoral tooth indistinctly dentate.

Tergites smooth, punctulate, from the seventh marginate, from the fifth to sixth bisulcate; the last without any median groove. *Sternites* smooth, marked with a pair of median impressions, one in front of the other and longer than it, in addition to two normal sulci; the last two without sulci.

Anal pleuræ with the process short and tipped with two spines; anal legs of average length and thickness; femur without any spine at its distal end, the other spines few in number, 1 or 2 on the upper inner, 2 or 3 on the under inner edge, and 2 or 3 on the under outer.

Legs without tarsal spurs; claws basally spined.

Length up to about 62 millim.

Loc. Merifano and Leikipia (*J. W. Gregory*); also Mombasa (*D. J. Wilson*, type).

This species is unmistakably nearly related to *O. nudum*, Poc. (Ann. & Mag. Nat. Hist. 1890, v. p. 247), from Madras, the form of the head and maxillipedes, the absence of spurs on the tarsi, the grooving of the sterna, &c. being the same in the two species. In *O. nudum*, however, the terga are wrinkled and subgranular and there is a spine close to the apex of the femur of the anal leg. Possibly these distinctions will break down with the discovery of fresh specimens.

Part III.—Millipedes (Diplopoda).

Polydesmoidea.

Orodesmus forceps, O. F. Cook.

Loc. Leikipia. One example (type).

Orodesmus ellipticus, O. F. Cook.

Loc. Ngatana. One example (type).

During a recent visit to the British Museum Mr. O. F. Cook, at my request, examined these two specimens and described them as representatives of two new species. So far as I know, the descriptions have not yet been published; but doubtless they will shortly appear.

Eurydesmus contortus *, sp. n. (Pl. XVIII. fig, 4.)

Colour (probably imperfect) a dull yellowish brown, with

* This species is provisionally only referred to *Eurydesmus*. Doubtless

paler keels and a pair of indistinctly defined paler spots on the dorsal surface of the hinder half of the segments; legs, antennæ, and ventral surface a uniform pale ochre-yellow.

Body broad, nearly parallel-sided, about five times as long as wide, its upper surface shining and nearly smooth, finely punctulate.

Keels well developed, nearly horizontal, though with the posterior angle slightly tilted; the anterior angle convexly rounded, the posterior acutely produced, though only in the last five segments is the hinder border directed backwards; margin around the pore considerably thickened.

Pores looking obliquely upwards and outwards on segments 5, 7, 9, 10, 11, &c.

The *dorsal area* between the keels strongly convex.

Tail triangular, with squarely cut apex and an angular tubercle on each side in front of it.

Lateral surface of segments finely shagreened; a distinct inferior crest visible as far as the seventh or eighth, then dying out and, at most, represented by a small tubercle.

Sternal areas wider than long, longitudinally impressed and, at the posterior end, transversely impressed between the legs, the anterior of which are connected by a ridge; the hinder border studded with long coarse bristles; in the last leg-bearing segment the pieces of the sternum that support the legs of the last pair are coxiform, the distance between the coxæ of the legs being less than the length of one of the coxæ. The sternum of the fifteenth (in the male) is furnished in front with a forwardly directed, small, triangularly pointed tooth, and a low tubercular tooth at the base of the posterior leg; that of the seventh produced posteriorly into a widely rounded basin-shaped hollow, for the reception of the copulatory apparatus; sternum of sixth with an anterior median triangular tooth, directed obliquely forward and downward.

Legs with strong claw, hairy, especially the lower surface of the two basal segments, which have at least one long seta mixed up with shorter ones; tarsus of the first six pairs with an apical pad.

Copulatory organ with its distal portion curled backwards beneath the proximal portion (for the rest see figure).

Measurements in millimetres.—Total length 25, width 5.

Loc. Mkonumbi. A single male example.

---

it will fall into one of the many genera which Mr. O. F. Cook has recently projected into literature. Most of these, without diagnoses and without type species, are at present *nomina nuda*; but we feel confident that the publication of them will not be long delayed.

Species allied to this form occur in tropical East Africa as far to the south as Natal; but, judging from the form of the copulatory organ, this species is distinct from all that have been hitherto described.

Tetracentrosternus flavocinctus, sp. n. (Pl. XVIII. fig. 5.)

Body black, first tergite margined with yellow, the rest with a narrow yellow band running from keel to keel along the hinder border; posterior half of keels and of tail yellow; legs and sterna yellow; antennæ black.

Antennæ long and slender, second to fifth segments the longest and subequal, sixth shorter.

Segments smooth above; keels moderately well developed, with posterior angle dentiform; the transverse groove on the tergite beginning on segment 5, dying out on segment 15 or 16; not beaded, nor is the groove separating the two halves of each segment; the lateral inferior crest strong and crescentic, extending as far back as segment 16; the tracheal tubercles also distinct.

Legs long and slender; trochanter about twice the length of the coxa and about half that of the femur; the femur, tarsus, tibia, and patella gradually decreasing in length in the order named.

Caudal process normal, triangular, with rather widely truncate apex.

Anal sternite triangular; the two tubercles moderately large, but not projecting so far as the median apex of the plate.

Sternal areas in the posterior half of the body furnished with a spiniform process at the base of each leg; these gradually die out on the anterior segments.

Length 27 millim., width 4·3.

♂. As in female, but smaller, thinner, with larger keels, and little broader yellow stripes; a broad median erect process on the sternum of the fifth segment.

Legs unmodified (the pair of the seventh segment absent); tarsi of those at the anterior end of the body padded with hairs below.

Copulatory feet as in figure.

Loc. Leikipia (♀); Ngatana (♂). A single example obtained at each spot.

I refer this species provisionally to *Tetracentrosternus* on the strength of the spine-armature of the sterna. It differs from the type of the genus, *subspinosus*, from Burma, in being stouter, in the form of the copulatory organ, as well as in colour. In the presence of spines it also approaches *St. Swinhoei* from China (Chefoo).

Spirostreptoidea.

Alloporus sulcatulus, sp. n.

♀. *Colour* of body and head deep black; antennæ and legs reddish yellow.

Head with deep frontal groove; rugose above, coarsely wrinkled between the antennæ and the adjoining area, smooth just above the labial margin; distance between the eyes rather less than the diameter of an eye; eyes acutely angular, internally composed of about 52 ocelli arranged in about 8 transverse series.

Antennæ moderately long, segments gradually decreasing in length from the second to the sixth.

First tergite wrinkled, punctured and irregularly sulcate above and at the sides; lateral process much enlarged, produced forwards into a large rounded angle, with a deep marginal sulcus, above which there is another very strong sulcus following nearly the same curvature, with a third strong sulcus on its postero-inferior angle. The rest of the segments with posterior part separated by a distinct groove from the anterior, and strongly though somewhat irregularly longitudinally sulcate from base to summit, as well as ornamented with less definite sculpturing, the sulci becoming fainter towards the hinder end; but anteriorly the areas that they define become at the sides of the body cariniform or tuberculiform, as in *Lophostreptus*; anterior part of segments transversely cristulate behind, smoother in front; sterna smooth.

Pores small in the middle of the posterior part of the segments.

Anal somite.—Tergite punctulate and rugose, scarcely angular; valves with thickened and strongly sulcate margin; sternite with posterior border nearly transverse.

Number of segments 47.

Length about 70–75 millim., width 7.

Loc. Giriama, near Fuladoya. A single female specimen.

Genus Lophostreptus, Cook.

Lophostreptus, Cook, Ann. New York Acad. Sci. ix. p. 5 (1895).

Lophostreptus armatus, sp. n. (Pl. XVIII. fig. 6.)

♀. *Colour* (in alcohol). Anterior portion of segments a dirty white, posterior portion quite black; head and antenna paler than posterior half of segments, sometimes brownish red; legs and anal somite reddish or yellowish brown.

Head densely punctured, though much more coarsely above than below; irregularly impressed above the labial border, frontal sulcus distinct; labial excision deep, the tooth large.

Eyes furnished with about 44 ocelli arranged in 6 transverse rows.

Antennæ punctured, moderately long, slightly incrassate, the second segment a little the longest, the segments strongly narrowed at the base.

First tergite densely punctured and rugulose, with a row of cariniform teeth along its hinder border; laterally these pass into a series of (6) oblique ridges, which traverse the side of the segment; this lateral portion evenly narrowed, with straight anterior border, obtuse anterior angle, and rectangular hinder angle. The rest of the terga with the posterior part sharply marked off from the anterior, the sulcus being very deep; the posterior part ornamented with a series of close-set, smooth, posteriorly dentiform, longitudinal keels, running from the base of the legs up to the summit; these keels become smaller, more dentiform, or even tubercular on the infero-lateral parts of most of the segments, but at the anterior extremity of the body they are stronger below than above; these keels are not always even, some being sometimes rather shorter than the others; keels vary in number from about 33 to 37 on each side, making a total average of about 70. Anterior part of segment in the middle of the body closely and finely punctulate above, rather more coarsely below; in the anterior part of the body the sculpturing of this half becomes coarser and coarser, and there is a fine transverse r idg just in front of the groove.

Sterna strongly sulcate transversely; a fine fringe running along the posterior border of the terga.

Anal somite not carinate, densely granular; no caudal process, the border of the tergite evenly convex; valves with a strong keel on each side of their suture, running from summit to base; sternite transverse.

Legs of medium length; each segment furnished below with one or two apical setæ, and a few shorter ones behind them; setæ stronger on the anterior legs.

Segments 1 to 3 open below, each with a pair of legs; the fourth without legs, its two sides united in the middle line below. The generative ducts, at least in the male, opening upon two small processes lying behind the second pair of legs at their base.

♂. Slenderer than female; collum not modified; angle of mandible larger; feet not padded.

Number of segments about 50.

Length about 50–55 millim.

Loc. Ngatana.

I think there is no reason to doubt that this species is congeneric with *Glyphiulus magnus* of Karsch (Zeits. Naturw. (3) vi. p. 14, 1881), which Mr. O. F. Cook has made the type of his genus *Lophostreptus*. The two, indeed, might be identical but for Karsch's statement to the effect that the tergites in *magnus* are scarcely visibly segmentate, whereas in *L. armatus* the sulcus is very deep.

Odontopyge Gregorii, sp. n.
(Pl. XVIII. fig. 7.)

♀.—*Colour.* Segments blackish or very deep green, with a clearly defined yellow band running along the hinder border from base to summit; the anterior covered portion yellow, with a fine median dorsal black line; legs also entirely yellow; collum or first tergite completely bordered with yellow; antennæ yellow at the base, for the rest deep green; lower half of head yellow, upper black; anal valves finely margined with yellow (the green and yellow were probably black and red respectively before immersion in alcohol).

Head smooth and polished, with a conspicuous frontal sulcus; a fine impression running from eye to eye; eyes with inner angle not very noticeably acute; a shallow impression close to the socket of antenna on the interantennal area; six pores above the labial impression and four close to the margin on each side of it.

Antennæ moderately long, with the distal segments (4 to 6) strongly narrowed at the base.

First tergite crossed below with two sulci in addition to the one that defines the border. The segments finely striolate above; the transverse sulcus strong and deep, the area in front of it finely striate transversely, the area behind strongly grooved longitudinally at the sides; on the anterior segments these grooves are deeper and run up above the pores, but posteriorly they become gradually weaker, do not surpass the pores, and almost die away.

Sterna smooth.

Pores moderately conspicuous, well behind the sulcus.

Anal tergite not carinate, posteriorly acutely angled; valves with margins not grooved, the teeth small and vertical; sternite triangular.

Legs with lower surface of all the segments bristly, the bristles longer at the distal ends of the segments; upper surface of the legs finely hairy, the hairs more conspicuous upon the tarsus and upon the basal segments (trochanters) of the anterior legs; in the anterior half of the body the trochanter of the posterior legs on each segment is flat below, while that of the anterior leg is compressed.

♂. Resembling female, but thinner, with the sixth segment a little expanded and the anterior angle of the first more rectangular.

Legs with fourth (antepenultimate) segment padded below, the pad larger on the anterior legs, gradually disappearing posteriorly and scarcely visible on the legs of the last six segments.

Copulatory foot as in figure; anterior lamina long and rather slender, notched inferiorly; coiled portion consisting of two main pieces—a double flagellum, of which the outer branch is longer, stouter, and spirally coiled at the tip, while the inner is much shorter, thinner and simply pointed, and of a complicated semi-membranous sheath, also double, one of the branches being leaf-like, with serrate edges and a bifid tip.

Number of segments over 70 (71 or 72).

Length about 85–90 millim.

Loc. Ngatana. Several examples.

Odontopyge semistriata, sp. n.
(Pl. XVIII. fig. 9.)

Allied to the preceding in most structural details, but certainly different in the following respects:—

The sides and lower surface of the body reddish yellow, but the posterior half of the upper surface ornamented with a black transverse stripe which extends down to the pore, though it thins off just above this point; when the body is spirally coiled these black bands are separated by the yellow colour of the anterior part of the segments, but when the body is extended, as in crawling, the black stripes are contiguous or nearly so, so that the upper surface of the body appears to be black; the first tergite with its posterior two thirds black above; anal tergite black above; valves black above; face black, rather paler inferiorly; antennæ fuscous, with the basal two segments pale; legs entirely yellow.

♀. *Head* resembling that of *O. Gregorii*, but with the transverse stria between the eyes much deeper, very conspicuous; the inner angle of the eye more acute; the area above the labrum distinctly grooved and roughened. No impressions at the base of the antennæ on the inner side. *Antennæ* with the segments thinner and longer, not strongly expanded at their distal end.

