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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

WILLIAM CARRUTHERS, Ph.D., F.R.S., F.L.S., F.G.S.,  
ARTHUR E. SHIPLEY, M.A., Sc.D., F.R.S., F.Z.S.,

AND

RICHARD T. FRANCIS, F.Z.S.

Schubert collect 1

VOL. III.—NINTH SERIES.



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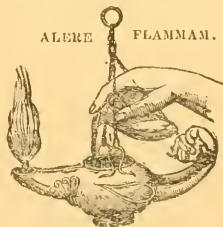
1919.

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

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



## CONTENTS OF VOL. III.

[NINTH SERIES.]

### NUMBER 13.

	Page
I. On the African Genera of Wingless <i>Brachyderinæ</i> with Con- nate Claws (Coleoptera, <i>Curculionide</i> ). By GUY A. K. MARSHALL, D.Sc. (Plate I.) .....	1
II. On <i>Lacerta praticola</i> , Eversm. By L. A. LANTZ and O. CYRÉN .....	28
III. The White-toothed Shrew of Palestine. By OLDFIELD THOMAS .....	32
IV. On the Structure of the Larvæ and the Systematic Position of the Genera <i>Mycetobia</i> , Mg., <i>Ditomyia</i> , Winn., and <i>Symmerus</i> , Walk. (Diptera Nematocera). By D. KEILIN, D.Sc. (from the Quick Laboratory, University of Cambridge). (Plates II.-V.) ....	33
V. Description of a new Genus and Species of the Homopterous Family <i>Cicadidæ</i> . By W. L. DISTANT .....	43
VI. Notes on the <i>Asilidæ</i> : Subdivision <i>Asilineæ</i> . By GERTRUDE RICARDO .....	44
VII. <i>Batopora</i> (Bryozoa) and its Allies. By ARTHUR WM. WATERS, F.L.S., F.G.S. (Plate VI.) .....	79
VIII. Two new African Freshwater Sponges. By JANE STEPHENS, B.A., B.Sc., National Museum of Ireland .....	94
IX. On some External Characters of Ruminant Artiodactyla.— Part VII. Domesticated Cattle ( <i>Bos taurus</i> and <i>B. indicus</i> ). By R. I. POCOCK, F.R.S. ....	101

	Page
X. On some small Mammals from Catamarca. By OLDFIELD THOMAS .....	115
XI. Descriptions and Records of Bees.—LXXXIII. By T. D. A. COCKERELL, University of Colorado .....	118
XII. Notes from the Gatty Marine Laboratory, St. Andrews.—No. XLII. By Prof. M'INTOSH, M.D., LL.D., D.Sc., F.R.S., &c. . .	125

## NUMBER 14.

XIII. New and insufficiently-known Moths in the Joicey Collection. By LOUIS B. PROUT, F.E.S. ....	165
XIV. Descriptions and Records of Bees.—LXXXIV. By T. D. A. COCKERELL, University of Colorado .....	191
XV. Note on <i>Chaudhuri</i> , a Teleostean Fish of the Order Opisthomi. By C. TATE REGAN, M.A., F.R.S. ....	198
XVI. On small Mammals collected by Sr. E. Budin in North-western Patagonia. By OLDFIELD THOMAS .....	199
XVII. Two new Argentine Species of <i>Akodon</i> . By OLDFIELD THOMAS .....	213
XVIII. New South-American Butterflies. By W. J. KAYE, F.E.S. ....	215
XIX. Some new Species of the Homopterous Family <i>Pyrrhocoridae</i> . By W. L. DISTANT .....	218
XX. Some Parthenogenetic <i>Chironomidae</i> . By F. W. EDWARDS. ....	222

## NUMBER 15.

XXI. On the Hymenoptera collected in New Caledonia by P. D. Montague in 1914. By ROWLAND E. TURNER, F.Z.S., F.E.S. ....	229
XXII. Descriptions and Records of Bees.—LXXXV. By T. D. A. COCKERELL, University of Colorado .....	240
XXIII. On a new Genus and Species of Bird of the Family <i>Drepanididae</i> from the Hawaiian Islands. By R. C. L. PERKINS, D.Sc., F.Z.S. ....	250

	Page
XXIV. Notes on Myriapoda.—XVI. Some Observations on Nomenclature. By HILDA K. BRADE-BIRKS, M.Sc., M.B., Ch.B., L.R.C.P., M.R.C.S., and the Rev. S. GRAHAM BRADE-BIRKS, M.Sc.	253
XXV. Some Observations on <i>Pleurocystis cuénoti</i> , Hesse, 1909, a Cœlozoic Parasite of the Earthworm. By W. HAROLD LEIGH-SHARPE, B.Sc. (Lond.)	256
XXVI. Notes on Gerbils referred to the Genus <i>Meriones</i> , with Descriptions of new Species and Subspecies. By OLDFIELD THOMAS	263
XXVII. Notes on the Family <i>Dendrocolaptidæ</i> , with Suggestions for its Division. By CHARLES CHUBB, F.Z.S., M.B.O.U., Zoological Department, British Museum (Natural History)	273
XXVIII. Descriptions of New <i>Pyrilidæ</i> of the Subfamilies <i>Crambince</i> and <i>Sigmeæ</i> . By Sir GEORGE F. HAMPSON, Bart., F.Z.S., &c.	275

## NUMBER 16.

XXIX. On <i>Deronectes depressus</i> , Fab., and <i>elegans</i> , Panzer. By FRANK BALFOUR-BROWNE, M.A. (Oxon. et Cantab.), F.R.S.E., Lecturer in Entomology in the Department of Zoology, University of Cambridge; Staff Lecturer in Entomology in France; Capt. R.A.M.C.T. Reserve. (Plates VII. & VIII.)	293
XXX. On the Geographical Distribution of the Genus <i>Cosmophilila</i> , a Noctuid of the Family <i>Gonopteridæ</i> . By Colonel C. SWINHOE, M.A., F.L.S., &c. (Plates IX. & X.)	309
XXXI. New Lycænids and Hesperids and Two new Species of the Noctuid Family <i>Acontiidæ</i> . By Colonel C. SWINHOE, M.A., F.L.S., &c.	314
XXXII. The Status of <i>Parabates</i> , Foerster, and <i>Parabatus</i> , Thomson [Hymenoptera, <i>Ichneumonidæ</i> ]. By J. CHESTER BRADLEY, Ph.D., Cornell University, Ithaca, N.Y.	319
XXXIII. The Malacoderm Genera <i>Prionocerus</i> and <i>Idgia</i> , and their Sexual Characters [Coleoptera]. By G. C. CHAMPION, F.Z.S. (Plates XI. & XII.)	325

	Page
XXXIV. A Note on the Egg-Burster of Eucephalous Fly-larvæ. By F. W. EDWARDS .....	372
XXXV. The Amphipod <i>Orchestia tucuranna</i> , Fritz Müller, of Brazil, redescribed from New Zealand Specimens. By CHAS. CHIL- TON, M.A., D.Sc., LL.D., C.M.Z.S., Hon. Memb. Roy. Soc. N.S.W.	376
XXXVI. North Pacific <i>Zoroasteride</i> . By WALTER K. FISHER, Director, Hopkins Marine Station of Stanford University, Cali- fornia .....	387
XXXVII. Notes on Fossorial Hymenoptera.—XXXVII. On some <i>Sphecinae</i> in the British Museum. By ROWLAND E. TURNER, F.Z.S., F.E.S. ....	393
XXXVIII. New Australian Diplopterous Hymenoptera. By ROWLAND E. TURNER, F.Z.S., F.E.S. ....	398
XXXIX. Remarks on the Age of some Arctic and North-Atlantic Starfishes. By JAMES A. GRIEG, Curator of the Bergen Museum, Bergen, Norway .....	400
XL. Synopsis of the American Species of <i>Rana</i> . By G. A. BOULENGER, F.R.S. ....	408
XLI. A remarkable <i>Cysticercus</i> from a rare Dolphin ( <i>Cysticercus</i> <i>Tenice Grimaldii</i> , Moniez, 1889). By H. A. BAYLIS, M.A. ....	417
XLII. On Indo-Chinese Hymenoptera collected by R. Vitalis de Salvaza.—I. By ROWLAND E. TURNER, F.Z.S., F.E.S. ....	425
XLIII. A remarkable new Ball-rolling Beetle (Family <i>Scara-</i> <i>boidae</i> ). By GILBERT J. ARROW .....	433
Proceedings of the Geological Society .....	435

## NUMBER 17.

XLIV. Descriptions of New <i>Pyralidæ</i> of the Subfamilies <i>Cram-</i> <i>binae</i> and <i>Siginae</i> . By Sir GEORGE F. HAMPSON, Bart., F.Z.S., &c.	437
XLV. Some new Entozoa from Birds in Uganda. By H. A. BAYLIS, M.A. ....	457
XLVI. Ethiopian Heteroptera: some new Species of <i>Reduviide</i> belonging to the Genera <i>Pysttala</i> and <i>Platymiris</i> . By W. L. DISTANT .....	466

	Page
XLVII. Papers on Oriental <i>Curabidae</i> .—I. By H. E. ANDREWES,	469
XLVIII. On Indo-Chinese Hymenoptera collected by R. Vitalis de Salvaza.—II. By ROWLAND E. TURNER, F.Z.S., F.E.S. ....	483
XLIX. Description of a new Genus and Two new Species of Heterocera. By Lord ROTHSCHILD, F.R.S. ....	487
L. On small Mammals from "Otro Cerro," North-eastern Rioja, collected by Sr. L. Budin. By OLDFIELD THOMAS.....	489
NUMBER 18.	
LI. A Collection of Entozoa, chiefly from Birds, from the Murman Coast. By H. A. BAYLIS, M.A. ....	501
LII. The Classification of the Mongooses ( <i>Mungotidae</i> ). By R. I. POCCOCK, F.R.S.....	515
LIII. On Two new Parasitic Mites ( <i>Myocoptes hintoni</i> and <i>Psoroptes natalensis</i> ). By STANLEY HIRST .....	524
LIV. The Selection of <i>Helix nemoralis</i> by the Song-Thrush ( <i>Turdus musicus</i> ). By MAUD D. HAVILAND, Hon. Mem. B.O.U., and FRANCES PITT .....	525
LV. On the Genus <i>Lepidobatrachus</i> , Budgett. By G. A. BOULENGER, F.R.S. ....	531
LVI. Descriptions of New <i>Pyralide</i> of the Subfamilies <i>Crambinae</i> and <i>Siginae</i> . By Sir GEORGE F. HAMPSON, Bart., F.Z.S., &c. ....	533
LVII. Description of a new Dyscophid Frog from Yunnan. By G. A. BOULENGER, F.R.S. ....	548
LVIII. On a new Variety of <i>Acanthodactylus boskianus</i> , Daud., from the Euphrates. By G. A. BOULENGER, F.R.S. ....	549
LIX. Notes on the <i>Ichneumonidae</i> in the British Museum.—I. By ROWLAND E. TURNER, F.Z.S., F.E.S. ....	550
LX. Two new Gerbils from Sinai. By OLDFIELD THOMAS ....	559
Index .....	561

PLATES IN VOL. III.

PLATE I. New African Curculionidæ.

- |       |  |
|-------|--|
| II.   | } Larvæ etc. of Mycetobia, Ditomyia, and Symmerus. |
| III.  |  |
| IV.   |  |
| V.    |  |
| VI.   | Batopora (Bryozoa).                                |
| VII.  | } Deronectes depressus and elegans.                |
| VIII. |  |
| IX.   | } Cosmophila.                                      |
| X.    |  |
| XI.   | } Prionocerus and Idgia.                           |
| XII.  |  |



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[NINTH SERIES.]

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"..... per litora spargite muscum,  
Naiades, et circum vitreos considite fontes:  
Pollice virgineo teneros hic carpite flores:  
Floribus et pietum, 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 conchyliâ succo."  
*N. Parthenii Giannettasi, Ecl. 1.*

---

No. 13. JANUARY 1919.

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I.—*On the African Genera of Wingless Brachyderinæ with Connate Claws (Coleoptera, Curculionidæ).* By GUY A. K. MARSHALL, D.Sc.

[Plate I.]

HAVING had occasion recently to identify a number of South African weevils of the genus *Strophosomus*, it became evident that several readily separable groups had been associated under this name; and, moreover, as might have been anticipated, a comparison of the Ethiopian species with the typical European forms reveals the presence of constant differences, which render it desirable that they should be separated generically. This has necessitated an examination of all the allied African genera, for which a synoptic key is here given. Unfortunately, two genera, each comprising a single species, are unknown to me and have therefore been omitted, viz.: *Ædophromus*, Schh., from Natal, and *Blosyridius*, Frm. (C. R. Ent. Belg. xxxv. 1891, p. 298), from Somaliland. The former, judging from Lacordaire's description of the tarsi, is related to *Mimaulus*, and the latter will come near *Proscaphaladeres*. Schönherr has also assigned to the genus *Cneorrhinus* three South African

*Ann. & Mag. N. Hist. Ser. 9. Vol. iii. 1*

species with which I am unacquainted. They probably do not belong to that genus as now understood, and appear to be related to the species here described under *Leurops*, from which they differ in the complete absence of the median stria on the forehead—an unusual character in this group. The Madagascar forms have not been included, as they are now being revised by M. A. Hustache.

In discriminating the genera use has been made of characters drawn from the epistome, mandibles, and mentum, which have not been previously employed in this group, but which seem likely to be useful for separating the principal subdivisions.

Unless otherwise stated, the types of all the new species are in the British Museum.

### Key to the Genera.

- 1 (24). Epistome well defined, bounded by a distinct carina or obtuse ridge; cutting-edge of mandibles with a median projection or tooth.
- 2 (17). Mentum entirely devoid of setæ\*.
- 3 (6). Tarsi narrow, setose beneath.
- 4 (5). Front tibiæ produced externally into a long process; corbels of hind tibiæ enclosed; mandibles squamose . . . . . *Mimaulus*, Schh.
- 5 (4). Front tibiæ not produced externally; hind corbels open; mandibles not squamose . . . . . *Mimaulodes*, gen. nov.
- 6 (3). Tarsi broad, spongy beneath; corbels of hind tibiæ open, bare.
- 7 (10). First ventral segment with the hind margin rounded; lower surface of rostrum more or less concave, the normal longitudinal impressions entirely or nearly obliterated.
- 8 (9). Elytra without any humeral prominence; head separated from rostrum by a fine stria which curves strongly forwards in the middle; rostrum strongly narrowed in front; funicle not squamose . . . . . *Pomphus*, gen. nov.
- 9 (8). Elytra with a conspicuous humeral prominence; head separated from rostrum by a deep, gently sinuous furrow; rostrum subquadrate; funicle squamose . . . . . *Bradybamon*, gen. nov.
- 10 (7). First ventral segment with the hind margin straight or sinuate; lower surface of rostrum with two deep

\* Some species of *Proscaphaladeres* have a row of flat scales along the front edge of the mentum, but no true setæ.

- longitudinal or oblique impressions, with a convex space between them.
- 11 (12). The three median ventral segments subequal in length; forehead trisulcate; scape short and stout, the externally visible portion much shorter than the funicle; rostrum separated from the head by a furrow that extends quite to the side . . . . . *Blosyrus*, Schh.
- 12 (11). Second ventral segment longer than the third or fourth; forehead with at most a single furrow; scape slender, the exposed portion almost or quite as long as the funicle.
- 13 (14). Metasternum between the coxæ very much shorter than the middle coxæ; mandibles squamose, with a well-marked longitudinal dorsal carina running from the scar to the base . . . . . *Procephaladeres*, Schh.
- 14 (13). Metasternum as long as or only slightly shorter than the middle coxæ; mandibles without a dorsal carina.
- 15 (16). Scrobes strongly dilated behind; scape not exceeding the middle of the eye; funicle and mandibles clothed with scales; eyes finely faceted . . . . . *Proscopus*, gen. nov.
- 16 (15). Scrobes almost parallel-sided; scape reaching hind margin of eye; funicle and mandible entirely devoid of scales; eyes comparatively coarsely faceted . . . . . [*Strophosomus*, Billb.]
- 17 (2). Mentum setose.
- 18 (21). Corbels of hind tibiæ very oblique, lying almost entirely on the inner face of the tibiæ, their upper fringe of setæ ascending the dorsal edge of the tibiæ in a straight line (as in *Tanymecus*); second ventral segment distinctly longer than the third or fourth, hind margin of the first more or less sinuate in the middle, the incision shallow.
- 19 (20). Rostrum separated from the forehead by a stria; eyes very prominent and produced backwards . . . . . *Protostrophus*, gen. nov.
- 20 (19). Rostrum continuous with the forehead; eyes simple, only slightly convex . . . . . *Leurops*, gen. nov.
- 21 (18). Corbels of hind tibiæ terminal, not ascending the tibiæ; the three median ventral segments subequal in length, hind margin of the first segment straight, the incision deep.
- 22 (23). Corbels of hind tibiæ enclosed; scape slender, clavate; forehead trisulcate;

- mentum with a transverse row of five or six setæ . . . . . *Pseudoblosyrus*, gen. nov.
- 23 (22). Corbels of hind tibiæ open; scape very broadly dilated; forehead without any longitudinal furrow; mentum with only two setæ . . . . . *Platycopes*, Schh.
- 24 (1). Epistome indistinct and quite undefined; cutting-edge of mandibles straight or rounded and without any median tooth; basal part of metepisternum angularly produced internally; hind coxæ reaching the elytra.
- 25 (26). Corbels of hind tibiæ open; metepisternal suture distinct in its basal half only; mesepisterna meeting the elytra at the extreme base; rostrum continuous with the forehead . . . *Synechops*, gen. nov.
- 26 (25). Corbels of hind tibiæ broadly enclosed; metepisternal suture distinct throughout; mesepisterna broadly separated from the elytra by the mesepimera.
- 27 (36). Rostrum separated from the forehead by a transverse furrow.
- 28 (35). Tarsi with two claws; mentum setose.
- 29 (32). Furrow separating the rostrum from the head straight or with a forward curve.
- 30 (31). Ventral intercoxal process truncate or gently rounded; front margin of prosternum without any prominences; furrow separating the rostrum from the head straight or slightly sinuous . . . . . *Ectatopsides*, Bovie.
- 31 (30). Ventral process strongly angulated; margin of prosternum with a prominence on each side above the coxæ; furrow separating the rostrum from the head deeply curved forwards . . *Ænassus*, Pasc.
- 32 (29). Furrow separating the rostrum from the head angulate, with the apex of the angle directed backwards.
- 33 (34). Punctures on elytra in regular rows; eyes not produced backwards . . . *Cychrotonus*, Pasc.
- 34 (33). Punctures on elytra partly irregular; eyes produced backwards . . . . . *Eucrines*, Jekel.
- 35 (28). Tarsi with only one claw; mentum devoid of setæ . . . . . *Gyponyehus*, Pasc.
- 36 (27). Rostrum not separated from the forehead by a transverse furrow or stria. *Embolodes*, Mshl.

#### Genus MIMAULUS, Schh.

To the characters cited by Schönherr (Mant. Sec. Curc. p. 18) and Lacordaire (Gen. Curc. vi. p. 33) the following

points may be added:—Mandibles multisetose, squamose, with a distinct median tooth; mentum bare and deeply sunk in its cavity. Antennæ with the funicle not squamose. Gular margin of the prosternum deeply sinuate; mesepimeron very small and not separating the mesepisternum from the elytron at the base; metasternum at its shortest much shorter than the mid-coxæ, metepisternal suture complete, metepisternum not dilated at its base, hind coxæ broadly separated from the elytra. Venter with the intercoxal process truncate and as broad as the hind coxa; hind margin of segment 1 gently arcuate, its length behind the coxa greater than that of segment 2, which is longer than 3 or 4.

As at present known, the genus is confined to South-east Africa, south of the Limpopo.

#### Genus MIMAULODES, NOV.

*Head* deeply constricted behind the eyes and with a central furrow which does not reach the vertex; eyes quite lateral, nearly flat and oblique, as seen from above, so that the head is broadest at their projecting hind margins. *Rostrum* about as long as the head and separated from it by a straight transverse furrow, strongly narrowed in front; epistome well defined, nearly three times as broad as long, shallowly sinuate in front, and the hind margin forming a low curve; mandibles bearing five or six setæ, not squamose, with a strong median tooth, the scar flat and almost circular; mentum bare, immersed; scrobes oblique, almost straight and parallel-sided, the upper edge touching the lower margin of the eye; lower surface of rostrum without longitudinal impressions, but shallowly excavated for the reception of the antennæ. *Antennæ* very short, squamose; scape reaching the middle of the eye, strongly clavate; funicle with joint 1 much longer and broader than 2, 3-7 very short and gradually widening. *Prothorax* much broader than long, the base arcuate in the middle and slightly sinuate at each side, the sides rounded. *Scutellum* invisible. *Elytra* fused together and strongly inflexed at the sides, only slightly broader at the rounded shoulders than the prothorax, the longitudinal outline forming a very low curve continuous with that of the pronotum, the posterior declivity almost vertical. *Sternum* with the gular margin shallowly sinuate; mesepisternum meeting the elytron only at the extreme base, the mid-coxæ very narrowly separated; metasternum much shorter than the mid-coxæ, its episternum not dilated

inwardly at the base, the episternal stria complete, the hind coxæ widely separated from the elytra. *Venter* with the intercoxal process slightly angulated at the base and narrower than the coxa; segment 1 with the hind margin straight, its length behind the coxa equal to that of 2, which is longer than 3 or 4. *Legs* short; tibiæ armed with stout spines, but the external apical angle not produced, the corbels of the hind pair open, squamose and very oblique; tarsi narrow, setose beneath, not spongy.

♂ unknown.

Genotype, *Mimaulodes fimbriatus*, sp. n.

The general form is entirely that of *Mimaulodes*, and the insects are similarly covered with a thick earthy incrustation, so that several of the structural characters given above can only be observed when the specimen has been scraped.

*Mimaulodes fimbriatus*, sp. n.

Integument pale brown, densely clothed with grey scales mingled with a natural earthy indumentum, and nearly always more or less coated with mud.

*Head* with stout, dark, suberect setæ and a dense patch of paler ones above each eye; eyes nearly circular and with a complete ring of pale scales. *Rostrum* almost flat above, with a very shallow transverse impression near the apex, so that the apical area appears to be raised; the sides quite vertical, so that no sign of the scrobe can be seen from above, the dorsal edge obtusely angulated above the base of the scrobe. *Prothorax* twice and a half as broad as long, broadest near the base and much narrower in front; the integument, when scraped, appears uneven and finely rugulose, being set with short, subrecumbent, stout, dark setæ, and there is along the lateral margin an uneven fringe of very long, upwardly curved setæ. *Elytra* broadly ovate, the sides gently rounded, broadest about the middle, the apical outline broadly rounded; the base not fitting very closely to the prothorax, jointly sinuate in the middle and rounding away at the sides; the dorsal surface with very shallow and broad sulci, the narrower raised intervals each bearing a row of stout, suberect, dark setæ, while at the shoulders and along the dorsal margins is an outstanding fringe of much longer setæ, these being longest at the shoulders and gradually diminishing behind. *Legs* densely squamose and with stout raised setæ; anterior pairs of tibiæ with four spines along the apical edge, two or three on the apical third of the dorsal



edge, and one on the lower edge; hind tibiae also with four apical spines and two on the lower edge, the corbel with a dorsal border of two to four short, closely set spines and a longer terminal one.

*Length* 3-3½ mm., *breadth* 2-2¼ mm.

TRANSVAAL: BENONI, 22. xi. 17 (*E. Buckles*).

Described from five specimens forwarded by the Division of Entomology, Pretoria, with a note that the species was damaging the leaves and bark of *Eucalyptus viminalis*.

#### Genus POMPHUS, nov.

*Head* short and broad, with a central stria that reaches the vertex and another on each side about midway between it and the eyes, behind which there is a deep constriction; eyes quite lateral, very prominent, subconical, not or but slightly sloping backwards, their greatest depth behind the middle. *Rostrum* strongly narrowed in front, longer than the head and separated from it by a stria which runs from the eye to the apex of the outer stria on the forehead, and there making a sharp angle runs forwards to the apex of the median stria; from the middle of the base diverge two oblique abbreviated furrows; epistome sharply defined, almost an equilateral triangle, the sides forming a very low carina; mandibles multisetose, with only a few scales and an obtuse median tooth, the scar almost circular; mentum bare, immersed; scrobes narrow, deep, bare, and almost straight in the basal two-thirds, the upper edge ending a little below the lower margin of the eye. *Antennae* with the scape rather slender, abruptly clavate and reaching beyond the middle of the eye; funicle not squamose, joint 1 as long as but thicker than 2, the remainder bead-like. *Prothorax* at least twice as broad as long, truncate at base and apex. *Scutellum* invisible. *Elytra* broadly ovate, the longitudinal outline moderately convex, not continuous with that of the pronotum, the basal margin jointly sinuate and elevated, the angles projecting, the punctation more or less irregular. *Sternum* with the gular margin sinuate, the front coxæ nearer to it than to the hind margin, the front margin raised into a prominent ridge on each side from the eye nearly as far as the coxa; mesepisternum meeting the elytron at the base; metasternum between the coxæ hardly half as long as the mid-coxæ, the episternal furrow complete, the episternum not produced inwardly at the base, the hind coxæ broadly separated from the elytra. *Venter* with the

intercoxal process rounded and narrower than the coxa; segment 1 (behind the coxa) longer than 2, and 2 longer than 3, the hind margin of segment 1 arcuate. *Legs* short and rather stout; femora moderately clavate and simple; tibiae unguiculate, the corbels of the hind pair oblique, bare, and open, but with the apical edge slightly bent inwards; claws connate.

In the ♂ the fifth ventral segment is shorter and flat, in the ♀ it is a little longer and slightly convex.

Genotype, *Strophosomus kirschi*, Faust (Ent. Nachr. xi. 1885, p. 88).

*Pomphus denticollis*, sp. n. (Pl. I. fig. 3.)

Black, with grey or sandy scaling, the pronotum with a very broad median brown stripe, and the elytra with very variable dark brown markings, which are sometimes almost entirely obliterated.

*Head* almost flat on the forehead and set with stout erect setae, the integument quite hidden by the scaling. *Rostrum* with the sides strongly convergent from the eyes to beyond the middle, thence nearly parallel; upper surface with two deep sulci strongly diverging from the centre of the base as far as the middle of the disk, the lateral areas outside them being shallowly impressed; the central carina is prominent where it meets the epistome, but diminishes behind and disappears about the middle; the clothing as on the forehead. *Antennae* with the apical half of the scape squamose; funicle with joints 3, 4, and 6 subequal and slightly longer than broad, 5 a little shorter, 7 as long as 6 but distinctly broader. *Prothorax* twice and a half as broad as long, the base (when seen clear of the elytra) not broader than the apex; the sides, as seen from above, distinctly denticulate, there being a specially marked projection close to the base, and the apical angles prominent; apical margin strongly reflexed down the sides, the ridge thus formed ceasing abruptly on a line with the outer edge of the coxa; upper surface strongly convex transversely, closely set with rather indefinite granules (the rugose sculpturing being hidden by the scaling), and with a central furrow that reaches neither the base nor the apex; the longitudinal outline only slightly curved, the apex being only a little lower than the base. *Elytra* with the sides strongly rounded, broadest about the middle, scarcely striate, but with rather irregular rows of punctures, which are conspicuous through the scaling and often duplicated; the intervals broad, finely aciculate

(beneath the scaling), and each bearing a single row of stout, flattened, erect setæ.

*Length* 4-4 $\frac{3}{4}$  mm., *breadth* 2 $\frac{1}{2}$ -2 $\frac{3}{4}$  mm.

PORTUGUESE E. AFRICA: Beira (*P. A. Sheppard*).

This species probably represents on the coast the very closely allied *P. kirschi*, Fst., which at present is known only from Nyasaland. The latter differs in having the sides of the prothorax simply rounded and not denticulate, the lateral areas of the rostrum are not impressed, the setæ on the elytra are distinctly longer and more slender, and the scales on the elytra are for the most part rather sharply pointed behind instead of being broadly rounded.

Described from 1 ♂ and 5 ♀ ♀.

#### Genus BRADYBAMON, nov.

*Head* with a short central furrow and slightly raised at the sides to form an obtuse eyebrow, which is higher behind than in front; eyes quite lateral, nearly circular, moderately prominent, and not produced backwards. *Rostrum* subquadrate, separated from the forehead by a deep sinuous furrow that distinctly reaches the sides, lower surface flattened or slightly concave; epistome forming a sharp acute angle behind, the bounding carinæ unusually high and finely laminate, the front margin rather shorter than the sides; mandibles multisetose, not squamose, with a median tooth, the scar flat and almost circular; mentum bare, somewhat sunk in its cavity; genæ deeply impressed, the posterior angle rather prominent. *Antennæ* with the scape abruptly clavate and reaching about the middle of the eye; funicle squamose, joint 1 equal to or longer than 2, the others short, 7 the broadest. *Scutellum* invisible. *Elytra* with the sides forming a straight slope from the base to the well-marked subhumeral prominence, the basal margin sinuate; in profile, the outline of the posterior declivity forms almost a semicircle, the apex being inflexed so that it lies in front of the middle of the declivity. *Sternum* with the gular margin gently sinuate, the centro-sternite forming an elongate tubercle; mesepisternum meeting or or very narrowly separated from the elytra; metasternum much shorter than the mid-coxæ, with a distinct antecoxal fold, the episternal furrow deep and complete, the episternum narrow and not angulate inwardly at the base, the hind coxæ separated from the elytra. *Venter* with the intercoxal process gently rounded and as broad as the coxa; the hind margin of segment 1 curved, so that segment 2 is much

shorter in the middle than at the sides, its length at the former point being about equal to that of 3 or 4. *Legs* rather short and stout; tibiae with a sharp mucro, the corbels of the hind pair open and bare; the claws connate.

All the specimens examined appear to be females.

Genotype, *Strophosomus granicollis*, Boh.

Thanks to the kindness of Prof. E. B. Poulton, F.R.S., I have been able to examine the cotypes of *S. granicollis*, Boh., in the Sommer collection, which he recently presented to the Oxford Museum.

From the description, it seems fairly certain that *Strophosomus verrucicollis*, Fst. (Ann. Soc. Ent. Belg. 1899, p. 390), from the Congo, also belongs to this genus.

The angulate elytra and tuberculate thorax would at once distinguish these insects from the other African "*Strophosomus*," and they have more the appearance of very small *Blosyrus*, which may however be distinguished by the very different structure of the epistome and lower surface of the rostrum, the more prominent eyes, and the straight hind margin of the first ventral segment.

#### *Key to the Species.*

- |        |  |                             |
|--------|--|-----------------------------|
| 1 (6). | Prothorax with small, close, confluent tubercles throughout.   |                             |
| 2 (3). | The two median furrows on the rostrum subparallel; the two basal joints of the funicle equal; punctures on elytra more or less irregular | <i>granicollis</i> , Boh.   |
| 3 (2). | The two median furrows on the rostrum strongly divergent in front; joint 1 of the funicle longer than 2.                                 |                             |
| 4 (5). | Elytra marginate at the base, the rows of punctures more or less irregular or duplicated   | <i>swalei</i> , sp. n.      |
| 5 (4). | Elytra not marginate at the base, the rows of punctures quite regular  | <i>regularis</i> , sp. n.   |
| 6 (1). | Prothorax punctate on the disk and tuberculate laterally   | <i>verrucicollis</i> , Fst. |

#### *Bradybamon swalei*, sp. n. (Pl. I. fig. 6.)

♀. Colour piceous, with dense earth-brown scaling; pronotum with a broad, median, darker brown stripe, which gradually widens from apex to base; elytra with an ill-defined dark stripe running obliquely from behind the shoulder to beyond the middle of stria 2 and edged behind with an indefinite pale stripe; the apical area with irregular dark brown and paler patches; these markings may become more or less obsolete.

*Head* with a short longitudinal impression on each side adjoining the supra-ocular ridge, the vertex transversely impressed; eyes very convex, deepest slightly behind the middle. *Rostrum* as long as its basal width, the dorsal area broadest at the base and gradually narrowed in front, with a shallow central impression containing a low scale-covered carina, on each side of it an oblique furrow running from near the centre of the base to the middle of the disk, and beyond this again an irregular shallow longitudinal impression; as seen from above the posterior angles of the genæ project strongly outwards, about three-fourths as far as the eyes. *Antennæ* with joint 1 of the funicle distinctly longer than 2, 3 as long as broad, 4-6 bead-like and transverse, 7 longer and broader. *Prothorax* much broader than long, truncate at the apex, the base gently arcuate and as broad as the apex, the basal angles rounded off, the sides moderately rounded, broadest about the middle, the apical constriction shallow; the upper surface serobiculate, set with low confluent tubercles, and with an irregular central furrow. *Elytra* subquadrate, nearly as broad as long ( $3\frac{1}{2} \times 4$  mm.), the sides almost parallel from the subhumeral prominence to beyond the middle, the basal margin raised, broadly rounded behind; with very shallow furrows containing rows of punctures that are more or less irregular and duplicated, except near the suture and extreme lateral margins; the intervals rather uneven and set with irregular rows of short, stout, erect setæ; the scales small, closely overlapping, pointed, and deeply fluted.

*Length* 5-6 mm., *breadth* 3-3 $\frac{1}{2}$  mm.

PORTUGUESE E. AFRICA: Caia, Zambesi R. (*Dr. H. Swale*).

Described from three specimens.

In addition to the characters given in the key, *B. granicollis*, Boh., differs in being a distinctly narrower insect, the eyes are larger, the genæ are scarcely visible from above, and the setæ on the elytra are longer and more numerous.

*Bradybumion regularis*, sp. n.

♀. Colour black, with uniform earth-brown scaling.

*Head* not transversely impressed on the vertex, the forehead with lateral impressions; eyes relatively large, not very convex, deepest behind the middle. *Rostrum* subquadrate, about as long as broad, the sides parallel and vertical, so that the genæ are scarcely visible from above; the upper surface with two median sulci, which diverge

strongly from the base to the middle of the disk and enclose a low median scale-covered costa, and on each side of these an indistinct longitudinal impression. *Antennæ* with joint 1 of the funicle longer than 2, the remaining joints short and gradually widening outwardly. *Prothorax* much broader than long, the base and apex of equal width, the former arcuate, the latter truncate, the sides very strongly rounded, broadest much before the middle; the upper surface closely set with small low confluent tubercles, and with an indistinct central furrow. *Elytra* oblong-ovate, parallel-sided from the subhumeral prominence to beyond the middle, very broadly rounded behind, the basal margin not raised; with very shallow sulci, each containing a single row of deep close punctures; the intervals only slightly convex and bearing a single row of broadly truncate, scale-like, erect setæ.

*Length*  $3\frac{3}{4}$ – $4\frac{1}{4}$  mm., *breadth* 2– $2\frac{1}{4}$  mm.

ZAMBEZI R.

Described from two specimens.

#### GENUS PROSCEPHALADERES, Selh.

To this genus are here referred all the African "*Strophosomus*" having subglobose elytra. Apart from their somewhat different facies, they may be distinguished from the other African species with which they have hitherto been associated by the following points:—The mentum is entirely devoid of true setæ, though in most of the species there is a row of scales along its anterior edge—a very unusual character; the corbels of the hind tibiæ are more nearly terminal in position; the first joint of the funicle is never longer than the second, being rarely equal to it and usually distinctly shorter; the apical margin of the rostrum is deeply sinuate; and the hind coxæ are distinctly separated from the elytra.

The true European *Strophosomus* differ in having non-squamose and non-carinate mandibles, non-squamose funicles, a distinctly longer metasternum, and more coarsely faceted eyes.

The described species which should be placed here are: *Strophosomus aspericollis*, Fhs., *S. lineatus*, Fhs., *S. variabilis*, Fhs. (Ofv. K. Vet.-Ak. Förh. 1871, pp. 13, 14), *S. binotatus*, Mshl., and *S. salisburyensis*, Mshl. (Proc. Zool. Soc. 1906, pp. 912, 913); and more than a dozen additional undescribed species are known to me.

## Genus PROSCOPUS, nov.

*Head* about as long as its width between the eyes, with a central furrow that almost reaches the vertex; eyes lateral, prominent, semicircular. *Rostrum* about as long as the head, narrowed in front, separated from the forehead by a deep furrow that reaches the sides; epistome short, well defined, but the sides not carinate, the front margin shallowly sinuate; mandibles squamose (setæ abraded), without any longitudinal dorsal carina, but with an obtuse median tooth, the scar indistinct and subtriangular; mentum bare, much wider in front than behind and rather deeply sunk in its cavity, which is more oblong than usual, the basal angles being almost right angles; scrobes lateral, curved, and squamose, becoming markedly wider and shallower behind, the upper edge below the lower margin of the eye. *Antennæ* with the scape rather stout, cylindrical, and gradually widening from near the base; funicle stout; squamose, the two basal joints of equal length, the remainder bead-like and subequal. *Prothorax* transverse, truncate at base and apex. *Scutellum* minute. *Elytra* subtruncate at the base, not constricted or marginate, without any humeral prominence, the apices jointly rounded. *Sternum* with the gular margin truncate, the coxæ in the middle of the prosternum; mesosternum longer than usual, the episternum meeting the elytron at the base; metasternum between the coxæ as long as the mid-coxæ, with a very shallow antecoxal fold, the episternum not angularly produced internally at the base, the episternal suture almost obliterated, the hind coxæ narrowly separated from the elytra. *Venter* with the intercoxal process slightly angulate and broader than the hind coxæ; segment 2 longer than 3. *Legs* rather slender; corbels of the hind tibiæ open, bare, and terminal; claws connate.

♂ unknown.

Genotype, *Proscopus marginatus*, sp. n.

The elongate metasternum is quite unusual in the African members of this group, and the general facies of the only known species is more like that of a Tanymericine of the genus *Iphisomus*.

*Proscopus marginatus*, sp. n. (Pl. I. fig. 4.)

♀. Black, with rather thin grey scaling (through which the shiny integument is clearly visible) and a few whitish markings; head with a narrow ring of whitish scales round

the eyes, expanding into a broad patch beneath, the setæ on the forehead slightly raised; prothorax with a narrow central whitish stripe, a broad lateral one behind the eye, and an ill-defined one above the coxæ, the setæ recumbent; elytra with numerous recumbent, scale-like, brownish setæ and the following whitish markings: a sutural stripe from the base to the middle, another on interval 7 starting a little before the middle and ending some distance from the apex, a short basal stripe at the shoulder continuous with the upper lateral one on the thorax, and a marginal stripe, which only reaches stria 10 in the basal half, gradually extending to stria 9 behind the middle and widening still more at the apex; along the dorsal striæ there are irregular spots of whitish scales, and the lower surface is unevenly clothed with similar scales.

*Head* rugosely punctate, the forehead flat, with two very irregular longitudinal impressions on each side of the central furrow; a shallow impression immediately below the eye. *Rostrum* rugosely punctate, the disk shallowly impressed and with a very broad and deep central furrow in the basal half; an obtuse ridge on each side, beyond which the sides slope gradually to the scrobes; the genæ not impressed. *Prothorax* nearly twice as broad as long, the sides moderately rounded, broadest in the middle, evenly and very rugosely punctate throughout, without any furrow or carina, and the basal margin not raised. *Elytra* regularly elliptical, the dorsal outline strongly curved and raised high above the pronotum, the posterior declivity becoming vertical on a line with the apex of stria 5; striæ shallow and containing deep separated punctures on the disk, the punctures shallower and the striæ deeper at the apex and sides; the intervals almost flat and much broader than the striæ. *Legs* with fairly dense pale scales, the tibiæ with rather long suberect setæ, the hind pair granulate internally.

*Length*  $6\frac{1}{2}$  mm., *breadth*  $3\frac{1}{4}$  mm.

CAPE COLONY: Namaqualand.

Described from a single specimen.

#### Genus PROTOSTROPHUS, nov.

*Head* with a central furrow and constricted behind the eyes, which are produced backwards. *Rostrum* strongly narrowed in front, separated from the forehead by a short stria or sulcus that does not nearly reach the sides, which are almost vertical, so that the scrobes are not visible from above, the apex almost truncate; epistome well defined,



almost an equilateral triangle; mandibles densely squamose (occasionally bare—*P. sparsus*, Fhs., and *P. longulus*, Boh.), multisetose, with a distinct median tooth, the scar variable; mentum with numerous erect setæ on the anterior half, usually arranged in a tuft of three to six on each side, the basal half sunk in the cavity; scrobes passing well below the eyes, more or less squamose. *Antennæ* with the scape slender, clavate, reaching about the middle of the eye; funicle squamose, joint 1 much longer than 2 (except in *P. strigifrons*, Fhs., in which they are equal). *Prothorax* variable in form, but always transverse and narrower at the apex than at the base. *Scutellum* invisible. *Sternum* with the gular margin more or less sinuate, the coxæ about in the middle of the prosternum; mesepisternum usually, but not always, separated from the elytron by its epimeron; metasternum much shorter than the mid-coxæ, with a more or less distinct antecoxal fold, the episternal suture complete, the episternum not produced inwardly at the base and rapidly narrowing to a point behind, the hind coxæ touching the elytra. *Venter* with the intercoxal process narrower than the coxæ, slightly angulate or gently rounded; hind margin of segment 1 shallowly sinuate, segment 2 much longer than 3. *Legs* with the corbels of the posterior pairs of tibiæ squamose or bare, very oblique, with the upper fringe of setæ ascending the dorsal edge of the tibia in a straight line, and the extreme apical edge narrowly enclosed (except in *P. sparsus* and its allies); claws connate.

In the males the elytra are narrower than in the females; the first ventral segment is very slightly impressed, and the last is shorter and more broadly rounded; in some species the legs are markedly stouter than in the females.

Genotype, *Strophosomus crucifrons*, Boh.

Distinguished from true *Strophosomus* by the setose mentum, the squamose mandibles and antennæ, and the very oblique corbels of the hind tibiæ.

Apart from the species here assigned to the genera *Proscaphaladeres*, *Brachybamon*, *Pomphus*, and *Leurops*, all the African "*Strophosomus*" known to me fall within the present genus; and, judging by the descriptions, this is also likely to prove true of *S. ancorifrons*, Boh., *rotundicollis*, Boh., *crucifer*, Boh., *obsoletesignatus*, Boh., *indoctus*, Boh., *pupillatus*, Boh., *dilataticollis*, Boh., *denticollis*, Quedf., *hamaticollis*, Pér., and *concinus*, Hartm. The position of *S. hystriæ*, Fst. (Ann. Soc. Ent. Belg. 1899, p. 389), from the Congo, is doubtful.

*Protothropus immerens*, sp. n.

♀. Black, with dense sandy-grey scaling; the prothorax with an ill-defined broad central brown stripe, an interrupted narrow line on each side of it, and a broad lateral stripe on the inflexed portion, the dorsal markings being sometimes absent; the elytra often with several rows of very indefinite darker spots, usually in the striae.

*Head* separated from the rostrum by a curved stria, which does not nearly reach the margins; the forehead smooth, the sculpturing entirely hidden by the scaling, and with a deep central furrow; the eyes prominent, strongly produced backwards, moderately convex, deepest about the middle, the hind edge of the orbit not projecting. *Rostrum* trapezoidal, much shorter than its basal width, rapidly narrowing in front, the sides straight; the upper surface flat, with only a very inconspicuous scale-covered central carina in the basal half, and the very shallow punctation hidden by the dense scaling; the genæ not impressed. *Antennæ* testaceous brown, with the first joint of the funicle distinctly longer and thicker than the second, which is about twice as long as the third. *Prothorax* not quite twice as broad as long (5:3), broadest at the middle, the sides moderately rounded, forming an obtuse granulated lateral edge, very deeply constricted laterally at the extreme base, and slightly emarginate on each side at the apex for the reception of the eyes; the basal margin narrowly raised, truncate and not broader than the apical, which is shallowly sinuate in the middle, the angles before the basal constriction rounded, and the apical ones almost right angles; the upper surface moderately convex transversely, but almost flat longitudinally, with fine confluent shallow punctation (hidden by scaling) and a shallow central stria, which is sometimes feebly indicated when the scaling is intact. *Elytra* oblong-ovate, almost parallel-sided from near the base to beyond the middle, jointly sinuate at the base and very broadly rounded behind; the striae very shallow, the punctures merely indicated through the scaling and each containing a minute recumbent seta; the intervals broad, slightly convex, finely rugose, and each with a row of recumbent pale setæ; the scales slightly smaller than those on the prothorax, smooth, subcircular, very dense and closely contiguous. *Legs* with the front tibiae dilated at the apex and there armed with eight short stout spines, of which the innermost pair are very small and contiguous, and the outermost spine is more distant from the rest; the mid-tibiae with four

or five similar apical spines and two more slender ones on the inner surface in the apical half: corbels of the hind tibiae with a single row of scales at the apex, the apical margin narrowly enclosed. *Sternum* with the mesepisterna separated from the base of the elytra.

Length  $3\frac{2}{5}$ –4 mm., breadth  $2$ – $2\frac{1}{5}$  mm.

ZULULAND: Ndumu, i. 1914.

Like a small specimen of *P. amplicollis*, Fls., to which it is very nearly related, but in that species the rostrum is more distinctly carinate, the hind margin of the orbit is produced beyond the eye, the sides of the prothorax are more explanate and much more strongly rounded, and its base is not marginate.

The adult beetles were found eating the leaves of the ground-nut (*Arachis hypogaea*). Received from the Division of Entomology, Pretoria.

*Protostrophus spinicollis*, sp. n. (Pl. I. fig. 5.)

♂ ♀. Colour black, the upper surface and the sternum clothed with dense pale green scales, those on the legs, venter, and the inflexed margins of the elytra being grey with a pale coppery reflexion, which colouring is also sometimes present on the head and pronotum.

*Head* separated from the rostrum by a deeply curved stria, which nearly reaches the eye on each side; the forehead flattened and on a lower level than the inner edges of the orbits, rugosely punctate (concealed by the scaling), and with a broad and deep central furrow; eyes very prominent and strongly produced backwards, moderately convex, and with the greatest depth far behind the middle, the posterior edge of the orbit not projecting. *Rostrum* unusually long and narrow, distinctly longer than its basal width, sharply narrowing from the base to the middle and thence parallel-sided to the apex; the upper surface almost flat, set with coarse shallow punctures, each containing a scale, and without any furrow or carina; the genæ simply rounded, not impressed. *Antennæ* with the first funicular joint broader and much longer than the second, which is nearly twice as long as the third. *Prothorax* broader than long, the sides gradually rounded from the apex to behind the middle and there armed with a sharp backwardly-directed tooth, behind which the sides are deeply sinuated, so that the base is scarcely wider than the apex; the basal margin rounded, with a shallow sinuation in the middle, the apical margin truncate; the upper surface strongly convex transversely

and moderately so on its long axis, finely wrinkled longitudinally (the sculpture hidden by the scaling, but the ridges showing through here and there like shiny granules), and with a broad central furrow, which is almost filled by a broad, flattened, shiny, impunctate carina. *Elytra* oval, broadest about the middle, jointly sinuate at the base, with the external angles projecting forwards into a short blunt point; when the scaling is intact the striæ appear narrow and very shallow, the intervals being broad, flat, and set with minute indistinct punctures (hidden by the scaling); the scales are small, almost circular, and contiguous, but not overlapping; the setæ are short, dark, scale-like, and recumbent. *Legs* with the corbels of the hind tibiæ bare, and the apical margin narrowly enclosed; the front tibiæ without distinct apical teeth. *Sternum* with the mesepisterna broadly meeting the elytra.

*Length*  $3\frac{1}{4}$ –4 mm., breadth  $1\frac{3}{5}$ –2 mm.

TRANSVAAL: Naboomspruit (*D. Anderson*).

An isolated species, distinguished by its long narrow rostrum, prominent eyes, and toothed prothorax.

Received from the Division of Entomology, Pretoria, with the information that the beetles were destroying young maize-plants.

#### GENUS LEUROPS, nov.

*Head* broad, the forehead almost flat and with a central stria which does not quite reach the vertex; eyes quite lateral, short-oval, horizontal, and only slightly convex, the curvature being unusually low as compared with allied genera. *Rostrum* a little longer than the head, strongly narrowed from base to apex, and completely continuous with the forehead; genæ not dilated; epistome small, depressed, the sides not carinate, the front margin shallowly sinuate; mandibles scaly and multisetose, with a strong median tooth, the scar almost circular and not very distinct; mentum with the basal half depressed and more or less deeply sunk in its cavity, the front half with numerous setæ; scrobes very narrowly visible from above and broadly dilated behind. *Antennæ* with the scape slender, abruptly clavate and reaching about the middle of the eye; funicle squamose, joint 1 much longer than 2, the remainder slightly longer than broad. *Prothorax* broadest at the base, the basal margin rounded. *Scutellum* minute. *Elytra* fitting very closely to the prothorax, their sides forming very nearly a continuous line; the dorsal longitudinal curvature very flat

and almost continuous with that of the prothorax, the lateral areas very sharply inflexed and without any humeral prominence; the surface very even and scarcely striate. *Sternum* with the gular margin sinuate, the coxæ in the middle of the prosternum, and the centro-sternite not tubercular; mesepisternum not transversely impressed at the base and separated from the elytron by the mesepimeron; metasternum between the coxæ much shorter than the mid-coxæ, and with no transverse fold in front of the hind coxæ, the metepisternum continuously narrowed behind almost to a point, its base not produced internally, and the dividing suture complete; hind coxæ extremely narrowly separated from the elytra. *Venter* with the intercoxal process distinctly narrower than the hind coxæ, and its margin gently rounded; hind margin of segment 1 very shallowly sinuate, segment 2 longer than 3 or 4. *Legs* short; the corbels of the hind tibiæ oblique, squamose, and narrowly enclosed at the extreme apex, the external fringe of setæ shortly ascending the dorsal edge of the tibia; tarsal claws connate.

There are no marked external sexual characters; the first ventral segment of the ♂ is shallowly impressed, and the last one shorter than in the ♀.

Genotype, *Leurops cana*, sp. n.

The absence of the transverse stria separating the rostrum from the forehead and the comparatively slight convexity of the eyes, combined with the oblique squamose corbels of the hind tibiæ, will readily distinguish the species of this genus from their allies.

*Leurops cana*, sp. n. (Pl. I. fig. 1.)

♂ ♀. Colour black, the legs black to piceous; the last tarsal joint, antennæ, mentum, and part of the mandibles dark testaceous. The scaling dense, ash-grey above and below, sometimes with an admixture of pale brownish scales above, forming a very faint, broad, central stripe on the pronotum and some broken lines on the elytra; the latter usually with traces of a whitish spot about the middle of interval 5 and another behind it on interval 3.

*Head* quite smooth, the fine close punctation almost entirely hidden by the scaling and the short, broad, backwardly recumbent setæ; eyes very short-oval ( $3:2\frac{1}{2}$ ). *Rostrum* a little shorter than its basal width, almost flat above, with a shallow central impression in the anterior half containing an indistinct longitudinal carina; the upper

edge of the scape running far below the eye. *Prothorax* perfectly smooth, the punctation and clothing as on the head, and without any central stria or carina; the basal margin not carinate, the front margin straight dorsally and hardly sinuate behind the eyes, and the sides very slightly rounded. *Elytra* very broadly ovate, the transverse dorsal curve very flat; the actual apex rapidly narrowed to a rounded point, but not visible directly from above; the basal margin jointly sinuate, embracing the base of the prothorax, but not constricted or marginate; the surface quite even, with regular rows of small separated punctures, each containing a minute seta; the intervals broad and finely coriaceous (the sculpture hidden by the scaling), and bearing irregularly placed, small, recumbent, scale-like setæ, which are by no means easy to see; the suture completely hidden by the scaling.

*Length* 4-5 mm., *breadth*  $2\frac{1}{2}$ -3 mm.

ORANGE FREE STATE: Bothaville (*Dr. H. Brauns*).

Described from seven specimens.

*Leurops obesa*, sp. n.

♂. Colour black, clothed with dense, uniform, ash-grey scaling; the antennæ, legs, and part of the mandibles piceous.

Very closely allied to the genotype, but differing as follows:—*Head* with the eyes more nearly circular ( $3\frac{1}{4}$ :3). *Rostrum* distinctly longer, a little longer than its basal width; the upper edge of the scrobe, if continued, would touch the lower margin of the eye, whereas in *L. cana* it would pass far below the eye; the scrobe itself distinctly shallower behind. *Prothorax* proportionately longer, with the front margin more deeply sinuate behind the eye.

*Length* 5 mm., *breadth* 3 mm.

INTERIOR OF S. AFRICA.

Described from a single male.

*Leurops substriata*, sp. n.

♂ ♀. Colour black, with dense scaling; the legs and antennæ piceous black. In a well-marked specimen the pattern is as follows:—Ground-colour pale grey; the upper-side of the head and rostrum light brown, except the apex of the latter and a bisinuate transverse line at its base, a central line on the forehead and a stripe above each eye,

which are grey; prothorax with a broad, dark brown, median stripe, a less distinct one on each side of it, and a narrower one on the inflexed sides; elytra with the suture narrowly light brown, and with dark brown macular stripes covering striae 1, 2, 5, and the base of 4. But some or all of these markings may be very nearly obliterated.

Also very close structurally to *L. cana*, but the eyes are decidedly more convex, and the central stria on the forehead is more concealed by the scaling; the rostrum is even shorter in proportion to its basal width, and the central carina is more raised at its base; the setae on the head and rostrum are longer and distinctly raised, whereas in *L. cana* they lie quite flat; the setae on the pronotum and elytra are similarly longer and much more conspicuous; the prothorax has the basal margin narrowly carinate and less strongly rounded; the scutellum is smaller, being scarcely perceptible; the elytra bear very shallow striae (of which there is no trace in the other two species), and when abraded the punctures appear appreciably larger and more closely set.

Length 5-6 mm., breadth 3-3 $\frac{1}{4}$  mm.

ORANGE FREE STATE: Paul Roux, 23. x. 1917 (*M. G. Ferreira*).

Described from one male and four females; received from the Division of Entomology, Pretoria, with a record that the insects were injuring maize-plants.

#### Genus PSEUDOBLOSyrus, nov.

*Head* twice as broad as long, trisculate, the eyes very prominent. *Rostrum* subquadrate, separated from the head by a deep sinuous furrow that reaches the sides, the lower surface with two deep longitudinal furrows and a transverse basal impression; epistome well defined, the sides forming an obtuse ridge, rounded behind, the front margin deeply sinuate and shorter than one of the sides; mandibles multi-setose and without scaling, with a distinct median tooth and a sharp longitudinal carina running from the scar to the base; mentum with the anterior part convex and bearing a fringe of setae, the posterior part flat and deeply sunk in its cavity; scrobes entirely lateral and quite invisible from above, very deep and gradually widening outwardly, the upper edge ending on a level with the lower margin of the eye. *Antennae* with the scape gradually clavate and reaching the middle of the eye; funicle squamose, the two basal joints

of equal length. *Prothorax* transverse, the basal margin finely carinate. *Scutellum* concealed. *Elytra* subglobose, fitting closely to the prothorax, with a subhumeral prominence and irregular punctation. *Sternum* with the gular margin shallowly sinuate, the coxæ in the middle of the prosternum, the centro-sternite small and tubercular; mesepisterna narrowly separated from the elytra and with a transverse furrow at their extreme base (often hidden by the prosternum); metasternum between the coxæ distinctly shorter than the mid-coxæ and with a strong antecoxal fold, the episternum angularly produced inwards at the base, the episternal suture more or less obliterated at its apex; the hind coxæ narrowly separated from the elytra. *Venter* with the intercoxal process strongly angulated, and nearly as broad as the hind coxæ; segment 1 with a small sinuation in the middle of the hind margin, segments 2-4 subequal in length. *Legs* comparatively slender, the femora only slightly clavate; all the tibiæ with a row of five to seven stout spines along the inner edge of the apical half, the hind tibiæ with the corbels obliquely terminal, bare and distinctly enclosed; claws connate.

♂. The last ventral segment bears a large deep impression.

Genotype, *Pseudoblosyrus sharpi*, sp. n.

Superficially just like a *Blosyrus*, but distinguished by the setose mentum, the enclosed corbels of the hind tibiæ, the angulated base of the metepisternum, and the irregularly foveate and tuberculate elytra.

*Pseudoblosyrus sharpi*, sp. n. (Pl. I. fig. 2).

♂ ♀. Black, not very shiny, with sparse grey scaling on the elytra and pale bluish scales on the head and pronotum.

*Head* with fine shallow punctation, the lateral sulci almost as deep as the central one; eyes hardly produced backwards, their greatest depth well behind the middle, the hind edge of the orbit not projecting. *Rostrum* longer than the head, about as long as broad, almost parallel-sided, somewhat flattened above, with a strong complete central costa, which bifurcates near the apex; adjoining the costa on each side a broad, deep, oblique impression, the punctation coarse, but very shallow. *Antennæ* with joints 4-6 of the funicle subequal, bead-like, a little longer than broad, and shorter than 3 and 7, which are nearly equal. *Prothorax* with the sides rather strongly rounded, broadest before the middle, the apical margin truncate, narrower than the base and quite



vertical laterally, the basal margin arcuate; the upper surface coarsely coriaceous, with a broad oblong median impression, the dorsal outline sloping from base to apex. *Elytra* subglobose, broadest before the middle, the dorsal outline strongly convex, deepest before the middle, the base sinuate and slightly raised laterally, the apices jointly rounded; set with shallow, irregular, more or less confluent and ill-defined foveæ, only the juxta-sutural row and those on the inflexed sides being regular; the intervals with numerous irregular, large, low, rounded tubercles, which are bare and closely and finely punctate; the small broad curved setæ are with difficulty distinguishable from the true scales.

*Length* 10–11 mm., *breadth*  $5\frac{1}{2}$ –6 mm.

TRANSVAAL: Pretoria.

*Types*, ♂ in Dr. D. Sharp's collection, ♀ in the British Museum.

Described from 1 ♂ and 6 ♀ ♀, all of which were kindly submitted to me by Dr. Sharp, who had already recognized that in spite of its superficial resemblance to *Blosyrus* this species is really more closely allied to the Madagascar genus *Holonychus*.

#### GENUS SYNECHOPS, nov.

*Head* with a central furrow which does not reach the vertex, not constricted behind the eyes, which are quite lateral and very convex. *Rostrum* strongly deflected, continuous with the forehead, oblong, the dorsal edges broadly rounded off, the lower surface parallel with the upper; epistome quite indefinite posteriorly, the apical edge deeply emarginate; mandibles multi-setose, not squamose, without any median tooth or dorsal longitudinal carina, the scar sub-triangular; mentum setose; scrobes narrow, deep, and squamose, the upper edge ending on a level with the lower margin of the eye, the apical portion partly visible from above. *Antennæ* with the scape rather abruptly clavate, reaching about the middle of the eye; funicle squamose, the two basal joints equal. *Prothorax* transverse, narrower in front than behind. *Scutellum* small, but distinct. *Elytra* fitting closely to the prothorax, the base not marginate, the apices jointly rounded, the shoulders rounded, the punctation irregular. *Sternum* with the gular margin truncate, the coxæ in the middle of the prosternum, the centro-sternite tubercular; mesepisterna meeting the elytra only at the

extreme base; metasternum shorter than the mid-coxæ, with a distinct antecoxal fold, the episternum produced inwards at the base, the episternal suture visible only in the basal half, the hind coxæ meeting the elytra. *Venter* with the intercoxal process angulated and narrower than the hind coxæ, the hind margin of segment 1 sinuate, and segment 2 longer than 3 and 4 together. *Legs* with the femora moderately clavate; tibiæ straight and cylindrical, not mucronate at the apex, the hind corbels open and bare; tarsi broad, the claws connate.

♂ unknown.

Genotype, *Synechops irregularis*, sp. n.

A rather isolated genus, readily distinguished by the following combination of characters: the complete absence of any dividing-line between the rostrum and forehead, the open corbels of the hind tibiæ, and the simple mandibles.

*Synechops irregularis*, sp. n. (Pl. I. fig. 8.)

♀. Black, with uniform, dense, sand-coloured scaling.

*Head* rather strongly convex transversely, shallowly impressed on each side behind the eyes, the long scale-like setæ quite recumbent; eyes nearly circular and hemispherical. *Rostrum* stout, parallel-sided, almost flat above, but with the dorsal edges gradually rounded away, with coarse confluent punctation (mostly hidden by scaling) and with a central furrow (continuous with that on the head) from the base to the middle. *Antennæ* with joints 3-7 of almost equal length, but 7 distinctly broader than the others, trapezoidal. *Prothorax* broader than long ( $2\frac{5}{8} \times 2$ ), the sides moderately rounded, broadest a little before the middle, with a very shallow transverse impression at about one-fourth from the apex, the basal margin very gently arcuate and not raised, the apex truncate; the upper surface with coarse confluent punctation (mostly hidden by the scaling and stout recumbent setæ) and no central furrow or carina, but with some irregular impressions on each side behind the middle; the dorsal outline almost level, forming a continuous curve with that of the rostrum and head. *Elytra* oblong-ovate, rather broadly rounded behind (as seen directly from above), the basal margin gently sinuate; the dorsal outline rising from the scutellum, then almost flat, and sloping steeply behind, the apical part quite vertical; the punctation coarse and quite irregular, except for a row

along the suture and two or three on the inflexed sides ; the spaces between the punctures, where visible, shining and coriaceous ; the scales small, nearly circular, convex, and shiny ; the stout flattened setæ irregularly placed and nearly recumbent.

Length  $8\frac{1}{2}$  mm., breadth  $4\frac{1}{4}$  mm.

CAPE COLONY : HEX RIVER.

Described from a single specimen.

#### Genus CYCHROTONUS, Pasc.\*.

As a result of following Faust's interpretation of the genus *Chaunoderus*, Gerst., I sank *Cychrotonus* as a synonym of it (Proc. Zool. Soc. 1906, p. 958). It is now clear that under *Chaunoderus* Faust associated insects having two distinct types of antennal scrobes. In the genotype, *C. stupidus*, Gerst., with which I am not acquainted, the scrobes are described as being of a normal Otiorrhynchine type—superior, directed straight towards the eyes, and disappearing a little before the middle of the rostrum ; whereas in *Cychrotonus* they curve downwards in front of the eye and extend to the base of the rostrum. Of the described species of *Chaunoderus* known to me, the following must be referred to *Cychrotonus*:—*C. marginulalis*, Fst., *C. subglaber*, Fst., *C. sternalis*, Hartm., and *C. apicalis*, Hartm.; whereas *C. brevicollis*, Fst., and *C. transversus*, Fst., may provisionally remain in Gerstaecker's genus.

#### *Cychrotonus ellipticus*, sp. n. (Pl. I. fig. 7.)

♂ ♀. Black or piceous, practically devoid of scaling above ; the lower surface of the head and rostrum, the sternum, and coxæ with scattered, flat, bluish scales ; the venter with numerous elongate, narrow, curved, whitish scales.

*Head* with rather coarse, longitudinally confluent punctation, the forehead flat, but not noticeably depressed below the vertex ; eyes rather less convex than usual, deepest in the middle and bounded internally by a deep furrow. *Rostrum* longer than broad, rather broader near the base than at the genæ, the sides sinuate in the middle ; coarsely

\* Journ. Linn. Soc., Zool. xi. 1871, p. 162.

punctate, with a low broad central carina (sometimes rather ill-defined) and a narrower curved one on each side of it; set with brownish curved scale-like setæ, and sometimes with some narrow bluish scales on the apical half; scrobes with the upper margin sharply angulate close to the base. *Antennæ* with the scape distinctly curved, the funicle with joint 1 hardly longer than 2, 3-7 subequal, bead-like, and slightly broader than long. *Prothorax* broader than long (3:2), broadest at the base, strongly narrowed in front, the sides rounded, the apical angles very prominent (as seen from above), the dorsal apical margin truncate, the basal margin arcuate; the dorsal outline strongly convex transversely and slightly so longitudinally, the apex being much below the level of the base; the upper surface strongly and very closely punctate, with a faint longitudinal impression in the middle of the base, the sculpture on the inflexed sides becoming more or less plicate; the lateral portion of the apical margin carinately raised, forming an obtuse angle below the eye and a sharp projection in front of each coxa. *Scutellum* closely punctate. *Elytra* narrowly elliptical and broadest before the middle in ♂, rather broader in ♀, which has the humeral angulation scarcely perceptible, the basal margin jointly sinuate; the elytra strongly compressed behind, so that the suture is elevated on the declivity, the longitudinal outline almost flat in ♂, the apical portion dropping almost at a right angle and sinuate in profile; in the ♀ the outline slopes more from the middle to the top of the declivity; the shallow striæ with large quadrate punctures, the intervals about as broad as the striæ, finely punctate and somewhat rugulose transversely, with scattered, extremely minute, scale-like setæ, which are conspicuous only on the declivity. *Sternum*: mesosternum with a perfectly smooth shiny patch adjoining the outer sides of the mid-coxæ and standing out in contrast with the strongly sculptured surface; metasternum sparsely granulate. *Venter* very rugosely punctate and granulate, especially in the ♂, in which the first segment bears behind the coxa a deep excision, the portion between it and the elytra being smooth and shiny.

Length, ♂  $11\frac{1}{2}$ -13 mm., ♀  $10\frac{1}{2}$  mm.; breadth, ♂  $4\frac{1}{2}$ - $5\frac{1}{2}$  mm., ♀  $4\frac{1}{2}$  mm.

BELGIAN CONGO: Kasenga, xi. 1912 (*Dr. Bequaert*).

This distinct species is specially characterised by its elongate shape, the two sharp prominences on the gular

margin of the prosternum, and the remarkable structure of the first ventral segment of the ♂.

Described from 2 ♂♂ and 1 ♀.

*Cychrotonus decoratus*, sp. n.

♂ ♀. Black or piceous, with inconspicuous and easily abraded dark scaling on the disk of the clytra, and with the following markings formed of pale metallic-green scales:— A stripe along the inner edge of each eye and the whole side of the head and rostrum; a narrow median stripe on the prothorax, a broader lateral one behind the eye, and another above the coxa: clytra with a stripe on interval 1 from behind the scutellum to about the middle, a short humeral stripe on 7 from the base to about one-third, a complete marginal stripe reaching stria 9, but broader at the apex and emitting at the middle a more or less dentate broad oblique band, which reaches the suture at the top of the declivity and is united by a sutural stripe to the apical patch; a very short isolated stripe at the apex of interval 5, and occasionally a still shorter one at the apex of 7: in the ♀ only there is a round spot at the middle of interval 3 and a trace of another on 5. The lower surface rather thinly clothed with pale greenish scales.

*Head* with strong, longitudinally confluent punctation, a deeply impressed line along the inner margin of the eye, and a large central fovea; eyes rather less prominent than usual, deepest in the middle. *Rostrum* a little longer than broad (7:6), parallel-sided, almost flat on the disk, coarsely and confluent punctate, with a low smooth median costa (rather broader and flatter in the ♀) which widens anteriorly, a low punctate costa forming the margin of the dorsal area, and beneath it a longitudinal impression in front of the eye. *Antennae* with the two basal joints of the funicle equal, joints 3–7 subequal and about as long as broad, the first joint of the club narrow and subcylindrical in its basal half. *Prothorax* about as long as the apical width, the sides subparallel from the base to the middle, then gradually narrowed to the apex, the apical margin broadly sinuate (as seen from above) owing to a marked thickening behind the eye, the base very shallowly bisinuate, the longitudinal outline nearly flat; the upper surface with close shallow punctures of varying sizes, each filled with a flat scale, the median line often very shallowly impressed in the basal half. *Elytra* narrowly

ovate in the ♂, broader in the ♀, broadest before the middle, with barely a trace of a humeral prominence in the ♀, the basal margin jointly sinuate; the shallow striae with large separated punctures; the intervals broad and with fine shallow punctation. *Sternum* rugose, but not granulate, except the mesosternum, which is finely aciculate. *Venter* with two oblique impressions on segment I behind the coxa in the ♂ only.

Length 8–10 mm., breadth  $3\frac{3}{4}$ – $4\frac{3}{4}$  mm.

BELGIAN CONGO: Lukombe, x. 1908 (*A. Koller*).

Described from 3 ♂♂ and 3 ♀♀.

Easily distinguished from all the other known species of the genus by its striking coloration.

#### EXPLANATION OF PLATE I.

Fig. 1. *Leurops cana*, sp. n., p. 19.

Fig. 2. *Pseudoblosyrus sharpi*, sp. n., p. 22.

Fig. 3. *Pomphus denticollis*, sp. n., p. 8.

Fig. 4. *Proscopus marginatus*, sp. n., p. 13.

Fig. 5. *Protostrophus spinicollis*, sp. n., p. 17.

Fig. 6. *Bradyhamon swalei*, sp. n., p. 10.

Fig. 7. *Cychrotonus ellipticus*, sp. n., ♂, p. 25.

Fig. 8. *Synechops irregularis*, sp. n., p. 24.

#### II.—On *Lacerta praticola*, *Eversm.* By L. A. LANTZ and O. CYRÉN.

BOETTGER remarks, in his account of the reptiles collected in the Talysh by G. Radde and H. Leder\*, that the two specimens of *Lacerta praticola* examined by him differ from Western Caucasian specimens in having five pairs of chin-shields instead of six, two instead of three forming a median suture. The author thinks it would be possible to establish a local variety, should this character be found to be constant.

This is indeed the case, as appears from our examination of a larger material collected in the same country. We found only isolated specimens—from the Talysh † as well as from the Western Caucasus ‡—with five chin-shields on

\* Radde, 'Fauna u. Flora d. südwestl. Caspigebietes,' Leipzig, 1886, p. 37.

† One specimen out of 21.

‡ One specimen out of 43.

one side and six on the other; in such case the median suture is formed by two shields on one side and three on the other. As the two forms differ also in other characters, such anomalous specimens can, however, easily be identified; therefore the separation of *L. praticola* into two subspecies seems to be justified.

Eversmann's description and figure of the type-specimen from Piatigorsk\* are not clear enough to settle the question, which of the two subspecies must be considered as the typical. A full description of the species was first given by Kessler †, who examined thirteen specimens from the Kuban district, Piatigorsk, valley of R. Bielaia, and Ananur, two of which formerly were in Eversmann's collection. Kessler indicates six pairs of chin shields, the first three forming a median suture. Relying on this, we intended to describe a Caspian subspecies, believing the Western Caucasian form to be the typical one.

Thanks to the kindness of MM. K. Derjugin and P. Nesterov we have been enabled to revise the collection of the Petrograd University. We found there several of Kessler's specimens, and amongst them one labelled "Piatigorsk, leg. Eversmann." We must admit that Kessler neglected to examine the chin-shields of this very specimen, as it has only five pairs of them and agrees in every respect with the Talysk *L. praticola*. It cannot, however, be considered as the type-specimen, because it has a normal interparietal and occipital, while Eversmann indicates these shields as separated by an accessory one.

Both the type-specimen and the specimen preserved in the Petrograd University are from the same locality; other material from Piatigorsk, Essentuki, and Kislovodsk ‡ was kindly examined for us by M. S. Tsarevski. All these show only five pairs of chin-shields, two of them forming a median suture. Therefore it is undeniably the Oriental subspecies which occurs at Piatigorsk and surrounding localities that must be considered as the typical *L. praticola*.

It is of great interest that *L. praticola praticola* seems to be confined to the Caspian Sea basin §, while the western

\* Lacerte Imperii Rossici (Moscow, 1834).

† Journey in Transcaucasia, St. Petersburg, 1878, p. 156 (in Russian).

‡ Coll. Acad. Petr. Nos. 5273, 6861, and 7900.

§ We examined specimens from Piatigorsk, Mount Il near Vladikavkar, Lagodekhi, Kala-Dagna, valley of R. Astara-tshai, Elburz Mountains between Astara and Ardebil, Shafe-rud near Enzeli.

subspecies is found practically only in countries draining towards the Black Sea\*—a fact which induced us to choose for the latter the name *pontica*. Judging from several specimens from Mehadia †, the Hungarian *L. praticola* also belongs to this form.

The two subspecies may be distinguished by the following characters :—

1. *Lacerta praticola praticola*, Eversm.

Head and limbs comparatively short. Proportion,  $\frac{\text{length of pileus}}{\text{length of head and body}}$  : 0.22–0.23–0.24 ‡ in the ♂ (8 spec.) and 0.18–0.20–0.23 in the ♀ (10 spec.). Proportion,  $\frac{\text{length of fore limb}}{\text{length of head and body}}$  : 0.30–0.31–0.33 in the ♂ (8 spec.) and 0.26–0.28–0.33 in the ♀ (10 spec.). Proportion,  $\frac{\text{length of hind limb}}{\text{length of head and body}}$  : 0.45–0.48–0.52 in the ♂ (8 spec.) and 0.39–0.43–0.49 in the ♀ (10 spec.).

Row of *superciliary granules* incomplete and generally reduced to a few granules. Occipital generally very small, narrower than, or as broad as, the interparietal, and penetrating only a little between the parietals. Always a single *postnasal*, in contact with the internasal. *Masseteric shield* moderate, rarely reaching the first supratemporal, and separated from the tympanic by 2, seldom by 1 or 3, rows of rather small temporals. 5, seldom 6, *lower labials*. 5 pairs of *chin-shields*, the first 2 forming a median suture. On a line between the suture of the chin-shields and the collar 16–19–22 *gular scales* (21 spec.). *Dorsal scales* comparatively broad and short, rather feebly keeled, and imbricate; in a transverse row across the middle of the body 35–39–43 scales (19 spec.). In the ♂ 26–26–27 (8 spec.), in the ♀ 28–29–30 (10 spec.), transverse rows of ventral plates.

2. *Lacerta praticola pontica*, subsp. n.

Head and limbs comparatively long. Proportion,  $\frac{\text{length of pileus}}{\text{length of head and body}}$  : 0.23–0.24–0.24 in the ♂ (16 spec.)

\* The specimens examined are from Georgievsko-Osetinskoie (Kuban Valley), Novorossiisk, Sotshi, mountains near Adler, Gagry, Gudaüt, Sukhum, Ananur (valley of R. Aragua); the latter locality only belongs to the Caspian Sea basin.

† Coll. Acad. Petr. No. 9814.

‡ The middle number means the average.



and 0.20-0.21-0.24 in the ♀ (12 spec.). Proportion,  $\frac{\text{length of fore limb}}{\text{length of head and body}}$ : 0.28-0.33-0.34 in the ♂ (16 spec.) and 0.26-0.29-0.31 in the ♀ (12 spec.). Proportion,  $\frac{\text{length of hind limb}}{\text{length of head and body}}$ : 0.47-0.51-0.54 in the ♂ (16 spec.) and 0.40-0.45-0.49 in the ♀ (12 spec.).

Row of *superciliary granules* generally not much reduced, often complete. *Occipital* comparatively large, generally broader than the interparietal, and penetrating rather widely between the parietals. *Postnasal* generally not reaching the internasal; sometimes two superposed postnasals, the upper small, in contact with the internasal. *Masseteric shield* large or very large, almost always in contact with the first supratemporal, and separated from the tympanic by one large scale or two superposed rather large temporals. 6, seldom 7, *lower labials*. 6 pairs of *chin-shields*, the first 3 forming a median suture. On a line between the suture of chin-shields and the collar, 14-17-19 *gular scales* (43 spec.). *Dorsal scales* comparatively narrow and elongate, rather strongly keeled, and imbricate; in a transverse row across the middle of the body 32-37-41 scales (43 spec.). In the ♂ 22-25-26 (23 spec.), in the ♀ 26-28-30 (18 spec.), transverse rows of *ventral plates*.

In reading the description of *L. vivipara stenolepis*, Nik.\*, we could not find any character to separate this form from *L. praticola*. This was confirmed on examining the type-specimen, a very large ♀ † offering the anomaly mentioned above, *i. e.* 5-6 chin-shields. By the other characters of scaling, and especially the rather small masseteric shield, the number of superciliary granules reduced to 3 on each side, it appears as a well-characterized *L. praticola praticola*, which cannot be confounded with *L. vivipara*.

Recently Nikolski described a new species from Sotshi, *L. colchica* ‡, which seems also to be closely allied to *L. praticola*. The author was so kind as to send us the type-specimen for closer examination. It is a typical *L. vivipara*, Jacq., entirely agreeing with some specimens from the Government of Moscow used for comparison. *L. vivipara* has never been recorded from Transcaucasia, and it is very doubtful that it occurs in that country; probably some error has taken place in labelling this specimen.

\* 'Herpetologia caucasica,' Tiflis, 1913, p. 54.

† Coll. Acad. Petr. No. 7203, from Mount Il near Vladikavkaz.

‡ 'Fauna of Russia, Reptiles,' i. (Petrograd, 1915).

III.—*The White-toothed Shrew of Palestine.*

By OLDFIELD THOMAS.

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CAPT. G. C. SHORTRIDGE has contributed to the British Museum a couple of specimens of a white-toothed shrew obtained by him during the Palestine campaign.

It appears to represent a new subspecies of *Crocidura russula*, and may be called

*Crocidura russula judaica*, subsp. n.

Like the large Central European *C. russula russula*, but colour paler and greyer.

Fur of back about 4.2 mm. in length; very few longer piles present.

General colour of upper surface rather darker than "light drab," much brighter, greyer, and less brown than true *russula*, owing to the reduction of the dark brown tips to the hairs and the greater degree to which the grey of the underfur shows through. Under surface distinctly lighter, the ends of the hairs whitish, with but little drabby suffusion. Tail rather short.

Skull as in *C. r. russula*. Third upper unicuspid rather broader than second.

Dimensions of the type (taken from skin):—

Tail 37 mm.; hind foot 13.

Of a specimen measured in the flesh:—

Head and body 58 mm.; tail 38; hind foot 13; ear 9.5.

Skull (of type): condylo-incisive length 21.2; greatest breadth 9.5; height of crown from basion 4.7; upper tooth-row 9.7.

*Hab.* Palestine. Type from near Jerusalem.

*Type.* Adult male. B.M. no. 18. 8. 1. 3. Collected April 1918, and presented by Capt. G. C. Shortridge. Two specimens.

While the other forms of the *russula* group described from S.W. Asia are darker than the typical European animal, the present one is readily distinguishable from all by being markedly lighter.

IV.—On the Structure of the Larvæ and the Systematic Position of the Genera *Mycetobia*, *Mg.*, *Ditomyia*, *Winn.*, and *Symmerus*, *Walk.* (*Diptera Nematocera*). By D. KEILIN, D.Sc. (from the Quick Laboratory, University of Cambridge).

[Plates II.—V.]

I. *Mycetobia pallipes*, Meigen.

The larvæ of *Mycetobia pallipes* were first described and figured by Lyonnet (1832) and Guérin-Méneville (1835).

Dufour (1841) and notably Perris (1870), after a more complete study of these larvæ, showed that their respiratory system is amphipneustic and called attention to their external resemblance to the larvæ of *Rhyphus fenestralis*, Scop.

Osten-Sacken (1892), referring to the papers of these entomologists, again raised the question of the larval resemblance of *Mycetobia* and *Rhyphus*, which in the adult stage seemed to be so different. But since Osten-Sacken the majority of entomologists dealing with *Mycetobia* unquestioningly referred this genus to the family Mycetophilidæ, passing over in silence the peculiar structure of its larvæ. Those who gave the matter any attention either doubted the correctness of the original observations of Dufour and Perris, or did not admit the value of larval characters in determining the systematic position of Insects.

However, a study of the life-history and larval morphology of *Mycetobia pallipes*, *Mg.*, and *Rhyphus fenestralis*, which I carried out in 1912–13 on material collected at Chaville (near Paris) has led me to the conclusion that the resemblance between these larvæ and their difference from those of Mycetophilidæ is much deeper than was ever supposed.

In the present paper I will point out only the main characters common to the early stages of *Mycetobia pallipes* and *Rhyphus fenestralis*, but not found in those of Mycetophilidæ.

A more detailed study of the larval anatomy of *Mycetobia* I propose to reserve for a special paper dealing with the family Rhyphidæ.

Characters common to *Mycetobia pallipes* (Pl. II. fig. 2, Pl. V. figs. 36, 37, 38) and *Rhyphus fenestralis* (Pl. II. fig. 1).

1. The eggs are invested with a gelatinous mass which is fixed to a solid substratum.
2. Eggs are pear-shaped.

Characters common to all the Mycetophilidæ (Pl. III.) except the genera *Ditomyia* and *Symmerus*.

1. Eggs are more or less scattered on the surface of the fungus or rotten wood.
2. Eggs are elongated or sub-spherical.

3. Embryo in the egg curved.
4. The larvæ move in a serpentine manner, or by means of very active mandibles.
5. The segments of the body are separated by intercalary rings (Pl. V. fig. 38).
6. The larval head with a pair of tentorial rods (Pl. II. figs. 1 & 2, *t.n.*) similar to those of the larvæ of *Trichoceera*.
7. Antennæ with a special sensory organ (Pl. V. fig. 37, *b.s.*), corresponding to the bell-shaped papilla of many other dipterous larvæ (for instance, those of *Ditomyia* and all cyclorhaphous Diptera) and with some small cylindrical papillæ.
8. Mandibles (Pl. V. figs. 35 & 36) show two distinct portions: basal portion (*b.p.*) with an internal hook (*h.*), and terminal or apical portion (*t.p.*) which is more chitinised, ending in three teeth and bearing two brushes of brown setæ.
9. Maxillæ fleshy and soft; the maxillary palp (figs. 1 & 2, *m.p.*) broad, thick, transparent, bearing two groups of sensory papillæ (*a.* and *b.*); the internal part of the maxillæ (*m.x.*), besides a few sensory organs, bears numerous long setæ.
10. Labrum with two mid-ventral protuberances covered with hairs (figs. 1 & 2, *l.r.* & *p.r.*) and a small comb-shaped plate (*c.m.*) on each side of posterior protuberance.
11. Labium well developed and with distinct labial palps (*l.p.*).
12. The thoracic sensory organs which are the remains of the thoracic legs are composed of four hairs (two long and two short).
3. Embryo straight.
4. The larval movements are worm-like.
5. No distinct intercalary rings (Pl. III. fig. 3); only some larvæ—for instance, those of *Ceroplastus*—have the segmentation of their abdomen masked by superadded transversal folds.
6. Head without tentorial rods.
7. Antennæ either elongated as in *Bolitophiia* (Pl. III. fig. 4, *A.n.*, and fig. 13) or reduced to a flat, wide, non-chitinised surface bearing some very small sensory papillæ.
8. Mandibles (figs. 5 & 7) flattened, strongly chitinised, and with their internal margin toothed.
9. Maxillæ (Pl. III. figs. 10, 11, 12) flattened and strongly chitinised, with their internal margin (*m.x.*) toothed, like those of the mandibles. The maxillary palps (*m.p.*) are very much reduced.
10. Labrum (figs. 6 & 8) without mid-ventral protuberances and without comb-shaped plates.
11. Labium reduced and not visible from exterior.
12. Thoracic sensory organs composed of four hairs of equal length (fig. 9).

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| <p>13. Respiratory system is amphipneustic with only two pairs of functional spiracles: (1) prothoracic and (2) postabdominal.</p> <p>14. Alimentary duct without anterior cœca.</p> <p>15. Anus ventral.</p> <p>16. Salivary glands short.</p> <p>17. Hypoderm of posterior segments of larvæ, which surrounds the anal cleft, is composed of very large and thick cells.</p> <p>18. Pupæ strongly chitinised with rows of small hooks on the abdominal segments and especially on the posterior end of their body.</p> | <p>13. Respiratory system is either hemipneustic (fig. 3) with one pair of prothoracic and seven pairs of abdominal spiracles, or propneustic (<i>Polylepta</i> or <i>Diadocidia</i>), or apneustic (<i>Ceroplastus</i>).</p> <p>14. Alimentary duct with a pair of anterior lateral cœca.</p> <p>15. Anus terminal or subterminal.</p> <p>16. Salivary glands very long.</p> <p>17. No special large cells in hypoderm of the posterior end of the body.</p> <p>18. Pupæ with thin chitin and without the rows of short spines or hooks.</p> |
|--|---|

All these characters show us clearly that the difference between the larva of *Mycetobia* and those of Mycetophilidæ (s. l.) is as striking as its resemblance to the larvæ of Rhyphidæ.

But to solve finally this question a comparative study of the adult stages of these Diptera had to be undertaken, and this was done by F. W. Edwards (1916, p. 115), who in his interesting paper "On the Systematic Position of the Genus *Mycetobia*, Mg.," arrived at the following conclusion:—

"*Mycetobia* agrees with the Rhyphidæ and diverges from the Mycetophilidæ in the possession of a large gular plate, in the structure of the second palpal joint, in the position of the forking of the radial vein; the course of the cubital vein, and in the chitinous spermathecæ of the female. Since the venation of *Mycetobia* has been shown to be directly derivable from that of the Rhyphid genus *Oligogaster*, it is probable that any resemblances in this respect to the Mycetophilidæ are due to convergent evolution, and not to relationship. The genus *Mycetobia* (and with it *Mesochria*, though not *Ditomyia* or *Symmerus*) must therefore, on grounds of adult as well as larval structure, be transferred from the Mycetophilidæ to the Rhyphidæ."

## II. *Ditomyia fasciata*, Meig.

The first indication of the habitat of this species we owe

to Meigen (1818, t. i. p. 230), who found a young undeveloped male of this fly in *Polyporus versicolor*.

Zetterstedt (1851, t. x. p. 4071) quotes Behrens, who bred this insect from a fungus which he found on *Juglans regia*.

According to Winnertz (1863, p. 669), the larvæ of *D. fasciata* live in different *Polyporus* and especially in *P. versicolor* and *ferrugineus*; he quotes also Kaltenbach who bred *D. macroptera*, Winnertz, from *Polyporus ignarius*.

Schiner (1864, i. p. 428) reared *D. fasciata* from various *Polypori*.

Frauenfeld (1866, p. 200) found the larvæ of this species in *Polyporus squamosus*; he also gave the first description of the larval and pupal stages of this fly. Unfortunately, his very short description does not contain any figure, and may be applied to many other dipterous larvæ. The only characters of his description worth mentioning are the following: (1) the intersegmental spaces are deeply constricted, (2) the first segment of the thorax is large, and (3) the posterior end of the body bears two protuberances ended by a sharp spine.

We have, finally, to mention that the collection in the Entomological Museum of Cambridge contains the pupæ and adults of *Ditomyia fasciata*, Mg., reared by Fryer (1910) from *Polystictus versicolor* collected at Chatteris (Cambs) and by H. Scott (1910) from the same fungus collected from beech-stumps at Henley-on-Thames.

I received the larvæ and pupæ of *Ditomyia fasciata*, which will be described here, from Mr. F. W. Edwards, who found them in a fungus, which he believes to be *Polystictus versicolor*, growing on old beech-stumps near Cambridge and at Baldock, Herts.

Later on, I collected myself a few of these larvæ in a piece of wood covered and penetrated by the mycelium of a fungus.

According to Edwards, in nature the larvæ usually live upon the old fungi, but in his breeding-jars he observed them attacking the fresh fungi also.

The larvæ are opaque white in colour and have very little power of movement. Pupation takes place within the fungus without the formation of any cocoon; before the emergence of the adult the pupa bores its way to the surface and comes halfway out.

The larva is 9.3 mm. long, with very deep intersegmental grooves (Pl. IV. fig. 14).

The head of the larva is completely free, though it may be retracted in the first thoracic segment. The antennæ (Pl. IV. fig. 23) are very small and consist of a short basilar segment which bears sensory organs of three different shapes: (1) the main bell-shaped (*b.s.*) sensory organ which is very common in dipterous larvæ, (2) one bi-articulated papilla (*p.*), and (3) five short cylindrical papillæ.

The labrum (fig. 15) shows on its anterior margin a brush composed of ordinary setæ mixed with sensory hairs. On each of its latero-anterior corners it bears a bidental chitinous plate (*d.*), and on its ventral side a series of short spines and scales and two strongly chitinised plates (*p.l.*).

The mandibles (fig. 22) are very well developed, thick, and of a dark brown chitin; their external margin is slightly cut into four teeth; they bear three lateral sensory hairs and a brush of ordinary brown setæ which originates from the internal basilar corner of the mandibles.

The maxillæ (fig. 17). The basal part or cardo of the maxillæ consists of soft and transparent chitin with a transverse brown band (*t.b.*) and a sensory organ in the form of a small circular groove. The internal part of the maxillæ (*m.x.*) is conical in shape and bears a long sensory hair (*s.h.*). The maxillary palp (*m.p.*) is very well developed and furnished with a series of sensory organs and some ordinary chitinous setæ.

The labium consists of a short chitinous plate terminating in two tridental processes. On the ventral side it bears two hemispherical palps (*l.p.*) of transparent chitin, each with three sensory papillæ.

The thorax is composed of three large segments furnished with a series of sensory hairs. Among the latter we may mention six groups of three hairs (fig. 19) which represent the remains of the thoracic legs. As I have previously shown (1911, 1915) these six groups of sensory organs exist in all dipterous larvæ and are always in direct connection with imaginal discs of the thoracic legs.

The eight abdominal segments bear also a series of sensory hairs, and on their ventral side they are furnished with lozenge-shaped projections or pseudopodia covered with very short setæ. The last abdominal segment differs from all the others in bearing the anus and a pair of dorsal projections terminated by spiracles.

The respiratory system of this larvæ is peripneustic, *i. e.* it is composed of nine pairs of functional spiracles (one pro-

thoracic and eight abdominal), and one pair of metathoracic non-functional spiracles connected with the main tracheal trunks by means of simple chitinous bands.

All the functional spiracles, except the last abdominal, are circular, with numerous trema surrounding a central chitinous plate which corresponds to the cork-shaped scar ("Bouchon cicatriciel") of the spiracles of *Trichocera*, Tipulid or Bibionid larvæ. The prothoracic spiracle (fig. 21) is much larger in size than any of the first seven pairs of abdominal spiracles (fig. 18).

The posterior abdominal spiracles (fig. 20, *s.p.*), which are situated on the dorsal projections of the last abdominal segment, are elongated and spine-shaped. The surface of their external scar (*s.c.*) is covered with very small chitinous hooks.

Alimentary canal (fig. 16). The very short pharynx is enclosed in the larval head. It is followed by a short œsophagus (*o.e.*) which enters the proventriculus (*pr.*). Two long lateral cœca (*a.c.*) arise from the anterior part of the midgut, just behind the proventriculus and, directed backwards, are tightly applied to the lateral sides of it. The midgut (*m.g.*) is in the form of a straight cylindrical tube. The four Malpighian tubes (*M.*) arise separately at the junction of the mid- and hind-gut. These four tubes lie in the posterior part of the body and surround the hind-gut.

The salivary glands (*s.g.*) are tubular and extend a small distance behind the posterior end of the anterior cœca.

The pupa (Pl. IV. fig. 24) is 8 mm. in length, completely free from the larval skin, and brown in colour. The head is much recurved on the ventral side, and the thorax, which projects forward, bears a pair of prothoracic respiratory horns (*p.h.*). The legs of the pupa are not superposed as is often the case in dipterous pupæ, but lie in the same plane. Each abdominal segment bears dorsally a row of short spines. The last segment (Pl. IV. fig. 25) is furnished with five pairs of hooks curved dorsally.

### III. *Symmerus amulata*, Meigen.

All our knowledge of the larvæ of *Symmerus* was contained in a short sentence of Winnertz (1863, p. 671), who bred "one female from a larva which lived in a decomposed fungus on *Carpinus betulus*."

During the month of May of this year Mr. Edwards in-



formed me that he had found a specimen of *Symmerus annulata* which had hatched in one of his breeding-jars. "The larvæ of this species," he added in his letter, "were boring in a piece of rotten elm wood. They are almost transparent and glassy in appearance, and, like those of *Ditomylia*, move very little and very slowly. The pupæ wriggle in an almost snake-like manner when extracted from their habitat. Unfortunately I found that all the full-sized larvæ had pupated. I have one larva preserved in spirit."

All the material Mr. Edwards could send me consisted of an empty pupa with a moulted larval skin attached to it and the larva preserved in spirit, mentioned in his letter.

This was, however, quite sufficient for the complete morphological study of this larva.

The larva of *Symmerus annulata* (Pl. V. fig. 26) is 11 mm. in length; its last abdominal segment bears the posterior spiracles, but is without the dorsal paired prominences which are present in *Ditomylia* larvæ. These two larvæ are easily distinguished from one another by their colour and post-abdominal prominences, but they are quite similar in the detailed structure of almost all their organs.

The antennæ (Pl. V. fig. 32), labrum (fig. 27), mandibles (fig. 31), maxillæ (fig. 29, *m.x.*), and labium (fig. 29, *l.b.*), with their palps (*m.p.*, *l.p.*) have the same structure as those of *Ditomylia* larvæ. The differences in detail of these organs in these two larvæ are shown in the above-mentioned figures.

We may mention only that in the maxillary palps of *Symmerus* larvæ we do not find the lateral sensory papilla which is well developed in *Ditomylia* larvæ (Pl. IV. fig. 17, *l.s.*). The labium in *Symmerus* larvæ is more rounded.

The thoracic and abdominal segments also bear the sensory hairs, and the remains of the thoracic legs are represented by three sensory hairs (fig. 30).

The last abdominal segment is rounded.

The respiratory system is peripneustic, with nine pairs of functional spiracles: one prothoracic and eight abdominal.

The spiracles (figs. 33 & 34) are very small, and their structure is similar to those of the first seven pairs of abdominal spiracles of *Ditomylia*.

Pupæ (fig. 28). Unfortunately I have only one empty skin of a pupa. I may mention, however, that the prothoracic horns are more elongated than in the pupa of *Ditomylia*, and that the thoracic segments bear a row of lateral short hooks.

The study of the larvæ and pupæ of *Ditomyia* and *Symmerus* shows clearly the great similarity in structure of nearly all their organs. It also shows, on the other hand, that the larval and pupal structure of these two genera is totally different from that of all the Mycetophilidæ.

The difference is especially striking in the structure of the antennæ, mandibles, maxillæ, and labium, with their palps, the sensory organs, respiratory system, structure of the spiracles, the salivary glands, and, finally, the form of the pupæ.

These two genera must therefore be re-united in a special family, the Ditomyidæ, which itself must be completely separated from the family of the Mycetophilidæ.

From the study of the larval and pupal characters it follows that the family Ditomyidæ must occupy among the Diptera Orthorrhapha Eucephala, of Brauer, a position equally important with that of the Mycetophilidæ, Bibionidæ, Rhyphidæ, &c.

As to the relations of this new family to the others we can state only that the larvæ of Ditomyidæ bear a closer resemblance to the larvæ of Bibionidæ than to those of any other Diptera, and more especially when we compare their labra, mandibles, maxillæ, and the structure of the spiracles.

The subfamily Mycetobiinæ of Winnertz (1861), composed of the genera *Mycetobia*, *Mesochria*, *Ditomyia*, and *Symmerus*, must therefore completely disappear, as *Mycetobia* (and with it, according to Edwards, *Mesochria*) must be transferred to the Rhyphidæ; while the two others go to form a separate family, Ditomyidæ, completely separated from Mycetophilidæ.

I must express here my best thanks to Mr. F. W. Edwards for sending me the specimens of *Ditomyia* and *Symmerus* larvæ. I may say that it is his re-discovery of these larvæ which has enabled me to accomplish this study.

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## EXPLANATION OF THE PLATES.

## PLATE II.

- Fig. 1. Head of the larva of *Rhyphus fenestralis*, Scop., ventral aspect. *a.* and *b.*, sensory organs of maxillary palp; *c.m.*, comb-shaped plate of labrum; *l.p.*, labial palp; *l.r.*, labrum with its anterior ventral prominence; *m.d.*, mandibles; *m.p.*, maxillary palp; *m.x.*, maxilla; *p.r.*, posterior ventral prominence of labrum; *t.n.*, tentorial rods.
- Fig. 2. Head of the larva of *Mycetobia pallipes*, Mg. Letters as in fig. 1.

## PLATE III.

- Fig. 3. Larva of *Mycetophila blanda*, Winn., viewed laterally.
- Fig. 4. Head of the larva of *Bolitophila fusca*, Meig.; dorsal aspect. *A.n.*, antennæ; *E.*, eyes.
- Fig. 5. Mandible of *Mycetophila blanda*, Winn.
- Fig. 6. Labrum of *Bolitophila fusca*, Meig.
- Fig. 7. Mandible of *Mycomyia marginata*, Meig.

- Fig.* 8. Labrum of *Mycomyia marginata*, Meig.  
*Fig.* 9. Pleural sensory organ representing the remains of thoracic legs of *Mycomyia marginata*, Meig.  
*Fig.* 10. Maxilla of *Mycomyia marginata*. *m.x.*; *m.p.*, maxillary palps.  
*Fig.* 11. Maxilla of *Bolitophila fusca*, Meig.  
*Fig.* 12. Maxilla of *Mycetophila blanda*, Winn.  
*Fig.* 13. Antenna of *Bolitophila fusca*, Meig.

PLATE IV.

[All the figures of this Plate concern the larva and pupa of  
*Ditomyia fasciata.*]

- Fig.* 14. Larva of *Ditomyia fasciata*, viewed laterally.  
*Fig.* 15. Labrum, ventral side. *d.*, dental chitinous plate; *p.l.*, ventral plate.  
*Fig.* 16. Alimentary canal of the larva. *a.c.*, anterior cœca; *m.g.*, mid-gut; *M.*, Malpighian tubes; *o.e.*, œsophagus; *p.r.*, proventriculus; *s.g.*, salivary glands.  
*Fig.* 17. Maxillæ and labium of larva. *l.b.*, labium; *l.p.*, labial palps; *l.s.*, lateral sensory organ of the maxillary palp; *m.p.*, maxillary palp; *m.x.*, maxillæ; *t.b.*, transversal chitinous band of the cardo of maxilla; *s.h.*, sensory hair of the internal lobe of maxillæ.  
*Fig.* 18. Abdominal spiracle of larva.  
*Fig.* 19. Sensory organ—remains of thoracic leg.  
*Fig.* 20. Last pair of abdominal spiracles. *f.c.*, felt-chamber ("chambre feutrée"); *T.r.*, tracheal trunks; *s.c.*, external scar; *s.p.*, spiracles.  
*Fig.* 21. Prothoracic spiracle—the black surface represents the external scar of this spiracle.  
*Fig.* 22. Mandibula.  
*Fig.* 23. Antenna. *b.s.*, bell-shaped sensory organ; *p.*, biarticulated papilla.  
*Fig.* 24. Pupa, viewed laterally. *p.h.*, prothoracic respiratory horns.  
*Fig.* 25. Posterior end of this pupa, showing the hooks.

PLATE V.

[Figs. 26–34 concern larva and pupa of *Symmerus annulata.*]

- Fig.* 26. Larva of *Symmerus annulata*, viewed laterally.  
*Fig.* 27. Labrum of the larva. Letters as in fig. 15.  
*Fig.* 28. Pupa of *Symmerus annulata*.  
*Fig.* 29. Maxilla and labium of this larva. Letters as in fig. 17.  
*Fig.* 30. Sensory organ—remains of thoracic leg.  
*Fig.* 31. Mandible.  
*Fig.* 32. Antennæ. Letters as in fig. 23.  
*Fig.* 33. Abdominal spiracle.  
*Fig.* 34. Last abdominal spiracle.  
*Fig.* 35. Mandible of the larva of *Rhyphus fenestralis*.  
*Fig.* 36. Mandible of the larva of *Mycetobia pallipes*.  
*Fig.* 37. Antenna of *Mycetobia pallipes*.  
*Fig.* 38. Larva of *Mycetobia pallipes*, viewed dorsally.

V.—Description of a new Genus and Species of the  
Homopterous Family Cicadidæ. By W. L. DISTANT.

IN the Ann. & Mag. Nat. Hist. (ser. 9, vol. i. p. 196) I brought the number of recorded species of Cicadidæ from Indo-China to the total of 75. Mons. R. Vitalis de Salvaza, in his last consignment to the British Museum, has included the beautiful genus and species here described, and the number of known species from this rich district must now be recognized as 76.

AYUTHIA, gen. nov.

Head including eyes narrower than base of mesonotum, almost the length of pronotum; front obliquely depressed; ocelli considerably farther removed from eyes than from each other, and their interspace strongly, broadly, longitudinally foveate; pronotum distinctly shorter than mesonotum, laterally moderately convexly amplified where the extreme margin is coarsely serrated, the posterior marginal area moderately broad and at the lateral angles angularly truncate; abdomen in male longer than space between apex of head and base of cruciform elevation, the dorsal surface moderately oblique on each side; tympanal orifices concealed; metasternum elevated; opercula in male short and broad, extending beyond base of metasternum; anterior femora strongly spined beneath; rostrum reaching base of metasternum; tegmina and wings semiopaque, tegmina with eight apical areas.

Allied to *Tosena*, A. & S.

*Ayuthia spectabile*, sp. n.

♂. Head and pronotum black, moderately palely pilose; head with the eyes, ocelli, and intra-ocular suffusions, narrow anterior and broader posterior margins of pronotum castaneous, the latter with three prominent black spots; mesonotum castaneous, with two large central obconical spots at anterior margin, followed by a longer, but more imperfect spot on each lateral area, a central fasciate line, the anterior angles of the cruciform elevation and two spots in front of same, pale castaneous; body above black; body beneath castaneous with black suffusions; face castaneous, with the apical area black; tegmina with nearly basal half opaque creamy-white,

the venation pale castaneous, apex of basal cell, a curved linear fascia extending from base of upper ulnar area to base of lower apical area, and a spot at the apices of the ulnar areas and apical veins black; wings (excluding extreme apical area) opaque creamy-white, the veins narrowly pale castaneous; rostrum reaching base of metasternum; other structural characters as in generic diagnosis.

Length, excl. tegm., ♂ 40, ♀ 35; exp. tegm. 120 mm.

*Hab.* Indo-China (*R. Vitalis de Salcaza*).

A more precise habitat is yet to be received.

## VI.—Notes on the Asilidæ: Sub-division Asilinæ.

By GERTRUDE RICARDO.

THE Asilidæ of Australia having been to a certain extent revised and described in the Ann. & Mag. Nat. Hist. [ser. 8, ix. (April, May), x. (July, Sept.) 1912; xi., January, April, May 1913; ser. 9, i., January 1918], this paper is the beginning of an attempt to bring the Asilidæ of the Oriental and South African Regions into some order, and to name such new species as are to be found in the Brit. Mus. Coll. and others sent me by Mr. L. Peringuey from the Cape Museum. The genera *Machimus*, *Neoitamus*, and *Heligmoneura* are here dealt with. The types are all in the Brit. Mus. Coll., unless otherwise specified.

### MACHIMUS, Loew.

Linn. Ent. iv. 1, 3 (1849).

This genus has as yet only been represented in the Oriental Region by *Machimus coruscus*, V. d. Wulp, from Java, a species unknown to me, and by *Machimus atratulus*, Wlk., mentioned below.

The species described from the South African Region are *Machimus lepturus*, Gerst., from Zanzibar, and *Machimus caudiculatus* and *penicillatus*, Speiser, both from East Africa.

Ten new species are now described from India and Ceylon, and one from S. China. The South African Region is represented by one new species.

*Asilus atratulus*, Walker, from Java, is placed by Wulp in this genus, the type (a female) is in the Brit. Mus. Coll., but in such a bad condition it is impossible to decide even its generic rank. It is a small blackish-brown specimen.

Moustache black. Legs piceous. Wulp thought he identified this species among specimens from Java and says the genitalia are black.

*Asilus deformis*, Walker, from Arabia, the type, a female, is in the Brit. Mus. Coll., but, as in the above it is impossible to decide what genus it belongs to, it may possibly be included in the genus *Machimus*, and is certainly not in *Apoclea*, where it is placed in Kertesz's Catalogue.

*Machimus chinensis*, ♂ ♀, sp. n.

Type (male), June 1899, and type (female), 1906, 89, from Tinghae, China (*P. de la Garde*), and another male and female from the same locality.

A large blackish species, covered with yellowish-grey tomentum; tibiæ and tarsi reddish. Moustache yellow, a few black hairs above.

Length, ♂ 23, ♀ 28 mm.

*Male*.—*Face* covered with yellow tomentum; tubercle large, darker; moustache composed of yellow bristles and a few black ones above and down the sides. Palpi black with yellow hairs. *Antennæ* blackish, the first two joints with black hairs, some being very stout bristles, the third joint is as long as the first two joints together; the arista not quite so long as the joint. *Forehead* with black bristly hairs. *Thorax* covered with greyish-yellow tomentum and the usual dark stripes, the median one not divided, a dark rich brown in colour, the side ones olive-coloured. Præsutural bristles three, supra-alar bristles three, postalar bristles two, one is yellow; dorso-central bristles about ten in number; pubescence on dorsum short, black, with some longer hairs intermixed. *Scutellum* with four black bristles on its margin. *Abdomen* covered with yellowish-grey tomentum, with dark brown large spots on each segment, the segmentations paler; sides with yellow bristles, continued on to the dorsum; on the segmentations pubescence consists of short, thick, appressed, fulvous hairs. Genitalia black, with chiefly black pubescence; the eighth ventral segment is produced to a short point, clothed with chiefly yellow bristly hairs. *Legs* black; tibiæ and tarsi bright reddish yellow, a little darker at the apices; fore femora with six bristles below, one near apex and two at apex, the middle ones with five below and two near apex, the hind ones with four below and two long white ones at the extreme base, two black ones on the upper-side, two near apex, and two at apex; the pubescence on femora is short, yellowish, on tibiæ and tarsi black. *Wings*

large, clear, with a yellowish tinge; veins yellow, the small transverse vein beyond the middle of the discal cell.

*Female* identical, the bristles on thorax and scutellum almost entirely yellow; the short bristles on the hind femora below are seven, with three on the upperside; ovipositor short, black.

The femora in the other male and female are reddish yellow.

*Machimus assamensis*, ♂ ♀, sp. n.

Type (male) and type (female) from Assam (*W. F. Badgley*), 1906, 185.

A handsome black species with yellow pubescence, in general appearance somewhat similar to *Machimus dubius*, sp. n. Legs with few bristles, uniformly black, with some yellow pubescence. Moustache black and yellow.

Length 22 mm.

*Male*.—*Face* covered with yellowish tomentum; tubercle large. Moustache composed of black bristles above and bright yellow bristly hairs below. *Palpi* black, with black hairs. Beard bright yellow, thick hairs round head the same colour, mixing with the postocular black bristles. *Antennæ* blackish brown, the first two joints with black bristly hairs, third joint broken off. *Thorax* greyish yellow, almost entirely covered by the blackish-brown stripes; præ-sutural bristles three in number, supra-alar three, post-alar two, all black and very long and strong; the dorso-central bristles apparently ten or so in number, interspersed with long black hairs; pubescence on dorsum black. *Scutellum* with four black bristles on its margin. *Abdomen* greyish yellow, the usual blackish spot on each segment gives the abdomen a black appearance; pubescence at sides and on dorsum bright yellow; genitalia shining black, with black and yellow hairs; the eighth ventral segment produced to a long blunt point covered with black hairs and with yellow hairs at the sides. *Legs* black; femora stout with short white pubescence and longer white hairs below, no bristles on the first pair, only two or so on the middle pair, very long and strong, on the hind pair two below, four on the upperside and two at apex, fore and middle tibiæ with yellow short hairs, the hind pair with black hairs, all with black bristles, the fore and hind pair and metatarsi with a thick fringe of appressed fulvous hairs on under surface. *Wings* grey, only a streak of pale colour in the middle and



at the base, small transverse vein beyond the middle of discal cell.

*Female* identical, but the abdomen has some black pubescence on the dorsum.

*Machimus cærulescens*, ♂, sp. n.

Type (male) (201) from Bhim Tal, 18. 6. 1912; and another male from Binsar, 23. 5. 12 (Imms Coll.), Kumaon.

A species distinguished from the other species of *Machimus* from India by the blue-black colour of the abdomen. *Wings* deep brown, clear at extreme base. *Legs* black. Moustache yellow with a few black bristles.

Length  $18\frac{1}{2}$  mm.

*Face* covered with yellow tomentum; tubercle large, blackish, covered by a dense yellow moustache; the black bristles are above and at the sides. Beard yellow. *Palpi* black with black hairs. *Thorax* blackish brown with an indistinct median grey line; shoulders and sides covered with greyish-yellow tomentum; præsutural, supra-alar, and postalar bristles severally two in number, black; the dorso-central ones are apparently two on each side with black hairs, mostly short, but some long ones intermixed on the dorsum. *Scutellum* blackish with ashy-grey tomentum, which is also present on the posterior part of thorax; bristles on scutellum appear to be four in number, now broken off. *Abdomen* uniformly blue-black, with white segmentations on the second, third, and fourth segments, appearing again on the apical segments; pubescence black; genitalia black with black hairs, the eighth segment below produced to a blunt short point with long black hairs. *Legs* greenish black; the fore femora with black hairs, two or three being long and bristle-like; middle femora stout with a row of short bristles below and two longer, very stout ones on the sides; hind femora with four or more stout long ones below and black hairs; tibiæ with numerous stout black bristles and soft black hairs below; tarsi with the same, especially the first joints; some reddish-yellow, very short pubescence is visible on the undersides of the tibiæ. *Wings* with only the basal cells and part of the anal cell clear; small transverse vein oblique, beyond the middle of the discal cell.

*Machimus dubius*, ♂ ♀, sp. n.

Type (male) (177) from Dharmoti, 7. 6. 1912.

Type (female) (17) from Bhowali, 5700 feet, July 1909 (*A. D. Imms*), and others from Takula, all in Kumaon.

A large blackish species, not unlike *Machimus armipes*, Becker, judging from the description, found in the province of Beluchistan, Persia; but the bristles on fore femora are more than two in number and those on the scutellum only four or five, not ten as in Becker's species. In this species the typical characteristic of the genus, viz., the production of the eighth ventral segment, is not very conspicuous, which is apparently also the case in Becker's species.

Length, ♂ 20-23, ♀ 20-26 mm.

*Male*.—*Face* and tubercle covered with pale yellowish tomentum; moustache composed of stout, long, yellowish-white bristles, with two black bristles below at each side. *Palpi* black, with long black hairs. Beard whitish yellow, the hairs round the head similar, but becoming bristles half-way up. *Antennæ* blackish brown, the first two joints with black hairs, the third with a style about the length of the joint. Postocular bristles black and very stout. *Thorax* greyish yellow with the usual brown stripes, the median one hardly divided anteriorly; the dorsum of thorax covered with small, very short, black bristles, the large bristles all black; the præsutural, supra-alar, and postalar all two in number; the dorso-central bristles are about ten, disposed in two rows, a few long black hairs are intermixed with them. *Scutellum* with four or five very stout, long, black bristles and with fine yellow hairs. *Abdomen* with the usual large black-brown spot on each segment, leaving the segmentations yellowish grey; the first segment has a tuft of yellowish hairs at each side and two long black bristles below; the next four segments with yellowish short bristles at the sides, continued on to the dorsum as fine yellowish bristly hairs; the eighth ventral segment only slightly produced with some long black bristly hairs on its margin and a few white ones beyond. *Legs* black, with appressed whitish pubescence; femora all stout, the fore pair with three black bristles above and four below, the middle pair with about nine in two rows and four at the apex; the hind pair with six below and one or two long white bristles at the base, four above and two near the apex and three at the apex; the fore femora with long, fine, yellowish hairs below; the fore tarsi with black ones and with orange-red appressed pubescence underneath, which is also present, but paler in colour on the hind pair; both the middle and hind pair have black hairs below, not so long as those on the fore pair; all tibiæ and tarsi armed with stout black bristles. *Wings* clear, the shading on fore border and apex not very distinct; the

small transverse vein oblique, at about the middle of the discal cell.

*Female* is identical, the long pubescence on the legs not so marked; ovipositor black, not much longer than the preceding segment.

*Machimus hirtipes*, ♂, sp. n.

Type (male) from Khasi Hills, Assam (*A. Chevrolt*), 93, 135, and two damaged specimens (? ♂ or ♀) from the same locality.

A medium-sized greyish-yellow species, distinguished by the pubescence on the abdomen and by the long hairs on the legs, the femora being red with a black stripe on their inner sides, the tibiæ the same.

Length 20 mm.

*Face* with greyish-yellow tomentum; the tubercle darker, large; the moustache composed of numerous stout black bristles, with some yellow ones below. *Palpi* black with black hairs. *Antennæ* blackish brown, the first two joints with black hairs. Beard yellow. Hairs round head the same colour; occipital bristles black. *Forehead* with black hairs. *Thorax* covered with bright greyish-yellow tomentum, the median stripe dark blackish brown, the side-stripes paler in colour; pubescence on dorsum black, consisting of short hairs and longer ones intermixed with the long, stout, black bristles; præsutural bristles two, supra-alar two, postalar three, dorso-central about twelve. *Scutellum* the same colour, with six long black bristles on its margin and some short black hairs on its dorsum. *Abdomen* greyish yellow with a dark spot on each segment and the segmentations paler; yellow bristles on sides, and soft yellow hairs and shorter yellow hair on the dorsum; genitalia reddish, black at apex with chiefly black hairs; eighth ventral segment produced to a rounded broad point ending in black hairs; the whole segment is hairy, all the under surface of abdomen with yellowish hairs. *Legs* reddish with black stripes on femora and tibiæ; fore femora clothed with long yellowish hairs above and below; middle femora with fewer, and with two long bristles below and two at apex; the hind pair has bristles below and on the sides, and some long yellowish and black hairs; tibiæ with yellow hairs; tarsi with black pubescence; all bristles on the legs are black. *Wings* clear with grey shading on apex.