First tergite laterally more squared, crossed by two sulci, the lower of which is only a little above the margin. The rest of the segments finely striolate, but shining, not dull as in *Gregorii*; the areas in front of and behind the sulcus more elevated than in the last-named. The apices of the anal valves a little longer and rather thicker.

Legs almost as in *Gregorii*, but less smooth at the sides and above; the trochanters not different.

♂. With fourth and fifth segments of legs padded; trochanter of posterior leg of each segment thick and flattened below, anterior compressed. First tergite laterally more expanded, with anterior angle rectangularly rounded.

Copulatory foot as in figure.

Length about 70 millim.

Number of segments 63 to 66.

Loc. Ngatana (types) and Leikipia.

Odontopyge Wilsoni, sp. n.
(Pl. XVIII. fig. 8.)

♀.—*Colour* (in alcohol) a tolerably uniform olive-brown, with a deeper band running along the hinder border of the segments.

Head as in *O. semistriata*, but more rugulose below, and the transverse interocular sulcus weaker.

Antennæ with long and slender segments.

Collum with one lateral sulcus in addition to the marginal one, as in *semistriata*.

Segments segmentate, striolate, and laterally striate, as in the other species, and showing same position of pores.

Anal segment shorter than in the preceding two species; height of the valves exceeding the length of the tergite. In the anterior third of the body the posterior legs of each segment have their basal four segments flattened and excavated below.

♂. Face smooth and polished below; first tergite laterally expanded, convexly rounded anterior angle.

Legs behind the seventh segment, with fourth and fifth segments padded below, except quite at the hinder end of the body, where the pad on the fifth entirely dies off and that on the fourth nearly so; the coxa and trochanter of the posterior leg of the segments behind the seventh expanded and flattened below.

Copulatory organ as in figure.

Number of segments, ♀ 69, ♂ 68.

Length of ♀ 130 millim., width 10·5; of ♂ 114, width 9·5.

Loc. Mombasa (*D. J. Wilson*), ♂ ♀. Fragments of a female example belonging apparently to this species were brought by Dr. Gregory from the Papyrus swamp north of Rangatan.

EXPLANATION OF PLATE XVIII.

Fig. 1. *Babycurus pictus*, sp. n. Enlarged.
Fig. 2. *Scorpio cavimanus*, Poc. Upperside of hand of male example from Ugogo.
Fig. 2 *a*. Ditto. Posterior tarsus from below.
Fig. 3. *Scorpio Gregorii*, sp. n. Upperside of hand of male example from Tzavo.
Fig. 3 *a*. Ditto. Posterior tarsus from behind.
Fig. 3 *b*. *Scorpio exitialis*, Poc. Posterior tarsus from behind.
Fig. 4. *Eurydesmus contortus*, sp. n. Right copulatory foot from the inner side.
Fig. 5. *Tetracentrosternus flavocinctus*, sp. n. Right copulatory foot from below.
Fig. 6. *Lophostreptus armatus*, sp. n. Anterior aspect of left half of copulatory organ.
Fig. 7. *Odontopyge Gregorii*, sp. n. Anterior aspect of left half of copulatory organ.
Fig. 8. *Odontopyge Wilsoni*, sp. n. Anterior aspect of left half of copulatory organ.
Fig. 9. *Odontopyge semistriata*, sp. n. Anterior view of right half of copulatory organ.

LXII.—*Descriptions of new Lizards from Madagascar.* By G. A. Boulenger, F.R.S.

Diplodactylus robustus.

Head large, oviform, very distinct from neck, once and one third as long as broad; the skin confluent with the cranial ossification; snout longitudinally grooved in the middle, as long as the distance between the eye and the ear; ear-opening narrow, vertical. Limbs moderate; digits short, granular inferiorly, very feebly dilated at the end; the granules replacing the subdigital lamellæ forming three longitudinal series. Upper surface of head covered with large polygonal juxtaposed tubercles; supraocular region covered with large polygonal flat scales in the middle, with granules on the borders; temporal region with small flat granules and large subconical tubercles. Rostral nearly twice as broad as deep, widely separated from the nostril; 10 or 11 upper labials, first entering the nostril; 10 lower labials, each with a small central tubercle; symphysial in contact with a pair of small chin-shields. Body covered above with small, irregular, flat granules intermixed with roundish, obtusely keeled, subtrihedral tubercles forming about 18 longitudinal series; these tubercles nearly as large as the largest tubercles on the snout, as long as or a little shorter than the greatest interspaces between them; ventral scales small, smooth, imbricate, 48 across the middle of the belly. Limbs granular above, with large tubercles, which are keeled on the fore limb and crus, conical on the thigh. Tail short, swollen, carrot-shaped, covered with unequal-sized scales and keeled tubercles. Pale greyish above; with five crescentic cross-bands interrupted on the vertebral line; these bands light in the middle, dark brown on the borders; the first band extends from eye to eye, across the nape; an oblique dark band from the eye to the lip below the nostril; lower lip with three vertical dark bars; lower parts white.

	millim.
Total length	104
Head	22
Width of head	17
Body	48
Fore limb	28
Hind limb	32
Tail	34

South-western Madagascar. A single female specimen, collected by Mr. Last.

Diplodactylus gracilis.

Head once and three fourths as long as broad; the skin confluent with the cranial ossification; middle of snout and interorbital region deeply concave; ear-opening vertically oval. Limbs slender; digits moderate, granular inferiorly, feebly dilated at the end; the granules replacing the subdigital lamellæ forming two or three longitudinal series. Upper surface of head with polygonal, juxtaposed, flat scales, the largest on the sides of the snout and bearing a slight central tubercle; temporal region with small granules and round tubercles. Rostral twice as broad as deep, entering the nostril; 11 or 12 upper labials, first entering the rostral, all except the two anterior with a small central tubercle; symphysial in contact with a pair of chin-shields, followed by an azygous subcircular shield. Body covered above with rough granules intermixed with numerous small conical tubercles; the largest of the tubercles smaller than the largest scales on the snout; ventral scales small, smooth, imbricate, enlarged on the umbilical region, about 20 across the middle of the belly. Thighs scaled like the back; fore limb and crus with subequal, small, obtusely keeled tubercles. Tail feebly swollen at the base, with rings of spine-like conical tubercles, tapering to a fine point. Reddish brown above, with four dark brown stripes along the body, the median pair with wavy outer borders; a dark brown stripe from the eye to the outer dorsal stripe; tail blackish brown, with light cross-bands; lower parts brown.

	millim.
Total length	118
Head	19
Width of head	11
Body	43
Fore limb	27
Hind limb	34
Tail	56

A single female specimen from Madagascar.

Diplodactylus porogaster.

Head once and a half as long as broad, the skin confluent with the cranial ossification; middle and sides of snout and interorbital region concave; ear-opening small, roundish. Limbs moderate; digits moderate, granular inferiorly, feebly dilated at the end; the granules replacing the subdigital lamellæ forming two or three longitudinal series. Upper surface of head with hexagonal, juxtaposed, strongly keeled tubercles, largest on the snout; temporal region with granules and feebly enlarged tubercles. Rostral twice as broad as deep, widely separated from the nostril; 12 upper labials, first largest, not entering the nostril; 10 lower labials; symphysial in contact with a pair of small chin-shields. Body covered above with rather large keeled granules, intermixed with strongly keeled subtrihedral tubercles. Ventral scales juxtaposed, granular anteriorly, strongly enlarged in the umbilical region, where each scale presents a large pore-like pit, as in some male Agamas. Limbs with feebly enlarged tubercles. Tail swollen, tapering to a fine point, with transverse series of large trihedral tubercles above. Greyish above, back with four longitudinal series of elongate brown spots; a dark brown stripe on each side of the head, passing through the eye; lips white, with vertical brown bars; whitish beneath, belly densely speckled with brown, throat with brown vermiculations.

	millim.
Total length	60
Head	11
Width of head	7
Body	21
Fore limb	13
Hind limb	17
Tail	28

South-western Madagascar. A single male specimen, collected by Mr. Last.

Homopholis heterolepis.

As the specific name chosen implies, this Gecko differs from the type of the genus in the heterogeneous lepidosis of the back. Its general agreement in other respects with *H. Wahlbergii*, Smith, is so great that I would alter the definition of *Homopholis* rather than establish a new genus, a course which is, besides, in keeping with that followed in other cases (e. g. *Stenodactylus*, *Hemidactylus*).

General proportions and digits exactly as in *H. Wahlbergii*; forehead concave; ear-opening rather small, oval, oblique. Snout covered with juxtaposed convex granules, largest on the sides; back of head finely granulate, with small round tubercles; rostral twice as broad as deep; nostril pierced between the rostral, the first labial, and four or five scales; 11 upper and 9 lower labials; a row of chin-shields in contact with the symphysial and the anterior lower labials, the median pair rather large and longer than broad. Back covered with small, juxtaposed, flat granules intermixed with round or oval, smooth or feebly keeled tubercles, disposed irregularly; 16 tubercles in a transverse series in the middle of the body. Limbs covered with small, juxtaposed, or subimbricate smooth scales; ventral scales small, imbricate, smooth. Tail cylindrical, tapering, covered with small, imbricate, smooth scales, above with transverse series of nail-shaped, smooth, or feebly keeled flat tubercles, below with a series of transverse shields. Greyish above, with rather indistinct wavy cross-bars; a dark streak from the eye to the first cross-bar; white beneath.

	millim.
Total length	227
Head	25
Width of head	20
Body	72
Fore limb	32
Hind limb	40
Tail	130

South-western Madagascar. A single male specimen, collected by Mr. Last.

Zonosaurus maximus.

Fronto-nasal a little broader than long, forming a broad suture with the rostral, and widely separated from the frontal, the præfrontals forming a long median suture; three or four lower labials anterior to the subocular; a small interparietal. Dorsal scales strongly keeled, in 20 or 22 longitudinal and 45 or 46 transverse series (from occiput to base of tail); ventrals in 8 longitudinal series. 20 to 30 femoral pores on each side. Tail moderately depressed at the base, strongly compressed further back, about once and two fifths the length of head and body. Dark olive-brown above, more or less distinctly spotted with darker, with or without a series of pale olive spots along each side of the back; sides pale olive, speckled and spotted with dark brown; yellowish or greenish white beneath.

	millim.
Total length	550
Head	40
Width of head	28
Body	190
Fore limb	65
Hind limb	100
Tail	320

A slightly larger specimen, with injured tail, measures 240 millim. from snout to vent.

Three specimens from Imerina, collected by the Rev. R. Baron.

Sepsina ornaticeps.

Closely allied to *S. melanura*, Gthr., with which it agrees in the general proportions and cephalic pholidosis. Distinguished by the much smaller postnasal, the internasal nearly reaching the first labial, the smaller ear-opening, which is but little larger than the nostril, and in the smaller number of scales round the body, viz. 22 or 24. Pale brown above, each scale darker behind; head whitish above, with dark brown vermiculations or wavy cross-bands descending to the lower lip; belly white; tail dark brown.

	millim.
Total length (tail injured)	110
From end of snout to fore limb	14
" " " hind limb	52
Fore limb	6
Hind limb	10

Five specimens from South-western Madagascar, collected by Mr. Last.

Pygomeles trivittatus.

Snout rounded, feebly projecting; ear-opening distinct, a little larger than the nostril. Rostral large, deeply notched on each side for the reception of the nasal, its upper portion nearly as long as its distance from the frontal; fronto-nasal twice as broad as long; frontal a little broader than long, in contact with three supraoculars; interparietal longer than broad, shorter than the frontal; parietals forming a suture behind the interparietal; nostril entirely in advance of the suture between the rostral and the first labial; three upper labials anterior to the subocular. Body much elongate; scales smooth, 24 round the middle of the body; a pair of feebly enlarged præanal scales. Limbs rudimentary; fingers 3 or 4, bud-like, clawed; toes 3, short, unequal, gradually increasing in length, clawed. Tail shorter than head and body, tapering to a sharp point. Yellowish flesh-colour above, with three blackish-brown stripes, the median extending to the frontal shield, the lateral to the nostril, passing through the eye.

	millim.
Total length	200
Head	10
Width of head	8
Body	100
Fore limb	$3\frac{1}{2}$
Hind limb	6
Tail	90

Four specimens from Imerina, collected by the Rev. R. Baron.

LXIII.—*Descriptions of Two new Batrachians obtained by Mr. A. Everett on Mount Kina Balu, North Borneo.* By G. A. Boulenger, F.R.S.

Cornufer baluensis.

Vomerine teeth in two oblique groups behind the level of the choanæ. Snout rounded, as long as the orbit; canthus rostralis obtuse; loreal region concave; interorbital space nearly as broad as the upper eyelid; crown flat; tympanum two thirds the diameter of the eye. Fingers and toes rather short, the tips dilated into well-developed disks, which are much smaller than the tympanum; first finger a little shorter than second; toes one-third webbed; subarticular tubercles moderately large, feebly prominent; a feebly prominent oval inner metatarsal tubercle, as long as the inner toe without the disk. The tibio-tarsal articulation reaches the nostril. Upper parts and throat granulate, some of the granules confluent into wavy longitudinal short ridges; belly and lower surface of limbs smooth. Greyish brown above, marbled with darker; limbs with rather irregular dark cross-bars; whitish beneath, throat and lower surface of limbs marbled with brown.

From snout to vent 30 millim.

A single female specimen.

Nectophryne Everetti.