*Machimus indianus*, ♂ ♀, sp. n.

Type (male) from near Bhowali (Kumaon), 5700 feet, July 1909.

Type (female) from Sham Ket, near Bhowali, 15. 5. 1912.

Other specimens from Dharmoti, 5300 feet; Bhim Tal; Takula; Airades; Chaubattia; Sat Tal; all localities in Kumaon. May and June 1912.

One male from Thundiani, W. Himalayas, 9000 feet, 4. 7. 1907 (*Major H. A. Morgarth*), 1907, 273.

Two females and one male from Mussooree, U.P. (*T. E. Middleton*), 1911, 418.

A rather large black species with white bands on the abdomen. Moustache white. Fore femora with usually three bristles below. *Wings* shaded at apex, on fore border, and on posterior border, leaving only the centre of wing clear.

Length, ♂ 19-23, ♀ 19-22 mm.

*Male*.—*Face* covered with yellowish-grey tomentum; the tubercle large, blackish, covered by the long, strong, yellow bristles which form the moustache, with two black bristles below on each side. *Palpi* black, with black hairs. Beard white and thick; the hairs round head white, becoming bristles posteriorly. *Antennæ* blackish, the first two joints with black hairs, the third with a style two-thirds of its own length. *Forehead* with yellow short hairs on each side. Postocular bristles stout and black, curved forwards. Collar with chiefly yellow bristles. *Thorax* yellowish brown, the median stripe dark brown, with a very narrow pale line dividing it anteriorly. Præsutural bristles three, supra-alar two, postalar two, sometimes three, all very strong black ones; dorso-central bristles about ten. Dorsum covered with very small, black, appressed bristles, a few long black hairs between the dorso-central bristles. *Scutellum* same colour as thorax, with yellowish pubescence and four very strong marginal bristles turned upwards. *Abdomen* yellowish grey, with dark blackish-brown square spots on each segment, so that the abdomen viewed generally appears blackish, with the segmentations whitish yellow; the first segment is armed with numerous black bristles of different sizes, on the sides with yellowish ones, which are also present on the sides of most of the segments, advancing towards the centre of dorsum on the anterior segments; short yellowish hairs are intermingled with these and continued above the hind margins of segments; underside with long weak white hairs; genital organs large, black, with short yellowish pubescence; the eighth

segment is produced ventrally to a short point armed with long black hairs, six or more in number. *Legs* uniformly blackish; the coxæ with long bristle-like yellow hairs; the femora stout with short white pubescence; the fore femora armed with usually three bristles below, very occasionally four are present, and with three above; the middle femora with about nine in three rows, two more near the apices, and two at the apex; the hind femora with sixteen or so bristles in three rows, two more near the apices, and four at the apices; tibiæ with strong bristles above and below, the tarsi also with very many strong bristles; tibiæ and tarsi with the same pubescence as the femora, all bristles black; femora and tibiæ have also long white hairs below, thickest on the front ones; the fore tibiæ and the hind tibiæ have deep orange-red pubescence on their lower outer edges; the first joints of tarsi on fore and hind legs have the same-coloured pubescence on their under surface.

*Female* identical. The fore femora with often only two bristles at the apex, the three above are very often absent, and the hind femora often have only three at the apices. The ovipositor is black with black hairs, not much longer than the last segment.

*Machimus khasiensis*, ♂ ♀, sp. n.

Type (male) and type (female) from Lower Ranges, N. Khasi Hills, Assam, 1878 (*A. Chennell*), 96, 135.

A species very similar to *Machimus hirtipes*, sp. n., but distinguished by the wholly black legs.

Length 17 mm.

*Male*.—Stripes of *thorax* are probably not so distinct, the median stripe not so dark; præsutural bristles three, supralar three, postalar two. *Abdomen* greyish yellow, the dark spot on each segment not very distinct; pubescence as in *M. hirtipes*; genitalia wholly black, the eighth ventral segment the same, but the hairs on the long projection are only black above, yellow and long below. *Legs* blackish; the fore femora with only three bristles above and long yellow hairs below, the mid-femora with three and two at apex, the hind femora with three above and three below in the female, but apparently fewer in the male, a few pale bristles are present; pubescence on femora short and yellowish, the same on the tibiæ, which have also thick appressed fringes of rufous hairs on their under surfaces. The species is distinguished from *Machimus nigritus*, sp. n., by the paler colouring of the abdomen and its thicker

pubescence and by the longer, more pointed eighth ventral segment.

*Machimus montanus*, ♂ ♀, sp. n.

Type (male), type (female), and others from Kotagiri, Nilghiri Hills, 6000 feet (*F. M. Cragg*).

A small greyish species, very similar in appearance to the European *M. atricapillus*, but at once distinguished from it by the eighth ventral segment, which is not two-horned. *Legs* black with reddish stripes, all the bristles black.

Length, ♂ 13-14, ♀ 15 mm.

*Male*.—*Face* covered with greyish tomentum; the tubercle blackish, large, covered with the black moustache, which is composed of very strong black bristles with weaker white ones below. *Palpi* black, with black bristly hairs. Beard and hairs round head white. The postocular bristles stout, black, curved forwards. *Forehead* blackish in the centre, greyish yellow at the sides with a few black hairs and two or three white hairs. *Antennæ* blackish brown, with black bristly hairs on the first two joints. *Thorax* yellowish grey with the median blackish-brown stripe very distinct, becoming a little narrower posteriorly; sides with paler-coloured, broad, interrupted stripes, not extending far beyond the suture; dorsum of thorax with small black bristles; two very strong præsutural bristles, two supra-alar, and three postalar, all very strong; the dorso-central ones number about twelve, with weaker ones intermixed, only two being præ-sutural. *Scutellum* yellowish grey, with some weak yellow and black bristles and with four large black marginal bristles curved forwards. *Abdomen* brownish grey or blackish grey, the segmentations lighter; the dorsum covered with very small, depressed, black bristles, and with longer yellow hairs at the sides. Genitalia reddish, the claspers blackish at apices; pubescence yellowish; the eighth ventral segment produced, ending in a point with long black hairs which extend to the sides, on its inside it is reddish yellow in colour.

*Legs* blackish; the femora reddish on their outer sides; tibiæ only black on their undersides; tarsi reddish, apices black; femora and coxæ with long white hairs, thickest on the fore pair, the middle pair with four strong bristles in the middle and two at their apices, the hind pair with three near the apices and two or more nearer the base and others beneath; the tibiæ with numerous long black bristles and with some weak yellowish hairs, which are long on the front

pair on the under surface; tarsi with similar long black bristles. *Wings* hyaline, grey on fore border and at apex, with grey streaks in the posterior cells, the small transverse vein barely beyond the middle of the discal cell.

*Female* identical, but the moustache is entirely black; ovipositor black, compressed, about the length of the two preceding segments together; abdomen with the pale segmentations more distinct and wider.

*Machimus nigrinus*, ♂ ♀, sp. n.

Type (male) (160), type (female) (148), and a series of both males and females from Bowdali, 5700 feet, July 1909; Khati, 7650 feet, 30. 5. 09; Bhim Tal, 18. 6. 12; Binsar, 28. 5. 12; Takula, 27. 5. 12; Airades, 1. 6. 12; Chaubattia, 13. 6. 12; all localities in Kumaon.

A small blackish species, distinguished from *Machimus montanus* by the wholly black legs and from *Machimus indianus* by the absence of bristles on the underpart of the fore femora. Abdomen blackish with greyish segmentations. Moustache black and white.

Length, ♂ 14-17, ♀ 13-17 mm.

*Male*.—*Face* covered with yellowish-white tomentum; tubercle large, blackish, covered with black stout bristles and long white bristles intermixed on the lower part, all forming the moustache. *Palpi* black with black hairs. Beard and hairs round head white. *Antennæ* blackish, the first two joints with black hairs, the third with a style about two-thirds of its length. *Forehead* blackish with black hairs, postocular bristles black. *Thorax* yellowish brown, the median stripe blackish brown, with a very fine dividing-line anteriorly, the side-stripes the same colour; præsutural bristles two in number, two supra-alar bristles, two postalar bristles, and about six dorso-central stout bristles, many fine bristles or hairs intermixed with them. *Scutellum* with six marginal bristles. Dorsum of thorax covered with short black bristles. *Abdomen* greyish, with a large brownish-black spot on each segment, not attaining the posterior border; sides of segments with weak yellowish bristles. Genitalia large, black, with chiefly black pubescence; the eighth ventral segment produced considerably, but not to a point, fringed with black hairs, at the sides they become sparse and yellow. *Legs* black, covered with greyish short pubescence; the fore femora with long black hairs below, no bristles; two very strong bristles near apex, middle femora with two very stout bristles at the apices, two or more on

upper border at sides, below only black bristly hairs are present; posterior femora with four black bristles below, two at the apex, and four on the upper border, all bristles on the legs are black; the fore tibiæ with a regular row of black bristles all the same size above and some soft hairs intermixed, other stronger bristles below; fore tibiæ and tarsi, also the posterior tibiæ and tarsi, clothed below with short rufous pubescence. *Wings* clear, shaded brown on the fore border, at apex, and in the centre of the cells on the posterior border.

*Female* is similar. Ovipositor black, barely the length of the last two segments.

*Machimus parvus*, ♂ ♀, sp. n.

Type (male) and four other males.

Type (female) and three other females, all from Kotagiri, 6000 feet, Nilgherri Hills (*F. M. Cragg*). Males and females from Trincomalee, Dambula, Ceylon (*Yerbury*); and from Horaweputone, Mahaganay, and Kenaratyodes, Ceylon; one female from Biserat, Siam (*H. C. Robinson and N. Annandale*), 1910, 21.

A small species distinguished by the bright red genitalia of the male, and in both sexes by the bristles on the abdomen being almost entirely black, and by the absence of any real bristles on the fore femora. Abdomen black with yellowish segmentations. Legs black.

Length, ♂ 9-10, ♀ 10-11 mm.

*Male*.—*Face* with yellowish tomentum; tubercle very large, covered with stout black bristles and a few white weak bristles appearing below, all comprising the moustache. *Palpi* black with black hairs. Beard yellowish. *Forehead* with black hairs. *Antennæ* blackish brown, the style of third joint barely more than half the length of joint. Postocular bristle black. *Thorax* greyish with blackish-brown stripes, the median divided by a fine line anteriorly. Presutural bristles two in number, supra-alar two, postalar two; dorso-central bristles about twelve, in two rows extending beyond the suture; dorsum of thorax with short black hairs. *Scutellum* with four very long bristles. *Abdomen* greyish, the first segment blackish, the second and third segments each with a large black spot having only the anterior and posterior borders grey, the fourth and fifth with similar spots, but only the posterior borders greyish, the remaining segments chiefly grey; all the bristles and hairs on sides black; genitalia large, bright red, shining, with some black



hairs; the eighth ventral segment produced, with a fringe of black hairs. *Legs* black; all the femora with long black hairs below, sometimes rather bristle-like; the middle femora with three bristles at the apex and one near the apex, the posterior pair with four on the upperside, two at the apex, and two near the apex; tibiæ and tarsi with strong black bristles; the tibiæ on their outer edges with a fringe of fine, short, whitish hairs, continued on the first two joints of tarsi, this fringe is most noticeable on the hind pair of legs. *Wings* clear, the usual shading very faint, the small transverse vein just before the middle of the discal cell or sometimes beyond it.

*Female* is similar. Ovipositor black, about the length of the last two segments.

*Machimus tibialis*, ♂ ♀, sp. n.

Type (male) (216) from Dehra Dun, U.P., 3. 4. 1912.

Type (female) (218) from Dehra Dun, U.P., 1. 4. 1912; and others from same locality and Bhowali, Kumaon, 5700 feet, July 1909, all from Inms Coll.

A small species with reddish-yellow tibiæ and some of the femora with a reddish-yellow stripe on the inside. Abdomen greyish yellow, with paler segmentations. Moustache black and white.

Length, ♂  $13\frac{1}{2}$ , ♀ 15-17 mm.

*Male*.—*Face* with grey tomentum; tubercle fairly prominent. Moustache composed of bristly white hairs, with black ones above and at sides. *Palpi* black with black hairs. Beard white. *Antennæ* blackish brown, the second one reddish, both with black bristly hairs below and whitish short hairs above, the third with an arista two-thirds of its length. *Forehead* with black hairs. Hairs round head whitish, the postocular bristles black. *Thorax* greyish yellow with the usual stripes; the præsutural bristles, the supra-alar, and postalar all two in number, black; the dorso-central bristles about eight in number, all accompanied by some long, fine, black hairs. *Scutellum* paler with pale yellowish pubescence and with six long bristles on its margin, some of these being yellowish. *Abdomen* greyish yellow, with a large dark spot on each segment; the segmentations lighter, the first three segments with whitish weak bristles on their sides; a few white hairs are visible on the sides of the others and on the segmentations of the last two segments; pubescence on dorsum very short, black; genitalia blackish above and reddish below, with chiefly

black pubescence; the eighth ventral segment small and very slightly produced, fringed with fairly long pale hairs. *Legs* yellowish; the femora blackish on their outer sides, all covered with short white pubescence; the fore femora with only soft yellowish hairs above and below, the middle pair with at least four black bristles and two at the apex, soft yellow hairs below, the posterior pair with four bristles below, one above, two near apex and two at the apex, and soft yellow hairs below; tibiæ with chiefly black pubescence on the first pair and a fringe of appressed reddish hairs on under surface; on the other tibiæ it is chiefly whitish, all with numerous black bristles. *Wings* clear, shading at apex and on posterior border faint, the small transverse vein is just beyond the middle of the discal cell.

*Female* is identical, the bristles on the scutellum only four in number; ovipositor short, blackish; femora more largely black on their outer sides, and the tibiæ have also a black streak; the tarsi blackish at their apices; some of the bristles on legs are yellowish. The male is very probably immature, so that others may be found with the femora as in the female.

*Machimus ugandiensis*, ♂ ♀, sp. n.

Type (male) and another from Mpanga Forest, Toro, 4800 feet; Uganda, 13-23 Nov., 1911 (*S. A. Neave*), 1912, 193; other males from Uganda Protectorate S. of Lake George, 3200-3400 feet, 17-19 Oct., 1911; from Dara or Durro Forest, Toro, 4000-4500 feet, 25-29 Oct., 1911; and from Buamba Forest, Semliki Valley, 2300-2800 feet: all by the same collector.

Type (female) from Mpunga Forest, others from Mabira Forest, Chagwe, 3500-3800 feet; from Buamba Forest, from between Seziwa River and Kampala, 3500-3750 feet; from Western Ankola, 4500-5000 feet, 10-14 Oct., 1911; and from Brit. E. Africa, edge of forest on S. and E. slopes of Kenya, 6000-7000 feet: all by the same collector.

This species is apparently nearly allied to *Machimus caudiculatus*, Speiser, from German E. Africa, but the description of the latter (not a very full one) describes the legs as yellowish grey on the fore tibiæ and tarsi and on the whole hind legs, being covered with close-lying yellow pubescence—in this species the legs are black and not clothed with these lighter hairs.

Length, ♂  $14\frac{1}{2}$ -16, ♀ 15-17 $\frac{1}{2}$  mm.

*Male*.—*Face* with golden-yellow tomentum. Moustache

on large tubercle composed of stout black bristles and a few weaker yellow ones below. *Palpi* black with black pubescence. Beard pale yellow. Proboscis clothed with pale yellow on its under surface. *Antennæ* black; the first two joints with black hairs and bristles, the third bare, the second is two-thirds the length of the first; the third is almost as long as the first two joints together, with a terminal bristle nearly as long as itself. *Forehead* same colour as face, with black hairs. *Thorax* with a median and side stripes deep black in colour, the rest of the dorsum is clothed with golden-yellowish tomentum and with short black hairs. Præsutural bristles three, supra-alar two, postalar two; the dorso-central bristles numerous, reaching the suture, all are stout and black, interspersed with smaller, finer, bristle-like hairs. *Scutellum* the same golden yellow as thorax or rather paler with short black pubescence and with four very stout black bristles on its posterior border. *Abdomen* blackish, showing traces of yellowish, or grey, or brown tomentum, with bright yellow hairs on the posterior borders of segments, which become longer and more like bristles at the sides: the dorsum elsewhere with fine black pubescence; underside greyish yellow, with yellow pubescence. Genitalia large and prominent, black with black hairs; the last segment on the underside with a finger-like stout process clothed with black hairs, which are thick at the tip, it is almost twice the length of the usual width of the segment. *Legs* deep black, with black bristles; the coxæ and the fore femora below with bright, soft, yellow, long hairs; the other femora with only short yellow pubescence on their upper and lower borders and with short black bristles and longer ones below which are sometimes yellow on the hind pair; the fore tibiæ also with long yellow hairs not so numerous, and with black and some yellow bristles, the black bristles on the outer side are very long, two or more in number; the middle tibiæ have not these, but yellow and black bristles of ordinary size and with some short yellow pubescence on their outer borders, the hind pair with black pubescence and bristles, and reddish or yellowish fringes of short hairs below on each apical border; the tarsi with black hairs and bristles, the first joint of hind pair with reddish or yellowish fringes in some of the specimens. *Wings* clear, grey at apex and on posterior border, leaving only the base and centre of wing clear; the small transverse vein this side of the middle of discal cell.

*Female*.—The yellow hairs on moustache are much less numerous, the yellow beard in both sexes is very thick and

continued round head; ovipositor short, not including the sixth or seventh segments. Fore femora with not so many yellow hairs below and with some darker ones intermingled, more bristle-like in two of the specimens; the bristles on scutellum are more numerous.

NEOITAMUS, Ost.-Sack.

Cat. Dipt. N. Amer. ed. 2, 82 & 235, 134 (1878).

*Itamus*, Loew, Linn. Ent. iv. 847 (1849).

This genus is represented in the Oriental Region by the following species: *Neoitamus griseus*, Wied; *Neoitamus longistylus*, *philus*, Wlk.—the former of these two includes six synonyms, see below.

*Neoitamus javanensis*, De Meijere; *Neoitamus spinicauda* and *melanopygus*, V. d. Wulp. Of these only *N. griseus* and *N. philus* are recorded from India and Ceylon. Nine new species are here described from India and surrounding districts, one from the Philippines, and one from Tientsin, S. China. From the South African Region only *Neoitamus armatus*, Becker, *podagricus*, Bezzi, and *N. sodalis*, V. d. Wulp from Arabia have been described. Two new species are now described.

All the species are fairly typical of the genus, with the exception of *N. pulcher* from Ceylon and *N. philus*, Walker.

*Neoitamus griseus*, Wied.

Dipt. Exot. p. 192 [*Asilus*] (1821); Wulp, Tijd. v. Ent. (2) vii. (xv.) p. 246 [*Itamus*] (1872). For other references see Kertész's Cat.

This species has been redescribed by Wulp, but unfortunately he does not specify very accurately the bristles on thorax and legs, and I have not been able to identify it with certainty, though a series from Ceylon in the Brit. Mus. Coll. may be this species, which is said to be about 20 mm. long, the femora having a black stripe on their upper border, otherwise they are reddish yellow.

*Neoitamus philus*, ♀, Walker.

List. Dipt. ii. p. 393 [*Asilus*] (1849), et vii. Suppl. 3, p. 725 [*Asilus*] (1855); V. d. Wulp, Tijd. v. Ent. xli. p. 145 [*Itamus*] (1898), et xlii. p. 55 [*Itamus*] (1899).

Type (female) from Silhet, 45, 107.

Females from Khasi Hills, Assam (*F. W. L. Sladen*), purchased from Doncaster, 98, 202; from Khasi Hills, purchased from E. Heyne, 97, 82; and collected by A. Chennell,

96, 135; from Sikhim, June 1895, 2000 feet (*J. G. Pilcher*), 97, 120; Taungu, 11, 89 (Bingham Coll.); Hanugtharaw River, Tenasserim, Burma, Feb. 1890 (*Col. C. F. Bingham*), 96, 282.

An easily recognized species, not at all typical of the genus, however; *thorax* and *scutellum* covered with bright reddish-yellow tomentum; the short black *abdomen* has some same-coloured tufts of hairs on the first segment, elsewhere the pubescence is black; the ovipositor including the sixth and seventh segments is nearly as long as the rest of the abdomen. *Legs* reddish yellow; the base of femora and knees black. *Wings* large with yellow veins, shaded grey at apex and narrowly so on the posterior border.

Length 27 mm.

*Neoitamus longistylus*, Wied.

Ausszweifel. Ins. i. p. 433 [*Asilus*] (1823). For other references see Kertész's Cat.

*Itamus latro*, Dol.

? *Asilus terebatus*, Macq.

*Itamus involutus*, Wlk.

*Itamus normalis*, Wlk.

*Itamus dipygus*, Schiner.

*Itamus dentipes*, Wulp.

*Asilus vertebratus*, Wulp.

Wiedeman's species was described from New Guinea and the Indian Archipelago; to the synonyms given by Kertész I have added Walker's species *involutus* described originally from Ternate, *normalis* from the same place, and *dipygus*, Schiner, which was only distinguished by him from *involutus* by the colour of the tarsi, which were black in his species, not red as in Walker's species, and the dark colour of the wings was more diffused.

These are all apparently identical with Wiedemann's species—or, at the utmost, local varieties.

There are specimens of the species in the Brit. Mus. Coll. from Ternate, New Guinea (see Austen, Trans. Zool. Soc. London, xx. (13) p. 405, 1915), Gilo'o, and Batjan; also from Nantauri, Central Group, Nicobar Islands; Dinding, Siam; and Biscrat, Siam—so that it appears to be a widely diffused species.

A handsome large species with tufts of golden hairs on the black *abdomen*. Male genitalia large and complicated, black with black hairs. Female ovipositor very long, almost as long as the other segments together; it includes the sixth and seventh segments. *Legs* are yellowish;

the femora at base and the knees black. Fore femora devoid of bristles, but with long soft black and white hairs below, the middle and posterior femora with a few black bristles and with short reddish-yellow pubescence; the tibiæ also have to a lesser extent long fine hairs below and some black bristles. Beard yellowish.

Length, ♂ 20-23, ♀ 25-27 mm.

For a more detailed description, see Schiner.

*Neoitamus ceylonicus*, ♂ ♀, sp. n.

Type (male) from Malay Cove, Ceylon, 3. 3. 92.

Type (female) from Trincomalee, Ceylon, 24. 2. 91 (*Lt.-Col. Yerbury*), 1892, 192.

A small species very similar in appearance to *N. inornatus*, sp. n., but distinguished by the pubescence and bristles on the legs and absence of bristles on fore femora.

Length, ♂ 13, ♀ 15 mm.

*Male*.—Moustache is almost wholly black, a few white hairs only present. Præsutural bristles are black and three in number, two supra-alar, three postalar, all black; the dorso-central bristles more numerous, all black, with fine, long, black hairs intermingled, and a *Machimus*-like crest of fairly long hairs on anterior median line of thorax reaching the dorso-central bristles; *scutellum* with four very long black bristles, also intermingled with fine, long, black hairs. *Abdomen* bluish black in colouring, with the same design as in *Neoitamus inornatus*; the bristles at sides chiefly black; genitalia stout, black, and shining, with black pubescence. *Legs* blackish; the tibiæ reddish yellow, black at apices; tarsi with the first joint reddish yellow, the remaining joints black; the fore femora have no bristles, but long black hairs on underside and a few silvery-white hairs on outer side; the middle femora with the same, but short black bristles are present on the uppersides and one at apex; the hind femora are the same; the fore tibiæ have conspicuous, very long, black hairs on the outer side intermingled with shorter ones, and three short weak black bristles on upperside of the base; pubescence short and black; the middle and hind tibiæ with short black hairs, strong black bristles, and black pubescence, on the hind pair rufous below; tarsi with all the numerous bristles black.

*Female* is dirty and not in good condition, but appears identical, the ovipositor including the sixth and seventh segments of abdomen.

*Neoitamus grandis*, ♀, sp. n.

Type (female) and three other females from Blowali, Kinnamon, 5700 feet, July 1909 (*A. D. Imms*).

A species rather similar in appearance to *Neoitamus longistylus*, Wlk., but distinguished at once by the black femora. *Abdomen* brownish, densely covered with yellowish-grey tomentum and yellow pubescence. Moustache yellow. *Legs* reddish yellow; femora partly black.

Length about 22 mm.

*Face* covered with greyish-yellow tomentum and with some yellow hairs at sides; tubercle very large, covered with the moustache, which consists of long, yellowish-white, bristly hairs. *Palpi* black with yellow hairs. *Antennæ* blackish, the first two joints with black hairs. *Forehead* brighter-coloured than face, with some black hairs. Beard yellowish white, the hairs round head the same colour till they reach the black occipital bristles. *Thorax* covered with yellowish tomentum (type is denuded) and with the usual brown stripes, the median one large, not divided. Præsutural bristles three, stout, black; supra-alar bristles three, postalar bristles four; dorso-central bristles about twelve in number, in the type some of the bristles near wings are yellowish; pubescence on dorsum black. *Scutellum* with greyish-yellow tomentum and four stout bristles on margin, yellow in the type, black on the others; some long yellow hairs on dorsum. *Abdomen* with the five first segments yellowish; the ovipositor composed of the last three segments is blackish. *Legs* reddish yellow; the fore femora with a broad black stripe on their upperside in the type, in the other females wholly black; no bristles below, but one black one on the inner side at apex, and long black bristly hairs at the base on underside, some of these are almost as stout as bristles; middle tibiæ incrassate, with numerous black bristles on their lower sides and some yellow ones on their outer sides, two yellow ones near apex, sometimes black; hind femora with two yellow ones near apex, one black one inside near apex, and black bristly hairs below; the pubescence on femora chiefly yellow; tibiæ reddish yellow with black bristles and black pubescence, some fulvous hairs below; tarsi reddish, black at the apices, with many black bristles. *Wings* large, clear, veins reddish, the small transverse vein at about the middle of the discal cell.

*Neoitamus hindostani*, ♂ ♀, sp. n.

Male (type) from Dharmoti, Kumaon, 8. 6. 1912.

Female (type) from same locality, 9. 6. 1912; and other males and females from Shum Ket, 15. 5. 1912; and Bhowali, July 1909, and 20. 6. 1912 (Imms Coll.).

A typical, well-defined, medium-sized species, yellowish grey in colour with dark brown spots on the abdomen, and stripes on the thorax; tibiæ reddish yellow. Moustache yellowish.

Length, ♂ 17, ♀ 19 mm.

*Male*.—*Face* silky yellowish, tubercle darker. Moustache thick, yellowish. Beard yellowish. *Palpi* black, with yellow hairs. *Antennæ* blackish brown, the first two joints with black hairs, the arista of third joint as long as the joint. *Forehead* darker than face with some black hairs. The hairs round head pale yellowish, meeting the postocular bristles, which are black. *Thorax* with the usual black-brown stripes; præsutural bristles four, two large and two smaller; supra-alar three, postalar three to four; dorso-central bristles ten to twelve, not so stout, long fine black hairs are intermixed with these, and the pubescence on the dorsum is short, black. *Scutellum* with five to seven black bristles on its margin and long yellow hairs on its dorsum. *Abdomen* ashy grey, covered by a large dark brown spot on each segment; the segmentations paler, the first segment with many long yellow hairs and a few yellow bristles; these are continued on the sides of the other segments, with about four stout yellow bristles on the posterior border at side of each segment, as far as the fourth segment. Genitalia large, black, a little red below, with black pubescence. *Legs* black, the tibiæ yellowish red, darker at their extreme apices; the fore and mid coxæ with dense white hairs; the fore femora with white short pubescence and some long, fine, black and yellow hairs below; the middle femora with four rows of short stout bristles at the base below and on the sides, and two or more weak yellow bristles at the apex; the hind femora with four yellow short bristles on the upper side and two near the apex, two weak small black ones at apex, below are long yellow hairs and weak yellow bristles with one or more black bristles intermixed; tibiæ and tarsi with black bristles, the tibiæ with pale yellow short pubescence on the sides, the middle and hind pair with black pubescence on the inner sides; the fore tibiæ with two or three long, weak, black bristles. *Wings* clear, the grey



shading at apex and on hind border not very distinct, but extending down the fore border as far as the junction of the second and third veins; the small transverse vein is just beyond the middle of the discal cell or at the middle.

*Female* identical. The hind femora appear to have only two or three yellow bristles on their uppersides. The ovipositor consists of the last three segments and is black with chiefly black pubescence.

*Neoitamus inornatus*, ♂ ♀, sp. n.

Type (male) and type (female), from Mussoree, U.P., India (*J. E. Middleton*), 1911, 448.

One female from Punjab (*Dudgcon Coll.*), 1904, 232.

A small inconspicuous-looking species. Abdomen blackish with segmentations and sides grey. Legs blackish; tibiæ and tarsi largely yellowish. Beard black and white. Fore femora with some bristles.

Length, ♂ 14, ♀ 16 mm.

*Male*.—*Face* blackish with grey tomentum; the tuberele large shining black, carrying a thick, tuft-like, white moustache surrounded by black bristles. *Palpi* black with black bristles. Beard white. *Antennæ* broken off, in the other female they are blackish, the base of the third joint reddish yellow. *Forehead* with black bristly hairs, the hairs round lead white, with strong black bristles at vertex on each side of the frontal incision. *Thorax* covered with greyish tomentum, having a very distinct median black stripe divided in the middle and with three blackish spots forming side-strips; the pubescence is short and black. Præsutural bristles are four, three being yellow; three supra-alar bristles, four postalar bristles; the dorso-central bristles are numerous but weak, many being yellowish, weak, bristle-like hairs. *Scutellum* covered with grey tomentum and with some long white pubescence, and three or four black bristles on its posterior border. *Abdomen* covered with greyish tomentum, leaving a large blackish-brown spot on each segment, rounded at their posterior border; on the side of each segment are two or more strong yellow bristles and long white hairs; on the dorsum the pubescence consists of very short yellowish hairs, more numerous and longer and paler on the first segment. *Legs* blackish; the femora at their apices yellow; tibiæ yellow with apices black; tarsi yellowish with black apices; fore femora incrassate, with three short yellow bristles at base below and a few black small bristles round the apex; pubescence blackish with some white hairs, all

short; the middle femora with three or four yellow bristles above and six or so below, pubescence of short black hairs, the posterior pair with more numerous yellow bristles above and below; the fore tibiæ with yellow bristles on each side and short black hairs; the middle tibiæ with the same, but two on the underside are longer and stouter, and those on the hind pair are stout and numerous; the tarsi with numerous black bristles, some yellow ones on the first three joints of the front and middle tarsi. *Wings* (absent). *Genitalia* very short and stout, black.

*Female* is identical, the white hairs of moustache largely replaced by black bristles. *Thorax* with the same number of bristles, though only three præsutural bristles seem present, two or three of them being yellow; on the other female some of the alar bristles are yellow. *Abdomen* rather blacker, the ovipositor including the sixth and seventh segments is long, more than half the length of the other segments together. The bristles on the underside of fore femora are largely black, on the tibiæ black and yellow, on the tarsi chiefly black. *Wings* clear, very faintly shaded at apex and on posterior border, the small transverse vein this side of the middle of the discal cell.

*Neoitamus nigrinus*, ♂ ♀, sp. n.

Type (male) and type (female), from Cape Engano, North Luzon (*J. Whitehead*), 98, 207.

This handsome species must be allied to Wulp's species, *N. spinicauda* and *melanopygus*, both from Celebes. It is deep black, the male with silvery-white tufts of hair on the last two segments of abdomen, and the female has a reddish-yellow ovipositor.

Length, ♂ 20, ♀ 22 mm.

*Male*.—*Face* black with golden-yellow, tomentum chiefly on its lower part. Moustache golden yellow below, black above. *Palpi* black with black hairs. *Antennæ* blackish, the third joint dull rufous. *Forehead* with black hairs; at vertex black bristles round the head continued as yellow hairs to the proboscis. *Thorax* black with traces of three grey tomentose stripes, sides with a dull yellow tomentose stripe. Præsutural bristles two in number, (?) one supra-alar bristle, three postalar bristles, and very many black long hairs represent the dorso-central bristles. *Scutellum* black with black hairs and four or more black bristles on its posterior border. *Abdomen* deep black with black pubescence, which is thick at the sides and on the segmentation; the

hairs on the sixth segment are tuft-like and yellowish, those on the seventh segment shorter, whiter, and less numerous, not tuft-like. Genitalia stout, complicated, black, with black pubescence. *Legs* black, the fore and middle tibiæ dull rufous; femora appear devoid of bristles, but have black pubescence, thick on the hind pair; the tibiæ have black bristles and black hairs, the latter long below, and some rufous short hairs are present on the fore and middle pair; tarsi black with black bristles and black hairs. the first joint incrassate and long, very heavily armed with black bristles. *Wings* yellowish grey, shaded grey at apex and on posterior border, the small transverse vein this side of the middle of discal cell.

*Female* is identical, but has no pale hairs on the sixth and seventh segments of abdomen; the ovipositor is reddish yellow, including the sixth and seventh segments, and as long as the three last segments together, at its apex with a few weak, yellow, short spines and hairs. *Wings* are more yellow in colour.

*Neoitamus pulcher*. ♂ ♀, sp. n.

Male (type) from Kandy, Ceylon, 20. 5. 92. (*Lt.-Col. Yerbury*), 1892, 192.

Female (type) from Haragam, Ceylon, 1. 6. 92. (*Lt.-Col. Yerbury*), 1893, 192; and another female from Kandy, 20. 5. 92 (*Lt.-Col. Yerbury*), 1892, 192.

A large fine-looking species with reddish-yellow antennæ and legs. Abdomen black with narrow reddish-yellow bands in the male and yellowish bands in the female. Wings shaded at apex and on hind border.

Length, ♂ 22, ♀ with ovipositor 25 mm.

*Male*.—*Face* chamois-yellow, with tomentum of same colour. Facial tubercle very large, carrying the moustache composed of stout yellow bristles, four or more black bristles above the mouth on each side. *Palpi* reddish brown with yellow hairs. *Antennæ* pale yellow, the second joint redder, the third joint wanting, black hairs on sides of the first joint which is fully four times as long as the second joint, the black hairs are also present on this joint. Hind part of head with yellow bristle-like hairs, continued as soft hairs to proboscis and below it. *Thorax* blackish brown with yellow-grey tomentum, the median stripe very distinct, continued just beyond the suture where it splits in half. Præ-sutural bristles apparently two, one being reddish, the other black; supra-alar bristles apparently two and both black;

postalar bristles two, one being black, the other reddish; dorso-central bristles not apparently present, with the exception of a few weak, bristle-like, reddish hairs which are also present on sides posteriorly. *Scutellum* reddish, darker anteriorly, with two or more weak reddish bristles. *Abdomen* blackish brown with narrow fulvous bands; dorsum covered with yellowish tomentum and with short reddish-yellow hairs, which on the anterior borders of the fulvous bands become more like short bristles redder in colour; sides of thorax with one long yellowish bristle on each segment interspersed with long yellow hairs; underside blackish brown with the fulvous bands, almost bare of pubescence. *Genitalia* blackish brown, about as long as the last segment. *Legs* reddish yellow, the knees blackish. Fore and middle femora with eight or more black bristles below and three stout ones on their upper inner sides; hind femora with only two black bristles and reddish hairs below, two dark reddish bristles above near the apex; tibiæ with one or two isolated reddish-yellow bristly long hairs and with yellowish hairs below; tarsi with stout black and reddish bristles; pubescence on legs short, black. *Wings* large, as long as the abdomen, greyish; the dark shading distinct, extending nearly to the fork of the third vein and continued on the posterior border to the fifth posterior cell; the posterior fork of third vein has an abrupt curve inwards; the small cross-vein is beyond the middle of the discal cell.

*Female* identical. The bristles near the mouth are yellow, not black. *Antennæ* with the third joint yellowish, not so long as the first joint, bearing a black arista almost twice its length. All the bristles on *thorax* are black; the dorso-central bristles are fairly numerous, but many of them are weak, short, bristle-like hairs. *Scutellum* is almost wholly reddish yellow, with black bristles. The light bands on the *abdomen* are yellower; the ovipositor is black, composed of the seventh and following segments, about as long as the fifth and sixth segments together. Fore femora with only four very strong black bristles, situated on the underside and interspersed with weak long black hairs, these are also present on the middle femora, with seven more on the upperside; on the hind femora five bristles below and eight on the upperside, besides two at apex; the fore and middle tibiæ have three very long, strong, black bristles on the underside and a few shorter stout ones above; the hind tibiæ have one near the base and two pairs beyond, with two weak hair-like bristles on the outer side; the pubescence on the underside of tibiæ and on the dorsum is yellow, elsewhere on the legs

short and black; the first joint of the tarsi has thick yellow hairs on the under surface. The shading of the wings at apex does not extend quite so far.

This species differs from the typical species of the genus, the ovipositor including only the seventh segment, not the sixth, and the genitalia of the male are very unobtrusive and simple; it approaches the genus *Cinadus* in having a strong bulge on the posterior branch of the third vein, but cannot be included in that genus, the genitalia being too small and the ovipositor not conical. For the present it is left in the *Neoitamus* genus.

*Neoitamus rubrofemoratus*, ♂ ♀, sp. n.

Type (male) and other males, type (female) and other females; all from Tientsin, 15. 6. 06 (*F. M. Thomson*), 1907, 200.

A large species in the same group as *N. involutus*, Wlk., *N. grandis*, *hindostani*, *tarsalis*, and *nigrinus*, sp. n., but distinguished by the almost wholly reddish-yellow legs, the femora with very indistinct black stripes; the ovipositor of the female determines the generic place, however. Antennæ reddish. Abdomen black with grey bands.

Length, ♂ 21-22, ♀ 23-25 mm.

*Male*.—*Face* covered with yellowish tomentum; the tubercle large, but not very prominent, carrying a yellow-haired moustache. *Pulpi* black with pale yellow hairs. Beard yellowish white. *Antennæ* with the first two joints black, the second red at apex, and third wholly red. Hind part of head with the usual strong black bristles, in the centre with yellow hairs, which also are present on the lower sides. *Thorax* covered with greyish-yellow tomentum and with dark black-brown stripes, the median one hardly divided in the centre, the side-stripes short; pubescence chiefly black, very distinct on the median stripe, reaching to its anterior border; two præsutural bristles, two supra-alar, and three postalar bristles, all long and black; the dorso-central ones numerous, but the bristles are much weaker. *Scutellum* same colour as thorax with two long black bristles. *Abdomen* with a rounded, large, blackish-brown spot on each segment; the sides and posterior borders grey. *Genitalia* very large, the underpart proceeding from below the last segment with a large black clasper on each side and a central yellowish curved process, the black part with black hairs, the upper part also large, black, with black hairs. *Legs* reddish yellow; the femora black at the base and at apex, often with an

indistinct black stripe, all the bristles on legs are black, very numerous on the tarsi: femora almost bare, the posterior pair with a few. *Wings* pale brownish, clearer at the base, and often with clear kernels in the cells; the small transverse vein beyond the middle of the discal cell.

*Female* identical; the ovipositor long, including the sixth and seventh segments.

*Neotanus siamensis*, ♂ ♀, sp. n.

Type (male) from Biserat, Siam, 9. 8. 1901 (*H. C. Robinson and N. Amandale*), 1916, 21.

Type (female) from K. Mabek, Siam, 13. 7. 1901.

Another male and female from Biserat.

Another male from Sungkie, Siam, 10. 2. 1902; all by the same collector, 1916, 21.

Another female from You Boi, Hainan, 5. 6. 04; 1911, 288.

A small black species with wide grey segmentation on the abdomen. Antennæ and legs black, the tibiæ partly chamois-yellow in colour.

Length, ♂ 15, ♀ 17 mm.

*Male*.—*Face* blackish covered with grey tomentum; the tubercle distinct. *Monstache* consists of chiefly white bristles, two or three black ones intermixed. *Pulpi* black with yellow hairs. *Antennæ* blackish, the first two joints with bristly black hairs. *Forehead* with the same; at vertex head with some strong black bristles, white hairs continued round head. *Thorax* blackish with grey tomentum, leaving the median black stripe distinct, narrowly divided, and three greenish-black spots at sides, the posterior one very small; pubescence on dorsum black. *Præsutural* bristles black, two in number; three supra-alar bristles, and two postalar bristles; the dorso-central bristles represented by weak, bristly, black hairs, some very long. *Scutellum* covered with grey tomentum, and with white hairs, and two stout black bristles on its posterior border. *Abdomen* with the dark spots deep black, becoming brownish at sides; the grey segmentations are continued up the sides, becoming more golden yellow at base of segments; pubescence short and black on the dark spots, whitish and long on the segmentations and at sides. *Genitalia* stout and complicated, black with black pubescence, and some reddish hairs on the upper piece. *Legs* blackish; the tibiæ pale reddish yellow on their outer sides; fore femora with no bristles, but with some scattered white hairs, the middle pair the same, but the

white hairs are longer and more inclined to be bristly, and two black bristles are present on the apex, also present on the hind tibiæ, which have an extra black bristle on the upper-side; fore tibiæ with black bristles and long black hairs below, and a thick fringe of short rufous hairs below; the middle pair the same with fewer black bristles and the long hairs are white; hind tibiæ with black bristles and the fringe of rufous hairs on each side, and no long hairs below; the first joint of tarsi stout and elongate with many stout black bristles; some white pubescence on outer side and rufous hairs below, and some long black hairs; the other tarsi studded with black bristles and with some black pubescence.

*Wings* clear, shaded on the apex and posterior border, the small transverse vein situated on apical third of the length of discal cell.

*Female* identical. Moustache with more black hairs. Ovipositor is very long, including the sixth and seventh segments, about as long as the four posterior segments together.

*Neoitamus tropicus*, ♂ ♀, sp. n.

Male (type) from Sat Tal, 9. 5. 1912.

Female (type) from Shan Ket, 16. 5. 1912; and another from Bhowali, July 1909, 5700 feet—all from Imms Coll.

A small species, very similar to the European *Neoitamus cyanurus*, but differing in the bristles on legs being largely yellow, and in the præsutural bristles being reddish yellow or yellow and three in number.

Length, ♂ 10, ♀ 13–15 mm.

*Male*.—Greyish black. *Face* covered with whitish tomentum; the tubercle which takes up the greater part of the face darker, covered by the dense dirty-white hairs of the moustache with some black bristle-like hair above them. *Palpi* black with black hairs. Beard dirty white. Hairs round head the same colour; postocular bristles black. *Antennæ* blackish, the arista not so long as the third joint. *Thorax* with the usual black stripes, the median one divided; the three præsutural bristles yellowish, two supra-alar bristles usually black, two postalar (one black, one yellow); the dorso-central bristles extend beyond the suture in two rows, all black; pubescence on the dorsum black, white at the sides. *Scutellum* with four stout long bristles on its margin, and white pubescence on the dorsum. *Abdomen* with the usual large black spot on each segment and long white hairs on the first segment, elsewhere short and white, sides with some

white bristles and hairs. Genitalia small, stout, black with black hairs above and some yellow below. *Legs* black, the knees of the femora and the tibiæ, except at their apices, reddish yellow; tarsi the same, blackish at the apices of the joints; fore femora with two short yellow bristles above and some below intermixed with yellow hairs, middle femora the same, hind femora with four above and four or more long ones below, pubescence on all short and white; tibiæ with only white bristles and chiefly yellowish pubescence; fore tarsi with some white bristles and black ones, the other pairs with fewer white ones. *Wings* clear, shading in apex hardly visible, small transverse vein beyond the middle.

*Female* identical. The fore femora have black bristles below, and the fore tibiæ a long row on their uppersides. Ovipositor, composed of the last three segments, black.

*Neoitamus tarsalis*, ♂ ♀, sp. n.

Male (type) from Kandy, Ceylon, 28. 5. 92 (*Lt.-Col. Yerbury*), 1892, 122.

Female (type) from Bentota, Ceylon, 13. 6. 91 (*Lt.-Col. Yerbury*), 1892, 122.

Two males from Trincomalee. 10 miles Kandy Road, same collector, 30. 5. 91 and 30. 8. 91.

One male from Baduella, Ceylon, 5. 6. 92, same collector.

A species not unlike in general appearance *N. pulcher*, sp. n., but at once distinguished by the broad first joint of fore tarsi armed with very stout bristles. *Leys* reddish yellow; femora largely black; knees and apices of tibiæ and the tarsi black. *Antennæ* black. *Abdomen* black, with broad grey segmentations.

Length, ♂ 18-19, ♀ 24 mm. with ovipositor.

*Male*.—*Face* covered with silky yellow tomentum and hairs. Moustache on the not very prominent tubercle, composed of whitish-yellow, long, weak bristles. *Palpi* black with yellow hairs, in the type some black bristles are present on the moustache. *Antennæ* blackish, the first two joints with black bristly hairs; the arista nearly double the length of the third joint, which is tinged reddish brown and is a little longer than the first joint. *Forehead* with black bristly hairs at the sides and on the central tubercle, hairs round the head white, four or five very stout black bristles are present each side of the frontal incision. *Thorax* covered with yellowish tomentum and with a distinctly marked median black stripe divided in the middle and two large blackish spots on each side; dorsum covered with short



black pubescence. Præsutural bristles are very large and stout, two in number, one supra-alar bristle only and three postalar bristles; the dorso-central bristles are only represented by some fine black hairs on each side and in the middle, those on the posterior part becoming bristly hairs; the dorsum is covered with fine black hairs and some longer pale yellowish ones posteriorly and on the sides. *Scutellum* covered with grey tomentum and with six blackish bristles on its posterior border, in the other males some of these appear yellow; dorsum with pale yellowish pubescence. *Abdomen* with large brownish-black spots on each segment, produced posteriorly, but not reaching the hind border which is covered with greyish-yellow tomentum forming a band on each segment continued up the sides; dorsum covered with short yellowish or white hairs and with the same at the sides; underside largely brown. *Legs* reddish yellow; the fore and middle femora black at the base and apex, the hind pair blackish for two-thirds of their length with a black apex; the tibiæ with dark apices; the middle and hind tarsi wholly brownish; the fore femora with no bristles, some long soft hairs below, the middle pair with two stout black bristles at the apex, the hind pair with five on the upper side and four or so below, and two stout ones at the apex; the tibiæ with five or more black bristles on the upper side of the fore pair, and a crown of them at the apex; underside with long, soft, yellowish hairs; the middle pair with rather fewer bristles on the upper sides and no soft hairs below, the hind pair with four or so on the upper and under side and four at the apex; the underside with a thick fringe of short yellowish hairs, also present on the upper side, these are present but less noticeable on the middle tibiæ; tarsi with the first joint enlarged and broad on the front pair and longer on the other pairs, on these last it is nearly as long as the four other joints together, all with numerous very stout black bristles at apex and on the underside, and with some yellowish hairs above, the other joints have fewer bristles; pubescence on the legs is otherwise short and black. *Wings* not so long as the abdomen. Genitalia are large, with black hairs, some white ones on the apex. The other males appear identical, the bristles and colouring of legs being the same, but the abdomen has a more hoary pubescence.

*Female* is identical. The bristles on the scutellum all black. Ovipositor very long, including the sixth and seventh segments, nearly as long as the first five segments. *Legs* not quite so dark; the fore femora with four or five weak

long bristle-like hairs below, besides the long soft hairs; the bristles on the hind pair of femora do not appear to be so numerous; fore tarsi are enlarged as in male. *Wings* as in the male are shaded at apex and on posterior border, and the small transverse vein is before the middle of the discal cell.

*Neoitamus neavensis*, ♀, sp. n.

Type (female) and five others, from 150–200 miles W. of Kambove, Congo Free State, 3500–4500 feet, 16. 10. 07 (*S. H. Neave*), 1907, 230.

A small black and grey species not unlike *Neoitamus sodalis*, Wulp, from Aden, according to the description, having no hairs or bristles on the scutellum; but Wulp makes no mention of the black stripe on the femora.

Length 17 mm.

*Face* covered with yellowish tomentum. Moustache scanty and yellow. *Palpi* black with yellow hairs. *Antennæ* (broken off), the first joint black with dark hairs. *Forehead* with some black hairs at sides. *Thorax* covered with greyish tomentum, leaving apparent a very distinct velvety black median stripe divided anteriorly; the side-stripes are represented by two large black spots and a small one; the two præsutural bristles are stout, black; the supra-alar consist of one stout one and a weaker, the postalar being similar; the dorso-central bristles are weaker and few in number. *Scutellum* grey, with no signs of bristles or hairs. *Abdomen* with large black velvety spots and grey segmentations, the sides are also grey, the first segment has a tuft of yellowish hairs at sides; pubescence on dorsum very short and chiefly dark; the ovipositor includes the sixth and seventh segments and is about as long as the four preceding segments. *Legs* slender, reddish yellow; the fore femora blackish on their upperside; tibiæ black at apices, the tarsi brownish from the second joint onwards, the middle femora also have a dark stripe, the hind pair are only black at their apices; only the middle and hind femora have bristles and then only two at the apex, with some very short pale yellow pubescence; the tibiæ have three or four each, one near the base with the same pubescence; the first joint is heavily armed with stout black bristles, most of them underneath, and the following joints also have them. *Wings* clear, grey, the small transverse vein is situated beyond the middle of the discal cell towards the apex of the wing.

*Neoitamus africanus*, ♀, sp. n.

Type (female) and two other females from edge of forest on S. and E. slopes of Kenya, 6600-7000 feet, Brit. E. Africa (*S. A. Neave*, Feb. 3-12, 1911), 1911, 177.

A large blackish species, measuring about 22 mm., distinguished by the wholly black moustache. Tubercle of face large, but not reaching the antennæ. *Thorax* with not very numerous black bristles on its dorsum; the presutural bristles consist of two very stout ones and two finer ones. *Scutellum* has six or more bristles on its posterior border. *Abdomen* (somewhat denuded) appears blackish with chiefly black pubescence, a few yellow hairs are apparent at sides and on the segmentations; ovipositor long, including the sixth and seventh segments, in length about equal to the three preceding segments together. *Legs* black, apices of fore femora reddish; tibiæ almost wholly reddish, as are the basal joints of the fore and middle tarsi; the fore tibiæ have a thick short fringe of rufous hairs on their lower side, the middle and hind pair have hardly any long hairs; pubescence elsewhere black, with stout black bristles. *Wings* pale brown, clear at base, the discal cell almost wholly clear; veins dark brown, the small transverse vein beyond the middle of the discal cell.

#### HELIGMONEURA, Bigot.

Thoms. Archiv. Entom. ii. p. 356 (1858).

*Mochtherus*, Loew, Linn. Ent. iv. p. 58 (1849) [præocc. Schmidt, Goebel Coll. 1846].

*Neomochtherus*, Ost.-Sack.

#### *Oriental and Australian Regions.*

This genus is very slightly represented in these regions.

Wulp described three species under *Mochtherus*, viz., *Heligmoneura gnava*, *patruelis*, and *striata*, from the Indian Archipelago, Java, and the Celebes, and one species *H. lauta* from New Guinea. In the *Annals & Mag. Nat. Hist.* (8) xi. p. 423 (1913), I removed *Asilus lascus*, Walker, to this genus, a species recorded from New Zealand.

Two new species are now described.

*Heligmoneura gnava*, V. d. Wulp.

Tijd. v. Ent. (2) vii. (xv.), p. 242 [*Mochtherus*] (1872).

Females from Kandy, Ceylon (*E. E. Green*) 1910, 415,

and from Khasi Hills, Assam, 97, 82; from Biserat, Siam (*Robinson and Annandale*), 1916, 21; and from Sandakan, British N. Borneo (*D. Cator*), 98, 83.

*H. striata* is distinguished from the above by not only the hind knees being black, but the posterior femora at apices and below and the posterior tibiæ and tarsi are all blackish; the antennæ are also blackish.

In *H. gnava* and *H. patruelis* they are yellowish, and the legs in the latter are more like those of *H. striata*. *H. lauta*, described from a male only, is a large species, 16–22 mm.; legs almost entirely reddish yellow.

*Heligmoneura indianus*, ♂ ♀, sp. n.

Male (type), female (type), and two other females from Katagiri, 6000 feet, S. India, (*F. Cragg*). A medium-sized species, yellowish grey in colour, the legs almost wholly yellow. Moustache composed in the middle of long bristle-like yellow hairs, surrounded by several longer black bristles. *Antennæ* blackish brown. *Wings* clear, shaded at apex and narrowly so on the posterior border.

Length, ♂ 13, ♀ 17–18 mm.

*Female*.—*Face* covered with silky-looking pale yellowish tomentum; tubercle small, covered by the moustache, which is continued on the sides of the epistome. *Palpi* black, with pale yellowish hairs. *Antennæ* blackish brown, the first two joints with black hairs; the arista of third joint nearly as long as the joint. Beard pale yellowish; hairs round the head the same colour, reaching the postocular bristles, which are few in number and black. *Forehead* darker than the face, with black bristly hairs on each side. *Thorax* with a distinct median brown stripe divided in the middle; dorsum of thorax with small bristles and a row of longer ones on each side of the stripe; præsutural bristles, supra-alar, and postalar bristles all two in number; the dorso-central bristles about six in number, with finer hair-like bristles intermingled. *Scutellum* with two black bristles on its margin and some fine long yellow hairs between. *Abdomen* yellowish grey or yellowish brown, the segmentations narrowly paler in colour, the yellow bristles weak and few in number; some appressed brighter-coloured pubescence on dorsum, thickest on the apical segments, elsewhere short and black; ovipositor black, almost as long as the fourth, fifth, and sixth segments together. *Legs* yellowish red, with fine but numerous black bristles; fore femora with only soft yellow hairs, mid-femora with at least seven strong black bristles, hind femora with

three very strong black bristles and other smaller ones ; pubescence on the legs short, black ; on the under edges of the tibiæ some reddish-yellow hairs are distinct. *Wings* with the small transverse vein beyond the middle of the discal cell.

*Male* is discoloured and damaged, but is no doubt the same species, though the femora appear almost destitute of strong black bristles, and some on the fore tibiæ are yellow ; genitalia not very large, black.

*Heligmoneura sinensis*, ♂ ♀, sp. n.

Type (male) and type (female) from Tientsin, 25. 6. 06 (*F. M. Thomas*), 1907, 200, and another female.

A fair-sized blackish-brown species with paler segmentations on the abdomen and legs wholly reddish yellow. *Antennæ* yellowish. Moustache composed of yellow bristles. *Wings* clear, shaded at apex and on posterior border.

Length, ♂ 15-20, ♀ 17 mm.

*Male*.—*Face* covered with silky-yellow tomentum ; the tubercle distinct, covered by the yellow moustache. *Palpi* black, with long yellow hairs. Beard yellowish. *Antennæ* yellowish, the third joint wanting in all the specimens. *Forehead* a little darker than the hind part of head with stout, not very long, yellow bristles. *Thorax* dark, with yellowish-grey tomentum, leaving a broad median blackish undivided stripe, with long yellowish bristles on the posterior part and short black pubescence on dorsum ; the præsutural bristles two in number, one yellow, one black ; one supralar and two postalar, all yellow. *Scutellum* with two yellow bristles. *Abdomen* covered with dense yellowish-grey tomentum, leaving a median dark stripe composed of long or triangular spots ; yellow bristles on each segment, two or three in number, more numerous on the first segment ; dorsum covered with yellow short pubescence. Genitalia chestnut-coloured, stout, and not very long with some short yellow pubescence. *Legs* reddish yellow, the bristles on the tibiæ yellow, with a few black ones intermixed. Femora somewhat incrassate, with chiefly black bristles ; tarsi darker at their apices, with black bristles ; the pubescence on legs short, yellow, dark on the outer sides of the tibiæ and on their dorsum. *Wings* with both branches of the fork of the third vein slightly curved.

*Female* similar. The ovipositor black, quite as long as the last two segments, the small transverse vein in the middle of the dorsal cell.

*South African Region.*

The species of *Heligmoneura* described from this region are: *Heligmoneura annulitarsis* and *sinuata*, Loew, from Caffraria; *H. deserticola*, Karsch, from E. Africa; *H. monobia*, Speiser, from Erythræa; *H. nuda*, Bezzi, from Erythræa; *H. modesta*, Bigot, from Gaboon; and *H. rothkirchii*, Speiser, from Kamerons. None of these species are represented in the Brit. Mus. Coll., except *H. sinuata*. *H. annulitarsis* must be nearly allied to it, but the fork of the third vein is said to be only very slightly curved, and the hind and middle tibiæ with only black spots. The ovipositor is larger than the last two segments of abdomen—not equal, as in *H. sinuata*.

Length 10 mm.

*H. deserticola* is described very shortly; the face with two rows of very black bristles down the middle, a characteristic not very probable in a species of this genus. *H. monobia* is described as a black species with yellow legs. *H. nuda* is described by the author as very like an *Ommatius* species, and, as he had not seen any specimen with perfect antennæ, the question of genus remains undecided. *H. rothkirchii*, Speiser, from Duala, Kamerons, is described as a very fine species, 20½ mm. long. Blackish with the ordinary yellow-grey tomentum of Asilidæ; the pubescence on the abdomen yellow, long at the sides. *Palpi* black, red-haired. *Antennæ* reddish yellow. *Legs* yellowish; the femora at apices, most of the tarsi, and the hind tibiæ black; described from one female specimen.

Three new species are here described.

*Heligmoneura sinuata*, Loew.

Dipt. Süd-Afrika, p. 168 (1860).

Males and females from Malvern and Howick, Natal, (*J. P. Creyoe* and *G. A. K. Marshall*).

A small species with almost wholly yellow legs, only black at extreme apices of posterior femora and tibiæ. *Monstacæ* yellow and black. *Scutellum* with two black bristles. *Abdomen* brownish with yellowish tomentum. *Wings* with the posterior fork of third vein very distinctly curved.

Length 13 mm.

*Heligmoneura newii*, ♂ ♀, sp. n.

Type (male) from N.E. Rhodesia, vicinity of Chambesi, 4000 feet, 18. 5. 1908 (*S. A. Neuve*).

Type (female) from same locality, 16. 5. 1908 (*S. A. Neave*). Other males and females from Sualaba River, 2500–4000 feet, 19. 4. 07, etc. (*S. A. Neave*), 1907, 230, and males from Kambove, Katanga, 4000–5000 feet, 2. 4. 07 (*S. A. Neave*), 1907, 230.

A species with a dusky or yellowish-brown abdomen, wholly yellowish-red legs and antennæ, white moustache, and genitalia of male bright reddish yellow.

Length, ♂ 16–17, ♀ 16–18 mm.

*Male*.—*Face* black, covered with yellowish or white tomentum in well-preserved specimens. Moustache composed of numerous white bristles and often two or more black bristles. *Palpi* black, with yellowish bristly hairs. Beard yellowish. *Antennæ* yellowish red with some black hairs on the first two joints. Occipital bristles on head yellowish, continuing as finer whiter hairs round head to beard. *Thorax* in type discoloured black and red, but in other specimens covered with yellowish-brown tomentum and with two faint narrow brown stripes; præsutural, supra-alars, and postalar bristles all two in number and black, as are the few central and side bristles; dorsum also covered with some fine blackish hairs. *Scutellum* same colour as thorax, with two black bristles. *Abdomen* blackish, but covered with yellowish-brown tomentum, with strong yellow bristles on the posterior borders of segments and below; dorsum with rather thick, fine, short, yellow and black pubescence. *Legs* with chiefly stout black bristles, yellow ones are present on the apices of fore tibiæ and on the under surface of the other tibiæ, and on the fore tarsi, also below the femora, which are devoid of the stout black bristles on the front pair, having only weak yellow bristles below; pubescence on legs chiefly consists of short black hairs, some yellow ones on sides of tibiæ, especially the hind pair. *Wings* clear, with small transverse vein beyond the middle of the discal cell, the posterior branch of the third vein with a very pronounced bend in the middle. Genitalia of male are long, with black fine hairs.

*Female* is identical, the black bristles on moustache at upper part and sides are always present and more numerous, but the yellow bristles on the legs are less numerous and hardly present on the fore legs; the ovipositor is black, not so long as the last two segments together.

*Heligmonewa africanus*, ♀, sp. n.

Type (female) and two others, from Magadi, Brit. E. Africa, April 1912 (*P. G. Hamilton*), 1915, 37, f.

A yellowish-brown species with blackish antennæ, white and black moustache, reddish-yellow legs with black stripes on the tibiæ; ovipositor short and black, not including the seventh segment.

Length  $13\frac{1}{2}$ –14 mm.

*Face* covered with dirty yellowish-white tomentum; tubercle distinct; moustache composed of white bristles with half a dozen or so fine black bristles above. *Antennæ* dark-coloured, both the two basal joints with strong black bristles and hairs, the third joint is wanting in all the specimens. *Forehead* with yellow tomentum and with black bristles on each side. Occipital bristles black, hairs round head white. Beard white. *Palpi* black with white hairs. *Thorax* blackish brown covered with yellowish tomentum and with two distinct dark brown stripes and shorter side-stripes; præ-sutural, supra-alar, and postalar bristles all black and two in number, central bristles long and stout with short bristles running up to the shoulders; pubescence chiefly consists of short black hairs. *Scutellum* with two long white bristles. *Abdomen* blackish brown, covered with yellowish-grey tomentum, with yellowish bristles on posterior borders of segments at sides and below, and with short yellow pubescence. *Legs* with black stripes on all the femora on the inner dorsal surface covered with fine white pubescence, and with yellow bristles at apex and below; tibiæ blackish at apex, with yellow bristles; tarsi largely black with black bristles; pubescence on legs black and short. *Wings* clear, the posterior branch of third vein with only a very moderate curve, small transverse vein about the middle of the discal cell.

*Heligmoneura natalensis*, ♂ ♀, sp. n.

Type (male) from Marley Kloof, Natal, and others from Natal and Mfongosi, Zululand.

Type (female) from Karkloof, Natal, Feb. 1897 (*G. A. K. Marshall*), 1903, 17, in Brit. Mus. Coll., and other females from Natal; and Mfongosi, Zululand (*W. E. Jones*).

A species differing from *Heligmoneura africanus* by the black bristles on the scutellum and black bristles on the legs; it is also larger on the whole.

Length, ♂ 16–17, ♀ 14–18 mm.

*Male*.—*Face* dark, covered with whitish tomentum; the tubercle bearing black bristles above and yellowish ones below, forming the moustache, with short black bristles below. *Palpi* black with black hairs. Beard scanty, white. *Antennæ* black. *Forehead* the same as face, with black



bristly hairs. The bristles on hind part of head black. *Thorax* dark, covered with grey tomentum, with two very distinct, narrow, blackish-brown, median stripes and duller greenish spots at sides; presutural bristles two in number; the supra-alar and postalar respectively three in number, all black and very stout; median posterior bristles also stout and numerous. *Scutellum* same colour as thorax, with two black bristles. *Abdomen* brownish black, covered with greenish-grey tomentum, very noticeable yellow bristles at sides of each segment, and the dorsum covered with short black pubescence; a stouter row of black bristly hairs on the posterior borders of segments, which also appear paler in colour; genitalia small, black and shining, with black pubescence. *Legs* reddish yellow, with a black stripe on all the femora and the two posterior pairs with black hairs; the posterior tibiæ darker at apices and the tarsi all darker at the joints; all bristles black with the exception of two or three long yellowish bristles on the fore and middle tibiæ at apices and at the bases of the first tarsal joints; pubescence short, black, some longer white pubescence on the underside of the fore femora and some short yellow pubescence on the outer edges of the tibiæ and first tarsal joints. *Wings* clear, grey at apex and on hind border, the posterior fork of the third vein slightly curved, the small transverse vein beyond the middle of the discal cell.

*Female* identical, the yellow bristles on the legs not always present; ovipositor, which does not include the seventh segment, is about the length of the last two segments together.

VII.—*Batopora (Bryozoa) and its Allies.*  
By ARTHUR WM. WATERS, F.L.S., F.G.S.

[Plate VI.]

CONTENTS.		Page
<i>Batopora multiradiata</i> , Rss. ....		83
<i>Mamillopora simplex</i> (Kosch.) .....		86
— <i>bidentata</i> (Rss.) .....		87
— <i>crassilabris</i> (Kosch.) .....		88
<i>Sphaerophora fossa</i> , Haswell .....		89
<i>Orbitulipora excentrica</i> , Seg. ....		90

As several interesting points have turned up relating to *Batopora* and its allies, it seems better to publish an account at once, without waiting for the publication of a paper,

now ready, dealing with species growing in a cupuliform shape, including Selenariadæ and Conescharellinidæ, as the consequences of war may cause delay.

The re-examination of some specimens of what Haswell described as *Sphærophora fossa* show the importance of this species in throwing light on certain fossils. The zoaria are small, and were described as subspherical "with a circular pit at the upper pole," but it does not seem that we must speak of the pit being at the upper pole. The growth is towards the pit, a fact correctly shown by Haswell, although he does not allude to it (Pl. VI. fig. 1). Another form with zoaria about the same size, described by Reuss\* as *Diplotaxis placentula*, now changed by Gregory† to *Biselenaria*, as the name *Diplotaxis* was preoccupied, grows on one surface to the border and then turns over to the other growing towards the centre. Although the growth in the two forms considered is not quite identical, they partially explain one another. Canu‡ in describing *Biselenaria affa*, Greg., says the zoœcia radiate from a "grande ancestrale," which, however, is not shown in Canu's figure, and, as the zoœcia are Membraniporidan, it is difficult to understand.

The importance of the pit was appreciated by Haswell, who did not attempt any explanation in his first paper, but in a subsequent one§ he mentions a *Cellepora* with minute Actinids lodged in cylindrical pits, excavated in the substance of the polyzoarium. He thinks this may throw some light on the pits of *Sphærophora fossa*, and described it as a case of symbiosis of Actinid with *Cellepora*. However, as regards *S. fossa*, the definite position of this pit in recent species from various localities, as well as in fossils from many localities, makes this very improbable; nor is this all, for it is clear that what was described as "aufrecht stehende Zelle" or "primordial Zelle" by Reuss and others in *Batopora* and some allied genera is a similar pit, though much smaller. In both cases there is a raised ridge surrounding the border (Pl. VI. fig. 6), and there are in the pits large pores leading to the surrounding zoœcia. Reuss, who had seen the tubes from these pores, spoke of them as a hydrostatic system, but how he considered that the system functioned is not clear. Canu|| and Bassler also refer to a hydrostatic system.

\* Bry. des deutsch. Unterolig. Sitz. d. k. Akad. Wissen. Wien, lv. p. 231, pl. ii. figs. 5-7 (1864).

† "Brit. Pal. Bry.," Trans. Zool. Soc. London, vol. xiii. p. 234 (1893).

‡ "Bry. Tert.," Ann. de Paléon. vol. ii. p. 30 (1907).

§ Proc. Linn. Soc. N.S. Wales, vol. vii. p. 608 (1882).

|| Early Tert. Cleil. Bry. p. 73; Smithsonian Inst. U.S. Nat. Mus. Bull. 96 (1917).

The pit in the common *Batopora multiradiata* is found to continue through the two layers, for the mature zoarium consists of two or more layers, as described by Reuss and as figured by me\* (see also Pl. VI. fig. 4). As the mature *multiradiata* is two-layered, we should be able to find an earlier stage, and to do so I again searched through material from different places where it occurs, and in most cases found a small globular *Batopora*, which is what I determined as *B. stoliczkai*, Rss., though what were taken to be appendages are probably young zoecia in course of formation and are not always found, and then there seems to be no material difference from *B. rosula*, Rss., so that perhaps *rosula* and *stoliczkai* are synonyms. The possibility of a globular *Batopora* being the first stage was foreseen by Reuss and also by me, but at that time was rejected.

The primary is well within this globular form. I have found a very similar pit in *Orbitulipora lenticularis*, Rss., from Montecchio Maggiore, but in a very different position—namely, near the periphery directed towards the middle of the zoarium, and in *Orbitulipora petiolus* one has been figured by Dixon † and by Gregory ‡ at the side. On p. 92 it is seen to be continuous from the centre to the circumference of the zoarium. MacGillivray § and Maplestone || speak of there sometimes being more than one pit in *S. fossa*, but I have seen nothing of the kind. Perhaps they had found a true *Cellepora*. Is there any other explanation of these pits, except the perforating Actinid? The large pores in the pits, with their tube or chamber leading to the zoecia (Pl. VI. figs. 3, 4), is undoubtedly a point of much importance, and the explanation now offered is that these pores indicate the attachment of radicles, which together form a solid bundle such as we know in various Bryozoa ¶.

The shape of the oral aperture (0.12 mm.) and of the

\* North Ital. Bryozoa, p. 33, figure in text; Quart. Journ. Geol. Soc. vol. xlvii. (1891).

† Geol. & Fossils of Tert. & Cret. Form. of Sussex, p. 151, pl. i. fig. 10 (1850).

‡ Brit. Pal. Bry. pl. xxxi. figs. 12, 13.

§ "Tert. Poly. of Vict.," Trans. R. Soc. Vict. p. 108 (1895).

|| "New or little-known Polyzoa," Proc. R. S. Vict. vol. xxv. p. 361 (1913).

¶ Preparations had been made, and the drawings for Plates completed, before I had an idea of any theories of Canu and Bassler. In a short letter from Canu, he seems to have come to the conclusion that *Concscharellina* and some other genera lived with the apex of the cone below, and were attached, as partly suggested by d'Orbigny. I see that there will be points of agreement between us, but I am awaiting their complete work.

zoëcia, as well as the ovicell would, if considered alone, place *Sphærophora fossa* with *Holoporella*, a genus which I separated from *Cellepora*.

A specimen of *Stichoporina reussi*, Stol., from Latdorf, given to me by Dr. Pergens, has a pit as described, and the zoëcial opening as first seen is round or slightly oval, but on looking down the peristome the lower edge of the oral aperture is found to be nearly straight (0.08 mm.) and this is also the case in *Batopora* (text-fig. 1, *f, g*).

Although there are these similarities between *S. reussi* and *Batopora multiradiata*, the underside of *S. reussi* shows the zoëcial shape and is not filled in, also the early growth must have been different. In my specimen of *reussi* the zoëcia near the pit are raised, whether because they are larger or because a second layer is commencing cannot be decided from the specimen—at any rate, the inner raised zoëcia are directed towards the pit, while the outer ones are directed away from it. Canu\* has united *S. reussi* and *Batopora multiradiata* as one species, which does not seem to be the case, nor will they probably remain in the same genus. Canu says “unilamellaire,” but *B. multiradiata* is bilamellar. This examination shows that Kosechinsky was not right in uniting his species of *Stichoporina* with Stoliezka’s, for none of Kosechinsky’s have a pit, besides which, the oral aperture of Kosechinsky’s species is much larger with a distinct contraction at each side, so that *S. simplex*, *S. protecta*, *S. crassilabris*, and *S. bidentata*, Rss., must be placed elsewhere, and they seem to agree with *Mamillopora*, Smitt.

Neviani † published a paper on *Stichoporina*, though now most species referred to seem to belong to the genus *Mamillopora*. The reason for separating them from *Stichoporina* has been given, and in none other that Neviani mentions is there a pit. *Fedora edwardsi*, Jull., is a hollow cylinder, as are also *Kionidella* (*Discoflustrellaria*) *dactylus*, d’Orb., and *F. excelsa*, Kosech., though with a small lumen, and both seem to belong to *Mamillopora*.

Canu ‡, speaking of *Stichoporina reussi*, Stol., says “ancestrule membraniporoide,” but are we yet correctly acquainted with the ancestrule?

The genus *Prattia*, d’Archiac, I should place under *Mamillopora*, though Canu § has left it as *Prattia*, and

\* Bry. Tert. p. 100.

† “Nuova sp. foss. di *Stichoporina*,” Bull. Soc. Rom. per gli Stud. Zool. vol. iv. p. 1 (1895).

‡ Bry. Tert. p. 100, pl. xi. figs. 16–18 (1907).

§ “Bry. du Sud-Ouest de la France,” Bull. Soc. Géol. de France, ser. 4, vol. x. p. 854 (1910).

Faura and Canu\* have done the same. Canu has refigured d'Archiac's specimens, and it will be seen that the zoëcia differ but very slightly from *Mamillopora* (*Stichoporina*) *simplex*, Kosch., although the avicularium is much larger, also the *Fedora glandulosa*, d'Arch., as figured by Canu, looks much like *Mamillopora crassilabris*, Kosch., and I should place it under *Mamillopora*.

*Mamillopora* (*Ascosia*) *pandora* †, Jullien, belongs to this genus or to the family. The barrel-shaped zoëcia are erect, and, as seen in a specimen given to me by Jullien, the appendages are not vibracular but avicularian, with a distinct bar and a prolonged mandible. The three supra-oral processes remind us of those of *Mamillopora crassilabris*, Kosch.

Héjjas has described as *Batopora ariculata*, H. ‡, a species with a large triangular avicularium, like those of *M. simplex*, K., below the oral aperture, but in the light of present investigations it is doubtful whether we must place it under *Batopora* or *Conescharellina*. He also makes a new genus *Batoporella* for a bilaminate form otherwise much like *Batopora*. Although he refers to the figure of it, there is none in my copy, and on the cover only two plates are referred to; evidently something has gone wrong about the plates, as the references do not correspond with the plates, and this is referred to as pl. v. fig. 13, though if it has been published it must have been on a plate vii.

*Batopora multiradiata*, Reuss.

(Pl. VI. figs. 4, 5, 6, 9, 10.)

*Batopora multiradiata*, Reuss, "Die foss. Anthoz. und Bry. der Schichtengruppe von Crosaro," Denk. math. naturwiss. Classe der k. Akad. der Wissenschaft. Wien, vol. xxix. pp. 265 & 292, pl. xxxi. figs. 1-4 (1869); Pergens, "Bry. foss. de Kolosvar," Bull. Soc. Roy. Malac. de Belgique, vol. xxii. p. 7 (1887); "Foss. Bry. von Wola Lu'zanska," Bull. Soc. Belge de Geol. vol. iii. p. 72 (1887); Waters, "North Italian Bryozoa," Quart. Journ. Geol. Soc. vol. xlvii. p. 32, figure in text (1891).

We have already learnt (p. 82) that the zoëcia, in mature zoaria, occur in two or more layers and the stage with only

\* M. Faura & F. Canu, "Sur les Bry. des Terr. Tert. de la Catalogne," Inst. Catalana d'hist. natural. p. 100, fig. 12 (1918).

† "Drag. du Trav.," Bull. Soc. Zool. de Fr. vol. vii. p. 505, pl. xiii. figs. 13, 14 (1882); Calvet, Exp. Sc. du Trav. et Talisman, vol. vii. p. 441 (1907). Busk named a specimen of this species *Cellepora abyssicola* in MSS. from the Atlantic, 780-1095 fathoms ('Porcupine,' 997.1).

‡ Héjjas, Emerich, "Beit. z. Kennt. der Tertiären Bry. Siebenburgens," Sitz. Med. Naturwiss. Section des Siebenburgischen Museumsverein, vol. xvii. p. 214, pl. iv. fig. 11 (1894).

one layer has been called *Batopora stoliczkai*, Rss.\*, and in very many localities both the first and mature stage have been found together. In sections, as in Pl. VI. fig. 4, the two layers are clearly seen, and also the interesting fact that the so-called "primordial Zelle" passes through the two layers. This has now to be called a pit, and is homologous with the pit in the *Sphærophora fossa* of Haswell. There are numerous tubes from the neighbouring zoëcia passing to the pit, and these were well seen during the preparation of the section; also in *S. fossa* the large pores in the pit were seen to pass into minute chambers in the zoëcia (Pl. VI. figs. 2, 3).

Reuss considered that the colony grew from this pit, but he had missed some points of structure, though, from a manuscript left relating to *B. rosula* and which Manzoni † published, he clearly understood that there were two layers in a mature form. Kosehinsky seems to have considered that the conical form grew first and then became globular, but this is reversing the process.

I think that one of the small zoëcia in the centre of the first stage is the primary, and also in *S. fossa* the primary was probably some distance from the pit. The base of the cone may also be covered by a secondary zoëcial growth. The base of the cone usually shows the one row of radiating zoëcia, but I have one specimen showing two rows (Pl. VI. fig. 5).

*B. multiradiata* is usually 2-3 mm. in diameter, sometimes showing the second layer as a cap (Pl. VI. fig. 4a); this outer layer is very irregular, being by no means always at the apex, in one the edge of the cap ends near to the pit. I have collected it mature from Brendola, Val di Lonte, Montecchio Maggiore, Priabona, Malo, Ferrara di Monte Baldo, Creazzo near Lonigo, Vilmezzano, Mazzurega, and the earlier or *stoliczkai* stage from Brendola, Val di Lonte, Montecchio Maggiore, Creazzo, Malo, Spiassi.

The base of the cone has the zoëcia arranged radially, just as in *Conescharellina*, and between the two genera there are only secondary differences on this surface, though in *Conescharellina* we are unaware of any case of the two layers, nor is there any pit, though there seem to be cases of

\* Reuss was very near this idea, for, speaking of *B. multiradiata* from Val di Lonte, he says no other form is found and we cannot therefore hold it for a higher form of *Batopora*. Since then I have found many specimens of *B. stoliczkai* from Val di Lonte.

† "Bri. foss. del. Mioc. d'Aust. ed Ungh.," Denk. math. natw. Ak. der Wissensch. Wien, vol. xxxvii. p. 6, pl. ii. fig. 6 (1877).

several large pores probably serving the same purpose; but in spite of the very great similarity of form of growth *Conescharellina* has a much smaller oral aperture, with a trace of a sinus and muscular attachments some distance from the border, while *Batopora* has a nearly straight proximal edge with contractions at the side, as in most *Lepralia*, as the genus has been understood.

*Orbitulipora* and *Sphærophora*, both of which have a somewhat similar pit (large in *Sphærophora* and lateral in *Orbitulipora*), have much larger oral apertures than either *Batopora* or *Conescharellina*, and have a nearly straight proximal edge and large curved distal end, just as in *Holoporella*; further, *Conescharellina* has small cells with semi-lunar slits, whereas none are known in *Batopora*. *Conescharellina* has regular elongate chambers within the cone (Pl. VI. fig. 8), and these were clearly formed after the outer layer of zoæcia, whereas in *Batopora* the irregular chambers are zoæcial chambers formed before the outer barrel-shaped zoæcia.

The small *Cellepora globularis*, Reuss, from Val di Lonte, is readily mistaken for *Batopora multiradiata*, as small specimens are about the same size, though the zoæcia are larger and have two peristomial avicularia. This small globular form was evidently seen by Reuss\* from Val di Lonte, but he and others have united under that name larger growths, without proof that they are the same species.

Also, *Conescharellina eocæna*, Neviani †, which occurs from several places in the Veneto, may at first glance seem to be *Batopora*, but examination of various characters and of the internal structure proves it to be *Conescharellina* (see Pl. VI. fig. 8).

*Loc.* Val di Lonte and Priabona (Reuss.), Pap Patak; Pap Falvi Patak; Pap Falva, Kolos Monostor, Bács Szucsag, Wola Lu'zanska, and Ofener Mergel (Hungary (Perg.)), Eocene of Bavaria, and found by me from Val di Lonte, Brendola; Priabona; Montecchio Maggiore; Ferrara di Monte Baldo; Malo; Creazzo; between Sarego and Grotte near Lonigo (Vicentine); Mazurega, near Fumane, Veronese (abundant in this locality); S. Urbano di Mt. Sgreve (Vicentine).

\* Bry. Crosaro, p. 264 (52).

† This is the *Batopora conica*, Hantken, as proved from a specimen in the British Museum sent by Hantken, and this is interesting, for though Hantken often refers to it, yet it is not known whether he has described it. This species is dealt with in my other paper.

*Mamillopora simplex* (Koschinsky).

*Stichoporina simplex*, Koschinsky, "Bry. der ält. Tert. des Süd-Bayerns," *Paleontographica*, vol. xxxii. p. 64, pl. vi. figs. 4-7 (1885); Kirkpatrick, "Hyd. & Poly. Torres Straits," *Proc. Roy. Dublin Soc.* vol. vi. p. 623, pl. xvii. figs. 4 a, b, c, d (1890); Waters, "North Ital. Bry.," *Quart. Journ. Geol. Soc.* vol. xlvii. p. 31, pl. iv. figs. 16-18 (1891); de Angelis d'Ossat, ed. A. Neviani, "Corall. e Bri. Neog. di Sardegna," *Bull. Soc. Geol. Ital.* vol. xv. p. 16 (1897).

*Mamillopora smitti*, Calvet, *Exp. Sc. du Trav. et du Talisman, Bry.* vol. viii. p. 424, pl. xxvii. figs. 4, 5 (1907).

There are four species called *Stichoporina* in the North Italian Tertiary Beds, differing principally in the position and character of the avicularia. In *S. simplex*, K., there is on one side above the oral aperture a large triangular avicularium, though very occasionally one on both sides. Koschinsky thought that the avicularium was below the oral aperture, though his figure would suggest its being above, apparently he mistook the zoecium to which it belonged. The second species, *S. protecta*, Kosch., has, as described by Koschinsky, a small round avicularium ("knopf-formiges—mit rundlicher Öffnung") at each side. This small avicularium, according to Canu \*, may be pointed.

The third species (*Cupularia*) *bidentata*, Rss., has a small round avicularium at the distal end of the zoecium, and the ovicell is very wide, wider than figured by Reuss. Canu also considers that what I determined as *S. simplex*, Kosch., is the *S. protecta*, K., but he seems to have overlooked the fact that Koschinsky mentioned and figured a large triangular avicularium at the side of the oral aperture in *S. simplex*. *S. crassilobris*, Kosch., from near Lonigo, Vicentine, has a projection above the oral aperture, often with a large central process or two lateral ones.

In neither of the four species mentioned have I seen a central pit, nor is one mentioned, while in (*Stichoporina*) *reussi*, Stol., which is the type, there is a distinct one, as figured by Stoliezka, and it is very marked in a specimen from Latdorf sent by Pergens. Other differences are mentioned on page 82.

The oral aperture of *S. reussi* is much smaller (about 0.08 mm.) than that of the *M. bidentata* group, in which in the wider part the oral aperture, contracted at the side by a denticle, is about 0.12 mm. It is thus seen that the group just mentioned does not correspond with *S. reussi* and must be placed under *Mamillopora*, Smitt. Whether *S. reussi* should be placed with *Batopora* we may leave open.

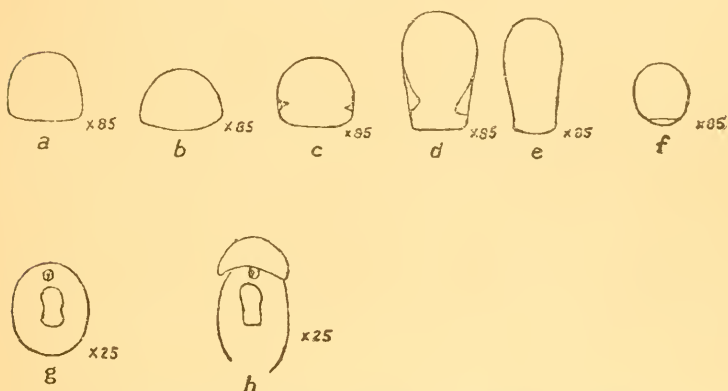
\* *Bry. Terr. Tert. des Env. de Paris*, p. 101 (1907).



Canu\* united *Stichoporina reussi*, Stol., and *Batopora multiradiata*, Reuss, but it does not now seem that this can be maintained.

The North Italian specimens of *simplex* are 5.8 mm. diameter with the dome very little raised. Kirkpatrick's are 20 mm. and Calvet's have a more elevated cone, but I do not think that they should be separated on these grounds.

Fig. 1.



- a. Oral aperture of *Sphaerophora fossa*, Haswell.  $\times 85$ .  
 b, c. Do. *Orbitulipora lenticularis*, Rss.  $\times 85$ .  
 d, e. Do. *Mamillopora bidentata*, Rss.  $\times 85$ .  
 f. Do. *Stichoporina reussi*, Stoliczka.  $\times 85$ .  
 g. Zoecium of *Stichoporina reussi*, Stoliczka.  $\times 25$ .  
 h. Do. *Mamillopora bidentata*, Rss.  $\times 25$ .

*Loc.* Götzreuth, Bavaria (*Kosch.*), and in my collection from Brendola; Priabona; Ferrara di Mt. Baldo; between Grotte and Sarego, near Lonigo; all in the Veneto: and living from Murray Island, Torres Strait (*Kirkp.*); also Cape of Good Hope and Malacca (*K.*); Saint Vincent, Cape Verde Islands, 21 met. (*Calvet*).

*Mamillopora bidentata* (Reuss).

(Pl. VI. figs. 7, 11; text-fig. 1, d, e, h.)

*Cupularia bidentata*, Reuss, "Pal. Stud. über die älteren Tert. der Alpen," Denk. Akad. Wiss. Wien, vol. xxix. p. 277, pl. xxix. figs. 1, 2 (1869); Pergens, Bry. Foss. des Env. de Kolosvar, p. 7 (only in list) (1887).

\* Bry. Tert. Ann. de Paleont. vols. ii.-iv. p. 100, pl. xi. figs. 16, 17, 18.

Reuss's figure was difficult to understand, but there is no doubt that specimens in my collection are this species, and also on further cleaning up the specimen from Pap Falvi Patak sent by Pergens the characters can be made out. The zoëcia are raised, the oral aperture is straight below and is contracted at each side, so that of course the aperture was filled by the operculum, whereas in *Cupularia* the opening is opesial. At the distal end of the zoëcium there is an appendage, but whether avicularian or vibracular it is difficult to say, though probably avicularian. The opening to this appendage is apparently round, but details cannot be deciphered.

There is no pit and the primary is a small zoëcium surrounded by six zoëcia (Pl. VI. fig. 7).

The ovicell is very wide and raised, similar to what I figured\* in *Fedora excelsa*, Koseh., and is placed beyond the avicularium—a position so far from the oral aperture is difficult to explain.

*Loc.* Val di Lonte and Granella (Rss), Eocene of Hungary; Pap Patak; Pap Falvi Patak; Marne de Buda (*Pergens*), Bocca di Sciesa, Colle Berici, and Malo, Vicentine (*A. W. coll.*).

#### *Mamillopora crassilabris* (Koschinsky).

*Stichoporina crassilabris*, Koschinsky, Bry. Süd-Bay. p. 66, pl. vii. figs. 1-4 (1855).

A specimen of *Mamillopora* from between Grotte and Sarego, near Lonigo, Vicentine, has a great thickening above the oral aperture, sometimes rising in one or three processes, the middle one of which is an avicularium or vibraculum, and it looks like the appendage of *M. bidentata* very much enlarged and erect. No other appendage is visible, but the state of the fossil is not satisfactory. A small specimen of *M. simplex* † from Brendola has a thickening above the oral aperture, also a large triangular avicularium by the side. There are six zoëcia round the primary and further cleaning recently has enabled better study. May not this thickening occur in various species of the group under certain conditions?

*Loc.* Götzreuth (*K.*), between Grotte and Sarego.

\* "N. Ital. Bry.," Quart. Journ. Geol. Soc. vol. xlvii. p. 29, pl. iv. fig. 6 (1891).

† *Loc. cit.* fig. 18.

*Sphaerophora fossa*, Haswell.

(Pl. VI. figs. 1-3; text-fig. 2, a.)

*Sphaerophora fossa*, Haswell, "Poly. from Queensland Coast," Proc. Linn. Soc. N.S. Wales, vol. v. p. 42, pl. iii. figs. 5, 6 (1880); "Note on a Curious Instance of Symbiosis," *op. cit.* vol. vii. p. 608 (1882).

*Cellepora fossa*, Waters, "Foss. Cheil. Bry. S.W. Australia," Quart. Journ. Geol. Soc. vol. xxxvii. p. 343, pl. xviii. fig. 89 (1881); *op. cit.* vol. xxxviii. p. 275 (1882); *op. cit.* vol. xxxix. p. 426 (1883); *op. cit.* vol. xli. p. 307, fig. 2 (1885); MacGillivray, "Tert. Poly. of Victoria," Trans. R. Soc. Vict. vol. iv. p. 108, figs. 8, 9, 10 (1895); Maplestone, "Tab. List Cheil. Poly. in Vict. Tert.," Proc. R. Soc. Vict. vol. xvii. n. s. p. 215 (1904); "New or Little-known Poly.," Proc. R. S. Vict. n. s. vol. xxv. p. 361 (1913).

? *Cellepora tubulosa*, Busk.

On re-examination of the fossil specimen from Curdies Creek, I find that the growth commences on the part opposite to the pit, it then grows over to the under-side, in which the pit is situated, a mode of growth which we have seen occurs in Reuss's *Diplotaxis*, so that when we are looking at the pit it is at the completion not the beginning of the zoarium. A similar pit, though much smaller, has been described as the "primordial Zelle" in *Batopora* and other genera (see page 80).

Haswell described the zoarium as subspherical, slightly depressed, with a circular pit at the upper pole, a description quite describing specimens from Queensland, which he kindly sent to me, as one side is somewhat flattened and the pit is at the opposite pole; but in some fossils\* from Batesford or Muddy Creek the surface with the pit is the flatter, showing the zoœcia directed to the pit (Pl. VI. fig. 1), and these are the best preserved of any specimens, recent or fossil, examined by me. In these the pit is 0.55 mm. in diameter, and from Percy Island the six specimens have pits 0.8 mm., 0.6 mm., 0.55 mm. In *Batopora multiradiata*, Rss., the pits are much smaller, being 0.25-0.27 mm. from Ferrara di Monte Baldo, Brendola, Montecchio Maggiore, and Val di Lonte; a pit in *Orbitulipora petiolus* measures 0.36 mm.

*Batopora* was described as with a single "aufrecht stehende Zelle." This so-called "primordial Zelle" also in *Sphaerophora* stands out surrounded by a border, and is much larger than any of the zoœcial openings, but we must now call it a pit and this is referred to on page 80. This reversal of the position of the zoœcia, though not quite the same as now known in *Conescharrellina*, yet reminds us of that genus.

\* "Foss. Chil. Bry. from Muddy Creek," Quart. Journ. Geol. Soc. vol. xxxix. p. 426 (1883).

It seems as though both in *Spharophora* and *Batopora* the zoëcia have grown over the primary in all directions, and this we see in *Orbitulipora excentrica*, Seg. (see page 92), and in *O. petiolus*.

The ovicell of *Spharophora* is large, round, raised, and open in front.

Referring to the two specimens from Batesford or Muddy Creek, it is well to recall the fact that Haswell mentions a form with a flat base without giving it a name. The fossil *Cellepora serrata*, MacG., also has a flat base and clearly belongs to *Spharophora*.

*Loc.* Holborn Island, Queensland (*H.*); Percy Island, Queensland, 11 fath., sent by Haswell; N.E. coast of Australia, sent by Brazier; South Australia (*Maplestone*).

*Fossil.* Curdies Creek, S.W. Victoria; Mt. Gambier; Aldinga and River Murray Cliff (*all A. W. W.*), Schnapper Point, Bird Rock, Corio Bay, Waurin Ponds (*all MacG.*), Cape Otway, Spring Creek, Muddy Creek, Shelford, Fyansford, Mornington, Mitchell River (*Maplestone*).

*Orbitulipora excentrica*, Seguenza. (Text-figs. 2, a, b, c.)

*Orbitulipora excentrica*, Seguenza, "Le Formaz. Terz.," Atti Reale Accad. dei Lincei, ser. 3, vol. vi. p. 130, pl. xii. figs. 22, 22 a (1879); Neviani, "Bri. neog. delle Calabrie," Pal. Ital. vol. vi. p. 188, pl. xvii. figs. 15, 16 (1900).

*Orbitulipora excentrica*, var. *flabellata*, D'Ossat & Neviani, "Coral. e Bri. Neog. di Sardegna," Boll. Soc. Geol. Ital. vol. xv. p. 18 (1897).

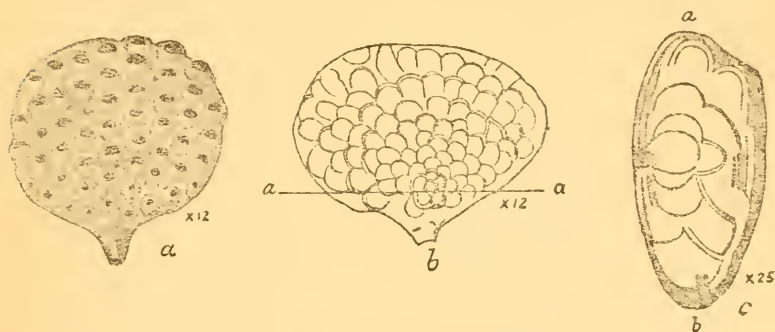
I had written a description of specimens from Mazzurega as *O. excentrica*, nov., before remembering that Seguenza had described a species with this specific name, which, although larger and with more zoëcia than the Mazzurega fossils, is apparently the same species. Mine are about the same size as Neviani's var. *flabellata*. There are several specimens from material collected from Mazzurega, near Fumane in the Veronese, N. Italy, sent to me by Professor Parona. The age was considered Bartonian, but is now called Priabonian. The bilaminar depressed zoaria are small, about 2-3 mm. in diameter, with a stalk (as it has been called in *O. petiolus*), from which the zoëcia spread out in fan-shaped form, more or less in rows. The stalk or pedicle is for attachment, as is the case with the pits of *Batopora* and *Orbitulipora*, and it sometimes gives a sub-triangular appearance to the zoarium.

The zoëcia are very distinct and rounded, as seen from above, and in the younger ones the aperture occurs about the centre of the apparently nearly round erect zoëcia,

while in the larger older zoëcia the aperture has a nearly straight proximal border, below which there is sometimes a large avicularian chamber. It is, however, as a rule, very difficult to see the shape of the oral aperture, so that, although outlined by the camera lucida, the restoration of some of the apertures has been necessary.

This is very closely allied to *O. petiolus*, Lonsdale \*, and he, Stoliczka †, Reuss ‡, Vine §, and Gregory ||, all show the central zoëcia the smaller, and speak of the zoëcia radiating from the centre of the zoarium; also the text and figures indicate that it is depressed, which is not the case in the North Italian fossils, nor is it always so in the specimens of *petiolus* which I have examined. Various authors have referred to an ovicell in *O. petiolus*, but it is spoken of as

Fig. 2.



*Crbitulipora excentrica*, Seg.

a.  $\times 12$ .                      b. Longitudinal section.  $\times 12$ .  
c. Transverse section near base.  $\times 25$ .

proximal to the oral aperture, whereas it is distal and directed towards the centre of the disk. In my specimens of *excentrica* no ovicells are distinguished, though some zoëcia have a large suboral avicularium.

Horizontal sections of *excentrica* are extremely interesting, as they show the primary very near to the stalk, referred to as the pit in *Sphaerophora*, *Batopora*, and *Stichoporina*. The

\* Dixon's 'Geology of Sussex,' p. 151, pl. i. fig. 10 (1850).

† Olig. Bry. von Latdorf, p. 91, pl. iii. fig. 5 (1861).

‡ Bry. d. deutschen Unterolig. p. 217, pl. i. figs. 1, 2 (1867).

§ Vine, "Notes on Brit. Eoc. Poly.," Proc. York. Geol. Polytech. Soc. vol. xi. p. 164, pl. v. fig. 10 (1889).

|| "On the Brit. Palæog. Bry.," Trans. Zool. Soc. Lond. vol. xiii. pt. vi. p. 253, pl. xxxi. fig. 12 (1893).

round primary is surrounded by five zoëcia, and then from these the ordinary zoëcia grow, so that there are zoëcia all round the primary, and I have already suggested that the first zoëcium of *Batopora* was not very far from the pit, formerly mistaken for a "primordial cell." The section, text-fig. 2, *c*, was made to show the central zoëcia at right angles to text-fig. 2, *b*, and the relationship of the zoëcia on each side. Text-fig. 2, *c*, is magnified about twice as much as text-fig. 2, *b*, and is from about the line *a-a*, text-fig. 2, *a*. A series of transverse sections are required to completely understand the growth, but this is not possible.

There is in *O. petiolus* a pit to the younger zoaria, and as growth proceeds this is prolonged, so that in mature zoaria there is a tunnel from the centre to the large external pit, and this can in places be seen through the layers of zoëcia covering it. Sections show this tube more clearly from the centre to the projection, and inside this tube fairly large pores occur in regular lines.

Some of the specimens in the British Museum, marked *Heteropora glandiformis*, Gregory\*, are young *O. petiolus*, and in one case a pit can be seen. Besides this there are one or two which, though worn, show signs of a base like that of *Conescharellina cancellata*, Busk (figure 22 in a paper now ready). The specimens, being mounted, could consequently not be examined all round, but in none was I able to distinguish Cyclostomatous characters.

Reuss thought that the process of *petiolus*, subsequently called stalk, pedicle, or pit, had no connection with the structure of the zoarium, and was only accidental, but we now see that it is the prolongation of the pit.

*O. petiolus*, Lonsd., occurs from beds of about the same age as the Mazzurega deposit, having been found by Dixon from Bracklesham, by Stoliczka from Latdorf, by Reuss from the Lower Oligocene of Calbe and Bünde; Vine says from Barton Bay; Bracklesham; Stubbington; Gregory besides these mentions Bramshaw and Brook; Vincent and Th. Lefèvre† say it occurs in Belgium from the Bruxellian, Laekenien (Upper Eocene), Wemmeliën and Tongrian (Oligocene), subsequently also referred to by Moulon; Canu mentions it from the Bartonian of Var in the Paris basin.

*Loc. of excentrica.* Tortonian (*Seg.*), Mioc. of Calabria

\* "British Palæogene Bryozoa," Trans. Zool. Soc. vol. xiii. p. 261, pl. xxxii. fig. 11 (1893).

† "Faune Laek. sup. des Environs de Bruxelles," Ann. Soc. Malac. de Belge, vol. vii. p. 29 (1872).

and of *Cadreas sopra Bonurra*, Sardinia (*Nev.*); *Mazurrega*, Veronese (*A. W. coll.*).

The forms dealt with may be provisionally placed as follows. It is a group with erect, usually barrel-shaped zoecia:—

I. With a pit towards which the zoecia are directed.

1867. *BATOPORA*, Rss.—Oral aperture small (0.09 mm.), nearly round, but examination shows straight lower edge. Bi-laminate. Primary zoecia hidden. Type, *B. stoliczkai*, Rss. (probably young of *B. multiradiata*, Rss.).

1861. *ORBITULIPORA*, Stoliczka.—Oral aperture large, with straight lower edge. Pit at the side. Bi-multilayered. Type, *O. huidingeri*, Stol.

1881. *SPHEROPHORA*, Haswell.—Oral aperture large (0.12 mm.), with straight lower edge. Grows in all directions from the early zoecia. Pit central. Multi-laminate. Type, *S. fossa*, Haswell.

1852. *STICHOPORINA*, Stoliczka.—Oral aperture small. Uni-laminate to bi-laminate? Pit central. Type, *S. reussi*, Stol.

II. Usually without a pit.

1873. *MAMMILLOPORA*, Smitt\*.—Oral aperture large (0.12 mm.), contracted at each side. Primary zoecium erect, surrounded by six similar zoecia. Only uni-laminate, showing the position of the zoecia on the under surface. Type, *M. cupola*, Sm. Tertiary fossils: *M. simplex*, Kosch., *M. bidentata*, Rss., *M. protecta*, Kosch.

1851. *CONESCHARELLINA*, d'Orb.—Oral aperture very small, slight sinus, opercula with muscles some little distance from the border, semi-lunar slits. Cone uni-laminal, filled in by large chambers. (To be dealt with in the larger paper.) Type, *C. angustata*, d'Orb. (A species fossil from N: Italy has large pores round the apex, and one near the centre is larger and might be called a pit.)

EXPLANATION OF PLATE VI.

- Fig. 1.* *Spherophora fossa*, Haswell,  $\times 10$ . Surface with a large pit. The zoecia are shown directed towards the pit. From Batesford or Muddy Creek, fossil.
- Fig. 2.* Ditto.  $\times 10$ . Section showing the pit. From Percy Island, recent.
- Fig. 3.* Ditto.  $\times 25$ . Section of the pit, showing the pores leading to the zoecia. From Percy Island.
- Fig. 4.* *Batopora multiradiata*, Reuss.,  $\times 25$ . Section showing the pit and the zoecia in a second layer round the first. From near Novezzina, fossil. (*a*)  $\times 2$ . Zoarium showing a cap formed by a second layer of zoecia. From Montecchio Maggiore.
- Fig. 5.* Ditto.  $\times$  about 10. Base showing two circles of zoecia. This is the only specimen showing two basal circles clearly.
- Fig. 6.* Ditto.  $\times 25$ . Showing the pit with smaller zoecia round it, as well as the ordinary zoecia. From Val di Lonte.

\* I have published a figure of the operculum of *Fedora edwardsii*, Jull., in "North Ital. Bry.," Quart. Journ. Geol. Soc. vol. xlvii. pl. iv. fig. 7; and Kirkpatrick has published one of *M. simplex*, Kosch. Proc. R. Dublin Soc. n. s. vol. vi. pl. xvii. fig. 4 (1890).

- Fig. 7. *Mamillopora bidentata*, Reuss,  $\times 25$ . Showing the primary zoecium and the six surrounding zoecia. From Bocca di Sciesa.
- Fig. 8. *Conescharellina eocæna*, Neviani,  $\times 10$ . Section from Spiassi, N. Italy.
- Fig. 9. *Batopora multiradiata*, Reuss,  $\times 25$ . Showing ovicells. From Montecchio Maggiore.
- Fig. 10. Ditto.  $\times 10$ . Showing the formation of a second layer from the neighbourhood of the pit. From Val di Lonte.
- Fig. 11. *Mamillopora bidentata*, Reuss,  $\times 25$ . Showing ovicell. From Bocca di Sciesa. (a) zoarium,  $\times 3$ .
- Fig. 12. *Conescharellina eocæna*, Neviani,  $\times 25$ . This figure is built up from various parts, as the preservation as a whole is not perfect. From Spiassi.

VIII.—*Two new African Freshwater Sponges.* By JANE STEPHENS, B.A., B.Sc., National Museum of Ireland.

SEVERAL years ago Dr. Annandale (5) drew attention to the somewhat oyster-like shells of the genus *Ætheria* as affording a favourable standing-place for the growth of freshwater sponges, not only on account of their roughened and often corrugated surface, but also owing to the fact that, like true oysters, their lower valve is firmly fixed to some solid support. Dr. Annandale stated that at least one species of freshwater sponge, *Corvospongilla loricata* (Weltner), had already been described from an *Ætheria* shell, when an examination of the shells belonging to this genus in the collections of the Indian Museum led him to the discovery of two new species of sponges. He remarked that he had little doubt that other sponges would be brought to light if the *Ætheria* shells preserved in museums were carefully scrutinized. Following Dr. Annandale's suggestion, the *Ætheria* shells in the collection of this museum were examined, with the result that two well-marked new species were discovered on one shell, and a few broken gemmules, too fragmentary to identify, on another.

As is well known, the genus *Ætheria* occurs only in Africa and in the north-west part of Madagascar. On the continent of Africa it is confined to the tropics, except that it descends the River Nile to the mouth. Many species have been described from time to time, but the researches of Drs. Anthony and Germain (6, p. 372) have shown that there is only one species—a very polymorphic one, namely *Ætheria elliptica*, Lamarck. Two varieties are, however, recognized by these authors—*Æ. elliptica*, var. *typica*, Germain, a smooth



form from streams and rivers, and *Æ. elliptica*, var. *tubifera*, Sowerby, a spined form from standing water. The fine shell on which the two new species of sponges are growing is spined, and therefore belongs to the latter variety, so that we may conclude that the sponges lived in still water. The locality of the shell is given merely as Benguela.

Shells in the museum collection belonging to the genera *Mulleria* and *Bartlettia* from South America, which with *Ætheria* comprise the family *Ætheriidae*, were examined also, but without any further sponges being found.

The following seven species of sponges have up to the present been described from specimens growing on *Ætheria* shells:—*Spongilla sumatrana*, Weber, vars.  $\alpha$  and  $\beta$ , Weltner; *S. ætheria*, Annandale; *S. schubotzi*, Weltner; *Corvospongilla loricata* (Weltner), *C. micramphidiscoides*, Weltner; *C. scabriscapulis*, Annandale; and *Potamolepis stendelli*, Jaffé. A specimen of *Spongilla carteri*, Bowerbank (fide Kirkpatrick), has also been found on one of these shells.

Weltner (11), in a paper published in the year 1913, gives a complete list of the freshwater sponges known in Africa up to that time. Twenty-four species and varieties are mentioned. Since then Dr. Annandale (5) has described two species and Jaffé (7) one species; these, with the two species now described, bring the total number of African freshwater sponges known at the present time to twenty-nine species and varieties. Thus Africa already compares favourably as regards number of species with other parts of the world known to be rich in freshwater sponges.

*Spongilla (Euspongilla) microspiculata*, sp. n.

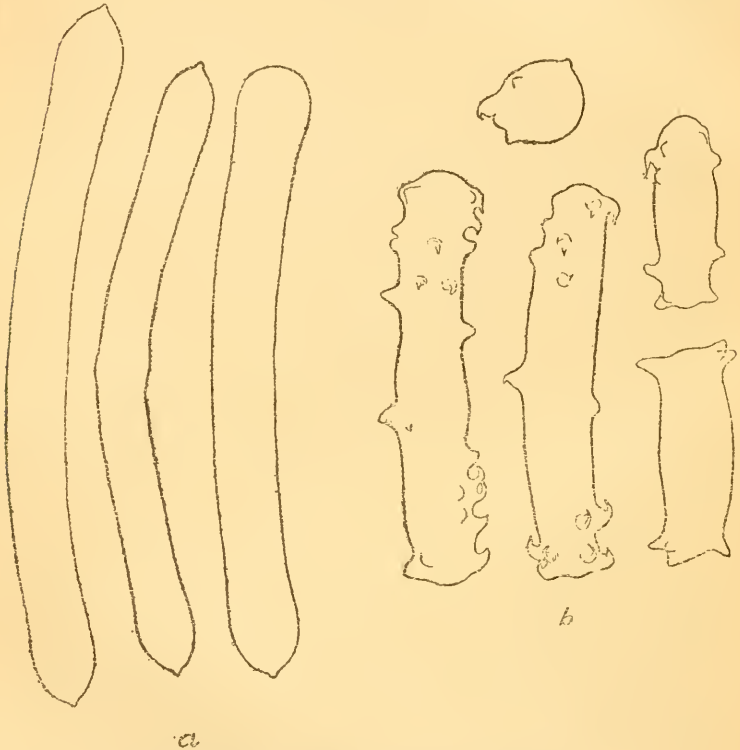
The sponge spreads in a fairly thick encrustation over about a third of the surface of the upper valve of an *Ætheria* shell, and coats some of the spines to their summits.

It is of a greyish-white colour in the dried state and is extremely hard to the touch. The surface is raised up into small ridges and rather prominent spines.

The skeleton is made up of very thick fibres, which consist of multiseriably arranged spicules bound together by a considerable quantity of spongin. The main fibres run vertically upwards through the sponge, dividing from time to time, and their extremities project above the general surface of the sponge and form the spines just referred to. They are united by rather thinner fibres at right angles to them, which run only from one main fibre to the next and do not themselves form continuous fibres. The whole constitutes a dense firm network.

The gemmules are numerous. They are spherical and occur singly towards the base of the sponge. They are about 0.55 mm. in diameter. Each is surrounded by a thick coat of spongin. Outside this is a layer of gemmule-spicules, lying two or three deep and densely packed together. The majority are arranged more or less tangentially, but some are placed nearly vertically and project, giving the

Fig. 1.



*Spongilla (Euspongilla) macrospiculata*, sp. n.  
*a*, oxea,  $\times 330$ ; *b*, gemmule-spicules,  $\times 600$ .

surface of the gemmules a shaggy appearance when seen under a low power of the microscope. The foramen is set on a very low tubule, which penetrates the layer of spicules, so that the opening is on a level with the general surface of the gemmule. A few gemmules, either singly or in groups, are

scattered over parts of the shell now free from the sponge. They are firmly attached to the shell and rest on a dense mass of gemmule-spicules.

*Spicules.*—The macroscleres are slightly curved, stout, smooth oxea, tapering abruptly at each end to a small sharp point into which the axial canal extends. The spicules are slightly swollen at the ends, and sometimes there is a faintly marked swelling at the centre of the shaft. There are not many abnormal forms present, but some of the spicules are irregularly bent and occasionally one end is rounded off. More rarely both ends are rounded. The macroscleres measure 0.275–0.335 mm. in length and have a thickness of 0.02–0.027 mm. They resemble in some degree the more pointed macroscleres of *Spongilla crassissima*, Annandale, var. *crassior*, Annandale, but they are more swollen at the ends and are somewhat longer and thicker.

There are no free microscleres present in the sponge.

The gemmule-spicules are short, thick strongyla provided with strong spines. Some of the spicules, especially the shorter ones, are swollen in the middle, so that they are barrel-shaped; others are nearly spherical, but still bear a few spines. The spines are grouped at either end of the strongyla, leaving the centre of the shaft smooth, but often a few scattered spines occur along the shaft. The spines are stout; typically they are strongly curved towards the centre of the shaft and end in a sharp point; but many of them are stout, straight, knob-like projections. The spicules measure from 0.035–0.1 mm. in length and have a thickness of 0.012–0.016 mm. Some of the short inflated ones are as much as 0.021 mm. in diameter.

*Locality.* Benguela; on a shell of *Ætheria elliptica*, var. *tubifera*.

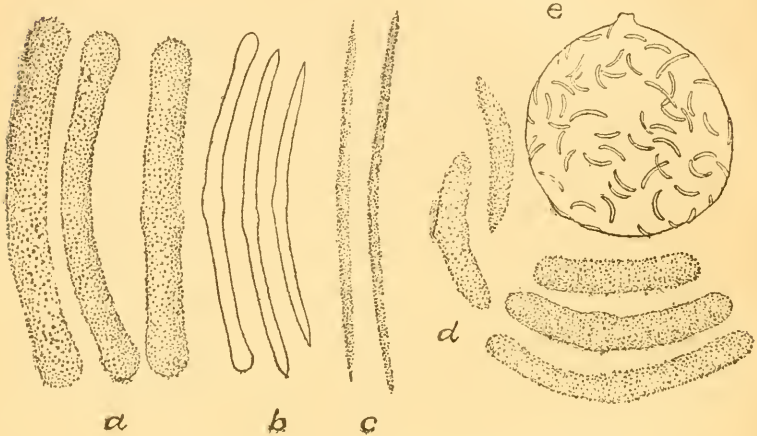
*Spongilla (Stratospongilla) benguelensis*, sp. n.

The sponge occurs in a number of very small patches towards the edges of the lower valve of the *Ætheria* shell on which the previously described species is growing. There are the remains of various other patches of the sponge also on the lower valve in the region of the hinge and one or two minute specimens on the upper valve. These patches of sponge are very inconspicuous, as they run chiefly in the furrows of the shell; in the dried state they are soft to the touch and their surface is even. Scattered over parts of the lower valve of the shell are quite a number of gemmules belonging to this species. Each gemmule is firmly fixed to

the shell by means of the spongin which binds together the cage of macroscleres in which it is enclosed.

The skeleton, as far as can be seen, is a rather close network of spicules. The spongin could not be made out, and it must be very scanty in quantity, as the spicules at once fall apart when a small specimen is sectioned by hand.

Fig. 2.



*Spongilla (Stratospongilla) benguelensis*, sp. n.

*a*, strongyla,  $\times 330$ ; *b*, developing strongyla,  $\times 330$ ; *c*, microxea,  $\times 600$ ; *d*, gemmule-spicules,  $\times 600$ ; *e*, gemmule freed from its cage of macroscleres,  $\times 60$ .

The gemmules, as already stated, are firmly fixed to the shell by means of the spongin binding the cage of macroscleres which encloses each gemmule. These macroscleres lie tangentially to the surface of the gemmule, they are strongly bound together by spongin, and adhere closely to each other, unlike the rest of the skeleton. The gemmule rests on the floor of the cage, and, at least in the dried state, there is a considerable space between the sides and roof of the cage and the gemmule. Similar cages of macroscleres have been described in other species—for example, in *Spongilla atheria*, Annandale, *Corvospongilla burmanica* (Kirkpatrick), *Corvospongilla lapidosa* (Annandale), and *Corvospongilla scabrispiculis*, Annandale. The gemmules themselves are spherical and are about 0.38–0.42 mm. in diameter.