Head small, as long as broad; snout short, prominent, obliquely truncate; canthus rostralis strong; loreal region vertical, concave; interorbital space broader than the upper eyelid; tympanum moderately distinct, one third the diameter of the eye. Fore limb very slender, nearly as long as the distance between the eye and the vent. Fingers slender, webbed at the base, feebly dilated and truncate at the end, first two thirds the length of second; toes nearly entirely webbed, scarcely dilated at the end; two very indistinct metatarsal tubercles. The tibio-tarsal articulation reaches the eye. Upper parts with scattered, small, horny tubercles; lower parts smooth. Olive-green above, with large, insuliform, reddish-brown, black-edged spots; limbs with reddish-brown cross-bars; upper lip whitish, with reddish-brown vertical bars; dirty white beneath, throat and breast marbled with grey.

From snout to vent 33 millim.

A single female specimen.

LXIV.—*On the Internal Appendices of the Genital Apparatus of the Orthoptera.* By M. A. Fénard *.

There is an entomological question which for some long time has appeared to require to be taken up, and to which it will be useful to call attention, namely the internal appendices of the genital apparatus in male and female insects. I have during the past three years and more studied this matter, and have commenced with the order Orthoptera. I have the honour to communicate to the Academy some of the results obtained, confining myself for the present to the male organs.

* From the 'Comptes Rendus,' tome cxxii. 1896, pp. 894-895.

I shall follow in this note the order of progressive complication of the organs studied.

Male Blattidæ exhibit no internal appendix to the vasa deferentia or to the ejecting canal; this accords with the primitive characters of these insects.

In the Forficulidæ or Labiduræ I can confirm the statements of Meinert, accepted by Palmen, namely, that there is but one vesicula seminalis, that it is dependent on the vasa deferentia, that these are continued beyond and maintain a semblance of equal function; but I regard the organ which Meinert has named *the nodiform gland* as being nothing more than an apparatus for propelling the semen.

The family Acrididæ comes next: it forms a very special group, in which the series of modifications are but slightly marked in the series of genera. There is to be found between the two vasa deferentia a dozen tubulous cæca, drawn out, more or less sinuous, and passing from the ejaculatory canal in which they are inserted as far as the middle of the height of the testicles; they are arranged in two symmetrical masses, braced together and fitting the ventral face of the rectum. One pair only contains spermatozooids, the others contain a secretion and are (to be regarded as) glands. From the anatomical standpoint the vesiculæ seminales are whiter, more sinuous, more twisted, and gathered into knots at their free extremity.

The Gryllidæ exhibit three kinds of appendices to the ejaculatory canal:—

1. Tubular cæca, to the number of a hundred on either side, in which spermatozooids are never seen, but only a secretion, which coagulates under the influence of mounting media and takes on the appearance of a very regular reticulum over a homogeneous mass, which often occludes a blackish powder consisting of crystals.

2. A large reniform vesicula seminalis, situate below the before-mentioned tubes, and in which the spermatozooids are placed.

3. A pair of prostatic glands on either side of the ejaculatory canal. In the group Gryllotalpidæ there are two vesiculæ seminales in place of one: these are the organs which some describe under the name of appendicular glands, and which may be seen crammed with spermatozooids a little before the rutting time.

The Locustidæ exhibit also three kinds of appendices to the ejaculatory canal: on the anterior part of the latter may be distinguished a large trunk which bifurcates; each of the two branches gives off almost immediately two branches, which are directed, one in front, the other behind: the first of these branches becomes the axis of the glandular tubes of *the first order* so-called; the second enlarges to form one or two oval reservoirs, into which there open some hundreds of glandular tubes of *the second order* so-called. These latter are barely 60 μ in diameter; they are but a third of the size of the others, but four times more numerous.

In the genera *Ephippigera*, *Meconema*, &c. I have noticed in the midst of the tubes of the second order a special bundle more strongly coloured, formed by half a dozen cæca.

Lastly, in the Locustidæ there is to be found a pair of prostatic glands with a lenticular appearance.

In the Mantidæ there are four kinds of appendicular organs:—

1. Some fifty tubular cæca which are glandular.
2. About twenty shorter cæca gathered into knots, which are also glandular in character.
3. A pair of large vesiculæ seminales, which are concealed by the organs before mentioned.
4. A pair of prostatic glands.

From the histological point of view all these organs are, as a rule, made up of a single layer of cells supported on a basilar membrane; around the vesiculæ a peritoneal envelope is plainly visible.

There is a further remarkable fact, namely the development of very tiny crystals in the glandular tubes just before copulation.

LXV.—*New Species of* Pyralidæ *from the Khasia Hills.* By W. Warren, M.A., F.E.S.

The types of the species now described are, like those of my previous papers, in the possession of the Hon. Walter Rothschild. The majority, as will be seen, are from the Khasia Hills, a district whose richness appears to be by no means yet exhausted.

Family **Pyralidæ**.

Subfamily *Chrysauginæ*.

Genus Lophopalpia ?, Hmpsn., MS.

Lophopalpia? chalybopicta, sp. n.

Fore wings deep brown, with a strong chalybeous reflection in certain lights except at base, along the costa, along the inner line, and over the outer third of wing; first line from one fourth of costa to near the middle of inner margin, broader above; a deep brown spot at end of cell; second line from shortly before apex to inner margin shortly before anal angle, bent outwards in middle, edged inwardly with deeper velvety brown, which broadens into a blotch towards the discal spot; marginal area dull brown, with steely reflection along the hind margin; fringe deep coppery brown, with a lustrous tinge. Hind wings olive-ochreous, tinged with darker olive; central area from near base to hind margin occupied by a dull fuscous elongated triangle, containing towards hind margin two broad brown bars, separated and preceded by steely scales; fringe like fore wings from apex to elbow, thence olive-fuscous like the inner margin. Abdomen ochreous, suffused with dark fuscous; head, thorax, face, and palpi dark purple-brown with lustrous reflections. Underside of both wings towards margin coppery red; base and disk of fore wings cinereous; base of costa bronze-black; bed of hairs yellowish, with dark hairs crossing them from the costa; fringes of both wings dark bronzy brown.

Expanse of wings 48 millim.

Several males from the Khasias.

PROROPERA, gen. nov.

Fore wings with costa straight, slightly indented beyond middle; apex produced, bluntly rounded; hind margin with a strong blunt beak in middle, concave on either side; anal angle rectangular. Hind wings with apex rounded and squared; hind margin straight to end of first median, where it is sharply bent inwards, thence rounded off into the inner margin. Head and face hairy; basal joint of male antennæ long and thick, the shaft lamellate, pubescent, and curving; tongue present; ocelli and maxillary palpi absent; labial palpi porrect, twice the width of head, laxly scaled, with terminal joint indistinct; a thick bed of scales along base of costa of fore wings beneath; hind tibia with four spurs. Neuration: fore wings, cell half the length of wing; discocellular acutely angled inwards; first median at four fifths, second at seven eighths; third and lower radial from lower angle of cell; upper radial from upper angle; last three subcostals stalked from upper angle, first and second free, first strongly curved upwards near its base towards the costal. Hind wings with the discocellular produced obliquely below; the two subcostals from upper angle of cell, the first anastomosing for a short distance with the costal; third median and radial on a short stalk, first and second medians as in fore wings. Scaling dense and somewhat glossy.

Type *Proropera vinosalis*, sp. n.

Proropera vinosalis, sp. n.

Fore wings vinous red, with scattered black scales; traces of two parallel deeper red antemedian lines, running obliquely outwards from costa to below middle, then straight and vertical to inner margin; a large roundish diffuse black discal spot, followed by a cloud of blackish scales; two postmedian zigzag deep red lines, marked with black scales in their upper half, the second rising from a small pale yellowish costal spot; fringe vinous red, preceded by a row of irregular black dashes, and these by black scales on a ground paler than the rest of the wing. Hind wings glossy fuscous, slightly tinged with red, with traces of two dark parallel lines before hind margin; fringes vinous red; the red of the fringes and the two lines stop short opposite the incision in hind margin, the inner marginal area being without markings and fuscous only. Head, face, thorax, and abdomen bright vinous red; extreme tip of abdomen pale. Underside glossy dark cinereous.

Expanse of wings 24 millim.

One male from the Khasias.

Subfamily *Epipaschiinæ*.

Genus Parasarama, Warr.

Parasarama conjuncta, sp. n.

Fore wings white, with olive and fuscous markings and suffusion; a white blotch at base of costa; basal area olive, its outer edge darkened with fuscous, the upper part vertical, then running out along the submedian to the inner margin just before the middle; on centre of costa a subquadrate olive blotch, with fuscous scales on it, enclosing a tuft of raised white scales in cell and followed by a large white oval costal blotch; exterior line dark fuscous, thick and bluntly dentate, curved outwards round the white blotch and attaining the inner margin at two thirds, where it is preceded by a central line, also fuscous, of two or three curves, not reaching the median vein; marginal area olive, much darkened with fuscous scales, containing a row of white submarginal spots; this dark marginal shade extends inwards as far as the central line, filling up the space between the first and third median nervules, and is thus connected with the lower end of the central costal blotch; fringe olive, chequered with fuscous, with a white apical spot, and preceded by a row of small white marginal dots. Hind wings white, with a broad diffuse olive-fuscous border; the whole of the space below the median vein from base to the border also suffused with olive, so that but a small portion of the wing towards base remains of the pale ground-colour; traces of a curved fuscous submarginal line, distinct only on the first median and internal vein, where there is a darker spot edged outwardly by a whitish one; fringe and margin as in fore wings. Head, face, palpi, thorax, and abdomen olive-ochreous; the metathorax and two basal segments of abdomen broadly white. Underside whitish; both wings suffused with dark fuscous towards base and apical region; the outer line very distinct, especially on the hind wings.

Expanse of wings 34 millim.

One male from the Khasias.

There is a female in the British Museum collection.

In this species the first subcostal of the hind wing approximates to, but does not anastomose with, the costal vein.

Parasarama rufitinctalis, sp. n.

Fore wings white, dusted finely with olive-green scales; a small white costal blotch at base; basal area restricted, fuscous olive, edged with darker, not reaching beyond one fourth of inner margin, where there is a blackish spot; a central costal dark blotch above the two cell-tufts, which are of raised black scales, with white scales beyond them; exterior line blackish, rather thick, running obliquely outwards, and curved in over the three median nervules, below which it disappears; marginal area fuscous black, strongly tinged with vinous, the vinous scales being massed along the veins, leaving a slightly paler edging to the outer line and a whitish spot on the costa; fringe vinous, chequered with dark fuscous at the ends of the veins, where there is a series of small pale dots. Hind wings pure white, with a deep fuscous border tinged with reddish, its inner edge running from four fifths of costa to the margin at the first median, there narrowed to the anal angle, with slight darker projections along the veins; fringe as in fore wings, with a pale basal line, preceded by a broad dark fuscous line. Head, face, thorax, and abdomen white; collar and patagia streaked with ochreous olive; abdomen mixed with grey scales and becoming ochreous towards anal segments. Palpi white beneath and internally, black externally. Underside white, with hind margins of both wings and costa of fore wings dark fuscous.

Expanse of wings 30 millim.

One male from the Khasias.

There is a female of this species in the British Museum collection from Sarawak.

Genus Scopocera, Moore.

Scopocera aglossalis, sp. n.

Fore wings pale ochreous, almost entirely covered with olive and fuscous scales; the base dark fuscous; first line at one third, bent in the middle, dark fuscous, preceded by a pale band and followed by diffused fuscous; a small obscure dark cell-spot; second line at two thirds, thick, forming an outward curve to the submedian fold, thence straight to inner margin not far before the anal angle, followed by a paler line; marginal area fuscous, darker at costa, and with a rosy tinge in places; a rosy diffused streak below the costa and along the submedian fold; fringe olive-fuscous. Hind wings olive-fuscous, with a darker denticulate central and postmedian curved line. Head, thorax, and abdomen concolorous; the abdomen somewhat darker. Underside paler, with the outer line marked in both wings; the disk of fore wings tinged with cinereous.

Expanse of wings, ♂ 30, ♀ 36 millim.

A few from the Khasias.

Trichotophysa, gen. nov.

Fore wings of male with costa slightly curved; apex blunt; hind margin curved, not very oblique; inner margin convex in the basal half. Hind wings with curved hind margin. Labial palpi slender, upcurved in front of face, the second joint long, reaching well above vertex, the third short and acute; maxillary palpi very fine, acute; antennæ pubescent, with a short tuft of scales from their base behind; tongue and ocelli present. Neuration: fore wings, cell not half as long as wing; the discocellular bent, followed by a fovea of crumpled membrane between the upper radial and the stalk of the last three subcostals, causing a distortion of all the veins and a bend in the costa itself above it; the fovea is covered above by a flat comb of curled scales; the median vein is much bent downwards towards end of cell, the three median nervules all rising near together and the lower radial from just above the angle; upper radial sinuous from below the upper angle; first, second, and stem of the other three subcostals curved at origin, the third, fourth, and fifth all starting from a point. Hind wings with costal closely approximated to, but not actually anastomosing with, the first subcostal nervule, which leaves the other close to their origin; first median at two thirds, second shortly before angle of cell, third and radial together from the angle.

Type *Trichotophysa olivalis*, sp. n.

Trichotophysa olivalis, sp. n.

Fore wings olive, tinged in parts with reddish, and dusted and suffused with dark fuscous; the central area between the lines darkest; first line at one third, wavy, obscure; the basal area paler, tinged with rosy, and with a black spot at base; second line at two thirds, curved and crenulate to inner margin at two thirds; a black spot at end of cell before the olive comb of scales; marginal area olive, with a darker fuscous shade in the middle, most evident on costa; a row of black spots before the olive fringes. Hind wing semitransparent, pale olive, tinged with rosy and fuscous, with traces of a denticulate submarginal grey line; fringe as in fore wings. Head and thorax olive; abdomen reddish, with paler anal tuft; metathorax with a dark brown tuft. Underside glossy, dull olive; the fore wings smeared with darker.

Expanse of wings 30 millim.

One male from the Khasias.

Subfamily *Pyralidinæ.*

Polycampsis, gen. nov.

Fore wings elongate, narrow; costa uneven, bulged at one third and two thirds, concave between the bulges and between the second and apex; apex shortly but strongly produced; hind margin shortly but strongly incised below apex, then remarkably gibbous; anal angle obtuse and rounded off; inner margin convex. Hind wings with apex somewhat produced, the hind margin slightly excised below it, then faintly curved; both wings beneath with strong wisps of hair from the base; fore wings with an oval indentation beneath at costa close to base, appearing above as a scale-covered blister. Antennæ of male simple, filiform, short; forehead oblique, hairy; maxillary palpi large, laxly haired, triangular; labial palpi decumbent, hairy, blunt, five times as long as head; the forehead, the maxillary and the labial palpi united to form a single plane; tongue very small; ocelli invisible; hind tibiæ with four spurs. Neuration: fore wings, cell about half as long as wing; discocellular deeply angled; first median at three fourths, second just before angle of cell, third from the angle; lower radial from just above the angulation; upper radial stalked with the last three subcostals, the third and fourth rising on a common stem from the fifth; first and second subcostals free. Hind wings: costal free; the subcostals on a long stalk; discocellular angulated, the lower arm very oblique; medians and radial as in fore wings.

Type *Polycampsis longinasus*, sp. n.

Polycampsis longinasus, sp. n.

Fore wings fulvous, mixed with yellowish and ferruginous; the two lines pale, diffuse, obliquely curved; first from middle of costa to inner margin at one fourth; second from apex to inner margin at middle; fringe ferruginous (?). Hind wings black-brown, as if burnt, the hind margin fuscous towards apex and the fringe lighter fuscous. Thorax ferruginous mixed with grey; metathorax pale, whitish; abdomen black-brown, with pale anal segment; palpi grey above, deep coppery red on sides and beneath. Underside fuscous cinereous; disk of fore wing with chocolate-brown hairs; hind wing more cinereous, with a pale curved submarginal line.

Expanse of wings 34 millim.

One male from the Khasias.

The type being somewhat rubbed, the coloration of the fore wings cannot be given with accuracy.

Xenomilia, gen. nov.

Fore wings narrow, elongate; costa strongly shouldered at base, then faintly incurved to apex; apex produced, falcate; hind margin with a prominent blunt rectangular projection at end of the second median nervule; concave above and below, but more strongly below; the upper half running slightly outwards, the lower very obliquely inwards; anal angle rectangular; inner margin convex towards base. Hind wings decidedly broader than fore wings, with both angles and the hind margin rounded. Abdomen of male long, with strong anal tuft; antennæ of male with a long basal joint, somewhat thickened at its upper end, the shaft simple, lamellate, forming an angle with basal joint; forehead with tuft of hair; labial palpi long, rostriform, decumbent, laxly scaled, terminal joint as long as second; no maxillary palpi or tongue; ocelli distinct; legs stout; hind tibiæ with four spurs; retinaculum a long recurved tuft of hair-like scales from the costal vein; frenulum stout. Neuration: fore wings, cell fully half as long as wing; the discocellular very oblique in its lower arm; first median at five sixths, second close before lower angle of cell, third and lower radial from the angle; upper radial stalked with the last four subcostals; the radial and the second subcostal rising from the same point, third subcostal halfway been second and the origin of fourth and fifth. Hind wings with costal free, the two subcostals stalked; medians and radial as in fore wings.

Type *Xenomilia humeralis*, sp. n.

Xenomilia humeralis, sp. n.

Fore wings reddish fawn-colour, deeper at base and along hind margin, dusted with black specks; first line double, at one third, slightly oblique outward, zigzag, dark grey; second line also double, at four fifths, sinuous, parallel to hind margin, followed above anal angle by a blackish shade. Hind wings paler, more ochreous, with a broad dark border along hind and inner margin. Head, palpi, face, and thorax reddish; abdomen dark grey. Underside duller, the exterior line single and broad.

Expanse of wings 38 millim.

One male from the Khasias.

HETEROCRASA, gen. nov.

♀. Fore wings elongate; costa curved; apex produced but blunt; hind margin obliquely rounded. Hind wings with both angles rounded, the hind margin slightly curved. Forehead tufted; labial palpi long, rough with hairs above and below, the third joint pointed, drooping; maxillary palpi invisible; tongue excessively minute; ocelli very indistinct, pale; antennæ filiform. Neuration: fore wings, cell half the length of wing; postmedian at three fourths, third and lower radial from end of cell, second halfway between first and third; first and second subcostals free; upper radial short-stalked with the other three; the three rising almost from the same point. Hind wings with costal free; the two subcostals from upper end of cell; medians as in fore wings, but the radial well above the lower angle; discocellular strongly angulated, the lower angle blunt.

Type *Heterocrasa expansalis*, sp. n.

Heterocrasa expansalis, sp. n.

Fore wings ochreous, with a pink suffusion, which is strongest at base and along costa and inner margin; the two lines slightly darker, the first at one fourth, curved, the second at three fourths, nearly parallel to hind margin; a slightly darker discal spot; fringe concolorous. Hind wings ochreous, hardly tinged with pink, but dusted with pale fuscous, with a faint submarginal darker line. Head, face, thorax, and abdomen ochreous, more or less tinged with pink, the patagia pink. Underside like upper, but the fore wings darker, being dusted with fuscous.

Expanse of wings 40–48 millim.

Many females, but no males, from the Khasias.

Genus ORTHOPYGIA, Rag.

Orthopygia pellucidalis, sp. n.

Fore wings pale pearly olive, the basal area and a shade beyond the second line slightly deeper olive; the lines pure white, both antemedian and postmedian vertical and wavy; the median area yellowish olive, darker towards inner margin, and with a patch of brown scales on the inner side of postmedian line; cell-spot minute; costal edge of median area dark, with three white dots; fringe concolorous with a row of concise black dots at base. Hind wings like fore wings, the basal and median areas both dusted with fuscous atoms. Head, thorax, and abdomen concolorous. Underside duller, with only the outer of the two lines shown, dull white; the small white costal dots extended to the base.

Expanse of wings 18 millim.

One male from the Khasias.

Genus PYRALIS, Linn.

Pyralis rectisectalis, sp. n.

Fore wings pinkish ochreous, sparsely dusted with black scales; basal area dull chocolate, edged by the first line at one sixth, which is perfectly straight, dull white; marginal area dull olive, edged inwardly by the second line at five sixths, which is also dull white and nearly straight; fringe olive, with a row of distinct triangular black spots at base; cell-spot denoted by a few black scales. Hind wings with the costal area whitish; basal area as in fore wings, but more restricted, followed by a distinct black spot; second line curved and edged inwardly by blackish spots, two larger ones below the costa and two before the inner margin; marginal area and fringe as in fore wings. Head, thorax, and abdomen pinkish ochreous. Underside less pink; the basal and marginal areas of fore wings dark brown, broader than above. Hind wings with basal area much dusted with dark brown, and with a strongly marked, curved, dark brown central line; cell-spot black, distinct.

Expanse of wings 26 millim.

One male from Peermaad.

A very distinct species.

Genus Peucela, Rag.

Peucela fumosalis, sp. n.

♀. Fore wings pinkish ochreous, the basal and marginal areas and the hinder part of the median area suffused with fuscous scales; first line at one third, bluntly elbowed in middle, whitish, finely edged with darker; second line beyond two thirds, crenulated, whitish, edged internally, except at costa, with a thick dark line; costa fuscous, dotted with ochreous; a rather large blackish cell-spot; a row of black triangular marks along hind margin; fringe reddish grey, ochreous towards base. Hind wings wholly suffused with fuscous, reddish ochreous along inner margin; a pale line edged outwardly with darker at one third, followed by a small dark cell-spot; a curved and crenulate submarginal line, edged internally with dark; marginal line dark; fringe darker than in fore wings, with a thick dark dividing line. Head, thorax, and abdomen ochreous, dusted with fuscous. Underside of fore wings thickly dusted with fuscous, of hind wings pale ochreous, more sparsely dusted; both wings with discal spot and outer line marked.

Expanse of wings 26 millim.

One female from the Khasias.

Peucela rubrifuscalis, sp. n.

Fore wings greyish stone-colour, sprinkled with black atoms; antemedian line at one fourth, curved outwards in upper half and inwards below, black, edged internally with red, entirely red in the lower half, the reddish tinge extending along the costa to the base; a small dark cell-spot; postmedian line from three fourths of costa to near anal angle, sinuous outwards in middle, inwards above and below, blackish, preceded by a very fine dark line of blackish atoms; marginal area black-brown, the apical region reddish; fringe black-brown and reddish, chequered, with a pale basal line; costa between the two lines dotted with black. Hind wings like fore wings, with two curved blackish lines, the antemedian preceded by a reddish and fuscous shade; the postmedian followed by a curved red line; hind margin and whole apical area tinged with red. Head, thorax, and abdomen concolorous with ground-colour, the abdomen red-tinged. Underside with basal and marginal areas broadly red.

Expanse of wings 24 millim.

One male from the Khasias.

Genus Comaria, Rag.

Comaria unilinealis, sp. n.

Fore wings pale brick-red, darker along costa, which is marked with dark slight points; a small reddish discal dot; an oblique line at three fourths parallel to hind margin, pale yellowish internally, edged beyond with dark red-brown; marginal area brick-red; fringe concolorous, with a pale basal line and darker dividing line. Hind wing dull reddish grey, dusted with darker, with a very broad dark grey border. Head, thorax, and abdomen reddish, dusted with dark atoms. Underside like upper.

Expanse of wings 24 millim.

One female from Masuri.

Genus Zitha, Wlk.

Zitha imperatrix, sp. n.

Fore wings rich coppery red, thickly dusted with black atoms except in the space between the first median nervule and the submedian, where the ground-colour is paler and brighter; costa to near the apex broadly putty-colour, its edge marked with numerous oblique short black strigæ; the two lines oblique, thick, black, neither reaching the costa, but starting from the lower edge of the costal streak; the first at one third, slightly sinuous, edged internally with pale coppery, which on the inner margin forms a small yellow spot; second line similar, at two thirds, edged outwardly towards inner margin with paler and likewise with a minute yellow spot on inner margin; space between costal streak and the median vein most thickly sprinkled with dark atoms; fringe dark coppery, with two or three lighter lines. Hind wings paler, bright coppery yellow, redder towards inner and hind margins, with a dark red-brown line from just above anal angle, not reaching the costa, and traces of a central line on inner margin only; fringe as in fore wings, but with dark coppery basal line. Abdomen with two basal and the anal segments coppery yellow, intermediate segments purple-black (probably from grease); thorax, head, and face coppery brown; palpi putty-colour. Underside dull reddish brown, with strong fuscous mottling; the outer line dark in both wings, with a paler edge; costa of fore wing with alternate yellowish and black spots; legs ochreous, dusted with reddish and fuscous.

Expanse of wings 36 millim.

Two or three males from the Khasias.

A very remarkable looking and handsome species.

Genus Ulotrichodes, Rag.

Ulotrichodes novalis, sp. n.

Fore wings yellowish ochreous, dusted in places with rather coarse blackish scales; first line at one fourth, vertical, sinuous; second line at three fourths, at first parallel to hind margin, bent in below the median and much thickened, reaching inner margin shortly before anal angle; marginal area thickly dusted with blackish; a large black cell-spot; costa regularly dotted with black; fringe concolorous. Hind wings whitish towards base, becoming pale ochreous outwardly; a submarginal darker line, parallel to hind margin. Head, thorax, and abdomen concolorous with fore wings. Underside paler and duller.

Expanse of wings 18 millim.

One male from Bombay.

Subfamily *Endotrichinæ*.

Neurophruda, gen. nov.

Fore wings narrow, with straight costa; apex produced, blunt; hind margin very oblique, slightly bent in middle. Hind wings narrow, with hind margin slightly bent. Antennæ (♂) lamellate, thick, and somewhat flattened; labial palpi porrect, rostriform, decumbent; maxillary palpi small; tongue present; ocelli invisible; legs long. Neuration: fore wings, cell about half as long as wing; discocellular inangled; first median at three fourths; second, third, and lower radial all close together from lower end of cell; upper radial from middle of discocellular; last three subcostals stalked, the fifth rising near the cell, and approximated to the upper radial near hind margin; second free; first absent.

Hind wings with first subcostal anastomosing with costal; medians and radial as in fore wings.

Type *Neurophruda daulialis*, sp. n.

Neurophruda daulialis, sp. n.

Fore wings orange, with bright fulvous markings; first line curved obliquely inwards, preceded below the median by an acutely angled tawny blotch; second line from three fourths, oblique inwards for one third, then forming a very acute angle towards hind margin, which it nearly touches, again angled and bent below the discal mark to inner margin about middle; space between the two lines beneath the median fulvous; marginal space with fulvous streaks radiating from the outer edge of second line towards hind margin; discal mark fulvous, oblique; fringe yellow, with a fulvous line at base. Hind wings yellow, paler towards base, with outer line and marginal area as in fore wings; on the hind margin at anal angle are four raised dots of coal-black scales. Head, thorax, and abdomen orange, mixed with fulvous. Underside dull yellow, with fulvous scales interspersed.