Each is enclosed in a thick coat of spongin. The gemmule-spicules lie tangentially to the surface, and are embedded in this coat. The spicules are fairly numerous, but are not closely packed together as in the allied species *S. indica*, Annandale, *S. sumatrana*, Weber, and *S. bombayensis*, Carter. There is a short foraminal tubule which lies rather to one side of the gemmule in its natural position.

*Spicules*.—The macroscleres are slightly curved, uniformly microspined strongyla. The ends are a little swollen and there is often a slight swelling in the centre of the shaft. The strongyla measure 0.13–0.17 mm. in length by 0.01–0.015 mm. Among them are scattered a few slender smooth oxea with a well-marked swelling in the centre of the shaft. These are nearly the same length as the preceding spicules, and are apparently young forms of the macroscleres, as they lead on to thicker spicules which are obviously developing macroscleres and which are nearly cylindrical, but some of which still retain rather pointed ends.

The free microscleres are slightly curved, sharply pointed, microspined oxea measuring 0.06–0.09 mm. in length by 0.0025 mm. Some have a very feeble swelling at the centre of the shaft.

The gemmule-spicules are small, curved, sausage-shaped spicules uniformly covered with minute spines. Sometimes the ends are pointed instead of being rounded off as is usually the case. There is often a slight swelling in the centre of the shaft. The spicules measure 0.035–0.06 mm. in length, with a maximum diameter of 0.008 mm.

*Locality*. Benguela; on a shell of *Ætheria elliptica*, var. *tubifera*.

The subgenus *Stratospongilla*, Annandale (1), to which the foregoing species belongs, is chiefly tropical in its distribution (4). At the present day it is known to be represented in India by three species—*S. bombayensis*, Carter, *S. indica*, Annandale, and *S. graveleyi*, Annandale; it occurs in Sumatra—*S. sumatrana*, Weber; in tropical and South Africa—*S. rousseleti*, Kirkpatrick, *S. schubotzi*, Weltner, varieties of *S. sumatrana*, Weber, and *S. bombayensis*, Carter; in the Fiji Islands—*S. gilsoni*, Topsent; and in Eastern China—*S. sinensis*, Annandale. One species—*S. clementis*, Annandale—from the Philippines is doubtfully assigned to the subgenus, and *S. navicella*, Carter, from the River Amazon, appears to be an allied form.

Of the foregoing species the following are most nearly related to *Spongilla benguelensis*, sp. n.:—*S. bombayensis*,

*S. indica*, *S. graveleyi*, and *S. sumatrana*. All these possess microspined macroscleres, spined microxea, and strongly gemmule-spicules. Apart from other characters, all these, except *S. indica*, are clearly marked off from the new species by the possession of oxea as macroscleres. *S. indica*, like *S. benguelensis*, sp. n., possesses strongly as macroscleres, but is separated from it by various differences in the size and character of the spicules, and particularly by the structure of the gemmules, which in *S. indica* are fixed to the substratum by their outer chitinous membrane and are not enclosed in cages of macroscleres.

A sponge belonging to another genus—namely, *Corvospongilla micramphidiscoides*, Weltner—has a very similar spiculation, but with the addition of free amphidiscs, the possession of which characterizes the genus.

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IX.—On some External Characters of Ruminant Artiodactyla.—Part VII. Domesticated Cattle (*Bos taurus* and *B. indicus*)\*. By R. I. ПОЦОК, F.R.S.

### I. INTRODUCTION.

The question of the origin of domesticated cattle has an extensive literature. The latest volume on the subject known to me was published in 1912 by the late Mr. Lydekker and entitled 'The Ox and its Kindred.' In this the views of previous writers are collated and analyzed, and accepted or rejected as the case may be, the general conclusions arrived at being apparently the following:—

1. Domesticated cattle are descended from two distinct species, one of which (*B. taurus*) is represented in its purest form at the present time by Pembroke, Kerry, West Highland, and British Park breeds, the other (*B. indicus*) by the breeds of zebus or humped cattle of India and elsewhere.
2. The extinct aurochs (*B. primigenius*) was the ancestor of *B. taurus*.
3. The existing banteng (*B. banteng*) was the ancestor of *B. indicus*, a theory originally propounded by Rüttimeyer in 1878 and supported by Keller in 1902 †.
4. The existence in the southern and some other countries of Europe of cattle partaking of the characters of *B. taurus* and *B. indicus* is due to the introduction of

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\* The substance of this paper was drafted in 1912 in the form of a review when Mr. Lydekker's volume, 'The Ox and its Kindred,' first came into my hands; but its publication was delayed for a variety of reasons, including my own occupation with other work and my friend's subsequent illness and death. Resumption of work upon the Ruminantia induced me to take up the paper again and cast it in its present form. Although compelled to criticise some inconsistent arguments and theories and dispute a few statements of fact it contains, I must disclaim all intention of disparaging this volume as a whole. It is a valuable compilation, containing in a handy form most of the information about cattle, useful to zoologists and laymen, that could be compressed into the allotted space.

† It is singular that Mr. Lydekker omits all reference to *B. indicus* in his 'Catalogue of Ungulate Mammals,' published in 1913. According to his views this form should have found a place under the subgenus *Bibos*. Perhaps the reason for its omission is that it possesses none of the characters of that group. It may be noted that if the opinion of the descent of *indicus* from *banteng* be true, *indicus* differs not merely specifically, but subgenerically, according to Lydekker, from *taurus*.

the latter into Europe and its subsequent interbreeding with the former.

Proposition 2 may pass as probably true\*. Proposition 3 appears to me to be equally probably untrue; while propositions 1 and 4 are open to dispute in the sense that they are founded on facts susceptible of other interpretations.

## II. THE BANTENG-DESCENT OF THE ZEBU.

Criticising this theory first of all from the ethnological, and admittedly therefore from a purely theoretical, standpoint, it appears to me improbable that a species domesticated by the Javanese belonging to the Malay stock of the Mongolian race of man was the ancestral form of the cattle of the people of India who belong to a different race. More likely does it seem that the ancestors of modern humped cattle were brought to India by invaders entering the country by way of the Punjab and Sind, unless an autochthonous species, now extinct as a wild animal, was found ready to hand for the purpose in India itself.

There are reasons for believing that the humped cattle have been a domesticated type for a very long time, certainly for a few thousand years B.C. So far as I am aware, there is no evidence, one way or the other, of the antiquity of the banteng as a domesticated animal; but if Rütimeyer's theory, supported by Keller and Lydekker, that the banteng was the ancestor of the zebu be true, its domestication must be assigned to a much earlier date to account for the acquisition of the distinctive peculiarities of the zebu. Yet, if this be so, it is surely strange that the domesticated banteng of Java and Bali differs in no important points from wild members of the species, still found in Java and Further India. This fact appears to me to be strongly suggestive of the conclusion that the domestication of the banteng has been of comparatively

\* This appears to be Prof. Ewart's opinion (P. Z. S. 1911, i. p. 281). In concluding his study of the skulls of Roman cattle obtained at Newstead, he wrote:—"Hence it may be said that up to at least the Bronze Age the majority of the domestic cattle of Europe were the descendants of *Bos primigenius*—some being nearly pure descendants of the imported 'Celtic' shorthorn breed, while others were pure or nearly pure descendants of the indigenous wild urus (*Bos taurus primigenius*)." But since he assumes it to be probable that the "Celtic" shorthorn was itself a domesticated dwarfed descendant of an Asiatic variety of *Bos primigenius*, there is clearly only one wild species involved in the ancestry. The evidence which excludes other breeds of cattle from this genealogy does not appeal to me as at all convincing.



short duration. It may not indeed date back beyond the Dutch occupation of Java in the seventeenth century.

In the second place, the theory seems to me to be inadequately supported on the zoological side. Judging from the banteng I have seen, I should say there is nothing distinctly zebu-like about them except the sloping croup and the sexual dimorphism in colour. Apart from these characters, which I suspect are primitive in the Bovinæ (*cf. infra*, p. 108), banteng exhibit no noticeable resemblances to zebus, except such as are shared by many European cattle above suspicion of zebu blood in their veins. Banteng, indeed, are remarkably "taurine" in style apart from their white stockings, white rumps, elevated withers, and the roughness of the naked skin of the intercornual area in adult bulls. And these characters, be it noted, also differentiate them from zebus, which, in my experience of many individuals of the best-defined breeds, never show a trace of them. This is not what one would expect if the theory of the relationship between the two types were sound. Mr. Lydekker certainly suggests that the white fetlock-rings seen in some zebus may be the remains of the white stockings in the banteng; but whatever be the value of this suggestion, it is discounted in the question at issue by the presence of this ring in some English park cattle claimed to be of pure aurochs descent.

Mr. Lydekker also attempts to explain the hump so characteristic of zebus as the concentrated remains of the tissue covering in the banteng the high spinous processes of the thoracic vertebræ, suggesting that it was left behind, so to speak, when according to the theory these bony processes became reduced during the evolution of the zebu from that species. I do not think this theory of the origin of the hump need be discussed until the supposition upon which it rests, that the vertebræ in question have been shortened, is supported by more evidence than is at present forthcoming. For myself, I should be inclined to compare the hump of the zebu to the accumulation of tissue which may be seen just in front of the withers in many well-fed European bulls (see, for example, pl. xiii. of Mr. Lydekker's volume), and which was quite perceptible in a bull banteng recently exhibited in the Zoological Gardens. However that may be, it cannot in my opinion be seriously claimed that the hump of the zebu and the elevated dorsal crest of the banteng are evidence of affinity between the two. The external appearance of the animals, in short, affords no support to the view that the banteng is the ancestor of the zebu.

It may be recalled that the difference in voice between

*B. indicus* and *B. taurus* has been frequently advanced as evidence of their specific distinctness. To this I shall refer later (p. 109). If there is any truth in the claim, the argument disposes of the theory of the banteng descent of the zebu. The voice of the zebu I have described below. It differs considerably from that of the banteng, which I have heard described as a roar or bellow. Perhaps Blanford's phraseology applied to the voice of the gaur will convey as good an idea of it as any. He said it is "a prolonged call, not very unlike the lowing of *Bos taurus*, but utterly unlike that of *B. indicus*." Blanford, however, seems to have been unacquainted with the true call of the zebu (*cf. infra*, p. 109). In my opinion, the voice of the zebu differs at least as much from the voice of the banteng as it does from that of *B. taurus*; but for reasons given below I do not think this necessarily disproves the theory of the descent of the zebu from the banteng.

The evidence derived by Rüttimeyer from the form of the skull in the banteng and zebu is rendered, in my opinion, untrustworthy by the extraordinary variability of the skull in domesticated cattle. In any case, the cranial resemblances between the two are not close, as a comparison between Lydekker's figure of the skull of a bull Gujrati zebu (published on pl. xx. of his volume on the Ox) with his figures of the skulls of the Javan and Bornean banteng (published on pp. 24 & 26 of his 'Catalogue of Ungulates' in 1913) will show. The banteng-skulls, indeed, have a relatively longer forehead and shorter face, and thus approximate to the typical taurine type. Nevertheless, the skull is so plastic that I should hesitate to take it as a reliable guide to affinity, one way or the other, where domesticated animals are concerned (*cf. infra*, p. 106).

One other point may be referred to. In both the gayal and the banteng, representing two distinct species of the *Bibos* group of cattle, the urethral canal of the penis ends in a small pointed process, free from the swollen termination of the glans. In the zebu there is no such process, the urethral canal terminating, as in typical *Bos*, on the underside of the swollen end of the glans (*Ann. & Mag. Nat. Hist.* (9) ii. pp. 451, 454-455, 1918).

### III. THE CHARACTERS OF *BOS INDICUS* AND *BOS TAURUS*.

The principal differences between an average Indian zebu and an average British or Spanish fighting bull are well known. The zebu has a hump of fleshy and fatty tissue on

the front of the withers, a more sloping croup, a heavier dewlap, a longer narrower skull with relatively shorter frontal and longer nasal maxillary region, and horns which are more upright in direction of growth. The European animal, on the contrary, has no hump, the plane of the croup is in a line with the back, the dewlap is shallower, the skull shorter but with its frontal portion relatively longer, and the horns are more horizontal in direction of growth. The voices of the two also are different, but not so different as literature would lead one to suppose. Habits and constitution supply further differences.

If there were no other types of domesticated cattle in existence there would be grounds for the opinion of Blyth and others as to the specific distinctness of the two types. But when the differences are analyzed they appear to me to lose much of their weight. Even amongst undoubted Indian zebus there is immense variation in most of the characters mentioned, the hump alone, so far as I am aware, forming an exception. The characters may be considered in order:—

*Horns.*—Of the horns of the zebu Lydekker (pp. 132–133) wrote:—“The horns of all humped cattle—both Indian and African—differ from those of the aurochs and the related types of European domesticated cattle by their distinctly lyrate shape, the first main curve having the convexity in front instead of behind. Their tendency is also to grow upwards and backwards rather than forwards.” This statement is untrue. In the first place, the horns of Heberstein’s aurochs (pl. iii.) are very like those of the Gujrati zebu (pl. xx.) in direction and curvature. In the second place, the horns of zebus are so variable that it is impossible to affirm anything definite with regard to them. From the type above described by Lydekker from the Gujrati breed the horns may deviate by taking a horizontal direction sideways or a horizontal and forward curvature or a downward inclination. Most curious of all is the type seen in the Mysore breed, here the horns arise close together on the top of the head and recede backwards and upwards, the whole of the anterior surface being concave. In the calf, indeed, they begin as erect buds, not as lateral horizontal buds as in the Gujrati. With regard to the question at issue, the point to be noticed is that the Mysore zebu differs more from the short-horned zebu in the position and curvature of the horns than the short-horned zebu differs from short-horned British cattle. Yet no one supposes these zebus to be other than domesticated breeds of one and the same species.

In European cattle, even setting aside for the moment

those breeds claimed to be of partial zebu descent from the shape of their horns, great variation in these appendages is met with. In any considerable herd of "shorthorn" the horns may be elevated, depressed, or horizontal; and in closely related breeds like the Chartley and Chillingham park cattle the horns differ greatly, being long and downturned in the Chartley and shorter and upturned in the Chillingham (see Lydekker, pl. iv.). Yet in spite of these differences the one breed, I take it, has as much claim as the other to be regarded as a pure-bred representative of *B. taurus*. Apart from the qualification, I entirely agree with Prof. Ewart's dictum (P. Z. S. 1911, pl. i. p. 272):—"Except when they curve forwards at right angles to the frontals, as in typical Celtic shorthorns, the horns assist but little in settling the race to which the Newstead skulls belong." I am not, however, sure whether the term "race" is used in this connection to signify artificially formed "breeds" or natural "species" or "subspecies."

*Skull*.—As stated above, the skulls of typical zebus differ from the skulls of European cattle of assumed purity of descent from the aurochs in having the frontal region of the skull shorter and the naso-maxillary region longer, coupled with orbits which are less prominent. Although importance has been attached to these points in the attempt to prove specific diversity between the two types, it is surely a matter of common knowledge that, in some domesticated mammals at least, no part of the skeleton is so plastic and subject to such profound variation in structure as the skull. This is well shown in dogs and almost equally well in cattle. One instance only need be cited in support of this statement. Speaking of the Niata or Nata breed of La Plata, Darwin remarked that "on comparison with the skull of a common ox, scarcely a single bone [of the skull] presents the same exact shape, and the whole skull has a wonderfully different appearance." It is needless to mention all the peculiarities described by Darwin and Owen, the most remarkable being the upward curvature of the jaws, the short broad forehead, the extremely abbreviated nasal bones, and the union between the premaxillæ and the lacrymals. These cattle breed true to type, and the interesting thing about them is that the breed must have originated since 1552, when cattle were first introduced into South America. Here, then, we have a clear case of the formation from ordinary European cattle of a type differing from them most profoundly in the structure of the skull. With this proof of the potential variability of the bones of the cranium in European cattle before us, what

justification have we for assuming that the comparatively slight differences between the skulls of European cattle and humped cattle indicate initial specific distinctness between these two? Obviously very little.

The unsatisfactory nature of the evidence supplied by skulls and horns, is attested by the variety of opinions held by authors who have attempted to solve the difficult question of the origins of domesticated breeds of cattle, by relying largely on characters furnished by the cranium and its appendages.

*Dewlap.*—The dewlap in zebus is often heavier and deeper and sometimes rises nearer the chin\* than in European cattle believed to be of unmixed aurochs descent. I cannot satisfy myself as to the precise value attached to this feature by Lydekker. He quotes it as characteristic of zebu, when contrasting them with the European breeds of the aforesaid type, and more than once cites it as evidence of zebu blood in those European breeds that reproduce the character. But a precisely similar difference in the development of the dewlap exists between the domesticated gayal and the wild gaur; yet in this case (pp. 149 & 177) Lydekker uses this difference to support the view that the gayal is nothing but a domesticated race of the gaur, and ascribes the larger size of the dewlap in the former to the effect of domestication, adding “the excessive development of the dewlap in the humped cattle of India is perhaps also the result of domestication.” I quite agree with this view, but it clearly disposes of the claim that the larger size of the dewlap in zebus is evidence of their specific distinctness from pure-bred European cattle.

*Ears.*—Blyth stated that the ears of *B. indicus* differ from those of *B. taurus* in shape, being more pointed. In a general way this is perhaps true; but no zebu that I have seen has ears approaching in apical attenuation those of the Hungarian cow depicted by Lydekker on pl. xv. Even amongst zebus themselves the ears differ so much in size and shape, as may be seen by comparing those of the Gujrati and Mysore breeds (pl. xvii.), that no reliance can be placed on these organs as evidence of specific distinctness between zebus and normal European cattle.

*Croup.*—Although zebus typically have a sloping croup, and never, within my experience, a horizontal croup like that of European cattle, nevertheless the differences between zebus

\* Many of Lydekker's figures illustrating breeds of European cattle show the anterior lobe of the dewlap in the interramal area behind the chin, as in zebus.

in this particular is very great, as is shown by the Mysore and Gujrati breeds represented on pl. xvii. The Gujrati zebu, indeed, has a croup very sensibly approaching that of European cattle in its elevation.

*Colour.*—One or two colour-characters are mentioned by Lydekker as evidence of specific distinctness between *B. taurus* and *B. indicus*. He speaks of white rings round the eyes and fetlocks as characteristic of the zebu. But since such typical examples of *B. taurus* as park cattle by no means infrequently have white rings round the fetlocks, and since the hair round the eyes in Jerseys, which are beyond suspicion of zebu blood, should, as Lydekker says (p. 115), be cream-coloured or greyish, it is quite clear that no value can be attached to these points. Again, the presence of a light spinal stripe in Kerry cattle (p. 95) in the Craven breed of longhorns (p. 84) and in Castilian bulls (p. 132) is quoted as certain evidence of aurochs descent. Very likely that is the case. But a white spinal stripe is not uncommonly present in pure-bred zebus. Hence if this character has the significance claimed for it by Lydekker, it is evidence of consanguinity between *B. taurus* and *B. indicus*.

Finally, in the tendency exhibited by bull banteng to become black, and thus depart from the rufous tint of cows and young bulls, Lydekker sees the origin of the sexual difference in colour between some breeds of zebu, the cows of which are whitish while the bulls are blackish or iron-grey\*. But traditional information about the aurochs suggests that that species also was sexually dimorphic in colour. One aurochs indeed was recorded as grey—presumably, that is to say, zebu-like. Hence the colour-difference between the sexes of zebus cannot be claimed with assurance as a banteng character. So far as it goes, indeed, it suggests closer affinity between the zebus and the aurochs than between the latter and typical breeds of *Bos taurus*, in which the sexes are, I believe, alike. But I am not prepared to lay any great stress upon this point, because, as stated above, I suspect sexual dimorphism of colour in cattle to be a primitive character inherited from a Tragelaphine ancestor †. How-

\* Bull calves of the Mysore and Gujrati breeds begin to darken in the first year.

† Lydekker (pp. 32-33 & 253) appears to have been attracted by Prof. Lönnberg's view that cattle are closely related to the gnus (*Connocheetes*). He adds, however, that although the direct ancestry of the ox tribe is still unknown, the earliest representatives of the group are related to the buffaloes, which constitute in some respects the most primitive of

ever that may be, it may be claimed that the coloration of zebus and European cattle affords no support to the view that they belong to distinct species.

*Voice.*—Blyth and those who have copied him attach great importance to the voice as a criterion of distinct specific origin between *B. indicus* and *B. taurus*. He and Blanford described the voice of the former as a grunt utterly unlike the “lowing” or bellowing of European domesticated cattle. This is only half the truth. Zebus, on the whole, are silent animals, but now and again they utter an abbreviated or prolonged grunt recalling that of a yak or American bison. But they also call with a loud voice which may be perhaps described as somewhat intermediate between the “moo” of an ordinary cow and the hoarse “baa” of a sheep. The sound is distinguishable from that of a cow or bull of British cattle, but I have heard a zebu calf, fretting for its mother, call her with a voice very like that of an English “shorthorn” calf.

The voice is certainly a criterion of kinship in wild animals; but to what extent it is to be trusted in domesticated forms appears to me to be doubtful. It is admitted, I take it, that domesticated fowls are the unmixed descendants of the Bankiva jungle-fowl (*Gallus gallus*). Nevertheless, the crow of the latter is generally, within my experience, distinguishable from that of the former, though unmistakably like it: and different breeds of domesticated fowls often differ to a certain extent in voice, thus attesting the variability, though limited, of this character. Domesticated dogs, too, differ from wolves in having added the bark to the howling voice common to both; yet the wolf or the jackal—it matters not which in the present connection—is usually accepted as the

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the living forms and are those whose horns come nearest in shape to those of gnus. This author's reliance on the shapes of horns as tests of affinity led him into few more unintelligible errors than this, excepting only his employment of the curvature of the horns, a manifestly useless character for the purpose, as a basis for the classification of the Bovidæ in his ‘Catalogue of Ungulates.’ With all respect to Prof. Lönnerberg, I am quite sure that his opinion about *Comochates* and *Bos* is unsound. The anatomical evidence that gnus are specialized hartebeests (*Bubalis*) and that the cattle are specialized Tragelaphines appears to me to be conclusive. The view that close affinity between the Bovines and Tragelaphines, attested more particularly by the Anoa, the primitive Asiatic buffalo, is quite in keeping with Lydekker's above-quoted statement that the earliest representatives of the ox-tribe are related to the buffaloes, which in some respects are the most primitive of living forms of Bovinæ.

wild prototype of the dog. Moreover, pure-bred dingoes and some Eskimo dogs, I am told, never bark. But no one believes them on that account to be specifically distinct from dogs which habitually bark. For these reasons I do not think the differences between the voices of *B. indicus* and *B. taurus* can be held as proof of specific difference between them, and the same concession must be made in the case of the claim of the banteng descent of *B. indicus*.

*Habits.*—Blyth pointed out that humped cattle in India differ from ordinary European cattle in that they never seek shade and never go into water and stand there knee-deep. Lydekker (p. 150) quotes this passage in his endorsement of Blyth's opinion that the zebu is of different specific descent from European cattle; but his acceptance of the theory that zebu are domesticated forms of the banteng involves the conclusion that an equally great change in habits has taken place, the banteng being a forest-dweller like its ally the gaur. Moreover, when discussing (p. 89) Professor Hughes's denial that British park cattle were derived from an ancestor which dwelt in forests, he admits that the habits of domesticated cattle have varied to some extent from those of their wild ancestors. This admission is founded on the known habit of park cattle of lying out in the open during periods of repose, coupled with the assumption that the aurochs (*B. primigenius*) resembled the gaur in seeking shade. Although the truth of this assumption cannot, in my opinion, be granted, considering that the gaur is a tropical Indian species, whereas the aurochs inhabited temperate latitudes in Europe and Asia, Lydekker's opinion that a change of habit has taken place in park cattle deprives of its value his support of Blyth's claim that the further change in the case of the zebu is evidence of specific difference of origin\*.

The zebu's avoidance of water may perhaps be explained, without reference to specific ancestral traits, by its being originally, at all events, a breed raised for survival in hot desert countries where water was periodically scarce, and where in times of drought and shortage of food the hump was useful for the sustenance it supplied. In specimens kept on

\* An interesting case attesting variation in habits and instincts of park cattle was reported to me some years ago. The Zoological Society sent a bull and a cow of a mixed Vaynol and Chartley breed to Calcutta. The bull soon died from exposure to the sun, disregarding the shade of a tree in the enclosure. The cow, having the instinct to avail herself of the shelter, survived.



short rations the hump soon begins to dwindle and sag like that of a camel. Prof. Ewart has, I believe, suggested a similar explanation for the accumulations of fat on the rump and tail of some breeds of domesticated sheep.

The constitutional difference between zebus and British cattle, shown by the capacity of the former to withstand the climatic and other conditions even of Brazil and Jamaica, to which British cattle succumb, is precisely what one would expect in the case of two breeds adapted for generations to such widely different physical conditions as are supplied, on the one hand, by tropical India, and, on the other, by temperate Europe.

Blyth maintained that zebus differ from European cattle in their habitual method of carrying the head when at rest. This is quite true of some breeds; Gujrati zebus, for example, hold the head somewhat elevated and not in a line with the spine in the attitude characteristic of *Bos taurus*. The splendid appearance of this breed of zebus, indeed, is due to that circumstance, and, when they are startled, to the alert stag-like lift of the head so different from the slouching carriage observable in other cattle. But Blyth's claim does not apply to all breeds. Mysore zebus, for instance, stand with the head depressed very much as in ordinary cattle. These differences between the two breeds of zebus are well illustrated on pl. xvii. of Lydekker's book, showing a Mysore cow in repose and a Gujrati bull standing at attention.

So far, then, as habits are concerned, there appear to me to be no difficulties in the way of believing in the common origin of *B. taurus* and *B. indicus*.

#### IV. EUROPEAN AND EGYPTIAN CATTLE OF SUPPOSED ZEBU DESCENT.

Most writers who have written on the subject find evidence of zebu blood in many breeds of cattle of Southern and Central Europe, the character of the horns forming the principal criterion. This claim may be perfectly true, but the testimony produced in its support is by no means convincing. Take, for example, the Transylvanian bull illustrated on pl. i. of Lydekker's book. This beast has the long body, straight back, high croup, long forehead covered with curly hair, short naso-maxillary region in the skull, and short thick legs wrapt up in one's conception of British shorthorns and park bulls. A comparison between the figure

in question and that of the Vaynol bull on pl. v. bears out this contention. The dewlap of the Transylvanian bull is a little deeper, it is true, but it is not appreciably deeper than in the Swiss and Simmenthal bulls, without claim to zebu blood, depicted on pl. xiii. The only striking difference between the Vaynol and the Transylvanian bulls lies in the horns, which in the latter are much longer and extend at first horizontally outwards and then upwards; but they are not like the horns of any Indian zebu I have seen, and differ no more, perhaps less, from the upturned horns of the Chillingham breed than the latter differ from the downturned horns of the Chartley breed shown on pl. iv. Hence it appears to me that the evidence of zebu blood in the Transylvanian bull is quite untrustworthy; and if the head of this animal be compared with the skull of the Spanish draught ox (pl. xiv.), another breed of assumed zebu descent, it will be evident that, so far as the head and horns are concerned, the two breeds are very much alike. The assumption that the Spanish draught cattle are wholly or partly zebus, in which the hump has been eliminated by selective breeding or crossing, seems to me inadequately supported by the facts.

The same theory has been put forward to explain the zebu descent of some of the humpless cattle of ancient Egypt, and to illustrate the characters of these cattle Lydekker reproduces two figures from Egyptian monuments—one (p. 135) showing four cows, the other a bull (pl. xvi.),—which in general style resemble the Transylvanian bull aforesaid, and are believed by Dürst and Lydekker to belong to the same stock and to have been introduced into Spain. That the Egyptian cattle belong to the same stock as the Spanish may be admitted, on the evidence, as probable, and that they were introduced into Spain as possible; but since they have the long bodies, humpless withers, high croup, and shallow dewlap of typical examples of *Bos taurus*, the claim that they are zebus with the hump artificially suppressed is surely unwarranted. At all events, the identification of these cattle must be admitted to be a matter of doubt. If they are not zebus, as I maintain, what becomes of the theory that their supposed introduction into Spain by the Moors or other invaders supplies the explanation of the alleged zebu blood in Spanish draught cattle?

I find similar difficulties in agreeing with Lydekker's determination of the Nineveh bull, depicted on p. 64, which he says appears to be an aurochs despite the absence of the mane and the excessive length of the tail. The animal,

however, has a collar on the neck suspiciously suggestive of domestication. It may be noticed, too, that the elevated carriage of the head recalls that of the Gujrati zebu shown on pl. xvii. Lydekker also remarks, in connection with this supposed aurochs, that it is "quite unlike the figure of the ancient Assyrian humped ox" reproduced on p. 140 of his book. Of these he wrote:—"In the contour of the neck and shoulders, as well as in the direction of the horns, the representations of these humped cattle differ widely from those apparently representing the aurochs (p. 64). That these long-horned cattle did not come from Egypt is demonstrated by the presence of the well-developed hump, but the horns are of the Egyptian type."

I cannot in any way reconcile these statements with the facts. The figure shows a pair of heavily built, short-bodied, long-legged oxen, with high carriage of the head. The animal in the foreground is polled, and has a very poorly, not a well-developed hump. It might pass for a polled zebu with an incipient hump, although the dewlap is absent, instead of being well grown as it is in that breed. The animal in the background, mostly hidden by its companion, has stout horns of medium length, which, instead of resembling, as alleged, those of the Egyptian cattle in their upward trend, are turned horizontally forwards in a line with the back, the point only being hooked upwards, almost exactly as in the figure of the Augsburg aurochs (pl. iii.). These horns appear to me to differ in no important respect from those of the supposed Assyrian aurochs, except that they are a little longer. The hump is not shown in the illustration; hence, if present, it was not larger than that of the ox in the foreground. Granting the presence of a small hump, it may be maintained that in that particular only does the horned bull of the pair in question, believed to be a zebu, differ from the above-quoted Nineveh bull, believed to be an aurochs.

If Lydekker's identification of these two Assyrian bulls be correct, it seems to me that the conclusion derived therefrom is precisely the opposite of that which he maintains, in the sense that the case supplies very strong evidence of the aurochs descent of the zebu. But apart from allowing that these Assyrian sculptures furnish interesting evidence of the existence of domesticated cattle approaching the zebu-type in many particulars in Mesopotamia at an early historic period, I do not think very great reliance should be placed upon structural details in mouldings apparently largely conventional. My purpose in referring to these and other cases

discussed in this section, is to show that the diversity of interpretation of which they are susceptible weakens the force of the contention that European breeds of cattle are of dual specific origin.

#### V. CONCLUSIONS.

1. Indian humped cattle (*Bos indicus*) are not descended from the banteng (*Bibos banteng*), but from some species of *Bos*, to which genus, or subgenus, they belong.
2. They intergrade in almost all characters with *Bos taurus*. Such differences as typical representatives of the two breeds exhibit are quite compatible with the view of their descent from a common ancestor, probably the aurochs (*B. primigenius*); but zebras may be the descendants of a form of *Bos* differing subspecifically, perhaps specifically, from *B. primigenius*, but closely related thereto. Nevertheless, if that be so, the extreme differences between *B. taurus* and *B. indicus* are not traceable to original ancestral differences, but are the product of long-enduring domestication, under widely distinct physical conditions, coupled with selective breeding along divergent lines guided by different tastes and needs\*.
3. The claim that some European cattle have an admixture, small or great, of zebu blood, due to the human introduction of that stock into Southern Europe is not established by the facts adduced in its support. It may, however, be true. On the other hand, the alleged zebu characters of such cattle may be explained, if the allegation be sound, by their representing stages in the evolution of the zebu type from *Bos primigenius*.

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\* Although the conclusion that *B. taurus* and *B. indicus* had a common ancestor or are possibly the descendants of two closely allied forms of *Bos* has been reached by the analysis of a different class of facts, it seems to coincide with that of several modern students of the group. Prof. Ewart, for example (P. Z. S. 1911, pt. ii. p. 281, footnote), thinks it probable that the long-browed short-horned zebu is probably representative of the small domesticated ox of Anau, the so-called Celtic shorthorn, itself of aurochs descent. Perhaps the settlement of the disputed relationship between *Bos namadicus*, the so-called Asiatic aurochs, and *Bos primigenius*, the European aurochs, which was apparently also of Asiatic origin, may supply an answer to the still doubtful question as to whether the domesticated cattle discussed in this paper trace their descent from two distinct species of *Bos* or from two local races of a single species.

X.—*On some small Mammals from Catamarca.*

By OLDFIELD THOMAS.

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THE British Museum has received a small collection of admirably prepared skins of mammals, mostly rodents, obtained at Chumbicha, Catamarca, by Sr. E. Budin, and a list of these seems desirable.

Chumbicha is about 60 kilometres due south-west of the town of Catamarca, and lies at an altitude of about 600 metres.

The collection consists of eighty-nine specimens, belonging to nine species, of which one has already been, and two are now, described as new.

1. *Eligmodontia marica*, Thos.

Ann. & Mag. Nat. Hist. (9) ii. p. 483 (1918).

♂. 299, 311; ♀. 296, 312. Eastern, desert, side of Chumbicha.

Notes about this beautiful little species have already been published (*l. c.*). Its type is no. 311. B.M. no. 18.11.11.1.

It is readily distinguishable by its small size and snowy-white belly.

The four specimens were all caught in one place in the desert area to the east of Chumbicha, and none were seen elsewhere.

2. *Hesperomys murillus cordovensis*, Thos.

♂. 231, 251, 292, 298, 300, 302, 306, 307, 313; ♀. 297, 301, 303, 304, 305, 308, 309, 310.

“Caught among the wild cactus-plants.—*E. B.*”

The type-locality of *cordovensis* is Yacanto, near Villa Dolores, Cordova, some 250 kilometres south-east of Chumbicha.

3. *Graomys* sp.

♂. 226, 232, 233, 236, 237, 245, 254, 260, 262, 263, 274, 275, 278, 281, 285, 288, 291, 293, 294, 314; ♀. 223, 244, 250, 261, 264, 279, 282, 284, 295, 315.

This fine series will be of much service when time and material are available for a thorough study of this difficult genus. Among these specimens there are examples with the belly-hairs white to the roots, and others with slaty-based

ventral hairs, but how far this is in part a character of age remains to be seen.

The present form seems most nearly allied to *G. chacoensis* and *lockwoodi*, but for the moment I prefer not to venture a definite determination of it. Its teeth and bullæ are larger than in the geographically adjacent *G. centralis*.

#### 4. *Phyllotis* sp.

♂. 224, 227, 234, 235, 239, 240, 246, 249, 258, 269, 271, 272, 283, 286, 287, 290; ♂. 238, 243, 255, 270, 276, 277.

Apparently not distinguishable from *Ph. wolffsohni*, Thos., but the members of the *darwini* group are all so closely allied that without a special study of them a definite determination is not easy to arrive at.

The presence of divergent supraorbital edges in the type of *Ph. wolffsohni*, as described in the original account, appears to be abnormal, or due to great age, as specimens since received are like *Ph. darwini* in this respect. Well-developed supraorbital ridges are characteristic of *Graomys*.

As in other places the *Phyllotis* and *Graomys* live side by side, and are by no means always easy to distinguish from one another at first sight. The latter, however, has a longer and more hairy tail, and its belly-hairs, whether grey at base or not, have always definitely white tips, while those of the *Phyllotis* are more or less drabby or brownish.

#### 5. *Oryzomys flavescens*, Waterh.

♀. 241.

Rather larger than Uruguay examples.

#### 6. *Akodon glaucimus*, sp. n.

♂. 222, 225, 242, 259, 266, 268, 280; ♀. 229, 230, 267.

Externally closely similar to the Tucuman *A. simulator*, but the general colour is paler and less "saturate," the buffy or clay-colour of the dorsal area is less intense and is absent or scarcely perceptible on the crown, while the shoulders and the area behind the ears are distinctly more bluish grey. The white patch on the chin is constantly present, as is also probably the case in *A. varius*, but, owing to the condition of the skins of the latter, it was not originally perceived.

Skull apparently similar in shape to that of *simulator*. Supraorbital edges, even of the oldest specimen, not very sharp. Set of incisors of the normal orthodont nature, not proodont as in *A. lactens*.

Dimensions of the type (measured in flesh):—

Head and body 98 mm.; tail 75; hind foot 22; ear 18.

Skull: greatest length 27.5; condylo-incisive length 26; zygomatic breadth 14.3; nasals 10; interorbital breadth 5; breadth of brain-case 12; palatilar length 12.2; palatal foramina 7; postforaminal palate 4; upper molar series 4.8.

A single very old male, no. 225, is decidedly larger, the head and body 115 and the skull 30.5 mm. in length.

*Hab.* as above.

*Type.* Adult male. B.M. no. 18. 11. 11. 57. Original number 222. Collected 24th June, 1918.

“Caught under rocks among roots of trees.”—*E. B.*

While there is no doubt that *A. varius*, *A. simulator*, and the present form are so closely allied that they may hereafter be shown to represent subspecies of one widely-spread species, I provisionally give a binomial name to this animal until such time as fuller material shows the true relationship between the different members of the group.

#### 7. *Akodon arenicola*, Waterh.

♀. 228.

#### 8. *Ctenomys fochi*, sp. n.

♂. 247; ♀. 248, 256, 265.

Closely allied to *C. bergi*, Thos., of Cruz del Eje, Cordova, with which it agrees in size. General colour, however, more drabby, the tone near “buffy brown” of Ridgway, while that of *bergi* is more like “sayal brown.” Hairs of under surface washed with paler drabby, the hairs everywhere slaty at base, while those of the interramia are in *bergi* buffy to their roots. Dark area on muzzle and crown nearly black, much darker than in *bergi*.

Skull like that of *C. bergi*, except that the bullæ are uniformly (four specimens as compared with three) rather more inflated, the line connecting the antero-internal angle with the meatal tube more distinctly convex forwards, as viewed from above.

Dimensions of the type:—

Head and body 162 mm.; tail 76; hind foot 30.

Skull: greatest diagonal length 39; condylo-incisive length 37; zygomatic breadth 23; nasals 11.2 × 5.2 (in another specimen 12.5 × 5.7); least breadth across brain-case 17; meatal breadth 24.5; bulla, greatest diagonal diameter 15.2, breadth at right angles to last (exclusive of meatal tube) 8.5; upper molar series (crowns) 8; alveoli 8.8.

*Type.* Young adult male. B.M. no. 18. 11. 11. 68. Original number 247. Collected 2nd July, 1918.

This species is clearly most closely allied to *C. bergi*, but is distinguished by the characters above described. From *C. tucumanus*, its next neighbour northwards, as also from *C. mendocinus* to the south, it is readily separated by its much smaller size and the darkened upper surface of the muzzle.

"Lives in very dry red earth."—*E. B.*

Named in honour of Gen. Foch, by whose genius victory in the recent great struggle has been so greatly accelerated.

9. *Marmosa elegans pallidior*, Thos.

: ♂. 253, 257, 273; ♀. 289.

The white middle area of the belly is quite as in the "Acochayas" of Bolivia and of Umahuaca, Jujuy, those of Tucuman and Leon, Jujuy (*M. e. cinderella*) having slaty-grey bases to the ventral hairs.

"Caught among the rocks."—*E. B.*

XI.—*Descriptions and Records of Bees.*—LXXXIII.

By T. D. A. COCKERELL, University of Colorado.

*Proteraner rhois*, Cockerell.

Male, Meadow Valley, Mexico (*Townsend*).  
New to Mexico.

*Sphecodes mexicanorum*, sp. n.

♀.—Length about 8.5 mm.

Black, with the abdomen red, the first segment with a large black area occupying the base and extending more than halfway to apex in middle, the third and fourth segments with a black stain in middle, the fifth and apical segments black. Head and thorax with dull white hair; mandibles dark reddish apically, with a blunt inner tooth far from apex; labrum short, simple, transversely sulcate; antennæ entirely dark; clypeus strongly punctured; front finely and densely punctured; mesothorax and scutellum strongly punctured, but shining, the punctures quite widely separated on disk; area of metathorax shining, with about twelve strong longitudinal plicæ; posterior face of metathorax very coarsely



punctured; tegulæ rufo-fuscous. Wings dusky, stigma and nervures dark brown. Legs very dark reddish brown; spurs ferruginous. Abdomen not appreciably constricted between first and second segments; first segment impunctate, the following with extremely fine punctures in the basal region; apical segments with hoary pubescence.

Meadow Valley, Mexico (C. H. T. Townsend). U.S. Nat. Museum.

In my table in Ann. & Mag. Nat. Hist., Nov. 1907, this runs to *S. dichrous*, Smith, from which it is readily known by the impunctate first abdominal segment and other characters. On account of the thin hoary pubescence on apical part of abdomen it recalls *S. pilosulus*, Smith, from Oaxaca, but that has the thorax closely punctured.

*Melissodes albocincta*, sp. n.

♀.—Length about 10 mm.

Compact, black; antennæ beyond the fourth joint ferruginous beneath; eyes pale grey; small joints of tarsi reddish; tegulæ piceous, posteriorly paler and reddish. Wings faintly dusky, nervures and stigma dark brown; hind margins of abdominal segments (first narrowly, second broadly) colourless; pubescence greyish white, pale on vertex, but disk of scutellum with fuscous hair. Hair on outer side of tibiæ and tarsi suffused with reddish, on inner side of hind basitarsi bright ferruginous; hind tibial scopa long, loose, and strongly plumose; hind margins of abdominal segments 2 to 4 with broad felt-like entire white hair-bands; black parts of first three segments exposed and shining, hardly punctured, but that of fourth covered with very short fuscous hair; fifth segment covered with dark chocolate hair, paler at margin, creamy-white at extreme sides; pygidial plate narrow; mesothorax and scutellum highly polished and sparsely punctured, the mesothorax with a shallow median longitudinal groove.

Mexico (Baker collection, 2320). U.S. Nat. Museum.

This may be referable to *Xenoglossodes*; I have not ventured to extract the mouth-parts of the unique type. It certainly closely resembles *X. excurrans*, Ckll., differing principally by the white hind margins of abdominal segments. In my table of *Melissodes* (1906) it runs next to *M. martini*, Ckll., which it does not resemble.

*Ptilothrix heterochroa*, sp. n.

♀ (type).—Length about 10.5 mm.; anterior wing 7.7 mm. Black, with black and greyish-white hair; hair at sides of

abdominal segments 2 to 4 strongly washed with orange, which extends some distance along the bands on 3 and 4; fifth segment with dark fuscous hair in middle and orange at sides; flagellum obscure reddish beneath; mandibles chestnut-red in middle; clypeus prominent, bare, highly polished, with sparse distinct punctures; front and sides of face with white hair, but vertex with black; face broad; tegulæ rufo-piceous. Wings reddish. Hair of upper part of thorax greyish white, but a fuscous band across mesothorax and another across scutellum; lower half of mesopleura with dark chocolate hair; mesothorax highly polished, with sparse punctures. Legs dark reddish, their hair black; hind spurs curved at end.

Very close to *P. tricolor* (Friese), but much smaller, with narrower abdomen, more sparsely punctured disk of mesothorax, and smoother, more polished basal area of metathorax.

♂.—Antennæ hardly reddened beneath; face and lower part of cheeks with white hair, but the black hair of vertex also invades upper part of front; clypeus finely and rather closely punctured; thorax above with black hair, the margins of the mesothorax (broadly in front) with greyish white; pleura with black hair, but a tuft of greyish white just below tegulæ; thorax posteriorly with black hair; small joints of tarsi red; abdomen with black hair; a cuneiform orange patch at each side of third and fourth segments, a little of the same at sides of fifth; greyish-white hair at sides of first and second, and disks of these segments with very thin greyish-white hair, but hair on base of first segment black.

Carcarana, Argentina (*L. Bruner*). U.S. Nat. Museum.

The female (81) is the type; the male (56) seems to be correctly associated, but it differs much in appearance and may possibly belong to a different species.

#### *Diadasia separata* (Holmberg).

Carcarana, Argentina (*Bruner*, male 42, female 68).

This is *Teleutemnesta separata*, Holmberg. Holmberg described only the female; the male is similar, but the flagellum is only faintly reddish beneath, and there is no red hair at end of abdomen. The hind basitarsi are slender and curved.

#### *Ceratina nauilana*, Cockerell.

Vera Cruz, Mexico, Dec. 14, 1907 (*F. Knab*).

The wings are browner than usual.

*Heriades sauteri philippinensis* (Friese).

Philippine Islands; the type from Los Banos. A female from Manila (*Robert Brown*) is in U.S. Nat. Museum.

This differs from *H. sauteri* in the more finely punctured mesothorax and first abdominal segment.

*Trigona itama*, Cockerell.

Described from Singapore, but I cannot distinguish a specimen from Pelaboean Ratoe, Java (*Bryant & Palmer*), in U.S. Nat. Museum.

The black tegulæ distinguish it from *T. iridipennis*, Smith, which seems to be the common species in Java. The wings are fuliginous.

*Nomia bantarica*, sp. n.

♂.—Length nearly 8 mm.; anterior wing 6·7 mm.

Head black, with the clypeus (except sides above) and region of mouth ferruginous; mandibles very pale basally, dark chestnut-red apically; face densely covered with golden pile; vertex polished and shining; scape clear ferruginous; flagellum black above and red beneath; thorax black, with the tubercles, scutellum, and postscutellum clear red; upper border of prothorax densely covered with cream-coloured tomentum; mesothorax bare, dullish, the sculpture extremely fine; scutellum convex, not at all bigibbous; metathorax highly polished; tegulæ testaceous. Wings dusky, nervures and the large stigma dusky reddish; second s.m. small, third long. Legs clear light ferruginous, with concolorous hair; hind legs simple, but the femora and tibiæ rather stout. Abdomen smooth and shining, without hair-bands, ferruginous, with a large black patch on each side of second segment, third and fourth segments with very broad black bands. The tegulæ are not enlarged.

Bantar, Gebang, Java (*Bryant & Palmer*). U.S. Nat. Museum.

By its coloration it recalls *N. gribodoi*, Vachal, from Borneo, but that has the abdomen eight-spotted and the scutellum bigibbous.

*Halictus leviventris*, Pérez.

Tokyo, Japan (*Sasaki*, 149).

Pérez says this is of the size of *H. fallax*, which would be 7·5–8 mm., but he says that *H. discrepans*, 8 mm. long, is smaller than *leviventris*. The specimens of *leviventris*

before me are about 9 mm. long, anterior wing 7.5 mm. The first abdominal segment is highly polished and impunctate. The insect is in all respects closely allied to *H. sexnotatus*, Kirby.

*Halictus occidentens*, Smith.

Kiso-fukushima, Japan, July 27, 1914 (*Sasaki*, 174).

The lateral borders of posterior face of metathorax are sharply margined. The hind spur has broad, rounded, nodule-like teeth.

*Halictus tsushimensis*, n. n.

*Halictus orientalis*, Pérez, 1905 (not of Lepeletier, 1841).

Tsushima, Japan.

Allied to *H. occidentens*, but with more punctured abdomen and very smoky wings.

*Halictus basicirus*, sp. n.

♀.—Length about 8 mm.; anterior wing about 6.5 mm.

Black, including the legs and hind margins of abdominal segments; head longer than broad, but not oval; mandibles reddened at apex; head and thorax with abundant pale ochreous hair, that on postscutellum light ferruginous; clypeus shining and well punctured; mesothorax very densely punctured, but shining between the punctures; area of metathorax semilunar, rather short, with fine, regular, but rather wavy longitudinal plicæ; posterior truncation very hairy, not conspicuously defined; tegulæ piceous. Wings hyaline, stigma and nervures amber-colour. Legs with pale ochreous hair, a line of fuscous on outer side of hind tibiæ; hind spur very minutely nodulose, appearing simple under a lens. First abdominal segment polished and shining, minutely punctured all over, the base broadly and densely covered with long pale ochreous hair; remaining segments also shining and punctured, the bases of segments 2 to 4 with entire bands of ochreous-tinted tomentum; caudal rima fringed with pale ochreous hair.

Japan, marked 167 and 358, but what these numbers signify I do not know. U.S. Nat. Museum.

In the Japanese fauna it seems nearest to *A. japonicola*, Strand, but it is larger and does not show the microscopic sculpture between the punctures on mesothorax and first abdominal segment. It is very close to *H. perangulatus*, Ckll., from Formosa, but the posterior part of mesothorax is much more closely punctured.

*Halictus japonicus*, Dalla Torre.

Smith described the male under the preoccupied name *H. tarsatus*. I found the female in the British Museum collection, and, as Vachal himself suggested, it appears to be the same as *H. tenuicellus*, Vachal, which may be safely regarded as a synonym.

*Halictus subopacus*, Smith.

Soochow, China (*N. Gist Gee*, 118, 119).

Another species of the type of *H. basicirus*, from which it is known by the dullish and closely punctured first abdominal segment.

*Halictus poonaënsis*, n. n.

*Halictus torridus*, Caméron, 1898 (not Smith, 1879).

Poona, India.

*Halictus nusaënsis*, Friese, in litt., 1914.

*Halictus nigroviridis*, Friese, 1914 (not Graenicher)

Java.

*Halictus bryanti*, sp. n.

♀.—Length about 8 mm.; anterior wing 6 mm.

Black, robust, with unusually broad abdomen, the sides of which are parallel except at the ends; hair of head and thorax scanty, dull white, the postscutellum with white tomentum; head ordinary; mandibles only faintly reddish at apex; face thinly covered with pale hair; clypeus with weak shallow punctures, the subapical middle depressed; front dull, vertex shining; flagellum very faintly brownish beneath; mesothorax shining but not highly polished (the surface being microscopically tessellate), with small sparse punctures; scutellum more polished, slightly bigibbous; mesopleura almost entirely opaque; area of metathorax short, with very distinct plicæ on its basal part; posterior truncation shining, impunctate, sharply margined at sides; tegulæ black, dark reddish in middle. Wings dusky; nervures and stigma dark fuscous. Legs black, with pale hair, fuscous bands on outer side of middle and hind tibiæ; hind spur with three very large obtuse spines. Abdomen shining, but the surface minutely lineolate, and with excessively minute punctures scattered all over; bases of segments with dull white hair, conspicuous and dense at sides of second; hind margins black; segments 3 and 4 with rather obscure subapical hair-bands.

Buitenzorg, Java, March 1909 (*Bryant & Palmer*). U.S. Nat. Museum.

In Friese's table of Java *Halictus* (1914) this runs nearest to *H. thoracicus*, Friese, which Messrs. Bryant & Palmer also took at Buitenzorg, but the sculpture of the thorax is entirely different.

*Halictus palmeri*, sp. n.

♂.—Length about 5.5 mm.; anterior wing 5 mm.

Black, rather robust for a male; head and thorax with very scanty dull white hair; head ordinary; clypeus produced, wholly black, shining, with sparse punctures; front slightly shining, with fine punctures; flagellum very faintly brownish; mesothorax and scutellum very highly polished, with only microscopical sparse punctures; area of metathorax rather long, with very fine anastomosing plicæ, appearing dull and granular under a lens; tegulæ dark reddish. Wings dusky; stigma and nervures dark reddish. Legs black, tarsi reddish apically. Abdomen shining, impunctate, with thin pale hair on apical part, small patches of white hair at lateral bases of second and third segments.

Tjibodas, Mt. Gede, Java, alt. 4500 ft., Oct. 9, 1909 (*Bryant & Palmer*). U.S. Nat. Museum.

Distinct from the species previously described from Java by the highly polished mesothorax, without evident punctures.

*Halictus gedensis*, sp. n.

♀.—Length about 6.5 mm.; anterior wing 6 mm.

Black, the head and thorax with scanty dull white hair; head ordinary, rather broad; mandibles black; clypeus shining, sparsely punctured, it and the supra-clypeal area distinctly longitudinally ridged in middle; front dull; flagellum very obscurely reddish beneath; mesothorax shining, but not highly polished, with small shallow punctures, and the surface microscopically tessellate between; scutellum with a median sulcus; postscutellum with long hair; area of metathorax poorly defined, with irregular plicæ on basal part; posterior truncation small; tegulæ reddish black. Wings dusky, long and ample; stigma and nervures dark brown. Legs black, with pale hair; hind spur white, with seven short spines. Abdomen shining, impunctate, without hair-bands; apical part and general surface more or less with pale hair, abundant on fifth segment.

Tjibodas, Mt. Gede, Java, alt. 5000 ft. (*Bryant & Palmer*). U.S. Nat. Museum.

Runs in Friese's table to the much larger *H. jacobsoni*, Friese.

*Halictus erythrurus*, Cockerell.

♀.—York, W. Australia (*O. H. Sargent*).

The specimen has two large black marks on the fifth abdominal segment, sublateral and lateral spots on the fourth, and lateral spots on the third. I have a specimen from the type-locality with lateral spots on the abdomen, so the peculiarity can hardly indicate a subspecies.

*Halictus melanurus*, sp. n.

♀.—Length about 4 mm.

Black, with the abdomen about as far as middle of third segment shining yellowish-ferruginous, beyond that very dark fuscous, almost black, basal half of first segment also dusky; labrum and mandibles except apex dark red; flagellum clear ferruginous beneath except at base; tegulæ clear ferruginous. Legs dusky red, with the anterior tibiæ in front and all the knees clear red; pubescence scanty, dull white. Abdomen without hair-bands. Wings clear, stigma and nervures ferruginous; outer r. n. and t.-c. much weakened; first r. n. meeting second t.-c. Head ordinary, face broad; clypeus shining; front dull; mesothorax moderately shining, very finely punctured; area of metathorax rough, with delicate plicæ, the margin shining. Microscopical characters:—Front densely punctured, the surface between the punctures finely sculptured; mesothorax microscopically tessellate, anteriorly transversely lineolate; area of metathorax with wrinkled plicæ; hind spur of the simple type (microscopically serrulate or spinulose).

York, W. Australia (*O. H. Sargent*). U.S. Nat. Museum.

Related to the Tasmanian *H. discclusus*, Ckll., but easily separated by the red tegulæ. It is also a smaller species. The scopa on hind tibiæ is rather short and thin, but beautifully plumose.

XII.—Notes from the Gatty Marine Laboratory, St. Andrews.—No. XLII. By Prof. M'INTOSH, M.D., LL.D., D.Sc., F.R.S., &c.

1. Preliminary Studies on *Filograna*: *a*, Historical; *b*, Faunistic; *c*, Structural; *d*, General.
2. On *Harmothoë watsoni*, M'I., an var. *H. marphysæ*, M'I.

1. Preliminary Studies on *Filograna*.

(a) HISTORICAL.

*Filograna*, the subject of the following remarks, has probably been known to marine zoologists from very early

times, though a definite name was not assigned to it. Amongst others, Seba\* (1758), in alluding to various marine "mosses, corallines," and tubular corallines, *Congerius minorum tubulorum*, which he figures in his 'Thesaurus,' specially refers to this form, which he found adherent to rocks and other structures, in one instance forming the basis to which *Thuiaria thuja* was attached (fig. 19 a). He figures correctly the spaces between the fascicles of tubes forming the mass. Though Plancus *De conchis minus notis* is quoted by some authors in this connection, nothing definite can be found in his work. Linnæus, Risso, Pallas, and others placed it under the genus *Serpula*, whilst a few included it under *Protula*. Oken termed it *Clymene filograna*; Ray, *Reticulatum trophaceum*; Boece, *Tubularia filograna*. The form is interesting in some other respects than zoologically, since it occasionally blocks the pipes leading from the sea to the Marine Laboratory tanks, as at Port Erin †.

Berkeley (1827) clearly described the form with the opercula, which he dredged at Weymouth. In the 'Zoological Journal, Volume of Supplementary Plates' (and not in vol. iii.) he gives a figure (pl. xviii. fig. 3) in which a somewhat pointed, hollow operculum is on each dorsal branchial filament. He shows seven pairs of thoracic bristles, and in the posterior (so-called abdominal) region is an indication of a twist, or it may be a bud.

*Filograna implexa*, as described by Sars ‡ (1846) in his first part of the 'Fauna Littorales Norvegiæ,' had six pairs of thoracic bristles in addition to the collar-bristles, two opercula on the dorsal branchiæ (right and left fans), and two eyes. He gave no minute description of the "vermidom" and figured only a few of its tubes.

Oscar Schmidt § (1848) alluded to *Filograna implexa*, and stated that he had found a new species at Faroë with buds at all stages. The same year he || described *Filograna schleideni* from the Faeroës, which he, as indicated, believed to be a new species, characterized by the absence of opercula and the arrangement of the eyes, which formed a row of four on each side of the middle line. He shows seven pairs of bristled feet in the anterior region, but does not differentiate the collar-bristles or figure them, unless he intends the first

\* 'Catalogue of the Curiosities in the Cabinet of Albertus Seba.

† I have to thank Mr. Chadwick for this information.

‡ Fauna Litt. Norveg. i. p. 86, Tab. 10, figs. 12-19.

§ Frorieps Notizen, No. 143, p. 162, August.

|| Neue Beitr. Naturgesch. Würmer, Jena, p. 33, Taf. iii. fig. 7.



of the series, which follows the same backward slope as the others, to represent them, though this is unlikely. He describes and figures a bud, and compares it with budding in the Turbellarians and Naidæ. On the whole, there are no reliable grounds for separating this form from *F. implexa*.

Dalyell\* (1853) gave a graphic account of the external features of the annelid and its mass of tubes, which, he correctly stated, was "penetrated by numerous deep cavities of indeterminable size and form." He also found the greyish annelids of unequal size, but he did not notice buds.

Huxley † in 1855 furnished a careful account of the southern type which he termed *Protula dysteri*, its distinguishing features being its "fissiparous multiplication" and its hermaphrodite condition. He described the branchiæ and their green blood-vessels; the alimentary canal with its crop, stomach, and intestine; the "vascular" system, which he did not consider equivalent to that of higher forms, the cœlomic fluid representing it; the nervous system, reproductive elements, setæ, and uncini; and concluded by a digest on fissiparous multiplication. He describes a ciliated canal running along the ventral surface of the intestine and apparently opening at the anus, but such probably was a misapprehension. He did not discriminate the differences in the structure and distribution of the bristles, yet the general account is worthy of the distinguished author, who, however, considered in 1865 that his form was probably identical with the northern type which had previously been described by Sars.

Keferstein ‡ (1862) found the same form at St. Vaast with free-swimming young. His figures of the bristle and hooks are insufficient for identification, though they apply to the common form.

Claparède § in 1863 procured *Protula dysteri* off the shores of France, and gave a detailed description of it. He likens the expanded branchial apparatus of the annelid to the lophophore of a Polyzoön. His examples had two eyes and occasionally other black specks. In the main his account agrees with that of Huxley, though he points out and figures the enlargements at the tips of the branchial filaments not mentioned by the English author. These enlargements,

\* Powers Creat. ii. p. 250, pl. xxxiv. figs. 1-6.

† Edin. New Philos. Jour. vol. i. n. s. p. 113, pl. i. figs. 1-11.

‡ Zeitsch. f. w. Zool. Bd. xii. p. 128, pl. xi. figs. 23 & 24 (1862).

§ Beobach. Anat. u. Entwicklungs. Wirb. Thiere, p. 31, Taf. xv. figs. 16-22.

which he describēs as leaf-like, are as conspicuous as in *S. edificatrix*, but his representation of them (pl. xv. fig. 17) would convey an erroneous impression as to their structure and relationship to the filaments. He did not discriminate, however, the minute structure of the collar-bristles of the anterior region, and his description and figure of the hooks is also different from Nature, for he appears to have counted the serrations of each hook as a separate organ—at any rate, his figure diverges from Nature. The first segment of the posterior region (his abdomen) he describes as devoid of bristles. He did not notice the two anal papillæ. The male elements (ripe sperms) he placed in the thirteenth segment, and the female in the following seven to eleven segments. In his description of the buds he alludes to the early condition of the branchiæ, but with the exception of a figure of the early stage he adds little to what Huxley had previously recorded.

Claparède (1873) thought that Huxley exaggerated the views of De Quatrefages in regard to the blood-system of the Annelids. He considered a pseud-hæmal system quite different from that of the superior animals, and resembling the vasculariform excretory system of the Rotifera, Cestodes, and Trematodes. He disagreed with this, for both morphologically and physiologically the blood-system is connected with assimilation.

De Quatrefages \* describes the genus as having two false opercula, whilst his species *Filograna berkeleyi* and *F. implexa* do not appear to differ, for the coalescent uncini of the former and the angular teeth of the latter need not be seriously considered, since his figures of bristle and hook are not sufficiently accurate. His third form, *Filograna dysteri* is Huxley's species, and his fourth is the *F. schleideni* of Schmidt †, a variety of the common form. De Quatrefages overlooked the distinctive characters of the collar-bristles.

The genus *Salmacina* ‡ was established by Claparède § in 1868 for Serpulids having a thoracic membrane, regular branchiæ with a circular base, devoid of an operculum, the first thoracic segment furnished with tufts of distinctive and much larger bristles than those which follow, and dwelling in calcareous tubes. While it agrees with *Protula* in the absence of an operculum, it differs in the larger collar-

\* Annales, ii. p. 485, pl. xv. figs. 9-12 (1865).

† Neue Beiträge Naturges. der Wurm. p. 33, pl. 3.

‡ Named after the hermaphrodite nymph *Salmacis*, a name already employed by L. Agassiz in the Echinids.

§ Annél. Chétop. Naples, p. 436.

bristles of the first thoracic segment. He was fully aware of its approach to the Serpulids and *Filograna*, yet the absence of an operculum separates it from both, though there can be no question of its close affinity with *Filograna*, the more so as *Salmacina* reproduces by posterior buds. He thought that *Protula dysteri*, which De Quatrefages united with *Filograna*, should probably be embraced in his genus, though the enlargements at the tips of the branchial filaments do not merit the name of opercula. He mentions, further, that it would be as reasonable to include the eyes at the tips of the branchiæ in *Branchiomma* as opercular as such swellings in *Protula dysteri*.

His first species was *S. incrustans*\*, which he thought might be synonymous with *Serpula incrustans* (Linn.), Grube †, and *Serpula filograna* of Sacchi ‡. In his specific characters, however, no distinctive feature of moment is recognizable, for in length (2 to 2.5 mm.), colour, the number of the thoracic segments (8), the three kinds of dorsal bristles, the pectinate uncini, the flexuous calcareous tube incrusting *Zostera* and other marine organisms, and the hermaphrodite condition, there is nothing diagnostic. Thus Langerhans subsequently showed that even the number of the thoracic segments varied in this form from seven to nine. The presence of eyes again corresponds with the condition in *Filograna implexa* and *Salmacina dysteri*, as also does the structure of the first pair of thoracic bristles; though the bolder character of their serrations above the "knee" indicates variation, it may be from environment, whilst the absence of serrations in the tapering blade beyond the hiatus in Claparède's description and figure is due to the artist, for they are present in specimens from Naples. The description and figures of the two other forms of bristles agree with the conditions in *Filograna*; and the same may be said of the abdominal bristles and the structure of the hooks. Claparède found in one a double tip to the tail with two cirri, perhaps the result of injury.

He regarded the anterior glands (nephridia) as the secretory organs for the tubes. Further, he describes the hermaphrodite animal as provided with orange ova in the anterior region of the abdomen, and zoosperms in the posterior, even to the extremity, and the sperms had an elongated head. Such an arrangement therefore differs from that usually observed.

\* *Op. cit.* p. 436.

† Echeniod Actin. u. Würmer, p. 62.

‡ Catal. Conch. reg. Neapol. p. 19, 1836 (*vide* Claparède).

In the 'Supplement to the Annelids of Naples' (1870) Claparède \* repeats the generic characters he had previously given, only adding that spatulate or pectinate bristles are absent from the posterior region. He also differentiates *Psymbranchus* more definitely from *Salmacina* by the entire absence of buds in the former, and by the hermaphrodite condition in *Salmacina*, which is to all intents and purposes, he says, a *Filograna* deprived of its operculum.

In this publication he describes a new species, *A. œdificatrix* †, characterized by the whitish granular tubercles along the exterior of the filaments, the absence of eyes, and the presence of nine thoracic segments, the other features being common to it and the other species. He states that this form is very near *S. incrustans*, which is found adhering throughout its length to the surface of Fuci and other marine plants, to the surface of shells, and other bodies, whereas *S. œdificatrix* is a deep-water form which constructs masses, by the branching and anastomosing of its tubes, identical in structure with those of *Salmacina dysteri* (from which the Neapolitan form is readily discriminated by the absence of enlargements at the extremity of the branchiæ), and so with *Filograna*. He thinks the structure of *S. œdificatrix* leaves little doubt as to its reproducing by posterior buds.

In his figure of the collar-bristles he is more accurate than Langerhans, the number of serrations on the flattened basal region being seven, and the hiatus is more in accordance with Nature; yet the bristle, as a whole, does not differ in any way from that of *Filograna*. The other segments carry bristles which do not differ from those of *S. incrustans*, and, it may be added, from those of *Filograna*. He holds that the hooks differ from those of *S. incrustans*, but it cannot be said that his figure (pl. 13. fig. 1, E) represents a full lateral view of the organ, but rather a partial lateral view, thus giving it greater length proportionally than it really has. These small organs are not readily mounted so as to exhibit a complete lateral view, and thus the able Swiss author was misled. They seem to agree with all the other forms examined.

Amongst other features, the author states that the achetous region between the thorax and the first abdominal bristles is equal to four or five segments, and that the abdominal bristles are capillary and winged, with a "knee" at the

\* P. 154.

† P. 157, pl. xiii. fig. 1.

tip. At the base of the branchial pinnæ are rows of granular cushions, but all he says about the extremity of the filaments is that they are bare, and in his drawing they are somewhat delicately tapered.

Giard\* (1875 and 1876) made two notes on the development of *Salmacina dysteri*, Huxley, with figures, from the early ovum to the post-larval stage, having three pairs of bristles. The description and figures of this able and industrious author are excellent.

Langerhans † (1880) describes *Salmacina incrustans* from Madeira as occurring in tubes on stones between tide-marks and on fish-baskets. The terminal process of the branchiæ has a coloured cushion composed of epithelial cells and at the tips of the pinnæ "einige solche Zellen." In the Mediterranean form these cells were absent. A pair of eyes; five to seven setigerous segments anteriorly, the first bearing the characteristic bristles, one of which he figures with five serrations on the wide basal process below the hiatus (Taf. v. fig. 40 b), and the other with a serrated edge devoid of a hiatus, but Neapolitan examples of the species show smaller and more numerous serrations on the basal web of the tip, viz., about double the number indicated by Langerhans, and the hiatus is less pronounced. This remark is made on the supposition that the form from Madeira is the same as that at Naples. The ventral uncini have only five teeth above the main fang, whereas in *S. œdificatrix* there are six; yet in the figure of the face of the hook in each case there are nine transverse rows. The anterior bristle with the curved (sickle-like) tip and serrations is also present, though the figure is indifferent. Bristles with smooth wings occur in this region, but he does not indicate any differentiation at the tip of the tail, though he describes those of *S. œdificatrix* as having serrated wings. In the Neapolitan examples the serrations of the tip were less prominent.

Carus (1885) distinguishes *Salmacina* thus: Thoracic membrane; branchiæ equal, base circular, destitute of an operculum. First thoracic segment with a tuft of bristles larger than the succeeding and of a distinct form, semicrenulate. From the third segment, besides winged setæ, are others semicrenulate. Spatulate and pectinate bristles absent from the abdomen—only simple falciform bristles.

He makes Claparède's *S. incrustans* synonymous with ? *Serpula filograna*, Sacchi, and so with ? *Serpula intricata*,

\* Comptes Rend. Acad. Sc. 17 January, 1875, and 24 January, 1876. Also 'Œuvres Diverses,' p. 316.

† Zeitsch. f. wiss. Zool. Bd. xxxiv. p. 122.

Grube, though the latter conclusion is unlikely. The body is 2-2.5 mm. long, of an orange colour; thoracic segments 8; dorsal bristles of two kinds; uncini pectiniform; tube sinuous and calcareous, incrusting *Zostera* and other marine structures. There is no diagnostic feature in this description.

*S. edificatrix*. Body dull orange, 2-2.5 mm. long, segments 45-50; branchiæ 4, white, with pale granular tubercles externally; no eyes; thoracic segments 9; collar-bristles geniculate, cuspidate at the base of the wings; rest of the segments have subulate bristles with wings, others pectinate; falciform; hooks small, multidentate; tube capillary, densely glomerate, and intricate.

Cunningham and Ramage\* (1887), while giving no details, have a figure of an adult example and a larva of *Filigrana implexa*. The adult has eight pairs of anterior bristles, a pair of eyes, and opercula on the branchiæ. The larva has three pairs of bristles, two large eyes, and a prominent protroch.

Ehlers† (1887) examined a form from the Tortugas which he named *Filigrana huxleyi*; having the general structure described by previous authors, with ova in the posterior segments (12-20), and in the case of a nurse-stock, from the seventh posterior segment of which a bud of six thoracic and seven abdominal segments arose, there were no reproductive elements. Each branchial filament, as in *Filigrana dysteri*, ends in a pear-shaped, cellular, flattened swelling with palpocils. He considers such an organ may be connected with food-supply, since he found a *Nauplius* amongst the pinnae. The stomachs, however, of most examined in Britain had only such objects as currents supplied, and in those from deep water Cocoliths were common, and so with many foreign forms. Ehlers states that Huxley describes certain warts on the branchiæ of his species, but they were not present in the American form. The homologies of the terminal enlargements with opercula or eyes (e. g. in *Branchiomma*), as Langerhans considered in *Salmacina incrustans*, are referred to. Ehlers gives a figure of the characteristic collar-bristles which differs from anything hitherto seen in the group, in so far as it has only six large serrations to the basal division of the wing, no hiatus, and a long, smooth, tapering tip. Further, no bristle

\* Trans. Roy. Soc. Edin. vol. xxxiii. p. 673, pl. xlv. fig. 35.

† "Report on the Annelids of the 'Blake,'" p. 314, Taf. 56, figs. 4-9.

with a reaping-hook curve is present in the succeeding segments, only those with a "knee" and an ordinary winged tip. The hook agrees with that found in the common *Filograna*, though the artist has not represented the streaks at right angles to the serrations. The earliest bud has only segments similar to the abdominal of the parent.

He considers his species near Huxley's *Protula dysteri*, though it has no eyes; both have the terminal organ of the branchial filaments. So far as can be seen, there is nothing in Ehlers's description to distinguish his species from *Filograna implexa*.

Lo Bianco\* (1893) mentions the following hermaphrodite forms: *Amphiglana*, *Salmacina*, *Spirorbis*, *Pileolaria*, &c., the ova being deposited in the interior of the tube or placed in the operculum; the young by-and-by forming colonies by fission. Fisi-parous reproduction occurs in *Salmacina* and *Telepsarus*.

In 1894 De St. Joseph† made a contribution to the history of this species (*Salmacina dysteri* variety), which he dredged frequently on shells, on *Rytiphlæa pinastroides*, and collected on rocks and stones at Rochardieu. He gives the size as 6 mm., and shows how in many features it resembles *Filograna implexa*, only it has no operculum. He further states that each branchial filament is terminated by a peculiar enlargement formed by a double row of cells with palpcils, the latter also occurring on the pinnæ. The segments of the anterior region (thorax) range from seven to nine, and have bristles and hooks resembling those of *Filograna implexa*. The naked region behind the anterior has ten or twelve segments, whilst the posterior region (abdomen) has from 40-50 segments, the middle being narrowed, and the anterior and posterior parts dilated, the tip again narrowing to the two terminal papillæ. The bristles agree with those of *F. implexa*. The alimentary canal, the blood-sinuses around the gut, and the excretory organs anteriorly debouching by a common aperture are all in accordance with the parts in *F. implexa*. He found ripe eggs and ciliated embryos in the cœlomic cavity, proving that impregnation is internal, the earlier atrochous forms of similar size to the eggs, and with two minute eyes in front; besides others more advanced, with a ciliated collar behind the eyes, three setigerous segments, and an anal. No hooks are present. This stage he thought anterior to that described by Giard in

\* "Gli annellidi tubicoli trovati nel Golfo di Napoli," *op. cit.*

† Ann. Sc. Nat. 8<sup>e</sup> sér. t. xvii. p. 340, pl. xiii. figs. 375-380.

the tube of the parent. Moreover, *S. dysteri* reproduces by buds, as in *F. implexa*, the nurse-stock of seven or eight anterior and fifteen to seventeen posterior segments, without sexual elements, giving rise to a bud at the eighth or ninth posterior segment as in *Filograna implexa*. He concludes by stating that *S. dysteri* is met with in different conditions:—

1. As a hermaphrodite form without buds, measuring 6 mm., with the anterior segments of the abdomen enclosing the male and female sexual elements, the following segments constricted, and the terminal enlarged.

2. As a short annelid of twenty posterior segments, without the filiform portion of the abdomen and which prepares for budding, or perhaps has already budded and regenerated, the detached segments.

3. As a form of the same size as the preceding with a bud at the eighth or ninth posterior segment.

4. As a shorter form from which a bud has been detached, which possesses only nine or ten posterior segments and is devoid of eyes.

In regard to the resemblances between *Filograna implexa* and the present species, they are identical except for the absence of the opercula in *Salmacina*. He mentions the case of the *Protula* described by Fritz Müller, which acquired an operculum on one of its pinnate branchiæ; then the barbules disappeared, and the filament became the stalk of the operculum. In *Salmacina dysteri* at complete maturity he found each of its branchiæ terminated by a mass which offered no indication of an operculum; and, since *Filograna implexa* at complete maturity retains its two opercula, he is of opinion that the two species are stable and distinct. Yet this very statement shows that between *S. dysteri* and *S. ædificatrix* there is a facile step on this head alone.

In referring to the proposal of Ehlers to suppress the genus *Salmacina*, Claparède, since its bristles resemble those of *Filograna*, De St. Joseph would conserve the genus *Filograna* as revised by Ehlers, but would divide it into two subgenera—viz., *Filograna* with an operculum and *Salmacina* without one.

De St. Joseph found on the tubes *Folliculina ampulla* and *F. atropurpurea*, anastomosing amongst them and the minute sponges, and Corynids and ova were also present. He observes that the dorsal hooks in the posterior region resemble the thoracic ventral hooks, but their rows are short and their number few.



Malaquin \* gives also an account of the sexual and asexual phases of *Salmacina dysteri* :—

I. Phase of a young protandrous form. The male genital segments are incorporated with the thorax, and are sterile.

II. Phase is that of asexual reproduction, or schizogenesis. In this the animals present incomplete male sexuality, manifested by the production of a few spermatozoa which attain maturity.

III. Phase—hermaphroditism. Gonads (male and female) are situated in distinct segments—the male in the three (two to four) anterior abdominal segments, the female in the eight to ten segments which follow. The circulation in *Salmacina* and *Filograna* resembles that of the Serpulids in the particular reticulation of vessels distinct from the cœlom. There are branchial and ventral vessels. Around the intestine is a vascular sinus, as in Serpulids and Sabellarians. In *Salmacina* and *Filograna* this sinus lies between the endothelium splanchnoplannique of the cœlom and the intestinal epithelium. This part of the hæmocoel represents exactly the primitive blastocœle.

The same author † (1911) gives an elaborate disquisition on the phases of *Salmacina*, grouping them as follows :—

I. The sexual forms, including the young protandrous forms, with three to five segments in the thorax, two intermediate, and six abdominal segments. II. The unisexual, rarely female, less rarely male. The female is  $2\frac{1}{2}$  mm. long, with three thoracic segments, an intermediate aseptigerous segment, and six to eighteen abdominal distended with oocytes. Probably this becomes hermaphrodite. The male is  $1\frac{3}{4}$ – $2\frac{1}{2}$  mm., with seven thoracic segments, sixteen ripe abdominal segments, and three or four terminal.

The hermaphrodites have eight branchiæ, eight thoracic segments, then two or three aseptuous segments ; immediately behind are two or three with male gonads, and the succeeding ten have female gonads with red ova. They reach 6–7 mm., and may have fifty abdominal segments. In some hermaphrodites male elements predominate, the female segments being reduced. In others a hermaphrodite segment occurs at the limit of the male region, the male elements being on one side, the female on the other. He has also seen a hermaphrodite gonad.

The metamere, as a rule, is unisexual, but, as mentioned, between the male and female regions a hermaphrodite one

\* Assoc. Française Adv. Sc. Lille, 1900, p. 135.

† Zool. Anzeiger, Bd. xxxvii. p. 201.

may occur. A large well-developed ovum may appear in the coelom and a male gonad in the segment.

In *schizogony*, in its asexual phase, it is exceptional to find seven segments in the thorax. At the tenth abdominal segment cephalo-branchial proliferations occur with two new segments of the thorax, instead of the three or four of the oozoite. No sexual elements appear. In *schizogony* accompanied by sexuality male elements are found in the abdominal segments (9-10), such probably being a further stage of the protandrous young. In the hermaphrodite forms the elements are reduced in quantity—for instance, in a schizozoote of twenty segments.

He makes the noteworthy remark that schizogonous individuals by their size and the number of their segments are little advanced in age compared with the hermaphrodite forms. Another fact is that when sexuality is present it is reduced male, female, or hermaphrodite. These are stages in the march to complete hermaphroditism.

Malaquin concludes that *Salmacina dysteri*, Huxley, exhibits all the forms of sexuality possible. It, indeed, shows a kind of indifferentiation in sexuality, marked by the absence of secondary sexual characters in the individual. The sole character which distinguishes the phases from each other is the position of the genital segments and their state of advancement. Schizogony occupies the middle period of the existence of the annelid. It is intercalated between the two sexual periods—protandrous or rarely female, or hermaphrodite. The sexual period ultimately marks the end of the evolutionary cycle in *S. dysteri*. The exclusive sexual form is hermaphroditism. In a certain number of these the male elements predominate. It thus reappears in the life-cycle after its presence in the young oozoite.

Miss Pixell\* (now Mrs. Goodrich) describes *Salmacina dysteri* from Gough Island, in the Antarctic Sea, as occurring in fairly large masses. No buds were present. She also finds the same species in various parts of the Indian Ocean †.

Fauvel ‡ (1914) describes *Filograna implexa* from the Gulf of Gascoigne, Monaco, and other sites, the agglomerated tubes forming considerable masses analogous to those of *Salmacina dysteri*, from which, he observes, the animal is easily distinguished by its two opercula. The same author alludes to *Salmacina incrustans*, the very fine tubes of which

\* Trans. Linn. Soc. vol. xvi. p. 87 (1913).

† Trans. Roy. Soc. Edin. vol. xlix. p. 350 (1913).

‡ Campag. Sc. Monaco, Fasc. xlvi. p. 327. I am much indebted to Prof. Fauvel for specimens and memoirs.

are more or less agglomerated on stones or shells. Certain specimens have the branchiæ coloured red at the extremities—an accidental condition. The collar-bristles have the web at the base of the tip with large teeth (two or three prominent) and with a few capillary bristles. There is no operculum. The uncini have numerous teeth. He distinguishes *S. dysteri*, Huxley, from the foregoing by the numerous fine teeth on the basal web of the collar-bristles. All the specimens had sausage-like cellular masses at the tips of the branchial filaments. He was of opinion that the *S. œdificatrix*, Claparède, was the same species. He never encountered a true representative of this species, which, he says, is distinguished from *S. dysteri* by the absence of the enlargements at the tips of the branchial filaments, and adds, strange to say, that the tubes are often intertwined with those of *Filograna implexa*.

J. H. Orton\* (1914) states that the common species of "*Filograna* carries ripe eggs and trochospheres at an age probably less than 4 months, having grown through the summer. About the same time another experiment yielded specimens with fully-developed eggs at an age not greater than 10 weeks and 4 days. Later in the year full-sized specimens with buds had an age not greater than 4 weeks and 2 days. There can be little doubt, therefore, that in this species there is an alternation of generations, the summer forms producing eggs and sperm, and the autumn and winter ones producing buds."

#### (b) FAUNISTIC.

In order to give a satisfactory view of the remarkable variations of *Filograna*, it is necessary in the first instance to glance at the condition of the specimens from the several grounds, which range from Shetland to the Channel Islands in Britain, and elsewhere from diverse distant localities stretching almost from pole to pole †.

In those from Plymouth no operculum has been seen up to date. In an example with a bud the branchiæ had short pinnæ, but the tips had sausage-like enlargements; the anterior region had seven lateral bristle-tufts besides the collar-tuft, two segments succeeded the anterior region without bristles; thirteen bristled segments followed; then the bud, the first two segments of which had no bristles, and twenty-three with bristles succeeded, two papillæ occurring posteriorly. Its branchiæ were simple filaments. In

\* Jour. M. B. A. vol. x. p. 316.

† Those from the area of the Clyde was sent by Mr. L. Renouf of the Museum and Laboratory at Rothesay.

older examples without a bud the anterior region had seven pairs of bristles besides the collar pair, a considerable smooth region, and fifteen segments and the pygidium posteriorly. The branchiæ were well developed, with sausage-shaped enlargements of the tips of the filaments, and the pinnæ were much longer than in the former. The apertures of some of the tubes show a slight expansion like the muzzles of old-fashioned shot-guns for sparrows, whilst others have cylindrical though rounded margins. In the first series of bristles, which in lateral view have the tip at an angle to the shaft, the basal part of the wing has numerous (fully a dozen) serrations sloping from the base to the distal end in lateral view, and then a hiatus, followed by a minutely serrated tapering blade. When viewed from behind, the shaft diminishes little to the end of the basal section of the wing, and the axis can be followed, as distinct from the wing, from the base to the tip, and then gradually tapers distally. Certain views point to the double nature of the basal expansion, serrations being seen on both sides. It may be that something similar exists in the distal wing. What have been mentioned elsewhere as simple bristles in this tuft are apparently only developing forms of the special type.

*Channel Islands* (off Guernsey and between tide-marks, Herm).

Most form fixed tubes on shells and stones—two opercula, as a rule, on each; these may be large and thin, or less expanded as circular discs. No enlargement of the tips of the other filaments. This form is common under stones (to which it is attached) between tide-marks in the Channel Islands. Ova occur in the posterior region of body. In the structure of the collar-bristles no distinction can be drawn between these and the Plymouth forms. The shaft, basal wings, and tip are the same. The hiatus and the mode of origin of the distal part of the wing agree, as also do its minute serrations.

*St. Andrews.*

Branchiæ without an operculum in two bearing buds; tips of branchiæ cylindrical in some, in others slightly clavate (in the spirit-preparations). The condition of the branchiæ depends on age; in young examples the filaments and pinnæ are short, but they vary, some of the same size of body having larger and better-developed branchiæ. The young have a short body. The collar-bristles show several with curved tapering tips, which do not have the gap

separating the widened and more boldly serrated base from the more minutely serrated terminal region. The structure of those with the gap, however, does not differ from that of the Plymouth form. The buds presented a similar condition, and the serrations of the basal region of the tip were bolder than the distal. In some of the unaltered tips slight hollows at the site of the gap indicated a change. Further, in addition to the foregoing, a series of simple tapering bristles without evident wing were present.

*Off the Hebrides.*

Two well-developed opercula of a flattened finger-nail shape. Series of rounded eye-specks. No enlargement of the terminal processes of the branchial filaments; long body; eight pairs of anterior bristles. Collar-bristles apparently agreed with the St. Andrews form.

*S.E. of the Isle of May.* August. 32 fathoms.

Two opercula, circular and rather small. No enlargement of the tips of the branchial filaments, and the pinnæ comparatively short. Ova in some with comparatively short bodies. Collar-bristles apparently similar to those from St. Andrews.

*Shetland.*

Two opercula (small and round) in some, others have none. The examples are small. Collar-bristles similar to those from St. Andrews.

*Moray Frith (dredged).*

Well-formed thin opercula. In another none. No enlargement of the tips of the branchial filaments in either. The collar-bristles in these forms agree with those from St. Andrews.

*Aberdeen Bay.* August.

Well-marked opercula in all. No enlargement at the tips of the branchial filaments. Collar-bristles indistinct, but apparently agreeing with those from St. Andrews.

*H.M.S. 'Triton' and 'Knight Errant.'* 530 and 87 fms.

An operculum is present in these as a rule, but it is a very thin circular plate—so thin as to be distinguished with difficulty in certain examples. No eggs, sperms, buds, or larvæ were seen in these specimens in August. Numerous coccoliths occurred in their stomachs. The specimens from both ships had exactly the same structure in the collar-bristles as at St. Andrews.

*North Sea* \*.

Station 18 a. 455 m. No. 29. 18.6.1906. Procured with the small trawl.

The shelly tubes of this form exactly resembled those of the other varieties. The annelids, whose bodies were of moderate length, are characterized by the free development of the branchiæ, which possess large filaments, and long and rather slender pinnæ with scarcely a trace of enlargement at the tips. The filaments do not appear to show any glandular thickenings such as occur in *Salmacina œdificatrix*. At the extremities the filament, which is comparatively broad at the last pinna, gradually tapers to a blunt point.

In one example with eight pairs of anterior bristles the two dorsal filaments were modified in an interesting manner, since one presented a somewhat thick terminal process, the tip of which was abruptly bevelled mainly on one side, the tapering tip being rather blunt, its cellular structure otherwise remaining the same as its neighbours; whilst the other had advanced a stage further, the clavate tip being unequally bevelled and hollowed so as to form a rudimentary operculum. This example carried ova well forward in the posterior region, but as it was imperfect, too much reliance need not be given to this feature. The region frequented by this colony seemed to be highly favourable, for in another example the tips of the branchial filaments were irregularly enlarged.

Station 18 a. 14.3.1907. Trawl.

Eyes present.

The type consisted of comparatively short bodies, with seven pairs of anterior bristles, and about twenty-five segments posteriorly, comparatively long branchial fans—fully half the length of the body, and with opercula. The form of the opercula, however, varied considerably from the thin, translucent, and more or less circular or hoof-shaped cup to a long vase with a tapering process on the lip, a bluntly clavate termination, or a cone at the end of the filament. The short bodies are terminated by the two anal papillæ. So far as could be observed, no reproductive elements were present. Food was abundant in the stomach, and the intestine had the elliptical fœcal masses.

The structure of the collar-bristles is identical with that in the St. Andrews examples.

Station 10. 27.5.1907.

These were characterized by small, thin, wineglass-shaped

\* I am indebted to Prof. D'Arcy Thompson for the opportunity of examining these.

opercula, seven pairs of anterior bristles, short pinnæ to the branchiæ, the filaments of which had rather short, stumpy, terminal processes, and by the great number of small ova, which in some stretched far forward. The number of the small ova far exceeded that seen in any other form, and point to their probable extrusion before fertilization, or, at any rate, immediately after. Sperms were not clearly demonstrated in front, but they may have been present, though in one the ova passed forward to the anterior region. This form also shows the isolated and elliptical fœcal balls in the posterior part of the gut. In structure the collar bristles correspond with those from St. Andrews.

Station 16 *a*. 195 m. No. 202. 9.6.1908.

Some had no opercula, others had two of the ordinary funnel-shape. In several without opercula the tips of the filaments were rather short and little tapered. In another the tips of the two dorsal filaments were flattened and wider than the rest. The number of the anterior bristles was seven pairs.

One presented the same circular or rounded granular masses on each side of the gut in the caudal region. Others showed distinct ova (small). The former is probably the early condition of the latter. In structure the collar-bristles agree with those from St. Andrews.

Station 16 *a*. 324 m. 13.6.1908.

The examples have slightly larger tubes, more laxly put together, and often showing a lip where the annelid protrudes—that is, the edge of the tube is expanded a little and turned over. The annelids have no opercula, and rather long tapering tips to the branchiæ, which also have long pinnæ. The collar-bristles have the same structure as those from St. Andrews.

Station 18 *a*. 324 m. 13.6.1908.

These have seven or eight pairs of anterior bristles, long branchiæ, with transparent opercula, and long pinnæ on the filaments, which in those having opercula showed no enlargement. In one about twenty of the terminal segments contained rounded granular bodies like early ova. In young forms seven pairs of anterior bristle-bundles occurred, and the branchiæ had short pinnæ and thick filaments. The posterior region in these had between twenty and thirty segments. The tips of the non-opercular filaments were rather long and tapered. In those with the granular masses posteriorly, no large ova could be seen. The aperture of

the tube is in some expanded a little and turned over. The structure of the collar-bristles is precisely the same as in the St. Andrews examples.

Station 18 a. 455 m. 18.6.1906.

The tips of the branchial filaments are enlarged as flattened lobate processes in every instance, and in several the expansion passed down the filament for some distance. The pinnæ on these filaments were all rather long and slender, and in marked contrast, for instance, to those from Plymouth, in which the short thick pinnæ are diagnostic, the whole branchial apparatus being less developed. The great length and the number of the pinnæ in the form from the North Sea give the branchiæ a densely capillary aspect. As a rule, the terminal pinnæ are shorter and thicker, partly, in all probability, from more active growth. Besides the examples just mentioned others showed similar enlargements at the tips of the filaments and no opercula; whilst in a third series a minute, flattened, or slightly saucer-shaped operculum appeared on each dorsal filament. Such could have been of no service as a protection. The structure of the collar-bristles of these specimens corresponds exactly with that of the St. Andrews form.

Station —. Off Moowick Head, 99 m. No. 165. Captured in trawl. 12.8.1908.

All these presented the rounded granular masses (early ova) on each side in the caudal region, and no ova in front. Opercula were present, and seven or eight pairs of anterior bristles. In structure the collar-bristles agree with St. Andrews examples.

Station —. 15.8.1908.

Those examined had two opercula and no enlargements at the tips of the branchial filaments. The anterior bristles were seven or eight, the young having fewer. The collar-bristles agree with those from St. Andrews.

'Poreupine,' 1870. 45 fms. off Cape Sagres.

In these examples the branchiæ are of moderate length (about that of the specimens from Plymouth) and furnished with two well-formed opercula. The pinnæ are somewhat more slender than those from Plymouth. Moreover, most or all of the opercula had a little process on the edge of the comparatively large organ. The rest of the filaments ended in a tapering tip. There were eight pairs of anterior bristles. The collar-bristles are minute and transparent, but the basal region of the wing is differentiated and serrated as



usual, then a gap occurs, after which the distal finely serrated wing tapers to a slender point. These bristles are more minute than any hitherto examined.

*Norway.*

These have large branchiæ, no opercula, and the tips of the filaments are comparatively short, not expanded, whilst the pinnæ are numerous. No sperms were seen, but ova occurred in the anterior region of the abdomen. There were seven pairs of thoracic bristles. Here then was a variation from the form described by Sars which had two opercula. The structure of the collar-bristles entirely agrees with that of the St. Andrews examples.

*Naples. (Salmacina œdificatrix, auct.)*

The comparatively large size of these examples and the great development of the branchiæ, their glandular swellings along the filaments, and the large size of the sausage-like tips, as well as the common occurrence of nine pairs of anterior bristle-bundles make them conspicuous. The pinnæ also take on the tendency to increase at the tips, especially the distal pinnæ, yet these pinnæ are not so long as in certain forms from the North Sea, also devoid of an operculum. The development of the axis or filament of each branchia is in contrast with the smaller parts in the northern seas, the glands of the filaments being smaller. The points or main fangs of the minute hooks appear to be directed forward—both in the anterior and the posterior regions. So far as can be seen, the sperms occur behind the bare segments of the anterior part of the posterior region, and in one with embryos they seem to pass backward, some being present at each side of the tail. In this example (with embryos and ova) the tips of the branchiæ showed rather less than the usual enlargements. The granular masses at the sides of the tail, however, may be sperms. Yet they resemble the granules in front. In those with advanced embryos most of the sperms appear to be shed.

The collar-bristles agree in structure with those from Plymouth and the north, having a basal division of the wing with numerous serrations, a gap, and a tapering distal region with a minutely serrated edge. The bristle has the same curvature at the end of the shaft. Ten points at least appear in a favourable view of the basal web of the collar-bristles and the others agree with those of the northern types.

*Dongonab, Red Sea. 2.12.1915.*

The vermidom is of the open pattern, so that aeration

goes on readily, yet it is stated they grow in quiet nooks at Dongonab. The long branchiæ are richly pigmented, and each animal is provided with a pair of eye-specks composed of a group or crescent of four or five points. The web at the base of the tip of the collar-bristles has eight or nine teeth. The tips of some of the branchiæ in a few are enlarged. In others this is not seen. One had more slender pinnæ than usual, and in this the tips of two of the filaments presented enlargements of the sausage-shape with lateral glands as in *S. edificatrix*. All have six pairs of anterior bristles, viz. first and five following. No opercula are present. One or two buds (early) were attached to the nurse-stock; and many young forms occurred. Buds thus develop in the quiescent condition of the reproductive elements, which were not visible.

*Dongonab, Red Sea. 2.2.1916.*

Since December (1915) the reproductive elements have been developed, the large ova occurring in masses in the non-bristled region behind the "thorax," leaving the posterior and caudal regions free. In some the spaces between the septa were filled with a uniformly granular mass. In a small form, which seemed to be male, the elements filled the posterior and caudal regions to the tip, whilst anteriorly the masses reached the thoracic border. No buds were observed in this series. The tips of the branchial filaments were slightly enlarged in some ovigerous forms, the outline being ovoid rather than sausage-shaped as in *S. edificatrix*, and in this respect they agreed with those procured in December, and in which the reproductive organs were not developed; indeed, some of the latter had large processes, so that this does not appear to be connected with the development of the gonads. The young as well as the adults presented the same slight enlargements of the terminal processes of the branchial filaments.

*Dongonab, Red Sea. 5.1916.*

Since February the reproductive elements in the body have disappeared, and more frequent instances of budding present themselves, the buds arising in a similar manner from the posterior end in front of the pygidium which forms the anal extremity of the bud. The tentacles develop early, and enable the eye to detect the bud even when very small. At a little later stage the outline anteriorly is marked by a separate and symmetrically shaped area—apparently the rudiment of the "thorax."

*Dongonab, Red Sea. 9.1916.*

Many of the tubes were empty, and the forms were young.

In the Red Sea *Filograna* produces ova in the coldest month of the year. In the same region Dr. Crossland\* found that *Meleagrina vulgaris* sheds ova in the winter, whilst *M. margaritifera* breeds only in the summer. The same careful observer remarks that he has not yet seen *Filograna* amongst coral, but it is common on buoys, on the bottoms of boats which have been standing in the harbour, on piles in sheltered water, and in sponges. All its habitats in shallow water are sheltered, and the fragility of the calcareous tubes probably render this necessary.

*Madras Harbour, India †.*

Tubes of the same form were dredged by the late Dr. John Anderson east of Verribles, India, in 13 fathoms.

The branchiæ of those from Madras Harbour show slight enlargements at the tips of the filaments. Though the preparations were not very favourable, yet in an example one of the tips exceeded the others in size, but had the same structure. As a rule, the tips are probe-pointed, though in some the terminal cushions are larger and more boldly glandular. From seven to eight pairs of bristles occur in the anterior region. So far as could be observed, the structure of the collar-bristles is typical.

*Sydney Harbour, Australia. 4.1916 ‡.*

The specimens are characterized by the blackish colour § of the branchiæ—especially their distal ends, which thus boldly contrast with the white tubes, and the anterior region of the body in some is also of a dark hue. The branchiæ appeared to be comparatively thick and stumpy, the pinnae in some and the terminal process of the filament devoid of enlargement, though it was stout. All had two eyes. The number of the bristle-bundles of the anterior region was usually nine, young forms had eight. There were no opercula. The collar-bristles agree with the type found at St. Andrews.

\* To whom I am greatly indebted for these and many other specimens.

† For the examination of these I have to thank Dr. Annandale.

‡ Kindly forwarded by Prof. Haswell.

§ Whether osmic acid had been used for killing is as yet unknown.

Some had the posterior region of the body distended with large ova. None had buds, but a band or two of large free ova in mucus occurred, as in the specimens at St. Andrews and as is also found in *Spirorbis*. Some of the tubes of mucus contained larvæ with three pairs of bristles, a powerful prototroch, two large eyes, and a segmented body.

A commensal Crustacean was found in the calcareous tube.

## PLYMOUTH.

Operculum (none).	Branchiæ (tips).	No. of anterior bristles.	Serrations of basal web of collar-bristle.	Gonads*.  Ripe sperms.
....	Slight enlargement.	7	About 12.	....
....	No distinct enlarge- ment	6	Fewer than 12.	....
Larger example ..	Enlargement greater.	8	About 10?	....
<i>March.</i>				
Young specimen .	Enlarged tips.	8	„ or more	....
Very young ....	....	8	„	....
Young .....	Enlarged tips.	8	„	....
<i>June.</i>				
With bud .....	„	7	„	....
Fairly adult ....	„	8	„	....
„	„	8	„	Ova.
„ (short post. region) ..	„	9	„	....
Fairly large ....	„	7	„	Ova.
„ with bud.	„	8	„	....
„ „	Slight.	8	....	....

## GUERNSEY.—JULY.

Opercula.	Branchiæ. Sausage-tips.	Anterior bristle-tufts.	Collar-bristles. Basal comb.	Remarks.
....	1	7 pairs.	About 1 dozen serrations.	....
2 opercula.	....	8 „	About 1 dozen.	....
2 „	0	7 „	„	Branchiæ pig- mented brown (or red?).
1 only visible.	....	6	„	....
....	2 or more.	8?	1 „ apparently with fewer teeth.	On shells.
2 opercula.	....	8	....	....
2 „	....	7	....	On shells.

\* The male elements were present in the majority with ova.

## ST. ANDREWS.

Opercula.	Branchiæ. Sausage-tips.	Anterior bristle-tufts.	Collar-bristles.	Remarks.
....	All with sausage-tip (long).	7	Fully 1 dozen fine serrations.	Large example.
Bud. ....	.....	8	.....	.....
2.	Slightly enlarged tip.	7 (developing).	No distinct notch.	Apparently five teeth.
....	.....	7	.....	June.
....	.....	8	.....	"
....	.....	8	.....	"
....	Slightly enlarged tips in two specimens.	....	.....	....
2.	.....	.....	.....	Bud, September.
1 developing.	.....	7	.....	"
1 developing.	.....	7	.....	"Nearly adult,"
2 developing.	.....	7	.....	September.

## OFF HEBRIDES.—JULY.

Opercula.	Branchiæ. Sausage-tips.	Anterior bristle-tufts.	Collar-bristles. Basal web serrated.	Remarks.
Large example, 2.	....	8	....	Pigment on branchiæ, two eyes.

## OFF ISLE OF MAY.

Opercula.	Branchiæ.	Anterior bristles.	Collar-bristles.
2	With pigmented tips.	7	Web with small teeth.

## OFF SHETLAND.

Opercula.	Branchiæ.	Anterior bristles.	Remarks.
Young, 2.	No enlargement of tips.	7	Ova.
Adult 2 or none.	....	....	....

## MORAY FRITH (DREDGED).

Opercula.	Branchiæ. Sausage-tips.	Anterior bristle-tufts.	Collar-bristles.	Remarks.
2	None.	7	Typical.	....
2	None.	8	"	Ova.
1	Very slight enlargement.	8	"	....

## ABERDEEN BAY.

Opercula.	Branchiæ.	Anterior bristles.	Collar-bristles.	Remarks.
2	No enlargement of the tips.	7	Small teeth (12).	Ova.

## PORT ERIN.

Opercula.	Branchiæ.	Anterior bristles.	Collar- bristles.	Remarks.
None.	Tips of filaments black.	8-9	Typical.	....

## 'KNIGHT ERRANT.'—AUGUST.

Opercula.	Branchiæ.	Anterior bristles.	Collar- bristles.	Remarks.
2	....	7	Typical.	Coccoliths in stomach.

## NORTH SEA.

Opercula.	Eyes.	Branchiæ.	Anterior bristles.	Collar- bristles.	Remarks.
Stat. 18 a. 18.6.06. 2 or none.	....	Largely developed, no enlargement at tip.	8	Typical.	Ova.
14.3.07. 2.	Present.	No enlargement of tip.	7	"	....
Station 10. 2.	....	" "	7	"	Ova numerous and small.
Stat. 16 a. 2 or none.	....	" "	7	"	Ova.
13.6.08. None.	....	" "	7	"	....
Stat. 18 a. 13.6.08. 2.	....	" "	7-8	"	Ova.
Stat. 18 a. 18.6.06. 2 or none.	....	Those without oper- cula had enlarged tips to filaments, which were long and slender.	7	"	Sperms.
No. 165. 12.8.02. 2.	....	No enlargements.	7-8	"	Early ova?
15.8.08. 2.	....	" "	7-8	"	Sperms.

## 'PORCUPINE,' 1870.

Opercula.	Branchiæ.	Anterior bristles.	Collar-bristles.	Remarks.
2 with a minute process.	Slender pinnæ; no enlargement.	8	Typical though minute.	....

## NORWAY.

Opercula.	Branchiæ.	Anterior bristles.	Collar-bristles.	Remarks.
2 or none.	Large branchiæ in those devoid of opercula, no en- largements at tips.	7.	Typical.	Ova and sperms?

## NAPLES.

Opercula.	Branchiæ.	Anterior bristles.	Collar-bristles. Basal web.	Remarks.
Absent.	Large sausage.	10	About 10 or 12 serrations.	Ova.
....	" "	9	....	Embryos.

## DONGONAD, RED SEA.

Opercula.	Branchiæ.	Anterior bristles.	Collar-bristles.	Remarks.
2nd December. None.	Pigmented, some tips enlarged.	6	Basal web, 8-9 teeth (typical).	Buds in a few.
2nd February. None.	Tips of branchia slightly enlarged both in young and adults.	6	Typical.	No buds.
May. None.	„ „	6	„	Many buds.
September. None.	.....	....	....	Young examples.

## MADRAS HARBOUR.

Opercula.	Branchiæ.	Anterior bristles.	Collar-bristles.	Remarks.
None.	Tips slightly en- larged.	7-8	Typical.	....

## SYDNEY HARBOUR.

Opercula.	Branchiæ.	Anterior bristles.	Collar-bristles.	Remarks.
None.	Pigmented branchiæ, no enlargement.	9	Typical.	Young had eight thoracic bristles.

## (c) STRUCTURAL.

In British Seas *Filograna implexa* has been at intervals under examination since 1863, and it was its structure that year in St. Andrews Bay which showed how closely it approached Prof. Huxley's *Protula dysteri*. Indeed, two years after, the English author admitted to the writer that there was no real distinction between them. Since that time numerous specimens from the east and west, north and south, from shore and from deep water, and from such localities as Norway, Shetland, the Hebrides, several stations (7) in the North Sea, Plymouth, the Channel Islands, the trawling-grounds of 1884, the deep water off St. Andrews Bay, the Moray Frith, the stations of the 'Porcupine,' Naples, the stations of the 'Triton' and 'Knight Errant' from the Red Sea, India, Africa, Australia, and the French coast, &c., have given a fair field for observation, especially when supplemented by living specimens.

Fresh examples from Plymouth in sea water, as Huxley and others truly said, resemble corals in so far as the branchial fans of the annelids project from the tips of the tubes as miniature flowers, the distal parts (branchiæ) of

which are pale greenish yellow, and the anterior region of a fine reddish hue which tints the cephalic region at the base of the branchiæ and passes a short distance along each filament. When eggs are present the posterior region is also reddish, the colour of these being of a brighter hue than the front. Two dark eyes occur on the dorsum of the reddish cephalic area. The anterior (thoracic) membrane is more deeply tinted in front than behind. When in full vigour the pure white of the calcareous tubes, the scarlet of the anterior region which just projects beyond them, and the pale greenish-yellow fans with their opaque tips make a picture at once beautiful and characteristic. The filaments of the branchiæ, when fresh, show under a low power a distinct moniliform arrangement of granular dots in all the British forms along each side—indicating a less developed stage of the more highly organized condition in the Mediterranean form—*Salmacina ædificatrix*. These granular masses are situated on the outer aspect of the interpinnate spaces, and are prominent in a face or a lateral view. The tips of the branchiæ are in all more or less cylindrical, and under a lens present a whitish opacity. The expanded branchial fan is even more beautiful than that of *Alcyonium* from the larger size and greater richness of the filaments and pinnæ. The separate filaments are often curved toward the mouth, approximated, expanded or drooped on one side, the movements in the absence of irritation generally being slow. When touched with a needle, however, the entire fan shrinks into the tube, and though it by-and-by unfolds it may sharply retract several times spontaneously as if in remembrance of the contact of the foreign body. The collar is often folded backward over the tip of the tube when the branchial fan is expanded. A separate branchia retains vitality for a considerable time and the pinnæ move as in the perfect fan, the tip of the filament also bending inward as if carrying out its usual functions, the whole occasionally rolling together like a ball and again expanding. The funnel-like aperture leading to the mouth is richly ciliated, and so with the anal groove posteriorly. Cilia also occur at the bases of the feet.

On arrival at St. Andrews those from Plymouth expanded their branchial plumes freely, and after the first two days various examples dropped from their tubes to the bottom of the vessels, and this continued during several weeks. The extruded forms quietly expanded their branchiæ on the bottom of the vessels, the filaments bending inward now and then and again being expanded, whilst those with long



posterior regions occasionally curved them as the body contracted—with or without a jerk. Fragments of the anterior region with the branchiæ survived a week or more, the movements of the branchiæ being similar, and even a cephalic region with the branchiæ had almost equal vitality. The distal process of the branchial filament is not ciliated, but a rich coating of cilia occurs on the inner surface of the pinnæ.

In reviewing the various examples from the diverse localities it is found that the mass of calcareous tubes—the vermidom, as Huxley called it—is identical in all, though two conditions may be distinguished, the solitary and the social. The tubes from deep water are large, yet light, masses, which invariably, as Dalyell observed, are honey-combed by spaces which permit the free passage of water and enable the annelids to expand their branchial fans in secure retreats. Therein they differ from the solid masses of the aporous corals, for instance, which lack the intricate chambers and which can only expand their polyps on the surface and sides. In some a distinct widening of the lip of the tube occurs, after the manner of a trumpet—a condition perhaps less frequently seen from their extreme brittleness.

The general size of the adult annelids does not offer much variety, though the Neapolitan examples, such as *Salmacina ædificatrix*, are pre-eminent.

The branchiæ vary considerably in their total length, in the length of their pinnæ, in the presence or absence of terminal enlargements to the filaments, and in the development of the paired glands at the base of the pinnæ. Moreover, the presence of opercula characterizes certain forms, yet they are not altogether confined to northern examples, since they are abundant in those from the Channel Islands and off Cape Sagres in the south of Spain. Opercula are absent from the Mediterranean examples, those from Plymouth, those from Madeira, India, and Australia, yet they are equally absent from swarms off St. Andrews Bay. So much has been made of the presence or absence of opercula that it is interesting to find that the enlargements at the tips of the filaments seem to take their places, for instance, at Naples and Plymouth. Where an operculum is present, as a rule no enlargement of the tips of the filaments occurs. The opercula may be comparatively large and thin, or less expanded as circular discs. But the most important fact is that on the same ground, as in Shetland, the Moray Frith, and St. Andrews, some in the same masses have and others do not have opercula. Thus in

swarms of those devoid of opercula from the neighbourhood of the Bell Rock a few were found with them. That fact would seem to dispose of the importance of the operculum as a specific distinction, for the animals are otherwise identical. In the same way some on the same masses from the North Sea had an operculum as an exception, and though Sars described the Norwegian representative as having an operculum, others lately examined from the same region had none. The varying size and shape of the operculum, and the remarkable susceptibility of the branchiæ themselves to change in filaments, pinnæ, terminal region, and glands, suggest the instability of a character derived from the operculum in *Filograna*.

The tips of the filaments, like the branchiæ as a whole, present equal response to external or internal influences. The maximum change, independently of the formation of an operculum, so far as at present known, is observed in the Neapolitan type—*Salmacina ædificatrix*,—in which the non-ciliated tip forms an elongated sausage-like process, though it is probably flattened. No operculum is developed in this type. Similar, though smaller, enlargements take place in the Plymouth and southern non-opercular forms, and which, though not specially noted by Huxley, were alluded to by Claparède. De Quatrefages supposed that in Huxley's *Protula dysteri* these enlargements corresponded to the ovigerous opercula of the Spirorbids.

In those with opercula from the French coast, the Channel Islands, Shetland, and Norway, no enlargement of the terminal region of the filaments, as a rule, was present. Only in certain examples from the North Sea modified opercula and terminal enlargements of the filaments occurred. Thus in an example with eight pairs of anterior bristles one dorsal filament had a somewhat thick terminal process, rather abruptly bevelled on one side, whilst the other filament had advanced a stage further—the clavate tip being unequally bevelled and hollowed so as to form a rudimentary operculum. On the same ground (455 metres) another had the tips of the filaments more irregularly enlarged as flattened lobate processes in every instance, and in several the expansion passed down the filament for some distance. Others showed similar enlargements at the tips of the branchiæ and no opercula, and a third series presented a minute flattened or slightly saucer-shaped operculum on each dorsal filament which could have been of little use as a protection. At other stations the forms of the opercula varied from the thin translucent, more or less circular or hoof-shaped cup to a

long vase with a tapering process on the lip, or the filament had a blunt clavate tip or a cone at the end. In another instance (197 metres) in which no operculum was present the tips of the two dorsal filaments were simply flattened and wider than the rest. Accompanying the foregoing were several—it may be young forms—in which the tips of the filaments were short and little tapered. The presence or absence of opercula, indeed, would appear to depend on no reliable data.

Variability is not confined to the tips of the branchial filaments, for the pinnae are short as in the young budding forms from Plymouth, or of great proportional length as in certain forms from the North Sea, the branchial fans of which, moreover, are about half the length of the body. The pinnae of these are much longer and more slender than in any from Plymouth, though the age of the specimen has considerable influence in this respect.

The number of the bristle-tufts in the anterior region is likewise variable—ranging from five to ten, though a considerable majority show seven, the number most frequent in the north.

The first pair of bristle-tufts, the collar-bristles, diverges from the others in size, direction, and structure, and in these respects is closely allied to the condition in *Spirorbis*. Those from Plymouth may be taken as the type, the first pair of bristle-tufts being conspicuous organs directed forward, upward, and outward. The shaft of each bristle is nearly cylindrical, diminishing a little when viewed from behind toward the commencement of the wing, and the tapering axis can be followed as distinct from the wing to the hair-like tip. The broad basal part of the wing has numerous (about a dozen) serrations, sloping from the base to the distal end in lateral view, then a hiatus occurs, followed by a minutely serrated tapering wing or blade. Certain views point to the double nature of the basal expansion of the wing. In some from St. Andrews several of the bristles of this tuft do not show the gap separating the more boldly serrated base from the minutely serrated terminal region of the wing. Moreover, a few simple tapering bristles without an evident wing were present. How far these may consist of developing forms has yet to be ascertained, but such is unlikely. These bristles are freely moved forward, outward, and inward for various purposes, and when feeble or dying they stand stiffly forward and outward. In the buds these bristles show the same structure, and slight hollows at the site of the gap between the basal and distal parts of the wing indicate the notch.

The second tuft has bristles with simple wings. The rest of the tufts in the anterior region have, in addition to the simple winged bristles, two or more with sickle-shaped or falciform tips, and in the ordinary preparations (microscopic) these are posterior. These tips are translucent and flattened, widened at the end of the shaft, characteristically curved and tapered to a fine point.

The bristles of the posterior region are few in number in the groups, and follow a blank space behind the anterior region. Though smaller, the structure is the same as the simple winged forms. The wings on the slender bristles of the last three or four segments are very narrow—just visible in living examples.

So far as can be ascertained, the hooks in the various forms correspond in intimate structure.

Though the Polychæta as a rule are unisexual, various hermaphrodite annelids are known; thus H. Parlin Johnson gives a list of sixteen or seventeen species possessing this character. No form, however, is more interesting than *Filograna* (Salmacinæ) which not only is hermaphrodite, but reproduces also by budding, as first pointed out by Huxley. In the hermaphrodite annelids, as Malaquin clearly observes, the male and female gonads may be quite distinct, as in the Nereid *Lycastis quadraticeps*, Gay, or they may be mixed, as in *Ophryotrocha puerilis*. In the Salmacinæ and Spirorbids, on the other hand, the male and female gonads are in different segments.

The budding in *Filograna*, as Sars noticed, takes place in the posterior region of the adult, viz., where the long paired bristles occur—six or seven of these being in front of the bud, which is formed of the caudal region of the nurse-stock with the vent and its two papillæ.

The early buds are ovoid and granular, wider than the ordinary caudal region, with nine or ten pairs of bristle-tufts characteristic of the posterior region, the anterior division being devoid of them, but having simple smooth filaments representing the branchiæ. No special differentiation of the granular interior of the bud can be made out, further than a more opaque granular wedge in front of the anal papillæ, and which probably represents the adult rectum. No trace of the collar is at first visible, then a fold, probably the ventral, occurs at the base of the short filaments.