Expanse of wings 14 millim.

One male from the Khasias.

Superficially resembling somewhat a small *Daulia*.

Genus Cangetta, Moore.

Cangetta venustalis, sp. n.

Fore wings white, from base to beyond middle suffused with fulvous grey; a reddish vertical outer line at three fourths, reaching only to middle of wing, the apical area beyond it being first grey, then orange-fulvous, the limit of the two colours marked by a deeper fulvous line from costa to middle of hind margin; fringe white. Hind wings white along costa and hind margin, the rest of the wing broadly orange-tawny in the middle, becoming red-brown towards inner margin; the tawny shade is bounded by a darker diffuse line, beyond which there is a grey patch; discal spot in the tawny shade white; fringe white. Head, face, and thorax whitish; abdomen more orange. Underside duller.

Expanse of wings 17 millim.

One female from the Khasias.

Genus Diplopseustis, Meyr.

Diplopseustis constellata, sp. n.

Closely allied to *D. minima*, Butler, but darker, the white cross-lines and costal rings and dots more distinct; the wavy white inner line is followed above the inner margin by a round blackish blotch containing a minute white centre; the black discocellular mark is followed by a white lunule, which has three white dots beyond it, one quite close, the other two more remote, from either end of the lunule; another white dot stands near the base of the cell. Hind wings as dark as fore wings, with faint traces of a wavy submarginal pale line; fringes white, beyond a dark basal line.

Expanse of wings 18 millim.

One female from the Khasias.

Diplopseustis pallidalis, sp. n.

Fore wings pale greyish, with the costal rings and dots and the transverse lines as in *D. minima*; first line wavy, whitish, followed below the middle by deep black scales; second line preceded by blackish suffusion towards inner margin; discal spot black, linear, followed by a whitish spot. Hind wings dull whitish, with a blackish cell-spot and a submarginal white, inwardly dark-edged line, followed at middle of hind margin by a blackish blotch; palpi pale, externally grey; face white; thorax like fore wings; abdomen whitish, with blackish dorsal marks.

Expanse of wings 17 millim.

A male from the Khasias.

Genus Hendecasis, Hmpsn.

Hendecasis fumilauta, sp. n.

Fore wings dull white, slightly washed with ochreous grey; the two lines double, curved, at one third and two thirds respectively; apical half of hind margin occupied by a round greyish-ochreous cloud, with darker inner edge; fringe white, with dark grey basal line. Hind wings a little more suffused with grey, with the two lines as in fore wings, but the inner one more curved outwards in middle. Head, thorax, and abdomen whitish; palpi grey. Underside duller white; fore wings with an oblique darker line, corresponding to the dark inner edge of the apical blotch.

Expanse of wings 12 millim.

Both sexes from the Khasias.

Genus Cotachena, Moore.

Cotachena peractalis, sp. n.

Fore wings pale fawn-colour, without the yellowish tint of *histricalis*, Moore, and *pubescens*, Warr.; all the three white spots more largely developed, the additional basal spot also conspicuous; the outer line, which in both of the above-mentioned species forms a slight but visible projecting sinus between the two outer spots, runs straight, and is followed by an additional white blotch consisting of three coalescent teeth. Hind wings whitish from base, becoming ochreous fawn-colour towards hind margin, but not yellowish. The fore wings have the apex more produced, subfalcate, and the hind margin is slightly elbowed in the middle.

Expanse of wings 24 millim.

Several of both sexes from Tenimber and Dili.

[To be continued.]

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

February 26, 1896.—Dr. Henry Hicks, F.R.S., President, in the Chair.

The following communications were read:—

1. 'On the Structure of the Plesiosaurian Skull.' By Charles W. Andrews, Esq., B.Sc., F.G.S.

Owing to the imperfection of the specimens described, various previous accounts of the Plesiosaurian skull are incomplete, and differ from one another in important particulars. There is in the National Collection a fine skull of *Plesiosaurus macrocephalus* which has lately been cleared from the matrix, with a description of which the present communication is mainly occupied, though other specimens, which are of assistance in clearing up some difficulties, are also noticed. The Author particularly considers the structure of the palate, and only such points in the structure of the rest of the skull as add to or are at variance with previous descriptions are considered.

The Author's observations indicate that a general similarity of palatal structure among reptiles does not necessarily imply any close relationship, but the very great resemblances existing between the Plesiosaurian and Rhynchocephalian palates, reinforced by numerous other points of resemblance in these skeletons noted by Baur, lead to the conclusion that the Plesiosauria are descended from a primitive Rhynchocephalian reptile, as already opined by Baur, Boulenger, and others.

2. 'The Fauna of the Keisley Limestone.—Part I.' By F. R. Cowper Reed, Esq., M.A., F.G.S.

The Author has examined a very full series of fossils from the Keisley Limestone of Westmoreland, and proposes to describe the fauna of the limestone. In this (first) part of the paper a description of the trilobites is given. He recognizes about forty species, belonging to ten families. Several of the forms are new, whilst others have previously been described, and many of them occur in the limestone of the Chair of Kildare and the *Leptæna*-limestone of Dalecarlia.

April 29, 1896.—Dr. Henry Hicks, F.R.S., President, in the Chair.

The following communications were read:—

1. 'Descriptions of New Fossils from the Carboniferous Limestone.—I. On *Pemmatites constipatus*, sp. nov., a Lithistid Sponge. II. On *Palæacis humilis*, sp. nov., a new Perforate Coral; with Remarks on the Genus. III. On the Jaw-apparatus of an Annelid, *Eunicites Reidii*, sp. nov.' By George Jennings Hinde, Ph.D., F.G.S.

I. The *Pemmatites*, belonging to a genus hitherto only known from the Permo-Carboniferous beds of Spitzbergen, was discovered in tho Yoredale Beds of Yorkshire by Mr. J. Rhodes, and is the only fairly complete sponge which has hitherto been detected in the Yoredale Beds of North-West Yorkshire. The Author gives a full description of the species.

II. The *Palæacis* was found by the Rev. G. C. H. Pollen in the Carboniferous Limestone and Shale Series, on the banks of the Hodder, near Stonyhurst. The specific characters of the form are given by the Author, who then remarks upon the genus *Palæacis*, which has been placed alternately with the corals and sponges, though latterly it has been generally regarded as a perforate coral. Nevertheless its real characters had not been definitely settled: the uncertainty, in the Author's opinion, being due to the fact that some writers have placed in the genus certain forms which differ widely from the typical species, and have then defined the characters of the genus largely from these foreign forms. The Author, in the light of the information now supplied, gives a fresh definition of the genus, which appears to represent a distinct family of perforate corals, in some features more nearly allied to the Favositidæ than to the Madreporidæ or Poritidæ.

III. The third specimen was discovered by Miss Margery A. Reid in the Lower Carboniferous Beds of Halkin Mountain, Flintshire, and is named in honour of its discoverer. A description of it is given, and it is stated that, notwithstanding certain peculiarities, the individual pieces correspond so closely with those of the recent *Eunice* family that it may well be included in the genus *Eunicites*.

2. 'Discovery of Mammalian Remains in the Old River-gravels of the Derwent near Derby.'—Part I. By H. H. Arnold-Bemrose, Esq., M.A., F.G.S.

A few mammalian bones were found in sinking a well at Allenton. On April 8th, 1895, the Authors commenced further excavations, and were successful in finding the lower jaw, 26 vertebræ, the os innominatum, left femur, tibia, fibula, calcaneum, cuboid, IV metatarsal, right fibula, calcaneum, cuboid, IV metatarsal, astragalus, left lunare and scaphoid, and portions of ribs of a *Hippopotamus*, also part of the breast-bone of an *Elephas*, and part of the tibia of a *Rhinoceros*. The *Hippopotamus*-bones were well-preserved, and probably belonged to one animal. The body was most likely stranded in an old channel of the River Derwent, and quickly covered up with sand and clay, but not before the bones were somewhat disturbed. They were found in a dark-coloured sand above the river-gravel, at a depth of 9 feet 8 inches below the surface.

Mr. Clement Reid found some twenty or more species of plant-remains in the sand. These plants 'indicate a moist meadow or swampy ground, and a temperate climate. The species are all widely distributed.'

Part II. By R. M. Deeley, Esq., F.G.S.

The deposits in which the bones were found occupy a wide trench which occurs on the inside edge of a gravel-terrace stretching for several miles south of Derby, at a height of 15 or 20 feet above the modern alluvial plain. The gravels are of later age than the Great Chalky Boulder Clay, and were formed at a time when the rivers were removing from their preglacial valleys the older Boulder Clays, with which they had been partially filled. Gravels of two ages are recognized: (*a*) recent gravels well stratified, undisturbed, and covered in many places by a thick layer of brick-earth; and (*b*) high-level gravels showing 'trail' and contorted bedding. It is in these latter gravels that the trench containing the mammalian remains occurs. The deposits occupying this old waterway and the contorted high-level gravels are placed together in the same period; and the Author gives reasons for supposing that they are both of interglacial age, the contortions and surface-disturbances having been produced during a recent cold period, most probably by a lobe of ice which passed down the Trent Valley. Several peculiar physical features of the valleys, such as the flowing surface-outlines of the higher gravel-terraces, and the occurrence of lacustrine deposits in the low-level area occupied by Sinfin Moor, are instanced as supporting this view.

MISCELLANEOUS.

On the Scaly Covering of the Regenerated Tails of Lizards. By Dr. Franz Werner, Assistant at the Zoological Institute and Royal University in Vienna.

The results of this research are as follows:—

1. The scales of the regenerated tail in certain Saurians, which

reproduce themselves with an altered scale-covering, instead of being constituted, as in the original, phylogenetically oldest forms of the family in question, on the primary tail, in all newly acquired parts exhibit an extensive differentiation from the form originally manifested, tubercle-scales, crests, spines, and keeled scales not being reproduced.

2. In the regeneration of the tails of all Saurians which reproduce them with an altered form of scale, the existing outer segmentation of the scaly coat, as well as the development of the preformed points of rupture of the skin, together with the differentiation of a vertebral column, is lost.

3. In some cases in which the scale-covering of the tip of the primary tail is different from that of the substituted tail the secondary tail agrees with the normal tail-tip, which consequently in this respect shows itself really in the original condition.

4. Differentiations of the scale-covering, which are wanting in the regenerated tails of lizards, such as tubercles, ridges, &c., are also not to be recognized in the embryos of the same species until they attain a certain age.

5. The regeneration of the tail generally fails to take place, or takes place to a very limited extent, when it has undergone a special differentiation into offensive or prehensile organs.

6. In cases of a second regeneration the tertiary tail agrees entirely with the secondary so far as the scale-covering is concerned.

7. Within the same family the regenerated tails of all forms agree, especially in the rule as to the arrangement of the scales.—*Sitzungsb. kais. Akad. der Wiss. Wien*, Jahrg. 1896, pp. 34–35.

On the Mollusca (Prosobranchiata and Opisthobranchiata, Scaphopoda and Lamellibranchiata) Dredged by the Austrian Deep-sea Expeditions of H.M.S. 'Pola' in the Years 1890–94. By Dr. Rudolf Sturany.

The question of the uniformity of the Molluscan fauna of the greater depths of the Mediterranean Sea (from about 400 metres onwards), which Fischer asserted and has proved from the results of the 'Travailleur' Expedition, are confirmed afresh by the dredgings of the 'Pola.' Further, the material obtained is of a kind to strengthen the conclusions of Dr. v. Marenzeller, recently published, which, based upon the nature of the various Echinoderms dredged at different depths and the uniform character of the whole deep-sea fauna from 200 metres up to the greatest depths, brought out the fact of the absence of a defined abyssal fauna.

Again, an Atlantic origin has very rightly been ascribed to the deep-sea fauna of the Mediterranean, from the fact that many abyssal mollusks of this basin are identical with Atlantic and North-Atlantic forms and occur in the Tertiary deposits of Sicily and Italy, and their ingress referred to a time when there was a much freer communication between the Atlantic and Mediterranean seas than exists at present (Jeffreys, Fischer).

Species having that distribution were dredged by the 'Pola.'

In this communication the Gastropoda, and, indeed (with the exception of the Heteropoda and Pteropoda), the Scaphopoda and Lamellibranchiata, are discussed. Of these groups there were in all 120 species dredged. In the Mediterranean expedition (I.–IV., 1890–93) there occurred 76 species (36 Gastropoda, 3 Scaphopoda, 37 Lamellibranchiata), in the Adriatic expedition (1894) 63 species (36 Gastropoda, 2 Scaphopoda, 25 Lamellibranchiata); 19 species were found in both seas.

In shallow places more species were naturally dredged than in deep; so in every proportion of the fauna with regard to the vertical distribution of species there must still be reckoned a considerable decrease of species from above downwards. This decrease is a much more striking one than in the western part of the Mediterranean, and it would appear from this, and having regard to the fact that on many stations at great depths the dredge yielded absolutely nothing, that the conclusion is justified that the deeper parts of the Eastern Mediterranean are still poorer than the analogous portions of the western basin.

The deepest part which still yielded molluscan shells was Station no. 82, northward of Alexandria, 2420 metres. Here 9 species were dredged, of which 5 were entirely new to science. One of these species belonged to a new genus, which, from the horizontal position of the hinge-teeth, was named *Isorropodon.* It is a shell of inconsiderable size, with a maximum length of 11 millim. and 8·5 millim. in height, and from its external morphology might be regarded as one of the Veneridæ. The relations of the complicated hinge point, however, to an affinity with *Cypricardia lithophagella*, Lam. In a second new form from the same station the author recognized a representative of the genus *Myrina*, which up to the present is only known as coming from North Australia and South Africa.

The sum total of new species amounted to 9; they comprised 1 littoral of the genus *Scalaria*, 3 continental of the genera *Fusus*, *Lyonsia*, and *Pecchiolia*, and 5 abyssal of the genera *Taranis*, *Defrancia*, *Lucina*, *Isorropodon* (new genus), and *Myrina.*

12 species which up to the present have only been found in the Western Mediterranean or in the Adriatic as the result of the dredging by the 'Pola' must now be regarded as having a distribution in the eastern basin.

One of the species dredged by the 'Challenger' expedition off the Azores extends into the Mediterranean—*Pleurotoma* (*Mangelia*) *macra*, Watson.

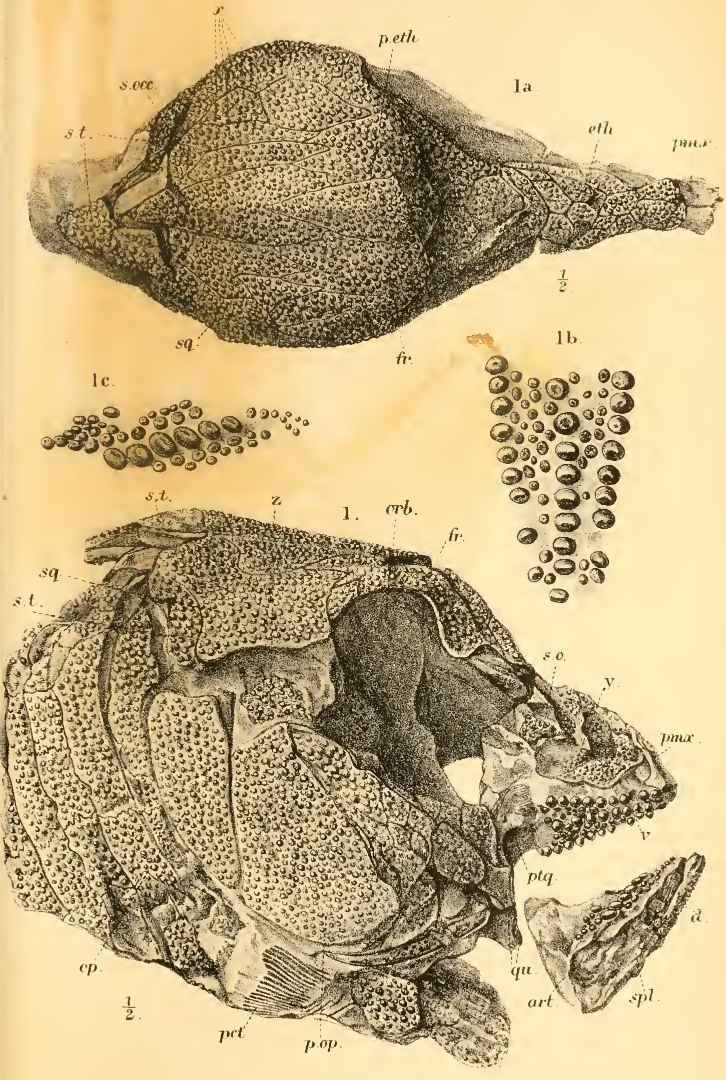
Two new varieties of *Raphitoma nuperrima*, Tib., form links with Watson's species *Pleurotoma* (*Mangelia*) *corallina* and *Pleurotoma* (*Mangelia*) *acanthodes* from the West Indies and the Azores.

Nine species, otherwise, it is true, already long known, are new to the fauna of the Adriatic.—*Sitzungsb. kais. Akad. der Wiss. Wien*, Jahrg. 1896, no. vii. pp. 56–59.

INDEX TO VOL. XVII.

END OF THE SEVENTEENTH VOLUME.

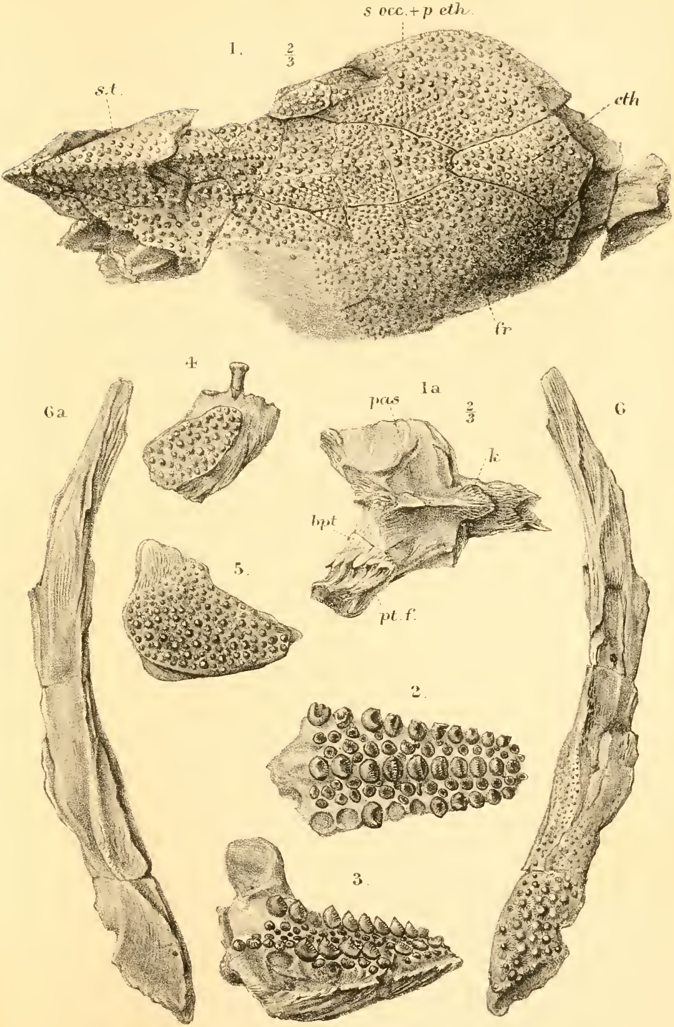
PRINTED BY TAYLOR AND FRANCIS,
RED LION COURT, FLEET STREET.



J. Green del et lith.

Mintern Bros. imp.

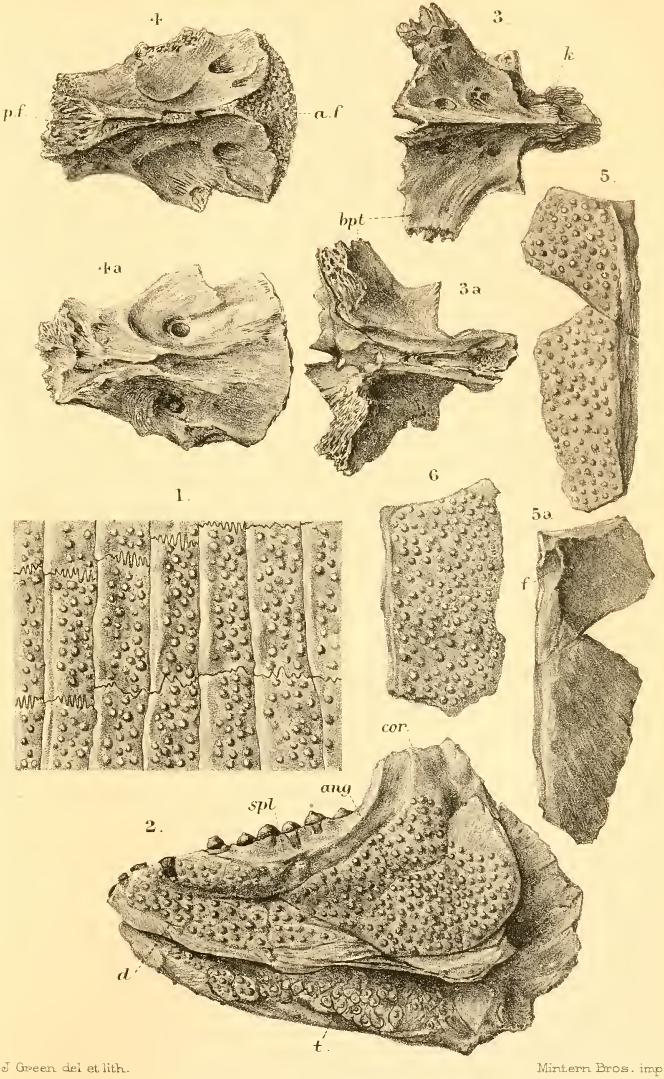
MESTURUS LEEDSI, *sp. nov.*



J. Green del. et lith.

Mintern Bros. imp.

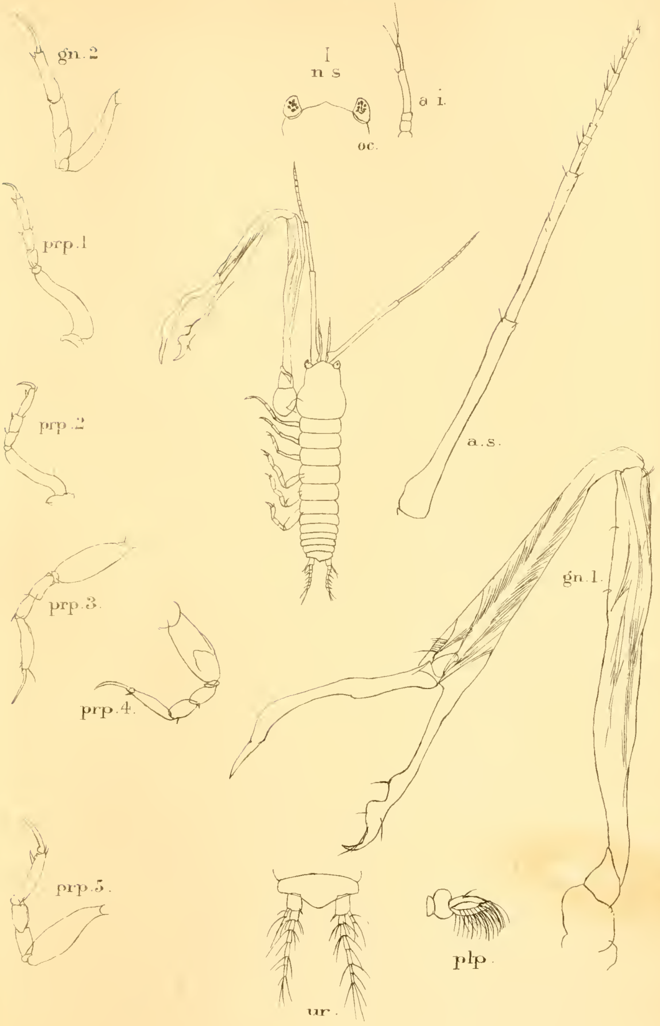
MESTURUS LEEDSI, *sp. nov.*



J Green del et lith.

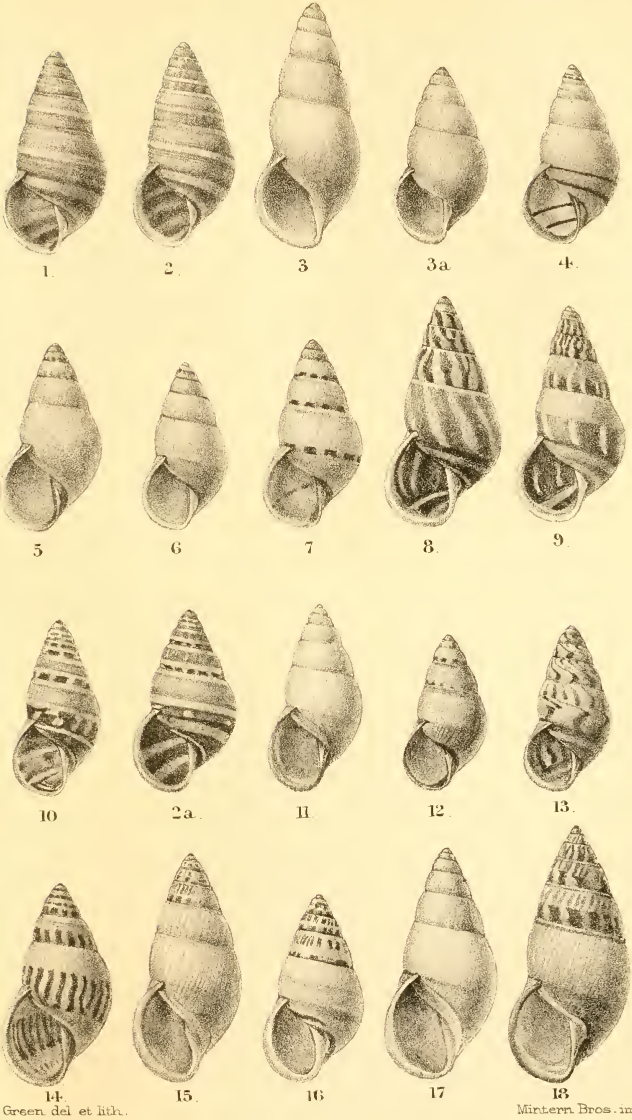
Mintern Bros. imp.