In the next stage the body of the bud is more elongated, the bristled segments are more numerous, and a streak along the middle line leads to the vent, and is in contact anteriorly with the alimentary canal of the adult, which in one contained a large foreign mass about its middle. The branchiæ

(four on one and three on other side) are longer and more slender, and are distinctly moniliform. A rounded process behind them on each side represents the lateral lobes of the collar, and a slightly opaque curved area on the anterior region probably indicates the alar membrane.

The buds appear to leave the nurse-stock when six pairs of anterior bristles are present, viz., the first pair which project horizontally and five behind these, the alar membrane being narrower behind than in front, and developing from before backward. The branchial filaments have pinnæ and terminal processes. The body is comparatively short and wide, the anterior and posterior regions being nearly equal in length. A part devoid of bristles occurs behind the anterior region, then follows ten or eleven bristled segments and a caudal region devoid of bristles.

In many from Plymouth the anterior part of the posterior division, the seat of the male elements, is marked by numerous closely arranged transverse lines apparently due to transverse rows of minute red pigment-granules on the stomach; yet in these the male elements at this date (8th June) had not attained great development, the ovigerous region behind being considerably in advance, as might be anticipated in view of the presence of the ova in the early bud. A portion of the tail, consisting of a variable number of segments (12-15 or more), being free from reproductive elements and presenting only the greenish blood-vessels of the gut and the feet. The contrast, therefore, between such specimens and those forwarded in March, in which month the reproductive elements were inconspicuous, though buds were numerous, was pronounced. In June, again, the budding forms had reproductive elements developed only in the bud, the reddish hue of which betokened the early ova, only a median greenish stripe, broad at the vent, indicating the alimentary canal in the bud ready to separate. Such subsequently developed a caudal region of numerous segments.

No uniformity appeared to exist as to the segment of the posterior region from which the bud sprung, for example, six, seven, eight, nine, and ten bristled segments occurred in a series in front of the bud.

The sperms frequently develop in the forms from Plymouth a little later than the ova, none indeed appearing in the bud, but by-and-by they fill the non-bristled region in front of the ovigerous segments and bulge laterally, the region being thus characterized by its pallor.

On the other hand, a short example having about twenty-five segments in the posterior region had only male elements in front of a part, containing thirteen segments and the

pygidium. The achetous region (of four or more pale segments) was filled with sperms—some ripe, the majority scarcely ripe. The sides of the posterior region, which would by-and-by form the bud, had opaque cells and granules (developing ova?). The sperms thus first attained maturity in the example. This, therefore, shows the variable nature of the form in this respect.

On the 9th June early trochospheres of a deep red colour occurred in the vessels, the prototroch being conspicuous at each side. These simply rotate or swim in small circles; but the larvæ with commencing segmentation dart through the water with great vigour, and often in a straight line, whilst others made larger circles near the bottom. One of the latter had three segments behind the head, and in all two eyes were distinct.

The mode of development in these forms thus differs from that observed in the preparations of *Salmacina edificatrix*, which produces large ova and trochospheres in the tube. No buds have been met with.

(d) GENERAL.

*Filograna* in itself demonstrates the difficulties which surround the idea of special creation as an explanation of the diverse conditions of structure and reproduction, since those with and those without opercula, those with enlarged tips to the branchiæ and those without them, those with eyes and those devoid of them, those with a few pairs of anterior bristles and hook-rows and those with an increased series of both, and other variations occur on the same site. It is more reasonable to believe that the observer is dealing with a species spread over the whole globe, and which is endowed with a capacity for variation almost unequalled in the animal series, than to adhere to the view that there are separate species or genera.

The sea is in a different position from Mr. Alfred Wallace's view of the land, where "so long as a country remains physically unchanged, the numbers of its animal population cannot materially increase. If one species does so, some others requiring the same kind of food must diminish in proportion." In the sea such strictures, perhaps, are less necessary, for there is an ample margin for every living form in so far as food is concerned. It is true "the numbers that die" (or are killed) "annually must be immense; and, as the industrial existence of each animal depends on itself, those that die must be the weakest—the very young, the aged, and the diseased; while those that prolong their existence can only be the most perfect in health and vigour—

those who are best able to obtain food regularly, and avoid their numerous enemies." It is difficult, however, to see how such an argument can apply to sedentary zoophytes which are browsed on by young cod, to the living corals which are crushed by the *Scari*, or to the sedentary Polychæts in calcareous tubes which are devoured by Echini and various fishes. It would be interesting to find out in these the "struggle for existence in which the weakest and least perfectly organised must always succumb." There is little competition in a colony of *Filograna*, or in that of *Obelia*, and it can hardly be said that there is a struggle for existence in such reef-corals as *Polythou* or *Zoanthus*.

Checks there must be on the extraordinary powers of propagation shown by *Filograna*, else the ocean would swarm with masses like coral-reefs, yet individual competition must be slight, since post-larval forms secrete their tubes, it may be, on new sites, whilst the buds may increase the parent mass of tubes on the old one. Each is perfect and capable of "performing the different acts necessary to its safety and existence under all the varying circumstances by which it is surrounded," and "perfect acquaintance with its organization and habits" would hardly enable us "to calculate the proportionate abundance of individuals which is the necessary result." It cannot be said that the inhabitants of the sea are "kept down by a periodical deficiency of food," though other checks exist. It is difficult also to explain the comparative abundance, say, of *Filograna* or the scarcity, say, of *Placostegus* as due to their organization and resulting habits, "which, rendering it more difficult to procure a regular supply of food and to provide for their personal safety in some cases than in others, can only be balanced by a difference in the population which have to exist in a given area."

If it be supposed that the ancestral form was devoid of an operculum, and that the presence of that organ in one form or another is a variation, the question as to its influence on the welfare of the species naturally suggests itself. Can the thin, almost membranous, operculum so guard the aperture of the tube as to be a decided advantage to the occupant—in contrast with the bare tips of the branchiæ or their enlarged extremities, which otherwise block it? The indiscriminate occurrence, in the same colony, of opercula, enlarged tips, and ordinary tips, would point to the view that the development of one or other of these is of secondary moment; yet it must be borne in mind that in certain northern localities the majority follow one condition or another, and that such races as *Salmacina œdificatrix* are characteristic of the

warm Mediterranean waters. Environment would thus appear to be a factor of importance in some instances, if not in all. Moreover, it would seem to be as unnecessary to place the weight given by some authors on the presence or absence of an operculum as to separate like species of oxen by the presence or absence of horns. Some, like Claparède and Fanvel, perhaps, might be disposed to separate as distinct species those with and those without an operculum, or to regard either as a sudden and an important mutation in a given series. It may, indeed, be asked why *Filograna*, with such a tendency to variation in the organs mentioned, as well as in reproduction, has not developed along the lines indicated and produced descendants in which each variation fitted it to survive more readily than its fellows—whether as regards its somatic cells or its germ-cells, both of which are affected? The continuity of the germ-plasm does not appear to restrict the variations indicated, even in reproduction, since there may be free ova, internal embryos, or buds. A study of karyokinesis in the sexual cells might, perhaps, aid in solving the problem, though this is conjectural.

Again, the variability in the number of the anterior (thoracic) bristles is a feature seen in not a few Polychæts—for instance, in the Sabellids. In *Potamilla reniformis*, O. F. M., the anterior bristles may range from five to twenty-six pairs, a much wider variation than in *Filograna*. Certain races of *Filograna* have seven pairs, others from seven to nine, whilst the Neopolitan types may reach ten. Such is not necessarily the effect of age, but rather of environmental conditions—for example, the general temperature of the surrounding water, the rich supply of nourishment, and the abundance of light.

In considering the differences in structure presented by *Filograna* the variations in the tips of the branchiæ occur under such diverse conditions, as well as on precisely the same site and under the same conditions, that one is at a loss to say wherein the process of selection and the "struggle for existence" lie. Their tubes give the necessary protection, so that the species can vary in any manner in which its inherent capacities permit, and a single generation may afford examples of change in the organs referred to. The enlarged tips of the branchiæ are of a glandular character, and thus differ from the opercula—though borne by the same parts. Moreover, it cannot be said that disuse has caused the disappearance of the opercula, since the forms devoid of them have as much need of them as before. The bright pigment of the branchiæ shows that light, as well as



aeration, plays an important part in the economy of the annelid.

In such a type as *Filograna* it is not the hard-and-fast rule that "like begets like," but the inherent tendency to vary in every particular in the parts indicated is the main factor. It is questionable if, with every care, the production of those with opercula or those with the greatly enlarged tips to the branchial filaments could always be relied on by breeding from suitable parents of each type, unless the exact surroundings are obtainable, since the tendency to variability is so intense. It is said that varieties replace the original species because they are "more perfectly developed and more highly organised, and in all respects better adapted to secure its safety, and to prolong its individual existence and that of the race. Such a variety *could not* return to the original form; for that form is an inferior one, and could never compete with it for existence. Granted, therefore, a 'tendency' to produce the original type of the species, still the variety must ever remain preponderant in numbers, and under adverse physical conditions *again alone survive*"\*.

Whilst many examples of the foregoing statement may be found in the higher vertebrates, the case of *Filograna*, for instance, does not seem to fall into line, for here are variations so numerous in structure and development and so intermingled with each other that it is difficult to say which is the original form and which the variation, since all forms may be found under like conditions. In this connection it may be asked what variety of *Filograna* has a tendency to maintain its existence longer than the original species or longer than any other variety? Can it be said that those with opercula are better fitted to survive than those devoid of them, or that those with the distal ends of the branchial filaments enlarged into sausage-like masses supplant those without them? Are those with eyes and nine pairs of anterior setigerous processes enabled to continue the species more effectively than those which have no eyes and only five or six setigerous processes? There is no proof that any of these is in a better position than another—yet Nature does nothing in vain; the facility with which variations occur and the vast distribution of the species would lead to the belief that a clue may yet be found to unravel the mystery. The species certainly fluctuates to and fro in regard to the organs mentioned, but does not progress along any of the lines

\* This and other quotations are taken from the important papers of Mr. Darwin and Mr. Wallace in the Proc. Linn. Soc. vol. iii. no. 9, 1858.

with sufficient continuity to evolve anything more than a variation.

The differences in the various races of *Filograna* do not appear to be so great as to warrant specific separation, and this is the more noteworthy in a species so widely distributed and so plastic. The variations lead to no change of habit or surroundings, no essential change in general structure, and the different methods of reproduction remain more or less the same throughout. No variety seems to excel the other in its influence on the stability of the species, or to lead to fixity and the formation of a new species, and the "extermination of the older and less improved forms." This species does not conform to the view that the "lesser differences characteristic of varieties come to be augmented into the greater differences characteristic of species"\*. If the struggle for existence held in the ordinary way, it is reasonable to suppose that certain variations of structure and development would have been singled out as permanent—to the exclusion of others.

The differences between the varieties of *Filograna* are more pronounced, perhaps, than in such a case as A. G. Mayer's *Epenthesis folleata* and *Pseudoclytia pentata*, the former with the typical four, and the latter with five radial canals, gonads, and manubrial lobes. The Cœlenterates, moreover, have a more simple structure, and their gelatinous tissues respond more easily to sudden variations.

Whilst there is wide variability in the plastic branchiæ, eyes, opercula, the number of "thoracic" segments, and the absence or presence of buds, there seems to be more or less uniformity in the structure of the bristles and hooks as well as of the tubes from pole to pole of the world. It may well be asked why the environment has not altered these organs (bristles and hooks)? Their functions, it is true, have not altered, but neither have the functions of branchiæ or opercula.

Yet, after all, and taking a broad view of the species, *Filograna* remains the same, and leads to no other type, for the Spirorbids, which have similar collar-bristles and branchiæ, are joined by no intermediate forms, their tubes are coiled and massive, and their opercula larger and calcareous. No change of surroundings in the varied waters stretching from Arctic to Antarctic seas makes the species other than *Filograna*. Moreover, there does not seem to be any correlation in the parts which vary, even the absence of the opercula and the presence of the enlargement of the tips of the branchial filaments are by no means

\* Darwin, 'Animals and Plants under Domestication,' vol. i. p. 7.

invariable. In the Neapolitan *Salmacina œdificatrix* many specimens would seem to show shorter and more slender pinnæ on the filaments, which throughout are terminated by the enlarged cushions.

The higher Polychæts, as a rule, have the sexes separate, but *Filograna* is hermaphrodite, and, moreover, increases by active budding, the buds rapidly developing sexual elements which may be shed or the ova may be fertilised internally and find exit as larvæ. All these processes exist, it may be, in one and the same colony, and it is not easy to explain why such diversity should occur, or why such characters, if acquired, should not be more stable.

There is little evidence of a struggle for existence in such a form, since the sea supplies at once food and calcareous matter everywhere; yet the warmer waters appear to favour the development of larger processes at the end of the branchial filaments in certain cases, but this falls under environment rather than individual competition, for it cannot be supposed that the great size of these processes is necessary for the well-being of the species generally. Whilst they may be associated with the environment, yet under the same conditions small terminal processes may be present, just as in colder waters opercula may be present or absent in the same colony. In connection with the statement that the warmer waters seem to favour rapid spread of the species it need only be pointed out that, in contrast with the colder eastern waters of Scotland, *Filograna* flourishes luxuriantly in the genial waters of the Laboratory at Port Erin and speedily blocks with its calcareous tubes the supply-pipes, whilst on the boats of Dongouab in the Red Sea it is equally, if not more, luxuriant.

Sexual selection would appear to have little or no effect in producing the varieties, though special varieties of opercula or branchiæ on a given site may owe their frequency to the qualities transmitted by parents, or by the process of budding from a nurse-stock.

The coloration of the branchiæ is a feature of moment, especially in connection with the incidence of light. This coloration is marked in the Australian forms and in those from the Red Sea, the Mediterranean, and the south generally, though it is by no means inconspicuous in those of colder climes. Is this coloration protective where it is highly developed, or is it only ornamental? The great beauty, as well as the endless variety, of the branchial circles or fans of the Serpulids must have struck every marine zoologist, and therein *Filograna* agrees with its family; but the pigment may have special physiological purposes to

perform, seeing that the cœlomic fluid is present in every branchial filament.

The effects of inbreeding can hardly affect the reproductive processes of this species, since the sperms are widely distributed in the water and fertilise, it may be, different ova either in the cœlom or in the free condition, whilst the buds form a further check of importance. Notwithstanding the wide range of the sperms shed by such forms in the sea, the question of hybridization does not appear to arise—indeed, no more than in the case of the cod, haddock, and pleuronectids which meet on the breeding-grounds.

Reversion or atavism appears to have little to support it in the case of *Filograna*, though the occurrence of a few with opercula in a race usually devoid of them may be held by some to indicate this feature, especially as the development of this organ seems to be less connected with the environment. If such organs appeared in a bud—that is, independently of sexual reproduction,—it might show that the tissues of nurse-stock and bud were imbued with an inherent continuity of plasm, which in function may remain latent or intermittently burst forth in the formation of such organs, just as the reappearance of coloured longitudinal stripes takes place in young feral pigs. Particular crosses may also favour the appearance or disappearance of opercula, enlarged tips to branchiæ, or other features in succeeding generations: as Darwin says “That a being should be born resembling in certain characters an ancestor removed by two or three, and in some cases by hundreds or even thousands of generations, is assuredly a wonderful fact.” As *Filograna* is hermaphrodite the so-called secondary sexual characters have a more direct line of transmission.

Whether the variations noted are hereditary is still an open question, though it would appear that in some cases at least these are not sufficiently stable to lead to the formation of species. Certainly *Filograna* is under “conditions of life incessantly inducing fresh variability” (*Darwin*), and thus, perhaps, has a check to inheritance in the ordinary sense of the term. Perhaps the species falls under the group in which selection has not been applied, and thus distinct races or even species have not been conspicuously formed; certainly it is difficult to see how natural selection affects *Filograna* to any extent. The variability in this species is not due to crossing, food, climate, or inbreeding. It is inherent.

2. On *Harmothoë watsoni*, *M'I.*, *an var.* *H. marphysæ*, *M'I.*

Whilst studying the structure and habits of *Lagis koreni*, Malmgren, forwarded from Lanfairfechan, in North Wales, Mr. Arnold Watson found a Polyroid as a commensal in the tube of an adult annelid and he kindly sent it for examination along with some remarks on its condition in life. It measured about one-fifth of an inch in length, with white scales bearing reddish-brown markings, which at their interior ends joined to form crescents. Anteriorly was a red disk, probably due to the cephalic ganglia. The median tentacle was long, and one anal cirrus was seen, though most of the dorsal cirri had been shed.

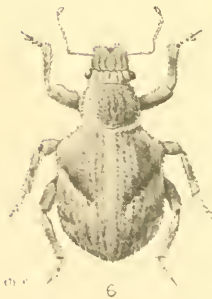
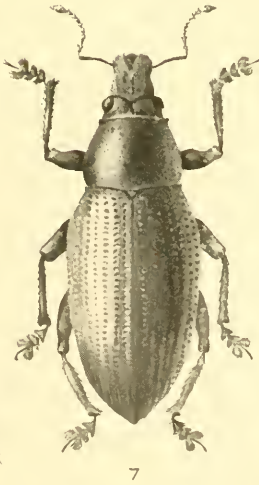
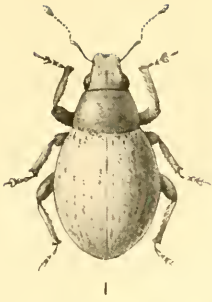
No scales remained on the body which had a fairly regular outline from the even disposition of the feet. The head is less elongated than in *Harmothoë marphysæ*, and in the preparation retained a pale brownish hue, with the usual median groove enlarging at the anterior peaks. The presence of these anterior peaks, which the dark pigment at the base of the median tentacle more clearly differentiates, the large size of the eyes, and the shorter head distinguish this form from *H. marphysæ*. All the eyes are visible from the dorsum, though the anterior pair, from their slightly lateral position, are less distinct than the posterior pair, which lie in front of the nuchal border. The anterior eyes are somewhat in front of the middle of the head, and thus separated from the posterior pair by a considerable interval, whilst they are also more distinctly lateral. Both pairs are, however, visible in a lateral as well as in a dorsal view, and all are of medium size, considerably larger than those of *H. marphysæ*. The median tentacle is long and furnished with clavate papillæ. The lateral tentacles are inferior and in the preparation have slightly enlarged or probe-shaped tips. The palpi are of moderate length with tapered extremities, and their surface is smooth. The tentacular cirri are comparatively short and have slender tips, whilst the surface has a few clavate papillæ.

The body is normal in shape, and thus differs from that of *H. marphysæ*, being slightly narrowed in front and more distinctly diminished posteriorly. The number of bristled segments is about thirty. When the scales are removed, a translucent bar, the proboscis, appears behind the head. The feet have a regular arrangement from front to rear, and the pale bristles project beyond them with similar regularity. A typical foot presents dorsally the cirrus, which is enlarged at the base and tapered distally, with numerous clavate papillæ. The tip of the organ does not project much beyond

the bristles, and thus appears to be somewhat shorter than in *H. marphysæ*. A slight eminence below the cirrus gives origin to the pale dorsal bristles which radiate from it in a fan-like manner, but when compressed laterally show a shorter, stouter, upper, and a longer, more slender inferior series. The upper shorter forms are boldly curved and serrated on the edge. The more slender inferior bristles are less curved and the serrations on the hair-like tip are minute. A spine pierces the lower margin of the elevation from which the bristles emerge—in lateral view. These bristles thus closely resemble those of *H. marphysæ*, differing only in the more minute serrations of the tips and their smaller size. The inferior division of the foot forms a cone with a pointed tip, up to the base of which the powerful spine goes. Its dorsal outline is sinuous, the ventral convex (in lateral view), the outline thus differing from that of *H. marphysæ*, though the size in the respective cases has to be remembered. The upper two have elongated simple tips with only a slight swelling above the shaft and very minute serrations on the edge. Those in lateral view are above the spine. Those below the spine have shorter tips, longer rows of spikes, and bifid tips, and the swelling above the shaft is more distinct. The short ventral cirrus has an enlarged base which rapidly tapers to a slender tip, and its surface has a few clavate papillæ. Posteriorly all the parts of the foot are diminished, and the bristles are proportionally more slender and elongated.

The scales have the colour mentioned by Mr. Arnold Watson, and a similar outline to those of *H. marphysæ*, but they are thinner and more translucent; moreover, in some no papillæ can be observed. In other scales the papillæ, from ten to twenty in number, form a small compact group on the thinnest margin of the scale and about its middle, whereas in *H. marphysæ* these papillæ stretch in the adult female as a long band to the angle of the thin edge. The changes here indicated may be the result of growth, but there is a decided divergence.

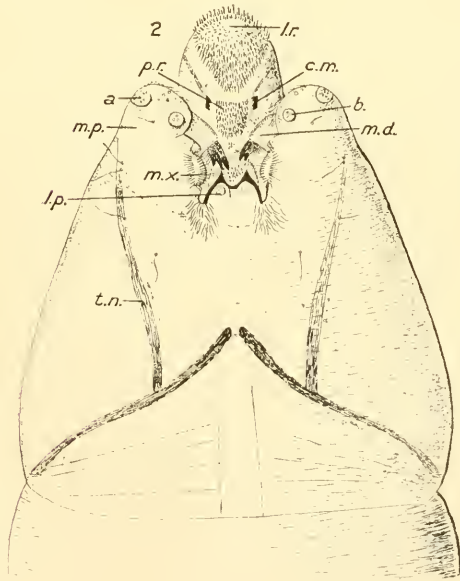
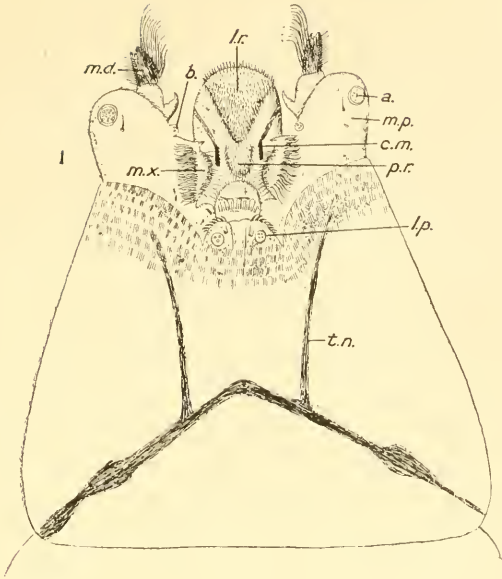
On the whole, this Polynoid closely approaches *H. marphysæ*, but the structure of the shorter head with its larger eyes, and the closer approach of the anterior to the posterior pair, the slight differences in the structure of the feet and the bristles all combine to cause hesitation. Intermediate examples, however, may yet enable future observers to unite them. It is an interesting fact, however, in connection with the ripe *H. marphysæ*, that a marked change in the condition of the feet accompanies reproduction, though the eyes remain as minute as before.



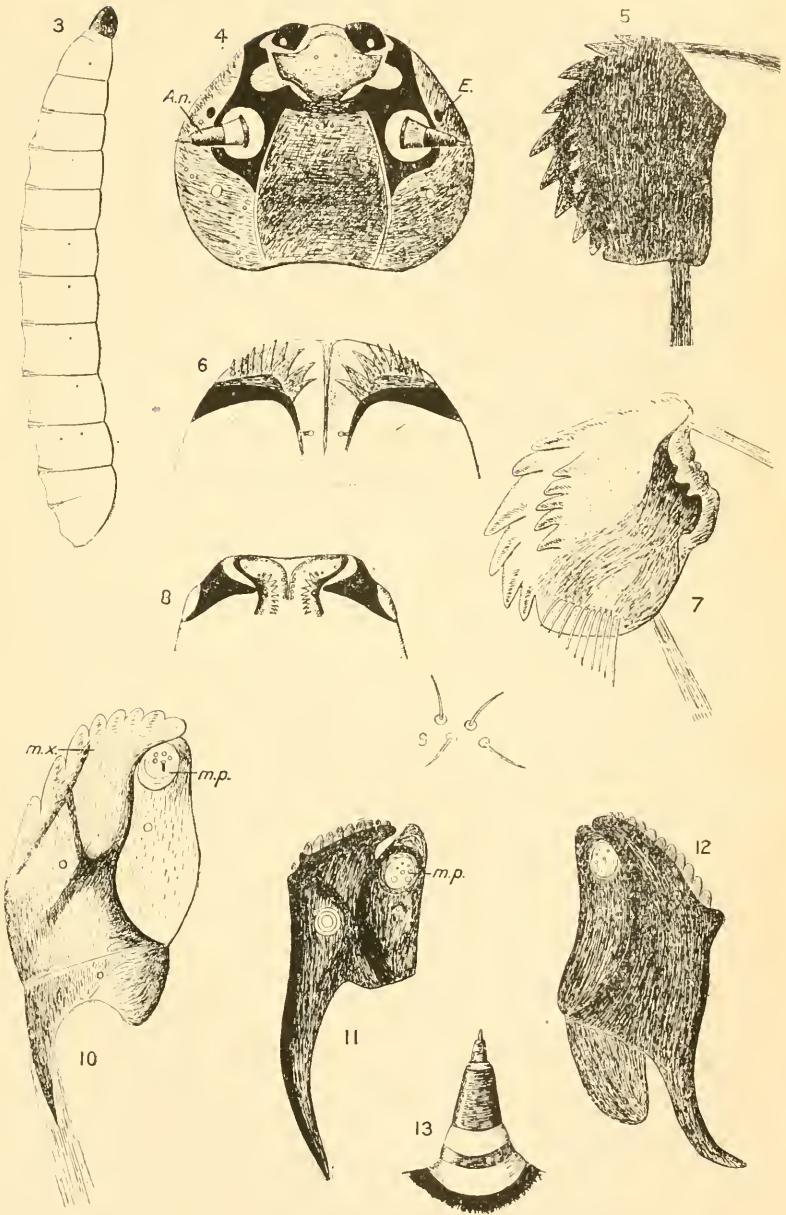
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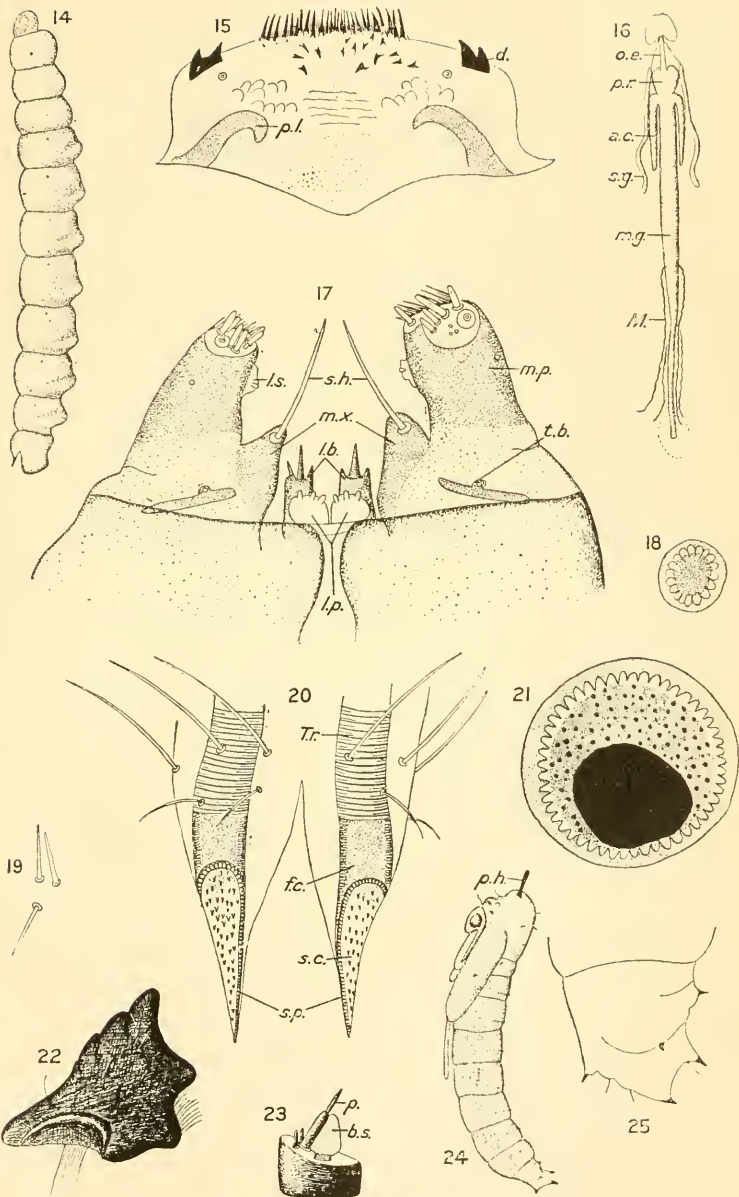




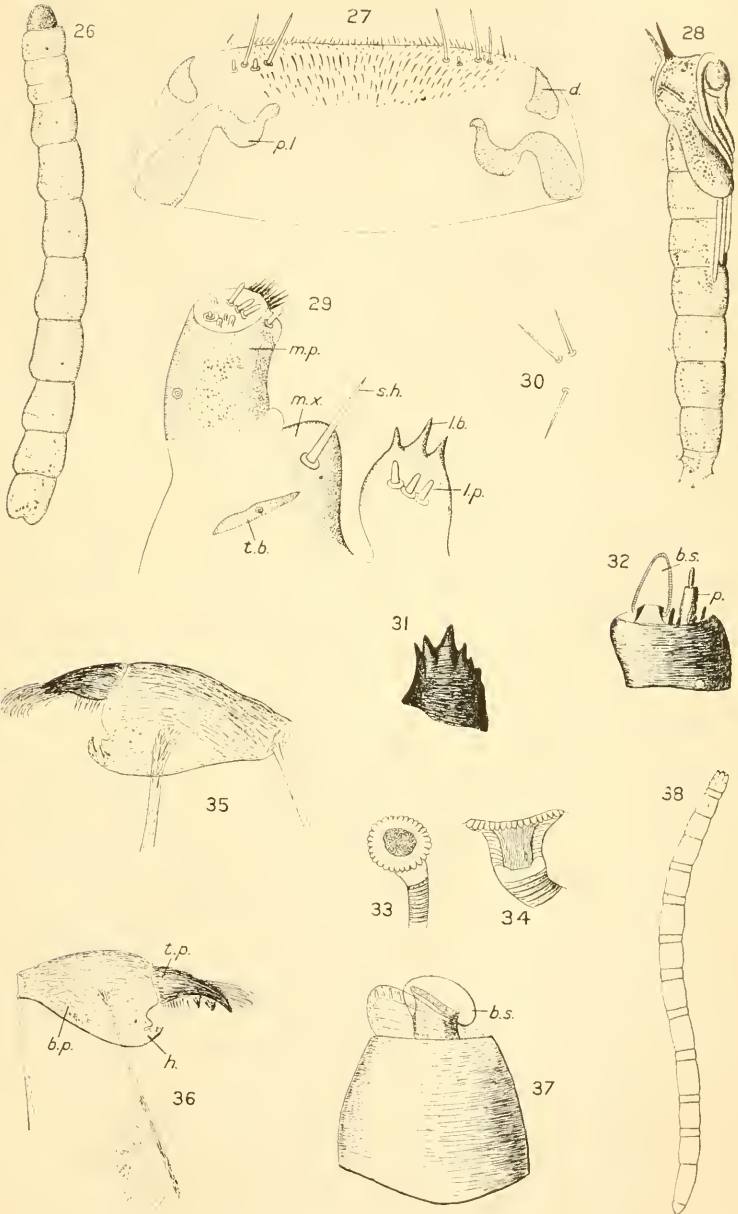






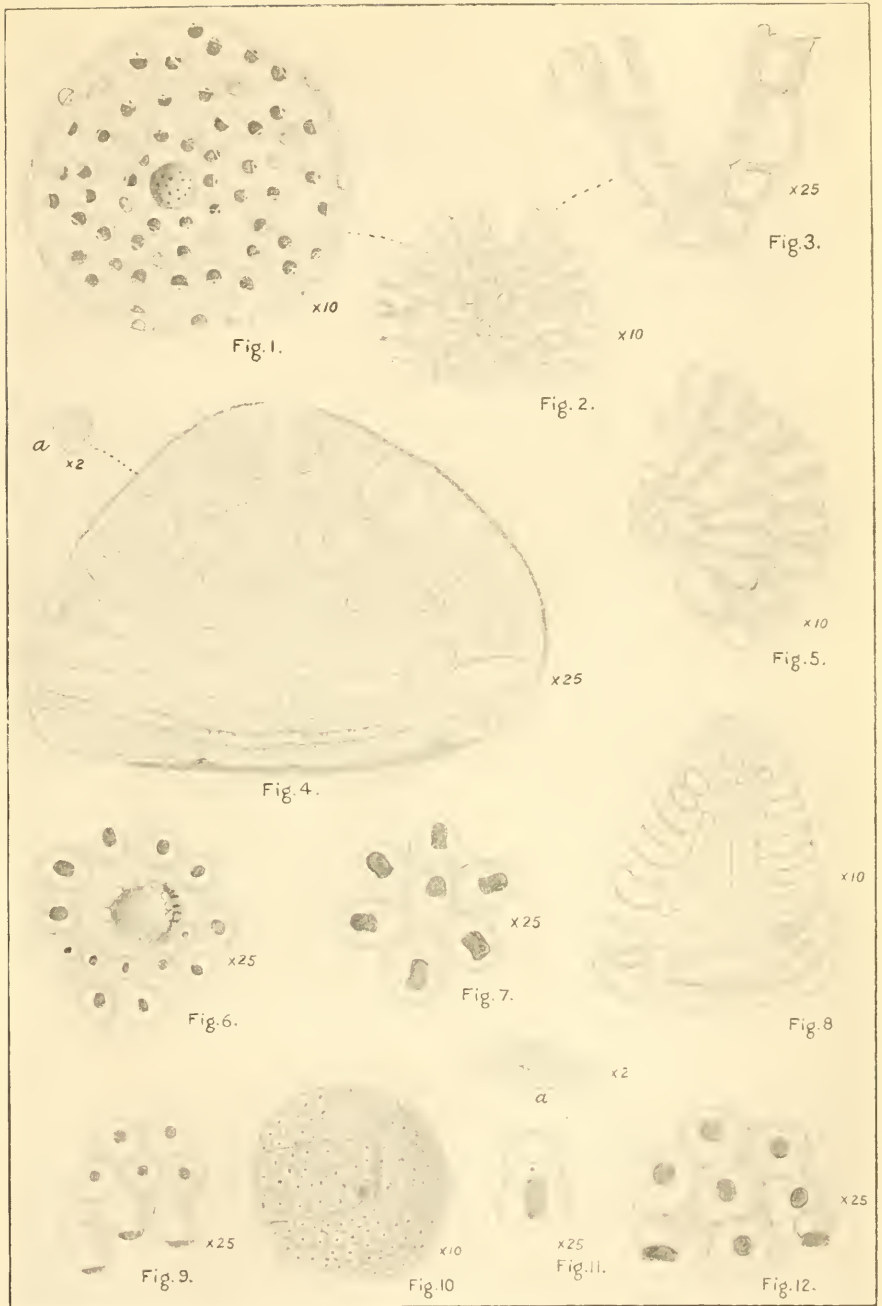






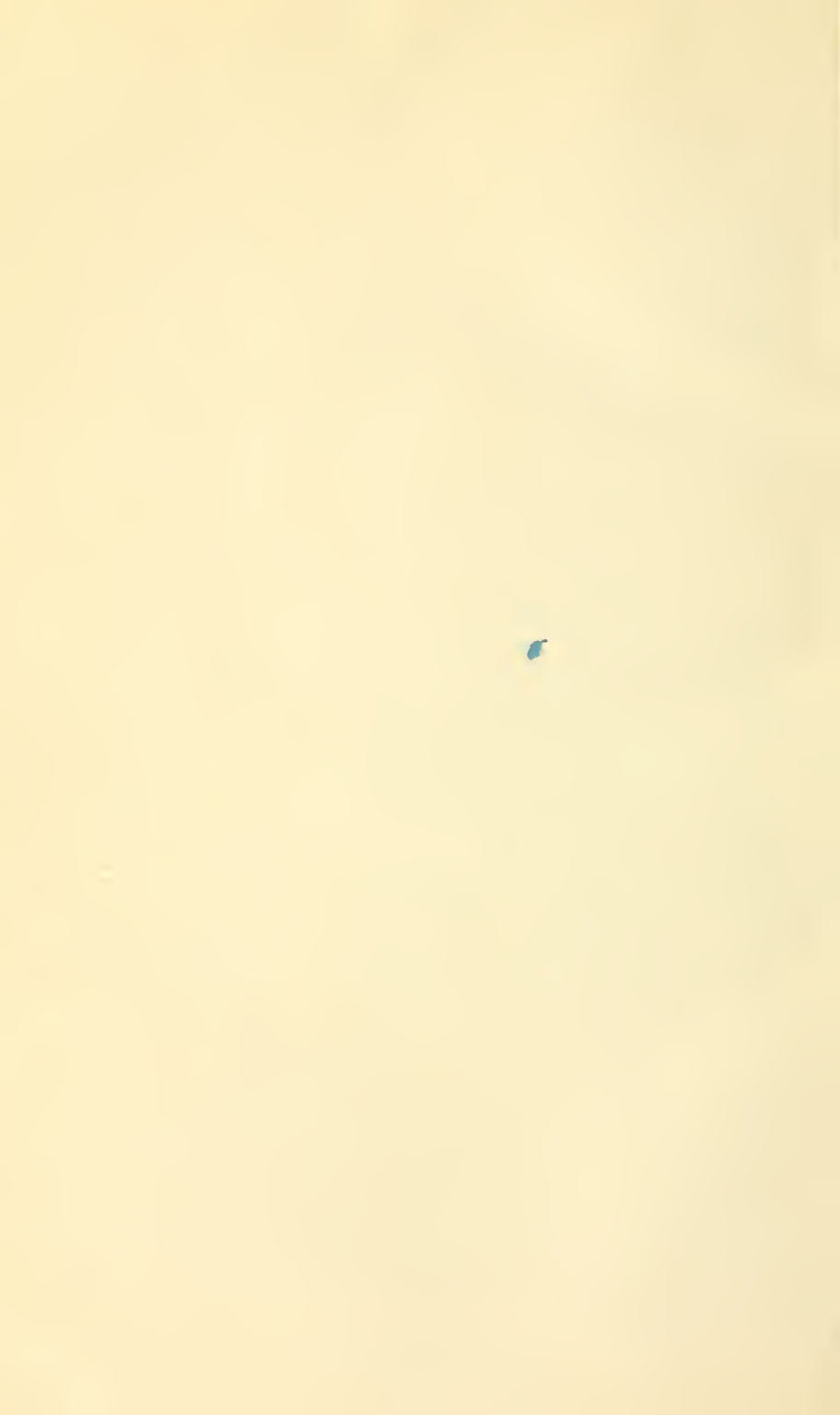






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CONTENTS OF NUMBER 13.—*Ninth Series.*

	Page
I. On the African Genera of Wingless <i>Brachyderinae</i> with Connate Claws (Coleoptera, <i>Curculionide</i> ). By GUY A. K. MARSHALL, D.Sc. (Plate I.).....	1
II. On <i>Lacerta praticola</i> , Eversm. By L. A. LANTZ and O. CYRÉN.	28
III. The White-toothed Shrew of Palestine. By OLDFIELD THOMAS.	32
IV. On the Structure of the Larvæ and the Systematic Position of the Genera <i>Mycetobia</i> , Mg., <i>Ditomyia</i> , Winn., and <i>Symmerus</i> , Walk. (Diptera Nematocera). By D. KEILIN, D.Sc. (from the Quick Laboratory, University of Cambridge). (Plates II.-V.) .....	33
V. Description of a new Genus and Species of the Homopterous Family <i>Cicadidæ</i> . By W. L. DISTANT .....	43
VI. Notes on the <i>Asilidæ</i> : Subdivision <i>Asilinae</i> . By GERTRUDE RICARDO .....	44
VII. <i>Batopora</i> (Bryozoa) and its Allies. By ARTHUR WM. WATERS, F.L.S., F.G.S. (Plate VI.) .....	79
VIII. Two new African Freshwater Sponges. By JANE STEPHENS, B.A., B.Sc., National Museum of Ireland .....	94
IX. On some External Characters of Ruminant Artiodactyla.—Part VII. Domesticated Cattle ( <i>Bos taurus</i> and <i>B. indicus</i> ). By R. I. POCCOCK, F.R.S. ....	101
X. On some small Mammals from Catamarca. By OLDFIELD THOMAS.....	115
XI. Descriptions and Records of Bees.—LXXXIII. By T. D. A. COCKERELL, University of Colorado.....	118
XII. Notes from the Gatty Marine Laboratory, St. Andrews.—No. XLII. By Prof. M'INTOSH, M.D., LL.D., D.Sc., F.R.S., &c. ..	125

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XIII.—*New and insufficiently-known Moths in the Joicey Collection.* By LOUIS B. PROUT, F.E.S.

IN the following descriptions it is to be assumed that all the types, paratypes, etc., enumerated are in the collection of J. J. Joicey, Esq., unless otherwise specified.

In working out the Noctuidæ, subfamily *Catocalinæ*, which form the great bulk of the paper, I am very largely indebted to my sister Miss A. E. Prout, who is at present arranging this family in Mr. Joicey's collection. Sir George F. Hampson has also kindly given his advice on some points.

Family Arctiidæ.

Subfamily LITHOSIINÆ.

1. *Chionæma gonypetes*, sp. n.

♂.—38–40 mm.

Head white, face narrowly red below, palpus and post-orbital rim red. Collar orange-red. Thorax white; patagia and tegulæ edged with red. Legs partly white (becoming yellowish on tarsi), partly orange-red. Abdomen orange, beneath white.

*Fore wing* with the lobes of underside formed about as in *conclusa*, Walk. (not quite so broad as in *axiologa*, Swinh., and *perornata*, Walk.), the proximal elongate, the distal circular, some rough orange-red hair-scales behind the proximal; above white, costal edge very narrowly red to

antemedian line; subbasal markings consisting of a small triangular red mark on costa, a black dot in cell, and an oblique, red, black-mixed dash behind  $SM^2$ ; lines red; antemedian rather thick, straight, from before one-third costa (where it is proximally edged by a few black scales) to beyond one-third hind margin; postmedian arising on costa about midway between subbasal mark and apex, strongly oblique outwards to  $M^1$ , here sharply bent, then straight to hind margin near tornus; a large anterior and a minute posterior black cell-dot; a red costal mark shortly beyond the postmedian line, connected with it by a faint reddish mark (really the reddened tips of the costal fringe); terminal line orange, thickening at apex.

*Hind wing* red-orange or orange-red, above with costal margin pale.

Fore wing beneath indefinitely mottled with ochreous and orange, posteriorly whitish; base of costa and lobes redder; costal edge whitish in front of the lobes; antemedian and postmedian lines present, but indistinct.

Mindanao, Philippines (*J. J. Mounsey*), 2 ♂♂. Probably near *axiologa*, Swinh.; may be placed as No. 648c in the subfamily.

### 2. *Chionæma brunneistriga*, sp. n.

♀.—19 mm.

Closely similar to *rubristriga*, Holl., the red markings light ochreous-brown.

*Fore wing* with antemedian line strongly bisinuate; postmedian rather thick, rather strongly angulated outwards in middle; three black-brown subapical spots, the middle one (between  $R^1$  and  $R^2$ ) well developed, the anterior and posterior ones minute.

Fort Crampel, French Congo.

Possibly a form of *rubristriga*, Holl., as the colour is known to be somewhat variable, and specimens of apparently that species from Sierra Leone and Gold Coast in coll. British Museum show faint traces of a brownish subterminal spot between  $R^1$  and  $R^2$ , but the antemedian line seems too different, and the Cameroon series in coll. Joicey shows no transition towards the new form.

### 3. *Chionæma additicia*, sp. n.

♀.—22 mm.

Closely similar to *basisticta*, Hmps., slightly broader-winged. Head white.

*Fore wing* with the markings yellowish ochraceous



costally, becoming redder posteriorly; an additional black dot, placed on DC<sup>4</sup>; terminal line broken into dots except towards apex.

Pujehun (Pujeon), Sierra Leone.

Family Noctuidæ.

Subfamily CATOCALINÆ.

4. *Acanthodica albiplena*, sp. n.

♂.—46 mm.

Head and body coloured as in the lighter examples of *splendens*, Druce.

*Fore wing* reddish brown mixed with grey and with purplish brown, slightly lighter than in *splendens*; the fine, black, green-edged lines as in that species; white subbasal and inner-marginal spots larger; reniform stigma almost wholly white, broad posteriorly; the spot behind it also whiter than in *splendens*, larger and less round, anteriorly almost reaching M just proximal to the hinder angle of cell; proximally to these, two much smaller round white spots, the anterior (indicated, though minuter and less conspicuous, in *splendens*) placed in the cell near its end, the posterior (larger and slightly more proximal) in the angle of M with M<sup>2</sup>; white inner median area clearer than in *splendens*, its anterior extension prolonged, almost confluent with the reniform; terminal area as in *splendens*.

*Hind wing* almost entirely glossy white, only with the hair-scales and fringe of abdominal margin light brown, and with a row of dark vein-dots slightly nearer the termen than those of *splendens*; a blackish terminal line, thickening at apex and becoming obsolete just behind M<sup>2</sup>, reappearing as a slight spot at end of SM<sup>2</sup>; fringe light brown, between M<sup>2</sup> and SM<sup>2</sup> and between SM<sup>2</sup> and tornus white.

Fore wing beneath similar to that of *splendens*, but lighter. Hind wing beneath predominantly white; costal area moderately irrorated with brown, with a broad dark mark from anterior extremity of DC to costa, the postmedian dots commencing at an oblique, somewhat curved dark costal streak, a small dark dash on middle of submedian fold, the terminal dark band (usually well developed in *splendens*) almost entirely obsolete except at apex.

Minea, Colombia, 2000 feet (*H. H. Smith*).

5. *Acanthodica sinuilinea*, sp. n.

♂.—46-49 mm.

Head and body coloured as in the lighter examples of

*splendens*, the contrast of colour between patagia and tegulae rather sharper.

*Fore wing* coloured and marked nearly as in *splendens*, but easily distinguished as follows: subbasal white mark more strongly developed, with more conspicuous M-shaped distal edge; reniform stigma (on an average more mixed with white) more strongly constricted in middle, 8-shaped or spectacle-shaped (the deeper indentation being in proximal side); postmedian line *incurved between R<sup>2</sup> and M<sup>1</sup>*.

*Hind wing* whiter than in *splendens*, the dark borders similar, but on an average appreciably narrower, often almost obsolete in posterior part.

*Underside* nearly as in *splendens*, the dark border of the hind wing tending to obsolescence posteriorly.

Yahuarmayo, S. Peru, 1200 feet, May–July, 1912 (*Watkins*), type; others from the same locality, from La Union, Rio Huacamayo, Carabaya, S.E. Peru (*Ockenden*), and from Rio Ampiyacu, Putumayo, Peruvian Amazons.

A ♀ from Contamana, Rio Ucayali, Peru, Nov.–Dec., 1912, which—on account of the curved postmedian line—probably belongs here, has almost the whole fore wings whitened from base to the reniform and the pale patch behind it, only an irregular costal border of about 2 mm. width (encroached upon at the subbasal white mark) and a spot on hind margin proximal to the antemedian line remaining normally coloured; hind wing with the dark borders broad, as in *splendens*, of which the ♀ is also unknown. As the three white central spots—the reniform and the spots placed proximally and posteriorly thereto (which are all discernible through their purer white outlines on the whitish area)—are all enlarged, this is possibly a species distinct from both those named.

#### 6. *Acanthodica caelebs*, sp. n.

♀.—44–46 mm.

Head and body coloured nearly as in *xylinoides*, Sehaus, the dark brown admixture rather stronger, especially on vertex, which in *xylinoides* generally remains clear ochreous-brown; “patagia” edged with bluish- or greenish-white proximally.

*Fore wing* ochreous brown suffused with red-brown, least heavily in costal region; a black longitudinal line running from near base to termen, in cell and between R<sup>1</sup> and R<sup>2</sup>; markings otherwise nearly as in *xylinoides*, but with the dark marks in anterior part quite small and weak and with

a conspicuous grey-white patch behind cell near base, as in *fosteri*, Hmps. n.

*Hind wing* with termen fuller in middle than in *xylinoides* (shaped more as in *fosteri*), the apex consequently less pointed; coloration nearly as in the darkest *xylinoides*, but slightly more clouded still, at least in apical and distal region.

*Underside* much as in heavily-marked *xylinoides*, but with the longitudinal line of upperside developed in distal half.

Minca, Colombia, 2000 feet (*H. H. Smith*), type and another ♀.

Perhaps the ♀ to *xylinoides*, which occurred with it in the same locality—which, however, is undoubtedly very rich in Noctuidæ. Unfortunately, ♀ ♀ of many of the species are still unknown.

7. *Agonista endochrysa*, sp. n.

♂.—96–98 mm.

Head and thorax above velvety black-brown; pectus chocolate-brown, posteriorly mixed with ochreous; hind coxa, femur, and tibia predominantly ochreous; abdomen golden yellow, dorsal surface anteriorly black-brown, narrowing off to a point about the fifth segment.

*Fore wing* velvety black-brown; fringe golden yellow, becoming black-brown behind SM<sup>2</sup>.

*Hind wing* velvety black-brown, somewhat lighter apically; abdominal margin golden yellow; fringe golden yellow from tornus to before M<sup>2</sup>.

Fore wing beneath dull chocolate-brown, rather darker basally; a small indistinct dark spot at end of cell; a row of minute yellow subterminal dots between the veins (smaller than those of *plateni*); fringe yellow. Hind wing beneath slightly darker, the abdominal region yellow about to M<sup>1</sup>, more or less heavily irrorated with dark brown at the junction of the two colours.

N. Borneo, the type from Sandakan (*A. L. Cook*).

Possibly the Borneo race of *endoleuca*, Guen. Has been misidentified as *plateni*, Pag. (compare Hmps. n., Cat. Lep. Phal. xii. p. 268). The true *plateni*, from Palawan, is very different and should form a separate section of the genus, with normally shaped ♂ hind wing (not elongate to tornus; termen convex); the absence of yellow on the abdomen, presence of a golden-yellow terminal band on hind wing from tornus to R<sup>2</sup>, narrower yellow abdominal margin above, more extended yellow abdominal region of hind wing beneath, and pale yellow tornus of fore wing beneath, further distinguish the Palawan species.

8. *Nyctipao hieroglyphica tenebrata*, subsp. n.

♂.—Differs from *N. hieroglyphica* in the complete absence of the pale postmedian markings on both surfaces of the fore wing.

♀.—Pale markings much reduced, especially on the underside; subapical streak of fore wing very narrow.

N. Borneo, type ♂ and allotype ♀ (Sandakan).

Misidentified by Hampson as *purpurata*, Druce, but differing in the venation of the fore wing (see Hampson's excellent classification in *Cat. Lep. Phal.* xii. p. 273 seq.) and slightly in the hind wing.

9. *Nyctipao albicrustata*, sp. n.

♀.—100 mm.

Head and body brown, the upperside of thorax strongly, of abdomen less strongly, darkened. Fore and middle legs predominantly deep brown.

*Fore wing* with the colours and pattern arranged as in ♂ *leucotania*, Guen. (*Hmps.*, *Cat. Lep. Phal.* xii. t. c. vii. f. 7), but less tinged with ochreous or reddish; proximal area more uniformly dark, the antemedian line (often distinct in *leucotania*) consequently almost entirely obsolete; white band outside median line broad from SC to beyond R<sup>2</sup> (5 mm. in cellule 7); subterminal white spots anteriorly placed further from termen, the series consequently forming a less acutely angulated line; the subcostal one considerably more elongate (anteriorly 8 mm.), the second also elongate (circ. 4 mm.), the rest moderate, wedge-shaped or triangular, posteriorly ill-defined.

*Hind wing* with white subapical spot longitudinal, not oblique; subterminal otherwise obsolescent, almost parallel with postmedian throughout.

Fore wing beneath with the white submarginal spots greatly enlarged, as compared with those of *leucotania*, the first (as above) 8 mm., the second and third larger than above, connected with an ill-defined pale shade proximally, those in cellules 5, 4, and 3 very large (9–10 mm.), the former two proximally reaching the median line. Hind wing beneath with the first white subterminal spot as above, the second moderate, the rest present but indistinct, forming a nearly straight line, in sharp contradistinction to the highly-angled one of *leucotania*.

Key Islands, Jan.—March 1916 (*W. J. C. Frost*).

Belongs to the same structure group as *leucotania*, which also inhabits the Key Islands, but abundantly distinct.

10. *Enmonodia villicosta*, sp. n.

♂.—86 mm.

Closely akin to *pudens*, Walk., of which it might be regarded as a local race. Coloration the same. Hair of hind tarsus only clothing the first joint (one hind leg only sound); that of pectus and femora brighter scarlet (in *pudens* more orange-ochreous, mixed or tinged with scarlet).

*Fore wing* with the variable dark spot near base of  $M^1$  in both the known examples small, its longitudinal measurement exceeding the transverse.

*Hind wing* with the almost straight median line showing behind  $R^1$  a very slight tendency to curve inwards, not (as in *pudens*) outwards; the postmedian dots rather nearer to and more nearly parallel with the median than is usual in *pudens*; a rather distinct narrow dark border, as in *feniseca*, Guen., and *lactipex*, Hmps. n.; *beneath with the long woolly hair occupying also the costal region*.

Mindanao, Philippines (*Mounsey*), type and another.

As the androconial hairs of the hind wing are evidently liable to abrasion, it is just possible that bred specimens of *pudens* would show them also in the mid-costal region; but many specimens have been examined (as also by Hampson) without revealing an indication of this.

11. *Speiredonia remota capitulifera*, subsp. n.

♂.—Differs from *remota remota*, Feld. (S. Moluccas to Aru) in having the median area of the *fore wing* darker, more uniform (in *r. remota* distally fading out to nearly the ground-colour), the head of the comma-shaped mark reduced in size (about  $3 \times 1.5$  mm.), entirely filled in with black.

*Hind wing* with central part blacker than in *remota remota*.

Bankala, Celebes (*J. C. van Hasselt*).

A ♀ ("Celebes ex Marsden"), possibly representing a different race, is smaller (56 mm.), the *fore wing* with the discoidal mark not reduced, the median line interrupted by it, the postmedian approximated to it (thus occupying about the position of the median of *remota remota*), the subterminal less deeply dentate, the hind wing with the whitish subterminal line much more distally placed.

## GENUS LAGOPTERA, GUEN.

Guenée's note (Spec. Gén. Léop. vii. p. 223) on the short third joint of the male palpus holds in all the species

represented in the Joicey collection, and presumably throughout the genus. Snellen's challenge of it (Tijd. v. Ent. xxviii. p. 11) was due to his erroneous composition of the genus, and it is curious that Hampson, who has purified it, has not noticed the palpal structure in more detail.

12. *Lagoptera rubida velutina* (Warr., MS. ?), subsp. n.

♀.—Differs from *rubida rubida*, Walk., as follows: Pectus much darker, strongly mixed with dark grey-brown.

*Fore wing* with posterior spot of reniform stigma (not mentioned in Hampson's description) much larger, nearly confluent with anterior spot, pale with dark centre; anterior part of postmedian line more sharply defined; pale distal border of more uniform width nearly to tornus, then obliquely cut off, the ground-colour running to tornus.

*Hind wing* with the blue-white band at least twice as broad (5 mm.), narrowing gradually at its extremities.

*Underside* rather more smoky than in *r. rubida*.

Arfak Mountains, Dutch New Guinea (*Pratt*), type and another, the type from Angi Lakes, 6000 feet, March 1914; the type labelled by Talbot "*Lagoptera rubida velutina* Warr.," which must be an unpublished name.

Perhaps a separate species.

13. *Lagoptera ochrobrunnea*, Strand.

*Lagoptera inversa* ab. *ochrobrunnea*, Strand, Arch. Nat. lxxix. A, (8) p. 71 (1914) (=ab. 1, Hmps., Cat. Lep. Phal. xii. p. 419).

It was overlooked by Hampson that this is a perfectly distinct species, and the differentiation from true *inversa*, Walk. (= *bivirgata*, Snell.), though just sufficient to give validity to Strand's name, needs supplementing.

♂ ♀.—Size and nearly shape of *inversa*, distal margin of hind wing perhaps slightly more irregular. Head and thorax more tinged with ochreous, *pectus* and *underside of palpus* clear ochreous. Abdomen rather paler, beneath more mixed with ochreous.

*Fore wing* more ochreous-brown than in *inversa*; subbasal line obsolete, except for the feeblest traces costally; ante-median rather more proximally placed; median area ample (8-10 mm. wide), containing in addition to the reniform a black proximal dot representing the orbicular; distal area without pale line in front of  $R^1$ ; narrow pale terminal band rather broader and more variegated than in *inversa*.

*Hind wing* with the bluish-white band much narrower and shorter than in *inversa*; white patches on fringe more ochreous and more extended than in *inversa*.

*Underside*, excepting the apical and distal region of fore wing, rather paler than in *inversa*, on proximal part of hind wing more ochreous; tornal fringe of fore wing pale; fringe of hind wing as above.

Penang, type in coll. British Museum. N. Borneo, both sexes in coll. Joicey.

13 a. *Lagoptera ochrobrunnea nicanora*, subsp. n.

♂ ♀.—64–80 mm.

Pectus and legs strongly suffused with smoke-colour or blackish.

*Fore wing* more reddish than in the name-type, sometimes almost as in *L. inversa*; median area generally less broad than in *ochrobrunnea ochrobrunnea*, but with the postmedian line still running to hind margin, not (as in *inversa*) to subterminal line; distal area with dark vein-streaks stronger and more diffused; terminal area slightly broader, with the fine line at termen dentate, enclosing a whitish interneural dot in each tooth; pale parts of fringe more clouded with smoky scales.

*Hind wing* above blacker, with the thin white streak generally sharper.

*Underside* darker, especially on fore wing.

Dutch New Guinea: Wandammen Mtns., 3000–4000 feet, Nov. 1914 (*A. E. & F. Pratt*), type and another ♂; Arfak Mtns., 4000 feet, Feb.–March 1909 (*C. B. Pratt*), 1 ♂. Also from Sudest and Rossel Islands. Here belong further Hampson's Dutch New Guinea records of "*inversa*."

Labelled by Talbot "*Lagoptera inversa nicanora*, Warr.," which must be an unpublished name.

14. *Anua subdiversa*, sp. n.

♂.—64 mm.

Head and thorax red-brown; palpus black-brown, at base mixed with ochreous beneath; antennal shaft proximally white. Pectus and femora reddish ochreous; tibiae and tarsi predominantly blackish. Abdomen light ochreous brown, dorsally suffused with dark grey.

*Fore wing* red-brown, with scattered blackish irroration and with more or less strong dark leaden-grey suffusions, which leave freer the middle of the wing and a very ill-defined subterminal band; extreme costal edge ochreous proximally; antemedian line indistinct, dark, distally pale-edged, sinuous and strongly oblique outwards to submedian

fold, here angled, then oblique inwards to hind margin; orbicular represented by a small dot, as in the allies; reniform dark leaden-grey, with a few minute olive-whitish dots at its proximal posterior corner and two less minute dots (anterior and posterior) at its distal edge; postmedian line nearly as in *reducta*—bicurved anteriorly, but less bent in front of  $SM^2$  than in that species; subterminal nearly as in *reducta*, but better developed at costa, with a strong triangular black spot in cellule 6; subtornal olive-grey patch larger, tripartite (crossing  $SM^2$ ); a row of pale dots close to termen.

*Hind wing* with the rounded lobe strong; colour of *xylochroa*, but slightly more ochreous at costa and with stronger black clouding in distal part; a dark cell-dot discernible; termen and fringe as in *reducta*.

Fore wing beneath paler ochreous-grey proximally than in the allies, the costal margin more smoky, the dark reniform sharply expressed; dark distal border sharply expressed, 8–9 mm. in breadth, continued proximally, though less sharply expressed, behind M to near base. Hind wing beneath similar to that of *reducta*, but with cell-mark present and with the dark distal border obsolete posteriorly.

Gambia (*A. Moloney*).

The ♀, from Friapere Forest, Coomassie, is similar above, though smaller, the fore wing with more uniform slate-grey suffusions, the hind wing darker; both wings beneath darker, the distal border of hind wing broader, complete. The species probably represents *reducta* (from Madagascar) in W. Africa, but in the absence of material from the intervening region I have not regarded it as a subspecies. It may be added that the group *Stenopsis*, Mab. (=Sect. D. Hmps., Cap. Lep. Phal. xii. p. 451), embraces also *david*, Holl., and *despecta*, Holl., the hind wing being produced in the whole group; of *david* the ♂ in coll. British Museum was damaged, of *despecta* Hampson knew only the ♀; “a” and “b” in Hmps. (pp. 451, 456) will therefore have to be merged.

### 15. *Anua producta*, Holl.

This species is evidently somewhat variable, and it is very doubtful whether *xylochroa*, Druce, is anything more than a pale form of it, perhaps a Congo race. From Entebbe, Uganda, Mr. Joicey has a further form, or perhaps closely allied species, of a more reddish tone (particularly noticeable on the thorax and along posterior margin of fore wing), the



fore wing with less dark clouding, lines more sharply expressed, postmedian with the bends less deep, subterminal black markings in cellule 6 developed, terminal white dots obsolescent, underside paler proximally and especially between cell and the dark distal border. I provisionally name this *Anua producta rubescens*, subsp. n.

#### 16. *Anua david*, Holl.

Probably also a rather variable species, recognizable in the ♂ by the bright ochreous hind wing beneath, in the ♀ generally by the bright ochreous fringes of the hind wing.

In a puzzling form from the Congo, however, which in the absence of the ♂ I provisionally refer to *david*, though it may probably prove a separate species, the fringes are more whitish yellow (intermediate towards those of the white-fringed allies); further distinguished by having the antemedian line oblique inwards from one-fourth costa, right-angled at M, in *david* from nearer base (mainly vertical), the postmedian more deeply bicurved anteriorly and bluntly angled inwards at submedian fold. I name this form ♀ *ab. camptogramma*, ab. n. (? bon. sp.).

*A. hypoxantha*, Hmps. (Nov. Zool. xxv. p. 206), may well be an eastern race of *david*.

#### 17. *Anua violisparsa*, sp. n.

♂ ♀.—65–70 mm.

Face deep brown mixed with whitish, upper part with rufous; vertex bright rufous. Palpus black-brown, somewhat sprinkled (especially beneath) with whitish scales. Thorax above deep chocolate-brown, patagia and tegulae rufous; pectus and femora paler, more ochreous, the tufts of hair in the ♂ here bright orange-ochreous. Abdomen dark above, paler beneath.

*Fore wing* reddish chocolate irrorated with light violet scales, the irroration very sparse between postmedian and subterminal lines; antemedian line very indistinct, apparently less acutely angled behind M than in the allies; a minute blackish dot in cell; a faint grey discoidal spot about as in *reducta*; postmedian indistinct, slightly violet-edged proximally, shaped nearly as in *reducta* or rather more irregular; subterminal line fine, black, interrupted, irregularly dentate, rather deeply incurved in middle, generally swelling in cellule 6 into a more or less conspicuous black spot; a less interrupted pale green line edging the subterminal distally, except at costal and posterior margins;

a strong though not sharply defined band of light violet irroration in distal area, approximately parallel to the sub-terminal; terminal line reddish, inconspicuous, deeply crenulate, with a white dot at proximal extremity of each tooth.

*Hind wing* dark grey-brown, with a very narrow mid-terminal area of violet irroration; a crenulate dark terminal line, in the distal interspaces of which the shading is pale violet or whitish, fringe with slight pale irroration but nowhere distinctly white.

Fore wing beneath dull grey-brown, the base, costal edge, and broad distal margin darker. Hind wing beneath palest at the base, in the ♂ with the rest of the costal and a very broad apical region darkened, in the ♀ with more than the distal half of wings darkened, the two shades in neither sex sharply defined.

Bitje, Ja River, Cameroons, 2000 feet, wet season (*G. L. Bates*), type ♂ (April-March 1912) and 3 ♀ ♀ (Oct.-Nov. 1913, and undated). Also a ♀ from Entebbe, Uganda. Belongs to the group *Stenopsis*.

#### 18. *Ercheia kebea borneensis*, subsp. n.

♀.—46-49 mm.

Thorax and *fore wing* (especially distal part) paler and more ochreous than in *kebea kebea* from New Guinea; tufts at end of "patagia" still brighter ochreous.

*Hind wing* less blackish than in *kebea kebea*, with some ochreous-brown admixture.

*Underside* much paler than in *k. kebea*, median band of hind wing twice indented behind middle.

Bidi, Sarawak, 1907-08 (*C. J. Brooks*), 2 ♀ ♀.

Perhaps the discovery of the ♂ will show this to be a separate species. The lobe on hind margin of fore wing is possibly less developed than in true *kebea*. Neither specimen shows any trace of the longitudinal line given by Hampson (*Cat. Lep. Phal.* xii. p. 483) as characteristic of the ♀, but this is only aberrational in the sex.

#### 19. *Ercheia amarna*, sp. n.

♀.—50 mm.

Head and thorax whitish grey, mixed with dark brown; palpus ochreous-brown, mixed with dark brown; patagia and tegulae red-brown, mixed with white at edges. Metathorax and abdomen above darkened; underside of body

and legs mostly light ochreous-brown; hair of fore tibia partly white. Hind tibial spines concealed (wanting?).

*Fore wing* with hind margin lobed and excised nearly as in *kebea*, termen evenly curved, feebly subcrenulate, thus transitional between Hampson's two sections (Cat. Lep. Phal. xii. pp. 483, 484); very variegated; costal edge narrowly blackish, irregularly dotted with ochreous; costal area from base to postmedian line and a narrow area between postmedian and subterminal lines predominantly of a warm brown; a broad central streak from base nearly to postmedian and the terminal area predominantly vinaceous; posterior region proximally darker, mottled (red-brown, purplish, and blackish), marked with a few green scales near hind margin; a large greenish (distally paler and yellower) blotch on hind margin proximally to the postmedian line, connected with a curved green line which anteriorly reaches  $M^2$  at its extremities; antemedian line obsolete; a minute dark dot in cell representing the orbicular; a longitudinal thick dark line from this to the postmedian, crossing the reniform, which is indefinitely outlined in green with a whitish dot at its anterior and a minuter one at its posterior distal extremity; postmedian line black, irregularly edged with greenish proximally, mostly very fine, at its extremities dentate, between  $R^1$  and  $M^2$  strongly excurved; a large but ill-defined dark semicircular costal patch (shaded with blackish brown and purple) between the postmedian and subterminal; subterminal whitish, mixed with some green, blue, and yellowish scales, very fine and ill-defined anteriorly, fine and dentate between  $R^1$  and submedian fold, then thicker, straighter, and whiter to hind margin close to termen; some irregular dark dots and dashes close to termen, obsolete anteriorly; fringe olive-brown.

*Hind wing* blackish fuscous, at costal margin pale and glossy; a narrow postmedian pale band indicated between  $R^2$  and  $SM^2$ , but not sharply defined; fringes ochreous, slightly darker proximally and with a small fuscous spot opposite  $R^3$ .

Both wings beneath fuscous, strongly mixed in proximal half with bright ochreous; a slightly elongate dark cell-spot (best marked on hind wing); a narrow pale postmedian band, sharply edged proximally with dark fuscous; fringes and part of termen light ochreous, the fringe with dark admixture; distinct dark interneural dots close to termen.

Arfak Mtns., Dutch New Guinea, 6000 feet, March 1910 (C. B. & F. B. Pratt).

20. *Ercheia latistria*, sp. n.

♀.—55 mm.

Head and body coloured as in sharply marked *dubia*, the white segmental lines of abdomen rather strong. Wings shaped as in *dubia*, or with the termen slightly more crenulate.

*Fore wing* with the coloration and essential markings of *dubia* and *cyllaria*; probably equally variable; in the unique type the prominent dark markings are the "semi-circular" costal patch between submedian line and apex, the costal end of antemedian and median lines, and a thick black longitudinal streak behind cell and proximal part of  $M^2$  from base nearly to postmedian line, here crossing  $M^2$  and continuing in cellule 2 to termen; postmedian line moderately distinct; subterminal line weak; broad but ill-defined terminal clouding between  $R^2$  and tornus.

*Hind wing* blackish fuscous, with clean white markings, similar to those of *quadriplaga*, Walk., but broader.

*Underside* as in the most sharply marked forms of *dubia*, the basal part of both wings being predominantly white; cell-spot of hind wing smaller than in most *dubia*.

Gilolo, 1904.

Perhaps a local race of *dubia*, in which case *quadriplaga* and *cyllaria* may also belong to the same protean species.

21. *Achæa cyanobathra*, sp. n.

♂.—47 mm.

Head and body dark brown, the abdomen darker dorsally; pectus and hair of femora and tibiæ partly more ochreous; bases and tips of spines and narrow rings at ends of tarsal joints also pale.

*Fore wing* dark brown with very strong purple gloss (in the proximal area somewhat darker and much bluer, in the narrow terminal area wanting); a faint curved pale subbasal line from costa to  $SM^2$ ; antemedian line 6 mm. from base at both margins, almost straight, slightly waved, little paler than the ground-colour; a weak dark spot representing the orbicular stigma; reniform nearly as in *intercisa*, Walk., but less conspicuous on the darker ground; postmedian line feeble, apparently formed as in *leucopera*, Druce, the veins beyond it with slight pale dashes; a dark double subterminal line slightly nearer the termen than in *leucopera* and wanting the apical ornamentation of that species; a crenulate dark terminal line; fringe with slender pale line at base and a less sharply defined one in middle.

*Hind wing* blackish brown, with golden-yellow apical patch formed about as the white patch of *leucopera*.

Fore wing beneath dark brown, somewhat varied with paler brown proximally; reniform large, dark, immediately followed by an ill-defined oblique ochreous band which ends in a rather large tornal patch; a slightly curved dark postmedian line, crossing the ochreous band but not reaching hind margin; a few minute ochreous costal dots between postmedian and subterminal; subterminal distinct from costa to  $R^2$ , slightly bent outwards at  $SC^5$ ; terminal area pale from costa to  $R^2$ . Hind wing beneath dark brown with darker discoidal spot, curved median line, thick but ill-defined postmedian line (placed rather further from the median than in *leucopera*, at least posteriorly), and light ochreous-brown apical patch corresponding to the yellow patch of upperside, but containing dark brown irroration and crenulate terminal line thickened into dots on the folds.

Bitje, Ja River, Cameroons, 2000 feet, April–May 1912, wet season (*G. L. Bates*).

May be placed next to *intercisa*, Walk., but probably really much nearer *leucopera*, in spite of the considerable superficial differences.

## 22. *Achaea jamesoni*, sp. n.

♀.—64 mm.

Head and body light brown, mixed (especially abdomen) with grey.

*Fore wing* rather light brown, from base nearly to postmedian line with violaceous reflections; antemedian dark line indistinct, from scarcely beyond one-fourth costa, somewhat oblique outwards to cell, then less oblique, slightly sinuate to hind margin at about 8 mm. from base; reniform chiefly indicated by dark spots at its anterior and posterior extremity; median shade almost obsolete, excurved beyond cell; a white costal patch near apex, clouded, except at its edges, with light tawny brown, relatively larger and narrower than that of *mabillii*, Saalm., its distal edge markedly indented at  $SC^5$ ; postmedian line crenulate, arising from posterior margin of costal patch, more nearly parallel with termen than in *mabillii*, slightly bordered with whitish and ferruginous scales distally, a rather larger, ferruginous, white-edged spot developing at fold; no subterminal line; termen very narrowly shaded with pale violaceous except at extremities; faint traces of dark terminal line.

*Hind wing* grey-brown, darkest in distal part, especially

anteriorly; a small white apical patch, terminating at SC<sup>2</sup>, where it attains a measurement of 3 mm.

Fore wing beneath coloured much as in *mabillii*, subapical patch much more irrorated (in the paratype obsolescent), postmedian line from R<sup>1</sup> onwards almost parallel with termen, a dentate whitish subterminal indicated from costa to R<sup>1</sup>, 3-4 mm. from termen, a conical white blotch from tornus obliquely to M<sup>2</sup>. Hind wing beneath with weak dark cell-spot and curved median and postmedian lines and with traces of a dentate whitish subterminal.

Congo, Inkissi (Nkissi) River, Nkalama Falls, 18 April, 1887 (*Jameson*), ex coll. Druce, wrongly identified by Druce (*Jameson's 'Story of the Rear Column,'* p. 450) as *illustrata*, Walk. A damaged ♂ from Fantee, Gold Coast, also mentioned by Druce, likewise belongs here. The date of the type-specimen, correctly given as 18 April on the label, and confirmed from *Jameson's* itinerary (p. 24), is misquoted "18 August" on p. 450.

Allied to *mabillii*, but very distinct in the differently shaped non-latticed subapical patch, much straighter postmedian line, lack of white basal dot, etc.

### 23. *Achæa ministra*, sp. n.

♂ ♀.—69-78 mm.

Near *serva*, Fabr., with which it has hitherto been confounded. Palpus of ♂ with third joint much longer, over one-half as long as second.

*Fore wing* with the markings and general coloration of the darker forms of *serva*, the blue-purple reflections and black-brown terminal clouding almost always strong; fringe from near apex to M<sup>2</sup> pale buff, thus lighter (generally very much lighter) than in *serva*.

*Hind wing* with the interrupted oblique blue-white median band narrower than in *serva*, apical white spot generally smaller.

*Underside* darker than in *serva*, the whitish postcellular patch of fore wing smaller.

Dutch New Guinea: Wandammen Mtns., 3000-4000 feet, November 1914 (*A. E. & F. Pratt*), type and another ♂ and allotype ♀; Arfak Mtns. (*Pratt*); Upper Setekwa and near Octakwa River (*Meek*). Key Islands, Dec. 1915-March 1916 (*W. J. C. Frost*).

Most of *Hampson's serva* ab. 1 (*purpurascens*, Strand, Arch. Nat. lxxix. A, (8) p. 73) belong to this species, but one or two, including the type-specimen, are dark aberrations of *serva*.

Rather variable, some forms superficially recalling *eusciata*, Hampsn., but with the first joint of mid-tarsus not fringed above. In the type-form there are strong bright ferruginous shades proximally to the antemedian line between cell and hind margin, and again near tornus, but these vary much in intensity and are sometimes entirely obsolete.

In Hampson's figure of the palpus of "*serva*" (Cat. Lep. Phal. xii. p. 521, fig. 123), the third joint is shown about twice as long as it appears in the fully-clothed palpus of true *serva*, but not quite as long as in the allies. As the figure of the entire insect does not belong here (see *infra*), it is not improbable that the anatomical details were also drawn from one of the allies; but, in any case, the importance of absolute precision in dealing with the palpi of this group was evidently underestimated.

24. *Achæa pentasema*, sp. n. (præc. subsp. ?).

♂ ♀.—72-82 mm.

Likewise similar to *serva*, but with the ♂ palpus of the preceding species.

*Fore wing* ochreous to red-brown, the purple gloss weak or wanting; markings as in *serva* and *ministra*, the dark cloudings of terminal area rarely very strong; reniform stigma commonly (as in some *serva*) obsolete, except for the anterior and posterior black dots; postmedian line in the type shaped as in *serva*, in other examples less sharply bent at R<sup>1</sup>; fringe pale, but rarely as pale as in *ministra*.

*Hind wing* with all five spots sharply expressed, the terminal one near tornus broader and much better defined than in either of the allies (also better defined beneath).

*Underside* nearly as in the lighter and more variegated forms of *serva*, the blackish distal suffusion between postmedian line and tornus of fore wing always strong.

New Caledonia (*Layard*), type ♂. Also "Ueva, New Caledonia" (? Ueva), 1 ♂, Laucala, Fiji, 1 ♀, Suva, Viti Levu, 2 ♀ ♀, all in coll. Joicey. Lifu and Friendly Islands in coll. Brit. Mus.

Figured by Hampson, Cat. Lep. Phal. xii. p. 521, fig. 123, as *serva*.

25. *Achæa dmoë*, sp. n.

♂ ♀.—56-60 mm.

Head, thorax, and base of abdomen yellowish brown, sometimes with a rufous tinge; abdomen otherwise strongly

mixed with dark grey, the anal tuft pale; pectus and venter pale grey.

*Fore wing* moderately broad, costa curved towards the apex, which is minutely falcate, termen otherwise more convex than in *mercatoria*, Fabr.; light yellow-brown or red-brown, with strong vinaceous reflections—at least, in median area; distal area and costal edge generally more yellow; a white dot close to base; lines grey or blackish; subbasal faint and interrupted, obsolete posteriorly; ante-median fine, oblique, slightly crenulate, especially in anterior part; median rather thick, almost *straight*, bent proximad in front of C, placed beyond middle of wing; postmedian fine, finely crenulate-dentate, slightly angled at  $R^1$ ; orbicular stigma represented by a black dot about 2 mm. from ante-median line, reniform by an anterior and a posterior black dot, 2 or 3 mm. inside median shade, with a weaker dot more proximally placed between them; a small pale violet-grey or somewhat vinaceous apical patch; a row of minute paired interneural dots (proximally black, distally white) close to termen.

*Hind wing* dusky greyish-ochreous, becoming almost black distally between costa and  $M^2$  and with more irregular blackish admixture near tornus; a small whitish apical spot; an ill-defined light ochreous-brown band beyond middle, from  $R^1$  or  $R^2$  towards tornus, interrupted posteriorly; a light brown terminal patch towards tornus; fringe (with extreme termen) whitish from before  $R^1$  to behind  $R^3$ , otherwise brown.

Fore wing beneath light brown, violet-grey along costa and part of termen, somewhat clouded in cell and behind proximal half of  $M^2$ ; cell-spot large, crescentic, black, touching the faint median shade; postmedian black, forming a very slight regular curve; a large black blotch beyond this, mainly between  $R^2$  and  $M^2$ ; traces of a pale crenulate subterminal line; minute admarginal dots nearly as above, but with whitish shading proximally. Hind wing beneath pale grey, more brownish costally and apically than posteriorly; a sharp black cell-dot, which sometimes shows through on upperside; three (usually in part ill-defined) brown lines beyond, the second and third dentate, the latter ending in a dark spot close to tornus; admarginal dots nearly as on fore wing; fringe warm brown except about the radials, posteriorly in dark-marked specimens fuscous.

Central Madagascar, 2500 feet, Jan.—March 1911 (*F. B. Pratt*), 4 ♂♂, 2 ♀♀.

Differs from *mercatoria*, Fabr., in shape, in straight median



line of fore wing, less irregular postmedian and more ochreous hind wing, marked more as in *faber*, Holl. Rather variable in colour and especially in the strength of the markings; an aberration in which the antemedian lines are weak and the median shade strong and black may be named *ab. unilinea*, *ab. n.*

26. *Achæa cymatias*, sp. n.

♂.—77–80 mm.

Head, thorax, and abdomen ochreous-brown, above darker. Palpus with third joint rather short. Antenna almost simple; mid-tarsus without hair; first and second joints of hind tarsus fringed with hair above.

*Fore wing* warm brown (ochreous mixed with dark olivaceous brown), between antemedian and median lines much paler, strongly overlaid with violaceous, in distal area variegated; antemedian line fine, almost straight, from one-third costa to two-fifths hind margin, whitish-edged distally; reniform narrow, crescentic, darkest and thickest at its ends, placed midway between antemedian and median; median line gently excurved in anterior part, incurved in posterior; postmedian from two-thirds costa to four-fifths hind margin, strongly bicurved (outwards between  $R^1$  and  $M^1$ , inwards between  $M^1$  and hind margin), dark-shaded proximally and edged by a fine white or whitish line distally; distal area whitish violaceous near the postmedian line and in an ill-defined oblique shade from middle of subterminal to termen about fold, narrowly darkened at termen from this point to near apex, otherwise mostly olive-brownish; an oblique blackish shade from apex towards outer lobe of postmedian; faint traces of zigzag whitish subterminal line; a black dot at fold close to termen; terminal dark line ill-defined; fringe with a pale line at base and a second beyond middle.

*Hind wing* more fuscous; an indistinct slightly curved oblique pale median line; very faint indications of other pale lines or shades distally; a whitish apical spot; termen and fringe nearly as on fore wings, the fringe paler anteriorly than posteriorly. Both wings beneath grey-brown with crescentic cell-mark (on hind wing rounder), curved median and crenulate postmedian line and vague pale crenulate subterminal, accompanied proximally by a dark shade; terminal area paler, especially in distal half, which contains a row of small interneural black dots.

Bitje, Ja River, Cameroons, 2000 feet (*Bates*), 3 ♂♂, the

type taken in 1915, the other two labelled "dry season" but not dated.

Perhaps a race of *hypopolia*, Hmps. (Nov. Zool. xxv. p. 208), from British Central Africa. Fore wing with ante-median line more upright, postmedian more deeply bisinuate, and with violet shade in median area; hind wing with white apical spot.

### 27. *Achæa indistincta*, Walk.

This species, of which the type is in coll. Joicey, has been sunk by Hampson (Cat. Lep. Phal. xii. p. 538) to *ablunaris*, Guen. On account of the broader dark border of the hind wing (two-fifths of length of wing, against two-sevenths in *ablunaris*), combined with more angulated postmedian line on underside of both wings, it seems likely that it is really a separate species.

Costa Rica to Bogotá.

### 28. *Parallelia valga*, sp. n.

♀.—58 mm.

Head and body coloured as in *rigidistria*, Guen.; palpus with third joint considerably shorter than in the ♀ of that species, less than one-third as long as second joint.

*Fore wing* coloured as in the lighter forms of *rigidistria*; subbasal line as in that species; antemedian arising somewhat further from base, *strongly incurved* between SC and base of  $M^2$ , strongly oblique outwards to hind margin near median line; median line slightly interrupted outward near costa; postmedian line much less deeply crenulate than in *rigidistria*, with a single angle at  $R^1$ ; indications of a dark line from this angle to apex; subterminal further from termen, the dark shading beyond it rather weak; fringe light brown.

*Hind wing* with termen rather fuller near tornus than in *rigidistria*; less clouded with blackish; pale postmedian line wanting; tornal pale mark weak.

*Underside* rather paler than in most *rigidistria*; fore wing with the median line obsolete, postmedian extremely weak, arising further from termen than in *rigidistria*, apparently deeply incurved so as to reach postmedian angle of cell; hind wing with cell-dot replaced by a weak comma, median and postmedian lines approximated, especially posteriorly, the latter scarcely crenulate, subterminal chiefly shown by three or four weak yellowish spots in anterior part.

Khasia Hills (*Nissary*).

29. *Parallelia isotima*, sp. n.

♂ ♀.—29-36 mm.

Head and front of thorax yellowish brown; rest of thorax and abdomen brown-grey, the latter somewhat darkened dorsally. Fore leg (as in *humilis*, Holl.) somewhat darkened, the tarsal joints more markedly pale at the extremities than in that species.

*Fore wing* shaped and marked almost exactly as in *humilis*, more glossy, paler (especially at termen), olivaceous tinge rather more noticeable, postmedian line more decidedly incurved from R<sup>f</sup>, thus forming an acuter angle at that vein.

*Hind wing* slightly less dark than in *humilis*, narrowly slightly paler at termen in posterior half; beneath with more extended white or whitish shading in terminal area (wanting in *humilis*).

Bitje, Ja River, Cameroons, 2000 feet (*G. L. Bates*), 5 ♂ ♂, 4 ♀ ♀. Also one from the same source in coll. Brit. Mus.

Apart from the smaller size and the distinctions above noted, *isotima* differs in having the genitalia smaller, more symmetrical (the right arm in *humilis* truncated), the penis differently shaped, etc.

30. *Parallelia curvisecta* (Warr., MS. ?), sp. n.

♂ ♀.—50-54 mm.

Similar to *interpensa*, Guen. Whitish lines on patagia and tegulæ better developed.

*Fore wing* with basal area concolorous with proximal part of median; subbasal white half-line well developed; *ante-median line curved*, parallel or nearly parallel with median.

*Hind wing* paler beneath, especially in abdominal region.

Dutch New Guinea: Wandammen Mountains, 3000-4000 feet, November, 1914 (*A. C. & F. Pratt*), type ♂ and allotype ♀; Arfak Mountains.

Labelled by Talbot "*Parallelia curvisecta*, Warr.," which must be an unpublished name.

31. *Parallelia euryleuca*, sp. n.

♂.—70 mm.

Palpus with third joint short; head brown; thorax light brown; antennal shaft white proximally. Abdomen pale yellow-grey beneath, dark-mixed dorsally except at ends of segments; anal tuft strong, tinged with light brown.

*Fore wing* lighter brown than in the allies (*cramerii*, Moore, etc.), with a faint olivaceous tinge; some violet-grey

irroration near base and at termen; basal area 9 mm. at costa, 10 mm. at hind margin, the straight white line which bounds it consequently less oblique than in *crameri*; a broad white median band very slightly irrorated in its proximal half with brownish; in the middle almost 6 mm. in width, broadening slightly at hind margin and slightly more at costa, its distal boundary being very gently curved; postmedian line slender, white, oblique outwards from costa 10 mm. before apex, right-angled at  $R^1$ , then oblique inwards, scarcely appreciably incurved in posterior part; a slight pale line from angle of postmedian. to apex; distal area beyond these lines paler than the ground-colour; a slight dark dot on fold close to termen, with a weaker dark spot proximal to it between  $M^2$  and fold; terminal line slight and slender; a pale line at base of fringe.

*Hind wing* concolorous; median white band less sharply bounded, 5 mm. wide anteriorly, tapering posteriorly; terminal region marked as in *crameri*.

*Underside* yellow-grey, the fore wing paler and more glossy posteriorly; fore wing with proximal area very slightly dark-shaded, median line obsolescent, postmedian curved anteriorly, followed by some brown shading, which contains the pale subterminal line and an ill-defined blackish blotch between  $R^3$  and fold, a narrow distal shade of violet-grey; hind wing with faint angulated median, waved postmedian, and dentate pale subterminal, the latter placed on weak dark shading, space between median and postmedian lines more yellowish grey than the rest of the wing; both wings with the cell-dot of *crameri* obsolete.

Sandakan, N.E. Borneo (*Pryer*).

Larger and paler than *crameri*, with differently shaped markings and much more feebly marked underside.

### 32. *Parallelia adunca*, sp. n.

♀.—36 mm.

Head and thorax light brown; abdomen more greyish, underside paler. Palpus moderate, with third joint nearly half as long as second. Wings shaped and marked nearly as in *erectata*, Hmps., of which it may be a subspecies.

*Fore wing* light ochreous-brown with slight darker suffusions (especially in distal half of median area), but less reddish than in *erectata*; a slender waved subbasal dark line from costa to  $SM^2$ ; antemedian line blackish, thickened except at extremities, finely pale-edged distally, very slightly sinuous, more vertical than in *erectata*; cell-mark grey,

lunular; median line grey, sinuous, excurved beyond cell-mark, incurved at fold; postmedian line black, produced to an acute angle outwards at  $R^1$ , then somewhat crenulate, *bent inwards at submedian fold*; a narrow paler band beyond the postmedian, faintly bisected from  $R^1$  to hind margin; a large black subapical dot as in *erectata*; apical dark mark minute and not strong; terminal line fine, eremulate, grey, not very conspicuous except in a black dot at fold.

*Hind wing* similar to that of *erectata*, but more weakly marked.

*Underside* pale grey tinged with yellow-brown, very feebly marked; cell-dots obsolete; postmedian indicated, at costa slightly pale-edged distally; a crenulate pale subterminal line indicated on hind wing.

Cameroons (*Watkins*).

### 33. *Tolnaodes dasynota calocraspeda*, subsp. n.

♂ ♀.—*Fore wing* in general less reddish than in *dasynota* from Colombia, Venezuela, and French Guiana, with darker clouding in distal area; fringe *above*, as well as beneath, white between the folds of cellules 4 and 5 and again before (and sometimes also behind)  $M^2$ .

*Hing wing* dark, in general with the subterminal markings less prominent.

Peru and Ecuador; the type and another ♂ from Santo Domingo, S.E. Peru, 6000 feet, November 1904 (*G. Ocken-den*); ♀ ♀ from Rio Pastaza, E. Ecuador, 3500–4900 feet (*G. Palmer*), and Rio Tabaconas, N. Peru, 6000 feet (*A. E. & F. Pratt*).

## Subfamily *FREBINÆ* (*Noctuinae*, Hmps.).

### 34. *Melapera roastis*, Hmps.

This interesting species, a genotype, was described (*Ann. & Mag. Nat. Hist.* (8) i. p. 488) from a single ♀ from Forêt d'Ambre, Madagascar. A ♂ in the Joicey collection (Fort Carnot, Tananarivo dist.) is smaller, 52 mm., the fore wing yellow, suffused with pink, becoming pink basally and posteriorly and with shadowy pale pink markings, namely, a roundish spot in cell, another at base of  $R^2-M^1$ , a smaller one anterior to this, and a subterminal row of smaller inter-neural ones about 4 mm. from termen, that in cellule 6 slightly displaced distad; the hind wing with strong red hair in abdominal region.

The generic characters do not need amplification except

to add that the antenna is bipectinate to apex, the branches rather long, shortening suddenly at apical end, and that vein C of the hind wing does not anastomose with cell in the middle, but is connected with a bar as in the Aganaidæ, with which the genus seems to show some affinity.

Subfamily *HYBLÆINÆ*.

35. *Hyblæa joiceyi*, sp. n.

♂.—46 mm.

Head and palpi purple-fuscous, palpus beneath whitish proximally. Thorax chocolate-brown; beneath paler, variegated with whitish and yellowish anteriorly, with reddish posteriorly. Abdomen above fleshy greyish; beneath mostly red, with a dark central line. Fore leg with gold-yellow tuft on coxa, femur white, tibia above brown, tarsus blackish; middle and hind legs predominantly red.

*Fore wing* not very broad, costal margin not strongly arched (very slightly wavel), termen almost straight and rather oblique from apex to  $M^1$ , somewhat excised between  $M^1$  and tornus: chocolate-brown, slightly variegated in the shadings, almost throughout with irregularly scattered dots and small spots of greenish white; faint indications of an elongate dark apical streak.

*Hind wing* scarlet-vermilion, unmarked; abdominal margin with tufts of very long yellowish hair; fringe yellowish, from apex nearly to  $R^1$  proximally infuscated.

Fore wing beneath red-orange, becoming infuscated midway between cell and termen, darker at extreme margin; costal margin dotted with fuscous; hind margin pale; a rosy patch in submedian area; an elongate dark cell-mark. Hind wing beneath orange-red with coarse purple-fuscous speckling, which in distal area is condensed into an ill-defined cloud; between fold and abdominal margin clear red, as above.

Isle of Mioswar, Geelvink Bay, North Dutch New Guinea, September 1909 (*C. & F. Pratt*).

Near *ibidias*, Turn. (*Proc. Linn. Soc. New South Wales*, xxvii. p. 135), but larger, the wings slightly narrower; further distinguished by the pale-spotted fore wing and even brighter red, entirely unmarked hind wing.

36. *Hyblæa puera vitiensis*, subsp. n.

♂, 40 mm.; ♀, 36 mm.

Abdomen beneath wholly red.

*Fore wing* above with strong purple shades (but evidently variable, as in the other forms).

*Hind wing* above with the orange markings entirely bright red, at most with a few orange scales in middle of anterior margin of central band; beneath brighter red than in the other forms, scarcely irrorated and not clouded with purple-fuscous, not mixed with yellow between  $M^2$  and abdominal margin; basal area, on the other hand, gold-yellow.

Suva, Viti Levu (*Woodford*), type. New Hebrides.

### Family Geometridæ.

#### Subfamily STERRIINÆ.

#### 37. *Scopula hesycha*, sp. n.

♂.—27 mm.

Face black-brown. Vertex whitish, narrowly black-edged behind. Antennal joints scarcely projecting, ciliation scarcely longer than diameter of shaft. Collar ochreous. Thorax and abdomen concolorous with wings. Hind tarsus well under one-half the length of tibia. Wings shaped nearly as in *delitata*, Prout, the bend at  $R^3$  of hind wing slightly more noticeable.

*Fore wing* slightly more brownish than in *delitata*, the irroration being equally fine and close but slightly darker; markings as in *delitata*, but slightly less weak, the whitish subterminal line standing out rather more sharply, a little recalling that of *bifalsaria*, Prout; terminal dots even more minute than in *delitata*, only discernible in anterior part or wholly wanting; fringe not irrorated.

*Hind wing* with corresponding markings; terminal dots wanting.

*Fore wing* beneath with rather strong reddish-smoky suffusions in and beyond cell, leaving the posterior and distal areas pale, the costal edge narrowly ochreous; cell-dot present; median shade weak; postmedian line well developed; a fine terminal line. Hind wing beneath whiter; cell-dot minute, scarcely noticeable; postmedian line faint; terminal line obsolescent, except as interneural dots.

Chang Yang, Central China, June 1888 (*A. E. Pratt*), type in coll. Joicey; paratypes, June and July, in coll. Brit. Mus. Moupin, W. China, June 1890 (*Kricheldorf*), a rather larger, rather more brownish ♀, in coll. Joicey.

Nearest *delitata*, but with shorter hind tarsus and antennal ciliation.

#### 38. *Scopula scialophia*, sp. n.

♂.—22 mm.

Closely like the less variegated forms of *fibulata*, Guen.,

from Ceylon and S. India. Antennal ciliation slightly longer. Hind leg formed nearly as in *cleoraria*, Walk., and its form (?) *effrenata*, Walk. (both wrongly sunk by Hampson under *fibulata*), i. e., with the tarsus relatively much shorter than in *fibulata*, less than one-half as long as the tibia. A large tuft of rather glossy, distally darkened hair at base of abdomen beneath. Fore wing with the irroration rather less black than in *fibulata*, median shade not very diffuse, postmedian line rather less sharply angulated at R<sup>1</sup>, terminal line not continuous, not running round apex.

Khasia Hills, type (*Nissary*); paratype in coll. British Museum.

Smaller than *cleoraria* and *effrenata*, antennal joints less projecting, the tuft at base of abdomen distinctive.

#### Family *Ægeriidae*.

#### Subfamily *ÆGERIINÆ*.

#### 39. *Homogyna spadiceicorpus*, sp. n.

♂. — 25 mm.

Face black in middle, white at sides. Palpus with first joint black; second joint above and beneath mostly white, the fringes of hair on both sides black; third joint mostly white. Postorbital rim white. Vertex light ochreous-brown. Thorax above glossy black, with slight blue reflections and with a narrow band of light blue in front; a large red shoulder-spot, in certain lights shot with violet. Abdomen above bright chestnut (in some lights with slight violet reflections), the segments narrowly ringed with black anteriorly, with whitish posteriorly: underside as far as the third sternite black with blue reflections, fourth sternite white, fifth to seventh white with anterior black border; anal tuft above blue-black, beneath orange-ochreous. Legs black with blue gloss, the fore coxa, hair-tufts, spurs, and narrow rings at ends of tarsal joints predominantly white.

*Fore wing* black, in some lights brown-black, in some lights with bluish or greenish gloss, especially along the margins.

*Hind wing* vitreous, the veins, cell-mark, costal and distal margins, and fringes concolorous with fore wing.

Source of Karungu River, N.E. Rhodesia, December 1916 (*S. A. Barns*).

Nearest to *sanguicosta* and *albiciecta*, Hampson.



XIV.—*Descriptions and Records of Bees.*—LXXXIV.

By T. D. A. COCKERELL, University of Colorado.

THE Indian bees recorded below were received from Mr. T. V. Ramakrishna Ayyar, Government Entomologist of Madras, and were collected by him, except when the contrary is stated.

*Crocisa smithii*, Dalla Torre.

Coorg, Sidhapur, Rockhill, 3500 ft., April 23–26.

This was described from "Bombay, Sumatra, Borneo." Bombay is herewith designated as the type-locality.

*Crocisa ramosella*, sp. n.

♀.—Length 10.5 mm.

The hair-spots white, not at all tinged with blue. Superficially appearing identical with *C. ramosa*, Lep., from France, but differing thus: flagellum longer, the middle joints longer than wide; posterior spots on mesothorax much larger; scutellum much more finely punctured, and much more deeply excised posteriorly, its margin W-like; transverse bands at sides of first two abdominal segments broader. In the flagellum this resembles the Arabian *C. fallibilis*, Kohl, but the scape is not longer than in *ramosa*, and *fallibilis* has the scutellum as in *ramosa*.

Chittoor, April 19–27, 1915.

*Crocisa albolateralis*, sp. n.

♂.—Length 12 mm.

Robust, with pure white markings. Very close to *C. ramosella*, but larger, with a tuft of white hair on the scutellum at the emargination (in addition to the white hair projecting from beneath the emargination, which is present in both); inner sides of scutellar lobes shallowly but very distinctly emarginate about the middle; patch of white hair on pleura considerably larger; hind tibiæ with more white hair; transverse bands on first abdominal segment narrowing mesad, subacute, thus quite different from those on second, which are very obtuse, with the upper edge concave (in *ramosella* the bands are nearly the same on the two segments); second abdominal segment less closely punctured, and with the basal half greenish.

Kurnool District, Tippamur, Aug. 16, 1913.

*Crocisa reductula*, sp. n.

♀.—Length 11 mm.

With pure white markings. Also similar to *C. ramosella*, but more slender, and also differing thus: anterior mesothoracic spots a little broader than long (conspicuously longer than broad in *ramosella*); a very small spot instead of a stripe on each lateral margin of mesothorax; emargination of scutellum forming a much wider angle; first two abdominal segments with strong purple tints on basal half; transverse extension of marks at sides of first segment short and pointed; third and fourth segments with only spots placed some distance from the lateral margins, fifth with a pair of large round spots placed more laterally; last ventral segment conspicuously produced; white hair on outer side of hind tibiae confined to basal half.

Bababuddin Hills, Mysore, 4700 ft., June 1, 1915.

*Crocisa ramakrishnae*, sp. n.

♀.—Length about 12 mm.

With very pale blue markings, which are not shining. Median stripe of mesothorax long, extending to front margin; anterior lateral spots rather small, longer than broad; lateral margins with complete stripes, very narrow posteriorly; posterior spots of mesothorax pyriform, pointed mesad; scutellum without spots, shining, sparsely punctured, the hind margin **W**-like, a tuft of white hair beneath the emargination; mesopleura with a large hairless coarsely punctured space in middle; anterior wings fuliginous; tibiae and basitarsi with bluish-white hair on outer side, hardly going beyond middle on hind tibiae. Abdomen with very broadly interrupted blue bands, the basal band of first segment narrow, and rather narrowly interrupted; pygidial plate with a weak keel not reaching its base. In my table in 'Entomologist,' 1910, p. 217, this runs to *C. decora*, Smith, which has a broad basal band on first abdominal segment, and is otherwise quite distinct. It also fails to find a place in the tables of Friese and Bingham, and is unlike any described Indian species.

Type from Marudamalai, Coimbatore, S. India, 2000 ft., Aug. 18, 1912. Another is from Coorg Sanivarsandai, Hansey Estate, 4000 ft., April 29-30, 1913.

*Anthophora subinsularis* (Strand).

Bangalore, 3000 ft., May 8, 1913.

Strand described this as a variety of *A. insularis*, Smith,

because it seemed to differ somewhat from Bingham's description. It is apparently quite distinct from the true *insularis*, which was described from Sarawak. It is closely related to *A. vigilans*, Smith, having quite the same appearance.

*Xylocopa sigiriana* (Cockerell).

♀. Bababuddin Hills, Mysore, 4700 ft., June 1, 1915.

Described as a subspecies of *X. amethystina*, but evidently a distinct species.

*Xylocopa ignita*, Smith.

♀. Dodabetta, Nilgiris, 8000 ft., May 1-3, 1916.

Larger than the last, with longer second submarginal cell. This does not quite agree with Maidl's description, but I think it is Smith's *ignita*. Possibly two or more closely related species have been confused under this name.

*Hypanthidium salemense*, sp. n.

♂. (Type.)—Length about 11 mm., anterior wing 8.5.

Black, with cream-coloured markings, the pubescence very scanty, pure white; femora with a red stripe on upper side, and hind femora largely reddish behind; first abdominal segment with a short red stripe on each side basally; mandibles elongate; antennæ entirely black; front and vertex very densely punctured; mesothorax and scutellum very densely and strongly punctured; scutellum prominent, sharp-edged, rounded, emarginate in middle; tegulae punctured, smooth in middle. Wings dilute fuliginous; second recurrent nervure going far beyond end of second submarginal cell; hair on inner side of tarsi orange; spurs red; no pulvilli; seventh abdominal segment very broadly rounded, with a keel down the middle, the hind margin might be called truncate; segments 3 to 6 with lateral teeth, that on 3 small. The pale markings are as follows: mandibles (except apex), clypeus (except narrow lower margin), rest of face except large black triangular area above clypeus, a stripe mesad of each antenna, an elongate mark below middle ocellus, a finger-like extension along each anterior orbit to level of middle ocellus, a broad band on upper part of each cheek, and two elongate spots on occiput, ends of tubercles, L-shaped marginal stripe on each side of mesothorax, axillæ, large mark on mesopleura, two crescentic marks on each tegula, broad stripe on under side of anterior and middle femora, long stripe on anterior and middle and

short (basal) one on hind tibiæ, two large marks on each side of first six abdominal segments, on first oblong, on second and third long and transverse, on the others shorter, that on sixth square.

♀.—Length a little over 8 mm.

Ventral scopa pale yellowish; clypeus black, with a large light spot near each lower corner; sixth abdominal segment with only minute light dots.

Salem, S. India, Dec. 2-18, 1914.

By its characters, this falls in the American genus *Hypanthidium*, but it is a very distinct form. The end of the abdomen recalls that of *Anthidium pulchellum*, Klug.

*Dianthidium ramakrishnæ*, sp. n.

♀.—Length about 6.5 mm.

Head, thorax, and abdomen black, with cream-coloured markings as follows: large spot on mandibles, clypeus, large triangular lateral face-marks (the inner part of each formed by a lateral spot on supraclypeal area), stripes on cheeks, reaching sides of occiput, band on mesothorax above each tegula (not reaching anterior corners of mesothorax), end of tubercles, spot on axillæ, narrowly interrupted band on scutellum, spot at each side of first abdominal segment, very broadly interrupted band on second, less broadly interrupted band on third, one very narrowly interrupted on fourth, and that on fifth only emarginate anteriorly in middle, sixth segment with a transverse oblong patch. Head and thorax very densely and finely punctured; flagellum dark chestnut-red beneath; pubescence of head and thorax very scanty, white; tegulæ large, closely punctured, with a pallid mark in front. Wings dusky; femora bright ferruginous; anterior tibiæ black with a pale stripe on outer side, red on inner; middle tibiæ similarly marked, but hind ones with only the apical part red on inner side; tarsi mainly dark, but the very broad hind basitarsi pale yellowish on outer side; hair on inner side of tarsi ferruginous; ventral scopa very pale yellowish. The hind tibiæ are very robust.

Bababuddin Hills, Mysore, 4700 ft., June 1, 1915.

Related to *D. rasorium* (*Anthidium rasorium*, Smith), but without the abundant white pubescence, and differing in the details of coloration.

*Parevaspis carbonaria* (Smith).

Coimbatore District, Bailur Forests, Nov. 23-28; Chittoor, April 19-27.

*Ceratina canarensis*, sp. n.

♀.—Length 10 mm.

Black, with bright yellow markings on head and thorax as follows: very broad band down middle of clypeus, with a short truncate projection on each side at lower end; low and broadly triangular supraclypeal mark; very broad bands along inner orbits, extending across to borders of clypeus and supraclypeal area; two spots below ocelli; cheeks, except uppermost part adjacent to eye; border of prothorax, not reaching tubercles; tubercles; very broad vertical band on pleura; two lines on disc of mesothorax, and short broad lateral bands above tegulæ; scutellum and axillæ, except extreme base; line on postscutellum; and metathorax except basal area. Eyes dark olive-green; mandibles dark apically, otherwise pale yellow suffused with red; flagellum very obscure reddish beneath; mesothorax polished and impunctate on disc, but anteriorly dull and finely punctured; tegulæ rufo-testaceous with a small yellow spot. Wings dusky, stigma and nervures piceous. Legs obscure reddish, anterior knees and tibiæ yellow suffused with reddish. Abdomen with the first three segments dark reddish, the others black, the apical margin of fourth and fifth narrowly testaceous; first segment with a yellow discal patch, subquadrate with a posterior extension, on each side of this the surface is black, but the posterior margin is broadly rufous; second segment posteriorly with a broad, paler, somewhat yellowish band, interrupted in middle.

South Canara District, Nagody, 2500 ft., Sept. 19, 1913.

Related to *C. hieroglyphica*, Smith, but distinguished by the coloration of the abdomen and the very broad lateral yellow bands on face.

*Lithurgus australior*, sp. n.

♂.—Length 12 mm.

Similar to the male of *L. atratus*, Smith (Khasia Hills, Sladen), but differing thus: face thickly covered with pure white hair, not mixed with black; a tuft of white hair

between ocelli; thorax anteriorly, and tubercles, with white hair, but hair of mesopleura black; tegulæ smaller. Wings shorter, marginal cell less sharply acuminate, second submarginal cell much shorter; hind basitarsi curved but simple, not enlarged at end. Abdomen above very smooth and shining, not distinctly roughened or punctured; black hair at sides of fifth and sixth segments much shorter. In Friese's table it runs to *L. dentipes*, Smith, but the true *dentipes* is Australian, and has pale yellow hair on face and ferruginous nervures; the stigma and nervures are reddish fuscous in *L. australior*, and the disc of the thorax, except anteriorly, has black hair.

Coimbatore, S. India, Nov. 12, 1913.

The abdomen is distinctly narrower than in *L. atratus*.

*Cælixys (Liothyrapis) dormitans*, sp. n.

♂.—Length about 13 mm.; anterior wing 7.8 mm.

♀ Black, including antennæ, tegulæ, legs, and spurs; pubescence pure white, abundant and dense on face, on the abdomen forming interrupted bands in the depressions, and marginal bands, evanescent or failing in middle; eyes dark brown, hairless; mesothorax and scutellum very densely and strongly punctured, except that in the middle the shining surface can be seen between the punctures (very narrowly and slightly on scutellum); scutellum convex, obtusely subangular posteriorly; axillar spines reduced to short obtuse tubercles. Wings dusky, but not strongly darkened; anterior coxæ with sharp spines. Abdomen shining, well punctured, the punctures on second segment conspicuously larger than those on third; terminal segment with a long subbasal spine on each side; apex produced, deeply sulcate, with no median spine; lower apical spines sharp and divergent, upper apical divisions briefly bidentate or tridentate. Related to *C. apicata*, Smith, but the end of the abdomen is different. In *C. apicata* the second submarginal cell receives the first recurrent nervure some distance from its end; in *C. dormitans* the first recurrent meets the first transverso-cubital nervure. (The *C. apicata* compared is from F. Smith's collection.)

Coimbatore, S. India, May 25, 1913, sleeping on grass.

*Megachile (Eumegachile) triangulifrons*, sp. n.

♀.—Length 15 mm.

Agreeing in all respects with Smith's description of his

*M. cephalotes*, except that the abdomen is not at all metallic, and the ventral scopa, instead of being entirely white, is cream-colour, black on the last segment and the apex of the penultimate one. It also differs from *cephalotes* in the structure of the face, which is not described by Smith. The supraclypeal area presents a large pit or hollow, surrounded by a triangular rim, which is variably but not coarsely punctured; the clypeus is smooth and deeply receding, with a strong dentiform median tubercle near the upper end.

Hindupur, Anantapur District, April 9-14, 1915.

*M. cephalotes* was described from Northern India; Bingham reported it from Dehra Dun and Ahmedabad.

*Megachile (Eumegachile) ramakrishnæ*, sp. n.

♀. (Type.)—Like *M. triangulifrons*, but smaller, length not quite 13 mm.

Ventral scopa black only at extreme apex, even the base of last segment with pale hair; supraclypeal basin less distinct, with large coarse punctures about its margin, the area between it and the clypeus (practically obsolete in *triangulifrons*) quite wide, and coarsely punctured, with a median smooth tubercle; clypeus short, with the median tubercle not nearly so large as in *triangulifrons*; mandibles with the second tooth, prominent in *triangulifrons*, subobsolete.

♂.—Length about 8.5 mm.

Hair of face dense and pure white, but the upper part of the clypeus is closely and minutely punctured, and bare; anterior coxæ with short but well-developed spines; anterior tibiæ and basitarsi polished and dark brown on inner side, the basitarsi distinctly hollowed and a little produced at end; end of abdomen bituberculate, and at the sides subapically are long black hairs.

Coimbatore, Nov. 1913.

There are three other species in the Indian fauna which should be compared with the above two. *M. arcuata*, Ckll., from Punjab, is similarly formed, and the distinct tubercle on the inner border of the mandibles is represented in *triangulifera*. In the species just described the hair on the dorsum of thorax is scanty and wholly white, but the thorax of *arcuata* has sparse black hairs above. *M. arcuata* also lacks the tubercle on clypeus.

*M. lissopoda*, Cam., from Bombay, has the hair of pleura soot-coloured; in our insects it is thin and white. *M. lisso-*  
*Ann. & Mag. N. Hist.* Ser. 9. Vol. iii. 14

*poda* has not the long curved mandibles of *M. cephalotes* and our insects, and the structure of the face differs.

*M. stirostoma*, Cam., from Dehra Dun, differs by the essentially hyaline wings, those of our insects being strongly smoky, except at base. The structure of the face and front also differ; thus there is no median tubercle on the clypeus. There is black hair on the apical part of scutellum and on postscutellum, but the hair of these parts is all white in our species.

*Megachile aureobasis*, sp. n.

♂.—Length about 10 mm.

Black, the wings fuliginous except the base, which is strongly orange. Very close in all respects to *M. umbripennis*, Smith, from Nepal, but differing thus: hair of thorax above thin and short, so that the thorax appears dark, except around the margins, where the fox-red hair is conspicuous; abdomen with entire hair-bands, that at apex of second segment red except at sides; front above antennæ without a distinct band of fulvous hair. The end of the abdomen is faintly emarginate.

Madras, Sept. 3, 1907 (*T. S. A.*).

Perhaps only a local race of *M. umbripennis*, but I have seen no intermediates.

*Megachile anthracina*, Smith.

♂. Coimbatore, Nov. 1913.

XV.—*Note on Chaudhuria, a Teleostean Fish of the Order Opisthomi.* By C. TATE REGAN, M.A., F.R.S.

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IN a recent memoir on the fishes of the Inlé Lake (Southern Shan States) Dr. Annandale\* has described a new genus and species to which he has given the name *Chaudhuria caudata*, and has made it the type of a new family—Chaudhuriidæ—of the order Apodes. On reading Dr. Annandale's description and studying his figures I came to the conclusion that this little fish was not a member of the Apodes (*cf.* Regan †), but

\* Annandale, "Fish and Fisheries of the Inlé Lake," *Rec. Ind. Mus.* xiv. 1918, pp. 33-64, 7 pls.

† Regan, "The Osteology and Classification of the Teleostean Fishes of the Order Apodes," *Ann. & Mag. Nat. Hist.* (8) x. 1912, pp. 377-387.



belonged to a very different group—the Opisthomi (cf. Regan \*)—and I think that *Chaudhuriæ* may be characterized simply as a *Mastacembelus* without spines and without rostral appendage. In other characters—form, scaling, structure and position of fins, nostrils, mouth, lips, dentition, gill-openings, branchiostegal rays, etc.—there seems to be no difference between the two genera. The few details given of the skeleton of the head of *Chaudhuriæ* are applicable to *Mastacembelus*, allowance being made for the præmaxillary, with the attached maxillary, being described by Dr. Annandale as the maxillary only. The peculiarities of the vertebræ, to which Dr. Annandale has called attention, are found in *Mastacembelus* also.

Dr. Annandale informs me that he has no time at present to make a further investigation in order to test the validity of my opinion as to the systematic position of *Chaudhuriæ*, and, as no specimens are available for examination in this country, it seems worth while to publish this note.

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XVI.—*On small Mammals collected by Sr. E. Budin in North-western Patagonia.* By OLDFIELD THOMAS.

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SEÑOR E. BUDIN, the collector of the Chumbicha mammals described in the last number of the 'Annals' †, helped by the kindness of Dr. O'Connor, Mr. Charles Lockwood, and the authorities of the Argentine Southern Land Company of Buenos Ayres, has also been enabled to make a collecting-trip to Lake Nahuel Huapi, in the mountainous part of North-western Patagonia, and to two other places in the same region, Pilcañeu on the Upper Rio Negro (41° S., 71° W.) and Maiten on the Upper Chubut (42° S., 71° W.).

At each of these places he made a collection of small mammals, mostly Muridæ and tucos-tucos, and all prove to be of the greatest interest.

Of the twenty forms obtained I have found it necessary to describe nine as new, while he has also collected an animal—the *Reithrodon longicaudatus* of Philippi—which proves to represent a very distinct new genus, quite unlike anything previously known to me.

\* Regan, "The Osteology of the Teleostean Fishes of the Order Opisthomi," *Ann. & Mag. Nat. Hist.* (8) ix. 1912, pp. 217-219.

† *Suprà*, p. 115.

In addition, his material of the short-tailed mole-like burrowing rats has greatly advanced our knowledge of these interesting and little-known animals, which now prove to belong to two distinct genera, of which, again, one needs description as new.

Our thanks are due to the kind friends who gave Sr. Budin help and hospitality, and to Sr. Budin himself for the keen and successful manner in which he has carried out the mission entrusted to him.

1. *Lasiurus borealis*, Müll.

♀. 60, 66. Beatriz, Nahuel Huapi. 800 m.

2. *Oryzomys magellanicus nizurus*, Thos.

♂. 195, 197, 200, 212, 215; ♀. 175, 191, 192, 196, 198, 199, 220. Maiten, Upper Chubut R. 700 m.

(?) ♂. 58, 102, 105, 113, 118, 119. Beatriz, Nahuel Huapi. 800 m.

"The most common species at Maiten. Called 'Coludo.'" —E. B.

3. *Reithrodon cuniculoides*, Waterh.

♀. 173. Maiten. 700 m.

Being a single specimen only I am not able to satisfy myself as to what subspecies of *R. cuniculoides* this should be referred to. All the forms that have been named in this difficult group are distinguished by somewhat intangible and more or less variable characters.

4. *Phyllotis xanthopygus*, Waterh.

♂. 128, 129, 132, 133, 134, 136, 147, 148, 151, 153; ♀. 130, 131, 137, 138, 140, 146, 149. Pilcañeu. 1400 m.

In these specimens the buffy wash on the under surface is far more marked than would be supposed from either Waterhouse's or Allen's description. But the type—no. 55.12.24.185—shows clearly the same general buffy tone to the hairs of the belly, none of them being really tipped with white.

"Caught among the cactus-plants."—E. B.

5. *Irenomys longicaudatus*, Phil.

♂ (imm.). 73. Beatriz, Nahuel Huapi. 800 m.

This most interesting specimen represents the re-discovery of Philippi's *Reithrodon longicaudatus*, whose identity has long been a mystery. It proves, as might be expected, to belong to an undescribed genus, which may be called

## IRENOMYS\*, gen. nov.

General facies as in *Oryzomys*. Upper incisors grooved. Molars hypsodont, laminate, the laminae lozenge-shaped in section.

Genotype. *I. longicaudatus* (*Reithrodon longicaudatus*, Phil.†).

The skull, judging by an immature example, is on the whole not unlike that of *Phyllotis*, and presents no very special peculiarities. The interparietal is of full size. The zygomatic plate is of average breadth, but little projected forward, not undercut. Palatine foramina long, penetrating between the molars. The internal pterygoids, however, are unusually thickened, flattened, and turned outwards above, though this may be partly due to immaturity. Bullae of medium size.

Upper incisors with a sharply defined groove.

Molars very peculiar, hypsodont, laminate, with three laminae to  $m^1$ , two to  $m^2$  and  $m^3$ , and the same numbers in the three molars below. The laminae of the upper teeth are very much as if the re-entrant angles of each side in the teeth of *Phyllotis* penetrated further into the teeth, so as to cut connection between the dentine spaces of each lamina, while still leaving the laminae lozenge-shaped and just touching each other at these median points. As a result, the shape in section of the laminae in a young animal is almost precisely similar to that in the African elephant, as viewed vertically, though of course the spaces between the lamina are not filled up with cement. Such teeth as these would in old age wear down to a sufficient approximation to Philippi's figure to render it certain that the two animals are congeneric.

This new genus is undoubtedly quite distinct from any previously recognized, and it is not easy to be certain as to its relationship to others. Probably it is most nearly allied to *Phyllotis*, of which it may be looked upon as a relative with grooved incisors and simplified molars. But, in any case, the difference is very considerable, and the study of adult specimens may cause some modification of this opinion.

Sr. Budin noticed that the single specimen was distinct from the ordinary *Oryzomys*, to which it has so marked a resemblance, and did all in his power to get further examples, but without success.

"Caught among the roots of fallen trees, like all the other species of the Beatriz peninsula."—*E. B.*

\* So named as a memento that its recognition coincided with the arrival of a glorious peace.

† An. Mus. Nat. Chile, pt. 14, "Muridæ of Chile," p. 64 (1900).

6. *Euneomys micropus alsus*, subsp. n.

♂. 171, 177, 183, 188, 201, 202. Maiten, W. Chubut. 700 m.

Similar in all essentials to true *E. micropus*, as represented by series from Koslowsky (lat. 46° S.) and Rio Chico, but almost or quite without the strong buffy suffusion on the fur, the general tone being more slaty greyish. Under surface also clearer greyish, with but little buffy wash.

Dimensions of the type (measured in the flesh):—

Head and body 123 mm.; tail 117; hind foot 27; ear 18.

Skull: greatest length 31·3; condylo-incisive length 28·7; zygomatic breadth 18; palatal foramina 7·8; upper molar series 5·7.

*Hab.* as above.

*Type.* Adult male. B.M. no. 18. 12. 2. 13. Original number 177. Collected 23rd April, 1918.

The series with which these specimens have been compared includes specimens killed in February, June, August, and December, so that the difference in the general colour is evidently not a seasonal one.

I may note here that my reference of *Mus (Phyllotis) xanthopygus*, Waterhouse, to the genus *Euneomys*—a reference probably induced by the noticeable resemblance it bears to *E. micropus*—now proves to be erroneous, as it is certainly a *Phyllotis*, the most southern member of that widely distributed genus. Its narrow incisors readily distinguish it from *E. micropus*, with which it is found.

The local modification in colour shown by this subspecies is exactly as in the *Abrothrix suffusus* of the same region.

7. *Eligmodontia morgani*, All.

♂. 142, 159, 165, 166; ♀. 125, 154, 157, 160, 161, 163, 164. Pilcañeu, Upper Rio Negro.

“Common. Lives in holes at the foot of the bushes.”—*E. B.*

8. *Abrothrix suffusus modestior*, subsp. n.

♂. 176, 182, 193, 203, 204, 211, 214, 217; ♀. 172. Maiten.

Like typical *suffusus* of the Koslowsky region, but rather darker and more slaty grey, the reddish or buffy of the back reduced both in extent and brightness. Face almost without buffy. Sides quite without buffy, so that there is a broad

greyish slaty band, dividing the subdued buffy area of the back from the greyish white of the belly, while in *suffusus* the same lateral region is buffy brownish in continuation with the back. Ears with a fairly well-marked greyish-white spot at their notch and on the base of the metentote. Under surface clear greyish white, quite as in *suffusus*. Feet white. Tail definitely bicolor, blackish above, whitish below, as in *suffusus*.

Skull as in *suffusus*.

Dimensions of the type:—

Head and body 97 mm.; tail 68; hind foot 23·5; ear 17.

Skull: greatest length 29; condylo-incisive length 25·8; zygomatic breadth 14·2; interorbital breadth 4·8; breadth of brain-case 13; palatal foramina 6·6; upper molar series 4·1.

*Hab.* as above.

*Type.* Adult male. B.M. no. 18. 12. 2. 22. Original number 204. Collected 2nd May, 1918.

This form, by its more subdued colour as compared with true *suffusus*, forms a step towards the following subspecies.

#### 9. *Abrothrix suffusus mærens*, subsp. n.

♂. 62, 70, 75, 76, 77, 78, 79, 80, 81, 82, 83, 84, 89, 90, 93, 97, 99, 101, 107, 112, 115, 116; ♀. 65, 67, 68, 69, 74, 86, 104, 106, 110, 117. Beatriz, Nahuel Huapi. 800 m.

Much darker than true *suffusus* or the previous subspecies, the back dark brown almost without buffy, and the belly—which is practically white in *suffusus* and *modestior*—“deep dull grey,” very much as in the Chilian *longipilis*. Ears almost without greyish patches at their bases. Hands and feet grey, near “pale neutral grey.” Tail averaging a little shorter than in the other forms, and less markedly bicolor, blackish above, greyish below.

Skull as in *suffusus*.

Dimensions of the type:—

Head and body 110 mm.; tail 72; hind foot 22·5; ear 16.

Skull: greatest length 29; condylo-incisive length 26; zygomatic breadth 14; interorbital breadth 5; breadth of brain-case 12·4; palatal foraina 6·6; upper molar series 4·2.

*Hab.* as above.

*Type.* Old female. B.M. no. 19. 1. 1. 22. Original number 104. Collected 25th February, 1918.

This form of *Abrothrix*, from the lake-region of Nahuel Huapi, is, so far as colour is concerned, much more distinct from *A. suffusus* than is that of Maiten, and I have hesitated

as to whether it ought not to be distinguished specifically. Besides its generally dark colour, its greyish belly, grey feet, and scarcely bicolor tail all help to distinguish it. But its skull is so precisely like that of *suffusus* and *modestior* that it evidently represents them in a more saturate area, and for the present, therefore, I retain it in connection with them. Perhaps, also, hereafter these forms will link up with the *A. hirtus* of San Rafael, Mendoza, still further to the northward.

To the list of the species belonging to *Abrothrix*, besides those mentioned in my paper on the grouping of the Akodont Muridæ\*, there should be added *Mus brachyotis*, Waterh., from the Chonos Archipelago.

All these forms of *Abrothrix* from the eastern slope of the Andes are readily distinguishable from *A. longipilis* of Chili by their far smaller skull.

"Trapped among the roots of fallen trees."—E. B.

#### 10. *Akodon beatus*, sp. n.

♂. 61, 85, 87, 91, 100, 103, 108, 109; ♀. 59, 63.  
Beatriz, Nahuel Huapi. 800 m.

A rather large species of the *arenicola* group.

Size decidedly greater than in *arenicola* of Uruguay and Buenos Ayres, the hind foot averaging  $1\frac{1}{2}$  or 2 mm. longer. Fur close and woolly. General colour above dark olivaceous, under surface greyish white (near "light neutral grey"), the hairs slaty at base, white or whitish terminally, practically without the drabby or buffy wash generally found in *arenicola*; as a consequence, the upper and under surfaces are more contrasted with each other than in the common species. Ears coloured like head. Hands silvery white, a little darkening on the metacarpus. Feet brownish, the digits lighter. Tail as usual longer than in the *wanthorhinus-canescens* group, rather prominently bicolor, blackish above, darkening terminally, whitish below.

Skull larger than that of *arenicola*, with large rounded brain-case and proportionally narrow interorbital region. Palatal foramina not extending so far back, their hinder edge hardly reaching the level of the middle of the second lamina of  $m^1$ .

Incisors of about normal set, the angle  $69^\circ$  in the type. Notch at front end of  $m^1$  not perceptible in any specimen, the youngest being, perhaps, three-fourths grown.

\* Ann. & Mag. Nat. Hist. (8) xviii. p. 340 (1916).

Dimensions of the type :—

Head and body 87 mm. ; tail 79 ; hind foot 22 ; ear 15.

Skull : greatest length 25·7 ; condylo-incisive length 23 ; zygomatic breadth 12·6 ; nasals 9·8 ; interorbital breadth 4·1 ; breadth of brain-case 12 ; palatilar length 10 ; palatal foramina 6 ; post-foraminal palate 3·2 ; upper molar series 3·7.

*Hab.* as above.

*Type.* Young adult male. B.M. no. 19. 1. 1. 34. Original number 108. Collected 26th February, 1918.

This appears to be the most southern of the widely spread *olivaceus-arenicola* group, which ranges from here northwards to Ecuador, and the members of which are the most common field-mice in almost every locality, taking the place in nature of our common voles. The other species obtained by Sr. Bulin are of the more southern *xanthorhinus-canescens* group, distinguished among other things by the much shorter tail.

[*Akodon iniscatus*, sp. n.

Size and proportions as in *A. xanthorhinus*, but skull more bowed and thickly built, with shorter muzzle. First molar with a deep and distinct anterior notch, which only wears off in old age. A white patch on the chin.

Colour of typical race coarsely lined brown, near Ridgway's "buffy brown."

Dimensions of the type :—

Head and body 92 mm. ; tail 53 ; hind foot 19 ; ear 11.

Skull : greatest length 23·7 ; condylo-incisive length 21·7 ; zygomatic breadth 12·4 ; interorbital breadth 4 ; breadth of brain-case 11 ; palatal foramina 5·4 ; upper molar series 3·5.

*Hab.* Southern Buenos Ayres Province southwards into Patagonia. Type from the Valle de Lago Blanco, Koslowsky region, Patagonia, 46° S. Other specimens from Peru Station, N.W. of Bahia Blanca, Chubut, and Port Desire, besides the Budin examples referred to below.

*Type.* Adult female. B.M. no. 3. 7. 9. 64. Original number XXX. Collected 26th April, 1900, by J. Koslowsky. Ten specimens examined.

Our knowledge of the small Akodons of Patagonia has been in a very confused condition, though an improvement was made by Dr. Allen, who corrected certain mistakes that had been made in the labelling of the Darwin specimens, on which their nomenclature hangs. He rightly fixed on B.M. no. 55. 12. 24. 157 as the primary type of *A. canescens*, Waterh., and 55. 12. 24. 156 of *A. xanthorhinus*, Waterh.,

these specimens therefore, whatever other co-types were mixed up with them, being able to be taken as lectotypes of their respective names.

Now over most of the area concerned we seem to have two quite distinct forms of *Akodon*—A, with a short, normal-shaped, rather bowed skull, on whose  $m^1$  a very distinct and fairly persistent anterior median notch is present, an animal externally lined greyish brown, with a contrasted white chin-spot, and B, with a flattened long-nosed skull, the  $m^1$  practically without a notch, this only being perceptible in an aborted form in specimens with quite unworn teeth. Externally this animal is greyish or yellowish, with the feet more distinctly yellow, and the chin-spot not contrasted.

Returning to the type-specimens, it is quite clear, as shown by their skulls and teeth, that both 55. 12. 24. 156 and 157 belong to B, and that therefore A is without a name. Young and supplementary specimens obtained by Darwin on the Rio Negro and at Port Desire are referable to A, but these do not affect the determinations, and I propose to give to the latter form the name of *A. iniscatus*. A local form of it, obtained by Sr. Budin, I now describe.]

#### 11. *Akodon iniscatus collinus*, subsp. n.

♂. 205, 208, 209, 210; ♀. 206, 207, 218. Maiten, W. Chubut. 700 m.

A more blackish race of *A. iniscatus*. A full description is given here instead of to the typical *iniscatus*, as quite fresh specimens are available of it, while those of that animal are less perfect.

Size small, about as in *xanthorhinus* and *canescens*, the tail short as in those southern species, not as in the *arenicola* group. General colour above dark grizzled olivaceous brown (more greyish olivaceous and less brown than Ridgway's "olive-brown"), the hairs ticked with black and dull buffy; sides rather more buffy. Under surface soiled greyish buffy, the hairs dark slaty at base, their ends drabby or buffy—a patch in the inguinal region more definitely buffy. Chin, or rather interramia, with a conspicuous patch of wholly white hairs, contrasting markedly with the general dark colour. Ears short, their proectote blackish, their metentote buffy. Hands and feet brownish white. Tail short, well haired, strongly bicolor, black along the top, whitish or buffy whitish on sides and below.

Skull rather bowed above, its surface smooth and unridged. Interorbital edges square, not ridged. Palatal foramina long,



reaching to the level of the second internal re-entrant notch of  $m^1$ .

Incisors about normal, their angle in the type  $72^\circ$ . Molars larger than in *xanthorhinus*;  $m^1$  with an unusually well-marked anterior median notch.

Dimensions of the type:—

Head and body 85 mm.; tail 56; hind foot 18; ear 12.

Skull: greatest length 24.5; condylo-incisive length 22; zygomatic breadth 12.6; nasals 9; interorbital breadth 4; breadth of brain-case 11.3; palatilar length 10; palatal foramina 5.8; postforaminal palate 3.6; upper molar series 4.0.

*Hab.* as above.

*Type.* Young adult female. B.M. no. 18.12.2.31. Original number 206. Collected 4th May, 1918.

"Caught among furze-bushes ('retamos')."—E. B.

#### 12. *Akodon canescens*, Waterh.

♂. 124, 127, 135, 145, 156, 158, 168, 169, 170; ♀. 121, 122, 141, 143, 167. Pilcañeu, Upper Rio Negro. 1400 m.  
♀. 216, 221. Maiten, W. Chubut. 700 m.

Although I provisionally use *canescens* for these greyish mice of the "B" group—since they correspond with the type of that name,—I strongly suspect that they are merely the grey seasonal phase of the yellowish *xanthorhinus*, the latter name having priority. But, though not inconsiderable, our material does not suffice to settle the question with certainty, and until such certainty is arrived at it is better not to assume so great a seasonal change as the absolute identification of *canescens* with *xanthorhinus* involves. A somewhat similar change is recorded by Dr. Allen, though his remarks are difficult to utilize fully, owing to a doubt as to how far specimens referable to *A. iniscatus* are included in what he calls *canescens*.

#### 13. *Chelemys vestitus*, Thos.

♀. 72. Beatriz, Nahuel Huapi.

This single specimen is young, and therefore does not furnish any information as to the relationship of *Ch. vestitus* to the more northern *Ch. macronyx* of San Rafael, Mendoza.

#### 14. *Geoxus* (gen. nov.) *valdivianus*, Phil.

♂. 92, 94, 98, 114; ♀. 88, 94, 95, 96. Beatriz, Nahuel Huapi. 800 m.

These specimens agree sufficiently closely with Philippi's figure and description of *Oxymycterus valdivianus* to render it fairly certain on geographical grounds that they should be referred to that animal. The question of its generic name is dealt with below.

"Live among the roots of fallen trees. Make burrows in the earth like tuco-tucos."—*E. B.*

15. *Geoxus fossor*, sp. n.

♂. 178, 194. Maiten, W. Chubut. 700 m.

"Found under bushes ('retanos'), where they make holes with small hillocks over them, just like tuco-tucos. The similar mice from Nahuel Huapi do not make such hillocks."—*E. B.*

The six long-clawed Murines placed under these two headings have enabled me to make a fresh examination of the relationship they bear to my *Notiomys edwardsi*, to the genus *Oxymycterus*, and to the far southern species that have been referred to the latter.

I have to confess that Dr. Allen's assertion that his *Oxymycterus microtis* (to which these specimens are closely allied) had nothing to do with *Notiomys* proves to be entirely correct, my supposition to the contrary being wrong. Thanks to the kindness of Prof. Trouessart, I have been privileged to re-examine the type-skull of *Notiomys edwardsi*, and so am able to base my opinion on a firm foundation.

Of pertinent specimens we had previously only the two examples, adult and young, from Koslowsky mentioned in 1903\*, which, without sufficient reason, I assumed to be both of the same species. The young one (whose skull was crushed) being certainly *Notiomys*, and the other closely agreeing with "*Oxymycterus*" *microtis*, Allen, the generic identity of the two seemed to follow.

But study of the present valuable accession shows that the two Koslowsky animals are really different—the young one being *Notiomys edwardsi*, Thos., and the adult the species described by Dr. Allen.

On comparing now the good skulls of the mole-like animals related to "*Oxymycterus*" *microtis* in Sr. Budin's collection with the type-skull of *Notiomys*, I can confirm all that Dr. Allen † has said as to their essential distinctness. In the former the skull is long and narrow, with long muzzle, smooth

\* Ann. & Mag. Nat. Hist. (7) xii. p. 243 (1903).

† Mamm. S. Pat. pp. 81-85, illustrated by figures of skulls, pl. ix. (1905).

brain-case, and rounded interorbital region. In *Notiomys*, on the other hand, the skull is short and broad, with short conical muzzle, very broad and square-edged interorbital region, and strongly built brain-case. Both have equally the remarkably small molars, by which they may be distinguished from any other known forms.

Nearly related to Allen's *Oxymycterus microtis* are two earlier-described species—*Hesperomys (Acodon) michaelsoni*, Matschie, and *Oxymycterus valdivianus*, Philippi—and my present material includes specimens referable to the latter, as well as the 1903 example of *microtis*.

But I cannot agree that these forms should be put actually into *Oxymycterus*, and now propose to make of them a new genus, which may be described as follows :—

#### GEOXUS, gen. nov.

Allied to *Oxymycterus*, but form more highly modified for burrowing, with velvety fur and very short tail.

Skull with no trace of squared edges to the interorbital space. Zygomatic plate narrow, more vertical than in *Oxymycterus*, its front edge scarcely projecting.

Incisors more slender and molars proportionally very much smaller than in the allied genus. The latter character also present in *Notiomys*.

Genotype. *Notomys fossor*, sp. n. (This selection is made to avoid any complications due to wrong identification of the other forms known—though I have really no doubt about any of them.)

Other species: *michaelsoni*, Matsch., *valdivianus*, Phil., and *microtis*, All.

The excellent description and figures given by Dr. Allen of *N. microtis* will readily show the characters of this new genus. Matschie has also given figures of *N. michaelsoni*.

With regard to the species *N. fossor*, it may be defined as follows :—

Essential characters as in *N. microtis*, but the fur even more thick and velvety and the general colour dark smoky greyish ("deep mouse-grey"), with none or scarcely any of the yellowish or drabby ticking which is described by Allen and is markedly present in our Koslowsky specimen of *microtis*. Under surface rather lighter grey, with a slight drabby suffusion; the hairs all broadly slaty at base, grey terminally, those on the chin alone greyish white to their bases.

Skull, as in *N. microtis*, with the palatal foramina only

just reaching the level of the front edge of  $m^1$ , while in *N. valdivianus* they extend to the level of the back of the first lamina of that tooth.

Dimensions of the type (measured in the flesh):—

Head and body 104 mm.; tail 44; hind foot 20; ear 12.

Skull: greatest length 28; condylo-incisive length 25.5; zygomatic breadth 13.7; nasals 10; interorbital breadth 5.2; breadth of brain-case 12.8; palatilar length 11.4; palatal foramina 6; postforaminal palate 4.1; upper molar series 3.5.

*Hab.* as above.

*Type.* Old male. B.M. no. 18. 12. 2. 37. Original number 194. Collected 30th April, 1918.

This series of the long-clawed mole-like Murines of the south is perhaps the most interesting part of Sr. Budin's collection, and forms a very valuable accession to the National Museum.

#### 16. *Ctenomys haigi*, sp. n.

♂. 179, 180, 181, 184, 189; ♀. 174, 185, 186, 187, 190. Maiten, W. Chubut. 700 m.

Allied to *C. colburni*, All., but smaller, with smaller bullæ.

Size medium. Fur soft, fine and silky, hairs of back about 11–12 mm. in length. General colour of upper surface finely ticked greyish brown, near "drab," without median darker marking on rump or crown, the top of the nose only dark brown. Sides clearer grey, and the lower flanks rather abruptly and prominently buffy ("light buff") in continuation with the buffy wash on the hairs of the under surface. Forearms also prominently pale buffy both externally and internally; hind feet dull whitish. Tail grey on sides, blackish above and terminally below, but this, as usual, is variable in extent.

Skull, as compared with that of *C. colburni* as figured by Allen\*, similar in shape, but smaller and with decidedly smaller bullæ, which do not project backwards beyond the level of the supraoccipital. Interparietal quite united with parietals in all the specimens, the line of junction generally marked by some discoloration. Bullæ of average size, markedly less swollen than those figured in the male *C. colburni*.

Dimensions of the type:—

Head and body 165 mm.; tail 70; hind foot 28.

Skull: greatest length in middle line 40.2; condylo-incisive length 38.7; zygomatic breadth 23.5; nasals 14.7;

\* Mamm. S. Pat. pl. viii, fig. 4.

interorbital breadth 7·1 ; least breadth across brain-case 16·5 ; meatal breadth 24·5 ; breadth across bullæ exclusive of meatus 22·5 ; palatilar length 16·5 ; horizontal diagonal length of bullæ 15·2 ; upper molar series, crowns 8·2, alveoli 9.

*Hab.* as above.

*Type.* Adult male. B.M. no. 18. 12. 2. 39. Original number 180. Collected 24th April, 1918.

This species differs from *C. colburni* by its smaller size, less swollen bullæ, and less fulvous coloration.

Named in honour of General Sir Douglas Haig, Commander-in-Chief of the British armies.

#### 17. *Ctenomys haigi lentulus*, subsp. n.

♂. 144, 155, 162 ; ♀. 152. Pilcañen, Upper Rio Negro. 1400 m.

Like true *haigi*, but the general colour browner and less grey-ticked, the dull patch on the muzzle more inclined to extend up on to the crown, the lower flanks more greyish brown, without the strongly marked buffy wash contrasting with the dorsal colour which is found in every specimen of *haigi*, and with the forearms also brownish, not buffy.

Dimensions of the type:—

Head and body 155 mm. ; tail 70 ; hind foot 30 ; ear 6.

Skull: greatest median length 40 ; condylo-incisive length 38·5 ; zygomatic breadth 23·5 ; nasals 15 ; interorbital breadth 7·7 ; meatal breadth 25 ; breadth across bullæ (exclusive of meatus) 25 ; upper molar series, crowns 8, alveoli 8·8.

*Hab.* as above.

*Type.* Adult male. B.M. no. 18. 12. 1. 23. Original number 162. Collected 4th April, 1918.

Most readily distinguished from the Maiten tuco-tuco by the absence of the light buffy wash on flanks and forearms.

#### 18. *Galea negrensis*, sp. n.

♀. 139. Pilcañen, Upper Rio Negro. 1400 m. Collected 23rd March, 1918. B.M. no. 18. 12. 1. 25. *Type.*

General external characters of *G. boliviensis*. Colour of back mixed blackish and buffy. Under surface whitish, the belly-hairs broadly slaty basally, but with completely white areas in the axillary and inguinal regions. Eyelids whitish as usual, and a buffy-whitish patch at the base of the proectote of the ear. Fore limbs with their whole inner and upper surfaces buffy white ; hands more strongly buffy. Inner side of hind limbs also whitish ; the feet dull buffy.

Skull, as compared with specimens from Cordova taken provisionally to represent *G. leucoblephara*, more heavily built, though with narrower interorbital region. Palatal foramina short. Mesopterygoid fossa broadly rounded anteriorly, the palatine level with the main inner re-entrant angle on  $m^3$ . In the Cordova specimens the fossa is continued further forward, and is narrowly pointed anteriorly. Bullæ comparatively small, scarcely larger than in the otherwise much smaller *G. b. littoralis*.

Dimensions of the type:—

Head and body 215 mm.; hind foot 38; ear 24.

Skull: greatest length 55; condylo-incisive length 48.5; zygomatic breadth 32; nasals 20; interorbital breadth 9.5; palatilar length 25; palatal foramina 4.2; greatest horizontal diameter of bulla 14; upper molar series 12.

*Hab.* and *type* as above.

The present is the furthest southern record for the genus *Galea*, the next northwards being that of *G. boliviensis littoralis* from Bahia Blanca. The present animal is larger than *littoralis*, and its more widely open choanæ distinguish it from *leucoblephara*. It has smaller bullæ than the still more northern forms of Bolivia.

#### 19. *Caviella australis*, Geoff. & d'Orb.

♀. 126, 143. Pilcañeu. 1400 m.

“Caught among burrows out on the fields.”—*E. B.*

#### 20. *Dromiciops australis*, Phil.

♂. 71; ♀. 111. Beatriz, Nahuel Huapi. 800 m.

The type-locality of Philippi's *Didelphys australis* appears to have been in the neighbourhood of Union, Valdivia, some 150 kilometres north-west of Nahuel Huapi, on the Chilean side of the Cordilleras. But, as already mentioned, the mountains in this region do not form an unbroken barrier, and Nahuel Huapi itself makes a gap in them, so that the identity of Sr. Budin's specimens with Philippi's species is quite natural.

Of this genus the Museum previously possessed the type of *Dromiciops gliroides* from Chiloe and an individual from Temuco presented in 1908 by Mr. R. M. Middleton.

“I was much pleased to obtain this striking little animal, which seems to be very rare. It was, like other things, caught among the roots of fallen trees.”—*E. B.*

A most acceptable addition to the Museum collections.

XVII.—Two new Argentine Species of Akodon.  
By OLDFIELD THOMAS.

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DURING the working out of Sr. Budin's Patagonian collection the two following species of *Akodon* have proved to need description:—

*Akodon neocenus*, sp. n.

A shaggy grey species allied to *A. varius* of Bolivia.

Size and general appearance very much as in *A. varius*, with the same loose and rather shaggy fur, which is, however, rather longer and thicker; hairs of back about 13–14 mm. in length, intermixed with longer bristle-hairs attaining 17 mm. General colour greyer than in *varius*, with less buffy, though the essential mixture of grey and buffy, varied by the dark tips to the hairs, is similar. Hands and feet whitish. Tail rather long, well haired, blackish above, whitish below.

Skull with the nasals narrower and more tapering posteriorly than in *A. varius*. Supraorbital broad with squared edges. Postero-external corners of brain-case developed into sharp angles, as viewed from above, this region being usually smoothly rounded; but this may possibly hereafter prove to be merely individual. Palatal foramina to the level of the front edge of the middle lamina of  $m^1$ . Bullæ decidedly larger than in *varius*, their breadth in the type, taken at right angles to the diagonal length, 4·3 mm.

Incisors rather more proodont than in *varius*, the angle  $78^\circ$  in two specimens as compared with  $72^\circ$ – $75^\circ$ .

Dimensions of the type (measured on the spirit-specimen):—

Head and body 108 mm.; tail 85; hind foot 23·5; ear 18.

Skull: greatest length 29·2; condylo-incisive length 28·2; zygomatic breadth 14·8; nasals  $11 \times 3\cdot2$ ; interorbital breadth 5·2; breadth of brain-case 13; palatilar length 12·8; palatal foramina 7; upper molar series (worn) 4·8.

*Hab.* Neuquen, Rio Limay, Upper Rio Negro, Patagonia.

*Type.* Old male in spirit. B.M. no. 11.11.19.12. Collected by E. Weiske, 4th November, 1910. Presented by the Hon. N. Charles Rothschild. An imperfect skin, No. 11.11.19.10, also in collection.

A southern representative of *A. varius*. Greyer than any of the members of the *A. obscurus-lenguarum* group which occur in the intermediate area.

*Akodon benefactus*, sp. n.

Allied to *A. lenguarum*, but smaller.

Character of fur and general colour very much as in *A. lenguarum*, the back equally varying from "fuscous" to dark "buffy-brown," the colouring resulting from a coarse and heavily lined mixture of black and dull buffy. Under surface soiled grey, the bases of the hairs slaty, the tips greyish white, varying to pale drabby along the middle line. Head like back; eye-rings buffy. Ears rather short, of the same general dark colour as head. No contrasted white spot on chin. Hands and feet brownish white, their hairs brownish basally, white at tip. Tail about equalling body without head, upperside blackish, lower dull white.

Skull decidedly smaller than that of *A. lenguarum* and with scarcely any trace of supraorbital ridges such as often develop in old age in that animal. Palatal foramina to the level of the back of the first lamina of  $m^1$ .

Incisors about as in *lenguarum* and *obscurus*, more proodont than in ordinary Akodons, but less so than in *lacteus*, the angle in the type  $81^\circ$ .

Dimensions of the type:—

Head and body 99 mm. ; tail 65 ; hind foot 19 ; ear 14.

Skull: greatest length 27 ; condylo-incisive length 26.2 ; zygomatic breadth 14.3 ; nasals 9 ; interorbital breadth 4.3 ; palatilar length 12.5 ; palatal foramina 5.7 ; upper molar series 4.5.

*Hab.* Bonifacio, South-west Buenos Ayres Province ; alt. 50 m.

*Type.* Adult male. B.M. no. 16. 10. 3. 35. Original number 2620. Collected 13th May, 1916, by Robin Kemp. Presented by Oldfield Thomas.

This species is related to *A. obscurus* of Uruguay and *A. lenguarum* of Paraguay, but is paler than the former and smaller than the latter.

Mr. Kemp seems to have found this species living in company with *A. arenicola* at Bonifacio, just as I did its relative *A. obscurus* in the neighbourhood of Montevideo.



## XVIII.—New South-American Butterflies.

By W. J. KAYE, F.E.S.

## Morphidæ.

*Morpho perseus demararæ*, subsp. n.

♂ ♀. Altogether paler than *M. perseus metellus*. Fore wing with a pale ochreous shade beyond middle, not involving the first transverse row of ochreous spots (faint in ♂, well defined in ♀) and scarcely extending beyond vein 2, except slightly distally. Inner margin slaty blue basally. Hind wing with the whole of the basal half slaty blue, except for some slight ochreous clouding in middle area near costa.

*Hab.* Demerara, Omai, Essequibo River, 1 ♀; Demerara River, 1 ♂.

Type in Coll. Kaye.

## Erycinidæ.

*Xynias potaronus*, sp. n.

Collar orange. Fore wing with all the margins broadly black. Some blue scaling along inner margin. Basal area to beyond middle pale bluish transparent with the veins black. A broad black band across discocellulars. A sub-apical band composed of three large elliptical white spots and a small blue spot at lower extremity. Hind wing with costa broadly black. Inner and outer margin narrowly black. Central area dusky transparent with a faint bluish tinge. Abdomen above blackish; below orange.

Expanse 37 mm.

1 ♂.

*Hab.* British Guiana, Tumatumari, July 1907 (*C. B. Roberts*).

Type in Coll. Kaye.

*Nymphidium multochrea*, sp. n.

Fore wing dark brown and orange without any white. A very broad costal brown band to well beyond cell containing orange blotches. Three of these lie within the cell and a fourth lies below the median but touching it on its upper edge. A large orange triangular patch occupies a large area from inner margin towards apex, and is there continued

vertically towards costa. Outer margin dark brown with a faint blue line running through it and some indistinct black intra-neural spots. Hind wing with basal two-thirds pale dirty brownish, palest towards base. A broad orange sub-terminal band slightly radiated on its inner edge. Outer margin dark brown containing some black spots which are edged internally with blue. Fore wing below with some whitish scaling beyond the cell and stretching across veins 2, 3, and 4. The subterminal orange band merged with the whitish-brown scaling in the area of the tornus. Hind wing below with the basal half whitish gradually becoming dusky before it meets the subterminal orange band.

*Hab.* Lower Amazon, Igaripe (*A. Hall*).

This may be an aberration of *Nymphidium caricæ*, as the underside shows some whitish scaling, but above the general fascies is strikingly different.

Type in Coll. Kaye.

#### Pieridæ.

##### *Pieris phaloe lamonti*, subsp. n.

A small island race of *phaloe*, Godt (= *buniæ*, Bois), which in addition to its small size has no orange at base of fore wing on underside, and only a very small amount of orange at base of hind wing on underside.

A full description is appended of both ♂ and ♀ in case the subspecies should turn out to be a good species and not only a race of *phaloe*.

##### *Pieris phaloe lamonti*.

♂. Fore wing white with the costa for half the length of cell black; the rest of costa (except the very narrow extreme margin, which is black) white. Apex rather broadly black and considerably concave on the inner edge. At termination of veins 3 and 4 on the margin are triangular black marks. A considerably reduced similar mark on vein 2 at margin. A small black discocellular spot slightly extended inwards. Faint scent-scale patches in the interspaces between the veins in discal area. Hind wing white with a very narrow black fringe. Some orange scaling at base beneath and at base of palpi.

♀. Fore wing white with a large black discoidal patch, continued as a curve to costa towards base, but not reaching it. Apex heavily black, the black continued in a zig-zagging

manner to tornus. It is widest at veins 3, 4, extending greatly inwards along vein 4. Between veins 2, 3 it recedes to extreme margin, but forms a black triangular patch on vein 2 and a linear black mark is present along vein 1 *b* at tornus. Hind wing white with a broad but much broken black margin. A long curved black streak along vein 8 almost throughout its length, except at origin. A black shade along vein 4 just beyond end of cell. Hind wing below cream-coloured, with a strong orange patch at base and black streaks as above, but paler.

Expanse ♂ 72, ♀ 75 mm.

*Hab.* Trinidad, Morne Diable, 9. 4. 17 (*Sir Norman Lamont*).

I have named the species after Sir Norman Lamont, who discovered it on Morne Diable, where he had made numerous fresh records for the island.

Types, ♂ and ♀, in Coll. Kaye.

#### Heliconidæ.

##### *Heliconius doris doris*, ab. *gibbsi*, nov.

Fore wing like typical *doris* from Guiana, except that all the markings are completely white. The basal streak along the median being considerably suffused with black scaling. Hind wing normal *doris* with the blue scaling extending on either side of the veins beyond the cell area.

*Hab.* British Guiana, Friendship, Berbice River.

Type ♀ in Coll. Schmassmann.

This very rare form, which is parallel to *H. doris metharina*, ab. *fascinator*, from N.W. Venezuela, was given unsuspectingly by the late Mr. A. E. Gibbs with many other *doris* to Mr. Schmassmann shortly before he died.

I have named the aberration after the late Mr. A. E. Gibbs.

##### *Heliconius wallacei brevimaculata*, ab. *halli*.

Fore wing like *brevimaculata*, with the short median band white in place of the usual yellow, broken by the extra dark scaling along vein 2. Hind wing like typical *wallacei*.

*Hab.* Lower Amazon, Serpa, March 1914 (*A. Hall*).

Type ♀ in Coll. Schmassmann.

This form is close to *clytia*, but as *brevimaculata* is a geographical race on the lower Amazon it is necessary to describe and record the occurrence of an accompanying white form.

I have named this aberration after Mr. A. Hall.

*Heliconius burneyi serpens*, subsp. n.

♀. Fore wing as in *H. burneyi burneyi*. Hind wing intermediate between *H. burneyi catharinæ* and *H. burneyi huebneri* with short streaks beyond the median vein, never extending more than half the distance to outer margin.

♂. With even shorter streaks and approaching nearer to *catharinæ* than to *huebneri*.

*Hab.* Lower Amazon, Serpa, Jan.—March, 1914 (*A. Hall*).  
Type in Coll. Kaye.

A series of males and females was taken by Mr. Hall and all the specimens are intermediate between *huebneri* and *catharinæ* showing that the race is a very well-marked one.

*Heteropterous*XIX.—Some new Species of the ~~Homopterous~~ Family  
Pyrrhocoridae. By W. L. DISTANT.

## Genus ODONTOPUS.

*Odontopus*, Laporte, Ess. Hem. p. 37 (1832).

*Probergrothius*, Kirk., n. n., Kirk. Entomologist, xxxvii. p. 280 (1904).

A genus under the name of *Odontopus* was proposed in the same year (1833), according to Scudder, by both Laporte (*Rhynchota*) and Silbermann (*Coleoptera*), Kirkaldy (*supra*) giving priority to Silbermann and sinking Laporte's generic name, for which he proposed the novelty of "*Probergrothius*."

Allaud, however, in 1889 (*Bull. Ent. Soc. Fr.* p. xlv) had shown that Laporte's name had priority over that of Silbermann, for which he substituted the generic name *Odontopezus*, and which is now used in the *Heteromera* (*Coleoptera*). Consequently Kirkaldy's name "*Probergrothius*" is another synonym.

*Odontopus antananarivos*, sp. n.

Head and pronotum testaceous, anterior pronotal constricted area ochraceous; scutellum and corium ochraceous, base of scutellum, and more than apical third of corium black, lateral margins of remainder of corium testaceous; membrane bronzy brown; body beneath ochraceous, head beneath, rostrum, and femora testaceous; tibiæ and tarsi black; antennæ with the first, second, and third joints black, extreme base of first joint testaceous, first joint moderately

thickened towards apex, second joint longer than first or third, fourth mutilated; rostrum reaching posterior coxæ; posterior angle of corium somewhat convexly angulate; lateral pronotal margins distinctly and somewhat broadly and roundly emarginate; tibiæ and tarsi distinctly palely pilose.

*Var.* Pronotum ochraceous, the lateral and posterior margins only testaceous; membrane black.

Long. 19 mm.

*Hab.* Madagascar; Antananarivo.

*Odontopus stramineus*, sp. n.

Ochraceous; anterior and posterior margins of the anterior pronotal constricted area narrowly black; two brown spots to corium—one transverse outside clavus, the other smaller and rounded before apex, membrane very pale ochraceous; antennæ wholly ochraceous, first, second, and fourth joints subequal in length, third shortest; membrane only just passing the anterior margin of the penultimate abdominal segment, rostrum reaching the intermediate coxæ; anterior femora moderately incrassated and strongly spined beneath on apical halves.

Long. 16 mm.

*Hab.* Sikkim (Atkinson Coll.).

I refrained from describing this species in the Faun. Brit. India, in the unsatisfied anticipation that I might receive another or more specimens. The abbreviated membrane and the moderately incrassated and spinous anterior femora almost indicate another genus. In general appearance and markings it is allied to *O. scutellaris*, Walk., and *O. binotatus*, Stål.

*Odontopus confusus*.

*Odontopus confusus*, Dist. Ann. & Mag. Nat. Hist. (7) ix. p. 39 (1902).

*Odontopus schoutedeni*, Bergr. Ann. Soc. Ent. Belg. xlvii. p. 290 (1903).

The specimen given specific rank by Bergroth (*supra*) is only a colour-variety of *O. confusus*. The black longitudinal vitta to the head is not of unusual occurrence, and the British Museum now contains a series of such varietal specimens acquired since I described the species. The first joint of the antennæ, I find by the examination of later specimens, is also sometimes sanguineous as originally described, sometimes with its apical area black and sometimes wholly black. It has a somewhat wide distribution in East Africa.

## Genus SERICOCORIS.

*Sericocoris*, Karsch, Entom. Nachr. 1892, p. 133.

*Hathor*, Kirk. & Edw. Wien. Ent. Zeit. xxi. p. 168 (1902).

*Sericocoris flavipes*.

*Dysdercus flavipes*, Sign. Thoms. Arch. ent. ii. pp. 308, 587 (1858).

*Odontopus flavipes*, Stål, Hem. Afr. iii. p. 7 (1865).

*Hab.* W. Africa.

*Delacampius militaris*, sp. n.

Head black; pronotum fuscous brown with the lateral margins testaceous; scutellum black; corium testaceous, clavus (excluding base) and a large semi-ovate spot connected with posterior half of clavus black; membrane black; sternum fuscous brown, abdomen beneath, rostrum, and legs a little paler; antennæ with the first, second, and third joints fuscous brown, fourth joint greyish white with its apex fuscous, first, second, and fourth joints almost subequal in length, third shortest; pronotum with the posterior area strongly coarsely punctate, and with a short, discal, longitudinal carination, lateral pronotal margins distinctly concavely sinuate; clavus somewhat sparsely and coarsely punctate; rostrum reaching posterior coxæ.

Long. 7 mm.

*Hab.* N.W. New Guinea (*A. R. Wallace*).

*Delacampius athiopicus*, sp. n.

Body above, head beneath, sternum, rostrum, and legs dark chocolate-brown; antennæ fuscous brown; extreme base of first joint of antennæ, coxæ, trochanters, and abdomen beneath ochraceous, posterior margins of sternal and abdominal segments pale ochraceous; pronotal margins, apex of scutellum, basal-lateral margins and angulated posterior margins of corium pale testaceous; membrane black; antennæ with the first, second, and fourth joints almost subequal in length, third joint distinctly shortest; rostrum almost reaching the posterior coxæ; lateral margins of the pronotum moderately concavely sinuate, the posterior lobe and the corium finely punctate; membrane reaching the abdominal apex.

Long. 7-8 mm.

*Hab.* Cameroons (*Escalera*). Gambia (*J. J. Simpson*).

*Delacampius rhodesianus*, sp. n.

Black; pronotal margins, basal-lateral, apical-claval, and angulated posterior margins of corium pale ochraceous; head

beneath and sternum black, sternal segmental margins and the coxæ pale ochraceous; abdomen beneath dark ochraceous, lateral margins testaceous and inwardly broadly black, posterior segmental margins pale ochraceous; antennæ with the first, second, and third joints black, third shortest, fourth mutilated; head somewhat elongate, its apex sanguineous; lateral margins of the pronotum distinctly upwardly laminate, but practically non-sinuate; membrane about or almost reaching abdominal apex; connexivum sanguineous.

Long. 8 mm.

*Hab.* N.E. Rhodesia; Serenje Distr. (*Neave Coll.*).

Allied to the preceding species, *D. aethiopicus*, Dist., but besides the different colour-markings it differs by the non-convexly sinuate lateral margins of the pronotum.

#### DINDYMELLUS, gen. nov.

Head elongate, anteriorly depressed, central lobe prominent and apically broadened, not constricted or impressed beneath; antennæ robust, first, second, and fourth joints longest and subequal in length; rostrum robust, long, passing the posterior coxæ, first joint about reaching base of head, second joint a little longest, third and fourth shortest; pronotum about as long as broad at base, the lateral margins acutely reflexed, basal margin about or nearly twice as broad as anterior margin, obscurely transversely impressed near middle; scutellum triangular, centrally about as long as broad; corium with the lateral margins moderately ampliate; membrane reaching abdominal apex; abdomen with the posterior margins of the second, third, and fourth segments very strongly, convexly, obliquely, and upwardly directed at their lateral areas.

Allied to *Dindymus*, Stål.

#### *Dindymellus coimbatorensis*, sp. n.

Brownish testaceous; antennæ piceous, basal area of apical joints luteous; eyes black; lateral margins of pronotum and about two-thirds of lateral margins to corium sanguineous, the latter with the extreme margin and about posterior third (narrowly) luteous; membrane fuscous brown; body beneath, legs, and rostrum fuscous brown; coxæ, trochanters, lateral margins of sternum and base of abdomen sanguineous; rostrum with the first and second joints reddish ochraceous, third and fourth joints fuscous brown; antennæ with the first, second, and third joints moderately thickened on their apical areas, fourth joint more slender and cylindrical; head practically impunctate; pronotum with a few scattered punctures on the basal area, where there is also a short,

median, longitudinal ridge; tibiæ finely spinulose; anterior femora incrassated with three prominent spines beneath at apex.

Long. 17 mm.

*Hab.* South India; Coimbatore (*T. V. Campbell*).

*Syncrotus circumscriptus*, Bergr. Proc. Roy. Soc. Vict. vii. p. 293 (1895).

Bergroth described this genus and species from a ♀ or ♀ specs., and his description requires some emendation. In the male the membrane reaches the abdominal apex and is considerably smaller than the other sex. "Rufo-castaneus" cannot be accepted as the predominant colour as stated by Bergroth, for the head and pronotum, in some cases the anterior lobe only, are black.

Long., ♂ 6, ♀ 9 mm.

*Hab.* Queensland; Kuranda (*F. P. Dodd*).

## XX.—Some Parthenogenetic Chironomidæ.

By F. W. EDWARDS.

So far as our present knowledge goes, parthenogenesis is of somewhat rare occurrence among the Diptera, but several instances of it have already been recorded in Chironomidæ, in the genera *Tanytarsus* and *Corynoneura*. In the case of *Tanytarsus* the first observations were made by Grimm in 1870, and have more recently been confirmed and extended by Zavrel (*vide* Bause, Archiv für Hydrobiol., Suppl. Bd. ii. 1913, p. 17). The observations of both these writers concern the rare phenomenon of pupal parthenogenesis. Zavrel found that in the summer broods of *Tanytarsus boiemicus*, Kieff. MS., eggs could be produced parthenogenetically either by the pupa or by the imago very shortly after emergence; the pupæ were often found floating dead on the water full of developing eggs, from which larvæ eventually hatched. In all cases the adults reared from such larvæ proved to be females.

Another case of parthenogenesis—in this instance of a more normal type—has been recorded by Goetghebuer as occurring in *Corynoneura celeripes*, Winn. (Bull. Acad. Roy. Belg. 1913, pp. 231-233). This author was able to rear three successive generations of parthenogenetically produced eggs, which in every case yielded female adults.



These, I believe, are the only cases so far placed on record of the occurrence of parthenogenesis in this family of the Diptera ; but I am now able to add two others.

*Chironomus clavaticrus*, Kieffer.

(*Tanytarsus flexilis*, Bause, ? Linné.)

During the month of May 1917 I collected some weeds and mud from a pond at Letchworth, Herts, in the hope of being able to discover the larvæ of certain Culicidæ, but was then only able to rear various species of Chironomidæ from the material. Among these were a number of specimens of a species which I determined later as *Chironomus clavaticrus*, Kieff. (Bull. Soc. Nat. Hist. Metz, xxviii. 1913, p. 17). My interest in these was aroused in the first place by the fact that this very distinctively marked species had not been recorded from Britain, and was quite unrepresented in the collections at the British Museum and at Cambridge. Secondly, it was noticeable that all the specimens which hatched (about forty) were females. Suspecting that this might be a case of parthenogenesis, I isolated a few pupæ in a small closed receptacle. Two females hatched, and each of these deposited an egg-mass. From these eggs larvæ developed which produced female adults on August 16 ; eggs were laid parthenogenetically on Aug. 18, and produced larvæ on August 23. These for the most part died young, owing, I believe, to lack of food ; a few lived through the winter and became full-grown in June 1918, but for some reason unknown to me no adults hatched from them.

I made a diligent search by sweeping with a net in the neighbourhood of the pond where the larvæ were obtained, but succeeded in finding only female specimens, and am inclined to believe that in this locality at least no males occur. It is interesting to note that the species was originally described by Kieffer from females only, reared from larvæ by Thienemann. It was also reared by Réaumur from larvæ collected near Paris ; he figures the larva and the female adult (Hist. Ins. iii. p. 179, pl. xiv. figs. 11-16). No other records of the adult of *C. clavaticrus* have been made, and the species is thus known only in the female sex at present.

The discovery of the male—supposing it to exist—would be a matter of some interest, since it might give a further clue to the correct generic position of the species. From the characters of the adult female alone, and particularly on account of the entirely bare wings, Kieffer was no doubt

justified in allocating it to *Chironomus*, but in its larval and pupal stages the species shows a much greater relationship to *Tanytarsus*. The early stages of *C. clavaticrus* have, indeed, been described in detail by Bause (Archiv für Hydrobiol., Suppl. Bd. ii. p. 73, 1913)\* as those of a *Tanytarsus*, which, on the authority of Thienemann, he calls "*Tanytarsus flexilis*, Linné," though he states that the larvæ have not yet been reared. Why Thienemann adopts this name, which has usually been allotted to a totally different species of *Chironomus*, is far from clear; but, since Bause states that Thienemann himself intends to give reasons for the identification in a later publication, I refrain from comment at present.

To the accounts given by Réaumur, Lauterborn, and Bause of the early stages of this species I can add the following points:—The egg-mass is about 6 mm. in length, 1 mm. broad, pointed at each end; those I observed adhered by one end to water-weeds, but whether this was accidental or whether they were fixed in this position by the fly I could not determine. The eggs in the egg-mass are arranged in a rather indefinite spiral; counts of the number in two separate masses showed 182 and 163 respectively. The larvæ emerge from the egg through a longitudinal fissure, and when newly hatched are about 0.6 mm. long and practically colourless, there being only small patches of yellowish-green granules at the sides of abdominal segments 2-7 and along the sides of the intestine; they have no trace of ventral blood-gills or of the hump on the eighth abdominal segment; "Lauterborn's organs" are present at the apices of the second and third antennal joints, as in the full-grown larva. The second stage larva much resembles the first †, but is a little over 1 mm. long, and has a slight hump on the eighth abdominal segment and a slight red tinge behind the head and in the middle of the body. In the third stage the red colour of the body is more widely spread, but not strong; the hump on the eighth abdominal segment is well developed, and blood-gills are present on the seventh segment, but are as yet colourless and have not their full length. The

\* The early stages of *C. clavaticrus* apparently agree in every respect with Bause's description and figures of *T. flexilis*, but there is, of course, a possibility that there may be two closely allied species.

† Miall and Hammond state ('Harlequin-fly,' p. 176) that the peculiarities of the newly-hatched larva disappear after the first moult. It is just possible that what I regarded as second-stage larvæ are merely first-stage individuals which have grown in size.

newly hatched larva, as soon as it has freed itself from the jelly of the egg-mass, loses no time in making itself a case. I was not fortunate enough to observe the process of formation, but apparently these cases consist chiefly of salivary secretion, to which minute particles adhere. Since I could never find any small empty cases, I am led to believe that the larva increases the size of the original case as it grows; but more observations are needed on this point, since the material of the case does not seem to be particularly elastic. The larva can turn completely round in its case and protrude its head from either end; in moving about from place to place it sometimes comes out as far as the fifth or sixth abdominal segment, but I never saw one completely leave its case—in fact, it is probable that the hump on the back of the eighth and the large ventral blood-gills on the seventh segment would prevent its being able to do so.

Before pupation the larva usually moors its case by one end in such a position that the other end is close to or touching the surface of the water. The pupa leaves the larval case only a short time before the emergence of the adult (I have not seen a free pupa, but have only found the skins floating on the surface of the water). A very noteworthy point is that the larva skin seems never to be completely shed, but remains attached to the abdomen of the pupa; pupæ removed from their cases, as well as cast pupal skins collected on the surface, always had the larval skin attached\*.

The adult, when freshly emerged, has still much of the blood-red colour of the larva—which, indeed, is the case with other Chironomidæ having blood-red larvæ. Another point worthy of special remark is the resting position of the adult fly, the front legs being held in a peculiar manner which I have not observed in any other Chironomid. The front femora are directed straight forwards, so that their clubbed tips almost or quite touch in front of the head; the tibiæ and tarsi are bent right back at an angle of about 40° with the body. A somewhat similar posture is adopted by some small species of *Tanytarsus*, which hold their front tibiæ and tarsi at right angles to the body; but I do not know of another instance in the Chironominae in which the normal manner of holding the front legs is departed from.

\* Miall and Hammond, in their monograph on the 'Harlequin-fly' (p. 139), note that "*occasionally* the larval skin is still adherent to the pupa when the fly emerges."

*Corynoneura innupta*, sp. n.

Though this species is not at all uncommon in the Letchworth district of Hertfordshire, it appears not to conform to any of the published descriptions of European species; it may be diagnosed as follows:—

♀. General colour bright yellow. *Head* black behind; face brownish yellow; palpi yellow; antennæ six-jointed, basal joint black, joints 2-5 yellow, oval, not quite twice as long as broad; last joint somewhat darkened, pointed, more than three times as long as broad. *Thorax* yellow; mesonotum with three rather widely separated black stripes, the middle one extending from the front margin halfway to the scutellum; base of scutellum, apical half of postnotum, also the mesosternum blackish. *Abdomen* yellow; the tergites rather broadly blackish grey towards the base. *Legs* pale; extreme tips of femora, tibiæ, and tarsal joints rather indistinctly darkened; front tibia about 1·7 times the length of the metatarsus. *Wings* clear; R extending very slightly beyond the middle of the wing; Cu forking noticeably beyond the tip of R.

Length 0·9 mm.

*C. innupta* must evidently bear a close general resemblance to *C. scutellata*, Winn., and *C. pumila*, Wulp (both of which are unknown to me), but these two are said to have the scutellum yellow at the *base* instead of the apex, and there are some other points in the published descriptions which seem to indicate that our insect cannot be the same as either.

In the autumn of 1917 I reared a few females of this species from the same pond from which I had obtained *Chironomus clavaticrus*. Again, in the spring of 1918 *Corynoneura* larvæ appeared in a breeding-jar for mosquito-larvæ. These latter were collected in a temporary puddle in a copse at Arlesey, Beds, and were supplied with dead leaves and water from a ditch (also temporarily full) in my garden at Letchworth. I do not know from which locality the *Corynoneura* larvæ originated. I have also swept female specimens from vegetation at the lakeside at Radwell, Herts.

From the larvæ in this jar, which was kept closed the whole time, about fifty specimens emerged in the early part of June, all of which were females; probably they were the offspring of a specimen which hatched unnoticed earlier in the year, since the material was collected early in April. Some of the pupæ were isolated, and both the specimens which hatched from them and the others in the main receptacle deposited egg-masses which produced larvæ about

June 19. Between July 5 and July 14 about seventy adults had hatched from these larvæ, again all females; these, again, produced egg-masses parthenogenetically, and another generation of flies (twenty specimens, all females) appeared at the end of July. A third parthenogenetically produced generation appeared about August 20 and a fourth about August 31. From this time until early October flies and larvæ were almost continually present (though in decreasing numbers), so that it became impossible to distinguish the separate generations; but it would be safe to say that there were at least five parthenogenetic generations during the year, and though a careful watch was kept on the breeding-jar, no males were seen.

The metamorphoses of *Corynoneura* are well known, and nothing need be said concerning this species, except that the food of the larvæ appeared to consist of rather large infusoria (*Paramecium*?) which swarmed in the breeding-jar. The larvæ could be watched under a lens apparently chasing the infusoria, though I could never be quite certain that they swallowed them. When the numbers of the infusoria diminished, the *Corynoneura* larvæ also became much scarcer. Both had disappeared entirely by the middle of October.

During the summer of 1918 I also reared a small number of males and females of *Corynoneura celeripes*, Winn. (or what I believe to be this species), from the pond which had provided me in 1917 with the first *C. innupta*, and also earlier with *Chironomus clavaticrus*. This species (*Corynoneura celeripes*), as already mentioned in the introduction, has been found by Goetghebuer to be occasionally parthenogenetic\*, but I could obtain no evidence that such was the case with any of my specimens. Newly hatched females isolated in separate tubes did not deposit egg-masses, nor did they do so after males had been placed in the tubes with them. It would appear that in this locality *C. celeripes* has not the power of parthenogenesis, and the fact that I failed to obtain any eggs at all may be explained by the not unlikely assumption that it will not pair except under certain natural conditions.

The species which I regard as *C. celeripes* appears to be

\* Since the European species of *Corynoneura* have not yet been critically studied, it is, of course, possible that Goetghebuer's species was really the same which I have here described as *C. innupta*, rather than the one I regard as *C. celeripes*. Should that be the case, there is nothing new in my observations, but they would still form an interesting confirmation of Goetghebuer's.

identical with *C. innupta* in all structural characters, differing only in the much blacker colour of the whole body, which is exhibited particularly in the broad confluent mesonotal stripes. It is a matter for speculation whether *C. innupta* may not be a pale parthenogenetic form of *C. celeripes*. However, it would seem to be impracticable to test this possibility, since the male *celeripes* (= *atra*, Winn.) appears equally indifferent in captivity to females of *celeripes* or *innupta*.

In considering the question of parthenogenesis in *Coryno-neura*, it may not be out of place to mention that a species exists in this country in which the males and females are similar in coloration, and in which, moreover, the male antennæ are hardly more hairy than those of the female. Bred specimens of this species (which is apparently undescribed) were sent me by Prof. J. W. Carr in 1914, and, being under the impression that all were females, I was at first inclined to regard this as another possible case of parthenogenesis; it was only on mounting a specimen for detailed study that presence of males was discovered. In the case of *C. innupta*, however, the occurrence of parthenogenesis is indisputable; since the females hatched from isolated pupæ produced eggs, there is no room for error on account of similarity of the sexes.

The question as to the origin of parthenogenetic species or varieties is too obscure to be profitably discussed, but, given the existence of forms which are capable of asexual reproduction, it is easy to understand how the male sex may be eliminated in a part or in the whole of the range of the species. It has been pointed out by Williams\* that many insects will not pair except under special conditions of space, heat, moisture, etc., and that under the abnormal conditions encountered in Nature by the spread to new localities of a female-producing parthenogenetic race, the male sex may be gradually lost. According to this suggestion, the apparent non-existence of males of *C. clavaticrus* (and perhaps of *C. innupta*) might be due to their having spread from some centre where both sexes existed, and where conditions were favourable to pairing. Another possible explanation would be that climatic conditions prevented pairing during the whole of one flight-season, leaving only unfertilized females to perpetuate the species.

\* C. B. Williams, "Some Problems of Sex Ratios and Parthenogenesis," *Journal of Genetics*, vi. 1917, pp. 255-257.

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CONTENTS OF NUMBER 14.—*Ninth Series.*

	Page
XIII. New and insufficiently-known Moths in the Joicey Collection. By LOUIS B. PROUT, F.E.S. ....	165
XIV. Descriptions and Records of Bees.—LXXXIV. By T. D. A. COCKERELL, University of Colorado. ....	191
XV. Note on <i>Chaudhuria</i> , a Teleostean Fish of the Order Opisthomi. By C. TATE REGAN, M.A., F.R.S. ....	198
XVI. On small Mammals collected by Sr. E. Budin in North-western Patagonia. By OLDFIELD THOMAS ....	199
XVII. Two new Argentine Species of <i>Akodon</i> . By OLDFIELD THOMAS. ....	213
XVIII. New South-American Butterflies. By W. J. KAYE, F.E.S.	215
XIX. Some new Species of the Homopterous Family <i>Pyrrhocoridae</i> . By W. L. DISTANT ....	218
XX. Some Parthenogenetic <i>Chironomidae</i> . By F. W. EDWARDS. .	222

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XXI.—*On the Hymenoptera collected in New Caledonia by P. D. Montague in 1914.* By ROWLAND E. TURNER, F.Z.S., F.E.S.

THE small collection on which this paper is founded was made by the late P. D. Montague in New Caledonia in the year 1914. The types are in the British Museum. A few of the species show a relationship to the Queensland fauna, but absolutely no connection with New Zealand. Of the twenty-eight species noticed, three are undoubtedly recent importations; it is remarkable that none of these have so far been recorded from Australia. Only two other Hymenoptera were included in Mr. Montague's collection, both of them belonging to the Chalcididæ, each represented by a single specimen, one in poor condition, the other belonging to the genus *Podagrion*.

#### Family Evaniidæ.

##### *Evania levipetiolata*, sp. n.

♂. Niger, rugose punctatus, sparse albopilosus; tibiis tarsisque anticis-brunneis; alis sordide hyalinis, stigmatibus venisque fusco-ferrugineis; petiolo nitido.

Long. 4 mm.

♂. Face opaque, very finely and closely punctured and clothed with short white pubescence, with a strong longitudinal carina; cheeks a little shorter than the second joint of

the flagellum. Front and vertex closely and coarsely punctured; posterior ocelli twice as far from each other as from the eyes. Scape shorter than the combined length of the two basal joints of the flagellum; second joint of the flagellum equal to the third, twice as long as the first. Thorax and median segment coarsely rugosely punctured, without spots of white pubescence; parapsidal furrows distinct; the surface of the truncation and sides of the median segment coarsely reticulate; pronotum straight anteriorly, the angles not rounded. Metasternal processes parallel, small. Petiole twice as long as the distance separating it from the scutellum, entirely smooth and shining. Hind tibiae with very feeble spines on the outer margin, the longest calcar about half as long as the hind metatarsus.

*Hab.* Mt. Ignambi, 2200 ft., August 14.

The sculpture, except on the face and petiole, resembles that of *E. impressa*, Schlett., but the petiole is much longer and more slender than in the male of that species.

#### Family Braconidæ.

##### *Ipobracon novocaledonicus*, Szépl.

*Ipobracon novo-caledonicus*, Szépl. Ann. Mus. Nat. Hungar. iv. p. 564 (1906). ♀.

*Bracon Quodi*, Vachal, Revue d'Entomologie, xxvi. p. 121 (1907). ♀.

*Hab.* Pt. Ngea, January 14, 1914; 1 ♂, 2 ♀ ♀.

##### *Cyanopterus rutilans*, sp. n.

♀. Rufa; capite, antennis, valvulisque terebræ nigris, abdomine ferrugineo; pedibus flavis, coxis rufo-testaceis; alis anticis fuscis, fere ad medium flavis; stigmatе flavo; macula sub stigmatе flavo-hyalina; posticis fuscis, dimidio basali flavis.

Long. 9 mm.; terebræ long. 2.5 mm.

♀. Smooth and shining; antennæ nearly half as long again as the whole insect; front minutely punctured and clothed with sparse, short, fulvous hairs; palpi flavo-testaceous. Parapsidal furrows distinct, but very shallow. First tergite as broad at the apex as long; second tergite with an oblique depression on each side at the base, nearly twice as broad at the apex as long and a little more than half as broad again at the apex as at the base. Basal angles of the third tergite with small but distinct areas; second suture smooth, broadly but feebly arched in the middle; valvulæ stout, somewhat thickened at the apex. Stigma large, about half as broad as long; recurrent nervure received distinctly

before the apex of the first cubital cell; first abscissa of the radius short, about one-fifth of the length of the second, first abscissa of the cubitus straight.

*Hab.* Plaine des Lacs, February 26, 1914; 1 ♀.

Nearly allied to the Australian *C. rufus*, Szép., and *C. profiscator*, Fabr., but has the terebra much shorter than in either. The hind legs are without black as in *C. crassicaudis*, Szép., but the terebra is much shorter than in that species.

*Bracon conspiciendus*, sp. n.

♀. Rufa; capite, antennis, terebræ valvulis, abdomineque, segmentis duobus basalibus exceptis, nigris; tergito secundo apice late nigro; pedibus flavo-testaceis; alis anticis fuscis, basi fere ad medium flavis; stigmato maculaque sub stigmatate flavis; posticis flavis, tertio apicali fusco-hyalinis.

Long. 8 mm.; terebræ long. 2 mm.

♀. Smooth and shining; head transverse, slightly narrowed behind the eyes; front subopaque and very finely punctured on the sides, with sparse short black hairs, smooth in the middle. Antennæ as long as the whole insect, scape smooth and shining above, clothed with short sparse hairs beneath. Parapsidal furrows distinct, smooth. First tergite with a deep longitudinal groove on each side; second tergite strongly bisinuate at the base, twice as broad at the apex as at the base, about half as long again as the basal breadth, much longer than the third tergite; valvulæ stout and clothed with short black hairs; hypopygium acute, not reaching beyond the apical tergite. Stigma large, half as broad as long; cubitus sharply bent downwards a little beyond one-third from the base of the first cubital cell; recurrent nervure received just before the apex of the first cubital cell, almost interstitial; first abscissa of the radius about two-fifths of the length of the second, the third a little longer than the second. Tibiæ and tarsi clothed with short golden pubescence; hind calcaria short, about one-quarter of the length of the hind metatarsus.

*Hab.* Mt. Mou, March 12, 1914; 1 ♀.

This is nearly related to *Bracon walkeri*, Turn., from N. Australia, the colour of the wings and the neurination being almost identical. But in *walkeri* the abdomen is wholly red, the terebra slightly shorter and the second tergite a little narrower at the base.

## Family Ichneumonidæ.

## Subfamily PIMPLINÆ.

## Genus NOTIOPIMPLA, Vachal.

*Notiopimpla*, Vachal, Revue d'Entomologie, xxvi. p. 118 (1907).

As Vachal has described four species of this genus and has not selected a type, I select *N. priocnemidea*, Vachal, as the type of the genus. This is a synonym of *Lissopimpla semipunctata*, Kirby; the generic name *Lissopimpla*, Kriechb., 1889, has priority over *Notiopimpla*. *L. semipunctata* is a common Australian insect. The three other species described by Vachal under the generic name *Notiopimpla* belong to the genus *Echthromorpha*, Holmg. *Notopimpla*, Krieg., is a different genus.

*Lissopimpla pacifica*, Morl.

*Lissopimpla pacifica*, Morl. Revision of Ichneumonidæ, ii. p. 35 (1913).  
♀.

*Hab.* Mt. Mou, March 12, 1914; 1 ♂.

*Echthromorpha quodi*, Vachal.

*Notiopimpla Quodi*, Vachal, Revue d'Entomologie, xxvi. p. 119 (1907).  
♀.

*Echthromorpha exquisita*, Morl. Revision of Ichneumonidæ, ii. p. 40 (1913). ♀ ♂.

*Hab.* Mt. Mou, March 14; 1 ♀. Kuakué, May 13, 1914; 1 ♂, 1 ♀.

Morley has overlooked Vachal's paper, hence the synonymy in this genus.

*Echthromorpha ceramocare*, Vachal.

*Notiopimpla ceramocare*, Vachal, Revue d'Entomologie, xxvi. p. 119 (1907). ♀.

*Echthromorpha bitecta*, Morl. Revision of Ichneumonidæ, ii. p. 39 (1913). ♂.

*Hab.* Mt. Mou, March 18; 1 ♀. Dumboa, January 29, 1914; 1 ♀.

*Echthromorpha platymischa*, Vachal.

*Notiopinpla platymischa*, Vachal, Revue d'Entomologie, xxvi. p. 120 (1907). ♀.

*Echthromorpha inermis*, Morl. Revision of Ichneumonidæ, ii. p. 46 (1913). ♂.

*Hab.* New Caledonia.

Not taken by Mr. Montague.

*Theronia simillima*, sp. n.

♀. Fulvo-testacea; antennis valvulisque terebræ nigris; scapo subtus testaceo; mandibulis flavis, apice nigris; alis nitidis, flavidescentibus, venis fuscis, stigmatate fulvo-testaceo.  
Long. 10 mm.; terebræ long. 3.5 mm.

♀. Mandibular teeth almost equal in length, the lower slightly the longer; temples and cheeks not buccate; clypeus transversely deflexed before the apex; antennæ 39-jointed. Carina of the mesosternum well defined; parapsidal furrows distinct, but very shallow; scutellum obliquely depressed anteriorly. Metapleural carinæ distinct and complete; median areola of the median segment not closed at the apex. First tergite distinctly less than twice as broad at the apex as at the base; terebra more than half as long as the abdomen. Hind tarsi not infuscate, the apical half of the tarsal unguis only black.

*Hab.* Ngoé, May 18; 1 ♀.

Very closely allied to *T. fumipennis*, Morl., from N. Queensland, differing in the yellower colour of the wings, in the colour of the hind tarsi, which are black in *fumipennis*, and in the distinctly slenderer first abdominal segment. The antennæ in the type of *fumipennis* have forty-one joints.

*Phytodietus austrocaledonicus*, sp. n.

? *Ophion austrocaledonicus*, Montr. Ann. Soc. Linn. Lyon, n. s. xi. p. 248 (1864).

♀. Nigra; facie macula rotunda, clypeo basi, tegulis, scutello in medio, postscutello macula mediana, scutello postscutelloque linea apicali, segmentoque mediano fascia transversa curvata utrinque postice pallide flavis; pedibus anticis intermediisque testaceis, coxis intermediis nigris; terebra ferruginea, valvulis nigris; alis subhyalinis, iridescentibus, venis nigris.  
Long. 9 mm.; terebræ long. 4 mm.

♀. Antennæ nearly as long as the whole insect, 39-jointed,

third joint nearly half as long again as the fourth. Eyes separated from the base of the mandibles by a distance equal to about one-quarter of the length of the third antennal joint. Head, thorax, and median segment opaque, the face very minutely and closely, the clypeus rather more strongly, punctured. Posterior ocelli a little further from each other than from the eyes; the head transverse, broader than the thorax. Parapsidal furrows distinct, but shallow; median segment not strongly convex, with an almost obsolete median sulcus, minutely punctured, broader than long. Abdomen shining, microscopically punctured, not petiolate; the first segment twice as broad at the apex as at the base, more than twice as long as its apical breadth, longer than the second segment. Tarsal ungues strongly pectinate. Areolet triangular, with a short petiole, receiving the second recurrent nervure at the apex; nervulus interstitial.

*Hab.* Mt. Mou, March 15; 1 ♀.

#### Subfamily OPHIONINÆ.

##### *Henicospilus montaguei*, sp. n.

♀. Testacea; antennis nigris, basi testaceis; alis hyalinis, iridescentibus, stigmatibus venisque nigris; cellula cubitali macula curvata brunnea.

Long. 16 mm.

♀. Very slender. Face very minutely and closely punctured; ocelli large. Antennæ measuring 17 mm. in length, the scape and four basal joints of the flagellum testaceous. Mesonotum subopaque, not punctured. Median segment smooth and shining at the base, the apical slope behind the transverse carinâ coarsely rugose. First abdominal segment long and slender, slightly swollen towards the apex; second about as long as the third and fourth combined, very slender, not compressed laterally, the apical half slightly swollen; the remaining segments strongly compressed laterally. Corneous spot in the cubital cell large at the base, narrow and curved strongly.

*Hab.* Mt. Mon, February 15; 1 ♀.

This somewhat resembles the Queensland species *H. turneri*, Morl., especially in the black stigma, but is without the second spot in the cubital cell, and the apical abdominal segments are not black as in that species.



Subfamily *CRYPTINÆ*.*Buodias unicolor*, sp. n.

♀. Nigra, pedibus palpisque rufo-testaceis; antennis 32-articulatis, articulo quinto apice, articulis 6-13 omnino, 14-15 supra albido-flavis; alis fuscis, venis nigris.

Long. 15 mm.; terebræ long. 4.5 mm.

♀. Third and fourth antennal joints long, about equal in length, the fifth distinctly shorter, the joints beyond the fifth diminishing rapidly in length. Clypeus and face closely punctured; front above the base of the antennæ smooth and shining, somewhat concave, with a low carina reaching to the anterior ocellus, ocellar region finely punctured, vertex smooth and opaque. Clypeus strongly depressed at the apex, the apical margin transverse. Eyes separated from the base of the mandibles by a distance equal to the length of the third joint of the fore tarsi. Pronotum rounded at the angles; mesonotum closely punctured-granulate, the parapsidal furrows deep; mesopleuræ and mesosternum closely punctured, the longitudinal groove between them well developed, mesosternum with a low transverse carina anteriorly; mesopleuræ anteriorly with a marginal carina. Scutellum smooth and shining, strongly convex, with a deep transverse depression at the base; postscutellum obliquely striated. Median segment broader than long, with a small smooth and shining rectangular enclosed area at the base; from each hind angle of the area runs an oblique carina not quite reaching the lateral margin of the segment, the portion of the segment before the carina irregularly punctured-rugulose; the portion behind the carina punctured-rugose, obliquely striated in the middle and also at the base of the posterior truncation; the spines at the hind angles of the dorsal plane stout and well developed; the apex of the dorsal plane is somewhat elevated in the middle and almost carinated in the middle of the apical margin. Abdomen shining; the first segment smooth, longer than the second, the basal half forming a petiole, the apical half rapidly broadened, half as broad at the apex as the second segment, the spiracles nearer to each other than to the apex of the segment; the remaining segments closely and minutely punctured; the second segment longer than broad; the abdomen about half as long again as the head and thorax combined. Areolet rectangular, much longer than high, receiving the second recurrent nervure close to the apex.

*Hab.* Mt. Canala, June 12 ; 1 ♀ .

I doubt if the differences between *Buodias* and *Skeatia* are of generic importance.

### Family Thynnidæ.

*Eirone obtusidens*, sp. n.

♂. Niger ; mandibulis, apice excepto, clypeo, scapo subtus, macula obliqua utrinque inter antennas, orbitis internis, orbitis externis latissime, pronoto margine antico, callis humeralibus, tegulis, mesonoti dimidio apicali linea longitudinali utrinque, scutello macula magna utrinque angulis basalibus, maculaque parva sub alis flavis ; femoribus, tibiis tarsisque testaceis ; scutello macula magna apicali, postscutello, segmento mediano, tergitisque secundo, tertio quartoque testaceo-ferrugineis ; alis flavo-hyalinis, venis testaceis.

Long. 12 mm.

♂. Mandibles much broadened to the apex, the outer tooth acute, the inner tooth not well defined, represented by a broad oblique cutting-edge. Clypeus short and broad, scarcely at all convex, produced triangularly at the apex, sparsely punctured and sparsely clothed with long blackish hairs. Inter-antennal prominence bilobed, not strongly raised. Head transverse, shining and sparsely punctured. Antennæ shorter than the abdomen, third joint of the flagellum distinctly longer than the second, the four apical joints slightly arcuate beneath. Thorax and median segment shining, sparsely punctured, the punctures on the median segment very shallow ; anterior margin of the pronotum distinctly raised and thickened. Abdomen narrow and elongate, segments 2-6 parallel-sided ; very sparsely punctured, the segments scarcely constricted at the base, sternites finely aciculate and more closely punctured than the tergites, the sides of the segments sparsely clothed with black hairs. Seventh tergite long, subtruncate at the apex, rather deeply punctured ; eighth sternite much longer than broad, narrowly subtruncate at the apex, with an apical fringe of short fulvous hairs, not projecting beyond the seventh tergite. Second and third abscissæ of the radius subequal, second recurrent nerve received just beyond one-third from the base of the third cubital cell.

*Hab.* Nonnea, January 23.

Not very near any Australian species of the genus, differing both in the form of the mandibles and of the clypeus. The apical joints of the maxillary palpi are not slender or elongate.

## Family Scoliidæ.

*Scolia* (*Dielis*) *novocaledonica*, nom. nov.

*Elis formosa*, Sauss. Spec. Gen. *Scolia*, p. 208 (1861). ♂ (nec ♀, nec Guér.).

This male is described by Saussure as the male of *formosa*, Guér., but his determination of *formosa* was wrong, the name being applied by him to the common Australian species previously described by him as *tasmaniensis*. True *formosa*, Guér., was described from a female taken in New Ireland, and apparently always has the second recurrent nervure incomplete. Males taken with a female corresponding to Guérin's description in North Queensland differ widely from New Caledonia males, as also does the male of *tasmaniensis*, Sauss. The male of *novocaledonica* closely resembles that of *aurulenta*, Sm., a common Malayan species, but has the first abdominal segment shorter and less narrowed to the base and the seventh tergite and hypopygium narrower, the lateral spines of the latter being nearer to each other than in *aurulenta* ♂. A female from New Caledonia, doubtless the female of *novocaledonica*, closely resembles typical *aurulenta*, but differs in the form of the apex of the radial cell, which is much more oblique and more distant from the costa, produced a little further beyond the second transverse cubital nervure, and more narrowly rounded at the apex; the orange abdominal fasciæ are also much broader than in typical Philippine specimens, though specimens from Ceram have the fasciæ almost as broad. The long calcar of the hind tibia is twice as long as the shorter one, spathulate at the apex, and only a little shorter than the hind metatarsus in *novocaledonica*, whereas in *aurulenta* it is only about two-thirds of the length of the hind metatarsus and more acute at the apex. The puncturation of the scutellum and median segment is also distinctly sparser in *novocaledonica* than in *aurulenta*, especially in the middle. I have not seen Philippine specimens of ♂ *aurulenta*, but several of both sexes from Ceram and Amboina. In the male of *novocaledonica* the radial cell is more truncate at the apex than in *aurulenta*.

The male is the type.

*Hab.* Mt. Tong-houé, January 26; 6 ♂♂. Kuakué, May 14; 3 ♂♂. Paompai, September 15; 1 ♀.

*E. septemcincta*, Fabr., is the male of *E. radula*, Fabr., and not connected with the present species as Saussure thought possible.

## Family Psammocharidæ.

*Priocnemis caledonicus*, Vachal.

*Priocnemis caledonicus*, Vachal, Revue d'Entomologie, xxvi. p. 116 (1907). ♀ ♂.

*Hab.* Noumea, January 24; 2 ♀ ♀. Plaine des Lacs, February 12-20; 6 ♀ ♀.

Closely allied to Australian species of the group of *P. australis*, Guér.

## Family Sphegidaæ.

*Ampulex compressa*, Fabr.

*Hab.* Noumea, January and February; several specimens of both sexes.

This species, probably indigenous in S. India and Ceylon, and ranging as far as Hongkong, has been imported into E. Africa, St. Helena, and other localities, but not into Australia.

*Sceliphron hemipterum*, Fabr.

*Sphex hemiptera*, Fabr. Suppl. Entom. Syst. ii. p. 244 (1798).

*Sceliphron hemipterum*, Saussure, Grandidier, Hist. Madagascar, xx. p. 440 (1892). ♀ ♂.

*Sceliphron Quodi*, Vachal, Revue d'Entomologie, xxvi. p. 116 (1907). ♀.

*Hab.* Noumea, January 20-February 1, 1914; 3 ♀ ♀. Also from Madagascar, Mauritius, and the Seychelles.

Evidently an imported species.

*Chlorion (Proterosphex) fumipennis*, Sm.

*Sphex fumipennis*, Sm. Cat. Hym. B.M. iv. p. 249 (1856). ♀ ♂.

*Sphex antennata*, Sm. Cat. Hym. B.M. iv. p. 252 (1856). ♂.

*Hab.* Noumea, February 1, 1914; 3 ♀ ♀. Kuakué, May 13; 1 ♀. Plaine des Lacs, February 20; 1 ♂. New Caledonia, without other data; 3 ♂ ♂. Also from the whole of Australia (*fumipennis* typical), and from Aneiteum, New Hebrides (*antennata* type).

Kohl gives *fumipennis* as a variety of *luctuosus*, Sm., but the males show that they are specifically distinct. Vachal records *Sphex nitidiventris*, Sm. (= *S. refulgens*, Kohl), from New Caledonia, but this is almost certainly an error of identification. The colour of the wings is not quite as dark in the insular specimens as in the Australian form, but I can find no structural difference.

*Notogonia clypeata*, Sm.

*Larrada clypeata*, Sm. Ann. & Mag. Nat. Hist. (4) xii. p. 294 (1873).  
♀.

*Hab.* Noumea, January 20, 1914; 1 ♂. Also from Api, New Hebrides.

*Pison rechingeri*, Kohl.

*Pison rechingeri*, Kohl, Wien. Denkschr. Akad. Wiss. lxxx. p. 309 (1908).

*Hab.* Noumea, January 20-24, 1914; 2 ♀ ♀. Also from Samoa, Tonga, and Fiji.

This is probably the species identified by Vachal with doubt as *P. punctulatum*, Kohl.

## Family Eumenidæ.

*Eumenes germaini*, Lucas.

*Eumenes Germaini*, Lucas, Ann. Soc. Ent. France, (5) v., Bull. p. lxxvi (1875).

*Hab.* Noumea, January 20-24; 7 ♀ ♀.

*Odynerus caledonicus*, Sauss.

*Odynerus (Leionotus) Caledonicus*, Saussure, Etud. Fam. Vespidae, i. p. 205 (1852). ♂.

*Hab.* Noumea, January 17-23; 1 ♂, 4 ♀ ♀. Pt. Ndea, January 14; 1 ♀.

*Odynerus quodi*, Vachal.

*Odynerus Quodi*, Vachal, Revue d'Entomologie, xxvi. p. 115 (1907).

*Hab.* Noumea, January 24; 1 ♀.

## Family Vespidae.

*Icaria duchaussoyi*, Grib.

*Icaria Duchaussoyi*, Grib, Miscell. Ent. iv. p. 13 (1896).

*Hab.* Baie Ouemo, April 7; 7 ♂ ♂.

*Polistes macaensis*, Fabr.

*Vespa macaensis*, Fabr. Ent. ii. p. 259 (1793).

*Hab.* Baie Ngo, February 10-11; Noumea, January 16-22.

Doubtless an imported species. It also occurs throughout Southern Asia, in most of the islands in the Indian Ocean, also in Fiji, Tahiti, and Hawaii.

Family Apidæ.

*Nomia sicheli*, Vachal.

*Nomia sicheli*, Vachal, *Miscell. Ent.* v. p. 92 (1897).

*Hab.* Noumea, January 23; Baie Ngo, February 10; Baie Ouemo, March 28.

A good series taken.

*Megachile australis*, Lucas.

*Megachile australis*, Lucas, *Ann. Soc. Ent. France*, (5) vi. p. 303 (1876). ♀.

*Hab.* Noumea, January 23; 1 ♂. Mt. Canala, June 12; 1 ♀.

*Megachile albomarginata*, Sm.

*Megachile albomarginata*, Sm. *Descr. New Spec. Hymen.* p. 66 (1879). ♀.

*Hab.* Noumea, January 22–February 1; 2 ♀ ♀. Mt. Mon, March 12; 1 ♀. Baie Ouemo, March 28; 3 ♂ ♂, 7 ♀ ♀.

XXII.—*Descriptions and Records of Bees.*—LXXXV.

By T. D. A. COCKERELL, University of Colorado.

*Anthophora borneensis* (Cockerell).

Both sexes from Sandakan, Borneo (*Baker*). Described as a variety of *A. zonata*. *A. zonata*, var. *andrewsi*, Ckll., also comes from Sandakan (*Baker*).

*Crocisa insulicola*, sp. n.

♀.—Agrees with *C. amata*, Ckll., from Formosa, except as follows: black band across mesopleura narrower; anterior thoracic spots larger, separated by a space in middle no wider than the median stripe; axillæ with rather large blue spots; pygidial plate of abdomen narrower and shining at end, the median keel weak. (In

*amata* the plate is broader at end, with the median keel very strong, and the axillæ have at most a few blue hairs.) Compared with *C. reducta*, Ckll., from Singapore, it is smaller, with the scutellum less deeply incised, the bands at sides of third abdominal segment entire (broken in *reducta*), and spots on fifth segment with posterior side oblique.

Island of Penang (*Baker*, 9595).

Were the range of this insect continuous with that of *C. amata*, it would be regarded as a local race or subspecies; but as it occurs in an island so remote from Formosa, it may represent a parallel or convergent type, not derived from the *amata* stock. It is quite distinct from the other Penang species, *C. ridleyi*, Ckll., and *C. callura*, Ckll.

*Crocisa angulifera*, sp. n.

♀.—Similar to *C. decora*, Smith, from Singapore, but differing thus: anterior spots on thorax separated by an interval equal to the length of one; median stripe narrower; discal spots much smaller; axillæ without spots; inner margins of scutellar lobes without a double curve; basal band of abdomen hardly half as broad; angular projections of blue at sides of first segment very sharply pointed; bands on following segments narrower, and truncate mesad. The black band on pleura is extremely broad. The basitarsi have blue hair on outer side. The scutellum is without blue spots.

♂.—Similar; going to *C. emarginata*, Lep., in Friese's table, but with large teeth on hind femora beneath.

Sandakan, Borneo (*Baker*, 9597, 9596). The female is the type.

*Xylocopa collaris*, Lepeletier.

A female from Sandakan, Borneo (*Baker*, 9603), has the band of white hair on thorax anteriorly narrowed, essentially as in subsp. *penangensis*. In a female from "Walnes S.," South-east Borneo (*Wolf v. Schoenberg*), this band is very broad. Is this a matter of individual variation or dimorphism, or are there two races in Borneo? The Sandakan insect is not *penangensis*, as it differs in the male.

*Trigona itama*, Cockerell, variety *a*.

A specimen from the Island of Penang (*Baker*, 9590) appears to belong to *T. itama*, having a hairy scutellum and all the general features of that species. It differs in having

the face more or less reddish, the malar space largely red, the postscutellum red, and the abdomen reddish brown basally. The wings are somewhat darker than in typical *T. itama*. Possibly the specimen is somewhat immature, but it may well represent a distinct race.

*Trigona melanocephala*, Gribodo.

Sandakan, Borneo (*Baker*, 9588).

*Trigona geissleri*, Friese, variety *a*.

A male from Sandakan, Borneo (*Baker*, 9387), differs in having the hind tibiæ narrower and the tegulæ redder, but in general it has exactly the characters of *geissleri*. A worker from the same place (*Baker*, 9586) has the flagellum black or nearly so above, except at extreme base, and ferruginous beneath. It differs from the Singapore workers, formerly referred to this species, by the darker flagellum, pure black eyes, and dusky sepia-coloured stigma and marginal nervure. It differs from *T. iridipennis* by the dusky wings.

*Trigona confusella*, sp. n.

*Trigona geissleri*, Singapore specimens, Cockerell, Ann. & Mag. Nat. Hist., Oct. 1918, p. 385.

*Worker*.—Length 4–4.5 mm.

Black, with broad abdomen, which may be dark brown or pure black; wings long, very distinctly reddish, but not dark, with clear light ferruginous stigma and nervures; mandibles and labrum red; clypeus dusky red; face covered with thin pale greyish tomentum; antennæ ferruginous, more or less dusky above; tegulæ dark reddish; front and mesothorax polished; scutellum strongly projecting, with much black hair; small joints of tarsi ferruginous.

Singapore (*Baker*).

In Bingham's table this falls in section C, and runs out because the mesothorax is entirely black.

*Trigona sandacana*, sp. n.

*Worker*.—Length about 6.5 mm., anterior wing 6.5 mm.

Shining black, with the abdomen fulvo-ferruginous, the apical part somewhat dusky; head large; mandibles black;



malar space well developed ; antennæ black, with scape red at extreme base, and flagellum dusky castaneous beneath ; face with a little pale greyish hair, but disk of clypeus nude and polished ; occiput with abundant stiff black hair ; mesothorax and pleuræ with thin short pale tomentum and scattered erect black hairs ; scutellum with long black hair ; dorsal surface of metathorax very large, smooth, and highly polished ; tegulæ dark rufous. Wings hyaline, stained with ferruginous, the apical field whitish ; nervures and stigma clear ferruginous. Legs black, with black hair, tarsi red at extreme apex. Abdomen moderately broad.

Sandakan, Borneo (*Baker*, 9593).

Resembles *T. castanea* (*Melipona castanea*, Bingham), but that has the head and thorax mainly castaneous. Also resembles *T. flaviventris*, Friese, but that has the wings quite differently coloured.

*Trigona hæmatoptera*, sp. n.

*Worker*.—Length 6·6 mm., anterior wing 7·5 mm.

Shining black, including the broad abdomen and the legs, except that the tarsi are reddened apically ; head large ; sides of face with thin inconspicuous pale hair ; occiput with stiff black hair ; mandibles dark castaneous ; scape dark castaneous, flagellum nearly black, except at base ; thorax above with stiff black hair, but without any distinct pale tomentum ; pleura with black hair, the lower part with slightly pallid hair ; tegulæ ferruginous. Wings very strongly reddened, the nervures and stigma ferruginous ; trochanters with a red stripe above. Legs with black hair ; hind tibiæ very broad apically. Abdomen with the first two segments highly polished, the others dullish.

Sandakan, Borneo (*Baker*, 9592).

Resembles *T. melanotricha*, Ckll., but easily separated by the very red wings and smaller, paler tegulæ.

*Trigona atomella*, sp. n.

*Worker*.—Length 2·5 mm.

Head, thorax, and legs shining black, small joints of tarsi testaceous ; abdomen rather dilute sepia-brown, the hind margin of first segment broadly pellucid whitish ; front with a deep median sulcus ; mandibles and labrum ferruginous ; malar space short and black ; lower part of clypeus suffusedly reddish ; face canescent with thin white hair ; scape ferruginous, flagellum blackish ; scutellum fringed

with pale hair; tegulæ rufo-piceous. Wings hyaline, faintly dusky, stigma and nervures dilute sepia. Abdomen rather broad, shining.

Island of Penang (*Baker*, 9585).

Related to *T. canifrons*, Sm., but known by the minute size.

*Trigona breviceps*, sp. n.

*Worker*.—Length about 6 mm.

Shining black, the legs and antennæ black, but scape testaceous at extreme base; head unusually broad and short, the facial quadrangle very broad; malar space short; mandibles and labrum black; occiput with erect black hair; thorax above with black hair; tegulæ black. Wings dilute fuliginous, stigma and nervures dark brown. Abdomen moderately broad.

Sandakan, Borneo (*Baker*, 9591).

Related to *T. itama*, Ckll., but easily separated by the shorter head and shorter malar space.

*Ceratina sexmaculata*, Smith.

Sandakan, Borneo (*Baker*, 9280).

*Ceratina penangensis*, sp. n.

♂. (Type).—Length about 6.5 mm.

Closely and strongly punctured; general colour olive-green, shaded with brassy, the sides of face almost golden, sides of front flushed with lilac, disk of mesothorax strongly suffused with lilac; abdomen beyond the third segment glaucous-green, the hind margin of fourth flushed with golden, especially in middle; mandibles black; labrum with a large semicircular yellow mark, emarginate above; clypeus with a broad yellow band, having a triangular expansion on each side below; antennæ black; area of metathorax shining golden, emarginate posteriorly in middle; tegulæ black. Wings strongly dusky; second s.m. narrowed almost to a point above, and receiving first r. n. far beyond middle; anterior femora and tibiæ with a yellow stripe on outer side; hind tibiæ with a yellow spot at base; abdominal segments 2 and 3 each with a pair of transverse smooth lines; end of abdomen broadly truncate, the corners of the truncation obtuse, and with a small dentiform angle at each side; underside of abdomen banded with light glaucous-green.

♀.—Length about 8 mm.

Labrum wholly black; yellow clypeal band very broad, without lateral extensions; yellow marks on legs reduced to a small spot at base of anterior tibiæ. The tubercles are not yellow in either sex. The ♀ has the second s.m. much broader above.

Type (♂) from Island of Penang (*Baker*); ♀ from Singapore (*Baker*, 9288).

By the bronzy colour it resembles *C. corinna*, Nurse, but that has yellow clypeus and tubercles.

*Ceratina ridleyi*, Cockerell.

Island of Penang, a typical male (*Baker*, 9284).

*Ceratina xanthura*, sp. n.

♂.—Length 8 mm.

Similar to *C. ridleyi*, but differing thus: smaller; no black bands at sides of clypeus; supra-clypeal area yellow with black corners; sides of prothorax pale yellow; meta-thorax all yellow except a broadly triangular basal area; first abdominal segment yellow with two black marks; two very broad pale yellow bands occupying bases of second and third segments and narrower apices of the ones before; apex weakly tridentate as in *C. ridleyi*, but broader and reddish yellow instead of black. The last character also distinguishes it from *C. kosemponis*, Strand, which is closely allied, and agrees in the yellow face. The yellow mark above the eyes is large and fusiform, not minute as in *C. flavopicta*, Sm. The mesothorax has four yellow stripes; the scutellum, axillæ, and postscutellum are yellow.

Island of Penang (*Baker*, 9285).

The following table separates a series of species related to *Ceratina hieroglyphica*, Smith, but apparently distinct from it and from each other. There is a good deal of confusion concerning *hieroglyphica*; thus a specimen received as such from Mr. Sladen, collected in the Khasia Hills, India, proves to be really *C. lepida*, Smith. This is the specimen referred to in *Ann. & Mag. Nat. Hist.*, Dec. 1899, p. 406. Smith himself evidently confused more than one species under *hieroglyphica*, since he gives the distribution as Northern India, Hong Kong, and the Philippine Islands.

In the table below, *C. hieroglyphica* falls with *incerta*, and the latter may prove to be no more than a subspecies, but there is a marked difference in the colour of the legs:—

Females .....	1.	
Males .....	4.	
1. Lateral face-marks divided. (Philippine Is.)		<i>tropica</i> , Crawford.
Lateral face-marks entire .....	2.	
2. Pleura with a yellow spot behind each tubercle .....		<i>accusator</i> , Ckll.
Pleura without such spots .....	3.	
3. Tubercles black .....		<i>pyramidalis</i> , Ckll.
Tubercles yellow .....		<i>incerta</i> , Ckll.
4. Abdomen beyond third segment entirely black, except a small inconspicuous spot on each side of fourth .....		<i>selangorensis</i> , Ckll.
Abdomen beyond third segment banded with yellow .....	5.	
5. Apex with a conspicuous median point; sixth segment with a large yellow mark .....		<i>collusor</i> , Ckll.
Apex without a distinct point, if any .....	6.	
6. Upper end of clypeus broadly black .....		<i>accusator</i> , Ckll.
Upper margin of clypeus narrowly black .....	7.	
7. Thorax laterad of parapsidal grooves with a large impunctate area, on which is a yellow mark; hind tibiæ black with about basal half of outer side yellow; hind basitarsi black; tegulæ piceous with rufous margins.....		<i>incerta</i> , Ckll.
Thorax laterad of parapsidal grooves entirely black and without punctureless area; hind tibiæ yellow, black on apical half within; hind basitarsi yellow; tegulæ testaceous ..		<i>conscripta</i> , Ckll.

*Ceratina pyramidalis*, sp. n.

♀.—Length a little over 9 mm.

Black, including legs, antennæ, and mandibles, but with the following bright yellow markings: U-shaped mark on labrum, cone-shaped or pyramidal mark on clypeus, broad but short lateral face-marks (not reaching level of antennæ), broad stripes (as long as eyes) on cheeks; slender line at each side of prothorax on upper margin, large mark on scutellum deeply notched in front, short line on post-scutellum, median mark on first abdominal segment, transverse mark at each extreme side of third, interrupted band (very slender sublaterally) on fourth, entire band (very slender laterally) on fifth segment. Tegulæ rufo-piceous; wings dilute fuliginous; mesothorax, except anteriorly, polished and impunctate.

Singapore (*Baker*, 9282).

Related to *C. perforatrix*, Smith, but the clypeal mark is quite differently shaped, and the legs have pale hair. It may be no more than a subspecies, but at present intermediates are unknown.

*Ceratina incerta*, sp. n.

♀.—Length 7·5–9·5 mm.

Black, including antennæ, mandibles, labrum, and greater part of legs; bright yellow markings as follows: reversed T (with very broad stem and long arms) on clypeus, supra-clypeal band (angulate above in middle), claviform lateral face-marks (the narrow upper end above level of antennæ), pair of frontal spots, band on cheeks (but no spots above eyes), upper margin of prothorax (slightly interrupted in middle), apical half of tubercles, broad subtriangular area on scutellum, mark on apical part of anterior femora, anterior tibiæ on outer side except apex (on inner face they are rufous), median mark on first abdominal segment, slender band on second segment interrupted in middle but swollen to a large patch at each side, broadly interrupted band on third segment, narrowly interrupted one on fourth, entire band on fifth having middle third broad and lateral thirds linear; four rather short slender lines on mesothorax. Mesothorax at sides densely punctured to level of anterior end of lateral yellow stripes, and beyond that polished; tegulæ piceous margined with rufous. Wings dusky; hind tibiæ with a prominent spine on outer side before the middle; anterior coxæ with a large tubercle in front.

♂.—Length about 7 mm.

Characters as given in table above; also the following: labrum with a yellow spot; clypeus yellow, with narrow black upper and lateral margins; yellow on front legs more extensive; middle tibiæ yellow on outer side; band on second abdominal segment reduced to the lateral patches; sixth segment with a large yellow patch; apical plate without a projecting point.

Singapore, both sexes (*Baker*, 9283); Island of Penang, female (*Baker*, 9290). The type is a female from Singapore.

Readily known from the true *C. hieroglyphica* by the absence of yellow on middle and hind legs of female, and the long lateral face-marks and cheek-bands. Compared with *C. morawitzii* the female has a higher clypeus, differently shaped lateral marks, &c.

*Ceratina conscripta*, sp. n.

♂.—Length about 6 mm.

Similar to *C. incerta*, but differing as shown in table above. Labrum yellow except at sides; antennal fossæ

very deep; lateral face-marks filling space between clypeus and eye, but above that linear, restricted by the fossæ; scape black, with a minute yellow mark at extreme base; band on cheeks restricted to upper part; yellow of prothorax continuous with that of tubercles; knees, tibiæ, and tarsi all yellow, the middle and hind tibiæ with black mark on inner side; first abdominal segment with a yellow band, excavated posteriorly on each side.

Island of Penang (*Baker*, 9286).

The yellow marks have been reddened by cyanide. Resembles *C. morawitzii*, but the end of the abdomen is quite different.

*Ceratina selangorensis*, sp. n.

♂.—Length about 6 mm.

Markings in general similar to other males of this group, but with the following special characters: stripe on cheeks slender and rather short; lateral face-marks claviform, a broad black area between yellow of clypeus and of lateral marks; scape entirely black; mesothorax entirely black (the punctured area in front broad); yellow of upper border of prothorax continuous with that on tubercles; no spot behind tubercles; yellow patch on scutellum broad and obtuse laterally; knees, tibiæ, and tarsi yellow, all the tibiæ with a large patch on inner side; first abdominal segment with a small spot at each side, but no median one; second and third segments with a large mark on each side, but no band; fourth with minute very obscure lateral spots; remaining segments wholly black. Clypeus high, with a delicate median keel and a few large punctures; tegulæ rufo-testaceous. Wings moderately dusky; lateral areas of mesothorax well punctured, with a small shining space posteriorly; area of metathorax rugose; apical plate of abdomen broadly rounded, with a minute inconspicuous median point.

Selangor, Malay Peninsula (*Baker*, 9287).

I follow the spelling of the locality on the label. Wallace's map has it Salangore, while Bartholomew's Atlas has Selangore.

*Ceratina collusor*, sp. n.

♂.—Length about 7 mm.

Markings as usual in the group, but with the following special characters: labrum yellow except at sides; clypeus with only a slender black marginal line; lateral face-marks

with upper part evanescent; scape with a large yellow spot at base and a smaller one at apex; yellow of upper border of prothorax continuous with that on tubercles; no spot behind tubercles; mesothorax with four rather short stripes; yellow area on scutellum very large, quadrate, about twice as broad as long; about half of anterior femora, and all of their tibiæ and tarsi yellow; middle and hind knees, and tibiæ on outer side, yellow; middle tarsi pallid, but hind basitarsi blackened; first abdominal segment with a band enclosing two black spots; second segment with entire band, having median angle, and greatly enlarged at sides; third with slightly interrupted band; fourth and fifth with bands and sixth with a large yellow patch. Clypeus with three faintly indicated keels; lateral areas of mesothorax with posterior half impunctate; area of metathorax with little sculpture; anterior coxæ prominently angulate; apex of abdomen with a median denticle. Tegulæ rufous; wings dusky.

Singapore (*Baker*, 9281).

Allied to *C. acuticauda*, Ckll., from Java, but that has the scape black and the apical plate of abdomen subangulate laterally. Also allied to *C. philippinensis*, Ashm., which it resembles in the ornamentation of the scape, but differing in the sculpture of lateral areas of mesothorax.

*Ceratina accusator*, sp. n.

♀. (Type.)—Length about 6·3 mm.

Black, with the tarsi ferruginous, and bright yellow markings as follows: reversed T on clypeus (with stem shorter than arms), supraclypeal band, frontal spots, rather narrow claviform lateral face-marks (the lower end turned inward, the upper going to level of antennæ), rather long stripe on cheeks, upper border of prothorax, tubercles, spot behind tubercles, four stripes on mesothorax (the lateral ones very short), semicircular patch on scutellum, anterior femora apically, middle knees, anterior and middle tibiæ on outer side, spot at extreme base of hind tibiæ, double median spot on first abdominal segment and indistinct lateral ones, sides of second and third segments with large marks resembling a hand with index-finger pointed, and bands on fourth and fifth segments, narrowed sublaterally. Scape slender, reddened in front, especially toward base; lateral areas of mesothorax with posterior half impunctate; base of metathorax finely rugose; tegulæ ferruginous. Wings brownish; hind tibiæ with a small projection on outer side; hind tibiæ

with very long hair ; underside of abdomen with glittering white hair.

♂.—Length about 5.5 mm.

Like the female, but clypeus yellow except the sides and very broad upper margin ; labrum with a very large yellow spot ; supraclypeal mark broadly triangular ; scape black, faintly reddish at extreme base ; stripe on cheeks shorter ; all the tibiæ yellow on outer side ; band on sixth abdominal segment. Apex of abdomen broadly rounded and obtuse.

Island of Penang (*Baker*, 9289).

Related to *C. obtusicauda*, Ckll., from Java, but distinguished by the spot behind tubercles, a character of *C. philippinensis*. The specific name is derived from the marks at the sides of the second and third abdominal segments, resembling hands pointed at each other in accusation. The sculpture of the lateral areas of mesothorax is unlike that of *C. philippinensis*.

XXIII.—*On a new Genus and Species of Bird of the Family Drepanididæ from the Hawaiian Islands.* By R. C. L. PERKINS, D.Sc., F.Z.S.

DYSMORODREPANIS, gen. nov.

Nearest to *Psittacirostra*, but distinguished primarily by the form of the beak. Maxilla strongly decurved, compressed so as to be cariniform, and extending beyond the mandible for a distance equal to one-third (or more) of its full length. The nostril is subreniform, the lower margin of the operculum being rounded ; numerous antrorse pale setiform feathers project over it from the base, and a few black setæ, longer than these, reach right to the apex. Seen in profile the mandible has its upper and lower margin subparallel on the basal part, but before the middle of its length they curve strongly upwards. The tip alone is received in the maxilla, about midway between its apex and the nostril, so that for most of the length of the mandible there is a free space between its edge and that of the maxilla and no co-adaptation at all. The upper margins of the mandibles are strongly bent inwards and would afford protection to the tongue lying in the deep channel between the inner edges. The tongue, which had been dry for years, even after long soaking in water and subsequently in potash, could only be very imperfectly studied, but apparently it agrees in general with



Gadow's description of that of *Loxioides*. It is not acute at the tip and is apparently emarginate there, with the edges microscopically serrulate. The tenth primary is rudimentary as in other Drepanididæ, the sixth, seventh, and eighth are equal and form the tip of the wing; the ninth is notably shorter than these, as also is the fifth; the latter is not so short as the ninth, however, while the fourth is a little shorter; third, second, and first decreasing in length. Tail rather short. Metatarsi short, only about equal in length to those of *Oreomyza montana* of the same island, but far stronger and stouter. In front the two basal scales are not long and apparently not very clearly divided, the second being not so long as wide; the third is quite elongate, subequal to the fourth, which is twice as long as wide in this dry specimen; the fifth still more elongate and deeply emarginate at the apex, its inner apical angle strongly produced, its outer one still more strongly, so that the short scale following is deeply enclosed in the emargination.

*Dysmorodrepanis munroi*, sp. n.

General colour above greyish olivaceous, less grey on the middle of the back and on the rump; head above in front and an indefinite stripe above and extending behind the eyes much more yellow; underparts of neck and body entirely pale, appearing white, irregularly suffused with pale yellow. Wings with all the primaries except the outer one with very narrow but conspicuous yellowish margin outwardly, this colour becoming white (or hardly tinged with yellow) on the distal ends. The inner web is largely white in all these feathers basally, the white gradually extending on the inner primaries and in these reaching the tip of the feathers. The inner secondaries are broadly white-tipped and margined with white inwardly, the innermost ones with the whole inner web white. The breadth of the white tip decreases towards the primaries. The rectrices are dark, the outer margins narrowly olivaceous.

Mr. Munro's notes give the following additions:—"Length six inches, sex not determined, the legs muscular with strong sinews, the jaw muscles more than usually developed, skull round almost like a marble, eyes large for the size of the bird, the iris dark brown, as also the upper mandible, the lower light brown, lighter beneath; legs light slate-colour, the soles of feet yellowish."

*Hab.* Lanai. "This specimen, the only one of the species that I know of, was taken in the Kaiholena valley, Lanai, at

an elevation of about 2000 ft. The stomach and throat were full of the ripe berries of *Urera glabra*, which is common in the locality" (Munro).

Mr. Munro, who has now for some years been permanently resident on Lanai, writes further that though he thoroughly explored the forest on that island in the years 1914, 1915, 1916, and subsequently, he has only twice come across birds that he suspects of being the same species as the one described. "On March 17th, 1916, further up the same valley, where it is very densely wooded, I heard two or three birds calling to one another, the cry being less sweet and not so loud as that of the Ou (*Psittacirostra*), and I watched one on the bare branch of a tree-top a short distance away. It called regularly at intervals and kept moving its head, stretching its neck and turning on its perch without changing its place on the branch. It looked smaller than an Ou and more active, but less so than *Chlorodrepanis*. The form of its bill could not be made out, but it was not that of the latter.

"On Aug. 12th, 1918, in a patch of dry forest on the south-west side of the mountain, at about the same elevation as that where the original specimen was obtained, I saw another bird, and was near enough to note the light colouring round the eye, but not the form of beak. Some of its notes were like those of *Psittacirostra*, but others new to me, especially a low squeak or whistle, and it was too small for that bird, not so thick-set, and with a very short tail. So I feel sure it was the other."

As so few specimens have been seen by so skilled a collector, the bird must be a great rarity, but its discoverer hopes that it may increase in numbers, as the forest is now rigidly protected and rapidly recovering. When I collected on Lanai in 1893 and subsequently the forest was in a deplorable condition, being rapidly destroyed by countless wild goats, and it was also full of wild pigs and cats that had run wild. The latter, as I have elsewhere recorded, were destroying native birds wholesale. Only on the sheer sides of the mountain and on a very small part of the narrow backbone was the forest in a natural condition. Neither Lord Rothschild's collectors nor myself ever found a specimen of this bird.

The specimen obtained was in a partially moulting condition, but the wing-feathers are fully grown. The lack of adaptation of mandible and maxilla recalls the condition in *Heterorhynchus wilsoni*, but it is much more exaggerated.

Paignton,  
Jan. 7th, 1919.

XXIV.—*Notes on Myriapoda*.—XVI. *Some Observations on Nomenclature*. By HILDA K. BRADE-BIRKS, M.Sc., M.B., Ch.B., L.R.C.P., M.R.C.S., and the Rev. S. GRAHAM BRADE-BIRKS, M.Sc.

IN a recent contribution to this Journal (1), in which Mr. R. S. Bagnall has dealt most admirably with the synonymy of three Leachian species of Diplopoda, our colleague evidently has in view the same objects which have actuated us in preparing the present paper—in the first place, the solution of some of the nomenclatural difficulties which beset the path of the modern student of English myriapodology, and then, again, the restoration of old specific names to their rightful place in our system of classification.

Not long ago we cited (2) in tabular form the species mentioned as English by Newport in his list of 1844 (5) and his catalogue of 1856 (6), adding some remarks of our own about synonymy in the last column. On that occasion we were doubtful about the validity of a number of names in common use. The specific designations we are about to advocate in the present note are, with the exception of the last, all to be found in the first column of the table to which reference has just been made (2), and they are there prefixed by the numbers which will now be set against them.

Passing through London recently, we paid a visit to the British Museum (Natural History), where we were courteously permitted to examine some of the types referred to in Newport's list (5) and catalogue (6), as well as other dry specimens of English "Myriapoda" dating back many years, and named, therefore, no doubt according to type. Subsequently, in the present note, we shall refer to certain of these old and valuable specimens (some of which may quite well be types, even though they are not labelled as such) as "classical examples."

As a result of our examination, we feel justified in drawing attention to several points connected with nomenclature, and we now advocate the use of the specific names which head the following paragraphs.

We take this opportunity of thanking Mr. A. S. Hirst, of the Department of Zoology at Cromwell Road, for facilitating our examination of a small part of the valuable collection of specimens under his care.

## CHILOPODA.

5. *Lithobius melanops*, Newport.

The examination of a classical example of Newport's species confirms our contention (2) that *Lithobius glabratus*, C. L. Koch, is a synonym.

## DIPLOPODA.

20. *Craspedosoma rawlini*, Leach.

We agree with Mr. Bagnall (1) in regarding *Craspedosoma simile*, Verhoeff, as a synonym.

21. *Polymicrodon polydesmoides* (Leach).

Again we agree with Mr. Bagnall (1). *Polymicrodon latzei* (Verhoeff) must be considered as a synonym. We have seen Leach's type.

23. *Iulus (Ophiulus) pilosus*, Newport.

A labelled classical example—a male—proves conclusively that this is *Iulus (Ophiulus) fallax*, Meinert. As Newport's name is of earlier date, it takes precedence.

24. *Tachypodoiulus niger* (Leach).

We saw Leach's type, and, as it exhibits the characteristic striation of the prozonites of *Tachypodoiulus albipis* (C. L. Koch), the synonymy so often suggested is established in favour of Leach's name.

27. *Cylindroiulus punctatus* (Leach).

The type appears to be a female, but there can be little reasonable doubt that this is *Cylindroiulus silvarum* (Meinert). Externally the two are identical, and no other club-tailed species of these dimensions has been recorded from England. Meinert's name must therefore give place to Leach's.

28. *Brachyiulus (Microbrachyiulus) pusillus* (Leach).

We have seen Leach's type. We agree with Mr. Bagnall (1) in regarding as synonymous with this species *Brachyiulus (Microbrachyiulus) littoralis* (Verhoeff). Of course, Leach's name takes precedence.

29. *Cylindroiulus latistriatus* (Curtis).

In 1844 John Curtis, F.L.S., contributed a paper (3) to the 'Journal of the Royal Agricultural Society,' in which he gave a brief description of several English Diplopoda. One of these he calls "*Julus Londinensis* of Leach," and gives two excellent figures, which show conclusively that even at that early date the typical "*Julus*" *londinensis*, Leach, was confused with the animal often known since (especially on the continent) under that name, for Curtis's figures are obviously of *Cylindroiulus londinensis teutonicus* (Pocock), which is tailless, whereas the true *Cylindroiulus londinensis* (Leach), which Curtis *thought* he was figuring, has a clubbed tail and is a much larger animal. What Curtis meant by "*Julus Londinensis* of Leach" is important when we come to his description of "*Julus*" *latistriatus*.

Curtis (*loc. cit.*) tells us that his specimens of *latistriatus* were sent to him from Namptwich (Nantwich), Cheshire, where they constituted a pest in garden and greenhouses. In London we saw the specimens Curtis presented to the British Museum (5), and we must regard them as his types. Externally they agree with *Cylindroiulus britannicus* (Verhoeff), and when we remember that this species is well established in the north of England (it is a pest in a greenhouse at Darwen, Lancashire), we can have little doubt about the synonymy of the two. For these reasons we strongly advocate the restoration of the specific designation used by Curtis and the rejection of that of Verhoeff which was established in 1891.