MESTURUS LEEDSI, *sp nov*



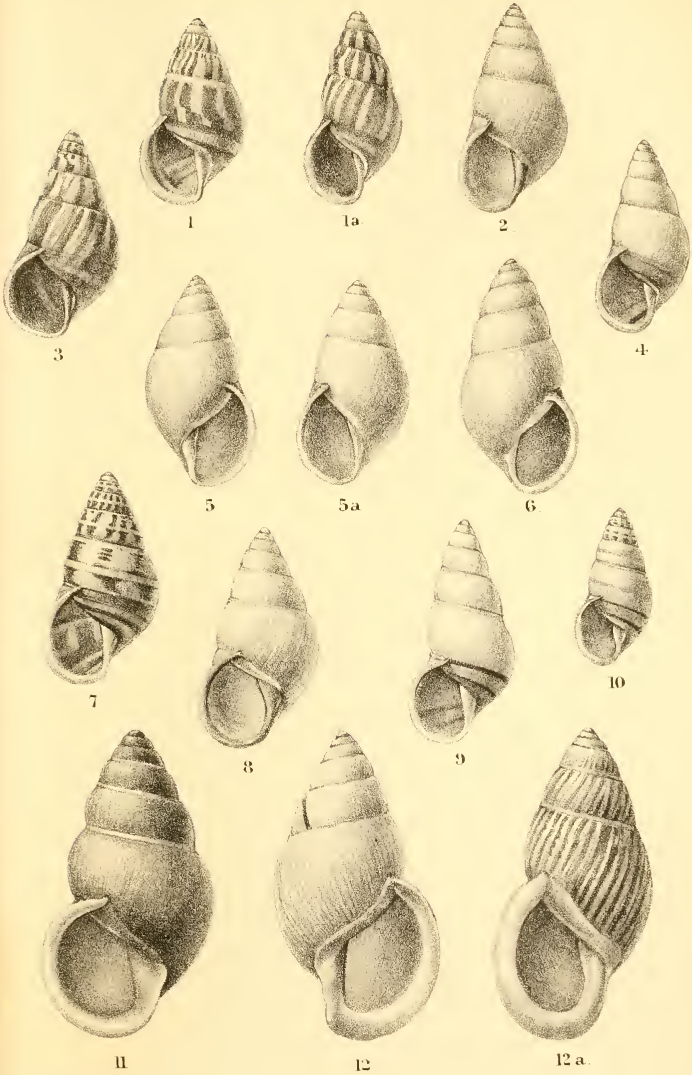
I. R. R. Stebbing del. Mintern Bros. lith.

DOLICHOCHELIA FORRESTI. n. g. et sp.



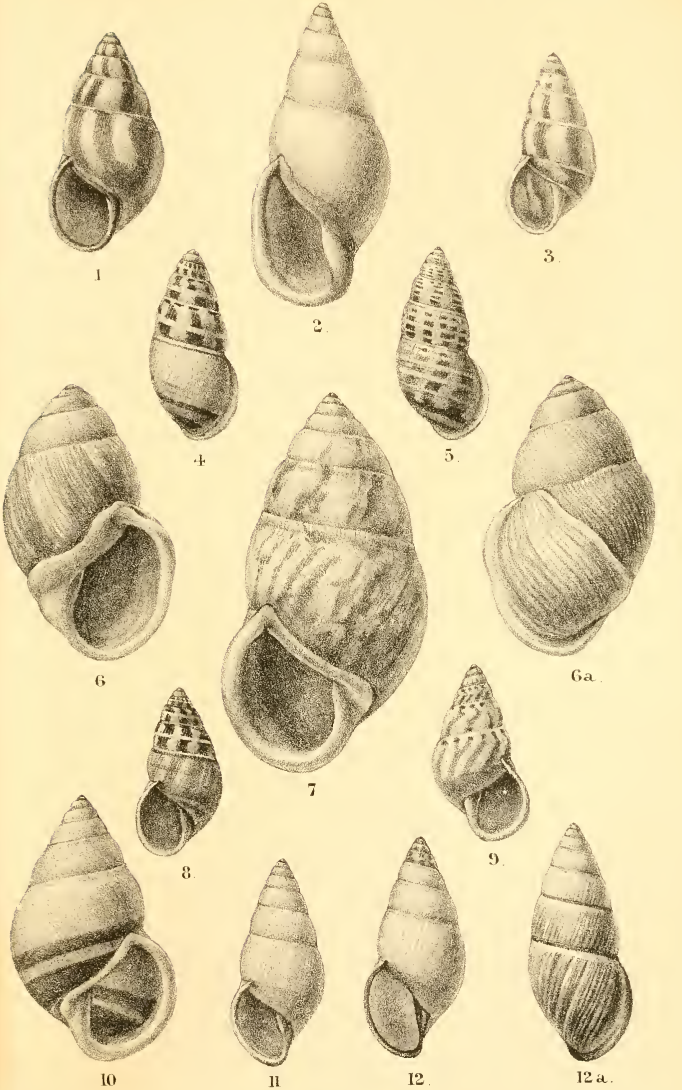
J. Green del et lith.

Mintern Bros. imp.



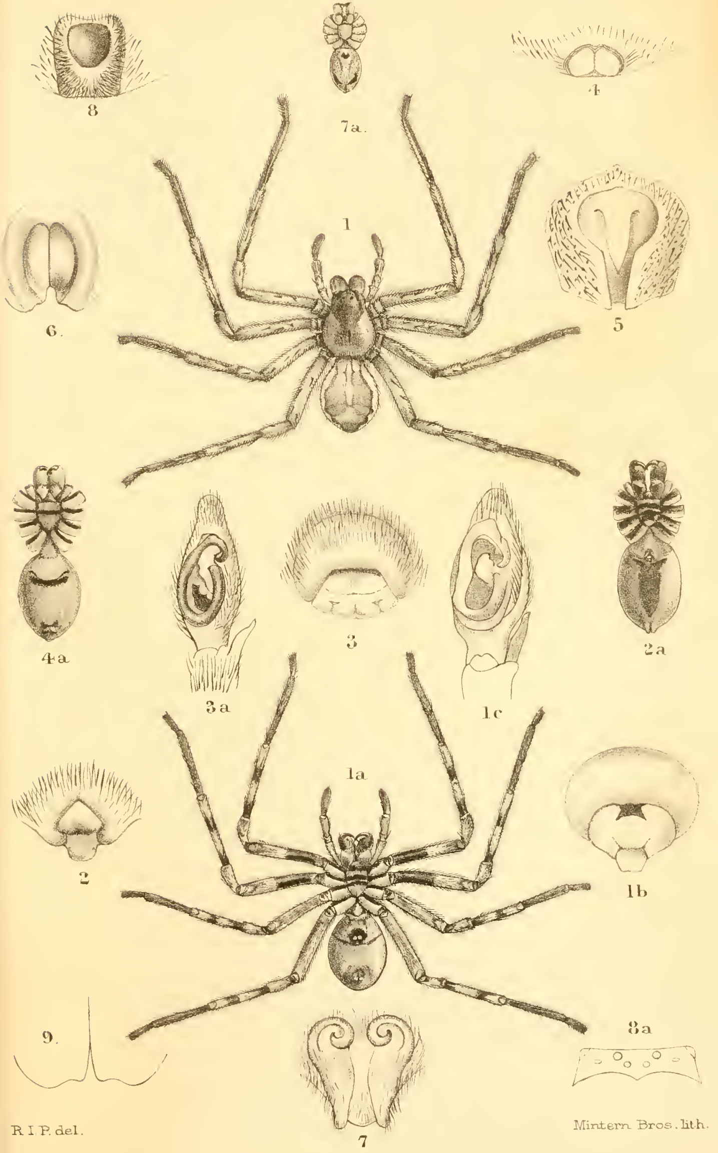
J. Green del. et lith.

Mintern Bros. imp.



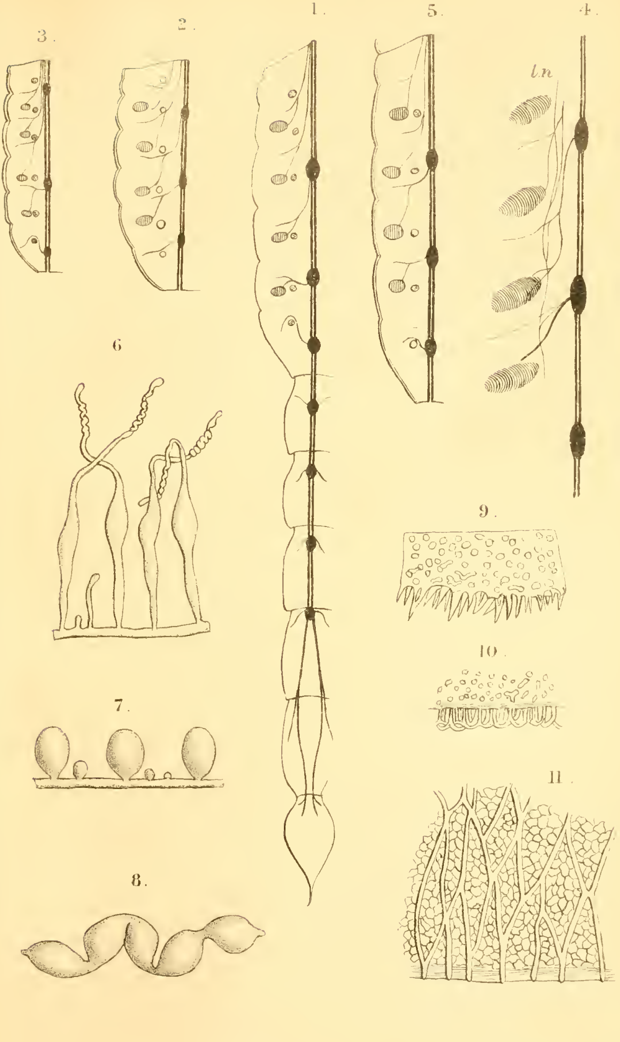
J. Green del. et lith.

Mintern Bros. imp.

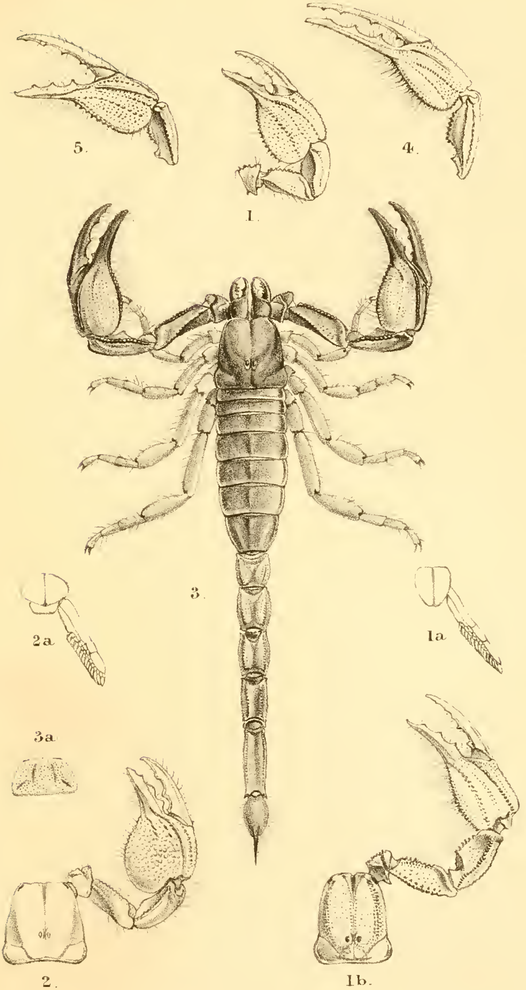


R. I. P. del.

Mintern Bros. lith.