Curtis's paper (3) was overlooked by Latzel when he compiled the bibliography for his monumental work (4), and it is probably unknown to many myriapodologists. We therefore append the original description of the species with which we are now especially concerned:—

"*Julus latistriatus*, Curtis, the broad-lined Snake-millipede, is 5 or 6 lines long, of a dull ochreous lilac with a purple tint, cylindrical, very shining, sparingly striated, the lines not approximating; down each side is a row of dots, and the penultimate segment is not mucronated, but slightly angulated and rounded, as in *Julus Londinensis*; the antennæ are stout and rather short, pilose and capitate, second joint the longest, the apex very pubescent."

Curtis adds that he at first took this "*Julus*" for the young of "*londinensis*," but that the striæ were twice as far apart as in any other species he had examined.

30. *Trichoblanius guttulatus* (Bosc).

Examination of several classical examples of *Julus pulchellus*, Leach, shows sufficiently conclusively that they are referable to the blind species *Trichoblanius guttulatus* (Bosc), which was established before Leach's name was given.

Although it does not concern our present study very closely, we may add that it follows, of course, that the specific name *pulchellus* is obsolete and cannot be used for the species furnished with ocelli often referred to under that name. For this animal we must in future use the later designation *Nopoiulus venustus* (Meinert).

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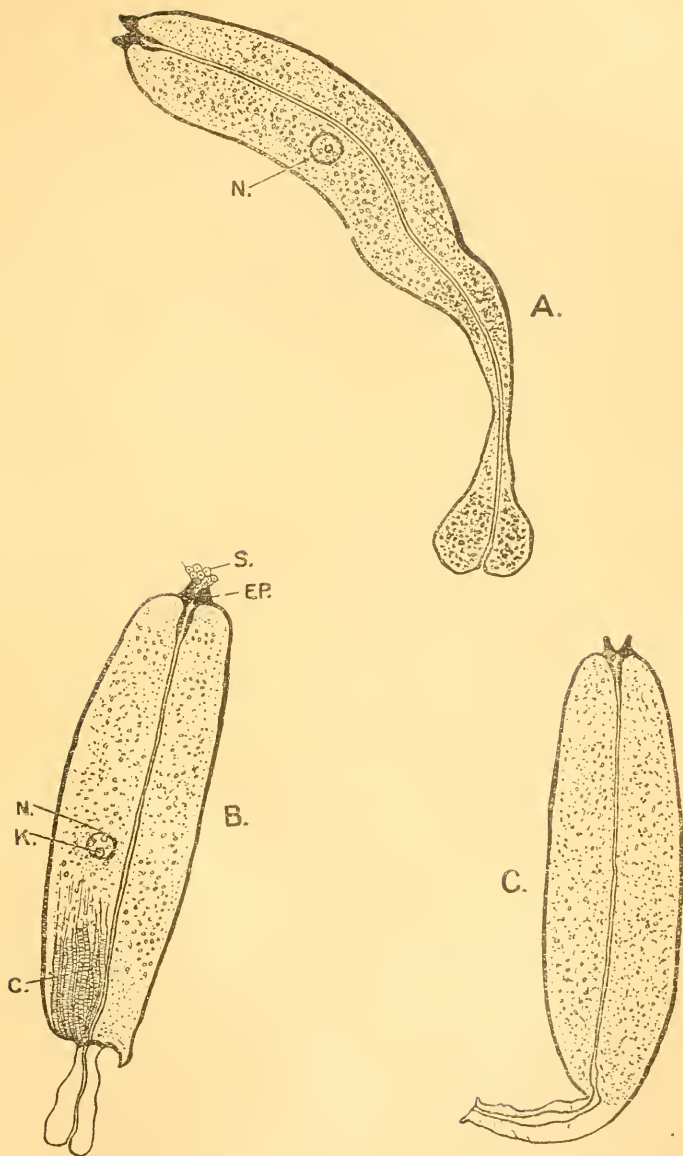
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16 Bank Street, Darwen, Lancashire,  
15th January, 1919.

XXV.—*Some Observations on Pleurocystis cuénoti*, Hesse, 1909, a Cœlozoic Parasite of the Earthworm. By W. HAROLD LEIGH-SHARPE, B.Sc. (Lond.).

ON February 14th, 1918, upon opening a *Helodrilus* (*Allolobophora*) *longus*, Ude, obtained from Red Lion Square, Holborn, London, I discovered seven specimens of diploids (fourteen individuals in all) of the gregarine parasite *Pleurocystis cuénoti*, Hesse, 1909, some of which I have herein figured.

Fig. 1.



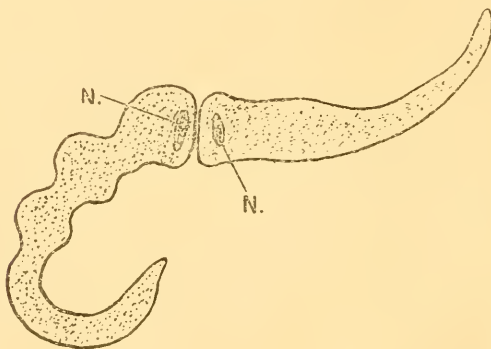
*Pleurocystis cuénoti*. Three diploids, **A, B, C**.

N., nucleus; K., nucleoli; EP., epimerite; C., cytomymes; S., cells from the seminal funnel of the earthworm.

The parasites reposed in the body-cavity of the worm, in segments 10 and 11, all but one diploid being on the host's right side. They appeared of an opaque china-white colour, the largest (fig. 1, A) being 5 mm. in length, the others 4 mm. All were laterally bowed in shape, and curved round the œsophagus of the worm between the calciferous glands and the pouch, but attached by their anterior extremities to the seminal funnels. The worm had been killed an hour and a half previous to dissection by immersion in methylated alcohol, and none of the parasites showed any sign of life.

It is remarkable that such a large number of parasites should occur within one host, and curious that here we have two individuals permanently associating as one, though not conjugating.

Fig. 2.



*Monocystis agilis*. Two conjugants in polar apposition.

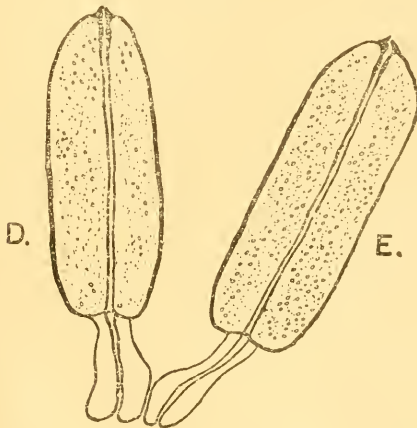
N., nucleus.

The unique presumed conjugation of *Monocystis magna*, Schmidt, has been described by Cuénot (1900) alone, who gives a figure which, to my mind, is not as satisfactory as might be, since it shows the supposed conjugants so clearly as two separate individuals, instead of being apposed in such a way as to look like one individual (fig. 1), the lines of demarcation between them superficially resembling the alimentary canal of some single animal. The association in this species alone was said to be longitudinal—a fact which appears to have been known at the earliest to Bosanquet (1894), who mentions it casually in describing another species, and even admits *en passant* into his paper a very



inadequate figure. In *Monocystis agilis* and other species the application of the conjugants is polar or "end-to-end" (fig. 2). Since the parasites are attached to the seminal funnels of the hosts permanently, as all agree (and they do not become detached *post mortem*), it is the close proximity of the individuals to one another which determines their association into diploids *inter se*, which must therefore of necessity be longitudinal. A curious confirmation of this is shown in fig. 3 in the case of the diploids D and E, which are partially attached to one another at their posterior extremities, from which I infer that diploidal association probably *always begins at this end*.

Fig. 3.



*Pleurocystis cuénoti*. Two diploids, **D** and **E**, partially attached to one another at their posterior extremities.

But Hesse (1909) pointed out that *Monocystis magna*, Schmidt, differed so materially from other species that he proposed for it the generic name of *Nematocystis*. Further, that there was existing another animal, which, agreeing in the main with the characters of *Monocystis* rather than with those of *Nematocystis*, became coupled, in a longitudinal manner, with a partner for life like *Nematocystis*, and not merely during the process of conjugation. To this form he gave the name of *Pleurocystis cuénoti*, and, while admitting that it is very rare, remarks that the animals are always in the diploidal condition and *never found singly*. After giving

careful consideration to the matter of the claims of *Nematocystis* and *Pleurocystis* as independent genera, I have come to the conclusion that the characters of my specimens agree in the main with those diagnostic of *Pleurocystis* except in regard to a small discrepancy as to size. Hesse states that *Pleurocystis* is 2 mm. long and *Nematocystis* 5 mm., whereas my specimens are of the length of 4-5 mm. If the animal is as rare as Hesse implies, it is possible that it may attain dimensions greater than that mentioned by him, or, again, that an English variety may be larger than the French one which he found in and around Dauphiné. There exists, as far as I can ascertain, no previous record of *Pleurocystis* occurring in the British Isles, though it has possibly been found and confused with the presumed conjugation stage of *Monocystis magna*, which Hesse has now determined is not a conjugation but a life-association into diploids, thereby deciding him to alter its name to *Nematocystis magna*.

The statement of Ceconi (1903) that in *Monocystis agilis*, at any rate, each conjugant separately forms a cyst around itself, which afterwards coalesces with that of its partner, was scouted by Cuénot. Such is not true at any rate for *Pleurocystis*, where the double (cuticular) separation between the individuals is *never broken down*. The cuticle exhibits a network of fine striations, and as the cytoplasm shrinks away from it by plasmolysis, it may perhaps have been mistaken for a cyst. Some of the specimens were ruptured, and others easily became so at the slightest touch. The endoplasm was plentifully stored with paramylum (or paraglycogen). Specimen A, which is also the largest, being 1 mm. longer than any other diploid, is markedly different from the rest. It exhibits a kind of caudal formation, as though it had been killed while making Euglenoid movements; further, the cytoplasmic contents extend right to the posterior extremity, and are more densely granular. Conversely, the other specimens present a normal specific outline, the cytoplasm is withdrawn from the posterior extremity as though shrinkage was occurring previous to cyst-secretion. From these observations I infer that A is an earlier, and possibly the earliest, stage of diploid association, and that the other figures represent subsequent stages. The figures of no other observer represent any such caudal formation.

Though I have figured a nucleus in two individuals, these were not apparent through the cytoplasm; but, upon rupture of the cuticle, when the contents become extruded the nucleus is plainly visible. The nucleus is situated about half-way

along the animal, or anterior to that position (specific character), not at the extreme anterior end as in *Monocystis agilis*, is enclosed in a well-marked nuclear membrane, and contains numerous nucleoli. (generic and specific character).

The posterior extremity of B exhibits, under a high magnification, in the inner portion of the ectoplasm, a layer of contractile fibrillæ which have been called myocytes, which I interpret to mean "muscle-cells." As the organism is unicellular, I propose that they be called *cytomyomes*, which I interpret as "cell-muscles."

As this species is a permanently fixed parasite upon the seminal funnels, one might reasonably expect to find some organ of attachment. As to whether one exists there appears to be some difference of opinion, none being mentioned by most of the earlier authors cited for *Nematocystis* (*Monocystis*) *magna*. I am of the definite opinion, however, that the cuticle of the anterior end is prolonged into a blunt petal-like projection (the equivalent of the epimerite of other Gregarines), which stains with picro-carminé like the remainder of the cuticle, is unprovided with hooks, and to which the cells of the seminal funnels of the earthworm are in several cases still adhering. This accords with a passage which Hesse quotes from Bütschli (1882), and not with his own observations, for while he appears to me to describe some organ of attachment, yet he denies that it is in any way an epimerite. I agree with Hesse that it comes in contact, by boring, with many host-cells, and is not attached to one only as he states is the case in *Nematocystis*.

No spermatozoa of the worm were found in the seminal vesicles, or round the seminal funnels, or attached to any of the diploids, such as other observers have figured, nor were any "tails" to be discovered. This may be because the worm had recently shed all its spermatozoa in the regular breeding-season, which obtains about this date, since the seminal vesicles were very small, or because the large number of parasites present had disintegrated and digested them all.

In specimens stained with Ranvier's picro-carminé 25 min. only the cuticle absorbed the carminé, while all the cell-contents became yellow from the action of the picric acid. In specimens stained with Meyer's hæmalum 5 min. both cuticle, cytoplasm, and nucleus became purple, as also the seminal funnel-cells of the host.

The partners of a diploid appear to adhere to one another by a mucilaginous extra-cuticular secretion of "cement"-substance analogous with that which binds the individual

cells of a filament of the alga *Spirogyra* to one another, and is affected by similar stains (e. g. Bismarck brown). It is unaffected by dilute (1 %) acids (cf. the cysts), but the individuals can be made to part from one another by pressure on the coverslip, though not without rupture of the cuticle—which is evidence against their permanent fusion into one organic individual.

#### SUMMARY.

- (1) *Pleurocystis* has established claims to be considered an independent genus.
- (2) It occurs in the same host (*Helodrilus longus*) both in England and France.
- (3) The individuals are in lifelong diploidal association, and not merely at the period of conjugation, as was supposed in *Monocystis magna*, since the nuclei show no signs of division, and it is improbable that seven presumed conjugants should be in the same initial stage.
- (4) The diploids show a caudal formation, but whether this is due to Euglenoid movements or oncoming cyst secretion, or is an artefact, is uncertain.
- (5) I have attempted to set forth reasons for believing that diploidal association commences at the posterior extremity of the individuals.
- (6) The animals attain a greater magnitude than Hesse asserted.
- (7) There is an anterior organ of attachment.
- (8) The partners are firmly but not inseparably attached by an adhesive secretion, and are not permanently fused into one individual.

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XXVI.—Notes on Gerbils referred to the Genus *Meriones*, with Descriptions of new Species and Subspecies. By OLDFIELD THOMAS.

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THE genus *Meriones* has long been in a very great state of confusion, partly owing to the carelessness of authors in lumping specimens from all sorts of localities together, and partly to the fact that the genus falls into groups distinguishable only by the different sizes of their bullæ, and that members of each of the groups may be found living side by side—so that a single district may contain two or three species, all looking so alike as to be readily confused with each other, and yet really distinguishable on close examination. Thus no less than three species are found in Egypt, the very country where certain names have been overlooked or misapplied—so as to add to the general confusion.

I have not been able to complete the work in any sense, but can make some preliminary observations on the habitats and characteristics of the different forms.

The bullæ, whose structure and development give the primary means of distinction, enable us to separate the species (apart from the aberrant *calurus* and *hurriane*) into four groups, as follows:—

(a) The bullæ very large, the swelling in front of the meatus projecting in front of the level of the hindmost corner of the zygomata, and the supraneatal triangle also very large. Meatal length (*i. e.* the distance from the back of the bulla to the front of the meatal swelling) approximately 14–15 mm.

(b) Bullæ similarly large, but the supraneatal triangle comparatively small. (Tail usually more bushy than in other species.)

(c) Bullæ smaller, the front side of the meatus little swollen, and not reaching to the level of the zygoma (meatal length about 11–12 mm.); triangle also small.

(d) Bullæ quite small for the genus, almost in normal proportion to the general size of the skull. (Meatal length in *M. blackleri* 8·2 mm.)

In Algeria the confusion of the names is too great to clear up now, but as a preliminary it may be said that north of the Atlas we have true *shawi* (group *c*), which is represented on

the plateau by *richardi* \*, and south of the Atlas by *guyoni*. Then the large-bulla group *b* is represented south of the Atlas by *schousboei* (a form doubtfully separable from *libycus*), but is not found to the north of the range.

Working eastwards, we have in Tripoli local representatives of *a*, *b*, and *c* ranging widely over the country, which is not broken up by any prominent orographical features. Two of these seem to need new subspecific names.

Next, in Egypt we have first of all the comparatively bushy-tailed animal, called quite unaccountably by de Winton † "*M. crassus sellysii*" (*sic*), which was obtained by Mr. N. C. Rothschild in the Wadi Natron, and which I identify with *Meriones libycus*, Lichtenstein, the first African name in the genus, but one hitherto altogether ignored. The locality, dimensions, and the "*caudâ apice floccosa*" all agree with the Wadi Natron animal, and there seems no reason to doubt the identification.

With *libycus* I also synonymize Rüppell's *melanurus*, which has been a prime source of confusion, for not only did he include both Alexandria and Sinai as its habitat, but he sent out specimens under its name which are referable to forms of both group *b* and group *c*. For of the two examples of it that he sent to the British Museum no. 42. 8. 15. 2 is the bushy-tailed *b* species, while 42. 8. 15. 6 belongs to *c*.

In consequence, it appears to be necessary now for me, as the first reviser who has a knowledge of the mixture of the two species, definitely to determine on to which the name *melanurus* shall be placed.

I therefore propose formally to apply it to the one with a prominently black-tufted tail, as Rüppell evidently meant, making the name itself suitable, even though then becoming synonymous with *libycus*.

The other course would result in the species with the least black on its tail bearing the inappropriate name *melanurus*.

In order to make this definite I propose to select as a lectotype of *melanurus* B.M. no. 42. 8. 15. 2, sent as a co-type of it by Rüppell in conjunction with 42. 8. 15. 6, which is

\* In dealing with Loche's many names, applied to animals with exact localities recorded, but without any mention of the bullæ, I have thought it best, in view of the admirable pioneer work he has done on the genus, to accept Lataste's reference of them to their respective groups (his "*shawi*" being *c* group and his *erythrurus b* group), and then to take the first name in each group according to its locality, and so identify them.

† Nov. Zool. x. p. 284 (1903). The type of *selysii* was from Oran, and the name is an absolute synonym of *shawi*. On the other hand, *crassus* was from Sinai, and is a wholly different species, belonging to group *a*.

the small-bulla species with almost no black on the tail, later obtained by Dr. Anderson near Alexandria.

This case of *melanurus* is a striking example of the advisability of selecting types, a plan still resisted by naturalists of backward tendencies. Rüppell was little to blame for mixing up the two species, which are really very similar to each other; but had he selected an individual type to represent his name, all the confusion that has surrounded it would have been avoided.

In the Sudan there occurs the gerbil to which Bonhote has applied the name *M. crassus pallidus*, a form belonging to the *a* group, and undoubtedly very nearly allied to the true *crassus* of Sinai, but widely different from Lower Egyptian forms to which that name has been applied.

Further eastwards material does not exist for any general review, but a number of local forms have proved to need description. It may, however, be noted that the *Meriones* of Asia Minor and Palestine seem to be mostly of the *d* group, while the remarkable *M. calurus* of Egypt and Sinai has the bullæ of the size found in group *c*, though the supræmental triangle is unusually small.

With regard to the aberrant *M. hurriane* of Baluchistan and N.W. India, I find that instead of being distinctly a desert animal, with light skull, large bullæ, and short normal claws, it is modified for a burrowing life by having a heavy bowed skull, small bullæ, and elongated digging fore-claws. It appears to me, therefore, that it ought to be generically separated from the other members of the group, and I would propose for it the name of *Cheliones*\*.

*Meriones pallidus tripoli*, subsp. n.

Group *a*. Like Sudan *pallidus* in all essential particulars, but the general colour slightly warmer, often approaching cinnamon-buff, and usually getting a little darker towards the base of the tail. Under surface usually white to the bases of the hairs, but sometimes they are pale slaty basally. White ear-patches larger and more conspicuous, generally too large to be hidden by the ear when this is folded backwards. Tail-tuft short and little developed, its hairs scarcely exceeding 10 mm.; the main part of the tail pinkish buff or cinnamon-buff, and equally buffy below; in *pallidus* it is markedly lighter, often white, below.

Skull as in *pallidus*.

\* Derived from χηλή, exactly as *Meriones* is from μῆρός.

Dimensions of the type:—

Head and body 129 mm.; tail 125; hind foot 30; ear 16.

Skull: median length 38.5; diagonal length 41; zygomatic breadth 21; interorbital breadth 5.9; bimeatal breadth 23.5; palatine foramina 7.1; upper molar series 5.3. Bullæ: diagonal length 16.8; meatal length 14.5; suprimeatal triangle, length 6.4, height 5.7.

*Hab.* Tripoli. Type from Gebel Limhersuk, in the north-west part of the country.

*Type.* Adult male. B.M. no. 2. 11. 4. 64. Collected 19th July, 1901, by E. Dodson. Presented by J. I. S. Whitaker, Esq. Fourteen specimens examined.

This Tripoli gerbil is very closely allied to *pallidus*, but seems to differ fairly constantly in the characters above noted. The Sudan animal is itself very near to true *M. crassus* of Sinai, but has rather less enormous bullæ.

The specimens representing both this and *M. libycus caudatus* were included under *Meriones schousboei* in my account of the Tripolitan mammals presented by Mr. Whitaker in 1902\*.

*M. crassus*, *pelerinus*, and *pallidus* are the species with the largest bullæ and suprimeatal triangles in the genus, and together form group *a*.

#### *Meriones pelerinus*, sp. n.

A species of group *a* allied to *M. crassus*, but with larger teeth and longer palatine foramina.

Size about as in *M. crassus* or a little larger. General colour paler and greyer than in that species, a little darker than "pinkish buff," the tips of the hairs blackened on the back, clearer on the sides. Belly quite white, not very sharply defined laterally. Lighter eye and ear-markings not strongly marked. Proectote of ears dark pinkish buff. Hands and feet white; soles with their posterior halves naked except just along the edges. Tail not very long, whitish buff, the terminal crest black, not heavily developed, extending along about 35 mm. at its end, its longest hairs 12 mm.

Skull, like *crassus*, with enormous bullæ, which project backwards about 3 mm. behind the level of the occiput, and have their premeatal swelling close against, and surpassing below, the posterior corner of the zygomata. Suprimeatal triangle very large, with rounded angles. Palatal foramina projecting backwards between the roots of *m*<sup>1</sup>.

\* P. Z. S. 1902, p. 9.



Molars decidedly larger than in *M. crassus*.

Dimensions of the type (measured in the flesh) :—

Head and body 125 mm.; tail 125; hind foot 32; ear 17.

Skull: median length 39; diagonal length 41.5; condylo-incisive length 35.5; zygomatic breadth 21.8; nasals 15; breadth of brain-case 18.3; bimeatal breadth 23; palatal foramina 7.7; upper molar series, crowns 5.9, alveoli 6.5. Bullæ: horizontal diagonal length 17; length from back of bulla to front of premeatal swelling 15; suprimeatal triangle, length 6.2, height 5.6.

*Hab.* Tebuk, on the Hedjaz Railway, N.W. Arabia. Alt. 2000'.

*Type.* Young adult male. B.M. no. 10. 3. 12. 5. Original number 5. Collected 3rd January, 1909, by Douglas Carruthers.

This species agrees with *M. crassus* in the very great size of the bullæ, the measurement from the back of the bulla to the front of the premeatal swelling decidedly surpassing that found either in the Egyptian or Tripolitan large-bulla forms. In correlation therewith the suprimeatal triangle is of a maximum size. From that species it differs by its larger molars and the greater posterior extension of its palatine foramina.

I have taken, as representing *M. crassus*, a spirit-specimen from Mt. Hor, south of the Dead Sea, collected by Mr. H. C. Hart, of which the skull seems closely to agree with that figured by Sundevall. Another specimen in skin, from the type-locality Sinai, collected by Mr. Claude Wyatt, is noticeably more ochraceous than *M. pelerinus*, but, owing to the bullæ of this example being lost, its determination is not absolutely certain.

#### *Meriones libycus caudatus*, subsp. n.

Group *b*. Closely like true *libycus* of Lower Egypt, but with markedly longer and finer tail.

General colour above warm buff, finely ticked with brown, below white with slaty bases to the hairs, as in true *libycus*. Postauricular white patches fairly well marked. Tail decidedly longer than head and body, well-tufted, the tuft beginning halfway along the upper surface, and even below covering more than the terminal inch, the hairs attaining 16–17 mm. in length. The tuft black, the rest buffy ochraceous.

Skull apparently quite as in *libycus*, the bullæ very large, the suprimeatal triangle small.

Dimensions of the type:—

Head and body 142 mm.; tail 153; hind foot 34; ear 20.

Skull: median length 40·5; diagonal length 42; zygomatic breadth 22; interorbital breadth 7·6; biacetal breadth 23; palatine foramina 8 2; upper molar series 5·3. Bullæ: diagonal horizontal length 17·5; front of meatal swelling to back of bulla 15·1; suprimeatal triangle, length 4·5, height 3·2.

*Hab.* Tripoli. Type from Ferdjan, a second specimen from El Hammam.

*Type.* Adult male. B.M. no. 2. 11. 4. 56. Original number 97. Collected 21st June, 1901, by E. Dodson. Presented by J. I. S. Whitaker, Esq.

This is a long-tailed form of the *b* group, with largest-sized bullæ but small suprimeatal triangle. It occurs between the original *libycus* of Lower Egypt and *schousboei* of Algeria, which have both comparatively short tails, and are, indeed, very doubtfully distinguishable from each other.

*Meriones syrius*, sp. n.

Nearly allied to *M. erythrourus*, but with longer foot and larger teeth.

General characters quite as in *erythrourus*, with the same proportions of the bulla and approximately the same coloration of body and tail. Upper surface near "pinkish buff," paler and more approaching "light buff" on sides. Under surface white, but the hairs pale slaty basally except on the chin and throat, where they are white to the roots. Light areas behind eyes and round bases of ears not strongly marked. Ears like head, the fringing hairs buffy white. Hands and feet white, more or less washed with buffy on the metapodials. Tail ochraceous, the terminal crest well developed, black, commencing rather more than halfway along the upper side.

Skull apparently like that of *erythrourus*, though rather more robustly built. Bullæ equally large, with a marked inflation on the front side of the meatus just surpassing the level of the hindermost point of the zygoma.

Incisors less bevelled and with less sharply defined groove than in *erythrourus*. Molars distinctly smaller.

Dimensions of the type:—

Head and body 142 mm.; tail 145; hind foot 35; ear 18.

Skull: median length 42·5; diagonal length to back of

bullæ 42·8; condylo-incisive length 39; zygomatic breadth 24·5; nasals 16·2; interorbital breadth 8; breadth of brain-case 18; meatal breadth 22·8; palatine foramina 7·6; upper molar series 5·8. Bullæ: horizontal diagonal length 16·2; back of bulla to front of meatal swelling 12·8; supra-meatal triangle, length 5, height 3.

*Hab.* Syrian Desert. Type from Karyatein (spelt Kargeten in Stieler's Atlas). Alt. 2000'. Another specimen from a point 320 km. east of the Dead Sea, 3000'.

*Type.* Adult male. B.M. no. 5. 7. 2. 2. Original number 27. Collected 3rd March, 1905, by Douglas Carruthers.

Of these gerbils with large bullæ—all once referred to *M. erythrourus*,—the true bearer of that name occurs in Afghanistan, ranging westwards through Persia to the edge of the highlands; then in the lower littoral country comes the smaller *M. charon*, succeeded again in the Syrian desert by the present species, which, though more like true *erythrourus*, is distinguishable by its longer feet and larger teeth.

#### *Meriones charon*, sp. n.

A small species with terminally crested tail, allied to *M. longifrons*.

Size a little less than in *M. longifrons*. General colour above finely speckled sandy buff ("pinkish buff" darkened by the brown points of the hairs), the tone warmer on the posterior back. Under surface white, the lateral line of demarcation not specially sharply defined. Cheeks greyish, the postorbital and postauricular whitish spots scarcely marked. Ears rather short, coloured like the head. Hands and feet white; soles with the median area of their proximal halves naked, their terminal halves hairy. Tail not very long, its greater portion short-haired, dull buffy, not more ochraceous than the body, its terminal 25–30 mm. with an upper crest of black hairs which may attain 15 mm. in length at the tip.

Skull very much as in *M. longifrons*, but the bullæ less swollen, their antero-internal extension considerably less. Suprameatal triangle nearly as high as long.

Dimensions of the type:—

Head and body 129 mm.; tail 132; hind foot 29·5; ear 17·5.

Skull; median length 37·2; diagonal length to back of bulla 38·3; condylo-incisive length 33·5; zygomatic breadth

20; meatal breadth 21; nasals 14·5; interorbital breadth 5·8; breadth across brain-case 17; palatine foramina 7·5; upper molar series 5·2. Bullæ: greatest diagonal horizontal length 15; back to antemeatal swelling 12·4; suprimeatal triangle, length 5, height 3·5.

*Hab.* Coastal plain in region of Karun River, Persia. Type from Ahwaz, alt. 220'. Mound of Susa (*K. Loftus*).

*Type.* Adult male. B.M. no. 5. 10. 4. 38. Original number 22. Collected 30th March, 1905, by R. B. Woosnam. Presented by Col. A. C. Bailward.

This gerbil is most nearly allied to Lataste's *longifrons* from Jedda, on the Red Sea, but may be distinguished by its smaller bullæ.

Mr. Woosnam says of it in February 1905:—"Plentiful all along the flat coast plain from Bushire to the Karun River"; but at the end of March he says "only a few here now, probably owing to failure of corn crop."

The Museum contains a specimen sent home by Kenneth Loftus from the Mound of Susa in 1853, two spirit-specimens from Ahwaz presented by Dr. Jayakar in 1900, and three excellent skins collected by Mr. Woosnam.

#### *Meriones ambrosius*, sp. n.

A naked-soled, bushy-tailed gerbil, related to *M. persicus*, but with smaller bullæ.

Size rather large. General colour above a beautiful "cinnamon-buff," slightly darker on the back, clearer on the sides, the posterior back of a rather warmer tone than the anterior; more uniform and less speckled throughout than in most species of the genus. Under surface as usual pure sharply defined white, the line of demarcation rather high up on the sides. A white spot above and behind each eye, and another above and behind the base of each ear; ear long, coloured like head. Hands and feet pure white. Soles smooth and naked posteriorly, granulated and naked anteriorly, but between the two, behind the granulations, there is an area with a certain number of small hairs on it. Tail long, rather heavily tufted terminally, the hairs attaining 20 mm. and more in length in the tuft, which is all round the tail, not specialized as a crest; main part of tail buffy, tuft dark brown.

Skull rather smaller than that of *persicus*, narrower across the brain-case, and with very much smaller bullæ. These are without any antemeatal swelling, do not project so far

backwards as the occipitals, and their postmeatal portion is but little swollen, with a straight posterior margin.

Dimensions of the type:—

Head and body 161 mm.; tail 183; hind foot 41; ear 28.

Skull: greatest length (median) 43; condylo-incisive length 38·5; zygomatic breadth 22·5; nasals 16·6; inter-orbital breadth 7; least breadth across brain-case 17·2; meatal breadth 21·3; palatine foramina 8·3; upper molar series 6·2. Bullæ: greatest diagonal horizontal diameter 13; distance from back of bulla to front of meatus 9; supra-meatal triangle, length 3·5, height 2.

*Hab.* (of type). Dopolan, Bichtiari Mountains, 120 miles N.E. of Ahwaz, Persia. Alt. 6000'.

*Type.* Adult male. B.M. no. 5. 10. 4. 35. Original number 36. Collected 18th April, 1905, by R. B. Woosnam; presented by Col. A. C. Bailward.

In my account of the Bailward collection \* I referred this exceedingly handsome gerbil to *M. persicus*; but now that I realize the systematic value of the difference in size of the bullæ, I consider it should be distinguished specifically from that animal.

#### *Meriones isis*, sp. n.

The Lower Egypt representative of the *c* group, that of which *M. shawi* is typical.

Size rather less than in true *shawi*. General colour rather greyish or drabby buff, but of the only two available skins one has been exhibited for many years and the other skinned out of spirit. Underside white, the hairs slaty at base. Light ear-patches little developed. Tail rather shorter than head and body, dull whitish or buffy whitish on the sides and for its whole length below, slightly darkened above by blackish hairs, but very little tufted at the end, the longest hairs barely 10 mm. in length.

Skull, as compared with that of *M. guyoni*, the South-Algerian and Tripolitan representative of *M. shawi*, of similar general form, with comparatively small bullæ and small supra-meatal triangles. Bullæ, however, slightly smaller, and interorbital breadth distinctly greater, this latter being the chief difference between the Egyptian and Algerian animals. Palatine foramina reaching to the level of the anterior root of *m*<sup>1</sup>.

\* P. Z. S. 1905, ii. p. 523.

Dimensions of the type (measured on a skin):—

Head and body 140 mm.; tail 131; hind foot 32·5.

Skull: median length 39; diagonal length 39; zygomatic breadth 23·5; nasals 14·3; interorbital breadth 8; bimeatal breadth 21; palatine foramina 7·6; upper molar series 5·6. Bullæ: diagonal length 14; meatal length (back of bulla to front of meatal swelling) 11; suprimeatal triangle, length 3·9, height 3·1.

*Hab.* Lower Egypt. Type from Ramleh, near Alexandria.

*Type.* Adult male. B.M. no. 92. 7. 1. 6. Collected and presented by Dr. John Anderson.

This is in part the "*Meriones shawi*, var. *melanurus*" of Anderson and de Winton's 'Mammals of Egypt,' but, as already explained, it seems best to apply the name *melanurus* to the form which has the prominent black tuft to the tail, and so agrees with Rüppell's figure and description. That name being disposed of, and the species being distinguished from the Algerian *guyoni* by its broader interorbital region, a new name becomes necessary for it.

*Meriones blackleri lycaon*, subsp. n.

General characters of true *blackleri* of Smyrna, but the colour warmer and more ochraceous and the tail without the white tip which occurs in all our four specimens of *blackleri*. Colour of back approaching cinnamon-buff; belly-hairs white to their bases. A whitish patch between eye and muzzle, behind eyes, and a small one behind ears. Hands and feet white; soles with but a narrow area along the centre of the proximal half naked. Tail buffy whitish, the terminal crest extending for about 2 inches at its end, not heavily developed, blackish, not becoming white at the extreme tip.

Skull averaging rather larger than in *blackleri*, but the specimens are mostly older. Palatine foramina ending quite in front of the roots of  $m^1$ , those of *blackleri* attaining the level of these latter. Bullæ slightly larger.

Dimensions of the type:—

Head and body 129 mm.; tail 146; hind foot 33; ear 20.

Skull: greatest median length 41; diagonal length to back of bullæ 41; zygomatic breadth 22·4; nasals 17·7; breadth across brain-case 17·1; bimeatal breadth 20; palatal foramina 7·3; upper molar series 5·2. Bullæ: length 12·8; front of meatal swelling to back of bulla 9.

*Hab.* Kara Dag, Lycaonia, Asia Minor. Alt. 3800'.

*Type.* Adult male. B.M. no. 8. 7. 1. 28. Original

number 18. Collected 3rd June, 1907, and presented by L. H. G. Ramsay, Esq. Five specimens.

It so happens that all the five specimens of this highland gerbil are older than any of the four of true *blackleri* from comparatively low down at Smyrna; but if the colour is affected by this fact, and even possibly the relative position of the palatine foramina and teeth, the constant presence in *blackleri* and absence in *lycaon* of a white tip to the tail seem to justify a special subspecific name for the highland form.

XXVII.—*Notes on the Family Dendrocolaptidæ, with Suggestions for its Division.* By CHARLES CHUBB, F.Z.S., M.B.O.U., Zoological Department, British Museum (Natural History).

WHEN the late Dr. P. L. Selater wrote the fifteenth volume of the 'Catalogue of the Birds in the British Museum' he included in the family Dendrocolaptidæ the ground-birds, bush-birds, and tree-climbing birds, dividing them into the following subfamilies:—Furnariinæ, Synallaxininæ, Philydorinæ, Sclerurinæ, and Dendrocolaptinæ. This was followed by the late Dr. Bowdler Sharpe in the 'Hand-list of Birds,' vol. iii. 1901, with two additional subfamilies, viz., Margarornithinæ and Glyphorhinæ, which had been established by Salvin and Godman (Biol. Centr.-Amer., Aves, ii. pp. 109, 171). Professor Ridgway, in his 'Birds of North and Middle America,' vol. v. pp. 157–295 (1911), has divided these into two families under the following titles:—Furnariidæ and Dendrocolaptidæ. Brabourne and Chubb, in their 'List of the Birds of South America,' did not recognize any of the divisions mentioned above, but simply included them all under the family Dendrocolaptidæ.

It appears to me, however, that these may be divided into four families, the first to include those that are essentially ground-birds—Furnariidæ—with the following genera:—

*Geobates*, Swains., 1838.

*Geositta*, Swains., 1837.

*Furnarius*, Vieill., 1816.

*Upucerthia*, Geoffr. Saint-Hilaire, 1832.

*Cinclodes*, Gray, 1840.

- Eremobius*, Gould, 1839.  
*Chilia*, Salvad., 1908.  
*Clibanornis*, Scl. & Salv., 1873.  
*Lochmias*, Swains., 1827.  
*Sclerurus*, Swains., 1827.

It must be mentioned, however, that the limits of this family are entirely different to those of Ridgway, who uses the same title.

The second to include the soft-tailed and bush-haunting birds—Synallaxidæ—with the following genera:—

- Aphrastura*, Oberh., 1899.  
*Sylviorthorhynchus*, Des Murs, 1847.  
*Schiæaca*, Cab., 1873.  
*Phleocryptes*, Cab. & Hein., 1859.  
*Leptasthenura*, Reichenb., 1853.  
*Synallaxis*, Vieill., 1819.  
*Siptornis*, Reichenb., 1853.  
*Metopothria*, Scl. & Salv., 1866.  
*Xenerpestes*, Berl., 1886.  
*Pseudocolaptes*, Reichenb., 1853.  
*Coryphistera*, Burm., 1860.  
*Anumbius*, d'Orb. & Lafr., 1838.  
*Thryolegus*, Oberh., 1899.  
*Linnornis*, Gould, 1841.  
*Berlepschia*, Ridgw., 1887.  
*Phacellodomus*, Reichenb., 1853.  
*Thripophaga*, Cab., 1847.  
*Pseudoseisura*, Reichenb., 1853.  
*Automolus*, Reichenb., 1853.  
*Philydor*, Spix, 1824.  
*Thripadectes*, Scl., 1862.  
*Ancistrops*, Scl., 1862.  
*Heliobletus*, Reichenb., 1853.  
*Anabazenops*, Lafr., 1847.  
*Xenicopsis*, Cab. & Hein., 1859.

The third to include the genera *Xenops* and *Pygarrhicus*, which appear to me to be intermediate between the Synallaxidæ and Dendrocolaptidæ, and for which I propose the name Xenopidæ:—

- Xenops*, Illiger, 1811.  
*Pygarrhicus*, Burm., 1837.



The fourth to include the spine-tailed and tree-climbing birds—Dendrocolatidæ—with the following genera :—

- Margarornis*, Reichenb., 1853.
- Premnornis*, Ridgw., 1909.
- Premnoplex*, Cherrie, 1891.
- Glyphorhynchus*, Wied., 1831.
- Dendrocincla*, Gray, 1840.
- Sittasomus*, Swains., 1827.
- Deconychura*, Cherrie, 1891.
- Xiphorhynchus*, Swains., 1827.
- Dendroplex*, Swains., 1827.
- Dendrexetastes*, Eyton, 1851.
- Hylexetastes*, Sclater, 1889.
- Xiphocolaptes*, Less., 1840.
- Picolaptes*, Less., 1830.
- Nasica*, Less., 1830.
- Drymornis*, Eyton, 1852.
- Campylorhamphus*, Bertoni, 1901.
- Dendrocolaptes*, Hermann, 1804.

It may be mentioned also that the limits of this family are not the same as those of Ridgway, who uses the same title.

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XXVIII.—*Descriptions of New Pyralidæ of the Subfamilies Crambinæ and Siginæ.* By Sir GEORGE F. HAMPSON, Bart., F.Z.S., &c.

THE following paper is a supplement to my classification of the Schænobianæ and Crambinæ in the 'Proceedings of the Zoological Society of London' for 1895, pp. 897 to 974.

The name of the former family has been changed, as *Siga* Hübn. is the oldest-described genus contained in it.

The types of the new species are in the British Museum, unless otherwise stated.

Family **Pyralidæ.**

Subfamily *CRAMBINÆ.*

Genus **NEARGYRIA.**

(2) *Neargyria persimilis*, sp. n.

Silvery white; palpi orange at sides; thorax with paired dorsal orange stripes; fore and mid legs and dorsal surface of abdomen tinged with ochreous. Fore wing with fine orange fasciæ on basal

third of costa and on inner margin except at base; an oblique orange band from three-fourths of costa, along which it is diffused to apex, to middle of inner margin; a fine dark brown terminal line; cilia tinged with fulvous; the underside of fore wing and costal area of hind wing tinged with brown.

*Hab.* D'ENTRECASTEAUX IS., Goodenough I. (*Meek*), 1 ♂; Woodlark I. (*Meek*), 1 ♀ type. *Exp.* 18 mm.

(1 a) *Ptochostola metascotiella*, sp. n.

Head and thorax dark brown; abdomen blackish with grey segmental rings. Fore wing dark red-brown with a white fascia from base through the cell to the submarginal line, intersected beyond the cell by an oblique rufous line, its medial part defined by a slight black streak below; some silvery scales at upper angle of cell and streaks on veins 2 and 3; a silvery submarginal line, obtusely angled on vein 5; an oblique white streak from apex and line on apical part of margin; the inner half of outer area dark grey with marginal series of black specks. Hind wing dark fuscous.

*Hab.* CAPE COLONY, Annshaw (*Miss F. Barrett*), 4 ♂ type. *Exp.* 14 mm.

(1 c) *Culladia albimedialis*, sp. n.

♂. Head and thorax white slightly tinged with red-brown; abdomen white; pectus and legs white, the fore tibiae and the tarsi tinged with red-brown. Fore wing white tinged with red-brown, the costal area, cell, and an oblique shade from its extremity to apex silvery white, leaving the costal edge tinged with red-brown to near apex; a slight oblique red-brown line from apex defining the lower edge of the white shade. Hind wing white with a very faint red-brown tinge. Underside of fore wing wholly tinged with red-brown.

*Hab.* QUEENSLAND, Peak Downs, 1 ♂ type. *Exp.* 20 mm.

(1 e) *Culladia irroralis*, sp. n.

♂. Head, thorax, and abdomen white; antennae tinged with red-brown; palpi, pectus, and legs white tinged with red-brown. Fore wing white irrorated with red-brown, rather more thickly on costal and terminal areas; indistinct diffused oblique antemedial and medial lines from cell to inner margin; a distinct oblique red-brown line from apex to inner margin beyond middle with faint diffused streaks beyond it in the interspaces; a fine red-brown terminal line and a line near tips of cilia. Hind wing white. Underside of fore wing tinged with red-brown.

*Hab.* BR. E. AFRICA, Kikuyu, Roromo Flat (*Crawshay*), 1 ♂ type. *Exp.* 18 mm.

(1f) *Culladia dentilinealis*, sp. n.

♀. Head, thorax, and abdomen white mixed with pale red-brown; palpi white with fuscous bands towards extremity of 2nd joint and at base of 3rd joint; ventral surface of abdomen white. Fore wing white suffused with pale red-brown, the terminal area finely striated with darker brown and with a dark patch on costa before apex; an oblique red-brown antemedial shade from submedian fold to inner margin; a red-brown shade from costa to below end of cell, with a white patch beyond it before the slight red-brown postmedial line which is obliquely excurved to vein 5, then incurved, again excurved above the submedian fold in which it is retracted to below the origin of vein 2, then oblique to inner margin; subterminal line white slightly defined on each side by red-brown, angled outwards below the dark costal patch, then rather irregularly dentate; a fine black terminal line and a brown line near base of cilia. Hind wing white suffused with red-brown. Underside white suffused with brown.

*Hab.* PUNJAB, Simla (*Pilcher*), 2 ♀ type. *Exp.* 20 mm.

(1h) *Culladia sinuimargo*, sp. n.

Fore wing with veins 4, 5 from the cell, the termen sinuous, the anal tuft of male very large.

Head and thorax white irrorated with dark brown; antennæ dark brown; palpi banded with black at sides; abdomen white tinged with rufous, the anal tuft of male fulvous ochreous; pectus, legs, and ventral surface of abdomen white. Fore wing white irrorated with dark brown and some black, the terminal area finely pencilled with blackish; postmedial line white defined on each side by black-brown, oblique to vein 6 where it is angled outwards, then inwardly oblique with an angle outwards at vein 2, erect below vein 1, the veins beyond it with rather diffused black streaks, slightly forking before the subterminal line, which is red-brown, excurved below costa, then slightly waved; a fine black terminal line; cilia brownish, white at base towards apex. Hind wing white, the veins and terminal area except towards tornus suffused with reddish brown; cilia with a brown line near base to vein 2. Underside of fore wing suffused with red-brown except the inner area.

*Hab.* TRANSVAAL, Pretoria (*Janse*), 4 ♂, 1 ♀ type. *Exp.* ♂ 22, ♀ 24 mm.

(1i) *Culladia innotalis*, sp. n.

Fore wing with the termen not sinuous.

♀. Head, thorax, and abdomen ochreous suffused with reddish brown, the vertex of head whitish; antennæ dark brown ringed with white; pectus, legs, and ventral surface of abdomen whitish, the fore and hind legs suffused with reddish brown. Fore wing

ochreous tinged with red-brown and slightly irrorated with greyish fuscous especially at termen in submedian fold and in discal fold in and beyond end of cell; cilia white tinged with ochreous. Hind wing white tinged with ochreous. Underside white suffused with brownish ochreous.

*Hab.* C. CHINA, Fokien, Ting-hai (*de-la-Garde*), 1 ♀ type.  
*Exp.* 24 mm.

(1) *Eufernaldia micralis*, sp. n.

Fore wing with vein 11 anastomosing with 12; hind wing with veins 4, 5 from the cell.

♂. Head, thorax, and abdomen whitish suffused with brownish ochreous. Fore wing whitish suffused with brownish ochreous and slightly irrorated with blackish; a blackish point at origin of vein 2; a faint curved dark postmedial line between veins 7 and 2 with another faint curved line beyond it from costa to vein 3; a terminal series of minute black points from below apex to vein 2 and a slight brownish line near base of cilia. Hind wing white tinged with ochreous. Underside whitish suffused with brownish ochreous.

*Hab.* JAMAICA, Constant Springs (*Walsingham*), 1 ♂ type.  
*Exp.* 12 mm.

Genus NEERUPA, nov.

Type, *N. argyrosticta*.

Proboscis minute; palpi downcurved, extending about twice the length of head and clothed with long rough scales; maxillary palpi strongly dilated with scales; frons smooth; eyes large, round; antennæ of male laminate and fasciculate; tibiæ smoothly scaled. Fore wing with the termen somewhat excised from apex to vein 4; vein 3 typically from well before angle of cell; 5 from above angle; 6 from well below upper angle; 7, 8, 9, 10 stalked; 11 from cell. Hind wing with vein 3 typically from well before angle of cell; 5 from above angle; 6, 7 shortly stalked; 8 anastomosing with 7.

(1) *Neerupa benepunctalis*, sp. n.

Fore wing with the termen rather strongly excised from apex to vein 4; vein 3 from close to angle of cell and 4, 5 from angle. Hind wing with vein 3 from close to angle of cell, 4, 5 shortly stalked, and 6, 7 from upper angle.

Head, thorax, and abdomen white suffused with red-brown. Fore wing whitish suffused with red-brown; the costal area white to beyond middle; a faint diffused dark postmedial line, excurved to vein 4, then incurved to middle of inner margin, the area beyond it rather whiter below vein 2; an indistinct double curved punctiform subterminal dark line filled in with slight whitish marks; a terminal series of prominent black points defined on inner side

by white marks. Hind wing and underside white suffused with brown.

*Hab.* COLOMBIA, Choko, La Silva San Juan, 1 ♂; PERU, Carabaya, Oconeque (*Ockenden*), 1 ♀ type. *Exp.* 22 mm.

(2) *Neerupa argyrosticta*, sp. n.

Fore wing with the termen slightly excised from apex to vein 4; both wings with vein 3 from well before angle of cell and 5 from above angle; hind wing with veins 6, 7 shortly stalked.

♂. Head and thorax deep rufous with a golden gloss; abdomen paler golden rufous. Fore wing deep rufous with a golden gloss; a silvery white medial line, excurved to median nervure, then oblique; a diffused whitish discoidal spot; an indistinct rather diffused red-brown postmedial line, somewhat narrowed towards costa, then oblique, a silvery white spot tinged with blue on it at costa and minute streaks at veins 7, 6, the veins beyond it slightly irrorated with bluish white scales; a terminal series of silvery white bars tinged with blue; cilia chequered with white at tips. Hind wing white tinged with rufous; a faint reddish brown subterminal line; a rufous terminal line. Underside of fore wing glossy red-brown, the costal area towards apex and the terminal area yellowish rufous. Hind wing with the costal and terminal areas suffused with rufous, the brown subterminal line distinct.

*Hab.* COLOMBIA, San Antonio (*Palmer*), 2 ♂ type; W. slopes, 1 ♂. *Exp.* 32 mm.

(5 a) *Crambus mesoscia*, sp. n.

♂. Head, thorax, and abdomen creamy white, the patagia suffused with red-brown except dorsally, the dorsum of thorax with brown streaks; antennæ rufous except above; frons at sides and palpi except above red-brown; legs suffused with red-brown. Fore wing creamy white slightly irrorated with brown; a rather diffused black-brown streak along median nervure with red-brown shades above and below it between discal and submedian folds, expanding beyond the cell to termen and with slight red-brown streaks above it in the interspaces towards apex; a terminal series of prominent black points; cilia with red-brown line near base and some red-brown at tips. Hind wing silvery white with minute dark points on termen from apex to below vein 3. Underside of fore wing except the costal edge on terminal half and the costal area of hind wing suffused with red-brown.

*Hab.* NATAL, Durban (*Leigh*), 1 ♂; CAPE COLONY, Kokstad (*Mrs. Pringle*), 1 ♂ type. *Exp.* 32 mm.

(6 c) *Crambus diodonta*, sp. n.

♀. Head, thorax, and abdomen white tinged with rufous; palpi with their lower half red-brown. Fore wing white tinged with rufous in parts, a patch of rufous suffusion beyond lower angle of

cell and the terminal area more distinctly tinged with rufous; a punctiform red-brown medial line, oblique towards costa, angled outwards beyond the angles of cell, then inwardly oblique; post-medial line red-brown, punctiform, oblique to vein 6, inwardly oblique below vein 4 and ending at submedian fold; a terminal series of black-brown points. Hind wing creamy white. Underside white, the fore wing and costal area of hind wing tinged with rufous.

*Hab.* S. NIGERIA, Old Calabar (*Crompton*), 2 ♀ type. *Exp.* 22 mm.

(8 a) *Crambus niveicostellus*, sp. n.

♀. Head, thorax, and abdomen pure white, the patagia rufous except dorsally; antennæ rufous; palpi tinged with rufous except above towards tips; fore tibiæ and the tarsi tinged with rufous. Fore wing with silvery white costal stripe narrowing to a point at apex, the area below it cupreous rufous to submedian fold, then white tinged with rufous; slight white streaks on the veins beyond the cell and a distinct white streak on vein 1; a terminal series of slight red-brown striæ; cilia white, tinged with rufous towards apex. Hind wing silvery white. Underside silvery white.

*Hab.* BR. E. AFRICA, Shambe (*Betton*), 1 ♀ type. *Exp.* 30 mm.

(13 a) *Crambus undilineatus*, sp. n.

Head and thorax grey-white mixed with red-brown, the head white, the antennæ and palpi with more red-brown; abdomen, pectus, and legs white tinged with red-brown, the fore legs deep red-brown on inner side. Fore wing grey-white thickly irrorated with red-brown, especially towards costa; an obscure whitish spot in the cell towards extremity and discoidal annulus open above; postmedial line whitish defined on each side by red-brown, minutely waved, obliquely excurved to submedian fold, then oblique; a terminal series of black points; cilia white with brown lines near base and tips. Hind wing white tinged with red-brown. Underside of fore wing suffused with red-brown.

*Hab.* BR. E. AFRICA, Eb Urru (*Betton*), 1 ♂; TRANSVAAL, White R. (*Cooke*), 1 ♂ type, Pretoria (*Distant*), 3 ♂, 2 ♀; CAPE COLONY, Brak Kloop (*G. White*), 1 ♂. *Exp.* 22-26 mm.

(13 b) *Crambus albidorsatus*, sp. n.

♂. Head and thorax white with a slight cupreous tinge, the patagia cupreous brown; antennæ cupreous brown; palpi cupreous brown, white above on terminal half; abdomen, pectus, and legs white mixed with cupreous brown. Fore wing cupreous brown irrorated with whitish; the inner margin with white streak, the veins beyond the cell finely streaked with whitish; a small black

spot at origin of vein 2; a faint very oblique red-brown striga from middle of costa and slight marks at end of cell; postmedial line red-brown slightly defined on outer side by white and very oblique to vein 7, then represented by slight somewhat dentate red-brown marks defined on outer side by whitish and inwardly oblique to inner margin; a slight white mark at apex and fine black terminal line forming minute spots at the interspaces; cilia pale rufous with a silvery gloss. Hind wing whitish suffused with red-brown; a fine dark terminal line; cilia white. Underside whitish suffused with red-brown, the fore wing with indistinct curved brown postmedial line with a white mark on its outer side at costa.

*Hab.* SINGAPORE (*Ridley*), 1 ♂ type. *Exp.* 22 mm.

(13e) *Crambus cuprescens*, sp. n.

♀. Head and thorax cupreous red-brown mixed with whitish; abdomen, pectus, and legs white tinged with cupreous brown, the fore tarsi red-brown ringed with white. Fore wing whitish tinged with cupreous and thickly irrorated with red-brown; traces of a red-brown medial line, excurved at end of cell, then incurved and again slightly excurved above inner margin; a faint slightly sinuous red-brown postmedial line, excurved below costa, then oblique; a fine slightly waved red-brown terminal line. Hind wing white with a faint cupreous tinge. Underside white, the fore wing and costal area of hind wing tinged with red-brown.

*Hab.* JUAN FERNANDEZ (*J. J. Walker*), 1 ♀ type. *Exp.* 24 mm.

(13f) *Crambus cinereus*, sp. n.

♀. Head and thorax grey-brown with a slight leaden gloss; abdomen white tinged with brown, the anal tuft tinged with rufous. Fore wing grey-brown with a slight leaden gloss; a faint oblique dark bar from middle of costa and slight mark at lower angle of cell; postmedial line indistinct, dark, formed by striæ in the interspaces, excurved to vein 4, then oblique; a terminal series of black points; cilia white tinged with brown and with a white line at base. Hind wing white, the costal area and termen to vein 2 with a faint red-brown tinge. Underside of fore wing and costal area of hind wing tinged with red-brown.

*Hab.* DUTCH N. GUINEA, Mimika R. (*Wollaston*), 1 ♀ type, Wataikwa R. (*Wollaston*), 1 ♀. *Exp.* 24 mm.

(13g) *Crambus melanerges*, sp. n.

Head, thorax, and abdomen black-brown with a leaden gloss, the last with the sides whitish; pectus and legs with some white. Fore wing uniform black-brown with a silvery leaden gloss. Hind wing tinged with brown. Underside of fore wing and costal area of hind wing greyish fuscous.

*Hab.* SIERRA LEONE (*Clements*), 1 ♀; UGANDA (*W. B. Gill*), 1 ♂, 1 ♀ type. *Exp.* 20-22 mm.

(14b) *Crambus discistrigatus*, sp. n.

Head and thorax pale olive-brown; antennæ brown, whitish towards base; palpi irrorated with white; abdomen, pectus, and legs whitish suffused with red-brown. Fore wing pale olive-brown, the costal area darker and the costal edge white; a white fascia above median nervure from before middle of cell forming rather diffused streaks beyond the cell on veins 6 to 4; a fine dark terminal line; cilia whitish at base with a fine brown line near base. Hind wing pale grey-brown, the cilia white. Underside whitish suffused with grey-brown.

*Hab.* PUNJAB, Hundes, 1 ♂, 1 ♀ type. *Exp.* 28 mm.

(14d) *Crambus medioradiellus*.

Head and thorax pale red-brown; abdomen yellowish white. Fore wing pale ferruginous irrorated with white scales; a white fascia in submedian fold from base to near outer margin; traces of a curved medial line; a more distinct submarginal line oblique from costa to vein 5 where it is angled, then outwardly defined by white; a marginal series of black points; cilia whitish with a brown line through them. Hind wing yellowish white.

*Hab.* QUEENSLAND, Cooktown, Cedar Bay (*Meek*), 2 ♂, 1 ♀ type. *Exp.* 20 mm.

(16b) *Crambus calamellus*, sp. n.

Head, thorax, and abdomen white tinged with reddish ochreous; antennæ and palpi more rufous. Fore wing white suffused with reddish ochreous and irrorated with brown, the costa brownish towards base; postmedial line brown, very obliquely excurved from costa to vein 4, then inwardly oblique; subterminal line brown, obliquely excurved from costa to vein 4, then rather inwardly oblique and sinuous; a terminal series of minute black points from apex to vein 2; cilia white at base with a fine brown line near base. Hind wing silvery white with a faint red-brown tinge on apical half of terminal area.

*Hab.* PARAGUAY, Santa Cruz (*Moor*), 1 ♀; ARGENTINA, Santa Fé, Ocampo (*Wager*), 1 ♀, Florenzia, Gran Chaco (*Wagner*), 1 ♀, Goya (*Perrens*), 4 ♂, 1 ♀ type. *Exp.* 18-20 mm.

(21a) *Crambus diascia*, sp. n.

♀. Head, thorax, and abdomen white tinged with red-brown, the patagia red-brown; antennæ fuscous except at base; palpi reddish brown at sides. Fore wing white tinged in parts with reddish brown and with a darker brown shade from median nervure to above inner margin to the postmedial line, which is slight, brown, very oblique to vein 7, then minutely waved, incurved



below discal fold and angled outwards at submedian fold; an indistinct curved minutely waved pale brown subterminal line; a terminal series of black points to submedian fold; cilia silvery white at base, tinged with red-brown at tips. Hind wing white, the termen tinged with red-brown to vein 2; cilia silvery white. Underside of fore wing suffused with red-brown except the inner area.

*Hab.* PARAGUAY, Sapucay (*Foster*), 2 ♀ type. *Exp.* 22 mm.

(21 b) *Crambus bidentellus*, sp. n.

*Crambus racabellus*, Druce, Biol. Cent.-Am., Het. ii. p. 290 (part.).

♀. Head and tegulæ creamy white; thorax and abdomen white suffused with red-brown; antennæ and palpi at sides red-brown. Fore wing white tinged with red-brown and slightly irrorated with darker brown; antemedial line represented by a slight blackish striga in the cell and dentate mark at vein 1; an indistinct blackish medial line, strongly angled outwards at discal fold beyond the cell, then oblique and angled outwards at submedian fold, obsolete below vein 1; an indistinct curved postmedial line from costa to vein 2, with a blackish shade before it except towards costa; a minutely waved pale red-brown subterminal line slightly defined on outer side by silvery white, the area beyond it finely pencilled with brown; a terminal series of minute black points to submedian fold. Hind wing white faintly tinged with red-brown, the cilia pure white. Underside white tinged with red-brown.

*Hab.* MEXICO, Durango (*Becker*), 1 ♀ type, Godman-Salvin Coll. *Exp.* 26 mm.

(23 b) *Crambus atristrigellus*, sp. n.

Head, thorax, and abdomen fuscous brown largely mixed with white, the inner area and still more the costal area strongly irrorated with bright rufous; the medial line represented by an oblique white streak from costa and oblique rufous line on inner area; the postmedial line white defined by bright rufous, oblique towards costa, angled at vein 6, and with a triangular rufous spot beyond it on costa; a terminal series of short black streaks; cilia rufous.

*Hab.* JAMAICA, Mandeville (*Cockerell*), 1 ♂ type, Newcastle, 1 ♀. *Exp.* 14 mm.

(24 c) *Crambus melanolepis*, sp. n.

♂. Head, thorax, and abdomen white with some black-brown scales; antennæ tinged with red-brown; palpi, pectus, legs, and ventral surface of abdomen white, the maxillary palpi blackish above, the fore tibiæ blackish below and the mid and hind tibiæ with blackish rings at extremities. Fore wing white, the costa with some dark brown towards base; an oblique slightly sinuous

black antemedial line from costa to submedian fold with a patch of black scales beyond it above vein 1; a rather oblique wedge-shaped discoidal spot tinged with red-brown and defined by black scales, angled outwards beyond the cell; a slight dark subterminal line, oblique towards costa and with a patch of black scales beyond it, then minutely waved; a slight dark line before termen and a fine black terminal line; cilia with some black scales at tips. Hind wing white, the terminal area faintly tinged with red-brown; a fine dark terminal line and lunulate black mark at tornus with a black bar beyond it on the cilia. Underside white tinged with red-brown.

*Hab.* PERU, R. Pacaya, 1 ♂ type. *Exp.* 16 mm.

(31 a) *Crambus melaneurus*, sp. n.

♂. Head and thorax white with a yellow tinge in parts; antennæ brownish except above; palpi with some dark brown at sides; abdomen white suffused with brown; pectus and legs white tinged with yellow-brown. Fore wing silvery white, the costal area to discal fold and the area beyond the cell suffused with golden yellow, narrowing to tornus; streaks of diffused black scales below costa and in upper part of cell from near base to end of cell and similar streaks in the interspaces beyond the cell to below vein 2; a terminal series of prominent black points; cilia brown glossed with metallic silver. Hind wing white tinged with fuscous brown especially on costal half, the cilia pure white. Underside of fore wing fuscous, the terminal half of costa golden yellow, the termen white; hind wing white tinged with fuscous except at termen.

*Hab.* PUNJAB, Dalhousie (*Barrow*), 1 ♂ type. *Exp.* 22 mm.

(44 a) *Crambus minimellus*, sp. n.

Head, thorax, and abdomen white tinged with ochreous; antennæ brownish except towards base. Fore wing pale ochreous; a rather diffused blackish medial line, oblique to submedian fold, then inwardly oblique; a rather diffused dark postmedial line defined on outer side by whitish, obliquely excurved to discal fold, then rather inwardly oblique and ending at submedian fold; blackish points on termen at veins 4, 3, 2. Hind wing white, the termen tinged with brown except towards tornus. Underside of fore wing tinged with brown except on inner area.

*Hab.* BR. GUIANA, Bartica (*Parish*), 2 ♂, 1 ♀ type. *Exp.* 10 mm.

(54 a) *Crambus dichotomellus*, sp. n.

♂. White; patagia tinged with pale rufous; abdomen irrorated with fuscous. Fore wing irrorated with fuscous; a black line from base through the cell obsolescent towards outer margin and defined by pure white below; very pale rufous suffusion on costal area and below base of median nervure.

*Hab.* CAPE COLONY, Annshaw (*Miss F. Barrett*), 1 ♂ type, Grahamstown, 1 ♂, Zuurberg (*Bairstowe*), 1 ♂. *Exp.* 24 mm.

(54 b) *Crambus ellipticellus*, sp. n.

♂. Head, thorax, and abdomen dirty white, the two latter suffused with pale brown; palpi brownish at sides. Fore wing somewhat elliptical and rounded at apex, white, the interspaces of costal half and the whole inner half suffused with pale brown leaving an almost pure white streak from base along median nerve to outer margin; the inner half irrorated with erect black scales of which there are a few on costal half also; a terminal series of black points. Hind wing white, the apical area suffused with brownish.

*Hab.* NATAL, Estcourt (*Hutchinson*), 2 ♂ type. *Exp.* 26-28 mm.

(62 a) *Crambus elongatus*, sp. n.

♂. Head, thorax, and abdomen white with a reddish ochreous tinge; antennæ fuscous; palpi with some blackish at sides, white above and below; pectus and legs suffused with fuscous. Fore wing white tinged with reddish ochreous leaving the costal area pure white except towards base; irrorated with a few black scales especially in submedian interspace and beyond the cell; a terminal series of black points to vein 3; cilia pure white. Hind wing white with a slight reddish ochreous tinge, the cilia pure white. Underside of fore wing suffused with fuscous brown, the terminal area white; hind wing white, the costal area tinged with brown.

*Hab.* CHILI, Chillan, 8000' (*Elwes*), 2 ♂ type. *Exp.* 40 mm.

(77 a) *Crambus tripartitus*, sp. n.

♂. Head white, the antennæ and palpi black; thorax black with a cupreous gloss and with dorsal white stripe; abdomen white with reddish brown hair on dorsum towards base; pectus and ventral surface of abdomen white suffused with cupreous brown; legs cupreous black-brown, the hind tibiæ streaked with white above. Fore wing with the costal area cupreous black-brown; a silvery white stripe through the cell and thence obliquely to apex, a broad cupreous black-brown stripe below it; the inner area silvery white with some cupreous brown scales on terminal half of inner margin and irroration on tornal area; a terminal series of black points from below apex to vein 2; cilia white with cupreous brown line near base except towards apex and some cupreous brown at tips. Hind wing silvery white. Underside with the fore wing and costal area of hind wing suffused with brown, leaving some white in and just beyond the cell of fore wing.

*Hab.* NATAL, Maritzburg (*Burnup*), 1 ♂ type. *Exp.* 24 mm.

(77 c) *Crambus chalcimerus*, sp. n.

♂. Head and thorax silvery white, the tegule, except dorsally, and patagia cupreous yellow; antennæ tinged with fuscous; palpi dark brown mottled with white; abdomen white dorsally suffused with cupreous yellow towards base; pectus, legs, and ventral surface of abdomen with some brown suffusion. Fore wing with the

costal area to discal fold cupreous yellow leaving the costal edge white; a silvery white stripe along median nervure and below discal fold to termen, a cupreous yellow stripe below its basal half, the inner area silvery white tinged and slightly irrorated with brown. Hind wing white suffused with reddish brown, the cilia pure white. Underside suffused with red-brown, the inner area of hind wing whiter.

*Hab.* BASUTOLAND, Masite (*Crawshay*), 1 ♂ type, Mohalishoek (*Crawshay*), 2 ♂. *Exp.* 2½ mm.

(128 a) *Crambus micralis*, sp. n.

Head white; thorax whitish mixed with cupreous brown; abdomen whitish with a slight cupreous tinge; antennæ brownish; pectus and legs whitish suffused with cupreous brown. Fore wing whitish tinged with cupreous and irrorated with dark brown; a patch of dark brown scales below middle of cell; postmedial line brown, oblique from costa to discal fold, where it is angled outwards, then inwardly oblique to middle of inner margin, forming a diffused spot at submedian fold; subterminal line double, dark cupreous brown, minutely waved, rather oblique towards costa, the inner line incurved at discal fold and curved inwards to inner margin; a black-brown terminal line; cilia white with a silvery gloss. Hind wing white tinged with brown, the cilia pure white. Underside of fore wing tinged with red-brown.

*Hab.* CUBA, Tanamo (*Schaus*), 2 ♂, 2 ♀; COLOMBIA, Honda, 1 ♂ type. *Exp.* 12 mm.

(131 a) *Crambus argentimaculalis*, sp. n.

Head, tegulae, and patagia white; palpi banded with brown; thorax brown; pectus and legs white, the tarsi banded with brown; abdomen fuscous above, white below. Fore wing red-brown; a large triangular white antemedial patch narrowing from below costa to inner margin; a diamond-shaped postmedial spot on costa and a hexagonal patch extending from vein 3 to inner margin; the fine postmedial line oblique from costa to vein 5, then joining the large patch at tornus; an apical spot; a fine dark terminal line; cilia white and rufous. Hind wing white tinged with yellow in male, with fuscous in female.

*Hab.* BRAZIL, Petropolis (*Doer*), 1 ♂, 1 ♀ type, Sao Paulo (*D. Jones*), 1 ♂, Castro Paraña (*D. Jones*), 1 ♀. *Exp.* 16 mm.

(131 b) *Crambus reseda*, n. n.

*Culladia mignonette*, Dyar, *Insec. Incit. Menstr.* ii. p. 164 (1914), nom. prav.

BR. & FR. GUIANA.

(131 d) *Crambus argyriplagalis*, sp. n.

♀. Head and thorax brown; palpi white mixed with brown; tegulae and patagia, pectus and legs white; abdomen fuscous above, white below. Fore wing red-brown; some white at base of

inner margin; a broad white antemedial band; a similar post-medial band with sinuous edges, its outer edge dentate below costa with an oblique striga from costa beyond it; a white patch at apex and another on termen from vein 4 to tornus; cilia white, silvery at middle. Hind wing white strongly tinged with fuscous.

*Hab.* SURINAM, Paramaribo (*Ellacombe*), 1 ♀. *Exp.* 14 mm. Type in Coll. Rothschild.

(132 a) *Crambus tessellatus*, n. sp.

♂. Head and thorax white mixed with dark cupreous brown; abdomen white suffused with brown; antennæ brownish; palpi cupreous brown, white above and below; pectus and legs white suffused with cupreous brown. Fore wing silvery white irrorated with some cupreous brown scales; a small rather wedge-shaped black-brown antemedial mark in cell and streak above inner margin; an ill-defined spot in middle of cell; a narrow cupreous brown medial band, oblique to middle of discocellulars, where there is an ill-defined black spot on it, then inwardly oblique and with elongate black mark on it below end of cell; an incomplete cupreous brown annulus beyond end of cell; subterminal line double, rather diffused cupreous brown, rather oblique to discal fold, then inwardly oblique and with diffused black spots on the inner line below veins 4 and 1; a slight black-brown subapical spot; a fine black-brown terminal line. Hind wing white tinged with reddish brown; cilia white with a brown line near base. Underside of fore wing suffused with reddish brown.

*Hab.* BR. E. AFRICA, N'dimu (*Betton*), 1 ♂ type. *Exp.* 14 mm.

(134 a) *Crambus perdentellus*, sp. n.

Head and thorax white, the patagia suffused with red-brown; antennæ dark brown; palpi banded with dark brown; abdomen whitish suffused with brown; fore legs and the tarsi cupreous brown above. Fore wing white irrorated and in parts suffused with cupreous brown; the costal edge black-brown towards base; medial line double, dark brown, very oblique to discal fold beyond the cell, where it is acutely angled outwards, then inwardly oblique, diffused and waved below the cell; subterminal line double, dark brown, obliquely excurved to discal fold, where it is angled outwards and also below vein 4, then strongly angled inwards just above submedian fold and outwards just below it; a fine black terminal line; cilia with a dark line near base and some dark brown at tips. Hind wing white, tinged with brown especially towards termen; cilia pure white. Underside of fore wing and costal area of hind wing suffused with dark brown.

*Hab.* BR. C. AFRICA, Mlanje plateau, 6500' (*Neave*), 2 ♂, 6 ♀ type. *Exp.* 22 mm.

(134 b) *Crambus apicenotatus*, sp. n.

♂. Head, thorax, and abdomen white tinged with reddish brown; antennæ ringed with brown; palpi brown mixed with

white. Fore wing tinged in parts and slightly irrorated with reddish brown; a dark streak in basal half of submedian fold and a blackish fascia in and beyond end of cell; slight diffused blackish marks beyond upper and lower angles of cell; the veins beyond the cell with slight white streaks defined by red-brown; subterminal line white defined on each side by brown, oblique to vein 6 near termen, then slightly sinuous, angled inwards at vein 2 and outwards at submedian fold, a semicircular chocolate-brown patch beyond it on apical part of costa; a fine dark terminal line; cilia with a dark line at middle. Hind wing white with a faint brown tinge; cilia with a pale brown line at middle. Underside of fore wing and costal area of hind wing tinged with brown.

*Hab.* FORMOSA, Banshorio (*Wileman*), 1 ♂ type. *Exp.* 12 mm.

(134c) *Crambus distictellus*, sp. n.

♂. Head white; thorax and abdomen white with a slight cupreous tinge; antennæ tinged with brown; palpi at sides, pectus and legs suffused with cupreous brown. Fore wing silvery white tinged with cupreous brown; an indistinct cupreous brown medial line, angled outwards at discal fold beyond the cell, then inwardly oblique and slightly sinuous, black points on it at discal and submedian fold; subterminal line double, cupreous brown filled in with white, very minutely waved, oblique to discal fold, then inwardly oblique and slightly incurved at submedian fold where there is a black point on the inner line; a dark cupreous brown terminal line; cilia silvery white at base, cupreous at tips. Hind wing silvery white with a faint cupreous tinge on costal area; a slight brown terminal line to vein 2. Underside of fore wing and costal area of hind wing suffused with cupreous brown.

♀. Thorax and fore wing more strongly suffused with cupreous.

*Hab.* FORMOSA, Takow (*Wileman*), 1 ♂, 1 ♀, Tainan (*Wileman*), 5 ♂ type, Anping (*Wileman*), 1 ♂, 1 ♀. *Exp.* 18 mm.

(134d) *Crambus prodontellus*, sp. n.

Head, thorax, and abdomen white suffused in parts with cupreous; palpi grey-brown at sides; tarsi white ringed with brown. Fore wing silvery white tinged with cupreous; dark streaks on subcostal and median nervure, slight cupreous brown streaks below basal half of costa and in discal fold and a shade below median nervure to just beyond end of cell; medial line double, dark, very oblique to discal fold where it is angled outwards to well beyond the cell, then angled inwards to origin of vein 2 and ending at submedian fold; subterminal line golden cupreous, slightly defined on outer side by silver, indistinctly double and oblique to discal fold near termen, then inwardly oblique and slightly sinuous, an oblique wedge-shaped dark brown mark beyond it from apex, defined below by white; a series of short black streaks in the interspaces of terminal area to vein 2; a fine blackish terminal line; cilia with a blackish line near base and some dark scales near tips. Hind wing white tinged with

cupreous brown, a rather darker terminal line; cilia white with a slight cupreous brown line near base. Underside of fore wing and costal area of hind wing suffused with cupreous brown.

Ab. 1. Fore wing with the markings paler and much less distinct.

*Hab.* BR. E. AFRICA, Kikuyu, Kiu (*Crawshay*), 1 ♀; TRANSVAAL, Groenvlei (*Janse*), 1 ♀, Doomfontein (*Janse*), 1 ♂, Pretoria (*Janse*), 1 ♂ type; CAPE COLONY, Zuurberg (*Bairstow*), 1 ♀. *Exp.* 18 mm.

(136 a) *Crambus diarhabdellus*, sp. n.

♀. Head and thorax white mixed with some black-brown; abdomen white, tinged with brown at base; antennæ brownish; palpi white above, brown below; legs streaked with brown. Fore wing white with slight red-brown irroration on costal half and more distinct irroration on inner half; a black streak on median nervure to end of cell and thence to the subterminal line below discal fold, defined below by a red-brown shade; a slight red-brown streak in discal fold beyond the cell; a slight red-brown line from middle of costa, angled outwards at discal fold to the subterminal line and ending at the black streak; subterminal line double, red-brown filled in with silvery white, obliquely excurved to discal fold, then rather oblique and sinuous, an oblique wedge-shaped black mark beyond it from apex and quadrate spots at discal and submedian folds; a fine black terminal line; cilia white, tinged with red-brown at tips. Hind wing white with a faint brownish tinge. Underside of fore wing and costal area of hind wing suffused with red-brown.

*Hab.* SUDAN, Blue Nile (*Flower*), 1 ♀; BR. C. AFRICA, Mt. Mlanje (*Neave*), 1 ♀ type. *Exp.* 22 mm.

(138 a) *Crambus microstrigatus*, sp. n.

Head and thorax white, the tegulæ at sides and patagia tinged with reddish ochreous; palpi tinged with brown; abdomen creamy white; tarsi brown ringed with white. Fore wing silvery white with a faint cupreous tinge in the interspaces; a black discoidal point; a fine golden cupreous line from middle of costa, angled outwards at discal fold to far beyond the cell, then inwards to origin of vein 2 and ending at submedian fold; subterminal line golden cupreous defined on outer side by silver, double towards costa, obliquely excurved to discal fold, then oblique, a golden cupreous streak beyond it from apex; a series of minute black streaks before termen from below apex to vein 2; a fine golden cupreous terminal line; cilia with a golden cupreous line near base and some golden cupreous at tips. Hind wing silvery white with a faint red-brown tinge, the cilia pure white. Underside of fore wing and costal area of hind wing with a slight red-brown tinge.

*Hab.* BR. C. AFRICA, Mt. Mlanje (*Neave*), 1 ♂, 5 ♀ type. *Exp.* 20-22 mm.

\* (138 b) *Crambus chionostola*, sp. n.

♀. Pure white. Fore wing with subbasal fulvous points in and below the cell; an oblique striga below costa before middle with a point on median nervure just beyond it and another striga on vein 1 nearer the base; a rather darker discoidal point; the post-medial line represented by an oblique striga from costa, with a longer and more oblique striga on its inner side to vein 7 where it is angled, then by a slightly incurved series of points; a terminal series of points; cilia chequered white and golden ferruginous. Hind wing with terminal ferruginous line from apex to vein 3.

*Hab.* ALOR IS. (*Doherty*), type ♀ in Coll. Rothschild. *Exp.* 24 mm.

(138 c) *Crambus agraphellus*, sp. n.

♂. Head, thorax, and abdomen white with a faint ochreous brown tinge; antennæ tinged with fuscous. Fore wing white slightly tinged with ochreous brown; a slight rather oblique brown discoidal lunule; a faint curved slightly waved brownish sub-terminal line; a slight brown terminal line. Hind wing silvery white. Underside of fore wing and costal area of hind wing suffused with red-brown.

*Hab.* SEYCHELLES IS., Aldabra (*Fryer*), 1 ♂ type. *Exp.* 16 mm.

(138 d) *Crambus monostictus*, sp. n.

♀. Head, thorax, and abdomen white; pectus, legs, and ventral surface of abdomen with a red-brown tinge. Fore wing white, the area beyond the cell tinged and irrorated with pale red-brown; a black discoidal point; traces of an obliquely curved red-brown line from costa beyond middle to middle of inner margin; a rather punctiform black terminal line; cilia with a fine black line near base and brownish line near tips. Hind wing silvery white with a slight red-brown terminal line except towards tornus. Underside of fore wing tinged with red-brown.

*Hab.* BR. C. AFRICA, Mpondas (*de Jersey*), 1 ♀ type. *Exp.* 18 mm.

(165 a) *Crambus argentictus*, sp. n.

*Crambus quinqueareatus*, Druce, Biol. Centr.-Am., Het. ii. p. 289 (nec Zell.).

Head and thorax golden cupreous; antennæ brown; palpi below and pectus in front white; abdomen whitish suffused with red-brown, the anal tuft whiter. Fore wing golden cupreous; a silvery white fascia from below costa to submedian fold, its lower edge very slightly angled at lower angle of cell, then narrowing to near termen and bent upwards as a wedge-shaped mark to apex; a slight dark streak below it in submedian fold to end of cell; postmedial line cupreous, oblique to discal fold, then inwardly oblique and



slightly sinuous, some slight white marks beyond it on costa and fine white pencillings below the fascia with short black streaks in the interspaces before termen to the submedian fold; a fine cupreous brown terminal line; cilia silvery white, tinged with cupreous brown at tips. Hind wing silvery white. Underside of fore wing white tinged with red-brown above and below the fascia which is faint and diffused.

*Hab.* MEXICO, Jalapa (*Trujillo*), 3 ♂, 6 ♀ type, Misantla (*Trujillo*), 1 ♀, Godman-Salvin Coll.; BAHAMAS, Andros (*Bonhote*), 1 ♂. *Exp.* 22-24 mm.

(167 a) *Crambus ruptifascia*, sp. n.

♀. Head and thorax cupreous brown; palpi white below at base; abdomen white, tinged with brown at base and more strongly on ventral surface. Fore wing cupreous brown; a silvery white fascia from base through the cell, ending in a point well beyond it, a short white streak on costa beyond middle and an oblique wedge-shaped mark from apex; a curved metallic silver subterminal line with a golden cupreous shade before it with slight silvery streaks before its inner edge; short black streaks in the interspaces before termen from below the oblique white mark to below vein 2; cilia silvery white tinged with red-brown and with a red-brown line near base. Hind wing whitish suffused with red-brown, the cilia white with a red-brown line near base. Underside of fore wing brown, of hind wing whitish suffused with brown.

*Hab.* MEXICO, Milpas (*Forrer*), 1 ♀ type, Godman-Salvin Coll. *Exp.* 30 mm.

(169 a) *Crambus aureorufus*, sp. n.

♂. Head and thorax cupreous red; antennæ brownish; palpi pale red-brown, white below; abdomen white tinged with red. Fore wing cupreous red, the inner area with a whitish tinge; a silvery white fascia from base through the cell, bidentate before the subterminal line and the upper tooth met by an oblique wedge-shaped silvery white mark from apex; a metallic silver subterminal line, oblique to vein 6; a series of short black streaks before termen from below the oblique white mark from apex to below vein 2; a blackish terminal line towards apex; cilia white tinged with rufous, pure white towards apex. Hind wing silvery white. Underside with the fore wing and costal area of hind wing rufous.

*Hab.* BRAZIL, São Paulo (*D. Jones*), 3 ♂ type. *Exp.* 26-30 mm.

(169 b) *Crambus brachiiferus*, sp. n.

♂. Head white; thorax cupreous with a white dorsal stripe; abdomen white tinged with red-brown; antennæ blackish; palpi pale brown at sides; pectus and ventral surface of abdomen white; legs pale brown. Fore wing cupreous; a silvery white fascia

defined by dark streaks from base through the cell, bifurcating and forming a lobster-claw mark before the subterminal line, the upper claw met by an oblique wedge-shaped silvery white mark from apex; a silvery white fascia from inner margin before middle to termen below vein 1, defined above and below by dark streaks except towards base; a white fascia below terminal part of submedian fold; subterminal line dark defined on each side by white and oblique to vein 6, then inwardly oblique and cupreous brown defined on outer side by silver; a triangular cupreous brown mark on apical part of costa; the terminal area white finely pencilled with cupreous brown below the oblique mark from apex and with fine black streaks in the interspaces to the submedian fold where the streak extends to before the subterminal line; the apex strongly produced and hooked, with a black line on termen towards apex; cilia white, tinged with cupreous towards tips. Hind wing silvery white tinged with red-brown, the cilia pure white. Underside of fore wing and costal area of hind wing suffused with red-brown.

*Hab.* BR. C. AFRICA (*Coryndon*), 1 ♂ type, Mt. Mlanje (*Neave*), 1 ♂; MASHONALAND (*Dobbie*), 1 ♂ *Exp.* 20-24 mm.

(169 c) *Crambus infradentatus*, sp. n.

♂. Head and thorax white tinged with brown, the patagia rufous; palpi dark brown mixed with white, white above; abdomen white tinged with red-brown. Fore wing cupreous; the costal edge white except towards base; a silvery white fascia from base through the cell to the subterminal line where it is met by an oblique silvery white wedge-shaped mark from apex, its lower edge with a black tooth on base of vein 2 and its upper edge defined by a black streak on terminal half, the oblique mark from apex also defined by black lines at sides; a diffused silvery white fascia along vein 1; postmedial line cupreous, very obliquely excurved and defined below by white from middle of costa to discoidal fold, then defining the lower edge of the fascia to vein 3 where it terminates; subterminal line cupreous, oblique and defined on outer side by silvery white to discal fold, then inwardly oblique defined on outer side by metallic silver and ending at submedian fold; the terminal area white finely pencilled with cupreous brown and with black streaks in the interspaces from below the oblique mark from apex to submedian fold and with fine cupreous brown terminal line; cilia silvery white with a cupreous brown line near base becoming black towards apex. Hind wing silvery white. Underside of fore wing suffused with brown, the inner and terminal areas whitish, the termen with dark line towards apex, then a series of points to submedian fold; hind wing with the costal area tinged with red-brown.

*Hab.* TRANSVAAL, White R. (*Cooke*), 1 ♂ type. *Exp.* 24 mm.

[To be continued.]

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CONTENTS OF NUMBER 15.—*Ninth Series.*

---

	Page
XXI. On the Hymenoptera collected in New Caledonia by P. D. Montague in 1914. By ROWLAND E. TURNER, F.Z.S., F.E.S. . . . .	229
XXII. Descriptions and Records of Bees.—LXXXV. By T. D. A. COCKERELL, University of Colorado. . . . .	240
XXIII. On a new Genus and Species of Bird of the Family <i>Drepanididae</i> from the Hawaiian Islands. By R. C. L. PERKINS, D.Sc., F.Z.S. . . . .	250
XXIV. Notes on Myriapoda.—XVI. Some Observations on Nomenclature. By HILDA K. BRADE-BIRKS, M.Sc., M.B., Ch.B., L.R.C.P., M.R.C.S., and the Rev. S. GRAHAM BRADE-BIRKS, M.Sc. . .	253
XXV. Some Observations on <i>Pleurocystis cuénoti</i> , Hesse, 1909, a Cœlozoic Parasite of the Earthworm. By W. HAROLD LEIGH-SHARPE, B.Sc. (Lond.) . . . . .	256
XXVI. Notes on Gerbils referred to the Genus <i>Meriones</i> , with Descriptions of new Species and Subspecies. By OLDFIELD THOMAS .	263
XXVII. Notes on the Family <i>Dendrocolaptidae</i> , with Suggestions for its Division. By CHARLES CHUBB, F.Z.S., M.B.O.U., Zoological Department, British Museum (Natural History) . . . . .	273
XXVIII. Descriptions of new <i>Pyralidae</i> of the Subfamilies <i>Crambinae</i> and <i>Siginae</i> . By Sir GEORGE F. HAMPSON, Bart., F.Z.S., &c. . .	275

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\*\*\* 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.

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



CONDUCTED BY

WILLIAM CARRUTHERS, Ph.D., F.R.S., F.L.S., F.G.S.,  
ARTHUR E. SHIPLEY, M.A., Sc.D., F.R.S., F.Z.S.,

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# THE ANNALS

AND

## MAGAZINE OF NATURAL HISTORY.

[NINTH SERIES.]

No. 16. APRIL 1919.

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XXIX. — *On Deronectes depressus, Fab., and elegans, Panzer.* By FRANK BALFOUR-BROWNE, M.A. (Oxon. et Cantab.), F.R.S.E., Lecturer in Entomology in the Department of Zoology, University of Cambridge; Staff Lecturer in Entomology in France; Capt. R.A.M.C.T. Reserve.

[Plates VII. & VIII.]

IN our standard work upon British beetles and in our catalogues there are five species of *Deronectes*, of which one is given as *Deronectes depressus*, F., sometimes with *elegans*, Panz., as a synonym.

Under this name we have two species mixed in our collections, and these two species, although easily confused, are really distinct, and with a little experience easily separated.

One of these is common throughout England and Scotland, while the other seems to be limited in its distribution, being confined, so far as I know at present, to Scotland and the north of England and to Ireland, where it is apparently the only one found. My uncertainty as to Ireland rests upon the fact that before I knew of the existence of these two species I had "*depressus*" in my records for most parts of that country—for twenty-four out of the thirty-eight county and vice-county divisions,—but I had actually kept very few specimens. These, however, all prove to be what I will call the northern species, and all other Irish specimens I have

since seen—a few in the Dublin Museum collection, a few in the Natural History Museum collection, some in the collection of Dr. G. W. Nicholson—belong to this species.

The discovery of the existence of this northern species in the British fauna I attribute to Dr. Sharp, although he tells me he remembers nothing about it and cannot now find in his collection the specimens which I thought I had seen there; but it was Capt. Ste. Claire Deville, of Épinal, France, who, in 1911, suggested to me the possibility of its existence in these islands. I had sent him a number of British water-beetles, and among them one or two English specimens of what I had named "*D. depressus*," and in acknowledging the receipt of them he said: "I agree with you for the names of all Dytiscidæ but *Deronectes depressus*, which seems to me to be our *D. elegans*, Sturm. The true *depressus*, an Arctic species, which I have from Russia, Norway, and also from Eastern Pyrenees, is perhaps also British" \*.

Later in the year I was in Brockenhurst, and I mentioned this matter to Dr. Sharp, who, as I think, agreed that our common form was "*elegans*," and showed me two rather large and dark specimens of *Deronectes* from some eastern Scottish locality—I think it was L. Brandy in Forfarshire—which he considered to be the "*depressus*" of Fabricius.

After casually looking through my specimens, and failing to recognize any differences among them, I let the matter drop until in July 1915 I came across a statement by Thomas Bold, who, speaking of *Hydroporus elegans*, Illiger, said:—"I take a strongly marked var. of this common insect in Talkin Tarn, Cumberland. At first sight they much resemble *H. 12-pustulatus*, being much larger and darker coloured than the specimens of *elegans* from running water. Some have the elytra wholly black, except a narrow yellow margin, others are more or less lineated with yellow, and scarcely any of them have the spotted appearance characteristic of the species" †. This re-aroused my interest in the subject, and, as I was just starting to motor to Scotland, I determined to make a slight detour so as to visit Talkin Tarn on my way. This small tarn lies about 9 miles east of Carlisle, at

\* Postcard, May 23, 1911.

† "Capture of some of the rarer *Hydropori* in the North of England," Zoologist, xii. pp. 4193-4195 (1854). *Vide also ibid.* xi. 1853, pp. 3924, 3925. Report of Proceedings of Tyneside Nat. Field Club Meeting, Mar. 30, 1853, where a large dark var. of *H. elegans*? from Talkin Tarn is mentioned.



about 400 feet above sea-level, and within 2 miles of the main road between Carlisle and Newcastle, so that it was not difficult to get at. The day of my visit was not propitious; it began to rain heavily just as I got to the tarn, and I spent a miserable fifteen minutes paddling about at the edge, during which time I collected five species of Hydradephaga, and among the few specimens were two of Bold's "large and dark *elegans*."

On an examination of these a few days later, and on comparison with some freshly caught specimens from the Nith at Dumfries, I began to suspect that the Talkin Tarn individuals were the "*depressus*" referred to by Ste. Clair Deville, and I returned to the tarn and collected a number of specimens for further examination.

During August I examined a number of lochs and streams in the south of Scotland (Selkirk, Dumfries, Kirkcudbright, and Ayr), and definitely came to the conclusion that there were two species; but I was also greatly struck by the extraordinary distribution of the rarer one, which occurred in only a few lochs scattered about the district. Shortly after that, military duties, illness, and a long convalescence intervened, and it is only recently that I have again taken up the matter, and during August of last year I explored a number of the Galloway lochs with a view to further investigating the distribution there of the form which I take to be the *depressus* of Fabricius.

The characters upon which the two species can be separated are three in number: (1) the shape of the thorax in ♂ and ♀, (2) the form of the anterior tarsal claws of the ♂, and (3) the form of the ædeagus.

In general appearance the two species are usually very much alike, the colour-plan being similar, but, as a rule, the northern species is rather larger than the other. The range of colour-tone in the common species is greater than in the northern one, which is always dark, the yellow being reduced to a minimum, the black always occupying a large extent of the surface of the elytra. In the common species, especially in specimens from the south, the yellow is usually lighter in tone and the black more limited, but the relationship between the black and yellow seems to be related to habitat and to climatic conditions, as is the case with *Platambus maculatus*, *Deronectes griseo-striatus*, and some other Hydradephaga. In the Scottish lochs I can find no difference whatever in colour-tone between the two species.

1. *The Thorax*.—To some extent the form of the thorax is of use as a discriminating character, although by itself it is of little value.

Comparing the males:—In the northern species the sides of the thorax tend to diverge, so that it is wider behind than in front, the greatest width being almost at the posterior angles. In the common species the sides of the thorax, although curved, run more or less parallel, the greatest width being some distance in front of the posterior angles.

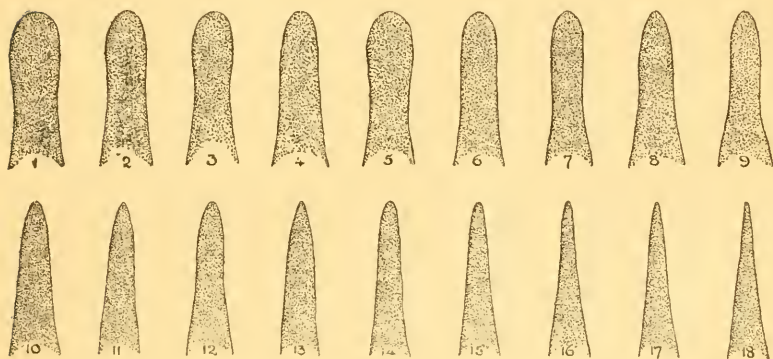
Comparing the females:—In the northern species the sides of the thorax are more or less parallel, so that it is about as wide, or very nearly as wide, posteriorly as anteriorly. Also the length in the median line from the anterior to the posterior edge is usually rather more than half the breadth at the broadest part. In the common species the sides of the thorax contract, so that it is distinctly narrower behind than in front, and the length in the median line is not quite half the breadth at the broadest part.

The form of the thorax is, however, not an entirely reliable character, as some males of the northern species are more parallel-sided, and some males of the common species, especially perhaps from some of the northern localities, have the thorax with at least a suggestion of greater width behind. In the females this character is even less reliable, which is specially unfortunate, since it is the best I can find, the female sexual armatures being quite similar. I will go so far as to say that the variation and overlapping of the two species in the form of the thorax in the female are such that I do not feel confident in determining the species from female specimens only. In three cases in which I had only females I named them tentatively. In two of these cases I later found males, and I happened to have been right in my determination, but I still feel that the female character is not reliable.

2. *The anterior tarsal claws of the males* form a useful character for distinguishing the two species. In the northern one these claws are usually much longer and the inner claw is much more strongly curved than in the common species. In both cases the curve is nearer the apex than the base, but the claw is more bent in the northern species, while in the common one the curve is gentle and regular. Whereas the outer (posterior) claw in the northern species is often slightly shorter than the inner (anterior) one, in the common species the two claws are more usually equal in length. The claw-

characters, taken in conjunction with the thorax-characters, generally enable one to separate the males with comparative ease, and so far, with one exception, I have always been able to determine the species on these characters, a subsequent examination of the ædeagus confirming my previous determination.

3. *The Ædeagus.*—In the northern species this organ, viewed from above, has a broad apex, while in the common form it has a pointed one, and until my recent visit to Gallo-way I regarded this character as definitely proving that we have two distinct species. On looking through my additional material from eighteen more lochs, I had no difficulty in separating the males of the two forms on the thoracic and



Apices of ædeagi of specimens of *D. depressus* ("the northern species") and *D. elegans* ("the common species"), chosen to show the range of variation.—Figs. 1-9. *D. depressus* (1, Talkin Tarn; 2, L. of the Lowes; 3, L. Ürr; 4, L. Doon; 5-9, L. Dungeon). Figs. 10-18. *D. elegans* (10, 11, R. Spey; 12, 13, Long L. of the Dungeon; 14, L. Stroan; 15, L. Aber; 16, L. Skene; 17, Broadford River, Skye; 18, Moorlinch, N. Somerset).

tarsal claw-characters except in one case—Loch Dungeon, the specimens from which I put down as "uncertain." On examining the ædeagus of these specimens I found a range of width in the apex from that of typical "northern" specimens to a comparatively narrow and bluntly pointed form (*vide* figs. 5-9 *infra*).

Now I had previously noticed that there was a variation in

width in both species, but until I examined the Loch Dungeon specimens there was always a wide gap between the two types of ædeagus, the northern form being rounded at or even slightly flattened across the apex, and the common form pointed; and here, in specimens from this one loch, I found intermediates closing the gap. In the tarsal claw-character the males are mostly of the northern type, but in the shape of the thorax there is considerable variation. The females, too, are mostly what, in the absence of males, I should have left unnamed or put down very doubtfully as the common species.

The first explanation which will occur to anyone is that we have in Loch Dungeon a hybrid; but there are one or two objections to this view. In the first place, I did not find in the loch any male with an ædeagus of the normal "common species" type. The narrowest ædeagus is as broad as or broader than the broadest ædeagus of the common species (*v. fig. 10*), although the surrounding lochs contain the common species with a narrower ædeagus.

In the second place, if this loch contains hybrids, why does no other of the thirty-two lochs I have examined contain them? \* With one exception I have not found both species present together in any loch, and in the exceptional case—Loch Stroan—I only found a single male of the northern species, while the common one was abundant there.

It seems open to question, therefore, whether we have merely one species showing extreme range of form or whether we have two species very closely related to one another. On the evidence in my possession, *i. e.*, after examining considerably more than five hundred specimens, I am inclined to adopt the latter view, first, because the variation in the ædeagus does not overlap in the two forms, and connecting-links have so far only turned up in the one loch, and, secondly, because of the extraordinary distribution, isolation, and rarity of this northern one, to which I will refer in detail later on.

Having come to the conclusion that these are two distinct species, the question arises, are they, as has been suggested, the *depressus* of Fabricius and the *elegans* of Panzer, or is one of them something new? The most direct method of settling the question would have been by comparison with the types of the two species, and I had great hopes that the "*depressus*"

\* I have altogether examined forty-five lochs in southern Scotland, but seventeen of these contained neither species.

type might exist in this country. Fabricius, in his 'Entomologia Systematica,' frequently mentions where his type-specimens are to be found, but in the case of "*Dytiscus depressus*" he gives no such information; and an examination of the Banksian Collection in the Natural History Museum and of Graham Kerr's published list of Fabrician types in the Glasgow University Museum failed to discover its location. It is presumably in Copenhagen or some other Scandinavian museum if it is still in existence.

As to Panzer's type, I could get no information, and in the absence of the types I had to fall back upon the literature. I therefore started with Fabricius's *Ent. Syst.*, and examined most of the important works from 1792 up to the present time, and I have looked up more than forty references in the course of this examination. Two points have struck me during this part of the work: one is the exceeding vagueness of the original descriptions, which give only colour-characters for the recognition of the species, and the other is that, where subsequent authors have treated *depressus* and *elegans* as distinct species, they have mostly shown an extraordinary lack of originality, relying, like their predecessors, mainly upon colour-characters and merely varying the words of the original descriptions.

I have included at the end of this paper a bibliography of the works I have looked up, with, in each case, a short note as to the view taken by the author, but a short *résumé* of some of the more important works may be of interest.

Fabricius's original description was published in 1792 and that of Panzer about 1793—Paykull, Illiger, and Marsham following in order of date. The first only refers to Fabricius's species, without giving any indication as to whether he knew *elegans*. Illiger describes the colouring of Panzer's species, and then says "the *D. depressus* appears to be closely related to this species," showing that he only knew the latter from a description.

How Marsham identified our common British species as *elegans* we have no means of knowing, but we can assume that either he did not know *depressus*, which seems probable, or that he regarded it as distinct from Panzer's species.

Dufts Schmidt seems to have been the first to regard "*elegans*" as a synonym of "*depressus*," though the remark he makes suggests that he possibly had the latter, since he mentions that whereas Panzer and Illiger describe their species as having the underside rusty red, his specimens have that part black.

From that time on the writers can be divided into those who regarded "*elegans*" as a synonym of "*depressus*" and those who recognized two distinct species. Among the former are Schonherr, Gyllenhall, Kunzé, Stephens, Zetterstedt, Wilson and Duncan, Aubé, Schiödte, Schaum (1868), and Sharp.

So far as I can make out, Stephens has merely followed Kunzé, since in his later work (1829) he gives the species as "*depressus*, Kunzé." Aubé regards individuals with the black reduced as *elegans*, Sturm, and his long description is mainly a colour one. Schaum, in an earlier paper (1843), regarded *elegans* as a distinct species, and he mentions its occurrence in salt lakes in Saxony, refers to the synonymy, and points out the longer form and darker underside of "*depressus*, F., Gyll., Sahlb., and Sturm, and also refers to the distribution of this latter species, which, he says, appears to be indigenous to Finland, Sweden, Denmark, and Kief (Mid-Russia), *elegans* being found throughout Mid and South Germany, France, and Switzerland. In 1868, however, he alters his opinion, giving "*elegans*" as a synonym of "*depressus*," but remarking that Swedish examples ("*H. depressus*, Gyll.)" are longer and darker than the German ones.

Sharp, in his 'Dytiscidæ,' says nothing about *elegans*, and gives what is mainly a colour-description of "*Dytiscus depressus*, Fab." His types (no. 241. 1 ♂ and 1 ♀ "Anglia" and 1 ♀ "Europa"), in the Natural History Museum, are, however, our common species, and I have therefore concluded that he regarded "*elegans*" as a synonym of "*depressus*."

Among those who regard *elegans* as a distinct species we find Sturm, Murray, Bach, Bosé, Seidlitz, Ganglbauer, Everts, and Reitter, while we may perhaps include the Sahlbergs and Thomson, who only describe *depressus*, but from a region where *elegans* would be less likely to occur.

Sturm makes three species out of his material, calling his new one "*brevis*," but, according to Schiödte, he admits that he has only seen a single specimen of the northern *depressus*, and his descriptions, beyond referring to minute differences in form, only deal with colour-characters. Subsequent authors have regarded his "*brevis*" as a synonym of "*elegans*."

In his 'Icones' on pl. cciii. he has a typical *elegans* labelled "*H. depressus*," which he explains is a mistake for "*H. brevis*." On pl. ccv. he illustrates "(A) *H. elegans*, Illig.,"

and “(B) *H. depressus*, Gyll.” The sex of the individuals drawn is not mentioned, but by the shape of the thorax A is more like *depressus*, while the dark colouring of B agrees with his description of that species, the shape of the thorax in his drawing suggesting either a ♀ *depressus* or a ♂ *elegans*.

Murray gives *H. elegans*, Illiger, as our British species, with the synonyms “*depressus*, Aubé, Steph., not *Fab.*, *brevis*, Sturm,” and this elimination of Fabricius’s species as something distinct is interesting. Further, his synonymy shows that he regarded Aubé and Stephens as wrong in their species.

Bach’s remarks are of interest mainly because of what he says as to the habitat of *elegans*. He describes *depressus* as very rare, while *elegans*, he says, occurs in the salt lake at Eisleben, a statement which agrees with Schaum’s observations at Sülldorf and Stassfurth, also in Saxony but a little farther north. For a species which elsewhere occurs in lakes and rivers this habitat is remarkable, but we find other Hydradephaga and Hydrophilidæ showing similar peculiarities—in fact, several at least of our brackish-water beetles are freshwater species in the Mediterranean district.

Seidlitz for the first time gets off the beaten track, and about ninety years after the discovery of the two species finds reliable characters upon which they may be separated. He refers to the different forms of the two insects, mentioning the thorax, and he also mentions the difference in form and size of the anterior tarsal claws of the males; and from his description, which has been enlarged upon by Ganglbauer, I regard our northern species as his “*depressus*” and our common one as his *elegans*.

In a footnote (1886, p. 57) he states that Sturm was the first to separate the two species, and that the earlier writings of Panzer and Illiger refer to *depressus*. Undoubtedly Sturm is the first author to refer to both and to describe them as separate species, but I can find no evidence for the statement as to Panzer and Illiger. So far as colour is of any value as a discriminating character, it is quite evident that Panzer is referring to lighter-coloured specimens than Fabricius, and from the chain of evidence which I have outlined I regard *elegans* as his species.

#### *Habitat and Britaninic Distribution.*

So far as habitat is concerned, *D. elegans* is a river and loch species in our islands, whereas, omitting Ireland, which

requires further investigation, *D. depressus* is apparently only a loch species.

The same type of loch suits both, and they occur upon a stony, gravelly, or sandy bottom, but apparently not on a peaty one. Some sort of vegetation seems to be necessary, but whereas in some lochs I found the beetles on ground carpeted with *Lobelia dortmanni*, in others this weed failed to produce any. The most fertile spot was usually where there was a patch of *Myriophyllum* or other weed on a stony bottom, but even such a place sometimes failed to produce a single individual.

I examined seventeen lochs without finding either species, and the following is a list of these:—

"Upper Loch," Lochmaben.	Dumfries.
Clearburn L.	Selkirk.
L. Smaddie.	Kirkcudbright.
L. Lurkie.	
L. Arthur or Lotus L.	Kirkcudbright.
Knocksting L.	"
Lochenbreck L.	"
Little Dornell L.	"
Blates Mill L. (by Woodhall L.).	Kirkcudbright.
Dry Loch (Dungeon of Buchan).	"
L. Dow (Craignaw).	"
Craiglee L. (top of Craiglee).	"
Long L. of Glenhead.	"
L. Minnoch.	"
L. Enoch.	"
L. Arron.	"
L. Neldricken.	"

In the case of one or two of these the peaty bottom perhaps made the habitat unsuitable (*e. g.*, Little Dornell L., Blates Mill L., and "Upper" L.), while in others perhaps altitude excluded them (*e. g.*, L. Enoch, 1600 ft.; L. Arron, 1400 ft.; Craiglee L., 1700 ft.; and L. Dow, 1300 ft.), but in the case of most of the others I cannot imagine why I found neither species, except that I was unlucky. Why, for instance, should L. Neldricken not have either of them, when both L. Valley and L. Narroch possess *elegans*? The Long L. of Glenhead is to all appearance quite as suitable for the species as the Round L., which contains *elegans*. Knocksting L. and L. Arthur I worked thoroughly and over very promising ground, and yet without result. L. Minnoch, lying between Lochs Harrow and Dungeon, I worked three times, and examined it all round, and yet failed to find any water-beetle at all. Such a result is very rare in my experience. Lochen-



breck L. being the only other loch in the list which gave a like result.

Seeing that *D. depressus* is a northern species, I certainly expected to find it at higher altitudes than *D. elegans*, and yet, whereas the latter occurred in several lochs above the 1000-foot line, usually with the true "Arctic" species *D. griseo-striatus*, the former was in no loch above this level—in fact, excepting L. Dungeon, which is about 1000 feet above the sea, all the other lochs in which it occurred are at a much lower altitude.

The habits of the two species seem to be identical. In some places the beetles occur in shallow water at the side, so that they can be caught without one having to take off shoes and stockings, while in other places the only way to get them is to strip and go in almost to the waist. In one part of L. Doon, for instance, I got a few specimens in about 2 feet of water, but none closer in, whereas in another part I failed to get any until I scraped about in the shallowest places. In Loch Dungeon I caught a single specimen in the shallows, and then found them in abundance in a place where the gravel suddenly sloped downwards into deep weedy water. In Loch Narroch I got nothing until I stripped and went in, and then I found plenty of specimens in 3 to 4 feet of water. Again, in Loch Ken, wading to the knees enabled me to obtain a dozen and more specimens within five minutes.

Possibly, of course, the beetles vary their depth at different times, and the same place in a loch might yield quite different results at different hours or on different days; but I have not yet investigated this point, and am merely recounting my experiences in obtaining my material.

With regard to the Britannic distribution of the two species, I have already mentioned that apparently only *D. depressus* occurs in Ireland, and I have in my collection or have seen specimens from Antrim, Fermanagh, Cavan, Sligo, and Cork West. In Britain the only counties in which I have so far taken this species are Cumberland, Selkirk, Dumfries, Kirkcubright, Ayr, and perhaps Dumbarton (Loch Lomond); but in the latter case I have only a female specimen, and, as I have said, I do not feel quite certain as to the species in the absence of a male.

Of the thirty-two lochs examined in which one or other of the two species occurred, *depressus* was only found in eleven, and the following is a list of these:—

Talkin Tarn.	Cumberland.	
St. Mary's Loch.	{	Selkirk.
L. of the Lowes.		

L. Urr.	Dumfries and Kirkcudbright (specimens taken in various parts of the loch).
L. Roan.	Kirkcudbright.
L. Ken.	"
L. Dungeon.	"
L. Stroan (1 only).	Kirkcudbright.
L. Dornell.	"
Woodhall L.	"
L. Doon.	Ayr.

With the exception of L. Stroan, where only one specimen (♂) occurred amongst many *elegans*, these lochs, scattered over a large district, were occupied by *depressus* to the entire exclusion of *elegans*. In some, *e. g.*, Talkin Tarn, L. of the Lowes, L. Roan, and L. Ken, it was abundant and easily taken, whereas in others an hour or more was necessary to get sometimes only a few specimens.

A glance at the Ordnance Map will show the extraordinary nature of this distribution. In the Merrick and Kells district, out of thirteen lochs examined only one (L. Dungeon) gave me this species, while seven gave me *elegans*. Why should Lochs Urr, Ken, Roan, Woodhall, and Dornell contain *depressus*, when Howie, Skerrow, Auchenreoch, Milton, Lochrutton, Aber, and Kinder contain *elegans*, or why should St. Mary's L. and the L. of the Lowes have the former, while L. Skene, an "Arctic" loch dammed up by moraine material, only contains the common species?

If *depressus* occurred in such lochs as Enoch and Skene, we could quite easily account for its distribution, on the ground that it is a remnant of the old fauna of the Glacial Period still holding on in a few isolated habitats; but its "spotty" distribution and its isolation from *elegans* are facts as to the explanation of which I can at present make no guess. When things once more settle down to their normal, I hope to further investigate the matter and to follow out the life-histories of the two species, from which, perhaps, something may be learnt.

The common species, *elegans*, is undoubtedly much more widely distributed than my records indicate; but this is not the time to worry other Coleopterists to send me their specimens for examination, so that I have been limited in material almost to what I have collected myself. I have in my collection or have seen specimens from the following counties and vice-counties:—Cornwall, W.; Devon, S.; Somerset, N. and S.; Hants, S.; Kent, E. and W.; Middlesex; Bucks; Herts; Cambs; Norfolk, E.; Suffolk, E.; Cumberland; Isle of Man; Dumfries; Kirkcudbright; Lanark; Renfrew; Peebles; Edinburgh; Mid-Perth; Easternness and Ebudes N.

I have records for *depressus*, Brit. auct., for 43 out of the 70 English and for 21 out of the 41 Scottish county and vice-county divisions, and it is most probable that the majority of these refer to *elegans*, which is almost certainly a typical "British" species in Watson's sense of the term\*.

With regard to the distribution of this species in the southern Scottish counties, it occurred in the following twenty-one lochs:—

L. Ettrick.	Dumfries.
L. Skene.	"
Castle L.	} Lochmaben, Dumfries.
Kirk L.	
Mill L.	
Hightae L.	
L. Kinder.	Kirkcudbright.
Lochrutton L.	"
Milton L.	"
Auchenreoch L.	"
L. Aber.	"
L. Howie.	"
L. Stroan.	"
L. Skerrow.	"
L. Dee.	"
Long L. of the Dungeon.	Kirkcudbright.
Round L.	" " " "
L. Narroch.	Kirkcudbright.
L. Valley.	"
Round L. of Glenhead.	Kirkcudbright.
L. Harrow.	"

In Cumberland the only loch I examined other than Talkin Tarn was Tindale Tarn, about 3 miles distant, and there this species occurred commonly.

So far I have not found *depressus* in any British stream, but if it occurs in Irish rivers—a point not yet determined, as all my Irish specimens are from lochs and canals—it may perhaps also occur in Scottish ones.

I have, or have seen, river specimens of *elegans* from the Nith, Dumfries; Spey, Easternness; Broadford R., Skye; Almond R., Mid Perth; and the Water of Leith, Edinburgh. These river specimens are always more brightly coloured than loch specimens, and I think I should not hesitate to determine female river specimens of *elegans* even in the absence of males. However, if *depressus* also occurs in some rivers it may have brightly coloured individuals also.

Much remains to be done on the economy of these two

\* 'Cybele Britannica, or British Plants and their Geographical Relations,' 1847.

species, but, as further investigations must be postponed indefinitely in these moving times, I have thought it well to put on record the existence of this additional species in the British beetle fauna, together with the notes I have made up to date.

### Summary.

There are apparently two species included by British authors under the name *Deronectes depressus*. One of these I regard as *D. depressus* of Fabricius and the other as *D. elegans* of Panzer.

The characters upon which these species may be separated are:—

1. The shape of the thorax in ♂ and ♀. By itself this is of little value, especially in the ♀, and in the latter sex there is, unfortunately, no other means of separating the species except by size, which, of course, is equally unreliable.
2. The anterior tarsal claws of the ♂, a character which, in conjunction with the shape of the thorax, makes the separation of the species easy in most cases.
3. The breadth of apex of the ædeagus. This varies in both species, and the variation is such that the narrowest ædeagus of *D. depressus* and the broadest of *D. elegans* are almost alike.

This discovery of a complete series from broad- to narrow-apexed ædeagus (*vide* text-figures) made me doubtful as to the specific distinctness of the two forms, but, having regard to the fact that the two species do not occur together, that the distribution of *depressus* in the district examined is limited to eleven out of thirty-two lochs and that these eleven lochs are scattered about in the district, I continue for the present to regard the two as good species very closely related to one another.

A short historical review of the two species is given, and a bibliography of the more important works referring to them.

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EXPLANATION OF THE PLATES.

PLATE VII.

- Fig. 1.* Drawing of *Deronectes depressus*, F., ♂. Talkin Tarn, Cumberland.  
*Fig. 2.* Drawing of *Deronectes depressus*, F., ♀. Talkin Tarn, Cumberland.  
*Fig. 3.* Drawing of *Deronectes elegans*, Pz., ♂. R. Cam, Cambridge.  
*Fig. 4.* " " " ♀. " "

PLATE VIII.

- Fig. 1.* Right anterior tarsal claws of ♂ *D. depressus*, F. Talkin Tarn, Cumberland.  
*Fig. 2.* Ditto, ditto. Loch of the Lowes, Selkirk.  
*Fig. 3.* Ditto, ditto. Lagan Canal, Co. Antrim.  
*Fig. 4.* Right anterior tarsal claws of ♂ *D. elegans*, Pz. Round L. of Glenhead, Kirkcudbright.  
*Fig. 5.* Ditto, ditto. Auchentreoch L., Kirkcudbright. (Note the inequality of the claws in this case, which is exceptional.)  
*Fig. 6.* Lateral view of ædeagus of *D. depressus*, F.  
*Fig. 7.* Dorsal view of ædeagus of *D. depressus*, F.  
*Fig. 8.* Dorsal view of ædeagus of *D. elegans*, Panz.

Drawings of the tarsal claws are all to the same scale.

XXX.—On the Geographical Distribution of the Genus *Cosmophila*, a Noctuid of the Family *Gonopteridæ*. By Colonel C. SWINHOE, M.A., F.L.S., &c.

[Plates IX. & X.]

Family *Gonopteridæ*.

Genus *COSMOPHILA*, Boisd.

Faun. Ent. Madagascar, p. 94 (1833).

Type, *xanthindyma*, Boisd. *l. c.*

A very interesting genus, well worth careful investigation. Heretofore, on account of the similarity of pattern, authors have put all the different forms from America to Australia, regardless of the localities, mostly under the American form *erosa*; in 'Moths of India,' ii. p. 411 (1894), Hampson puts *xanthindyma*, Boisd., from Madagascar, *indica*, Guen., from India, *auragoides*, Guen., from Natal, *variolorosa*, Walker, from North India, and *edentata* from Queensland all as synonyms of *erosa*, Hübner, from America.

Staudinger, in his Catalogue, 1901 edition, puts *xanthindyma*, *indica*, and *auragoides* under the American form.

Warren, in Seitz's 'Macrolepidoptera of the Palæarctic Region,' vol. iii. p. 359 (Nov. 1913), puts *auragoides*, *variolorosa*, and *edentata* as synonyms with *xanthindyma*; under *erosa* he puts *indica*.

The superficial pattern of all these is more or less the same, but there are differences. I could not get myself to believe that, notwithstanding the geographical distances, they could all be one and the same species, and consequently I got the Rev. C. R. N. Burrows, who is an expert on the genitalia of Lepidoptera, to examine specimens from many different parts of the globe, and I am very grateful to him and to Mr. F. N. Pierce of Liverpool for the pains they have taken in the matter. All the Plates are from drawings by Mr. Burrows, and all the notes on the genitalia are his, many of them having been submitted to Mr. Pierce for verification.

Mr. Burrows says that the dissections show a relationship to the *Erebosidæ*, to the genera *Argiva* and *Patula* in the large extensile *coremata*, dorsal of the valves; he further

*Ann. & Mag. N. Hist.* Ser. 9. Vol. iii. 21

says, "I am thinking much of the *Gnathos* in your *Noctuæ*; this forms quite a feature, locates them in the direction of the *Geometræ*, removes them from the bulk of the *Noctuæ*, and it is remarkable that the species which occur in Britain should be so selected that all (except *Brephos*) should lack this feature."

The examination of the genitalia divides all those that have been dissected into six groups, as follows:—

1. *Cosmophila erosa*, Hübner, Zutr. Samml. exot. Schmett. ii. p. 19, figs. 287, 288 (1810).

*Hab.* America.

*Valves* wide compared with length.

*Harpe* soft and spined.

Costal arms very thin, scale-like.

*Anellus*\*, lateral arms smooth, not knobbed.

*Coremata* very small and slight, single.

*Penis* short and broad, cornutus delicate.

The stiffening of the eighth abdominal segment very slight. (Pl. IX. fig. 1.)

Caracas, Venezuela, Jalapa (Mexico), Newcastle (Jamaica), Sapucay (S. America).

2. *Cosmophila vanthindyma*, Boisd. Faun. Ent. Madagascar, p. 94, pl. xiii. fig. 7 (1833).

*Cosmophila auragoides*, Guen. Noct. ii. p. 397 (1852).

*Harpe* well developed on valve, rigid.

Costal arms not evident.

*Anellus* very pronounced, lateral arms solid, rigid, knobbed.

*Coremata* very voluminous, single.

*Penis* long and narrow, cornuti scarcely evident. (Pl. IX. figs. 2, 3.)

Dar-es-Salam, Karachi.

3. *Cosmophila edentata*, Walker, xi. p. 750 (1857).

*Harpe* soft and spined.

Costal arms rigid, slightly hooked.

\* Passage through which the penis passes.



*Anellus* very pronounced, lateral arms smooth, knobbed, decorations large and continuous.

*Coremata* double. (Pl. IX. fig. 4.)

Queensland, Australia.

4. *Cosmophila lyona*, nov.

*Harpe* soft and spined.

Costal arms rigid, hooked.

*Anellus* pronounced, lateral arms smooth, not knobbed.

*Coremata* double, very voluminous.

*Penis* stout, one large *cornutus*. (Pl. X. fig. 5.)

Padang (Sumatra), Ternate (Moluccas).

5. *Cosmophila indica*, Guen. Noct. ii. p. 396 (1852).

*Cirrædia variolosa*, Walker, xi. p. 750 (1857).

*Harpe* soft and spined.

Costal arms strong, hooked.

*Anellus* with the arms smooth and straight.

*Coremata* double.

*Penis* very stout. (Pl. X. fig. 6.)

Assam, Bombay, Gooty, Palni Hills, S. India.

6. *Cosmophila dona*, nov.

*Anellus* very large, the valves without armature and angled (which is not the case in any of the others).

*Coremata* double, very voluminous.

The eighth segmental plate of the abdomen is reduced to a bar.

*Penis* narrow, *cornuti* scarcely evident (the penis is entirely different from any of the others). (Pl. X. fig. 7.)

Roeburne, Sherlock River, Australia.

1. *Cosmophila erosa*, Hübner, Zutr. Samml. exot. Schmett. ii. p. 19, figs. 287, 288 (1810).

Uniformly larger than the Old-World species; wings yellower, fore wing fairly uniform in colour throughout, the outer portion sometimes slightly darker than the inner; transverse lines and bands of the usual pattern, but very little

darker than the ground-colour ; hind wing uniformly pale greyish ochreous without markings.

I have many examples from Venezuela, Mexico, S. America, and Jamaica.

2. *Cosmophila xanthindyma*, Boisd. Faun. Ent. Mad. p. 94 (1833).

A darker insect, transverse lines more or less similar ; the outer portion of the fore wing (nearly the half) nearly always suffused with chocolate-brown ; hind wing grey, generally dark grey on the outer portion.

*Hab.* Madagascar, Africa.

3. *Cosmophila edentata*, Walker, xi. p. 750 (1857).

The discal line of the fore wing is nearly straight and at its upper end is widely apart from the antemedial line ; the upper part is bent inwards to the costa ; the stigma in the cell is pure white and circular and isolated.

*Hab.* Queensland, Australia.

4. *Cosmophila lyona*, nov.

♂ ♀. Fore wing markings much as in *edentata*, colour paler and yellower ; the discal line, however, is not nearly straight as in that species, but is angled inwardly at its middle ; the genitalia in some respects are similar, but differ in the formation of the anellus ; the decorations are small and bilobed, the armature of the valve is not quite the same, the eighth segment of the abdomen is much the same ; the *penis* differs somewhat, being stronger than that of *edentata*, and both are entirely different from those of the other groups.

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

*Hab.* Padang, W. Sumatra.

5. *Cosmophila indica*, Guen. Noct. ii. p. 397 (1852).

*Cirrædia variolosa*, Walker, xi. p. 750 (1857).

♂ ♀. Generally a smaller insect than *xanthindyma* ; the colour of the fore wing is brighter yellow, the discal band is more uniform, and the hind wing is yellowish white, generally quite uniform in colour. Guenée's type is from

"India," Walker's type N. India; it is a common form in the Khasia Hills and in Southern India.

*Hab.* N. India, Assam, Bombay, Gooty, Palni Hills, S. India.

#### 6. *Cosmophila dona*, nov.

♂ ♀. Of a uniform dark lilacine-grey colour: fore wing covered with minute darker grey striations; markings chocolate-brown; a short transverse line across the median vein one-third from the base of the wing, indications of its continuance at the costa, where there are also two very minute black dots; a mark at the end of the cell, a line below it followed by a large square cluster of chocolate dots, its outer portion having a line above it which does not reach the costa and has another cluster of dots outside it; some very minute black dots between these clusters and the outer margin; cilia concolorous with the wing, with deep black spots at the interspace-ends: hind wing dark grey, with the outer portions with darker suffusion; cilia white; palpi ochreous grey, whitish beneath; head and body concolorous with the wings. Underside uniform pale grey, rather pale on the hind wing; pectus and sides of the abdomen whitish; the female has only very faint indications of the markings; the angle in the middle of the outer margin of the fore wing is very slight.

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

*Hab.* Roebourne, W. Australia.

By the genitalia it is obviously a very distinct species, almost worthy of a separate genus, but the general build in so many other respects denotes close affinity.

#### 7. *Cosmophila milva*, nov.

♂. Fore wing ochreous-fawn colour, irrorated with very minute grey atoms; transverse lines brown, first subbasal sinuous, double; second antemedial, not sinuous, angled outwards on the median vein; third postmedial, straight from the hinder margin to near the upper end of the cell; fourth from a white costal spot, halfway between the third line and the outer margin, is slightly bent outwards near the costa, then nearly straight to vein 4, where it is angled outwards, then turns inwards on to the next lower vein, some dark shading outwards containing a slightly darker sinuous transverse band which gradually fades away hindwards; cilia

dark brown: hind wing ochreous grey, outer marginal line brown; cilia whitish, with brown tips: palpi brown; body concolorous with the wings. Underside uniform pale ochreous brown; hinder marginal space of fore wing pale, an outwardly curved brown line like a half-circle from the costa before the apex, and an outwardly curved discal line on the hind wing.

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

*Hab.* Gilolo Isl., North Moluccas (*Doherty*).

XXXI.—*New Lycenids and Hesperids and Two new Species of the Noctuid Family Acontiidæ.* By Colonel C. SWINHOE, M.A., F.L.S., &c.

#### Family Lycænidaæ.

##### *Lycænopsis trita*, nov.

♂. Upperside cerulean-blue, similar in colour to *L. ladonides*, de l'Orza\*, which it very much resembles; marginal lines of both wings black; cilia white. Underside cream-white, with a few blue irrorations at the base of both wings and along the abdominal margin of the hind wing: fore wing with a pale brown lunule closing the cell; five discal linear brown marks, four in a line, the upper one subcostal and well inwards; a double series of pale brown marks on the outer margin, the inner series lunular, the outer composed of triangular spots: hind wing with the outer margin similarly marked; a pale brown line closing the cell, a black spot on vein 6 near the base, and one below it in the cell, near the origin of vein 2; a subcostal black spot near the apex of the wing; a curved series of black spots in interspaces 4, 3, 2, and 1, two close together and well outwards in the interno-median interspace, and three black spots on the abdominal margin. Antennæ black with white rings; head and body above blue-black, white on the underside, head with black and white stripes; eyes ringed with white; palpi

\* Lep. Japan, p. 20 (1869).

brown above, white beneath; legs brown above, white beneath; tarsi brown, with white rings.

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

*Hab.* Murree, N.W. Himalayas; two examples.

*Tajuria drucei*.

*Tajuria drucei*, Swinhoe, Lep. Indica, ix. p. 107, pl. 728. figs. 4, 4 a, ♂ (1910).

♀. Upperside coloured like the male, but somewhat paler. Fore wing with the costal and outer marginal black band narrower: hind wing with the costal space blackish; a submarginal lunulate brown line and marginal square black spots, decreasing in size upwards; a black marginal line and a round black spot in the anal lobe; cilia of both wings white. Underside as in the male.

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

*Hab.* Shan States, Haipau. Both sexes received.

Superficially much like *T. jehana*, Moore.

*Ruralis pavo*.

*Zephyrus pavo*, de Nicé. P. Z. S. 1887, p. 460, pl. xl. fig. 11 ♀; id. Butt. of India, iii. p. 309 (1890); Elwes, P. Z. S. 1892, p. 635.

*Ruralis pavo*, Swinh. Lep. Indica, viii. p. 273, pl. 705. figs. 1, 1 a, 1 b (1910).

♂. Upperside metallic green: fore wing with the costal line black, outer marginal band also black, moderately broad and even: hind wing with the costal space broadly black, outer marginal band evenly black, abdominal fold grey inwardly suffused with black. Underside silvery grey, markings chocolate-brown: fore wing with a thin costal band; a thick bar closing the cell; a broad discal band from the costa to vein 2, narrows gradually hindwards, its inner edge close to the discoidal bar; a submarginal thin band: hind wing covered with pale bluish irrorations, especially on the basal half; a discal band, broad on the costa, runs along it on each side, narrows hindwards, its outer edge angled on the veins, extends to near the anal angle, where it runs acutely inwards to the abdominal margin; two short costal marks between this band and the base of the wing; a thin submarginal lunular band, which curves inwards above the anal angle, outwardly deeply lined with orange, which

runs into the anal and subanal black spots ; both wings with an anteciliar line.

Expanse of wings,  $1\frac{3}{16}$  inch.

*Hab.* Simla ; also recorded from the Naga Hills, Upper Assam, and Bhutan.

De Nicéville described a female from Buxar Bhutan, and states that Doherty took a male near Margherita in Upper Assam at 400 feet elevation which agrees closely with his female type, and suggests that his own type may also be a male ; but his figure is evidently that of a female, and Elwes says he has little doubt that Doherty's specimen (which he had before him) is a female also ; my example is an undoubted male from Simla which on the underside is somewhat similar to de Nicéville's figure, but on the upperside is of the usual bright green colour so universal in the allied forms, with a black marginal border to both wings much as in *R. syla*, Kollar.

### Family Hesperidæ.

#### Genus QUEDARA, nov.

♂. Antennæ more than half the length of the costa of fore wing ; club long, terminating in a short thin point. Fore wing with the costa slightly curved, wing narrow, apex subacute, outer margin concave, of the same length as the hinder margin, which is straight ; cell more than two-thirds the length of the costa ; upper discocellular short, outwardly oblique, middle and lower discocellulars in nearly a straight line and of equal length ; vein 2 from before the middle of the cell, 3 and 4 from the end, 5 from the middle of the two lower discocellulars : hind wing with the costa and outer margin in an even curve, the wing rather narrow across ; vein 2 from close to the end of the cell, 3 and 4 from the end ; discocellulars faint, angled inwards in the middle ; vein 5 absent, 7 from one-fourth before end of cell, 8 curved from base to the apex of the wing. Palpi porrect, densely covered with hairs, last joint minute and pointed ; hind tibiæ with two pairs of spurs ; a pair of thick tufts of hairs standing up behind the collar.

Type, *comoplea*, nov.

*Quedara comoplea*, nov.

♂. Of a uniform dark violet-brown colour without any markings; the underside is slightly paler than the upperside, with the hinder marginal space of the fore wing palest.

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

*Hab.* Kina Balu, N. Borneo.

I place it in the section *Plastingiinae*.

Genus *ARUNENA*, nov.

♂. Antennæ about two-thirds the length of the costa of fore wing; club fine, bent at about a right angle; palpi suberect, very short, very hairy, pressed close against the face, third joint minute. Fore wing short, costa slightly arched, outer margin convex, not nearly so long as the hinder margin, which is straight; cell broad, a little more than half the length of the wing; vein 2 from one-third before end of cell, 3 and 4 from the end; discocellulars erect, the upper very minute, the others of equal length, vein 5 from their junction, veinlet in cell in continuation; vein 12 reaches costa well before end of cell: hind wing evenly rounded, vein 2 one-fourth before end of cell, 3 and 4 from the end, discocellulars and vein 5 not visible, 7 from a little before the upper end of the cell, 8 curved from base to apex of the wing. Hind tibiæ with two pairs of spurs.

Type, *nigerrima*, nov.

*Arunena nigerrima*, nov.

♂. Of an uniform very dark black colour without any markings; the underside is as dark as the upperside; the hinder marginal space of the fore wing is broadly pinkish grey.

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

*Hab.* Khasia Hills, Assam.

I put this genus in the group *Astictopterinae*.

## Family Acontiidæ.

*Maurilia gilva*, nov.

♀. Fore wing dark rufous; a square orange patch at the

middle of the costa intersected by a brown line and surrounded by dark brown suffusion, two small round orange spots in the suffusion near the lower outer end of the square patch; transverse lines dark brown, the first subbasal, the second and third antemedial, somewhat close together and parallel with each other, very sinuous, ending outwards to the middle of the hinder margin, the outer one at its upper end edging the inner side of the square orange patch; two similar lines from the costa beyond the middle to the hinder margin near the hinder angle, the upper portion of the inner one edging the small round orange spots; a short pale brown band on the costa near the apex of the wing, which is attached to a broader pale brown marginal band which narrows hindward to a point at the hinder angle; cilia dark brown: hind wing grey, whitish at the costal space, the outer margin suffused with brown; cilia grey. Palpi, head, and thorax brown, the fore part of the thorax with ochreous hairs, the first two joints of the palpi with a white line beneath; abdomen dark grey. Underside: body and wings grey, the cell-space of the fore wing suffused with brown; pectus white.

Expanse of wings, ♀,  $1\frac{2}{5}$  inch.

*Hab.* Cape York.

Resembles *M. fortis* \* *mili*, from New Guinea, but is much smaller, the orange patch of the fore wing is differently shaped, and the outer transverse lines are different.

*Acontia elima*, nov.

♀. Fore wing milk-white with very minute chocolate-coloured irrorations; the markings pale chocolate-brown; an indistinct short line from the costa at the base; a band of conjoined somewhat square marks from the costal third to near the middle of the hinder margin, the band consisting of two somewhat sinuous lines crossed by six lines forming the squares; a somewhat similar but broader band divided by the cross-lines into four parts, its upper portion somewhat suffused, the band extending from the costa beyond the middle to near the hinder angle, its lower half with a short pale brown band attached to its outer side; a triangular pale brown patch on the outer margin a little above the middle; cilia pale orange with brown spots, except at its upper and lower parts, where it is concolorous with the wings with

\* Ann. & Mag. Nat. Hist. (9) ii. p. 72 (1918).



brown outer edges: hind wing and its cilia pure white. Head and body concolorous with the wings, abdomen with brown segmental bands; palpi orange, the terminal joints white. Underside: body and wings uniform silvery white.

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

*Hab.* Queensland.

XXXII.—*The Status of Parabates, Foerster, and Parabatus, Thomson [Hymenoptera, Ichneumonidae].* By J. CHESTER BRADLEY, Ph.D., Cornell University, Ithaca, N.Y.

THERE is a confusion concerning the status of the so-called genus *Parabates*. It was described by Foerster (1868) without mention of included species, being separated from *Paniscus* by reason of the front wing lacking an areolet. The only known Palearctic species in which this is normally the case is *nigricarpus* (in *millieratæ*, Kriechbaumer, it is in some individuals lacking). Specimens of *virgatus* without areola are not known to occur.

The International Commission on Zoological Nomenclature in its 46th published opinion has ruled on such cases that the genera are valid. "If (as in *Aclastus*, Foerster, 1868) it is not evident from the original publication of the genus, how many or what species are involved, the genus contains all of the species of the world which would come under the generic description as originally published, and the first species published in connection with the genus (as *Aclastus rufipes*, Ashmead, 1902) becomes *ipso facto* the type."

The species *rufipes* referred to as an example, having been described subsequent to the publication of *Aclastus*, Foerster, it is evident that the opinion means to include in the genus all species in the world which fit the original description, whether already described at that time or described subsequently.

The opinion states that the first species published in connection with the genus becomes *ipso facto* type, and we accordingly may infer that in the case of several species being simultaneously included in the first mention of species in the genus, without one of them being designated as type,

the ordinary rules of type-fixation must be applied. The opinion, however, leaves a little uncertainty, whether in such cases *any* of those species first included may be chosen as type, or whether it must be one that agrees with the original generic definition. In view, however, of the fact that the opinion says "the genus contains all of the species of the world which would come under the generic description as originally published," it would seem that the selection must be restricted to such of the first-published species as do come under the generic description as originally published, and that if none of them come under it they are none of them available. Mr. Viereck, in fixing the types of the genera of Ichneumonoidea, has evidently thought otherwise.

Thomson (1888, Opusc. Ent. xii. 1194) established a genus *Parabatus*, without any reference to Foerster's name *Parabates*. In it he recognised two sections and four species as follows: *Section A*, without areolet [= *Parabates* in sense of Foerster's description], *nigricarpus*, sp. n.; *Section B*, *latungula*, sp. n., *virgatus*, Grav. (i.e. Fourcroy), and *cristatus*, sp. n.

The first mention of species, in connection with Foerster's original name *Parabates*, seems to have been in Dalle Torre's 'Catalogus Hymenopterorum,' iii. p. 75 (1903). The four species included by Thomson under *Parabatus* and four others are included under the generic name *Parabates*.

According to the code (Article 36, Recommendations) *Parabatus*, Thomson, is potentially at least a distinct genus from *Parabates*, Foerster, whether they are synonyms depending entirely upon the fixation of the type of each and upon whether the types are congeneric. Viereck (1914) has fixed, correctly, the type of *Parabatus*, Thomson, as *virgatus* (*Ichneumon virgatus*, Fourcroy). Mr. Viereck (1914) also designates *virgatus*, Fourcroy, as the type of *Parabates*, Foerster, which would make *Parabates* and *Parabatus* identical, as is desirable. However, it does not seem that this is permissible. *Ichneumon virgatus*, Fourcroy, does not fall under the generic definition of Foerster's *Parabates* (in as much as it always possesses an areolet, as I have pointed out). It would, therefore, seem that it must be excluded from consideration as type of the genus. The only known Palearctic \* species that normally † agrees with Foerster's

\* *Ophelloideus johnsoni*, Ashmead, 1900, a Nearctic species, may be congeneric with *Parabatus nigricarpus*, Thomson, and like it lacks an

generic definition is *nigricarpus*, Thomson, which alone forms Section A of Thomson's *Parabatus*—a section, as I have already stated, distinguished by the absence of the areolet. It would therefore seem, and I hereby so designate it, that the type of *Parabates*, Foerster, must be *Parabatus nigricarpus*, Thomson, and that *Parabates*, Foerster, must be equivalent to Section A of Thomson's genus, and *Parabatus* to Section B.

Szepliget (1911, 'Genera Insectorum,' fasc. 114) restricts *Parabates*, Foerster, to *nigricarpus*, Thomson, synonymizing Section A of *Parabates*, Thomson, with *Parabates*, Foerster, and Section B with *Paniscus*.

Schmiedeknecht (1910, 'Opuscula ichneumonologica,' iv. 1847), separates *Parabatus*, Thomson, from *Paniscus*, Gravenhorst, as follows:—

"Nervulus interstitial, sehr selten etwas vor der Gabel. Scheitel und Wagen hinten nicht durch eine Leiste abgegrenzt. Areola zuweilen fehlend.—*Parabatus*, Foerster.

"Nervulus weit hinter der Gabel. Hinterhaupt durch eine Leiste abgegrenzt. Areola stets vorhanden.—*Paniscus*, Grav."

He further remarks: "Es könnte wie bei so vielen Gattungen die Frage auf geworfen werden, ob das nicht immer deutliche Vorhandensein oder Fehlen der Hinterhauptsleiste und die etwas Schwanken der Stellung des Nervulus genügt, um die beiden Gattungen *Parabatus* und *Paniscus* von einander zu trennen. Wem diese Unterscheidungsmerkmale nicht genügen, den mag die *Parabatus*-Arten mit zu *Paniscus* rechnen, aber er mag nicht behaupten, dass *Parabatus* und zahlreiche andere Gattungen nicht aufrecht erhalten werden können."

Schmiedeknecht (*l. c.*, and earlier, 1904, 'Die Hymenopteren Mitteleuropas,' p. 605) states that *Parabates*, Foerster, has nothing to do with *Parabatus*, Thomson, and that what Foerster meant to include under *Parabates* is difficult to say. I do not believe that that is the case. *Parabatus nigricarpus*, Thomson, agrees entirely with Foerster's definition of *Parabates*, the only possible point of question being found in the following statement: "Cubitalquerader stark gebogen, mit

areolet, but was not included by either Thomson or Dalla Torre in *Parabatus* or *Parabates*.

† As previously indicated, aberrant individuals of *millieratae*, Kriechbaumer, also lack the areolet.

der Cubitalader nicht in einen Spitzen winkel zusammentreffend, letztere daher nicht aus der Spitze der Diskokubitalzelle hervorgehend." A comparison of the wing of *nigriscarpus* with an *Eremotylus* (with which genus and *Allosamptus* Foerster is comparing *Parabates*) makes his meaning obvious.

Ashmead (1900, 'Classification of the Ichneumon Flies,' Proc. U.S. Nat. Mus. xxiii. 96) recognising minutiae of structure as of generic rank, erects a new genus *Opheltoideus* for the species without an areolet (and which would therefore include *nigriscarpus* and be a synonym of *Parabates*, Foerster, as here defined) and separates *Parabates*, Foerster, which he states is equivalent to *Parabatus*, Thomson, from *Paniscus*, primarily on the basis that the basal and submedian veins are interstitial in the former, or very nearly, and the submedian cell longer than the median in the latter. In *Parabates* he further says the discocubital vein is not broken by a stump of a vein, while in *Paniscus* it is usually but not always so.

Morley (1913, 'Revision of the Ichneumonidae,' ii. 129) writes: "*Parabatus*, Thomson. Known from *Paniscus* only by the continuous basal nervulus through the median nervure, thus forming both the upper and lower basal nervures of a single line; this I do not always find associated with an occipital costa, and I have been obliged consequently to place species with this capital structure occasionally in the genus *Paniscus*. Thomson originally placed four Swedish species in the present genus and others were subsequently added; but Szepligeti, for some occult reason, has restricted Thomson's genus to a single species, the first here placed by its author, which differs from the other three in little more than the aborted areolet, and further he has synonymized—entirely arbitrarily, I think—Ashmead's Nearctic genus *Opheltoideus* with its single and still MS. species, *O. johnsoni*. I have already pointed out (Revis. Ichn. Brit. Mus. i. 60) that the latter almost certainly appertains to the *Anomalides*."

Szepligeti's course in restricting *Parabates* to the one species *nigriscarpus* was not occult, but perfectly logical, since it is the only one falling under Foerster's original definition. Nor was it arbitrary to assign *Opheltoideus*, Ashmead, as a synonym, since the published characters of that genus leave no other course possible. On the other hand, Mr. Morley's conclusion that *Opheltoideus* is an anomalous genus is open to grave doubt. It was arrived at

solely on the basis of the determination by Herr Sigmund Brauns of a North American specimen sent him by Mr. Morley as "*Opheltoideus* sp.?" But there is not the slightest evidence that the determination was correct, or that Herr Brauns had any more knowledge of what *Opheltoideus* is than has Mr. Morley or anyone else who has not seen Ashmead's specimen of *johnsoni*.

Mr. Morley's key to the genera (1913, *l. c.* p. 101) makes no provision at all for *Parabates*, Foerster, s. s. (i. e. *nigricarpus*, Thomson, a species without an areolet), as it neither agrees with his *Paniscus* and *Parabatus*, both of which are stated to have an areolet, nor with *Parca* which is the only provision made for species with the areolet absent, but which differs in other respects.

Mr. Morley does not make it clear what species of *Paniscus* lack the occipital carinæ. It is weak in even the type-species, *testaceus*, and readily may not be associated with the relative length of the median and submedian cells, as he suggests, nor with any other structural character.

To sum up, there seem to be a group of species which have the nervulus interstitial ( $m-cu$  and  $M_4 + Cu_1$  opposite) and a group which do not, but of the former two or three species have the nervulus sometimes a little beyond the apex of the cell, and one species (*franki*, known from a single German female, which may be abnormal) has it widely before the apex of the median cell. On the other hand, specimens of *testaceus*, the type-species of *Paniscus*, determined for me by Professor Schmiedeknecht, show a varying distance between the apex of the median cell and the nervulus, in one case the distance being quite insignificant. Secondly, *nigricarpus*, *millieratæ*, *pallescens*, *tarsatus*, *gansuanus*, *virgatus*, *latungula*, *cristatus*, and *franki* are stated by Schmiedeknecht (in giving his generic description) to lack an occipital carina, while he states that all of the species of *Paniscus* possess such a carina. So far as I have observed, this distinction holds, and probably is the best primary character available for group-definition. Morley, treating of additional species from other parts of the world, finds species lacking the carina which, on the basis of the venational character just discussed, he treats as *Paniscus*. Finally, *nigricarpus* and *johnsoni*\* lack an areolet normally, but at least also *millieratæ* in aberrant individuals.

\* In the case of *johnsoni* probably not enough individuals are known to be sure what is normal.

Since there seems, therefore, to be no strongly distinctive structural character between these groups, and especially since there seems to be *no association of structural characters*, their logical treatment would seem to be as at most subgenera of a single genus, *Paniscus*.

The arrangement and synonymy will therefore be:—

### PANISCUS, Gravenhorst.

#### Subgenus PANISCUS.

Type.—[*Ichneumon luteus*, Ross] = *Paniscus testaceus*, Gravenhorst, the only originally included species.

Distinguishing characters: Head with an occipital carina; nervulus ( $M_4 + Cu_1$ ) apicad of the apex of the median cell; areolet present and complete.

#### Subgenus PARABATUS, Thomson.

Type.—*Ichneumon virgatus*, Fourcroy, by designation of Viereck, 1914.

Distinguishing characters: Head without an occipital carina; nervulus interstitial, but in some species slightly apicad of the apex of the median cell, in another (known from a unique and possibly aberrant Palearctic female) basad thereof, and in some species not interstitial (according to Morley, who would on that account put them in *Paniscus*); areolet present in normal individuals, but lacking in aberrant individuals of at least one species.

#### Subgenus PARABATES, Foerster.

Type.—*Parabatus nigricarpus*, Thomson, by present designation, and by virtue of the fact that it is the only one of the species first included in *Parabates*, which comes under the original generic definition. Therefore, not *Ichneumon virgatus*, Fourcroy, which was cited as type by Viereck.

Synonym.—*Opheltoideus*, Ashmead, of which the type is *johnsoni*, Ashmead. Synonym by reason of the types being congeneric so far as published descriptions indicate.

Distinguishing characters: Head without an occipital carina; nervulus interstitial; areolet absent.

XXXIII.—*The Malacoderm Genera Prionocerus and Idgia, and their Sexual Characters [Coleoptera]*. By G. C. CHAMPION, F.Z.S.

[Plates XI. & XII.]

THIS paper is based upon a study of the species of *Prionocerus*, Perty, and *Idgia*, Cast., contained in the National Collection at S. Kensington, in the Hope collection at Oxford, and in that of Mr. H. E. Andrewes, the last-named being rich in Indian forms \*, including types or co-types of various insects determined by Bourgeois and Gorham. The British Museum material includes the types of three Indian species belonging to the genus *Idgia*—*Cantharis melanocephala*, Fabr., *Telephorus assimilis*, Hope, and *Thaccona dimelæna*, Walk.—which have been omitted from or are wrongly placed in our catalogues; many interesting Malayan forms captured by Mr. Doherty or Mr. G. E. Bryant; and very extensive series of several species from the highlands of Eastern and Central Africa. The two genera here studied, which Lacordaire, Redtenbacher, and Bourgeois were inclined to treat as one, are restricted to Africa and Asia; and upwards of sixty species have been described as belonging to them, about half of these having been named during recent years by Pic.

The sexual characters of the forms enumerated in this paper are described in detail, important tarsal and other structures having been apparently overlooked by all writers on these insects, including Bourgeois, who has given a good deal of attention to the subject. Another mark of distinction, unnoticed in our text-books, and common to the two sexes, is the single spur to the anterior tibiæ, the absence of the second spur being characteristic of the Edemerid genera *Nacertes* and *Xanthochroa*, the species of which bear a superficial resemblance to many *Idgiæ*. The males of *Prionocerus* and *Idgia* have, in common, a closely, regularly pectinate, black comb along the inner edge of joints 1-3 of the anterior tarsi, which is quite conspicuous in the yellow-legged forms †. A similarly pectinate comb

\* The types of the new species described from his collection and a selection of the others have been presented by Mr. Andrewes to the Museum.

† The males of one or two Lampyrids allied to *Phengodes* have a row of scattered teeth on the first joint.

on the front feet is also present in the corresponding sex of the Dasytid-genus *Lobonyx*, Jacq. Duval, in which, however, it is restricted to joints 2 and 3, the basal joint being relatively shorter than in the genera here studied; this structure, clearly visible in males of *Lobonyx* captured by myself in Spain and Algeria, has been figured and described by Duval (Gen. Coleopt. Europ. iii. p. 183, pl. 46. fig. 225 c).

Other ♂-characters, apart from the usually larger eyes, the stronger serration of the antennæ in *I. viridipennis* and



*Idgia plectrophora*, sp. n., anterior leg, ♂ (cf. p. 330).

*belli*, and the emargination of the fifth ventral segment, have been detected in certain cases, such as the thickening of the posterior femora, the curvature or sinuation of the posterior tibiæ, the acutely produced posterior trochanters, the form of the basal joint of the anterior and intermediate tarsi, &c.

In one species, *I. plectrophora*, all the tibial spurs are longer than usual in both ♂ and ♀; and in another the



upper posterior tibial spur is longer than the lower one. *I. flavirostris* and one or two others have the tarsal claws widened to near the middle, instead of at the extreme base only, but there is no trace of a membranous lobe in any of these insects. The numerous testaceous forms with the head in part or entirely, and the apices of the elytra, black have given me the greatest difficulty in distinguishing the species; and it has been found impossible in some cases to separate them at all satisfactorily till the ♂-genital armature, or the sixth ventral segment, has been examined. These structures have been dissected in nearly all the species of which the males are represented in the collections before me\*. The tegmen (*sensu* Sharp and Muir) is furnished with two elongate, digitiform or spoon-shaped lobes, convex and almost smooth above, concave beneath, together forming an open tube, the lower outer edge of each (lateral) lobe being more or less ciliate or finely denticulate, and sometimes sinuate or emarginate before the tip. The median lobe † (=penis-sheath or aedeagus of some authors) consists of a long, acuminate tube, usually curved downward at the tip, but peculiarly shaped in the two Arabian forms here described (*cf.* Pl. XI. figs. 9*a* and 10*a*), the opening from which the membranous sac or intromittent organ is extruded being placed on the dorsal aspect at some distance before the tip. The sixth ventral segment is normally triangularly emarginate in ♂, but in one species at least (*cf.* Pl. XII. fig. 49*a*) it is so deeply bi-excised as to appear trilobed.

One or two species have the sutural angle of the elytra strongly hooked or dentiform (*cf.* Pl. XII. fig. 50), a character peculiar to the ♀, as in the American genus *Astylus*. Figures of the ♂-armature of nearly all the species here enumerated are given on the accompanying Plates.

The "Prionocerides," forming a subtribe of the "Melyrides" of Lacordaire based upon *Prionocerus* and *Idgia*, should be treated as a separate group or family of the Malacodermata, distinguished by the emarginate eyes, the single spur to the anterior tibiae, the simple tarsi and claws (the latter at most widened in their basal half), the more or less curved or excavate eleventh antennal joint, and the closely pectinate tarsal joints 1-3 of the male.

\* They have all been made by Mr. A. Cant.

† *Cf.* Sharp and Muir, *Trans. Ent. Soc. Lond.* 1912 and 1918. The term "penis-sheath" has been used by me for this organ in a recently published paper on the genus *Astylus*.

## PRIONOCERUS.

*Prionocerus*, Perty, Obs. Coleopt. Indiæ Orient. p. 33 (1831).

This genus, type *P. cœruleipennis*, Perty, a common Malayan insect, is here restricted to the species with the antennæ short and very strongly serrate, and the apical joint deeply excavate, in the two sexes. *P. bicolor*, Redt., belongs to it, and possibly one or two other Asiatic forms not represented in the collections before me. The two mentioned have a different general facies from the typical *Idgia*, due to their small, narrow head and short, strongly serrate antennæ.

1. *Prionocerus cœruleipennis*.

*Prionocerus cœruleipennis*, Perty, Obs. Coleopt. Ind. p. 33, t. 1. fig. 4 (1831); Bourg. Ann. Soc. Ent. Fr. 1890, p. 175; Gorch. Ann. Soc. Ent. Belg. xxxix. p. 318 (1895).

♀. *Prionocerus fuscipennis*, Lewis, Ann. & Mag. Nat. Hist. (5) iv. p. 464 (1879).

♂. *Prionocerus forticornis*, Schauf. Horæ Soc. Ent. Ross. xx p. 126 (1887).

♀. *Prionocerus brevicornis*, Schauf. l. c.

♂. Anterior tarsal joints 1-3 with a comb along their inner edge. Genital armature (Pl. XI. fig. 1): lateral lobes very long, narrow and somewhat hooked at the tip; median lobe broad, abruptly acuminate and sinuate at apex.

*Hab.* INDIA; BURMA; MALAYAN REGION generally; ANDAMAN IS.; JAPAN; E. AFRICA, Usagara (*S. A. Neave*), Usambara (*Mus. Brit.*); AUSTRALIA (*sec. Schaufuss*).

Bourgeois gives the sexual characters of this species at considerable length, but he omitted to notice the structure of the ♂ anterior tarsi. The elytra vary in colour—blue, violaceous, or green, rarely æneo-fuscous. The two forms named by Schaufuss, already sunk as synonyms by Bourgeois, are from the Philippines and Macassar respectively. *P. fuscipennis*, Lewis, from Yokohama, is an immature ♀, with the elytra more obscurely coloured than usual, some specimens from Borneo and Manila in the British Museum being similar in that respect. A monstrosity, ♂, with three antennæ and distorted elytra, has been figured and described by Keyl (*Tijdschr. voor Ent.* lvi. pp. 1-12, pls. 1, 2, 1913). *P. cœruleipennis* has doubtless been introduced into E. Africa. About 200 examples are contained in the collections before me.

2. *Prionocerus bicolor*.

*Prionocerus bicolor*, Redt. Reise der Novara, ii. p. 109, t. 4. fig. 3 (1868); Gorh. Ann. Soc. Ent. Belg. xxxix. p. 318 (1895).

*Idgia* (*Prionocerus*) *bicolor*, var. *notaticollis*, Pic, L'Echange, xxvi. p. 53 (1910).

♂. Anterior tarsi and genital armature (Pl. XI. fig. 2) as in *P. cæruleipennis*, Perty; except that the median lobe is less sinuate at the tip.

*Hab.* INDIA, Sikkim, Allahabad; BURMA; SIAM; MALAYAN REGION generally.

This insect is extremely closely related to *P. cæruleipennis*, and occurs with it in some of the Malayan localities, differing from that species in having the antennæ a little less dilated in the two sexes, and the elytra wholly fulvous. The type was from Java. *P. bicolor* has been found in numbers by Mr. H. Stevens at Gopaldhara, in the Rungbong Valley, Sikkim, unaccompanied by its near ally. Females preponderate in the series before me. A variety from Tharrawaddy, Burma, with the scutellum yellow has been recorded by Gorham (*l. c.*), and another, from Sumatra, with a dark median patch on the prothorax, by Pic.

## IDGIA.

*Idgia*, Castelnau, in Silberm. Rev. Ent. iv. p. 27 (1836); Hist. Nat. Ins. Coleopt. i. p. 275 (1840).

*Deromma*, Kollar and Redtenbacher, in Hügel's Kaschmir, iv. 2, p. 512 (1844).

*Diprosopus*, Mulsant, Mém. Acad. Lyon, i. p. 209 (1851).

*Thacoma*, Walker, Ann. & Mag. Nat. Hist. (3) iii. p. 260 (1859); Gemminger and Harold, Cat. Coleopt. vii. p. 2179 (1870) [sub *Edemeridæ*].

The generic name *Idgia*, type *I. terminata*, Cast., from Senegal, is here used for all the *Prionocerids* with the antennæ filiform or moderately serrate, at least in ♀. The structure of the anterior tarsi is precisely similar to that of *Prionocerus*, and the form of the genital armature of the males also shows their close relationship. The superficial resemblance of many of the species to the *Edemerid* *Nacerdes melanura*, L., and the Telephorid *Rhagonycha fulva*, Scop. (= *melanura*, Oliv.), is very striking, one, indeed, having been described as belonging to the first-named group. The Museum material includes, in addition to species here enumerated, a very elongate, large, subopaque, blue form,

coloured like the Chinese *I. hügelii*, Redt., represented by a single damaged example, which must be left unnamed for the present, no locality-label being attached to it.

### African Species.

Prothorax (except in <i>I. dimidiata</i> , var. <i>tripartita</i> , Pic) and elytra testaceous, the apical portion of the latter to a greater or less extent black.	
Tibial spurs long.....	No. 1.
Tibial spurs short.....	Nos. 2-6.
Prothorax and elytra nigro-cyaneous.....	No. 7.
Prothorax fulvous, the elytra black or nigro-cyaneous....	No. 8.

#### 1. *Idgia plectrophora*, sp. n.

Extremely like *I. (Prionocerus) dimidiata*, Gerst., and similarly coloured, and only separable therefrom by its structural characters: tibial spurs long, including the one on the anterior pair, in both sexes, strongly developed in ♂; anterior tarsal joints 1 and 2 elongated, 1 slightly curved, smooth and almost glabrous at the base, and produced into a dentiform lobe at the inner apical angle, 4 small, narrow, the comb on 1-3 extending along the greater part of their length; joint 1 of intermediate and posterior tarsi compressed, slightly curved, and smoother at the base. Genital armature (Pl. XI. fig. 3): lateral lobes long, broad, rounded at tip; median lobe narrow, drawn out into a long, slender, downwardly-curved point.

Length (excl. head) 9-13, breadth  $3\frac{1}{2}$ - $4\frac{1}{2}$  mm. (♂ ♀.)

*Hab.* E. AFRICA, Tabora (*ex coll. Fry*: type, ♂), Salt Lake—Wawamba (*Scott Eliot*), East shore of Victoria Nyanza near Karungu, Lusinga Isl., Kisumu (Port Florence), Upper Kuja valley, S. Kavirondo (*S. A. Neave*), S. Masai Reserve (*T. J. Anderson*), Mogorr River (*A. O. Luckman*); UGANDA, W. and S.E. Ankole (4400-5000 ft.), and S. of Lake George (*S. A. Neave*), Maramu and Kamwezi (*C. H. Marshall*).

The series examined includes upwards of 250 examples, showing but little variation, the black apical patch rarely reaching forward to the middle of the elytra, the prothorax constantly fulvous, the armature of the tibiae and tarsi perfectly constant, the females separable from the same sex of *I. dimidiata* by the longer tibial spurs. The genital armature of several males has been examined.

2. *Idgia dimidiata*.

*Prionocerus dimidiatus*, Gerst. Arch. für Naturg. xxxvii. p. 56 (1871)<sup>1</sup>;  
 Von der Decken's Reise in Ost-Afrika, iii. 2, p. 158, t. 8. fig. 11  
 (1873)<sup>2</sup>.

Elongate, depressed, slightly widened posteriorly; thickly pubescent, the elytra also with scattered, long, seriatly arranged, erect black setæ, the head and prothorax with numerous curled black bristly hairs, those behind the eyes projecting laterally; black, the prothorax and scutellum, and the elytra with from one-fourth to nearly one-half their length, fulvous or luteous, the apical patch often with a bluish or violaceous lustre. Head polished, with a few small scattered punctures, the labrum large, transverse, angularly dilated laterally; eyes very large in ♂, a little smaller in ♀, well separated in both sexes; antennæ moderately long in ♂, shorter in ♀, joints 3-11 longer than broad, widened, subserrate, 7-10 decreasing in length, 11 much longer than 10, concave on its inner face. Prothorax as long as broad, sparsely punctured. Elytra long, densely granulated-punctate, the seriatly arranged setigerous impressions each preceded by a minute tubercle, the apices obtuse, in some specimens angulate at the sutural angle.

♂. Anterior tarsal joints 1-3 with a comb along their inner edge, 1 simple, scarcely longer than 2, 4 small, shorter and narrower than 3; joint 1 of intermediate and posterior tarsi simple, slightly longer than 2; posterior tibiæ feebly curved. Genital armature (Pl. XI. fig. 4): lateral lobes long, broad, rounded or obtuse at tip; median lobe gradually narrowed, drawn out into a very long, slender, curved, somewhat sinuate point at apex.

Length (excl. head)  $9\frac{1}{2}$ - $13\frac{1}{2}$ , breadth  $3\frac{1}{2}$ -5 mm. (♂ ♀.)

*Hab.* ABYSSINIA, Higo Samula (*R. J. Sturdy*); E. AFRICA, Mombasa<sup>1</sup> [type], Masongaleni (alt. 3000 ft.), Kibwezi (alt. 3000 ft.), M'gori Valley in S. Kavirondo (alt. 4200 ft.), Mtito Andei (alt. 2500 ft.), Makindu (alt. 3300 ft.), Voi (alt. 1800 ft.), Usangu district (alt. 3500-4500 ft.) (*S. A. Neave*), Lulanguru (*G. D. H. Carpenter*), Samburu (*C. S. Betton*); NYASALAND, Masai (*Mus. Brit.*), Mombera district (alt. 4000 ft.), Lilongwe district in Central Angoniland (alt. 4000-5000 ft.) (*S. A. Neave*); N.E. RHODESIA, on road Fort Jameson-Lundazi (alt. 4000 ft.), Upper Luangwa River (*S. A. Neave*); MASHONALAND, Salisbury (*G. A. K. Marshall*); ZULULAND (*Mus. Brit.*); NATAL (*Mus. Brit.*), Greytown (*H. B. Marley*), Estcourt (*G. A. K. Marshall*), Port Natal (*Boheman*<sup>2</sup>); ? S. AFRICA, Cape of Good Hope (*Mus. Brit.*).

Var.  $\alpha$ . The scutellum more or less infuscate and the apical half of the elytra black. ( $\sigma$   $\text{\textasciitilde}$   $\text{\textasciitilde}$ .)

*Hab.* E. AFRICA, W. slopes of Kenya on Meru-Nyeri road (alt. 6000-8500 ft.) (*S. A. Neave*); NYASALAND, Valley of Rukuru, Karonga district (alt. 2000-4000 ft.) (*S. A. Neave*).

Var.  $\beta$ . The prothorax and scutellum black, the prothorax sometimes rufo-variegate or fulvous with an indeterminate black patch on each side of the disc. ( $\sigma$   $\text{\textasciitilde}$   $\text{\textasciitilde}$ .)

*Idgia tripartita*, Pic, Bull. Soc. Ent. Fr. 1912, p. 300<sup>3</sup>.

*Hab.* E. AFRICA<sup>3</sup> (*C. S. Betton*), 30 miles from Magadi Junction (*F. G. Hamilton*), Kibwezi (alt. 3000 ft.), Nairobi to Fort Hall Road (alt. 4500-5000 ft.) (*S. A. Neave*); N. NIGERIA, Panyam in Banchi Province (*G. F. Fox*).

About 200 examples of this species are contained in the Museum collection, including specimens from the two localities quoted by Gerstaecker, Mombasa and Natal. The variety *tripartita* was received with the typical form from Kibwezi, five of the thirty examples before me being intermediate, having the prothorax partly red. The long series from the slopes of Kenya (6000-8500 ft.), and those from the Karonga district of Nyasaland are also darker than typical *dimidiata*, having the apical half of the elytra and the scutellum black, these specimens (39  $\text{\textasciitilde}$   $\text{\textasciitilde}$ , 5  $\sigma$   $\text{\textasciitilde}$   $\text{\textasciitilde}$ ) forming a transition to the still darker *tripartita*. Some of the southern examples ( $\sigma$   $\text{\textasciitilde}$   $\text{\textasciitilde}$ ) have the elytra distinctly angulate at the sutural angle, a character apparently of no great importance. Males of each form have been dissected, showing a similar genital armature. The tuft of long hairs behind the eyes mentioned by Pic in his description of *I. tripartita* is to be found in all the allied African species known to me. His *I. nigricollis* (1906), from Sierra Leone, is not represented in the collections at the Museum.

### 3. *Idgia terminata*.

*Idgia terminata*, Cast. Hist. Nat. Ins. Coleopt. i. p. 275 (1840).

$\sigma$ . Elongate, rather narrow, shining, thickly pubescent, and also set with scattered, curled or erect, blackish bristly hairs, those on the elytra seriatly arranged; testaceous, the head (the labrum excepted), joints 5-11 of the antennae, a large patch at the apex of the elytra, the knees, tibiae, and tarsi black. Head as wide as the prothorax; eyes

extremely large, almost contiguous; labrum transverse, subtrapezoidal, moderately large; apical joint of maxillary palpi long, cultriform; antennæ moderately long, joints 4-10 gradually increasing in width and decreasing in length, 10 longer than broad, 11 about the length of 9 and 10 united, curved, hollowed on its inner face. Prothorax longer than broad, very uneven, rugulose punctate. Elytra long, rounded at the tip; densely, rugulose punctate. Anterior tarsal joints 1-3 with a narrow black comb on their inner edge. Genital armature (Pl. XI. fig. 5): lateral lobes broad, short; median lobe drawn out into a very long, slender, strongly curved point.

Length (excl. head) 9, breadth 3 mm.

*Hab.* W. AFRICA, Senegal (*Mus. Brit.*).

A male in the Museum, labelled "*Epiphyta melanura*, Dj., Senegal," agrees with the brief diagnosis of *I. terminata*, Cast., from that locality, and a longer description is given from the specimen before me. It is separable from *I. longipalpis* by the smaller labrum, the shorter, less dilated antennæ, and the wholly testaceous prothorax. *I. abyssinica* has a much larger labrum, a smaller head, a narrower apical patch, &c. The similarly-coloured *Prionocerus senegalensis*, Cast., under which *E. melanura*, Dej., is placed as a synonym in the 'Munich Catalogue,' should have the antennæ serrate as in the type-species of that genus.

#### 4. *Idgia apicalis*.

*Prionocerus (Idgia) apicalis*, Gerst. Arch. für Naturg. xxxvii. p. 56 (1871); Von der Decken's Reise in Ost-Afrika, iii. 2, p. 159 (1873).

♂. Eyes very large, subapproximate above and beneath; anterior tarsal joints 1-3 with a black comb along their inner edge, 4 small, narrow. Genital armature: lateral lobes long, broad; median lobe narrow, acuminate, somewhat hooked at the tip.

*Hab.* E. AFRICA, Mombasa and Zanzibar.

A male from Zanzibar, received by the Museum in 1868, is certainly referable to this species. A narrow, elongate, ochraceous insect, with the head (except in front), and a small patch at the tip of the elytra, black; the antennæ long, subfiliform; the body thickly pubescent, the head with numerous long dark bristly hairs, and the elytra sparsely, seriatly nigro-setose; the apical joint of the maxillary palpi long, subcultriform; the labrum transverse, subquadrate. The genital armature has not been dissected, but it is partly extruded in the single specimen before me.

5. *Idgia abyssinica*, sp. n.

♀. Elongate, rather narrow, shining, thickly pubescent, and also set with scattered, curled or erect, long black bristly hairs, those on the disc of the elytra seriatly arranged, the margins of the latter nigro-ciliate; fulvo-testaceous, the head (the labrum excepted), joints 5-11 of the antennæ, the elytra and abdomen at the tip, and the legs (the bases of the femora excepted), black. Head rather small, somewhat produced in front; labrum broad, transverse, large, angularly dilated; apical joint of maxillary palpi subcultriform; eyes large, well separated; antennæ long, rather slender, joints 5-10 slightly widened, subserrate, 7-10 decreasing in length, 11 much longer than 10, hollowed within. Prothorax as long as broad, wider than the head, uneven, sparsely, rugulose punctate. Elytra very long, rounded at the tip; densely, rugulose punctate, the seriatly-arranged setæ each preceded by a minute smooth granule. Legs rather stout, long.

Length (excl. head) 10, breadth 3 mm.

*Hab.* ABYSSINIA (*Mus. Brit.*).

One female, acquired in 1876. Not unlike *I. apicalis*, but broader, with a larger labrum, and stouter, outwardly infusate antennæ, the legs (the bases of the femora excepted) and apex of the terminal ventral segment black. The general system of coloration is like that of *I. assimilis*, Hope, and many other eastern members of the genus, most of which have a much smaller labrum. The elytra are broader and less parallel, the antennæ are stouter, the head is smaller, and the apical joint of the maxillary palpi is less elongate, than in *I. longipalpis*. The antennæ are not so slender as in the Indian *I. assimilis*, Hope, from which the unusually enlarged, angularly dilated labrum is sufficient to distinguish the present species.

6. *Idgia longipalpis*, sp. n.

♂. Elongate, narrow, shining, thickly pubescent, the head and prothorax also set with long, curled, projecting or erect, black bristly hairs, the elytra seriato-nigro-setose on the disc and strongly ciliate along their outer margin; black or piceous, the palpi and labrum, the basal four or more joints of the antennæ, the anterior femora at the base, the anterior tibiæ, the tarsi in part, and the elytra for fully two-thirds of their length, testaceous, the prothorax rufescent or testaceous along the basal, apical, and outer margins.



Antennæ long, rather slender, subfiliform. Eyes extremely large, almost contiguous. Labrum large, angularly dilated, transverse. Apical joint of maxillary palpi elongate, cultriform, that of the labial palpi securiform. Prothorax narrower than the head, very uneven, rugulose punctate. Elytra elongate, rounded at the tip; densely, rugulose punctate, the seriatly-arranged setæ each preceded by a minute smooth tubercle. Sixth ventral segment sulcate down the middle. Anterior tarsal joints 1-3 with a narrow black comb along their inner edge, 4 small. Genital armature (Pl. XI. fig. 6): lateral lobes long, broad; median lobe abruptly narrowed towards apex, the apical portion long and slender, sharply hooked at the tip beneath.

Length (excl. head)  $8\frac{1}{2}$ -9, breadth 3-3 $\frac{1}{8}$  mm.

*Hab.* ABYSSINIA (*Mus. Brit.*).

Three males, received in 1876. Closely related to *I. apicalis*, Gerst., and separable therefrom by the large black apical patch on the elytra, the broadly infusate disc of the prothorax, the blackish under surface and legs, the more elongate apical joint of the maxillary palpi, and the different genital armature.

### 7. *Idgia cyanea*.

*Idgia cyanea*, Pic, L'Echange, xxii. p. 43 (1906).

♂. Tarsi formed very much as in *I. dimidiata*, joints 1-3 of anterior pair with a similar comb on their inner edge, 1 and 2 subequal in length, 4 small, shorter than in ♀; tibial spurs small, as in ♀. Genital armature (Pl. XI. fig. 7): lateral lobes narrower than in *I. dimidiata*; median lobe sinuate, and drawn out into a long, narrow point, which is abruptly curved downward and rather blunt at tip.

*Hab.* UGANDA, S.E. shore of Lake Kioga and between that place and Kakindu in W. Busoga, alt. 3400-3500 ft. (*S. A. Neave*); S. NIGERIA, Oyo Yoruba.

Thirteen examples from Uganda, including five males, are referred to this species, the type of which was from Oyo Yoruba. Very like *I. dimidiata*, var. *tripartita*, wholly black or bluish black, with the exception of the rufous tarsal claws and the uniformly nigro-cyaneous elytra, the antennæ a little less widened.

### 8. *Idgia fulvicollis*.

*Idgia fulvicollis*, Reiche in Ferret and Galinier's Voy. Abyssin., Ins. p. 286, t. 17. figs. 5, 5 a-e (1849). (♂ ♀.)

♂. Eyes larger, more convex, and more narrowly separated

than in ♀; anterior tarsal joints 1-3 with a conspicuous comb along their inner edge, 4 small; posterior tibiæ curved. Genital armature (Pl. XI. fig. 8): lateral lobes rather short; median lobe drawn out into a long, slender, curved point.

*Hab.* ABYSSINIA (*Mus. Brit.*); E. AFRICA, Alhî Plains and Nyems Ndogo (*Gregory*), Higo Samula (*R. J. Stordy*: 30. x. 1911).

There are five males and three females of this species in the Museum, including a ♀ from Abyssinia received in 1855. A hairy, elongate insect, black or piceous, with the prothorax and tarsal claws, and usually the scutellum also, testaceous, the elytra with a faint bluish tinge; the antennal joints 3-10 elongated and slightly widened, 11 curved, hollowed on its inner face, much longer than 10 in ♂. The faintly indicated elytral costæ are exaggerated in Reiche's figure. *I. fulvicollis* has the antennæ less widened than in *I. dimidiata*, both species occurring at the same locality in Abyssinia. *I. henonii*, Fairm., from Choa (1883), may be a form of the ♀ with an infuscate prothorax? The genital armature is very like that of *I. dimidiata* and *I. plectrophora*.

#### Arabian Species.

- Prothorax and elytra testaceous, the apical portion of latter broadly black; antennæ long and slender in ♂ and ♀; head rostrate ..... No. 9.  
 Prothorax testaceous, elytra nigro-cyaneous; antennæ long and broadly dilated in ♂, shorter and less widened in ♀; head rostrate ..... No. 10.

#### 9. *Idgia arabica*, sp. n.

? *Prionocerus hirtus*, Walk. List Coleopt. J. K. Lord, p. 14 (1871).

Very elongate, somewhat widened posteriorly, shining, the elytra rather dull; finely pubescent and sparsely nigro-setose; fulvous, the head (the labrum and epistoma excepted) and the antennæ from about the fourth joint black, the elytra with a large apical patch (occupying one-third or more of their length) nigro-cyaneous. Head long, narrow, strongly produced anteriorly, the labrum about as long as broad, hollowed down the middle; eyes very large, moderately convex, subcontiguous in ♂, narrowly separated in ♀; antennæ long in ♂, a little shorter in ♀, joints 5-10 elongate, feebly serrate, moderately widened, subequal in length, 11 concave within, slightly longer than 10. Prothorax oblong-subquadrate, wider than the head, uneven,

quite sparsely punctulate. Elytra very elongate, at the middle twice as wide as the prothorax, densely granulato-punctate. Legs very long.

♂. Posterior femora feebly clavate; anterior tarsal joints 1-3 with a narrow black comb along their inner edge; terminal dorsal segment entire. Genital armature (Pl. XI. figs. 9, 9 a): lateral lobes sinuate, curved inward and somewhat hooked at the tip, as seen from above (fig. 9 a), broad as seen in profile (fig. 9); median lobe gradually acuminate, the apex broadly, abruptly dilated, subsagittiform.

Length (excl. head) 11-14, breadth  $3\frac{1}{5}$ - $4\frac{2}{5}$  mm. (♂ ♀.)

Hab. ARABIA, Yemen (*Milligen, in Mus. Brit.*).

The above description is taken from four males and three females. They agree with Walker's diagnosis of *P. hirtus*, except as regards their larger size, the unnotched eyes\*, and the broad joints to the antennæ. His type, from Tajura, on the opposite African coast, appears to have been lost. The median lobe of the male is very peculiarly formed.

#### 10. *Idgia laticornis*, sp. n.

Elongate, somewhat widened posteriorly, shining, the elytra duller; finely pubescent and sparsely nigro-setose; fulvous, the head (the labrum and epistoma excepted) and the antennal joints 5-11 black, the elytra nigro-cyaneous or black. Head long, narrow, strongly produced anteriorly, the labrum about as long as broad, hollowed down the middle; eyes very large, moderately convex, narrowly separated in ♂, more distant in ♀; antennæ (♂) elongate, joints 4-11 broad, stout, feebly serrate, tapering towards the apex, 4 not longer than 3, 5-10 subequal in length, longer than broad, 11 deeply excavate within, longer than 10, (♀) much shorter and more slender. Prothorax wider than the head, oblong-subquadrate, narrowed anteriorly, uneven, sparsely punctulate. Elytra very long, at the middle twice as wide as the prothorax, densely granulato-punctate.

♂. Anterior tarsal joints 1-3 with a black comb along their inner edge; anterior tibiæ slightly curved towards the apex; posterior trochanters toothed behind. Genital armature (Pl. XI. figs. 10, 10 a): lateral lobes rather short, narrowed and slightly sinuate distally, as seen from above; median lobe stout, abruptly bent downward and broadly, angularly dilated towards apex, the apical portion straight, hooked above and beneath at tip.

\* Almost certainly an error of observation.

Length (excl. head)  $10\frac{1}{2}$ – $12\frac{1}{2}$ , breadth  $3\frac{1}{4}$ –4 mm. ( $\sigma$  ♀.)

*Hab.* ARABIA, Yemen (*Millingen*), Ktubu and El Kubar (*G. W. Bury*).

Three males and two females. Near *I. arabica*, but with the  $\sigma$ -antennæ dilated as in a Lycid, the elytra wholly nigro-cyanaceous or black. One of the females, that from El Kubar, somewhat discoloured, has the head almost entirely black, the legs partly infusate, and the elytra black. The narrow, elongate head, broad antennæ, shorter pubescence, differently coloured body, &c., separate *I. laticornis* from the Abyssinian *I. fulvicollis*, Reiche. The stout, abruptly bent median lobe, as seen from above, has the long apical portion broadly sagittiform.

#### Chinese Species.

Prothorax and elytra testaceous, the apices of the latter black.....	Nos. 11, 12.
Prothorax flavous, head and elytra metallic; tarsal claws simple; body narrow, elongate.....	No. 13.
Prothorax and front of head testaceous, elytra obscurely metallic; tarsal claws widened basally; body narrow, very elongate.....	No. 14.
Prothorax, base of head, and elytra uniformly greenish; tarsal claws widened basally; body very narrow and elongate.....	No. 15.

#### 11. *Idgia deusta*.

*Idgia deusta*, Fairm. Ann. Soc. Ent. Fr. (5) viii. p. 118 (1878).

$\sigma$ . Anterior tarsal joints 1–3 with a comb along their inner edge; posterior tibiæ (as in ♀) almost straight and with very small spurs. Genital armature (Pl. XI. fig. 11): lateral lobes long, broad, curved inward at the tip, as seen from above; median lobe long, rather narrow, feebly sinuate from near the base, terminating in a slender hooked point.

*Hab.* CHINA (*Fortune*, in *Mus. Brit.*), Foo-Chow (*C. B. Ricket*, *G. Lewis*), Suiling in W. China (*W. A. Maw*), Shanghai (*J. J. Walker*).

Numerous specimens from the above-mentioned localities are referred to *I. deusta*, Fairm., the type of which was found by Abbé David in Central China. Bourgeois (Ann. Soc. Ent. Belg. xxxvi. p. 238, 1892) sinks the Chinese insect as synonymous with the Indian *I. melanura*, Koll. & Redt., which also has the tip of the elytra and the whole of the head black, the legs and antennæ infusate, the eyes very large, &c.; the present species, however, has the upper surface less densely punctate and more shining (approaching

*I. nitida* in that respect), and the ♂-armature very different from that of *I. melanura*.

The length (excl. head) varies from  $8\frac{1}{2}$ –10 mm. The eleventh antennal joint is deeply excavate and more than twice the length of the tenth.

### 12. *Idgia ungulata*, sp. n.

Elongate, narrow, shining, finely pubescent, and sparsely setose; testaceous, the head (except the labrum in part or wholly, and sometimes a spot at the base), and a small patch at the apex of the elytra, black, the antennæ, tibiæ, tarsi, and apices of the femora more or less infuscate. Head somewhat produced in front, the labrum transverse, concave eyes very large, almost contiguous in ♂; antennæ slender, distinctly widened outwards, joint 4 a little shorter than 3 or 5, 11 deeply excavate within, twice as long as 10. Prothorax very little wider than the head, slightly longer than broad, feebly sinuate at the sides posteriorly, sparsely punctate. Elytra moderately elongate, finely, somewhat densely punctate.

♂. Anterior tarsal joints 1–3 with a comb along their inner edge; posterior tibiæ distinctly arcuate towards the apex, the spurs strongly developed, curved, the upper one longer than the other. Genital armature (Pl. XI. fig. 12): lateral lobes long, broad; median lobe sinuate, gradually narrowed to the rather blunt tip.

Length (excl. head)  $6$ – $7\frac{1}{2}$ , breadth  $2$ – $2\frac{3}{4}$  mm.

*Hab.* CHINA (*Mus. Brit.*), Hong Kong (*Mus. Brit.*, *F. W. Terry*, *J. J. Walker*), Amoy (*G. Lewis*).

A long series, males preponderating. Less elongate than *I. deusta* as here identified, the head not wholly black in front, the apical patch smaller; the male with differently formed posterior tibiæ, longer asymmetric spurs (suggestive of those of certain *Scirtes*), and dissimilar genital armature.

### 13. *Idgia flavicollis*.

*Idgia flavicollis*, Redt. Reise der Novara, ii. p. 111 (1868); Fairm. Ann. Soc. Ent. Fr. (6) ix. p. 45 (1889).

♂. Eyes distant, as in ♀; anterior tarsal joints 1–3 with a comb along their inner edge. Genital armature (Pl. XI. fig. 13): lateral lobes long; median lobe narrow, pointed at tip.

*Hab.* CHINA, Hong Kong.

There is a long series of this species in the Museum, including several examples captured by Commander Walker

in 1893. A slender insect, not unlike an *Asclera* (fam. *Edemeridæ*), green or bluish green, with the palpi, antennæ, and sometimes the tibiæ and apex of the abdomen also, testaceous or flavous; the antennæ very slender; the head small. Two males have been dissected. *I. flavicollis* appears to have been unknown to Pic.

14. *Idgia flavirostris*.

*Idgia flavirostris*, Pasc. Journ. Ent. i. p. 43 (April 1860); Fairm. Ann. Soc. Ent. Fr. (6) ix. p. 44 (1889).

♂. Eyes small, distant, as in ♀; anterior tarsal joints 1-3 with a comb along their inner edge. Genital armature (Pl. XI. fig. 14): lateral lobes long, narrowed outwards, their apices truncate and hooked beneath; median lobe gradually narrowed, curved upward at the tip.

*Hab.* CHINA (*Mus. Brit.*), Chusan Is. (*J. J. Walker*), Ta-maon Isl., Hong Kong (*Mus. Brit.*).

Of the eighteen examples of this species before me, including the type, one only, from the Chusan Is., is of the male sex. A close ally of *I. flavicollis*, with a longer prothorax and very elongate elytra, the anterior portion of the head, palpi, basal joints of the antennæ, prothorax, and femora testaceous. The head is small and comparatively short. The tarsal claws are distinctly widened to about the middle. An allied form from China has been described by Fairmaire under the name *I. moupinensis*.

15. *Idgia virescens*, sp. n.

♀. Very elongate, narrow, subopaque, finely cinereo-pubescent, and sparsely nigro-setose; obscure metallic green, the anterior half of the head, palpi, antennæ, underside of prothorax, abdomen, coxæ, femora, and tibiæ in part, testaceous. Head scabroso-punctate, small, slightly produced in front, excavate between the eyes, the labrum transverse; eyes distant; apical joint of maxillary palpi elongate; antennæ very slender, long, joints 3 and 4 equal in length, those following still more elongate. Prothorax longer than broad, wider than the head, somewhat dilated at the middle, opaque, densely, very finely scabroso-punctate. Elytra very elongate, much broader than the prothorax, rounded at the tip; densely, rugulosely punctate, each with five series of conspicuous granules on the disc, the margins crenulate. Legs very long and slender; tarsal claws widened to about the middle.

Length (excl. head)  $8\frac{1}{4}$ , breadth 2 mm.

*Hab.* W. CHINA, Chin-Fu-San (*M. A. Maw*).

One specimen, in poor condition, received by the Museum in 1908. Near *I. flavirostris*, Pasc., but smaller, narrower, and more slender, the prothorax opaque and coloured, like the elytra, the seriately arranged granules on the latter conspicuous.

*Indian and Malayan Species* \*.

- a. Antennal joints [♀] 8-10 serrate, different in shape from those preceding; head small; prothorax vittate; elytra broad, black . . . . . No. 16.
- b. Antennal joints 8-10 similar in shape to those preceding.
  - a<sup>1</sup>. Antennal joint 4 very short, about as long as 2, the antennæ themselves strongly serrate in ♂; prothorax testaceous; elytra metallic . . . . . No. 17.
  - b<sup>1</sup>. Antennal joint 4 nearly or quite as long as 3 or 5.
    - a<sup>2</sup>. Antennæ strongly serrate in ♂; body brilliantly metallic . . . . . No. 18.
    - b<sup>2</sup>. Antennæ not strongly serrate in ♂, not differing greatly in the two sexes.
      - a<sup>3</sup>. Elytra metallic; the prothorax rufescent or testaceous, maculate in some of the species.
        - a<sup>4</sup>. Posterior femora not thickened in ♂ . . . . . Nos. 19-21.
        - b<sup>4</sup>. Posterior femora more or less thickened in ♂. . . . . Nos. 22-24.
      - b<sup>3</sup>. Elytra infusate or black (paler in *I. gorhami*, Pic, var.), sometimes with a metallic lustre; the prothorax testaceous, maculate in *I. nilgirica* . . . . . Nos. 25-30.
    - c<sup>3</sup>. Elytra infusate, with the sutural and outer margins in part or entirely flavescent; the prothorax testaceous, maculate in *I. marginata*. . . . . Nos. 31, 32.
    - d<sup>3</sup>. Elytra viridi-vittate on disc and the prothorax maculate, the former dilated at base . . . . . No. 33.
    - e<sup>3</sup>. Elytra and prothorax testaceous or luteous, the former black at tip.
      - c<sup>4</sup>. Posterior femora thickened in ♂ . . . . . Nos. 34-36.
      - d<sup>4</sup>. Posterior femora not thickened in ♂.
        - a<sup>5</sup>. Apical patch on elytra extending forward to about the middle . . . . . Nos. 37, 38.
        - b<sup>5</sup>. Apical patch moderately large, rarely reaching so far forward . . . . . Nos. 39-48.
        - c<sup>5</sup>. Apical patch small.
          - a<sup>6</sup>. Sixth ventral segment triangularly emarginate in ♂ . . . . . Nos. 49-59.
          - b<sup>6</sup>. Sixth ventral segment trilobed in ♂ . . . . . No. 60.

Species provisionally referred to *Idgia* (♂ wanting):  
 small, slender, metallic, Dasytiform . . . . . No. 61.

16. *Idgia triserrata*, sp. n.

♀. Moderately elongate, widened posteriorly, the head and prothorax shining, the elytra dull, finely pubescent and

\* ♂ ♂ wanting of Nos. 16, 33, 37, 43, 48, 59.

sparsely setose; bluish black, the head nigro-æneous; the basal joints of the antennæ obscurely rufescent, the prothorax (an elongate black patch on the disc excepted) rufo-testaceous. Head small, narrow, somewhat produced anteriorly, the labrum concave, nearly as long as broad, rounded at the sides; eyes distant; antennæ short, slender at the base, widened outwards, joints 8-10 serrate, 10 sub-transverse, 11 concave within, barely as long as 9 and 10 united. Prothorax much wider than the head, about as long as broad, uneven, polished on the disc, sparsely punctate laterally. Elytra broad, long, widened to beyond the middle, rounded at the tip; densely, finely, rugulose punctate. Legs rather short.

Length (excl. head) 10, breadth 4 mm.

*Hab.* INDIA, Manipur (*Doherty*).

One specimen. This species resembles *Prionocerus cæruleipennis* and *P. bicolor* in shape, but it has the antennæ slender at the base and joints 8-10 abruptly serrate; the head is small and narrow; the prothorax is red, with a black, anteriorly narrowed median vitta; and the elytra are broad, dull, and bluish black in colour. *I. submetallica*, Pic (1911), from Kandy, which has the elytra red, except at the tip, seems to be an allied form.

### 17. *Idgia viridipennis*.

♀. *Idgia viridipennis*, Pic, L'Echange, xxii. p. 55 (1906).

*Prionocerus viridipennis*, Bourg. Ann. Soc. Ent. Belg. li. pp. 103, 104 (1907). (♂ ♀.)

*Hab.* S. INDIA, Wallardi in Travancore [type], Anamalai Hills, alt. 1100 metres (*H. L. Andrewes*).

This species is easily recognizable by the very short fourth joint to the antennæ, the bluish-green head, elytra, under surface, and legs, the testaceous prothorax, and the partly testaceous basal joints of the antennæ. The three females from the Anamalai Hills in the Andrewes collection have joints 5-10 of the antennæ cyaneous, considerably widened, and distinctly serrate, these joints, according to Bourgeois, being broadly serrato-dilatate in the ♂; his definition of the ♀ antenna as "subfiliform" is misleading. The sutural angle of the elytra in ♀ is dentiform, as described by Pic.

### 18. *Idgia belli*.

*Idgia belli*, Gorb. Ann. Soc. Ent. Belg. xxxix. p. 319 (1895)<sup>1</sup>.

♂. *Prionocerus cærucutus*, Fairm. Notes Leyden Mus. xviii. p. 94 (1896)<sup>2</sup>.



♂. Eyes much larger, more convex, and more approximate, and the antennal joints 6-10 broader and more strongly serrate, than in ♀; anterior tarsal joints 1-3 with a comb along their inner edge, 4 small, narrow; terminal dorsal segment rounded at tip. Genital armature (Pl. XI. fig. 15): lateral lobes long, rounded at apex; median lobe narrow, sharply acuminate, curved at tip.

*Hab.* S. INDIA (*Mus. Brit.*), Kanara<sup>1</sup> (*T. R. Bell*), Malabar<sup>2</sup> (*type of Fairmaire*), Nilgiri Hills (*H. L. Andrewes*, *A. K. Weld Downing*, *Sir G. F. Hampson*), Travancore (*G. S. Imray*), Periya Ghat [Malabar], alt. 2500 ft. (*E. Bullard*).

An elongate, slender, brilliantly metallic green, blue, or æneous insect, with the ♂-antennæ dilated and strongly serrate, approaching that of the type of *Prionocerus*; the legs long and slender; the labrum trapezoidal, rather large, deeply foveate in the centre at the base; the apical joint of the maxillary palpi elongate-triangular; the terminal joint of the antennæ curved and deeply excavate. Mr. Andrewes's collection contains a long series of this species from the Nilgiri Hills, and there are numerous examples of it in the British Museum. The Kauara type of Gorham is ♀.

### 19. *Idgia viridescens*.

*Idgia viridescens*, Gorh. Ann. Soc. Ent. Belg. xxxix. p. 319 (1895).

*Prionocerus metallescens*, Fairm. Notes Leyden Mus. xviii. p. 94 (1896).

♂. Eyes larger and more approximate, and the antennal joints 5-10 a little more acute at their inner apical angle, than in ♀; anterior tarsal joints 1-3 with a comb along their inner edge, 4 small, narrow; terminal dorsal segment bisinuato-truncate at apex. Genital armature (Pl. XI. fig. 16): lateral lobes broad, narrower and curved inward at tip, as seen from above; median lobe stout, acuminate, and almost straight at apex.

*Hab.* N. INDIA (*Mus. Brit.*), Simla (*Hauser: type of Fairmaire*), Kasauli (*Col. H. J. W. Barrow; coll. Andrewes*), W. Almora (*H. G. Champion*), Gopaldhara, Rungbon Valley, Sikkim (*H. Stevens*), Mungphu, Sikkim (*ex coll. Atkinson*); CENTRAL INDIA (*Capt. Boys, in Mus. Oxon.*).

A large, elongate, rather broad, posteriorly widened, obscure æneous or nigro-cæruleous form, with the prothorax and the tip of the antennæ fulvous or testaceous; the labrum transversely subquadrate, small, concave; the eleventh antennal joint curved and deeply excavate; the apical joint of the maxillary palpi elongate. Numerous

specimens of this insect have recently been sent by my son from W. Almora, from elevations between 7000 and 9000 ft. Two males have been dissected. Gorham's description of *I. viridescens* was based upon two examples ( $\delta$ ?) from "India." The yellow base of the last abdominal segment mentioned by him doubtless refers to the pallid membranous space visible between the ventral segments 5 and 6 in  $\delta$ .

#### 20. *Idgia andrewesi*.

*Prionocerus* (*Idgia*) *andrewesi*, Bourg. Ann. Soc. Ent. Belg. li. p. 104 (1907). ( $\delta$  ♀.)

$\delta$ . Eyes extremely large, almost contiguous (narrowly separated in ♀); anterior tarsal joints 1-3 with a comb along their inner edge, 4 narrow, small; posterior trochanters acuminate at tip (obtuse in ♀). Genital armature (Pl. XI. fig. 17): median lobe rather broad, as seen from above, narrower than the lateral lobes, sinuate, acuminate at tip, the latter subtruncate; lateral lobes moderately broad, the concave apical portion, as seen from beneath, separated from the rest by an oblique fold.

*Hab.* S. INDIA (*Mus. Brit.*), Nilgiri Hills (*H. L. Andrewes*, *Sir G. F. Hampson*), Anamalai Hills (*H. L. Andrewes*).

An elongate, nigro-cyaneous insect, with a long, flavo-testaceous prothorax, the basal joints of the antennæ, and also the apical one, the palpi, and sometimes the scutellum in part, flavescent; the antennæ long and slender, with joint 11 sinuate, considerably elongated in  $\delta$ ; the apical joint of the maxillary palpi long; the head somewhat produced in front; the labrum narrow, somewhat oval, about as long as broad in some specimens, shorter in others. There are two males and six females of this species in Mr. Andrewes's collection, and a pair in the British Museum. Bourgeois overlooked the tarsal and trochanter characters, which are conspicuous in the labelled type,  $\delta$ . The length varies from 11-13 mm.

#### 21. *Idgia chloroptera*.

*Idgia chloroptera*, Redt. Reise der Novara, ii. p. 111 (1868).

$\delta$ . Eyes large, subcontiguous (a little more distant in ♀); anterior tarsal joints 1-3 with a comb along their inner edge. Genital armature (Pl. XI. fig. 18): lateral lobes long, broad; median lobe curved and acuminate at tip.

*Hab.* CEYLON [type] (*Thwaites*, in *Mus. Oxon.*:  $\delta$ ), Kapulahani (*Mus. Brit.*:  $\delta$ ), Maskeliya (*E. E. Green*: ♀).

There is a pair of this species in the British Museum and a male in the Hope collection at Oxford. A very elongate, dull, greyish-green insect, with the anterior and basal margins of the prothorax, the extreme bases of the femora, the abdomen, and the under surface in great part, testaceous; the antennæ slender, filiform; the prothorax rugulose, the dark patch on the disc sometimes divided down the middle; the elytra unusually long and densely, rugulosely punctate; the legs slender in both sexes.

## 22. *Idgia cyanocephala*, sp. n.

Elongate, narrow, subparallel, moderately shining, finely cinereo-pubescent, and sparsely nigro-setose; cyaneous, the elytra and under surface greenish, the prothorax and basal joints of the palpi testaceous, the antennæ piceous, testaceous at the base and tip. Head narrow, moderately produced anteriorly, the labrum transverse; eyes somewhat distant in both sexes; antennæ slender, subfiliform, joints 3 and 4 about equal in length, 11 much longer than 10, concave within. Prothorax scarcely wider than the head, sinuate at the sides posteriorly, about as long as broad. Elytra elongate, subparallel, at the middle twice as wide as the prothorax, rounded at the tip, flattened on the disc; densely, rugulosely punctate, with four rows of rather prominent granules, the margins crenulate. Legs slender.

♂. Anterior tarsal joints 1-3 with a narrow comb along their inner edge; posterior femora slightly thickened. Genital armature (Pl. XI. fig. 19): lateral lobes moderately long, feebly sinuate, narrowed towards apex; median lobe stout, sinuate, pointed.

Length (excl. head)  $7\frac{1}{2}$ - $8\frac{1}{2}$ , breadth  $2\frac{1}{4}$  mm. (♂ ♀.)

*Hab.* MALACCA, Perak (*Doherty*).

One male and two females. Smaller than the Indian *I. viridipennis*, Pic, the head narrower, the antennæ slender and with the fourth joint as long as the third, the eyes larger, the elytra flattened on the disc, the fourth row of granules forming a distinct ridge. Compared with *I. cæruleiventris*, which also occurs at Perak, the metallic-blue head, elytra, and legs and the slightly thickened posterior femora of the ♂ will serve to distinguish *I. cyanocephala*.

## 23. *Idgia rouyeri*.

*Idgia rouyeri*, Pic, L'Echange, xxii. p. 43 (1906).

Elongate, narrow (♂), broader (♀), shining, thickly

pubescent, and sparsely nigro-setose; testaceous, the head, the outer halves of the femora, the antennæ (except at the base and tip), and sometimes the tibiæ and tarsi also, infuscate or black, the elytra bluish, bluish green, or fusco-æneous, the prothorax in two examples with a small blackish spot on each side. Head rather small, the labrum transverse; eyes very large and subcontiguous in ♂, somewhat narrowly separated in ♀; antennæ slender, slightly thickened towards the apex, moderately long, joint 11 deeply excavate within, a little longer than 10. Prothorax longer than broad, sinuate at the sides posteriorly, uneven, sparsely punctulate. Elytra long, subparallel; densely, rugulose punctate, and with seriatly arranged graules extending down the disc, the margins crenulate.

♂. Intermediate and posterior tibiæ feebly curved; posterior femora thickened; anterior tarsal joints 1-3 with a comb along their inner edge, 4 small. Genital armature (Pl. XI. fig. 20): lateral lobes long; median lobe stout, sinuate, acuminate at tip.

Length (excl. head) 9-10, breadth  $2\frac{1}{2}$ - $3\frac{1}{2}$  mm. (♂ ♀.)

*Hab.* JAVA [*Rouyer*: type] (*Mus. Brit.*, *Mus. Oxon.*), Depok (*G. E. Bryant*: 18. iv. 1909); SUMATRA, Palembang.

Four males and four females, two of the latter with a bimaculate prothorax, are referred to this species, the colour-characters only of which are briefly given by Pic in a synoptic table.

#### 24. *Idgia femorata*, sp. n.

Elongate, rather broad, robust, shining, finely pubescent, and sparsely setose; testaceous, the head (the labrum excepted) black, the elytra nigro-cæruleous. Head somewhat produced in front, the labrum transverse, subquadrate; eyes extremely large and narrowly separated in ♂, more distant in ♀; antennæ long, shorter in ♀, joints 5-10 moderately widened, 3-7 elongate, 8-10 gradually decreasing in length, 11 much longer than 10, concave within. Prothorax about as long as broad, somewhat rounded at the sides. Elytra long, finely, densely, rugulose punctate. Terminal dorsal segment entire.

♂. Anterior tarsal joints 1-3 with a comb along their inner edge; posterior femora incrassate. Genital armature (Pl. XI. fig. 21): lateral lobes long; median lobe stout, drawn out into a curved point.

*Var.?* The antennæ (except at base) and legs (the basal

portions of the femora excepted) infusate or black, the elytra less metallic.

Length (excl. head)  $10\frac{1}{2}$ –12, breadth 3–4 mm. ( $\sigma$   $\varphi$ .)

*Hab.* INDIA (*Walter Elliot*, in *Mus. Brit.*: type,  $\sigma$ ), Belgaum (*H. E. Andrewes*: type  $\varphi$ ), Mysore (*Mus. Oxon.*: var.,  $\sigma$ ), Poona (*coll. Andrewes*: var.,  $\varphi$ ).

Described from a similarly coloured pair, the  $\sigma$  without definite locality. The examples with partly infusate legs and antennæ, the  $\sigma$  with thickened posterior femora, seem to belong to the same species, the genital armature being similar in the two forms. *I. femorata* is closely related to *I. gorhami*, Pic, as here restricted, differing from it in the strongly incrassate posterior femora in  $\sigma$ , the simple terminal dorsal segment in both sexes, and the slightly dilated antennæ. The median and lateral lobes are much shorter than in the two males of *I. gorhami* dissected. The type,  $\sigma$ , of the present species was presented to the British Museum many years ago.

### 25. *Idgia gorhami*.

*Idgia gorhami* and var. *diversipennis*, Pic, Bull. Soc. Ent. Fr. 1911, p. 241 (exclud. var. with bimaculate prothorax)<sup>1</sup>.

$\sigma$ . Anterior tarsi, terminal dorsal segment, and genital armature (Pl. XI. fig. 22) as in *I. dimelæna*, Walk. (= *cardoni*, Bourg.), No. 44, infra.

*Hab.* INDIA (*Mus. Brit.*), Nilgiri Hills<sup>1</sup> (*Sir G. F. Hampson*, *H. L. Andrewes*, *A. K. Weld Downing*), Coonor (*W. Davison*), Belgaum<sup>1</sup> (*H. E. Andrewes*), Kanara (*T. R. Bell*); BURMA, Paungde (*Mus. Brit.*).

The dissection of two males from the Nilgiri Hills shows that *I. gorhami* is a form of *I. dimelæna*, Walk., with infusate, submetallic elytra, the variety *diversipennis* being intermediate. The two insects are common in the Nilgiri Hills, but as *I. gorhami* does not appear to extend to Ceylon it is here given specific rank. The anterior portion of the head, the antennæ, scutellum, legs, and under surface are testaceous, as in *I. dimelæna*, and the terminal dorsal abdominal segment is similarly cleft at the tip in the two sexes, the apex appearing bilobed.

### 26. *Idgia nilgirica*, sp. n.

*Idgia oculata*, Gorb. Ann. Soc. Ent. Belg. xxxix. p. 319 (1895) (nec Redt.).

*Idgia gorhami*, Pic, Bull. Soc. Ent. Fr. 1911, p. 241 (var. with bimaculate prothorax).

Elongate, narrow ( $\sigma$ ), broader ( $\rho$ ), subparallel, feebly shining, finely pubescent, and sparsely nigro-setose; testaceous, the head (the labrum excepted), and a large oblong patch on each side of the prothorax, black, the antennæ (except at the base and tip), elytra and legs (except the bases of the femora to a variable extent) fuscous or nigro-fuscous, the elytra sometimes with a faint bluish tinge. Head rather long, narrow, the labrum transverse, trapezoidal, concave; antennæ slender, filiform, joint 11 concave, a little longer than 10. Prothorax slightly longer than broad, sinuate at the sides posteriorly, densely, rugosely punctated. Elytra elongate, densely, rugulose punctured, and with rows of scattered granules on the disc.

$\sigma$ . Anterior tarsal joints 1-3 with a narrow comb along their inner edge; terminal dorsal segment deeply, narrowly cleft in the middle at apex (the notch much deeper than in  $\rho$ ). Genital armature (Pl. XI. fig. 23): lateral lobes curved, broad; median lobe drawn out into a long, slender, compressed piece, which (as seen from above) is feebly dilated and somewhat spoon-shaped at the tip\*.

Length (excl. head) 8-11, breadth 2-3 mm. ( $\sigma$   $\rho$ .)

*Hab.* INDIA, Nilgiri Hills (*H. L. Andrewes, Sir G. F. Hampson, A. K. Weld Downing*).

Two males and eight females. Narrower than *I. gorhami*, the prothorax rougher and nigro-bimaculate, the legs and antennæ partly infuscate. The  $\sigma$  has a similarly cleft (or bilobed) terminal dorsal segment, but the genital armature is very different. The allied *I. flavolimbata* and *I. marginata*, from the same region, have the sutural and outer margins of the elytra more or less testaceous, and the terminal dorsal segment simple. *I. maculicollis*, Pic (1906), from Java, has a similarly maculate prothorax.

### 27. *Idgia cæruleiventris*, sp. n.

Elongate, narrow, subparallel, shining, closely cinereo-pubescent, and sparsely nigro-setose; nigro-fuscous, the head black, under surface and femora bluish or violaceous, the palpi, basal joints of the antennæ, prothorax, and tarsal claws testaceous. Head slightly elongated anteriorly, the labrum transverse; eyes large, narrowly separated in  $\sigma$ , more distant in  $\rho$ ; antennæ long, slender, a little shorter in  $\rho$ , joint 11 concave within, considerably longer than 10. Prothorax about as long as broad, very little wider than the

\* Not visible in profile figure.

head, sinuate at the sides posteriorly. Elytra long, densely, finely, rugulose punctate with rows of conspicuous raised granules on the disc, the apices rounded. Legs slender in both sexes. Terminal ventral segment conical.

♂. Anterior tarsal joints 1-3 with a narrow comb along their inner edge. Genital armature (Pl. XI. fig. 24): lateral lobes abruptly narrowed and curved downward towards the apex, the slender apical portion hooked at the tip above; median lobe stout, sinuate distally, simply acuminate at apex.

Length (excl. head) 6-8, breadth 2-2½ mm. (♂ ♀.)

*Hab.* MALACCA, Penang (*Mus. Brit., H. N. Ridley*), Perak (*Doherty*).

Thirteen specimens, including males from each locality, the two from Penang [types] dissected exhibiting peculiarly modified lateral lobes in ♂. This is one of four extremely closely allied small Malayan or Indian forms, with a testaceous prothorax and the rest of the body and legs infuscate.

#### 28. *Idgia cavilabris*, sp. n.

♂. Extremely like *I. cæruleiventris* and similarly coloured above, but differing as follows: the head broader, the labrum concave, the eyes somewhat distant (as in ♀ *cæruleiventris*), large, and convex; the prothorax longer and narrower, not so wide as the head; the elytra with the seriatly arranged granules inconspicuous; the ventral segments not metallic. Genital armature (Pl. XII. fig. 25): lateral lobes elongate, stout; median lobe drawn out into a very long slender point, which is sharply sagittate at tip.

Length (excl. head) 7, breadth 2 mm.

*Hab.* S. INDIA, Nilgiri Hills, alt. 3000 ft. (*H. L. Andrewes*), Kanara (*T. R. D. Bell*).

Two males—one with the scutellum testaceous, from the Nilgiri Hills, taken as the type, the other (injured by pinning) dissected and exhibiting a very peculiarly formed median lobe.

#### 29. *Idgia uncigera*, sp. n.

Extremely like *I. cæruleiventris*, but differing as follows: black or pitchy black (the under surface included), the antennæ (except several of the intermediate joints in ♀), palpi, and prothorax testaceous; the eyes larger, subcontiguous in ♂; the antennæ considerably widened from joint 6 onward in ♂, shorter and more slender in ♀; the

elytra in ♀ furnished with a long, slender, curved hook, or a shorter dentiform process, at the sutural angle (Pl. XII. fig. 50).

Length (excl. head) 7-8, breadth  $2\frac{2}{5}$ - $2\frac{1}{2}$  mm.

*Hab.* BORNEO, Kuching in Sarawak (*J. E. A. Lewis*: ♂ ♀), Quop in W. Sarawak (*G. S. Bryant*: iii., iv. 1914: ♀), Kina Balu (*Mus. Brit.*: ♀), Sanga Sanga, Moorjawa (*H. D. Jensen*: ♀).

Two males and five females. The ♀ found by Mr. Jensen in E. Borneo has a shorter and straighter tooth at the sutural angle than in the other specimens of that sex before me, *I. viridipennis*, Pic, ♀, having the elytra somewhat similarly armed. The Kuching males were not detected at the Museum till after the Plates accompanying this paper had been drawn, and the genital armature therefore has not been dissected for figuring; the apices of the elytra of ♀, however, are shown on the second Plate (Pl. XII. fig. 50).

### 30. *Idgia javana*, sp. n.

♂. Very like *I. caruleiventris* and *I. uncigera*; nigro-fuscous, the palpi [antennæ broken] and prothorax testaceous, the legs reddish brown, the head grooved between the eyes, the latter narrowly separated, the elytra less elongate, the terminal ventral segment convex, conical, narrow, polished. Genital armature (Pl. XII. fig. 26): lateral lobes broad, spoon-shaped at tip as seen from beneath, narrowed distally as seen in profile; median lobe drawn out into a long, rather narrow, upwardly curved point.

Length (excl. head)  $6\frac{2}{3}$ , breadth 2 mm.

*Hab.* JAVA (*Mus. Brit.*).

One male, with genital armature so different from that of *I. caruleiventris* that a name is required for the Javan insect, which may be referable to *I. sumatrensis* or its var. *I. kannegieteri*\*, Pic, from Sumatra, Java, and Borneo. The only tangible characters given for *I. sumatrensis* are the small size (length 9 mm.) and the very narrow, infuscate, non-metallic elytra, the type having a maculate prothorax. It is highly probable that more than one species was included by the author under the latter name.

### 31. *Idgia marginata*, sp. n.

Elongate, narrow, and subparallel (♂), broader (♀), moderately shining, finely cinereo-pubescent, and sparsely nigro-

\* 'L'Echange,' xxii. p. 43 (1906); op. cit. xxvi. p. 75 (1910).



setose; testaceous, the head (the labrum and anterior margin of epistoma excepted) black; the elytra nigro-fuscous or fusco-violaceous, with the sutural and outer margins very narrowly testaceous at the base or to near the apex, the apices sometimes with an indeterminate black patch; the antennæ in one specimen fusco-annulate. Head slightly produced anteriorly, the labrum transverse; eyes very large and subcontiguous in ♂, narrowly separated in ♀; antennæ slender, joint 11 a little longer than 10. Prothorax about as wide as the head in ♂, longer than broad, wider in ♀, strongly sinuate at the sides posteriorly, closely, rugulose punctate. Elytra very long, quite narrow in ♂; densely, rugulose punctate, with rows of somewhat conspicuous granules on the disc. Terminal dorsal segment of the abdomen simple.

*Var.* The elytra testaceous with an indeterminate black patch at the shoulders and apex. (♀.)

♂. Anterior tarsal joints 1-3 with a black comb along their inner edge. Genital armature (Pl. XII. fig. 27): lateral lobes short, broad, slightly curved, as seen from above; median lobe curved, compressed from about the middle, and drawn out into a blunt, downwardly directed point.

Length (excl. head) 8-11, breadth 2-3½ mm. (♂ ♀.)

*Hab.* INDIA, Nilgiri Hills (*H. L. Andrewes*).

Two males and ten females, including two of the variety which corresponds with the var. *diversipennis* of *I. gorhami*, Pic. More shining than *I. flavolimbata* from the Anamalai Hills, the antennæ, legs, and under surface testaceous, the ♂-armature very different. The males are much narrower than specimens of the same sex of *I. gorhami*, and are separable therefrom by the simple terminal dorsal segment of the abdomen, the pale sutural and outer margins of the elytra, and the ♂-armature.

### 32. *Idgia flavolimbata*, sp. n.

♂. Elongate, narrow, subparallel, depressed, shining, the elytra dull; finely pubescent and sparsely setose; fuscous, the head (the labrum included) black, the palpi, base and tip of the antennæ, prothorax (a broad space on the disc excepted), scutellum, mesosternum, coxæ, and bases of femora, testaceous; the elytra with a sharply defined black patch at the apex, the sutural and outer margins to near the tip, the extreme base, and an indeterminate undulate fascia preceding the apical spot, testaceous. Head moderately long, the labrum transverse, concave; eyes very large, subcontiguous;

antennæ long, slender, joint 11 about as long as 10, concave. Prothorax slightly longer than broad, not wider than the head, sinuate at the sides posteriorly, rugulose. Elytra very long, narrow, subparallel, densely, rugulose punctate. Anterior tarsal joints 1-3 with a narrow comb along their inner edge. Terminal dorsal segment rounded at apex. Genital armature (Pl. XII, fig. 28): lateral lobes long, narrow, almost straight, angularly dilated on their lower edge basally, as seen in profile; median lobe stout, feebly curved, gradually acuminate to the tip.

♀. Antennæ darker at base; eyes less approximate; prothorax with two large, oblong, black patches on the disc, densely rugulose; scutellum infuscate; elytra uniformly nigro-fuscous (the pallid sutural and outer margins excepted) to the tip.

Length (excl. head)  $8\frac{1}{2}$ - $9\frac{3}{4}$ , breadth  $2\frac{1}{2}$ -3 mm.

*Hab.* S. INDIA, Anamalai Hills (*H. L. Andrewes*).

One male [type] and two females, assumed to be the sexes of the same species. A close ally of *I. nilgirica* with the sutural and outer margins of the elytra testaceous to near the tip, the genital armature very different. The ♂ has the apices of the elytra peculiarly marked, the black apical spot being bordered in front by a pallid undulate line. *I. circumdata*, Pic (1909), from "Indes ou Java," and *I. suturalis*, Kirsch (1875), from Malacca, must be allied forms, the latter having the prothorax wholly testaceous.

### 33. *Idgia viridivittata*, sp. n.

♀. Very elongate, narrow, depressed, subopaque (the head excepted) above, shining beneath, finely cinereo-pubescent, the head with several long bristly hairs; the epistoma, palpi, antennæ, margins, apex, and base of prothorax, sutural region (broadly) and outer margin (narrowly) of elytra, and bases of femora, testaceous, the labrum black, the head between and behind the eyes, a broad space across the disc of the prothorax, and the legs in great part, nigro-cæruleous, the scutellum, a broad vitta extending down the outer part of the disc of the elytra to near the apex, and the under surface (the testaceous ventral sutures excepted) green or bluish green. Head small, produced in front, the epistoma transverse, convex, extending forwards, limited behind by a deep groove; labrum transverse, subtrapezoidal; antennæ long, slender, filiform; eyes large, rather widely separated. Prothorax as long as broad, wider than the head, narrowed anteriorly, transversely depressed towards the base,

scabroso-punctate. Elytra extremely elongate, depressed along the suture, twice as wide as the prothorax at the base, gradually narrowed from the somewhat swollen humeri to the tip, the apices produced, dehiscent, and rather sharp; densely, very finely, rugulosely punctate, the seriately-arranged setigerous impressions clearly traceable. Legs long and slender.

Length (excl. head) 13–13½, breadth 3½–3¾ mm.

*Hab.* ASSAM, Nagas (*Doherty*).

Described from two females, both abraded and in rather decayed condition. The extremely elongate, subacuminate, basally widened, viridi-vittate elytra, narrow head and prothorax, filiform, testaceous antennæ, &c., readily distinguish this species, which has the general facies of a large *Cedemerid*. It may have to be removed from *Idgia* when the male is found.

### 34. *Idgia maculiventris*, sp. n.

Elongate, robust, the prothorax and elytra opaque, the rest of the surface shining, finely pubescent and sparsely nigro-setose; luteous, the head (the sides of the labrum excepted), a rather large patch at the tip of the elytra, and the apex of the abdomen, black or bluish black. Head small, the labrum transverse, trapezoidal, concave; eyes very large and almost contiguous in ♂, narrowly separated in ♀; antennæ slender, comparatively short, filiform, joint 11 a little longer than 10. Prothorax slightly wider than the head, about as long as broad, rugulose. Elytra very long, twice as broad as the prothorax, subparallel, narrow at the tip; densely, rugulosely punctate, the erect seriately-arranged setæ very conspicuous.

♂. Posterior femora incrassate; posterior tibiæ curved, compressed and slightly widened at the apex; anterior tarsal joints 1–3 with a black comb along their inner edge; terminal dorsal segment rounded at tip. Genital armature (Pl. XII. fig. 29): lateral lobes rather narrow, long, widened in their basal two-thirds beneath, the distal edge of the dilated portion flavo-ciliate; median lobe very long, sinuate, drawn out into a somewhat hooked, upwardly curved, blunt point.

Length (excl. head) 10½–11, breadth 3–3½ mm. (♂ ♀.)

*Hab.* S. INDIA, Nilgiri Hills (*H. L. Andrewes*).

One male and three females. Separable from large examples of *I. dimelæna* by the relatively broader elytra and the black tip to the abdomen, the male with incrassate posterior femora and curved posterior tibiæ, the genital armature also different.

35. *Idgia flavilabris*, sp. n.

Elongate, narrow, slightly widened posteriorly in ♀, shining, finely pubescent, and sparsely setose; luteous, the head (the labrum excepted) and a rather small apical spot on the elytra black. Head small, the labrum transverse, flattened; eyes extremely large, contiguous in ♂, very narrowly separated in ♀; antennæ long, slender, filiform, joint 11 concave within, twice as long as 10. Prothorax longer than broad, about as wide as the head, sinuate at the sides posteriorly. Elytra elongate, at the middle twice as wide as the prothorax; densely, finely punctate, the setæ on the disc and margins long and conspicuous.

♂. Sixth ventral segment triangularly emarginate; posterior femora moderately incrassate; posterior tibiæ hollowed at the apex within, the spurs short; anterior tarsal joints 1-3 with a black comb along their inner edge; terminal dorsal segment rounded at tip. Genital armature (Pl. XII. fig. 30, : lateral lobes narrow, curved downward and more slender at the apex; median lobe drawn out into a blunt curved point at the tip.

Length (excl. head)  $8\frac{1}{4}$ -9, breadth  $2\frac{1}{2}$ -3 mm. (♂ ♀.)

*Hab.* MALACCA, Perak (*Doherty* : ♂ ♀), Penang (*G. E. Bryant* : 30. x. 1913 : ♀).

One male and three females. Near *I. maculiventris*, which also has the posterior femora incrassate in ♂; but smaller, narrower, and more shining, the apical spot on the elytra not so large, the ventral segments wholly luteous, the ♂ with peculiarly formed posterior tibiæ and dissimilar genital armature. *I. bourgeosi*, Pic (1906), from Java, length 12-13 mm., is probably another allied form; it is described as having slightly dilated posterior femora in ♂, the elytra narrow and very elongate, the posterior part only of the head black, &c.

36. *Idgia geniculata*, sp. n.

♂. Elongate, narrow, subparallel, shining, finely pubescent, and sparsely setose; testaceous, the head (the epistoma and labrum excepted), a streak at the apices of the femora, and a rounded spot at the apex of the elytra, black. Head rather small, the labrum transverse, flattened; eyes large, somewhat narrowly separated; antennæ long, slender, filiform, joint 11 concave and longer than 10. Prothorax longer than broad, very little wider than the head, sinuate at the sides posteriorly. Elytra long, at the middle nearly twice as wide as the head;

densely, finely punctate, with rows of small scattered granules on the disc. Posterior femora moderately incrassate; posterior tibiæ simply arcuate, of equal width to the apex; anterior tarsal joints 1-3 with a black comb along their inner edge; terminal dorsal segment broadly subtruncate at tip. Genital armature (Pl. XII. fig. 31): lateral lobes moderately long, curved inwards at the tip as seen from above; median lobe drawn out into an almost straight, blunt point.

Length (excl. head) 8, breadth  $2\frac{1}{4}$  mm.

*Hab.* CEYLON, Hapulahani, Haldummulle (*Mus. Brit.*).

Described from a single male, the only other specimens before me from the same locality, ♀ ♀, being certainly referable to the closely allied *I. dimelena*, Walk., the ♂ of which has slender posterior femora, almost straight posterior tibiæ, and a different genital armature.

### 37. *Idgia dichroa*, sp. n.

♀. Elongate, shining, finely pubescent, and sparsely setose; luteous, the head (labrum included) black, the apical half of the elytra nigro-cæruleous. Head slightly produced in front, narrow, the labrum transverse, unimpressed; eyes very large, subcontiguous; antennæ long, slender, filiform, joint 11 elongate, feebly sinuate within, about  $2\frac{1}{2}$  times the length of 10. Prothorax a little wider than the head, oblong-subquadrate, slightly sinuate at the sides posteriorly; sparsely, very finely punctate. Elytra long, about twice as wide as the prothorax, densely, finely punctate, the seriatly-arranged granules on the disc somewhat conspicuous on the apical half.

Length (excl. head) 10, breadth  $3\frac{1}{4}$  mm.

*Hab.* BORNEO, Sarawak (*A. R. Wallace, in Mus. Oxon.*).

One female, in good condition. This species agrees with the description of *I. longissima*, Pic, from Sumatra, in having an unusually elongate eleventh antennal joint, differing from it in the entirely pale limbs, and in the shorter, relatively broader elytra, with much more extended bluish-black apical patch. *I. semitecta*, from Ceylon, is somewhat similarly coloured.

### 38. *Idgia semitecta*, sp. n.

♂. Elongate, narrow, moderately shining, finely pubescent (the setæ abraded); testaceous, the head (the labrum excepted) and nearly the apical half of the elytra black, the antennal joints 5-11 nigro-piceous. Head rather long, the

labrum transverse, flattened; eyes very large, narrowly separated; antennæ unusually elongate, slender, widening outwards, joint 11 nearly twice as long as 10, concave. Prothorax slightly wider than the head, longer than broad, sinuate at the sides posteriorly, rugulose punctate. Elytra very long, a little widened posteriorly; densely, rugulose punctate, with an indication of raised lines on the disc. Anterior tarsal joints 1-3 with a black comb along their inner edge. Terminal dorsal segment broadly subtruncate at tip. Genital armature (Pl. XII. fig. 32): lateral lobes moderately long; median lobe sinuate, drawn out into a downwardly-curved point at the tip.

Length (excl. head) 8, breadth  $2\frac{1}{2}$  mm.

*Hab.* CEYLON (*Mus. Brit.*).

One male, received at the Museum in 1875. A very narrow, elongate insect, with the antennæ unusually lengthened and infuscate from near the base to the tip, the black apical patch on the elytra occupying nearly the apical half. A somewhat similar form was found by Wallace at Sarawak. *I. semitecta* might easily be mistaken for a Telephorid of the genus *Rhagonycha*. It is allied to *I. dimelæna* and other somewhat similarly coloured species with simple posterior femora in ♂. *Prionocerus* (*Deromma*) *redtenbacheri*, Kirsch (1875), from Malacca, which is said to have a broader apical black patch than *I. melanura*, seems to be an allied form.

### 39. *Idgia melanocephala*.

*Cantharis melanocephala*, Fabr. Sp. Ins. i. p. 260 (1781).

*Idgia ceylonica*, Pic, L'Echange, xxvi. p. 76 (1910).

“*C. testacea*, capite elytrorum apicibus tibiisque nigris. Habitat in Coromandel. Mus. Dom. Banks. Magna. Caput cum antennis atrum immaculatum. Thorax marginatus, testaceus, immaculatus. Elytra lævia, testacea, apice nigra. Abdomen testaceum. Pedes nigri femoribus testaceis.” [*Fabricius*.]

♂. Anterior tarsal joints 1-3 with a narrow comb along their inner edge. Genital armature (Pl. XII. fig. 33): lateral lobes moderately long, broad, feebly sinuate; median lobe with the apical portion very long, narrow, compressed, abruptly curved downward at the tip, and armed with a sharp tooth before the apex above.

*Hab.* S. INDIA, Coromandel (*coll. Banks*), Bangalore (*Mus. Brit.*); CEYLON (*F. B. Fletcher*), Hapulahani (*Mus. Brit.*), Wadduwa (*Pic*).

There are five specimens of this species in the Museum, in addition to the Fabrician type. It is not unlike the E. African *I. dimidiata*, Gerst., but more sparsely pilose, the head, palpi, antennæ, legs (the bases of the femora excepted), and nearly the apical third of the elytra, black, the rest of the body fulvous; the antennæ, ♂ ♀, moderately long, feebly serrate, the eleventh joint curved, concave within, as long as 9 and 10 united; the labrum large, trapezoidal; the eyes large, somewhat narrowly separated in the two sexes. The genital armature figured is taken from the Hapulahani ♂.

#### 40. *Idgia assimilis*.

*Telephorus assimilis*, Hope, Zool. Misc. 1831, p. 26.

*Diprosopus melanurus*, Muls. Mém. Acad. Lyon, i. p. 210 (1851).

*Idgia melanura*, Bourg. Ann. Soc. Ent. Belg. xxxvi. p. 237 (1892);  
Gorh. op. cit. xxxix. p. 319 (1895) (nec Kollar and Redt.).

“Luteus, antennis flavis elytrorumque apicibus nigris. *T. melanuro*, Fabr., proximus. Long. lin. 5, lat.  $1\frac{1}{4}$ .” [Hope.]

Elongate, narrow, moderately shining, finely pubescent, and sparsely nigro-setose; testaceous, the head (the labrum and anterior portion of the epistoma excepted), a patch at the apex of the elytra, the outer halves of the femora, and usually the tibiæ and tarsi in great part, piceous or black, the antennæ (joint 11 excepted) more or less infusate towards the apex. Head moderately large, not much produced in front, the labrum transverse, trapezoidal, concave; antennæ in ♂ long and slender, shorter in ♀; eyes large and almost contiguous in ♂, well separated in ♀; apical joint of maxillary palpi elongate. Prothorax slightly longer than broad, narrow, sinuate at the sides posteriorly. Elytra long, subparallel, densely, rugulose punctate.

♂. Anterior tarsal joints 1–3 with a comb along their inner edge; terminal dorsal segment entire. Genital armature (Pl. XII. fig. 34): lateral lobes moderately long; median lobe stout, abruptly acuminate and slightly curved at tip.

Length (excl. head) 9–10, breadth  $2\frac{3}{4}$ –3 mm. (♂ ♀.)

*Hab.* INDIA, Nepal (*Mus. Brit.*, *Mus. Oxon.*: ♂ ♀), W. Almora (*H. G. Champion*: ♂).

Ten specimens seen from Northern India, including the types from the Hardwicke collection in the British Museum. Various others from Belgaum and Madura (*Andrewes coll.*) and Bhotan (*Mus. Oxon.*), and Paungde in Burma (*Mus. Brit.*), are a little less elongate; but the genital armature of a ♂ from Belgaum being very similar (except that the

median lobe is less abruptly acuminate) to that of the Nepal and Almora insects, the southern examples are referred to the same species. A large, broad ♀ from the Anamalai Hills, and a small ♀ from the Nilgiris with the eyes more distant than usual, both in the Andrewes collection, may also belong here? Bourgeois's *I. melanura* was from Kunbir Nowatoli, that of Gorham from Belgaum and Madura. The type of *Diprosopus melanurus*, Muls., which has a testaceous labrum, was said to have been found at Nimes, France; but there must have been some mistake as to this locality (see Jacquelin Duval, Gen. Coleopt. Europ. iii. p. 189).

#### 41. *Idgia melanura*.

*Deromma melanura*, Kollar and Redt. in Hügel's Kaschmir, iv. 2, p. 512, t. 25. fig. 6 (1844).

Extremely like *I. assimilis*, Hope, but with the head almost entirely, the antennæ (except at the tip), and legs (the bases of the femora excepted), black. Genital armature (Pl. XII. fig. 35): median lobe gradually narrowed into a long, blunt point.

*Hab.* N. INDIA, Cashmere [type], Kasauli (*H. J. W. Barrow*), Kangra and Palampur, Punjab (*G. E. Dudgeon*), Chitral (*R. Hill*), W. Almora (*H. G. Champion*: ♀), Gopaldhara in Sikkim (*H. Stevens*: ♂ ♀), N.W. Provinces (*coll. Andrewes*).

The numerous specimens from the above-mentioned localities in Northern India differ from the types of *I. assimilis*, Hope, in having the anterior portion of the head, as well as the basal portion of the antennæ, infuscate or black, and the median lobe of the ♂ differently shaped. Bourgeois and Gorham included several species under the name *I. melanura*, as shown by the differences in the ♂-armature of the examples dissected, including a specimen from Sikkim of the present insect. The apical black patch is much smaller than in *I. melanocephala*, F., and the antennæ are more slender. The very elongate elytra are indicated in the figure in Hügel's work.

#### 42. *Idgia longissima*.

♂. *Idgia longissima*, Pic, Bull. Soc. Ent. Fr. 1909, p. 245; op. cit. 1910, p. 346.

♂. Antennæ long, slender, with joint 11 unusually elongate, about as long as 8-10 united (in ♀ shorter, and with joint 11 as long as 9 and 10 together); eyes very large,



contiguous (narrowly separated in ♀); anterior tarsal joints 1-3 with a comb along their inner edge. Genital armature: lateral lobes narrowed and sinuously curved towards the apex; median lobe broad, gradually narrowed, slightly hooked at the tip beneath.

*Hab.* SUMATRA, Padang [type], Sungei Kumbang, Siolak Daras, and Barong Bharu in Korinchi, alt. 3100-4500 ft. (*Robinson-Kloss Expedition*: iv. 1914).

Eleven specimens (5 ♂♂, 6 ♀♀) obtained by the above-mentioned Sumatran expedition are perhaps referable to *I. longissima*, Pic, type from Padang. Three only of them (♀♀), with a relatively shorter apical joint to the antennæ, have the legs wholly testaceous as described by the author, the others (♂♀) having these limbs in part or almost entirely, as well as the head in front and the antennæ (except at the tip), infuscate or black. The greatly elongated eleventh antennal joint is one of the characters given to separate *I. longissima* from similarly coloured forms (testaceous, with black head and violaceous apex to elytra) inhabiting the same regions. In the series before me the apical patch varies in development, from about one-eighth to nearly one-half the elytral length. To judge from Pic's table (1910) of the testaceous Javan and Sumatran representatives of the genus, *I. longipennis* and *I. longissima* may be based upon the two sexes of one variable insect. Unfortunately, the ♀ only of the form with pale legs and antennæ, with shorter apical antennal joint, is at present available for examination.