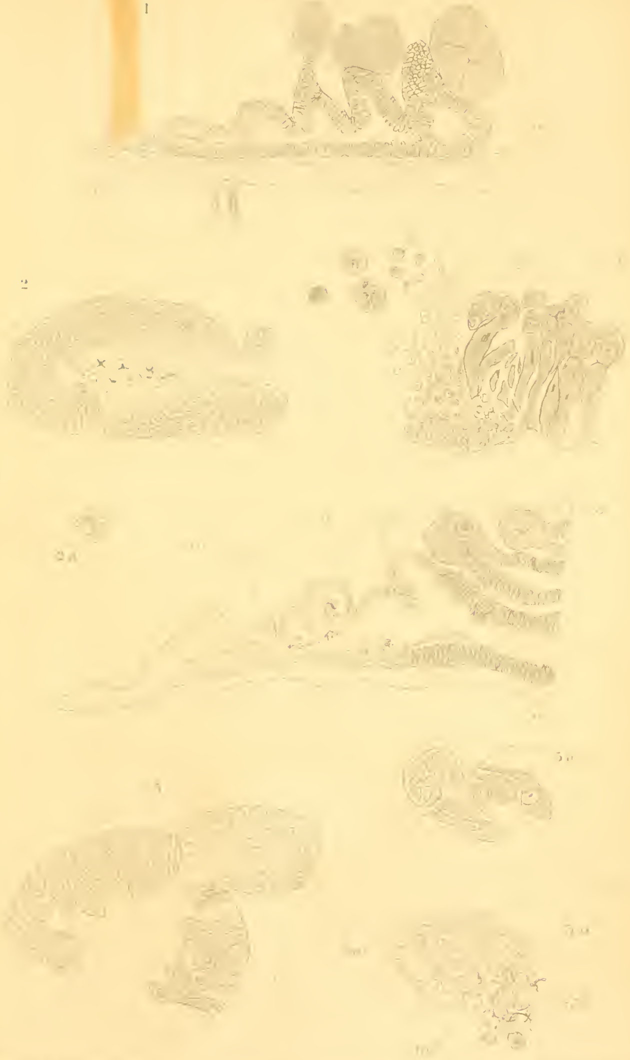


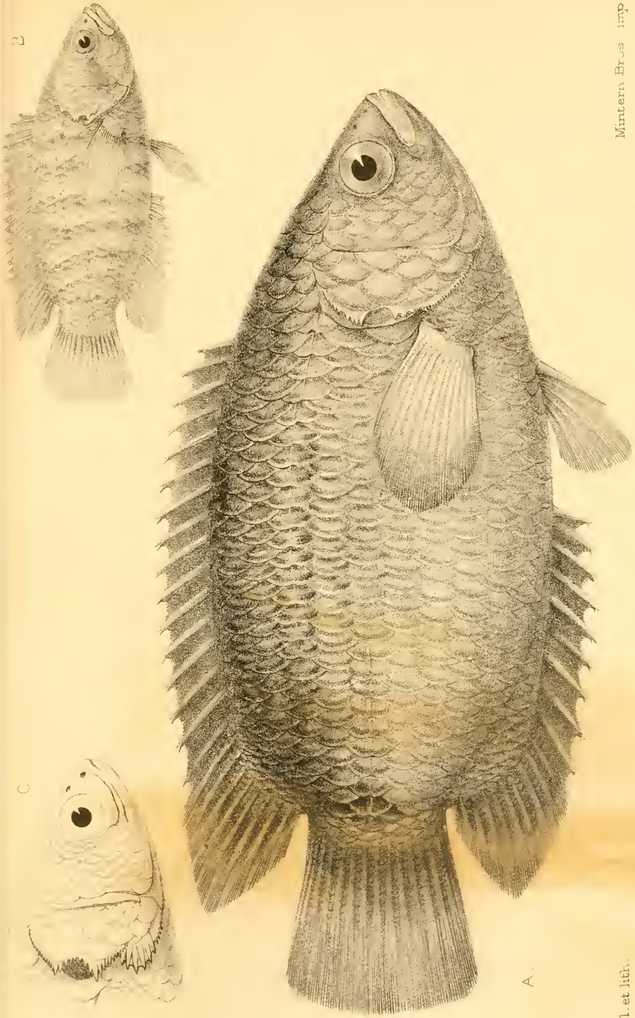
Mintern Bros. lith.



J. Green del et lith.

Mintern Bros. imp.



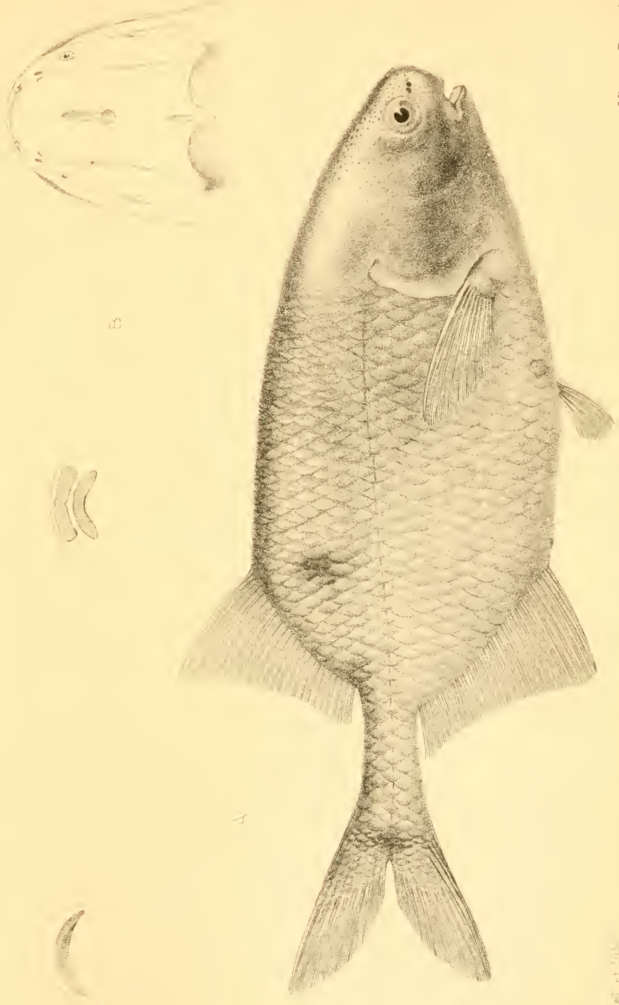


J. Green del. et lith.

Mintern Bros imp.

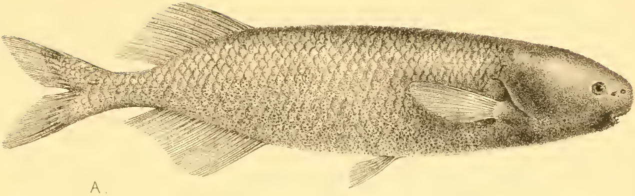
A. CTENOPOMA KINGSLEYÆ. B. CT. NANUM. C. CT. GABONENSE.

Mintern Bros. imp.

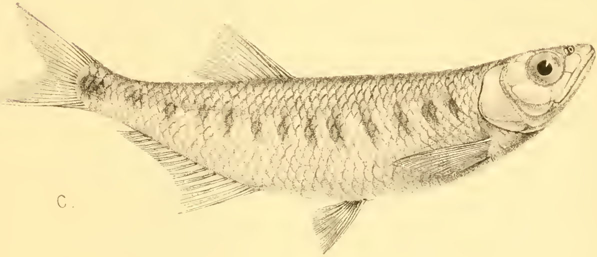


A. MORMYRUS AMBLYSTOMA. B. CLARIAS WALKERI.

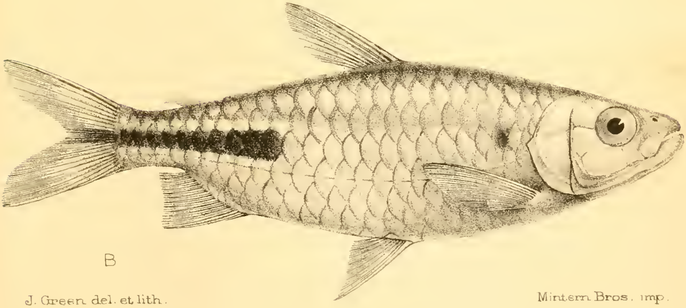
J. Green del. et lith.



A.



C.

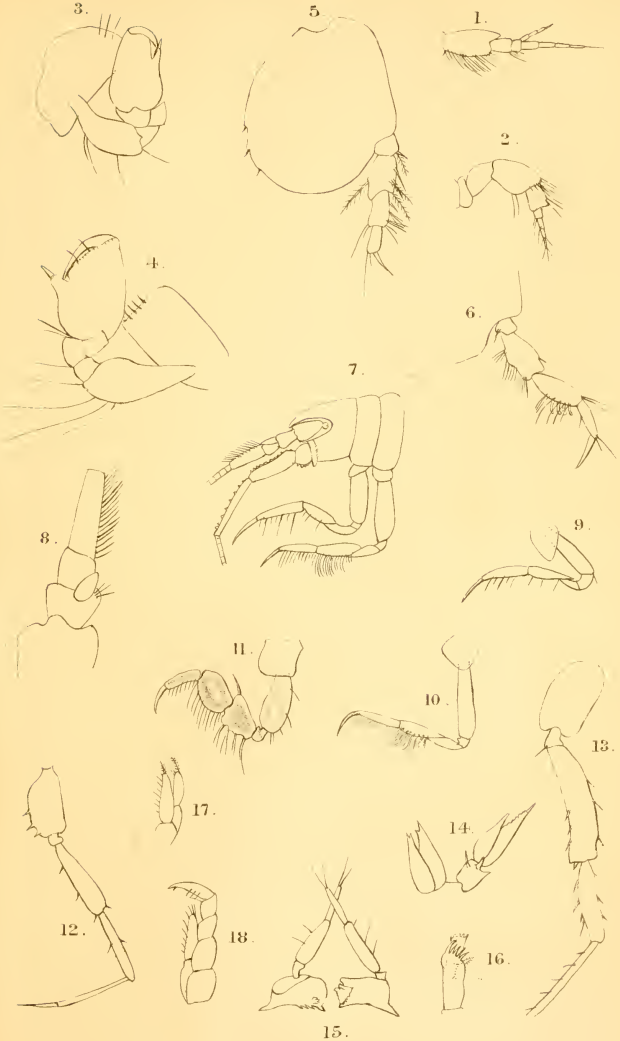


B

J. Green del. et lith.

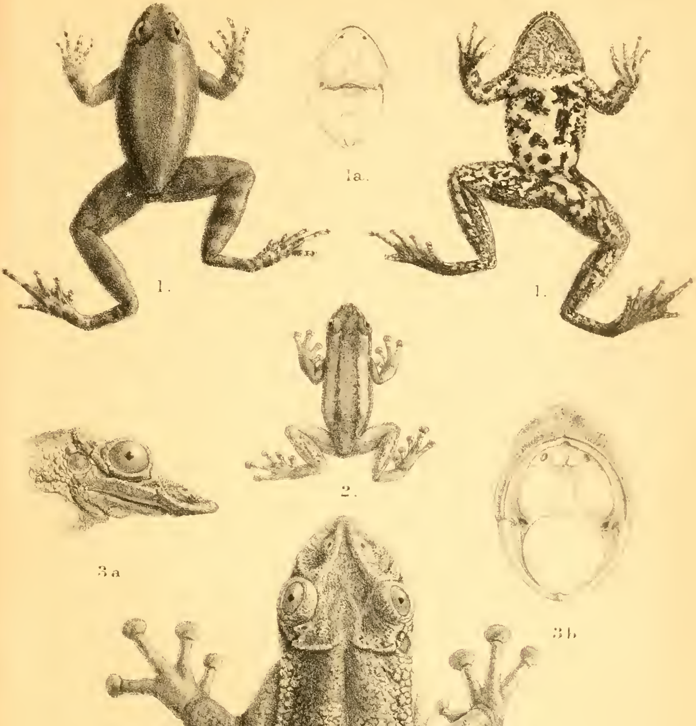
Mintern Bros. imp.

A. MORMYRUS KINGSLEYÆ. B. ALESTES KINGSLEYÆ.
C. BARILIUS BIBIE.



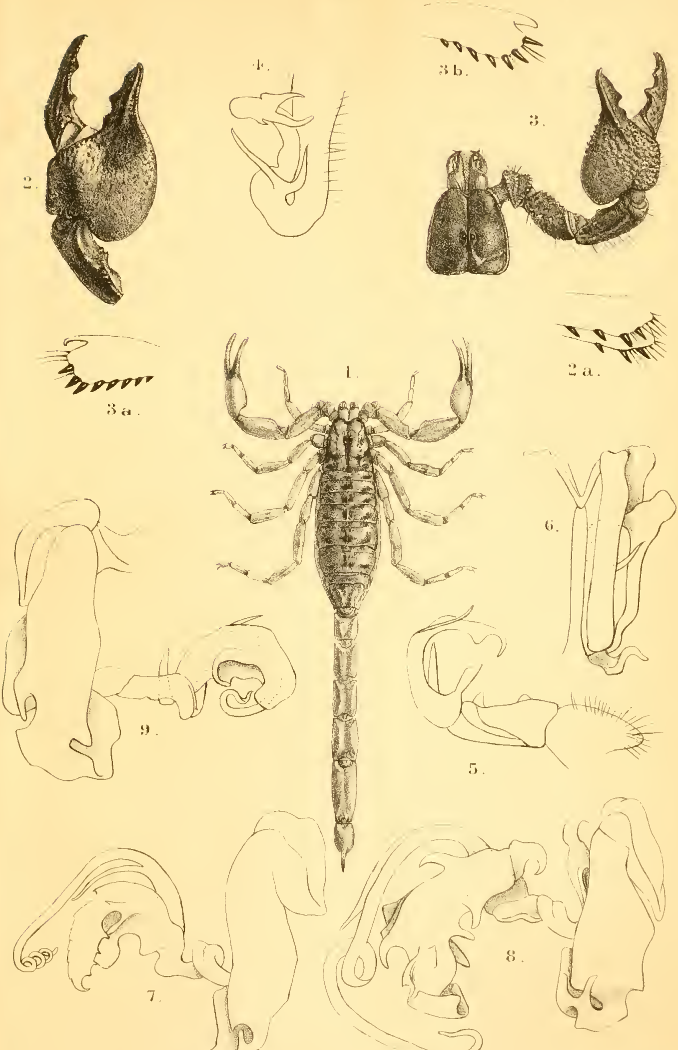
A. O. Walker del.

Mintern Bros. lith.



R. Mintern & J. Green del. et lith. Mintern Bros. imp.

1. OREOBATRACHUS BALUENSIS. 2. MEGALIXALUS BRACHYCNEMIS. 3. CORYTHOMANTIS GREENINGI.



R. I. P. del. Mintern Bros. lith.

CONTENTS OF NUMBER 102.—*Sixth Series.*

PROCEEDINGS OF LEARNED SOCIETIES.

MISCELLANEOUS.

*** It is requested that all Communications for this Work may be addressed, post-paid, to the Care of Messrs. Taylor and Francis, Printing Office, Red Lion Court, Fleet Street, London.