#### 43. *Idgia cyanura*, sp. n.

♀. Elongate, widened posteriorly, shining, the elytra dull; finely pubescent and sparsely nigro-setose; testaceous, the head, antennæ (except the basal joints and the tip of 11), legs (the bases of the femora and the claws excepted), and a space down the middle of the ventral segments black, the elytra with a large nigro-cyaneous patch at the apex. Head small, the labrum strongly transverse, hellowed in the middle in front, appearing subarcuate; eyes large, well separated; antennæ slender, rather short, slightly widened outwards, joints 7-10 decreasing in length, 10 subserrate, 11 twice as long as 10, deeply excavate within. Prothorax wider than the head, not longer than broad, feebly sinuate at the sides. Elytra long, rather broad, widened posteriorly; densely, rugulose punctate, without granules on the disc.

Length (excl. head)  $8\frac{1}{2}$ , breadth 3 mm.

*Hab.* CEYLON, Kandy (*G. E. Bryant*: vi. 1908).

Very like *I. dimelæna*, Walk., but with the antennæ and legs in great part, and the labrum, infuscate or black, the apical patch on the elytra as large as in *I. melanocephala*, the head small, the labrum short and subarcuate, the penultimate antennal joint subserrate. *I. cyanura* cannot be satisfactorily included under *I. assimilis* or *I. melanura*, and as these latter are not known from Ceylon, a name is required for it, even in the absence of the male. *I. submetallica*, Pic (1911), also from Kandy, is similarly coloured above, but it has the under surface metallic.

#### 44. *Idgia dimelæna*.

*Thaccona dimelæna*, Walk. Ann. & Mag. Nat. Hist. (3) iii. p. 260 (1859) [sub (Edemeridæ)]<sup>1</sup>.

*Idgia cardoni*, Bourg. Compt. rend. Soc. Ent. Belg. xxxv. p. cxli (1891) (♂ ♀)<sup>2</sup>, and Ann. Soc. Ent. Belg. xxxvi. p. 237 (1892)<sup>3</sup>; Gorh. op. cit. xxxix. p. 319 (1895)<sup>4</sup>.

♂. Anterior tarsal joints 1-3 with a black comb along their inner edge; terminal dorsal segment narrowly, deeply excised in the middle (the notch much deeper than in ♀), appearing bilobed at tip; sixth ventral segment triangularly emarginate. Genital armature (Pl. XII. fig. 36): lateral lobes very long; median lobe very elongate, almost straight from near the base, the apex abruptly drawn out into a long slender curved point.

*Hab.* S. INDIA (*W. Davison*), Bombay, Malabar (*Mus. Brit.*), Kunbir Nowatoli<sup>2</sup>, Mandar<sup>3 4</sup> (*sec. Bourgeois*), Belgaum<sup>4</sup>, Madura (*H. E. Andrewes*), Anamalai Hills (*H. L. Andrewes*), Nilgiri Hills (*H. L. Andrewes*, *Sir G. F. Hampson*); CEYLON<sup>1</sup> (*Thwaites*, *G. Lewis*). Colombo (*H. P. Green*), Madulsima (*F. B. Fletcher*), Hapulahani (*Mus. Brit.*), Kandy (*G. E. Bryant*).

A common insect in Ceylon and Southern India, females greatly preponderating in the long series before me. One of Walker's types from Ceylon and a Nilgiri example have been dissected, and these show a precisely similar genital armature in ♂. The wholly testaceous labrum, antennæ, and legs, the slender antennæ, and the simple posterior femora in ♂, are its chief characters, but there are several very similar forms in the same regions. The apical black patch varies in size, but it is never very small. The length (excl. head) ranges from 9-10½ mm. The eyes are large and subcontiguous in ♂, the head is rather small, and not much elongated anteriorly, and the antennæ are slender.

The three females seen from Mandar (*P. Cardon*), all of large size, have stouter antennæ, and they may belong to a different species? *I. gorhami*, Pic, is a colour-variety of *I. dimelæna*, see ante, p. 347, though the former is here given specific rank.

#### 45. *Idgia flavibuccis*.

*Idgia flavibuccis*, Bourg. Ann. Soc. Ent. Belg. xxxvi. p. 237 (1892)  
(♂ ♀).

♂. Eyes extremely large, almost contiguous (narrowly separated in ♀); antennæ moderately elongate, a little longer than in ♀, distinctly thickened outwards, joints 7-10 gradually decreasing in length, 11 concave within, curved, nearly as long as 9 and 10 united; anterior tarsal joints 1-3 with a black comb along their inner edge. Genital armature (Pl. XII. fig. 37): lateral lobes sinuous within and curved inward at the tip, as seen from above; median lobe almost straight, drawn out into a curved point at the apex.

*Hub.* INDIA, Mandar in Western Bengal (*Cardon*: type), Bhotan (*Dr. Pemberton*, in *Mus. Brit.*: ♂ ♀).

This is a form of the variable *I. dimelæna*, Walk. (= *cardoni*, Bourg.), with the head wholly testaceous, a Λ-shaped black mark between the eyes excepted, the antennæ shorter and not so slender, and the terminal dorsal segment of the abdomen entire. The median lobe is very similar in the two insects.

#### 46. *Idgia luteipes*, sp. n.

♂. Elongate, narrow, feebly shining, finely pubescent, and sparsely nigro-setose; testaceous, the head (the labrum and anterior portion of the epistoma excepted), and a rather large apical patch on the elytra, black. Head slightly produced anteriorly, the labrum transverse, trapezoidal, excavate; eyes very large, almost contiguous; antennæ long, slender, filiform, joints 3-10 subequal in length, 11 concave, a little longer than 10. Prothorax longer than broad, scarcely wider than the head, strongly sinuate at the sides posteriorly, rugulose punctate. Elytra long, subparallel, densely, rugulose punctate, without seriatly-arranged granules on the disc. Anterior tarsal joints 1-3 with a narrow black comb along their inner edge; terminal dorsal segment deeply emarginate. Genital armature (Pl. XII. fig. 38): lateral lobes stout, long; median lobe drawn out into a long, slender, sinuate point, which is armed with a sharp, backwardly-directed tooth at the tip above.

Length (excl. head)  $7\frac{1}{2}$ , breadth  $2\frac{1}{2}$  mm.

*Hab.* S. INDIA, Nilgiri Hills (*A. K. Weld Downing*), Anamalai Hills (*H. L. Andrewes* : type).

Three males, one from each locality dissected, showing a precisely similar genital armature. Extremely like *I. dimelæna*, but separable therefrom by its narrower form, smaller size, the excavate labrum, and the slender, sinuate, sharply hooked apical portion of the median lobe.

47. *Idgia indicola*, sp. n.

♂. Elongate, narrow, shining, the elytra duller; finely pubescent and sparsely nigro-setose; testaceous, the head (the labrum and anterior margin of the epistoma excepted), and a rather large apical patch on the elytra, black. Head short, the labrum transverse, flat; eyes very large, narrowly separated; antennæ slender, filiform, moderately long, joint 11 concave, one-half longer than 10. Prothorax slightly wider than the head, longer than broad, strongly sinuate at the sides posteriorly, rugulose punctate. Elytra long, parallel, densely, rugulose punctate, without granules on the disc. Anterior tarsal joints 1-3 with a narrow black comb along their inner edge; terminal dorsal segment narrowly, deeply excised. Genital armature (Pl. XII. fig. 39): lateral lobes long; median lobe, as seen in profile, stout, compressed, and obliquely sloping from a little beyond the middle, the apex drawn out into a short, curved, downwardly-directed point.

Length (excl. head) 8, breadth  $2\frac{1}{2}$  mm.

*Hab.* INDIA, Nilgiri Hills, Teppukadu, alt. 2500 ft. (*H. L. Andrewes*).

One male. Extremely like *I. luteipes*, but with the anterior portion of the head a little shorter, the labrum flat, the elytra slightly narrower (appearing more elongate), and the median lobe very differently shaped. From *I. dimelæna*, ♂, the strongly sinuate sides of the prothorax, the narrow, parallel elytra, and the very different genital armature will serve to distinguish the present species. *I. puncticollis*, Bourg. (1903), length 10-12 mm. (♂ ♀), said to be a common insect "at light" at Pondichery and Mahé, must have a rougher prothorax and shorter antennæ; it has not been identified in the material examined by myself.

48. *Idgia rostrifera*, sp. n.

♀. Elongate, rather dull, thickly pubescent, and sparsely setose; obscure rufo-testaceous, the head (the epistoma and labrum in great part excepted), scutellum, a patch at the apex of the elytra, the sixth ventral segment, and apices of the femora black, the tarsi slightly infuscate. Head long, narrow, the mandibles, epistoma, and labrum elongated, the labrum distinctly longer than broad, foveate in front; eyes large, separated by a rather wide space; antennæ long, slender, filiform, joint 11 constricted at the middle, a little longer than 10. Prothorax longer than broad, much wider than the head, very uneven, and closely, rugulosely punctate. Elytra long, subparallel, densely, rugulosely punctate, and with the usual rows of granules on the disc.

Length (excl. head) 9, breadth 3 mm.

*Hab.* INDIA, Anamalai Hills (*H. L. Andrewes*).

One specimen. Separable from *I. melanura* and *I. assimilis*, and all the similarly coloured Indian forms known to me, by the anteriorly elongated, subrostrate head, the labrum being longer than broad and foveate in the centre in front. The larger size, black knees and sixth ventral segment, elongate labrum, &c., distinguish *I. rostrifera* from *I. luteipes*, which was found by Mr. Andrewes in the same locality. The Arabian *I. arabica* and *I. laticornis* have a similarly elongate head.

49. *Idgia maindroni*.

*Idgia maindroni*, Pic, Bull. Soc. Ent. Fr. 1909, p. 245.

♂. Anterior tarsal joints 1-3 with a comb along their inner edge; terminal dorsal segment broadly subtruncate at tip. Genital armature (Pl. XII. fig. 40): lateral lobes broad, moderately long; median lobe broad, as seen from above, abruptly acuminate and hooked at the tip.

*Hab.* S. INDIA, Wallardi in Travancore [type], Nilgiri Hills (*H. L. Andrewes*: ♂ ♀).

A pair from the Nilgiri Hills are referred to this species. They are very like the larger examples of *I. dimelana*, Walk. (= *cardoni*, Bourg.), but have the head more produced in front and testaceous from the eyes forward, the latter very large in ♂; the elytra relatively longer, more shining, distinctly tricostate on the disc, and with a small black spot at the tip; and the pubescence longer, with very few setæ intermixed.

50. *Idgia nitida*, sp. n.

Elongate, narrow, shining, finely pubescent, and very sparsely setose; testaceous, the head between and behind the eyes, and a small apical patch on the elytra, black. Head slightly produced in front, grooved between the eyes, the labrum transverse, convex; eyes very large, subcontiguous in ♂, more distant in ♀; antennæ slender, subfiliform, joint 11 concave, a little longer than 10. Prothorax about as long as broad, not wider than the head in ♂, broader in ♀, feebly sinuate at the sides posteriorly. Elytra elongate, finely, closely, but not very densely punctate, the interspaces shining. Legs slender.

♂. Anterior tarsal joints 1-3 with a black comb along their inner edge; posterior tibiæ very slightly curved; terminal dorsal segment rounded at tip. Genital armature: lateral lobes rather short; median lobe drawn out into a long, narrow, slightly curved point.

Length (excl. head)  $8\frac{1}{2}$ - $10\frac{1}{2}$ , breadth  $2\frac{1}{2}$ - $3\frac{1}{2}$  mm. (♂ ♀.)

*Hab.* INDIA (*Stebbing*), Karachi (*T. R. Bell*), Lahore (*coll. Andrewes*).

Six females and two males, both the latter in a bad state of preservation, the locality on Mr. Stebbing's specimens illegible. Separable from the numerous similarly coloured forms by the rather sparsely punctate, shining elytra, and the wholly testaceous antennæ, ante-ocular portion of the head, and legs.

51. *Idgia fruhstorferi*.

*Idgia fruhstorferi*, Pic, L'Echange, xxvi. p. 76 (1910); Bull. Soc. Ent. Fr. 1910, p. 346.

Elongate, narrow, shining, finely pubescent, and sparsely fusco-setose; testaceous, the head (the epistoma and labrum excepted), and a small spot at the tip of the elytra, black. Head a little produced in front, the labrum transverse; eyes very large, contiguous in ♂, narrowly separated in ♀; antennæ long, slender, joint 11 hollowed within and at least twice as long as 10. Prothorax longer than broad, about as wide as the head, sinuate at the sides posteriorly. Elytra very elongate, densely, finely punctate.

♂. Anterior tarsal joints 1-3 with a black comb along their inner edge; sixth ventral segment triangularly emarginate. Genital armature (Pl. XII. fig. 41): lateral lobes long, strongly sinuate (as seen from above), incurved and

blunt at the tip ; median lobe feebly sinuate, drawn out into a curved point at the apex.

Length (excl. head) 8-9½, breadth 2½ mm. (♂ ♀.)

*Hab.* JAVA (*Bowring, Horsfield*).

Four specimens, two of each sex, are referred to *I. fruhstorferi*, Pic, but they differ from his second amended definition in having the head infuscate behind the eyes, which is certainly a variable character. A ♀ from Tenasserim may also belong to the same species? The small apical spot, the wholly testaceous labrum, antennæ, and legs, the long apical joint to the antennæ, and the form of the lateral lobes of the ♂-tegmen are its chief characters. The slender posterior femora of the male separates the present insect from *I. bourgeisi*, Pic (1906), from the same island, as well as from *I. flavilabris*, from Perak and Penang.

### 52. *Idgia apicata*.

*Idgia apicata*, Gorch. Ann. Soc. Ent. Belg. xxxix. p. 320 (1895).

♂. Anterior tarsal joints 1-3 with a black comb along their inner edge ; sixth ventral segment triangularly emarginate at tip. Genital armature (Pl. XII. fig. 42) : lateral lobes long, broad, sinuous on their inner edge above, slightly hollowed near the tip beneath, the apices incurved and obtuse as seen from above ; median lobe sinuate, drawn out into a curved point at apex.

*Hab.* MALACCA, Singapore (*A. R. Wallace* : ♂ ♀).

Two specimens, ♂ ♀, in the Oxford Museum, from the same source as the type, are presumably referable to *I. apicata*. A narrow, testaceous form, with the head (the anterior portion excepted) and the tips of the elytra black ; the antennæ long and slender, with joint 11 twice as long as 10, and hollowed within ; the eyes very large, contiguous in ♂, very narrowly separated in ♀ ; the elytra somewhat produced at the tip, and with the blackish setæ long and very conspicuous.

### 53. *Idgia dohertyi*.

*Idgia setifrons* (Kirsch), var. *dohertyi*, Pic, Bull. Soc. Ent. Fr. 1912, p. 300.

♂. Elongate, narrow, shining, finely pubescent, and sparsely fusco-setose ; pale testaceous, the head around the eyes (in one specimen in great part, the anterior portion excepted), the eyes themselves, and the tips of the elytra,

infusate or black. Head a little produced anteriorly, the labrum transverse; eyes very large, almost or quite contiguous; antennæ long, slender, joint 11 hollowed on its inner face, at least twice as long as 10. Prothorax longer than broad, about as wide as the head, sinuate at the sides posteriorly. Elytra long, densely, finely punctate. Anterior tarsal joints 1-3 with a black comb along their inner edge. Sixth ventral segment triangularly emarginate. Genital armature (Pl. XII. fig. 43): lateral lobes long, sinuous on their inner edge above, obliquely truncate on their lower edge before the tip, the apices narrow, curved, and somewhat pointed; median lobe almost straight, gradually tapering to a curved point.

Length (excl. head)  $6\frac{3}{4}$ -7, breadth  $2\frac{1}{4}$  mm.

· *Hab.* MALACCA, Perak (*Doherty*: type).

Three males from Perak seem to be referable to *I. dohertyi*, Pic, which is treated by him as a pale-legged variety of *I. setifrons*, Kirsch. A form of *I. apicata*, Gorh., with the lateral lobes of the tegmen differently shaped, the basal portion of the head partly testaceous, the elytra more depressed and with their apices a little less produced.

#### 54. *Idgia varicornis*, sp. n.

Elongate, narrow, shining, finely pubescent, and very sparsely setose; luteous, the head and a spot on the apex of the elytra, the antennæ (joint 11 excepted), tibiæ, and tarsi, and the apices of the femora above, infusate or black. Head rather short, the labrum transverse, small; eyes very large, almost contiguous in ♂; antennæ long, slender, joint 11 sinuate, about one-half longer than 10. Prothorax slightly longer than broad. Elytra densely, finely punctate.

♂. Anterior tarsal joints 1-3 with a narrow comb along their inner edge; sixth ventral segment triangularly emarginate. Genital armature (Pl. XII. fig. 44): lateral lobes moderately long, narrow, simple; median lobe almost straight from near the base, slightly curved and pointed at tip.

Length (excl. head)  $6-7\frac{1}{2}$ , breadth  $2-2\frac{2}{3}$  mm. (♂ ♀.)

*Hab.* TENASSERIM, Tavoy (*Doherty*: ♂ ♀); ASSAM, Sudiya (*Doherty*: ♀).

One male [type] and five females. A small, narrow, moderately elongate form, with the antennæ and legs partly infusate, the head and the tip of the elytra black, and simple lateral lobes to the ♂-tegmen. Near *I. apicata*, Gorh.



55. *Idgia atriceps*, sp. n.

Elongate, narrow, shining, finely pubescent, and sparsely fusco-setose; testaceous, the head, and a small dull spot at the tip of the elytra, black, the antennæ (joint 11 excepted), tibiæ, and tarsi infuscate. Head rather long, the labrum transverse, small; eyes very large, contiguous in ♂, narrowly separated in ♀; antennæ long, slender, joint 11 hollowed within, twice as long as 10. Prothorax longer than broad, about as wide as the head, sinuate at the sides posteriorly. Elytra elongate, densely, finely punctate.

♂. Anterior tarsal joints with a comb along their inner edge; sixth ventral segment triangularly emarginate. Genital armature (Pl. XII. fig. 45): lateral lobes comparatively short, broad, sinuously curved as seen from above, hollowed on their lower edge before the tip; median lobe feebly curved, drawn out into a long, strongly arcuate point at the apex.

Length (excl. head), 7-7½, breadth 2-2½ mm. (♂ ♀.)

*Hab.* BURMA (*Bowring*).

Two males and one female. Separable from the allied forms with partly infuscate limbs, small apical spot, and long terminal joint to the antennæ, by the clear testaceous femora, black head, and ♂-armature. The elytra are much smoother than in *I. indicola* from the Nilgiris, and have a less developed apical patch. *Prionocerus* (*Deromma*) *setifrons*, Kirsch (1875), from Malacca, an insect not identified by myself, must be nearly allied to the present species.

56. *Idgia varipes*, sp. n.

♂. Elongate, very narrow, shining, finely pubescent, and sparsely setose; testaceous, the head, antennæ (joint 11 excepted), and tips of the elytra, the femora along their upper edge, and the tibiæ, and tarsi (the tips excepted), infuscate or black. Head slightly produced anteriorly, the labrum trapezoidal, triangularly depressed in the middle; eyes very large, subcontiguous; antennæ long, slightly widening outwards, joints 3-10 elongate, 4 shorter than 3 or 5, 11 curved, a little longer than 10. Prothorax longer than broad, as wide as the head, constricted posteriorly. Elytra long, narrow, subparallel, densely, finely punctate.

♂. Anterior tarsal joints 1-3 with a narrow comb along their inner edge; sixth ventral segment triangularly emarginate. Genital armature (Pl. XII. fig. 46): lateral lobes rather short, almost straight, blunt at tip, closely ciliate

on their lower edge; median lobe \* drawn out into a short, feebly curved point at apex.

Length (excl. head)  $6\frac{1}{2}$ , breadth  $1\frac{3}{4}$  mm.

*Hab.* MALACCA, Penang (*H. N. Ridley*).

One male, received at the Museum in 1874. This insect has the general facies of *I. pallidicolor*, ♂, as here identified, differing from it in the distinctly longer, stouter, curved apical joint of the antennæ, the darker limbs, the simply emarginate sixth ventral segment, and different armature. *I. atriceps*, from Burma, has a more elongate apical joint to the antennæ, the head more produced anteriorly, the femora testaceous, and a dissimilar ♂-armature.

#### 57. *Idgia decolor*, sp. n.

Elongate, narrow, shining, finely pubescent, and sparsely fusco-setose; testaceous, the clytra paler and somewhat transparent, the tips of the latter and the head black, the antennæ and legs (the bases of the femora excepted) infusate. Head elongated anteriorly, the labrum about as long as broad; eyes very large, contiguous in ♂, narrowly separated in ♀; antennæ long, slender, joint 11 sinuate, concave within, about one-half longer than 10. Prothorax longer than broad, slightly wider than the head, sinuate at the sides posteriorly. Elytra long, densely, finely punctate.

♂. Anterior tarsal joints 1-3 with a comb along their inner edge; sixth ventral segment triangularly emarginate. Genital armature (Pl. XII. fig. 47): lateral lobes long, rather narrow, feebly curved, blunt at the tip; median lobe very long, slightly sinuate, drawn out into a short, curved point at apex.

Length (excl. head) 8-10, breadth  $2\frac{1}{2}$ -3 mm. (♂ ♀.)

*Hab.* BURMA, Karen Mts. (*Doherty*, type: ♂ ♀); TENASSERIM, Tavoy (*Doherty*: ♀).

One male and six females. Separable from its allies by the pallid, somewhat transparent clytra, with small apical spot, the elongate black head, the infusate antennæ and legs (the bases of the femora excepted), and the ♂-armature, which is very different from that of the allied Burmese *I. atriceps*, the latter also having a relatively longer apical joint to the antennæ. One of the females from Tavoy with wholly pale head (eyes excepted), and another (immature) with the legs and antennæ also testaceous, doubtless belong to the same species.

\* In the figure it is removed from its proper position and shown from the ventral aspect.

58. *Idgia angustata*, sp. n.

♂. Elongate, very narrow, shining, finely pubescent, and very sparsely nigro-setose; pale testaceous, the head (the labrum and anterior margin of epistoma excepted), and a small, rounded, sharply defined spot at the tip of the elytra, black, the antennæ (except at the base and apex) slightly infuscate. Head somewhat produced anteriorly, the labrum transverse, trapezoidal; eyes very large, subcontiguous; antennæ long, filiform, joint 11 sinuate, twice as long as 10. Prothorax longer than broad, about as wide as the head, sinuate at the sides posteriorly. Elytra very long, narrow, parallel, densely, finely punctate. Sixth ventral segment triangularly emarginate. Anterior tarsal joints 1-3 with a black comb along their inner edge. Genital armature (Pl. XII. fig. 48): lateral lobes moderately long, sinuately curved as seen from above, deeply emarginate on the lower edge before the tip, the latter obtuse; median lobe curved, drawn out into a short arcuate point at the apex.

Length (excl. head)  $7\frac{1}{2}$ , breadth 2 mm.

*Hab.* N. BORNEO, Labuan (*Mus. Brit.*).

One male. Very like *I. pallidicolor*, Pic, but with a long, sinuate, apical joint to the antennæ and a simply emarginate sixth ventral segment. From the same sex of *I. dohertyi*, from Perak, the relatively narrower elytra and different ♂-armature will serve to distinguish the present insect. A female from Sarawak (*Wallace, in Mus. Oxon.*), with larger apical patch, may belong here?

59. *Idgia dubia*.

*Cantharis dubia*, Gyll. in Schönh. Syn. Ins. i. 2, p. 73, nota (1808).

*Idgia dubia*, Gemm. and Harold, Cat. Coleopt. vii. p. 1721 (1869).

“Elongata, pallide testacea, antennis, oculis, elytrorum apice pedibusque nigris.—Ind. or.” [*Gyllenhal.*]

*Hab.* INDIA (*Mus. Brit.*), Patkai Mts., Assam (*Doherty*).

Two females in the Museum collection, with the head wholly testaceous (the eyes excepted), may belong to this species, but the dark mark on the vertex mentioned by Gyllenhal is wanting. They have the antennæ, knees, tibiæ, and a small spot at the tips of the elytra infuscate or black, the antennæ a little shorter than in most of the allied forms, with the terminal joint excavate and about twice as long as the tenth. *I. dubia*, treated by Pic as a “species incerta,” is compared by him with his *I. pallidicolor* from Java.

60. *Idgia pallidicolor*.

*Idgia pallidicolor*, Pic, L'Echange, xxii. p. 43 (1906); Bull. Soc. Ent. Fr. 1910, p. 346.

♂. Anterior tarsal joints 1-3 with a narrow black comb along their inner edge; terminal dorsal segment emarginate in the middle at tip; sixth ventral segment (Pl. XII. fig. 49 a) deeply, narrowly, obliquely bi-excised at apex, the median portion shorter than the broader, truncate, curved lateral portions. Genital armature (Pl. XII. fig. 49): lateral lobes long, narrow, more or less emarginate on their lower edge before the tip; median lobe long, almost straight, curved downward into a blunt point at apex.

*Hab.* JAVA [type], Depok (*G. E. Bryant*, 18. iv. 1909: ♂); SIAM, Renong (*Doherty*: ♂ ♀); MALACCA, Perak (*Doherty*: ♂ ♀), Penang (*G. E. Bryant*, x. 1913: ♂ ♀); BORNEO, Quop (*G. E. Bryant*, 27. iii. 1914: ♀); TENASSERIM, Tavoy (*Doherty*: ♂ ♀); BURMA, Karen Mts. (*Doherty*: ♂); ASSAM, Patkai Mts. (*Doherty*: ♀).

A small, narrow, shining, pale testaceous form, with the tips of the elytra black; the head usually infusate around the eyes, sometimes wholly testaceous, or with the base black (those from Penang and Borneo); the basal joints of the antennæ, the tibiæ and tarsi, and in some specimens the apices of the femora also, infusate, rarely entirely testaceous; the antennæ long and slender, with the almost simple apical joint about as long as the tenth; the eyes very large, approximate in ♂, narrowly separated in ♀. Amongst the numerous closely allied insects from the same region, *I. pallidicolor*, as here identified, is recognizable by the trilobed sixth ventral segment of the male, and the non-elongated eleventh antennal joint in the two sexes, a character used by Pic in his first table of the Javan and Sumatran forms. Males from the localities quoted have been dissected: those from Java, Tenasserim, and Burma agree *inter se*; but the one from Penang (with blacker head) has the median lobe of the last ventral segment notched in the middle, that from Perak having the corresponding lobe longer, narrower, and rounded at the tip.

61. *Idgia dasytoides*, sp. n.

♀. Elongate, very narrow, slender, moderately shining, closely cinereo-pubescent, and sparsely nigro-setose; green or brassy-green, the antennæ piceous, the basal joints and

tip, and the palpi also, testaceous; the head and prothorax closely, minutely, the elytra densely, rugulosely punctate, the latter with seriatly-arranged raised granules extending down the disc. Head somewhat produced in front, narrow; eyes moderately large, distant, emarginate; apical joint of maxillary palpi elongate-triangular; antennæ very slender, long, joints 4-6 gradually increasing, and 7-10 rapidly decreasing, in length, 3 and 4 subequal in length, 11 as long as 10, constricted at the middle. Prothorax a little longer than broad, the sides rounded anteriorly and feebly sinuate before the base, the disc canaliculate. Elytra long, subparallel, much wider than the prothorax, rounded at the tip. Legs long, very slender; tarsal claws widened in their basal half.

Length (excl. head) 5, breadth  $1\frac{1}{2}$  mm.

*Hab.* BURMA, Karen Mts. (*Doherty*).

Six examples. This species has the general facies of a *Dasytes*, from which it is readily distinguished by the emarginate eyes, a character bringing *I. dasytoides* into the "Prionocérides" of Lacordaire. In the absence of the male, it can remain under *Idgia* for the present, the Chinese *I. flavirostris*, Pasc., having similar tarsal claws, slender legs and antennæ, a small head, &c.

Alphabetical numbered list of the species of *Prionocerus* and *Idgia* enumerated in this paper, the generic name indicated of those placed under the first-named genus; the new names marked with an asterisk:—

- |  |                    |
|--|--------------------|
| *abyssinica, 5.                          | *dichroa, 37.      |
| andrewesi, 20.                           | dimelæna, 44.      |
| *angustata, 58.                          | dimidiata, 2.      |
| apicalis, 4.                             | dohertyi, 53.      |
| apicata, 52.                             | dubia, 59.         |
| *arabica, 9.                             | *femorata, 24.     |
| assimilis, 40.                           | flavibuccis, 45.   |
| *atriceps, 55.                           | flavicollis, 13.   |
| belli, 18.                               | *flavilabris, 35.  |
| bicolor ( <i>Prionocerus</i> ), 2.       | flavirostris, 14.  |
| *cæruleiventris, 27.                     | *flavolimbata, 32. |
| *cavilabris, 28.                         | fruhstorferi, 51.  |
| chloroptera, 21.                         | fulvicollis, 8.    |
| cæruleipennis ( <i>Prionocerus</i> ), 1. | *geniculata, 36.   |
| cyanea, 7.                               | gorhami, 25.       |
| *cyanocephala, 22.                       | *indicola, 47.     |
| *cyanura, 43.                            | *javana, 30.       |
| *dasytoides, 61.                         | *laticornis, 10.   |
| *decolor, 57.                            | *longipalpis, 6.   |
| deusta, 11.                              | longissima, 42.    |

\*luteipes, 46.  
 \*maculiventris, 34.  
 maindroni, 49.  
 \*marginata, 31.  
 melanocephala, 39.  
 melanura, *Kollar & Redt.*, 41.  
 \*nilgirica, 26.  
 \*nitida, 50.  
 pallidicolor, 60.  
 \*plectrophora, 1.  
 \*rostrifera, 48.  
 rouyeri, 23.  
 \*semitecta, 38.  
 terminata, 3.  
 \*triserrata, 16.  
 \*uncigera, 29.  
 \*ungulata, 12.  
 \*varicornis, 54.

\*varipes, 56.  
 \*virescens, 15.  
 viridescens, 19.  
 viridipennis, 17.  
 \*viridivittata, 33.

SYNONYMS and VARIETIES.

brevicornis (*Prionocerus*), 1.  
 cæruleatus, 18.  
 cardoni, 44  
 ceylonica, 39.  
 diversipennis, 25.  
 forticornis (*Prionocerus*), 1.  
 fuscipennis (*Prionocerus*), 1.  
 melanura, *Muls. & Bowg.*, 40.  
 metallescens, 19.  
 notaticollis (*Prionocerus*), 2.  
 tripartita, 2.

EXPLANATION OF PLATES XI. & XII.

*Figs. 1-49.* Profile views of the ♂ genital armature of species of *Prionocerus* and *Idgia*, one only of the lateral lobes shown and the free tubular median lobe lowered from its normal position, so that a clearer outline could be given of it, the apical portion of the sac (when visible in the dried specimens) added; 9a and 10a, dorsal views of 9 and 10, the median lobe omitted in 9a; 49a, sixth ventral segment of *I. pallidicolor*, ♂; 50, apices of elytra of *I. uncigera*, ♀; all × 12. In fig. 46 the median lobe is out of its normal position, and shown from the ventral aspect.

XXXIV.—*A Note on the Egg-burster of Eucephalous Fly-larvæ.* By F. W. EDWARDS.

IN widely separated divisions of the animal kingdom special embryonic organs are found whose function is to facilitate the hatching of the embryo from the egg. Everyone is familiar with the hard knob which occurs on the tip of the upper jaw in the chick as well as in other oviparous vertebrates. Among the Insecta egg-bursting organs are often found on the dorsal surface of the head, and assume a variety of forms. Different types have been described by Packard ('Text-book of Entomology,' p. 585), Berlese ('Gli Insetti,' vol. 2, p. 218), and Williams and Buxton ('Trans. Ent. Soc. London, 1916, p. 88). In other cases these organs appear to be part of the amnion rather than of the embryo itself; instances of this are given by Riley (*vide* Packard, Text-book, p. 585) and Kershaw (Bull. Trinidad Dept. Agric. xii. 1913, p. 94).

In regard to the Diptera, I have only succeeded in tracing two published references to an egg-burster, both relating to the Culicidæ. Howard, Dyar, and Knab, in their 'Mosquitoes of North and Central America and the West Indies,' say (vol. i. p. 97):—

"The first-stage larva may be recognized by the presence on the head of the egg-burster. This is situated dorsally on the middle of the head and consists of an oval, pale, depressed area, in the middle of which is situated a chitinous disc surmounted by a small black chitinous peg."

Scott Macfie (Bull. Ent. Res. vii. 1917, p. 298) says in regard to *Stegomyia fasciata*: "The 'egg-burster,' situated dorsally about the middle of the head, is a conspicuous feature in the first phase"; he also gives a figure which shows this organ, though not in any great detail.

In several Dipterous larvæ of different families which I have been able to examine, the egg-burster has a position and structure similar to that indicated by the above-mentioned authors for the Culicidæ. It is essentially the same in *Anopheles maculipennis*, *Aedes argenteus* (= *Stegomyia fasciata*), *A. (Ochlerotatus) geniculatus*, *Theobaldia annulata*, *Chaoborus* (= *Corethra*) *plumicornis*, *Simulium angustipes*, *S. austeni*, *Chironomus dorsalis*, *Bolitophila pseudohybrida*, and *Trichonta* sp. In none of these cases does it resemble that of *Pulex canis*, described by Packard as "a thin vertical plate, like the edge of a knife."

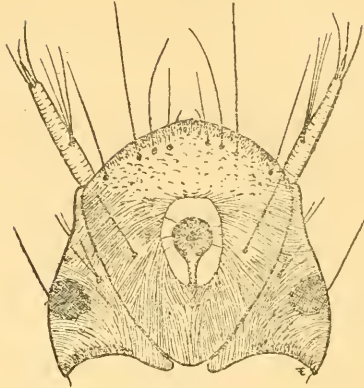
Though the list given above comprises all the species which I have observed, it is sufficiently comprehensive to warrant the belief that the egg-burster will be found to be present in a similar form in all the eucephalous larvæ of Nematocera, though it may not always be functional.

In every case all trace of the structure disappears after the first moult, though sometimes (at least in *Chironomus dorsalis* and *Aedes geniculatus*), and perhaps always, a minute black pigment-spot is observable under the cuticle of the second-stage larva in the position occupied by the egg-burster in the first stage.

In an egg which is about to hatch, the young larva can be observed (provided the shell is thin enough) moving its head up and down and cutting or scratching a slit in the shell. I have observed this process in *Bolitophila pseudohybrida*, and in the newly-hatched larvæ of the same species have seen the egg-burster being raised and lowered. Presumably this latter movement also took place within the egg, though I was not able to observe it.

It would seem that the lowering of the egg-burster is

Fig. 1.

*Aedes geniculatus* (Olivier).

Dorsal view of head of first-stage larva, to show position and form of egg-burster: from a living specimen.  $\times$  about 60. (The shading is intended to represent fine ridges in the chitin, which occur over the greater part of the head.)

Fig. 2 a.

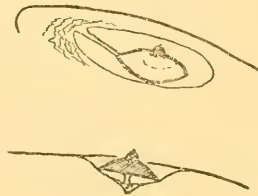


Fig. 2.

Fig. 2.—*Aedes argenteus* (Poiret) [*Stegomyia fasciata* auct.]. Egg-burster, seen from posterior end of head, showing thickness of disc and strong central peg.  $\times$  about 100.

Fig. 2 a.—The same, half side view. From cast skins; diagrammatic.

Fig. 3.

*Theobaldia annulata* (Schrank).

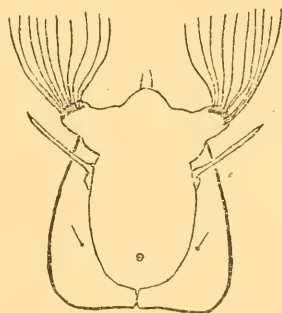
Sectional view (transverse) through egg-burster, showing attachment of muscles.  $\times$  about 120. From a balsam mount in the British Museum, prepared by Mr. W. D. Lang.



effected by a pair of muscles which are attached to the inside of the disc and pass across to the ventral side of the head. These muscles are easily seen in the perfectly transparent larva of *Chaoborus* (*Corethra*); they are shown also in the accompanying diagram of the egg-burster of *Theobaldia annulata*. Though they almost meet on the chitinous disc, the muscles are wide apart at their ventral insertion. I have not ascertained whether they persist beyond the first larval stage. One must suppose that the egg-burster is raised and so brought into use by blood-pressure on the relaxation of this pair of muscles.

The precise form of the chitinous disc varies somewhat in the different species examined. It is relatively larger and more conspicuous in the Culicidæ than in the Chironomidæ and Mycetophilidæ, while among the Culicidæ it is

Fig. 4.

*Simulium austeni*, Edw.

Dorsal view of head of newly hatched larva, showing minute egg-burster near posterior end of clypeus.  $\times$  about 60. From a spirit-specimen.

decidedly more heavily chitinised in *Aedes* than it is in *Theobaldia* or *Anopheles*. In *Aedes* it is connected by a narrow chitinous rod with the posterior part of the clypeus, the rod arising from a thickened bar in the chitin. I have not been able to detect this rod in other Culicidæ or in the other families examined. The eggs of *Aedes* have usually great powers of resistance to desiccation, and probably on this account have a thick chorion, which necessitates a more efficient egg-burster.

The two species of *Aedes* examined show slight differences: the egg-burster in *A. argenteus* is nearer the posterior end

of the clypeus than it is in *A. geniculatus*\*, while in the latter species the chitinous disc bears a sharp transverse ridge on each side of the central peg.

In *Simulium austeni* the egg-burster is very small and inconspicuous, and appears to have no membranous area surrounding it, but this may not be the case throughout the genus. I hatched out in 1915 a number of young larvæ of *S. angustipes*, and, though these were not kept, my recollection of them is that they had egg-bursters as well developed as those of the Culicidæ. If this is so, it may be due to differences in breeding-habits between the two species.

The subject is one of considerable interest and will certainly bear further investigation.

XXXV.—*The Amphipod Orchestia tucurauna, Fritz Müller, of Brazil, redescribed from New Zealand Specimens.* By CHAS. CHILTON, M.A., D.Sc., LL.D., C.M.Z.S., Hon. Memb. Roy. Soc. N.S.W.

ON July 11th, 1910, I collected near the mouth of the Waitohi stream at Picton, New Zealand, several specimens of a sand-hopper that I thought at the time would probably be *Orchestia chiliensis*, Milne-Edwards, which is common on the neighbouring shores of Queen Charlotte Sound and elsewhere on the New Zealand coasts. On examination, however, I found that, though two of the specimens were *O. chiliensis*, the others differed considerably from *O. chiliensis* in the shape of the second gnathopods of the male. One male specimen of these was dissected and mounted and to some extent examined, and was provisionally named *O. redmani*, sp. n., in my MS. in honour of Dr. Redman of Picton, to whom I am indebted for much assistance. I felt sure that I had seen somewhere a drawing of a gnathopod similar to the second gnathopod of this specimen, but at the time could not ascertain where this was; consequently the specimens were laid aside for a more favourable opportunity. Recently, in looking up Stebbing's paper in the Trans. Linn. Soc. vol. vii. p. 395, 1909, for another purpose, my attention was drawn to his figures of *O. sulensoni* (pl. xxx. C), owing to the

\* This character would appear to be variable, since the egg-burster is shown nearer the middle of the head in Scott-Macfie's figure than it appeared to be in the cast skins of the same species which I examined.

resemblance of the second gnathopod to that of my Picton specimens. A comparison of my specimens with Stebbing's description and figures of *O. sulenisoni* made it appear very probable that they belonged to the same species, though the palm of the second gnathopod of *O. sulenisoni* is shown considerably more oblique and that species was supposed to have been obtained at Madeira, the locality, however, being doubtful.

Stebbing states that his species agrees with the imperfectly described *O. tucurauna*, Fritz Müller, in regard to the finger and the notched palm of the second gnathopods, but appears to differ in not having the fourth and fifth joints of the fifth peræopod thickened or broadened. In turning up Fritz Müller's reference to his specimen in 'Facts and Arguments for Darwin,' 1869, p. 79, I find that the second gnathopod of the male, as figured by Fritz Müller, agrees pretty closely with that of the Picton specimens, and that, moreover, the description given by Fritz Müller of the changes that take place in the males even after they attain sexual maturity and his account of the more immature males agree very well indeed with those exhibited by the Picton specimens. Thus I had already noted that in them the first few joints of the flagellum of the second antenna were more or less completely fused in the fully developed males and that in the young males the process on the finger and the corresponding notch on the palm of the second gnathopod were only slightly developed. There seems little doubt that the specimen described by Stebbing as *O. sulenisoni* is really the same as Müller's *O. tucurauna*. Stebbing's description of the various characters not mentioned by Fritz Müller agrees closely with the Picton specimens; thus, while the basal joint is oval in the third and fourth peræopods and partially so in the fifth, its hind margin in that limb is almost quite straight as described by Stebbing. In my specimens, in the better developed males the second antennæ are strong and have the last two joints of the peduncle considerably broadened, but in none of my specimens have I seen the fourth and fifth joints of the fifth peræopod specially broadened; they are comparatively slender, as drawn and described by Stebbing. I have little doubt, however, that Fritz Müller is right in saying that this character is shown only in the older males and is not fully developed until after they come to sexual maturity. I have often noticed the same thing in the nearly allied species *O. chiliensis*, M.-Edw., where the males may have the characteristic form of the second gnathopod and of the antennæ, though they have not yet developed the thickened

joints of the fourth and fifth peræopods, this latter character being found in comparatively few individuals.

Consequently from a comparison of my specimens with the two descriptions as given by Müller and Stebbing I feel little doubt that they are sufficiently near to be considered as belonging to the same species, notwithstanding the widely separated localities from which they were obtained. Fritz Müller does not mention the locality from which he collected his species, but presumably it was obtained while he was living in South Brazil either at Blumenau or at Desterro. My Picton specimens were obtained on the banks of the Waitohi stream at some little distance from its mouth in a place that would not be affected by ordinary high tides, though it would be reached by unusually high tides. At the same time and place I collected specimens of *Porcellio scaber*, several beetles, spiders, &c.—animals not by any means confined to the sea-shore. I have never seen the species from any other part of New Zealand. Fritz Müller gives no particulars as to the conditions under which the specimens were collected, and the locality of the single specimen of *O. sulensoni* in the Copenhagen Museum described by Stebbing is uncertain, though it is supposed to have come from Madeira.

I am inclined to think that the single specimen from Kapiti Island described by Filhol as *Orchestia dentata* (1885, p. 462, pl. liii. fig. 1) belongs to *O. tucurauna*, but neither his description nor his figure is sufficient to make the identification certain\*.

The occurrence of *Orchestia tucurauna* both in South America and in New Zealand is interesting as another example of the connection between the two faunas; *O. chiliensis*, M.-Edw., which was found at Picton along with

\* A few days after the MS. containing the statement above was posted I found a tube containing some Amphipods collected in 1906 by Dr. Cockayne at Kapiti Island "on rocks at base of a waterfall." Of the three specimens in the tube (the existence of which I had previously forgotten), one is a well-developed male of *O. tucurauna* agreeing well with the Picton specimens, the lower antenna being quite stout and the fifth peræopods, though not showing any definite broadening, hardly as narrow as the Picton specimens. There can be little doubt, therefore, that *O. dentata*, Filhol, from Kapiti Island, is really the same as *O. tucurauna*, as I had suggested. Of the other two specimens, one is *Parorchestia sylvicola* (Dana), the land-hopper found all over New Zealand, often far from the sea, and the other is an imperfect specimen of *Orchestia chiliensis*, M.-Edw.

It may be noted that both the Picton and the Kapiti Island specimens were obtained where the water was probably brackish or even fresh at the time; and I suspect that *O. tucurauna* will be found to be more or less confined to such localities.

*O. tucurauna* and is common on all New Zealand coasts, also occurs on the coasts of Chile, and, as I have pointed out elsewhere, numerous other Crustacea have a similar distribution—for example, the shore Isopod, *Deto bucculenta* (Nicolet), which is found in New Zealand (including the outlying Chatham Islands) and in Chile, South America (see Chilton, 1909 A, p. 602, 1909 B, p. 799, and 1915, p. 453).

I give below a specific diagnosis, with figures of the species *O. tucurauna*, and a few additional notes on its structure.

I wish to express my grateful thanks to my assistant, Miss E. M. Herriott, M.A., for the care she has taken in preparing the drawings for this paper.

*Orchestia tucurauna*, Fritz Müller. (Text-figs. 1-14.)

*O. tucurauna* (also printed *O. tucuratinga*), Fritz Müller, 1864, 'Für Darwin,' p. 54, figs. 50 & 51, and 1869, 'Facts and Arguments for Darwin,' p. 79, figs. 50 & 51.

*O. tucurauna*, Stebbing, 1906, p. 534.

*O. sulenoni*, Stebbing, 1899, p. 400, pl. xxx. c, and 1906, p. 541.

*O. redmani*, sp. n., Chilton, MS.

? *O. dentata*, Filhol, 1885, p. 462, pl. liii. fig. 1.

*Specific Diagnosis.*

*Male*.—Side-plates not deep, anterior lobe of side-plate of peræopod 3 much deeper than the posterior lobe. Pleon-segment 3 with postero-lateral angles quadrate, acute, scarcely produced, posterior margin with a few short setæ. Eyes of moderate size, round. Antenna 1 not reaching to end of penultimate joint of antenna 2, first joint as broad as long, second and third each a little longer than the preceding; flagellum of four to six joints, the first three being coalesced, subequal in length to the peduncle. Antenna 2 stout, last joint of peduncle longer and slightly more slender than the penultimate; flagellum subequal in length to the peduncle and of about twenty joints, the first four or five more or less completely coalesced, especially in old males. Gnathopod 1 with side-plate small, somewhat triangular, slightly produced anteriorly, its inferior margin bearing a few small setæ; basal joint narrow at base, widening distally, its anterior surface grooved; ischium without apical process; carpus with prominent, narrowly rounded, distal pellucid process; propod oblong, widening to the palm, and bearing distally a rounded pellucid process, palm not distinctly defined and overlapped by finger; all the joints beset with numerous short setæ. Gnathopod 2, basal joint narrow at the base, not broadening greatly distally, anterior surface grooved; carpus

very small, triangular; propod very large, broadly oval, widening slightly to the palm, both margins almost free from setæ, the hind one with a few small setæ towards distal end,

Fig. 1.

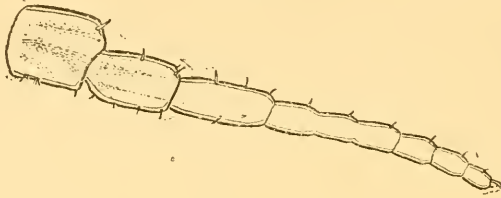
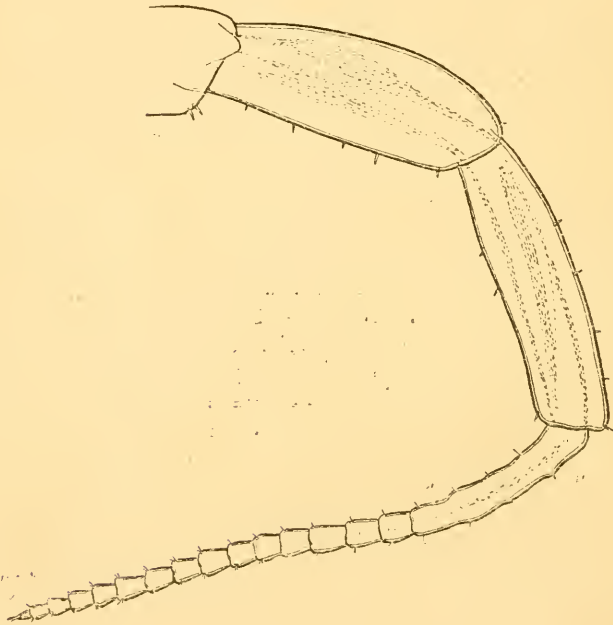


Fig. 2.

Fig. 1.—*Orchestia tucurana*, first antenna of male.Fig. 2.—*Orchestia tucurana*, second antenna of male.

palm nearly transverse in old males, more oblique in younger individuals, spinulose, irregularly convex between the blunt defining tooth and a deep depression near the hinge; dactyl

Fig. 3.

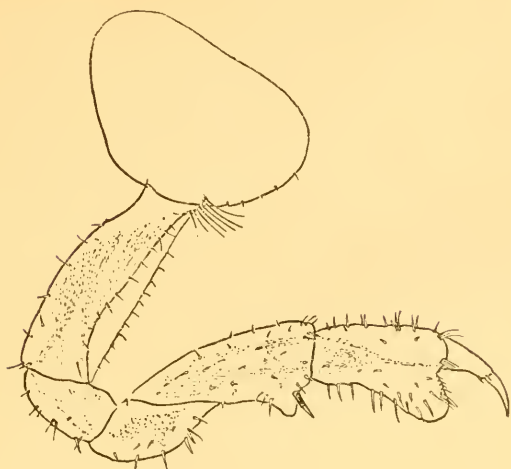


Fig. 4

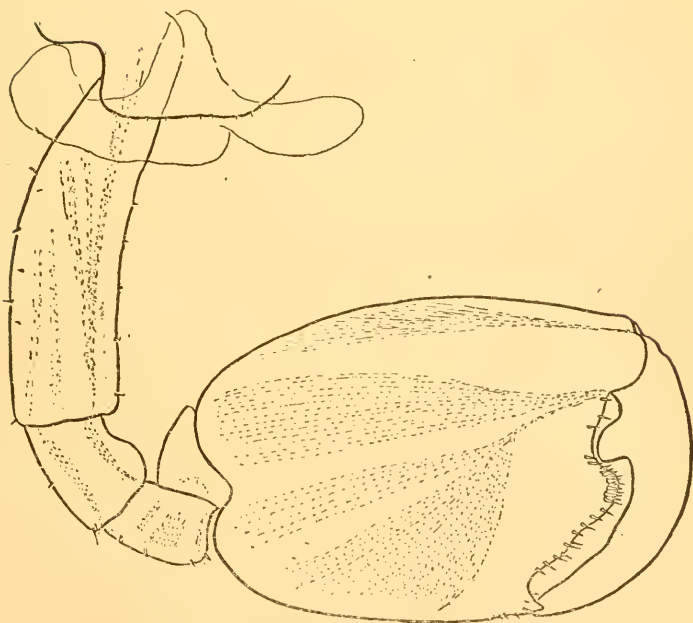


Fig. 3.—*Orchestia tucurauna*, first gnathopod of male.  
Fig. 4.—*Orchestia tucurauna*, second gnathopod of male.

Fig. 5.

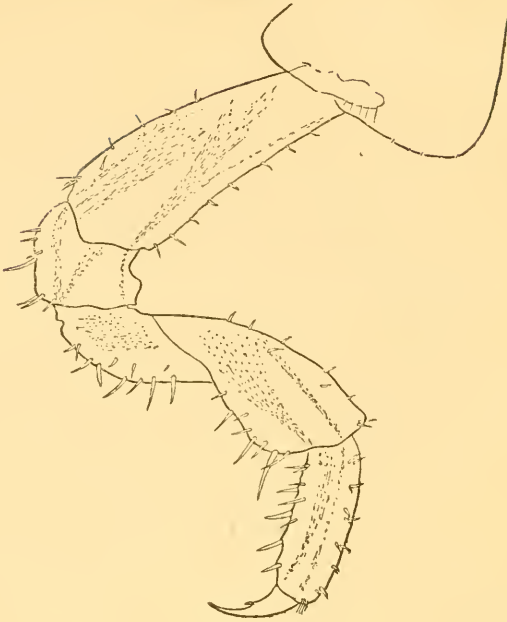


Fig. 6.

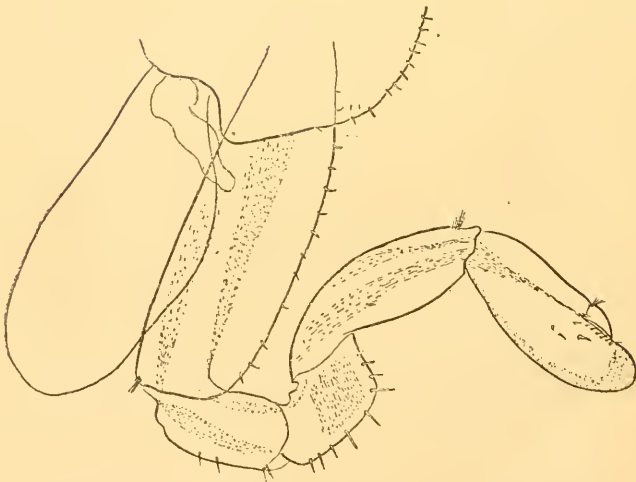
Fig. 5.—*Orchestia tucurauna*, first gnathopod of female.Fig. 6.—*Orchestia tucurauna*, second gnathopod of female.



Fig. 7.

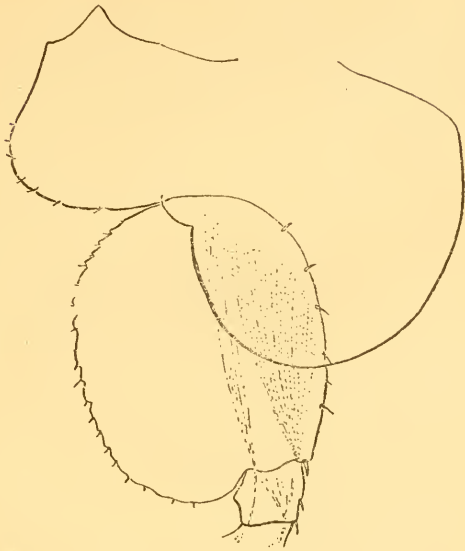


Fig. 8.

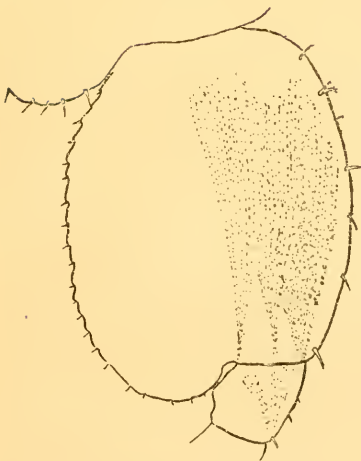


Fig. 9.

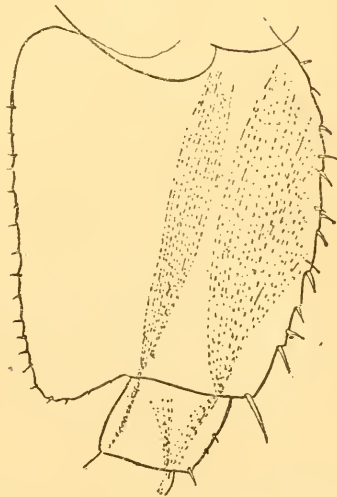


Fig. 7.—*Orchestia tucurauna*, side-plate and basal joint of peraeopod 3 of male.

Fig. 8.—*Orchestia tucurauna*, basal joint of peraeopod 4 of male.

Fig. 9.—*Orchestia tucurauna*, basal joint of peraeopod 5 of male.

large, strongly curved, its inner margin bearing a prominent convex process near the base, fitting into the depression in the palm. Peræopod 1 slightly longer than the second, which has the finger indented. Peræopods 3 and 4 with basal joint oval, larger and slightly narrower in the fourth

Fig. 10.

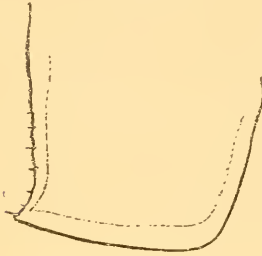


Fig. 12.

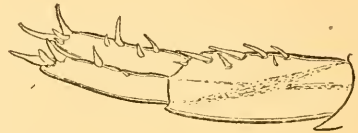


Fig. 11.



Fig. 13.

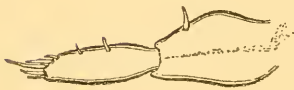


Fig. 14.



Fig. 10.—*Orchestia tucurauna*, inferior portion of third pleon-segment.

Fig. 11.—*Orchestia tucurauna*, first uropod.

Fig. 12.—*Orchestia tucurauna*, second uropod.

Fig. 13.—*Orchestia tucurauna*, third uropod.

Fig. 14.—*Orchestia tucurauna*, telson.

than in the third; basal joint of fifth with hind margin almost straight, posterior angle somewhat produced downwards; posterior margin in all serrate and with fine spinules; remaining joints in all rather slender in specimens examined,

but those of the fifth said to become broader in old males (Fritz Müller). Uropod 1 with peduncle scarcely longer than rami, its upper margin bearing numerous spines, both rami with lateral as well as terminal spines. Uropod 2 with rami about as long as peduncle, both with lateral and terminal spines. Uropod 3 with ramus about as long as peduncle, with spines on margin and at apex. Telson with posterior margin rounded and fringed with numerous spines, very slightly indented in middle.

*Female*.—First gnathopod with side-plate small, triangular produced in front, carpus longer and slightly broader than the propod, which narrows distally, so that the joint is simple, without palm. Second gnathopod with basis of nearly same width throughout, broadened, but not greatly so; carpus and propod subequal, long-oval, posterior margin of carpus moderately and regularly convex. Peræopods as in male, but with the joints a little more slender. In other respects closely resembling the male.

Length of largest male examined about 14 mm.

*Locality*. Banks of Waitohi stream, Picton, at some distance from mouth; Rapiti Island (*Filhol*) (?).

*Distribution*. New Zealand, South Brazil, Madeira (?).

#### *Remarks.*

The mouth-parts are of the type usual in *Orchestia*, and do not call for detailed description. The palp on the first maxilla is minute, but distinct. In the largest male examined there appears to be an obscure rudiment of the fourth joint of the palp of the maxilliped, but I can find no sign of it in two other specimens mounted, viz., a male less developed and a female.

The New Zealand specimens appear to differ from Stebbing's description of the single specimen of *O. sulenisoni* in having the first antenna slightly longer, the flagellum having more than four joints. In the first gnathopod the rounded lobe at the distal end is more distinct and in the second the palm is more transverse; both these differences are probably due to the fact that the type-specimen of *O. sulenisoni* was hardly so mature as the Picton specimens. In the third uropod the ramus is as long as the peduncle; Stebbing describes it as "not half as long or half as broad."

Fritz Müller's account deals only with a few special points. His figure of the second gnathopod of the male does not show the tooth defining the palm, but the strongly marked convex

process on the base of the finger and the corresponding depression in the palm are quite the same as in the New Zealand specimens and are very distinctive of the species. His figure of the second gnathopod of the female shows the limb shorter and stouter and the basal joint much broader than in my specimens. As already mentioned, he states that in old males the joints of the fifth peræopod become broadened; this is not shown in any of my specimens nor in the type of *O. sulensoni*.

I do not consider these differences in the descriptions and figures sufficient to counterbalance the close resemblance in the distinctive character of the second gnathopod of the male, supported as it is by Müller's account of the coalescence of the basal joints of the flagellum of the second antenna and by the resemblances in other characters to those given by Stebbing for *O. sulensoni*.

*Orchestia tucurauna* appears to belong to that section of the genus containing *O. chiliensis*, M.-Edw., *O. miranda*, Chilton, and *O. platensis*, Krøyer, in which there is a tendency in the males for the second antenna to become stout and for some of the joints of the fifth peræopod to be broadened. *O. pickeringii*, Dana, should perhaps also be grouped in the same section.

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XXXVI.—*North Pacific Zoroasteridæ* \*. By WALTER K. FISHER, Director, Hopkins Marine Station of Stanford University, California.

STARFISHES of the family Zoroasteridæ are abundant on muddy bottom in deep water off the west coast of the United States, and form a very characteristic element of the fauna. While the species are not especially numerous, individuals apparently swarm in some localities, judging by the results of dredge-hauls.

In this paper one new species and three new subspecies are briefly diagnosed. Keys to the west American species of *Zoroaster* and *Myxoderma* will serve, it is hoped, to designate by contrast the characters of the new forms. A synopsis of the genera of Zoroasteridæ is included in order to present in compact form our present knowledge of the status of these groups. The anatomical details for which some novelty may be assumed will be dealt with in more detail in a monograph of Philippine and Moluccan sea-stars now in press.

Further study of *Myxoderma*, first proposed as a subgenus, has shown it to be very distinct from *Zoroaster*. The capture by the 'Albatross' of large examples of *Cnemidaster wyvillii*, not a great distance from the type-locality, has thrown new light upon a genus which was based upon a young and wholly inadequate specimen. Very small examples of Zoroasteridæ are very different from the adults—in fact, they sometimes differ from the mature specimens in characters of generic importance! To put the matter more concretely, very young *Zoroaster* has all the adambulacral plates subequal (= *Prognaster* stage), which is true also of little examples of *Cnemidaster*. The latter lack also adradial plates, the presence of which is about the only constant character by which the adult can be distinguished from *Mammaster*.

I have not seen a specimen of *Prognaster*. Perrier confused the matter by publishing a second description with virtually a second type, *P. longicauda*, which appears to be a slender-rayed *Zoroaster*.

#### *Synopsis of the known Genera of Zoroasteridæ.*

- a'*. Dorsal surface not devoid of spines and not covered with a smooth tough membrane, in sharp contrast to the spinous or squamiferous actinolateral regions.

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\* Published with permission of the U.S. Commissioner of Fisheries.

- b'*. Superambulacral plates absent, no conspicuous buttress extending from the upper enlarged end of the first two pairs of ambulacral plates to the body-wall at the interradial angle.
- c'*. All adambulacral plates carinate on the furrow face. Genotype, *Prognaster grimaldii*, Perrier ..... *Prognaster\**, Perrier.
- c*<sup>2</sup>. Adambulacral plates alternately carinate and non-carinate.
- d'*. Rays long, slender; disk small; abactinal, marginal, and actinolateral plates arranged in regular longitudinal lines along ray, a series of adradial plates being always present; all but the median radial or carinal, which are larger, form also transverse series; plates are covered with small, papilliform, skin-covered spinelets, and most of them bear an enlarged spine; papular areas generally very small but sometimes nearly as large as plates; forciform pedicellariæ present; actinolateral plates in three to five series, the upper subequal to the inferomarginal plates; superomarginal plates not conspicuously larger than the inferomarginal plates. Genotype, *Zoroaster fulgens*, Thomson . . *Zoroaster*, Thomson.
- d*<sup>2</sup>. Plates of ray arranged in regular longitudinal series, the carinal plates the largest; abactinal and marginal plates armed with fairly large, skin-covered scales which mask all plates except some of the disk-plates and the carinal series along ray; no pedicellariæ; actinolateral plates, in two or three series, much smaller than inferomarginals; superomarginal plates much larger than inferomarginal plates. Genotype, *Pholidaster squamatus*, Sladen. *Pholidaster*, Sladen.
- b*<sup>2</sup>. Superambulacral plates present; a conspicuous buttress, the specialized first superambulacral plate connects the upper end of the first two ambulacral plates with the body-wall at interradial angle.

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\* *Prognaster*, Perrier, 'Comptes rendus,' cxii. no. 21, May 5, 1891, p. 1226. Type, *P. grimaldii*. Also 'Résultats des campagnes scientifiques du Prince de Monaco,' fasc. xi. 1896, p. 22, pl. ii. figs. 1, 1 *a-b*. In the meantime, Perrier described *Prognaster* as a new genus with *P. longicauda*, new species, ostensibly as type (Expéd. scientif. du 'Travailleur' et du 'Talisman,' 1894, p. 119). This species does not seem to be congeneric with *grimaldii*, which, of course, is the genuine genotype.

- c'. Adradial plates present; two series of papular areas between the carinal and superomarginal plates, the latter never conspicuously enlarged nor overlapping the carinals. Genotype, *Zoroaster sacculatus*, Fisher. . . . . *Myxoderma* \*, Fisher
- c<sup>2</sup>. No adradial plates; one series of very small adradial papular pores; superomarginal plates of two sizes, alternately larger and smaller, overlapping the carinals strongly and dominating these plates, which are sunken below the level of the superomarginals. Genotype, *Bythiolophus acanthinus*, Fisher . . . . . *Bythiolophus* †, Fisher.
- a<sup>2</sup>. Abactinal plates of disk, the carinals, adradials (when present), marginals, and sometimes one series of actinolateral plates devoid of spines or any conspicuous armature, but mostly smooth and covered with a tough membrane of variable thickness, often partly obscuring the plates; two to four lower series of actinolateral plates covered with squamiform fleshy spinelets and sometimes a conspicuous appressed spine; superambulacral plates present, the first conspicuously enlarged into a buttress connecting the upper end of the first two ambulacral ossicles with the body-wall.
- b'. With a series of adradial plates more or less well developed; four or five series of actinolateral plates. Genotype, *Cnemidaster wyvillii*, Sladen . . . . . *Cnemidaster* †, Sladen.
- b<sup>2</sup>. Adradial plates absent, the inner lobe of the superomarginal plates overlapping the carinal plates; three series of actinolateral plates with rudimentary fourth series in large specimens. Genotype, *Zoroaster sigsbeeii*, Perrier . . . . . *Mammaster*, Perrier.

*Key to the North Pacific Species and Subspecies of Zoroaster.*

- a'. With four series of actinolateral plates on proximal part of ray; dorsolateral and intermarginal papular areas very small with normally one papula each; inferomarginal and actinolateral spines slender, closely appressed.

\* *Myxoderma*, Fisher (subgenus), Bull. Bureau Fisheries, 1904, vol. xxiv., June 10, 1905, p. 316.

† *Bythiolophus*, Fisher, 'New East Indian Starfishes,' Proc. Biol. Soc. Washington, vol. xxix., Feb. 24, 1916, p. 31.

‡ I have examined large adult specimens. Sladen's type was small, very immature, and therefore had not developed some of the characters of the adult.

- b'*. Superomarginal spines very slender, appressed; no adradial spines; ten carinal plates correspond to fourteen adradial and fourteen superomarginal plates; fourth or lowest actinolateral series extending far along ray; plates of first two actinolateral series as broad as inferomarginals; adradial plates broadly overlapped by adjacent series . . . . . *ophiurus*, Fisher.
- b''*. Superomarginal spines more robust, often bristling; an incomplete series of adradial spines; ten carinal plates correspond to nineteen adradial and nineteen superomarginal plates; fourth or lowest actinolateral series short (one-sixth length of ray); plates of first actinolateral series, only, as broad as the inferomarginals; adradial plates exposed (about 50 per cent. broader than in *ophiurus*) . . . . . *actinocles*, sp. n.
- a''*. With three series of actinolateral plates; the two dorso-lateral and the intermarginal series of papular areas with two to four papulae, the areas rather large; all spines rather long and bristling.
- b'*. No large pedicellaria regularly on the second spine of the prominent or carinate adambulacral plates . . . . . *evermanni*, Fisher.
- b''*. A large pedicellaria regularly present on the second spine (from furrow) of the prominent or carinate adambulacral plates . . . . . *mordax*, subsp. n.

*Zoroaster actinocles*, sp. n.

Rays 5.  $R=161$  mm.,  $r=11$  mm.,  $R=14.6r$ ; breadth of ray at base, 13 mm. Rays slender, evenly tapered to the extremity, which is capped by a relatively large terminal plate; disk elevated at centre; carinal ridge rather prominent. Resembling a slender-rayed *Z. fulgens*, but differing in having the plates of the second, third, and fourth actinolateral series smaller, the fourth series being rudimentary; in having slenderer superomarginal spines (which are decidedly slenderer than the carinal spines), fleshier spinelets, relatively larger carinal plates, never but one actinolateral spine to a plate; in having a decidedly larger terminal plate, and a large pedicellaria on the second (from furrow) adambulacral spine. The papular pores are small; there are five regular longitudinal series, with the beginning of a sixth at base of ray, on either side of the carinal plates—namely, two dorso-lateral, one intermarginal, 2+1 incomplete actinolateral series. Papulae solitary and small. Carinate or prominent



adambulacral plates with a transverse series of five spines, the first deep in furrow, the second with a pedicellaria about 1.5 mm. long attached to its base.

*Type-locality*.— $53^{\circ} 12' N.$ ,  $171^{\circ} 37' W.$ , 43.5 miles northwest of west point of Yunaska Island, Aleutian Islands, 1217 fathoms, fine black sand; bottom temperature  $35.2^{\circ}$  Fahr. (U.S. Fisheries steamer 'Albatross,' 1906).

*Zoroaster evermanni mordax*, subsp. n.

Closely resembling *Z. evermanni*\*, but differing in having more robust primary spines (which are typically also a little shorter actinolaterally), and in having on the second from inner spine of prominent adambulacral plates a large pedicellaria (or sometimes two), from 1.5 to 2.5 mm. long, and conspicuously bigger than the cluster of small pedicellariæ on the furrow-spine.  $R=153$  mm.,  $r=10+$  mm.,  $R=15r$ .

*Type-locality*.—Off Washington,  $47^{\circ} 28' N.$ ,  $125^{\circ} 15' W.$ , 477 fathoms, green mud.

This race is distributed from off Washington to southern California. At the southern end of its range it is found only in water deeper than 600 fathoms, while the typical *evermanni* occurs from San Diego, California, to Santa Cruz Island, California, in 216 to 510 fathoms.

*Key to the North Pacific Species and Subspecies of Myxoderma.*

*a*. Size large (R, 200 mm.). The plates and spines invested in a thick pulpy membrane, slimy in life; abactinal papular areas large, the dorsal skeleton being open and rather irregularly reticulate at base of ray; abactinal plates without accessory spinelets to any extent; actinolateral spines pointed, tapered, sometimes somewhat flattened, but never spatulate; terminal plate large, ovoid, especially conspicuous in young specimens; rays attenuate distally.

*b*. Rays thicker and skeleton stouter, third or lowest series of actinolateral plates extending five-eighths the length of ray; abactinal spines robust and stubby;

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\* *Zoroaster evermanni*, Fisher, Bull. Bureau Fisheries, 1904, vol. xxiv., June 10, 1905, p. 317. Further investigation has shown that this is not a *Myxoderma*, as it lacks the essential anatomical characters of that genus.

- abactinal pedicellariæ smaller and less numerous. Bering Sea to central California ..... *sacculatum* (Fisher).
- b<sup>2</sup>. Rays longer and slenderer, the third or lowest actinolateral series of plates extending along only the proximal third of the ray; spines rather slenderer, and abactinal pedicellariæ larger and more numerous. California, south of Point Conception ..... *ectenés*, subsp. n.
- a<sup>2</sup>. Size medium, the plates and spines not especially sacculate or slimy—about as in *Zoroaster*; abactinal papular areas medium in size, the areas with one or two papulæ which do not occupy all the area; adradial plates small, more or less overlapped by the carinals and superomarginals; abactinal plates with numerous, accessory, military spinelets; actinolateral spines broad, flat, and more or less truncate; terminal plate small; rays not attenuate distally.
- b<sup>1</sup>. Rays slenderer and longer, disk smaller; plates, especially the carinal and marginal, not broader than long; superomarginals not noticeably prominent; spines slenderer; pedicellariæ larger. Southern California (south of Point Conception) and Lower California ..... *platyacanthum* (Clark).
- b<sup>2</sup>. Rays broader and shorter, disk slightly larger; plates, especially the carinal and marginal, broader than long; superomarginals noticeably prominent, at least distally; spines more robust; pedicellariæ shorter. Oregon to Central California ..... *rhomaleum*, subsp. n.

*Myxoderma sacculatum ectenes*, subsp. n.

Differing from typical *M. sacculatum* \* (Fisher) in having slenderer and longer rays, the third or lowest actinolateral series of plates present on only a small proximal portion (about a third) of each ray, rather slenderer abactinal spines generally, and larger and more numerous abactinal pedicellariæ.  $R=210$  mm.,  $r=16$  mm.,  $R=13r$ ; breadth of ray at base 19 mm.

*Type-locality*.—South-west of Santa Cruz Island, California, 640 fathoms.

This race is found off southern California, from the vicinity of Santa Cruz Island to Los Coronados Islands, and from about 500 to 1100 fathoms, usually on green mud.

\* *Zoroaster* (*Myxoderma*) *sacculatus*, Fisher, *ibid.* p. 316.

*Myxoderma platyacanthum rhomaleum*, subsp. n.

Differing from *M. platyacanthum*\* (Clark) in having constantly broader and slightly shorter rays, slightly larger disk, much heavier abactinal and marginal spines, slightly shorter and decidedly heavier actinolateral spines, and shorter abactinal pedicellariæ.  $R=100$  mm.,  $r=12.5$  mm.,  $R=8r$ , breadth of ray at base 13 mm.; at a little beyond base 15.5 mm. Disk elevated, dome-shaped, rays very gradually tapered, but not attenuate distally.

*Type-locality*.—Off Oregon ( $43^{\circ} 46' N.$ ,  $124^{\circ} 57' W.$ ), 277 fathoms, grey sand; bottom temperature  $42.2^{\circ}$  Fahr.

Known from off Oregon and Central California, 277 to 296 fathoms, grey sand;  $41.8^{\circ}$  to  $42.2^{\circ}$  Fahr.

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XXXVII.—*Notes on Fossorial Hymenoptera*.—XXXVII. On some Sphecinae in the *British Museum*. By ROWLAND E. TURNER, F.Z.S., F.E.S.

Genus SCELIPHRON.

*Sceliphron masaicum*, sp. n.

♀. Nigra, nigro-pilosa; petiolo, tertio apicali nigro, trochanteribus posticis, femoribus posticis dimidio basali, tibiis posticis tertio basali, metatarso postico basi nigro, tarsisque posticis articulo secundo flavis; alis subhyalinis, flavo leviter suffusis, venis nigris, alis anticis apice angustissime infumatis.  
Long. 20–21 mm.

♀. Clypeus very distinctly bilobed at the apex, closely punctured and clothed with long black hairs, which also extend over the whole head and thorax; on each side of the bilobed central portion of the apical margin is a small tooth; mandibles bidentate at the apex, the outer tooth the longest. Eyes distinctly nearer to each other on the vertex than on the clypeus; second joint of the flagellum a little longer than the first and third combined. Pronotum deeply longitudinally grooved in the middle, finely punctured; mesonotum rugulose, scutellum and postscutellum closely longitudinally striated. Median segment with a deep and broad

\* *Zoroaster platyacanthus*, H. L. Clark, Bull. Amer. Mus. Nat. Hist. vol. xxxii., July 9, 1913, p. 199, pl. xlv. figs. 1 & 2.

longitudinal median groove, the dorsal surface rather finely obliquely striated; the oblique posterior slope finely transversely striated, with a deep median groove; the sides of the segment closely vertically striated. Petiole not quite as long as hind coxa, trochanter, and femur combined. Tarsal unguis with a small median tooth, the pulvillus large. Second abscissa of the radius at least as long as the first and third combined; first recurrent nervure received close to the middle of the second cubital cell, second at about one-eighth from the apex of the same cell.

*Hab.* British East Africa, Ngare Narok, Masai Reserve, 6000 ft. (*A. O. Luckman*), December 31, 1913, 6 ♀♀; Mogorr River (*A. O. Luckman*); Nandi Plateau, 5700–6200 ft. (*S. A. Neave*), May 30–June 4, 1911; Uganda, Tero Forest (*S. A. Neave*), Sept. 26–30, 1911.

This is a larger species than *S. quartineæ*, Grib., with differently coloured pubescence and fore legs; the apical third, or in some specimens half, of the petiole is black; it is a smaller species than *S. spirifex*, Linn., differing also in the colour of the legs, petiole, and wings, and in the much greater length of the second abscissa of the radius.

*Sceliphron eckloni*, Dahlb.

*Pelopæus eckloni*, Dahlb. Hymen. Eur. i. p. 434 (1845).

*Pelopæus clypeatus*, Fairmaire, Arch. Entom. ii. p. 264 (1858).

Probably identical with *S. spinola*, Lep., as suggested by Gribodo, but I have not seen Indian specimens.

Genus SPIEX (*Ammophila*, auct.).

*Sphex tenuis*, Pal. Beauv.

*Sphex tenuis*, Pal. Beauv. Insect. rec. en Afriq. & Amer. p. 48, Hymén. (1837). ♂.

*Ammophila guineensis*, Ritsema, Tijdschr. v. Entom. xvii. p. 192 (1874). ♀.

*Ammophila maculifrons*, Cam. Ann. Transvaal Mus. ii. p. 134 (1910). ♀.

*Ammophila cæruleornata*, Cam. Ann. Transvaal Mus. ii. p. 135 (1910). ♂.

*Sphex beniniensis*, Pal. Beauv.

*Sphex Beniniensis*, Pal. Beauv. Insect. rec. en Afriq. & Amer. p. 48, Hymén. (1837). ♂.

*Ammophila cyaniventris*, Guér. Mag. de Zool. xiii. P. 114, p. 9 (1843). ♂.

*Ammophila* (*Parapsammophila*) *lugubris*, Gerst. Monatsber. Akad. Wiss. Berlin, p. 510 (1857). ♀ ♂.

*Ammophila lugubris*, Gerstaecker, Peters, Reise u. Mossambique, Zool. v. p. 480 (1862).

*Sphex braunsi*, sp. n.

♀. Nigra; mandibulis, apice excepto, tergitis sternitisque primo secundoque, tertio basi extrema, femoribus anticis subtus, intermediis dimidio apicali, supra nigro-lineatis, tibiis anticis intermediisque, tarsisque anticis ferrugineis; petiolo segmento primo nigro; tegulis testaceis; alis subhyalinis, apice leviter infumatis, venis nigris; pronoto mesonotoque transverse striatis.

♂. Fœminæ similis; mandibulis tarsisque anticis nigris.  
Long., ♀ 18, ♂ 16 mm.

♀. Mandibles with a long acute apical tooth and two strong teeth on the inner margin. Clypeus with sparse large punctures, microscopically punctured and pubescent; head subopaque, with sparse large punctures, a deep groove from the anterior ocellus to the base of the antennæ. Eyes almost parallel on their inner margins; posterior ocelli much further from the eyes than from each other, separated from the eyes by a distance about one-third greater than the length of the third joint of the flagellum. Pronotum a little longer than the scutellum, nearly twice as broad anteriorly as long, with a deep median groove on the posterior half, rather strongly transversely striated. Mesonotum strongly transversely striated, with a deep median sulcus reaching almost to the posterior margin, where the striæ are oblique. Scutellum and postscutellum longitudinally striated. Median segment rugose, with oblique striæ, which are more distinct laterally than in the middle. First joint of the petiole black, almost exactly equal in length to the hind femur, a little longer than the second joint of the petiole; second tergite longer than its apical breadth. Tarsal ungues simple, with a distinct pulvillus. Pleuræ rugose, with more or less distinct oblique striæ, evenly covered with very delicate whitish pubescence. Spiracle of the first tergite situated considerably behind the middle.

♂. One large tooth only on the inner margin of the mandibles; eyes converging towards the clypeus; apical margin of the clypeus widely and shallowly emarginate; eighth sternite rather narrowly rounded at the apex. Third cubital cell in both sexes small, contracted both on the radius and cubitus, second abscissa of the radius longer than the first in the female, a little shorter in the male, more than twice as long as the third.

*Hab.* Willowmore, S. Africa (*Dr. Brauns*), October 1, 1916.

The pronotum is much longer than in the common *S. tenuis*,

Pal. Beauv., and the colouring is also very different. The male genitalia are also different, the stipes being narrower and more acute at the apex than in *tenuis*. The pulvillus is absent in *tenuis*.

*Sphex dolichoderus*, Kohl.

*Ammophila dolichodera*, Kohl, Verh. zool.-bot. Ges. Wien, xxxiii. p. 383 (1883). ♂.

*Ammophila pulchricollis*, Cam. Ann. Transvaal Mus. ii. p. 133 (1910). ♂.

According to Dr. Brauns, Cameron's type is a female. Kohl, in his table a few pages before the description of *dolichodera*, gives the name of the species as *macrocola*. Probably he originally intended to use this name and changed it in the description, but neglected to make the alteration in the table.

*Sphex ferrugineipes*, Lep.

*Ammophila ferrugineipes*, Lep. Hist. nat. Insect. Hymen. iii. p. 383 (1845). ♀.

*Ammophila dunbrodyensis*, Cam. Rec. Albany Mus. i. p. 322 (1905).

*Sphex basalis*, Sm.

*Ammophila basalis*, Sm. Cat. Hym. B.M. iv. p. 214 (1856). ♀.

*Ammophila nigripes*, Sm. Cat. Hym. B.M. iv. p. 215 (1856). ♂.

*Sphex (Coloptera) tuberculiscutis*, sp. n.

♀. Nigra; mandibulis, apice excepto, clypeo, antennis articulis sex basalibus, prothorace, mesonoto lateribus, mesopleuris macula sub alis, tegulis, scutello, postscutello, tergito secundo leviter nigro suffuso, petiolo subtus, sternitis pedibusque, femoribus supra nigrolineatis, ferrugineis; alis sordide hyalinis, flavo-suffusis, venis nigris; pronoto fere polito, antice subexcavato, utrinque tuberculato, postice in medio obsolete transverse striato, mesonoto transverse striato; scutello postscutelloque longitudinaliter striatis, postice productis, lamellato-tuberculatis.

♂. Feminæ similis, tergito secundo nigro, basi fusco-ferrugineo; clypeo apice in tuberculo producto.

Long., ♀ 21-22, ♂ 22-25 mm.

♀. Mandibles with one large, broad, blunt tooth on the inner margin, clypeus broadly subtruncate at the apex. Eyes almost parallel on the inner margins; posterior ocelli almost as far from each other as from the eyes; front not concave, without a distinct longitudinal sulcus; the face and sides of the clypeus clothed with very delicate pale golden

pubescence. Propleuræ almost smooth; mesopleuræ rather sparsely punctured; sides of the median segment coarsely rugulose, dorsal surface of the segment rugose; the humeral calli, the apex of the median segment, and a long band on the hind margin of the mesopleuræ clothed with very delicate shining silver pubescence. First joint of the petiole about as long as the hind femur and trochanter combined; second tergite slender, half as long again as its apical breadth. Pulvillus well developed. Second abscissa of the radius about half as long as the first.

♂. Eyes very slightly convergent towards the clypeus; posterior ocelli a little nearer to the eyes than to each other. Clypeus produced into a porrect tubercle in the middle of the anterior margin. Transverse striæ of the pronotum more developed than in the female. First joint of petiole distinctly longer than the hind femur and trochanter combined; eighth sternite broadly truncate at the apex.

*Hab.* British East Africa, Masongaleni, 3000 ft. (*S. A. Neave*), March 29–April 1; Kibwezi, 3000 ft. (*S. A. Neave*), April 2–4; Mitto Andei, 2500 ft. (*S. A. Neave*), March 26–28; Tiwa River, Ukamba (*S. W. J. Scholefield*), January 22–27.

Nearly allied to *saussurei*, Buys., but easily distinguished by the curious form of the pronotum and by the more strongly produced scutellum and postscutellum. The male clypeus differs strongly from that of the Palæartic species *barbara*, Lep., and *judæorum*, Kohl.

#### GENUS CHLORION.

##### *Chlorion (Isodontia) apicata*, Bingham.

*Ammophila apicata*, Bingham. *Fauna Brit. India*, Hymen. i. p. 234 (1897). ♀.

##### *Chlorion (Isodontia) prasinus*, Guér.

*Sphex prasinus*, Guér. *Voy. Coq.*, Zool. ii. p. 262 (1839).

*Sphex morosa*, Sm. *Journ. Proc. Linn. Soc.*, Zool. iv., Suppl. p. 122 (1860).

##### *Chlorion (Proterosphex) paulinieri*, Guér.

*Sphex Paulinieri*, Guér. *Magas. de Zool.* xiii. P. 114, p. 8 (1843). ♀.

*Sphex eximia*, Lep. *Hist. nat. Insect. Hymén.* iii. p. 360 (1845). ♂.

This belongs to the group of *aurulentus*, Fabr., with the median segment transversely striated. Kohl wrongly treats the species as a true *Chlorion* in the most restricted sense, but had not seen a specimen.

XXXVIII.—*New Australian Diplopterous Hymenoptera.*

By ROWLAND E. TURNER, F.Z.S., F.E.S.

*Paralastor aterrimus*, sp. n.

♂. Niger; clypeo apice anguste, fronte interantennali, scapoque subtus flavis; tarsis fusco-brunneis; alis hyalinis, anticis, præcipue area costali, infuscatis; venis nigris; clypeo apice subtruncato; sternito secundo basi elevato-tuberculato.

Long. 10 mm.

♂. Clypeus closely microscopically punctured, with larger scattered punctures, with very delicate close-lying pubescence at the base, the apex subtruncate, scarcely emarginate. Front coarsely and rather closely punctured, vertex coarsely punctured-rugose. Thorax and median segment coarsely punctured-rugose; tegulæ very coarsely punctured. First tergite very coarsely punctured, second much more finely and sparsely punctured; the apical margins of tergites 3-6 narrowly fuscous brown. Second sternite shining, rather strongly, but not very closely punctured, raised and subtuberculate at the base. The first abdominal segment is broad. Antennæ, as in all males of the genus, with only eight well-developed joints, the joints beyond the eighth minute and concealed.

*Hab.* Townsville, Queensland (*Dodd*).

*Paralastor diabolicus*, sp. n.

♂. Niger; clypeo apice late maculaque magna basali, fronte interantennali scapoque subtus flavis; tarsis articulo apicali luteo; alis hyalinis, anticis dimidio costali fortiter infuscatis, venis nigris; clypeo apice late emarginato; sternito secundo basi fortiter elevato-tuberculato.

Long. 11 mm.

♂. Clypeus closely microscopically punctured, with sparse larger punctures intermingled, the apex widely, but not very deeply emarginate. Head coarsely punctured, rather more sparsely on the front than on the vertex; a low arched carina above the anterior ocellus. Thorax and tegulæ very coarsely punctured; median segment punctured-rugose. First tergite broad, very coarsely punctured; second much more finely punctured, shining between the punctures; second sternite very strongly raised and bluntly



tuberculate at the base. The apical sternites from the third are dull ferruginous brown.

*Hab.* Townsville, Queensland (*Dodd*).

Extremely like *aterrimus*, but differs in the broader and emarginate clypeus, in the yellow base of the clypeus, in the colour of the apical sternites, and in the more strongly raised and tuberculate base of the second sternite. Both species are very different in colour from other species of the genus, superficially resembling *Odynerus dietrichianus*, Sauss., and other similarly coloured *Odynerus*. In both species the clypeus is feebly convex, somewhat more strongly in *aterrimus* than in *diabolicus*. The two species appear to be closely allied, much more so than is usually the case in species with the same colour-pattern found in the same locality.

*Paralastor submersus*, sp. n.

♀. Nigra; macula parva interantennali, tergitoque secunda macula maxima utrinque in medio confluentibus, flavis; alis infuscatis, venis nigris.

Long. 11 mm.

♀. Clypeus strongly and rather sparsely punctured, flat, widely and rather shallowly emarginate at the apex, the apical margin distinctly raised. Head coarsely and closely punctured, thorax punctured-rugose, tegulæ sparsely punctured at the base, more closely towards the apex. Median segment punctured-rugose; first tergite strongly punctured, the punctures becoming sparse and smaller towards the apex; second tergite much more finely and sparsely punctured, the punctures becoming much closer and rather larger at the apex. Second sternite strongly punctured, raised and subtuberculate at the base.

*Hab.* Lolworth Station, N. Queensland; June 29, 1901. Received from Mr. Froggatt. 1 ♀.

Superficially this somewhat resembles *P. conspicendus*, Perkins, but the form of the clypeus shows that it is really allied to the group of *P. mackayensis*, Perkins, and *P. carinatus*, Sm. The vessel on which the box containing the specimen was sent was torpedoed, and the box was submerged, but after treatment the specimen was dried in a fairly satisfactory manner.

In all species described here the length measurement is to the apex of the second abdominal segment. The types are in the British Museum.

XXXIX.—*Remarks on the Age of some Arctic and North-Atlantic Starfishes.* By JAMES A. GRIEG, Curator of the Bergen Museum, Bergen, Norway.

DR. MORTENSEN has shown, in "Smaa faunistiske og biologiske Meddelelser"\*, that ophiurids of various ages are found simultaneously in shallow water at the same locality within the boreal region; transformed young were collected recently, together with one-year old, fully developed two-year old, and older individuals. At Sallingsund Dr. Mortensen obtained young of *Ophiura ciliaris* with a disc-diameter of  $\frac{1}{4}$ – $\frac{1}{2}$  mm., one-year old individuals with a disc-diameter of 3–4 mm., two-year old ones with a disc-diameter of 7–11 mm., and several whose disc-diameter was more than 12 mm. and whose age was probably three years.

The circumstances are the same on the Norwegian southern and western coasts; on the other hand, Dr. Mortensen in "Echinoderms from East Greenland"† mentions that a large number of *Ophiura sarsi* obtained off Jan Mayen were all of about the same size (disc-diameter 15–20 mm.). As numerous specimens of *Ophiura robusta*, a very small species, were taken in the same haul, the small *Ophiura sarsi* could not have been overlooked. At Jan Mayen there could only have lived a single year-class of *Ophiura sarsi*, whose age Dr. Mortensen estimates at one year, though I am most inclined to estimate it at three years.

An examination of the ophiurids collected by the 'Michael Sars' in the Norwegian Sea shows that very often a single year-class occurs at a locality, exactly as stated by Dr. Mortensen in regard to Jan Mayen; but several year-classes may also be found—in this case, one of them is generally more numerously represented than the others‡.

In this paper I shall confine my remarks to a haul which the 'Michael Sars' made in the summer of 1914 off the mouth of the Varanger Fjord. From this haul 157 *Ophiura sarsi* were obtained with a disc-diameter of 16–27 mm., and one specimen measuring 11 mm.; of these no fewer than 99 (or 63 per cent.) have a disc-diameter of 22–24 mm.—this large group represents a year-class whose age must be put at four years. There were also several individuals—not very

\* Vidensk. Meddel. 1897, p. 321.

† Meddel. om Grönland, xxix. 1903, p. 82.

‡ 'Bergens Museums Aarbok,' 1903, no. 13, p. 23.

distinct, however—with a disc-diameter of 16–19 mm., which must correspond to Dr. Mortensen's of 15–20 mm. from Jan Mayen; the majority in this group cannot be more than three years old. Finally, there is the specimen of 11 mm., the age of which must be estimated at two years.

The ophiurids from the great depths of the North Atlantic collected by the 'Michael Sars' in 1910 show that the same conditions exist as in the Norwegian Sea. A species of ophiurids may be represented at a locality by several year-classes, but only one of them numerously.

During the examination of the echinoderms collected by the 'Michael Sars' in 1910, I also commenced work on the starfishes to see whether the conditions were the same as in the ophiurids. In order to have material as abundant as possible I did not confine my attention to that taken in 1910, but added some from other cruises of the 'Michael Sars' and similar expeditions. Altogether I examined 14 species, which were collected in Arctic waters, off the Norwegian coasts, and in the North Atlantic. I had abundant material of some species: thus of about 500 specimens of *Pontaster tenuispinus* 155 were from one locality, and of about 800 specimens of *Otenodiscus crispatus* 355 were from one locality; of the remaining species the material was somewhat scanty—it is, however, of importance for the purpose of comparison. The result of these investigations is more fully discussed in "Nogen asteriders alder og aarsklasser"\*; as this paper is written in Norwegian, I here give an abstract from it.

The diameter of the disc served to determine the annual classes of the ophiurids, but in the starfishes it was more convenient to use the radius of the disc.

The measuring method requires many examples, and even then the age of a specimen can only be determined with certainty if its size comes within the measurements of the majority of the individuals of a year-class. Another drawback to this method is that the conditions of life and, consequently, growth may differ at different localities; the results from one locality can therefore not be applied unconditionally to another. Following the usual practice when studying fishes, I have examined the marginal plates of the starfishes and other parts of their skeleton in order to arrive at the age of each individual, but I have not definitely succeeded in finding annual rings. I have therefore been obliged to fall back upon the measuring method.

\* 'Bergens Museums Aarbok,' 1916–17, Naturvidensk Række, no. 1.

Radius of disc in millimetres.	<i>Pontaster tenuispinus.</i>				<i>Ctenodiscus crispatus.</i>			<i>Hymenaster pellucidus.</i>	<i>Bathyblastus robustus.</i>	<i>Plutonaster bifrons.</i>	<i>Benthopecten sphinosus.</i>	<i>Dytaster agassizii.</i>	
	Mouth of Sogne Fjord.	Coast of Romsdal.	Fro Island.	Kara Sea.	Barent's Sea.								E. off Iceland.
1	...	...	1	1	1	...	...	1	...	...	1	...	
2	...	...	6	11	19	...	...	...	...	...	...	...	
3	...	...	13	20	9	...	...	...	...	...	...	...	
4	...	...	9	10	6	...	...	...	...	...	...	...	
5	...	...	4	5	10	...	...	...	...	...	...	...	
6	...	...	...	3	4	...	...	...	...	...	...	...	
7	...	...	...	3	...	...	...	...	...	...	...	...	
8	...	...	...	...	...	...	...	...	...	...	...	...	
9	...	...	...	...	...	...	...	...	...	...	...	...	
10	...	...	...	...	...	...	...	...	...	...	...	...	
11	...	...	...	...	...	...	...	...	...	...	...	...	
12	...	...	...	...	...	...	...	...	...	...	...	...	
13	...	...	...	...	...	...	...	...	...	...	...	...	
14	...	...	...	...	...	...	...	...	...	...	...	...	
15	...	...	...	...	...	...	...	...	...	...	...	...	
16	...	...	...	...	...	...	...	...	...	...	...	...	
17	...	...	...	...	...	...	...	...	...	...	...	...	
18	...	...	...	...	...	...	...	...	...	...	...	...	
19	...	...	...	...	...	...	...	...	...	...	...	...	
20	...	...	...	...	...	...	...	...	...	...	...	...	
21	...	...	...	...	...	...	...	...	...	...	...	...	
22	...	...	...	...	...	...	...	...	...	...	...	...	
23	...	...	...	...	...	...	...	...	...	...	...	...	
24	...	...	...	...	...	...	...	...	...	...	...	...	
25	...	...	...	...	...	...	...	...	...	...	...	...	
	153	52	34	55	37	169	149	335	26	25	87	12	34

Originally my intention was only to settle whether one or several year-classes of a species of starfishes occur at a locality, and, if several, whether one of these is more numerously represented than the others. In the course of my investigations it appeared that a similar number of annual classes is gathered at the same locality of more than one species. In *Pontaster tenuispinus* we find an annual class with a disc-radius of 3-4 mm., another of 8-10 mm. We find the same number of *Ctenodiscus crispatus*, *Psilaster andromeda*, etc., or else the numbers are very close to those mentioned for *Pontaster tenuispinus*. Therefore, if we could determine the age of a year-class for one species, that of the others would also be known. Among some echinoderms from Utne, Hardanger, I was fortunate enough to find some very small *Psilaster andromeda*, which had apparently been recently transformed to the bottom stage. This was consequently group 0, other material belonged to group I., etc.

The measurements mentioned in this paper are given in the table on p. 402, the remainder appear in "Nogen asteriders alder og aarsklasser."

I shall first endeavour to show that starfishes occurring at a locality are, as a rule, represented by several year-classes, but only one of them numerously. The 'Voeringen' took 153 *Pontaster tenuispinus* off the mouth of the Sogne Fjord: of these one specimen had a disc-radius of 3 mm., the rest measured 5-12 mm., with a maximum of 119 specimens (or 76.8 per cent. of the total number) at 8-10 mm. A year-class is evidently gathered about these measurements. The 3 mm. specimen belongs to another year-class, as is clearly shown by 34 specimens taken by the 'Voeringen' off the Fro Islands; of these one specimen had a disc-radius of 9 mm., the rest 1-5 mm., including 12 specimens at 3 mm. The conditions in the two localities were therefore quite different: off the Fro Islands there was a maximum of 12 specimens at 3 mm. and one only at 9 mm.; the Sogne Fjord locality had, on the contrary, a maximum of 48 specimens at 9 mm., but one only at 3 mm. Common to both localities is the circumstance that two year-classes were represented, only one of them numerously.

At a station off the coast of Romsdal the 'Voeringen' took 52 *Pontaster tenuispinus*, which had a disc-radius of 6-11 mm., with a maximum of 45 specimens at 7-9 mm. Evidently only one annual class was represented here, and that one must have been of the same age as the large group from the station off the Sogne Fjord. As stated above, there was at

this locality a maximum at 8–10 mm., while at the station off the coast of Romsdal it was at 7–9 mm. The difference must be attributed to the fact that there were better conditions of life at the one locality than at the other.

Quite the same result that the Fro Islands material gives is exhibited by 55 specimens from a locality in the Kara Sea. As the table shows there is a marked maximum of 49 specimens at 3–5 mm., while only 5 specimens have a disc-radius of 7–10 mm. From another locality in the Kara Sea there are 37 specimens, which show that three year-classes may be represented at a locality, but only one of them numerously. We have first a large group of 29 specimens which have a disc-radius of 2–7 mm., with a maximum of 22 specimens at 3–5 mm. Then, a group of 7 specimens with a disc-radius of 9–13 mm., and, finally, one specimen of 23 mm. Each of these groups must represent an annual class, the youngest of which only was numerous.

The material of *Pontaster tenuispinus* examined by me shows that this species has a year-class at 3–4 mm., another at 8–10 mm., and I have had some specimens with a disc-radius of more than 13 mm. The material of this last group is unfortunately so sparing that it has not been possible to determine where its maximum is to be found; I should be inclined to think that it must be looked for at about a radius of 15 mm. With a disc-radius of 23 mm. *Pontaster tenuispinus* has attained its maximum of growth. Whether it is possible to find one or two year-classes between 13 mm. and 23 mm. cannot at present be definitely determined, but I am most inclined to think that representatives of two year-classes are to be found between these two sizes.

From three localities in the Barent's Sea I have measured 169, 149, and 335 specimens respectively of *Ctenodiscus crispatus*. The specimens from the first locality measured 3–13 mm. and had a maximum of 128 specimens (or 77·7 per cent. of the total number) at 7–10 mm.; at the second locality there was a maximum of 132 specimens (or 88·6 per cent.) at 8–11 mm.—these specimens measured 6–13 mm.; at the third locality the specimens measured 6–16 mm.—at 9–12 mm. there was a maximum of 267 specimens (or 79·7 per cent. of the total number). If we compare the material, we find that the majority of the specimens at all three localities are of the same size and represent the same annual class. It is very probable, however, that at two of the localities, at least, there were specimens of still another year-class, for material from other localities indicates that the smallest specimens from the

first locality and the largest from the last-named one must be of an age other than the rest.

I stated above that the examples of *Pontaster tenuispinus* examined represent three or possibly four annual classes. The material of *Ctenodiscus crispatus* is only composed of three year-classes: the maximum of the youngest class is at 4-5 mm., that of the second at about 10 mm., and that of the third at 15-16 mm. A fourth year-class seems to be out of the question in the case of this species, as it has already attained its maximum growth at 18-19 mm.

It has been mentioned already that the food-conditions and therefore the conditions of growth may be different in different localities. The maximum of a year-class will be gathered about a measurement which varies somewhat for different localities. In speaking of *Pontaster tenuispinus* I have called attention to this fact, which is still more striking when we compare the material of *Ctenodiscus crispatus* mentioned above. As will be shown below, the two-year old annual class has its maximum at a disc-radius of 7-10 mm. at one locality, at 8-11 mm. at another, and at 9-12 mm. at a third, which has evidently offered the best conditions of life. I ought to mention that the material from all localities was collected in June, though in different years.

As it is with these two species, so it is with others that live at shallower depths in Arctic and boreal waters. The conditions are the same at the great depths in the Norwegian Sea and the North Atlantic. The 'Michael Sars' took 26 *Hymenaster pellucidus* in 1900 in the cold area off the east coast of Iceland with a disc-radius of 4-25 mm. This material affords a maximum of 9 specimens at 8-9 mm., fewer at 14-15 mm., and still fewer at 22 mm.; there were thus three year-classes from this locality. Other material indicates that the 4 mm. specimens represented a fourth annual class.

Another species characteristic of the cold area of the Norwegian Sea is *Bathybiaster vexillifer*, which may also be represented by several year-classes at a locality. It may be mentioned that the juvenile specimens of *Bathybiaster vexillifer*, described by Danielssen and Koren under the name *Hyaster mirabilis*, was taken together with two full-grown ones. The 'Michael Sars' found in 1902 at a locality in the cold area north of the Faroe Islands a very young specimen whose disc-radius measured 4 mm., another of 7 mm., and still others of as much as 22 mm.; some of these were thus among the largest known in this species. In other words,

there have been living at least three year-classes at the same locality. In the cold area off "Tampen" the 'Armauer Hansen' in 1914 took three *Bathybiaster vexillifer* whose disc-radius measured 2.7, 3.5, and 25 mm. respectively; here were therefore two quite young individuals which must represent one annual class and a full-grown individual belonging to quite another.

In the North Atlantic the genus *Bathybiaster* is represented by *Bathybiaster robustus*, a species which shows so much likeness to *Bathybiaster vexillifer* that Verrill\* considered it as probably identical. A closer examination, however, shows that they are two different species, each living within its own territory—the one within the cold area of the Norwegian Sea, the other in the warm area of the North Atlantic. They also differ from one another in the structure of the skeleton. There is the same difference between them that there is between *Pecten frigidus* of the Norwegian Sea and *Pecten biskayensis* of the North Atlantic. S.W. of Ireland the 'Michael Sars' obtained 25 specimens of *Bathybiaster robustus*, which are grouped as follows: two specimens measured 11–12 mm., the rest 15–21 mm., with a maximum of 11 specimens at 19–20 mm. That the maximum is found among the largest specimens seems to indicate that the smallest (11–12 mm.) specimens must belong to another annual class.

In the eastern part of the North Atlantic *Plutonaster bifrons* is the most commonly distributed starfish. It is known from numerous localities between Faroe-Shetland Channel and the Cape Verde Islands. In 1910 the 'Michael Sars' collected this species at no fewer than seven localities, at some of them in great numbers—thus at a station W. of the Hebrides as many as 87 specimens were found. This material has a disc-radius of 8–21 mm., besides which there is a specimen of 24 mm. There are two marked maxima, one at 10–11 mm. comprising 28 specimens (or 32.2 per cent. of the total number) and another at 17–18 mm. with 17 specimens (or 19.5 per cent. of the total number). Both these maxima must represent annual classes. Judging from material from another locality the 24 mm. specimen must belong to yet another year-class.

The examples given must suffice. It appears from all the material examined that starfishes living at a given locality may belong to one year-class; but most frequently they

\* Proc. U.S. Nat. Museum, xvii. 1894, p. 256.



represent two or more, only one of them being numerous. The material also shows that each year-class is grouped about certain definite sizes, and that these as a whole are common to all species examined. *Pontaster tenuispinus* has a year-class whose maximum is gathered about a disc-radius of 3-4 mm.; *Ctenodiscus crispatus*, *Leptychaster arcticus*, *Bathybiaster vexillifer*, *Solaster papposus*, *Hymenaster pellucidus*, *Henricia sanguinolenta*, etc., have likewise a year-class of this size; *Pontaster tenuispinus* has the next year-class at 8-10 mm. In like manner we find that *Plutonaster bifrons*, *Dytaster agassizi*, *Ctenodiscus crispatus*, *Hymenaster pellucidus*, etc., have a year-class at the same size. It should be noted that the figures are not absolutely exact; with respect to some species and localities they may be found a little above or a little below those given, as I have already stated. Speaking generally, these are agreements which cannot be due to accidental circumstances. Each of these year-classes must have a fixed age, and if the year-class 3-4 mm. of *Pontaster tenuispinus* is one year old, then that year-class of the other species which is of the same size must also be one year old. It was therefore important to fix the age of a year-class in a species, as thereby the age was given for the other species.

I was fortunate to determine the age of some of the specimens of *Psilaster andromeda*, collected by Dr. D. C. Danielssen at Utne, Hardanger. The smallest specimens from Utne have a disc-radius of 0.5 mm. They were young which had recently been transformed to the bottom stage, and thus belong to group 0. Of the rest two specimens measured 3 mm., three 7-8 mm., four 10-12 mm., and two 14-15 mm. By comparing this material with some from other localities it appeared that the next year-class, which is one year old (group I.), is gathered about a disc-radius of 3-4 mm. Two-year old individuals (group II.) have a disc-radius of 7-8 mm., three-year old ones (group III.) 12-15 mm., and four-year old ones (group IV.) 18-20 mm. *Psilaster andromeda* has attained its maximum of growth at a disc-radius of 20-22 mm. It should not therefore attain a greater age than four years. The same also holds good for *Pontaster tenuispinus*, *Plutonaster bifrons*, *Bathybiaster vexillifer*, and probably most of the Northern starfishes.

Among the species whose age I have determined, *Ctenodiscus crispatus* and *Hymenaster pellucidus* differ from the above; the former seems only to attain three years and the latter five or possibly six years.

Several species, among them our most common starfish (*Asterias rubens*), I have been unable to examine. The material of some of the species was rather scanty and was from a single locality only. This was the case with *Benthopecten spinosus* and *Dytaster agassizi*. The specimens examined of these two species (see the table, p. 402) have a disc-radius of 5-10 mm. and 6-12 mm. respectively\*, and seem to belong to the same year-class (group II.). The question regarding the age of the starfishes therefore needs further investigation.

### XL.—*Synopsis of the American Species of Rana.*

By G. A. BOULENGER, F.R.S.

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#### I. Toes pointed or with slightly swollen tips.

A. Glandular dorso-lateral fold absent or flat and ill-defined, or, if narrow and prominent, not extending to the hip; tympanum at least  $\frac{2}{3}$  diameter of eye, usually much larger, especially in males; tibia  $2\frac{1}{2}$  to 4 times as long as broad; toes  $\frac{3}{4}$  to entirely webbed; outer metatarsals separated by web nearly to the base; nasal bones in contact with each other or narrowly separated.

1. Male with internal vocal sacs; dorso-lateral fold absent or flat and very indistinct.

Vomerine teeth between the choanæ (rarely just behind them); first finger as long as or a little longer than second; tibio-tarsal articulation reaching tympanum or eye; heels meeting or slightly overlapping when the hind limbs are folded at right angles to the body; tibia  $2\frac{1}{10}$  to  $2\frac{1}{2}$  times in length from snout to vent; tip of fourth toe free; no dorso-lateral fold .....

*R. catesbiana*, Shaw.

Vomerine teeth between the choanæ; first finger a little shorter than second; tibio-tarsal articulation reaching tympanum

\* The material of *Benthopecten spinosus* has not a maximum; of *Dytaster agassizi*, on the other hand, there is a marked maximum at 9-10 mm. comprising 18 individuals (or 52.9 per cent. of the total number).

or eye; heels meeting or narrowly separated; tibia  $2\frac{1}{4}$  to  $2\frac{1}{3}$  times in length from snout to vent; web extending to tip of fourth toe; no dorso-lateral fold.

Vomerine teeth on a level with posterior borders of choanæ, or just behind them; first and second fingers equal; tibio-tarsal articulation reaching eye; heels meeting or slightly overlapping; tibia 2 to  $2\frac{1}{3}$  times in length from snout to vent; one or two phalanges of fourth toe free; dorso-lateral fold present or absent . . . . . *R. grylio*, Stejn.

2. Male with internal vocal sacs; dorso-lateral fold usually very distinct; vomerine teeth between choanæ or just behind them; first finger as long as or a little longer than second; tibio-tarsal articulation reaching eye or between eye and tip of snout; heels overlapping; tibia  $1\frac{2}{3}$  to  $2\frac{1}{4}$  times in length from snout to vent; one or two phalanges of fourth toe free.

Dorso-lateral fold not extending beyond sacral region . . . . . *R. clamitans*, Daud.

Dorso-lateral fold extending beyond sacral region . . . . . *R. onca*, Cope.

3. Male with external vocal sacs; tympanum not larger than eye; first finger as long as or slightly longer than second; heels meeting or not.

Head as long as broad; tibio-tarsal articulation reaching tympanum; tibia  $2\frac{2}{3}$  to  $2\frac{2}{3}$  times in length from snout to vent; two phalanges of fourth toe free; no dorso-lateral fold . . . . . *R. virgatipes*, Cope.

Head broader than long; tibio-tarsal articulation reaching tympanum or eye; tibia 2 to  $2\frac{1}{3}$  times in length from snout to vent; fourth toe webbed to the tip, or last phalanx free; usually a more or less distinct dorso-lateral fold . . . . . *R. montezumæ*, Baird.

B. Glandular dorso-lateral fold very distinct, extending to the hip (exceptionally interrupted posteriorly); nasal bones widely separated from each other.

1. Outer metatarsals separated nearly to the base; toes obtusely pointed,  $\frac{2}{3}$  to nearly entirely webbed; tibio-tarsal articulation reaching eye, tip of snout, or a little beyond; tibia  $3\frac{1}{2}$  to  $5\frac{1}{2}$  times as long as broad,  $1\frac{2}{3}$  to  $2\frac{1}{6}$  times in length from snout to vent.

a. Male with vocal sacs.

Head as long as broad or a little broader or a little longer; interorbital space much narrower than upper eyelid; dorso-

lateral folds narrow or moderately broad, usually with interrupted folds or elongate warts between them; outer metatarsal tubercle absent or very indistinct; male with external or internal vocal sacs.....

*R. halecina*, L.

Head as long as broad; interorbital space much narrower than upper eyelid; dorso-lateral folds very broad, with a pair of similar folds between them; outer metatarsal tubercle usually present; male with internal vocal sacs ..

*R. palustris*, Leconte.

*b.* Male without vocal sacs.

Head broader than long; interorbital space as broad as or narrower than upper eyelid; tympanum  $\frac{2}{3}$  to once diameter of eye; outer metatarsal tubercle absent or very indistinct .....

*R. draytonii*, B. & G.

Head as long as broad or slightly broader than long; interorbital space narrower than upper eyelid; tympanum  $\frac{2}{3}$  to  $\frac{1}{2}$  diameter of eye; a more or less distinct outer metatarsal tubercle .....

*R. aurora*, B. & G.

2. Web not penetrating beyond basal half of outer metatarsals.

*a.* Glandular dorso-lateral fold narrow or moderately broad; head moderately large; vomerine teeth on a level with or behind posterior borders of choanæ.

Tibio-tarsal articulation reaching tympanum or eye; tibia 3 to  $4\frac{1}{2}$  times as long as broad, 2 to  $2\frac{1}{2}$  times in length from snout to vent; toes  $\frac{2}{3}$  to nearly entirely webbed; inner metatarsal tubercle  $\frac{1}{4}$  to  $\frac{1}{3}$  length of inner toe; male without vocal sacs .....

*R. pretiosa*, B. & G.

Tibio-tarsal articulation reaching tympanum or eye; tibia 3 to 4 times as long as broad,  $2\frac{1}{5}$  to  $2\frac{1}{2}$  times in length from snout to vent; toes  $\frac{1}{2}$  to  $\frac{2}{3}$  webbed; inner metatarsal tubercle  $\frac{1}{2}$  to  $\frac{2}{3}$  length of inner toe; male with internal vocal sacs .....

*R. cantabrigensis*, Baird.

Tibio-tarsal articulation reaching beyond eye; tibia 4 to 5 times as long as broad,  $1\frac{2}{3}$  to 2 times in length from snout to vent; toes  $\frac{2}{3}$  to  $\frac{3}{4}$  webbed; inner metatarsal tubercle  $\frac{2}{3}$  to  $\frac{3}{4}$  length of inner toe; male with internal vocal sacs .....

*R. silvatica*, Leconte.

*b.* Glandular dorso-lateral fold broad; vomerine teeth between the choanæ.

Head moderate, slightly broader than long, 3 to  $3\frac{1}{2}$  times in length to vent; loreal

region feebly oblique; tibio-tarsal articulation reaching eye; tibia  $4\frac{1}{2}$  to 5 times as long as broad,  $2\frac{1}{7}$  to  $2\frac{2}{5}$  times in length from snout to vent; toes  $\frac{2}{3}$  webbed; male without vocal sacs . . . .

*R. godmani*, Gthr.

Head very large, as long as broad or a little broader than long,  $2\frac{2}{3}$  to 3 times in length to vent; loreal region very oblique; tibio-tarsal articulation reaching anterior border of eye or between eye and nostril; tibia 4 to 5 times as long as broad,  $1\frac{3}{4}$  to nearly 2 times in length from snout to vent; toes  $\frac{1}{2}$  webbed; male with external vocal sacs.

*R. areolata*, B. & G.

Head very large, much broader than long,  $2\frac{1}{2}$  to  $2\frac{6}{7}$  times in length to vent; loreal region very oblique; tibio-tarsal articulation reaching tympanum or eye; tibia 3 to  $3\frac{1}{2}$  times as long as broad, 2 to  $2\frac{1}{4}$  times in length from snout to vent; toes  $\frac{1}{2}$  webbed; male with external vocal sacs . . . . .

*R. capito*, Leconte.

II. Toes ending in very small discs; outer metatarsals separated nearly to the base; interorbital space equal to or a little less than breadth of upper eyelid; nasal bones widely separated from each other.

A. Loreal region moderately oblique; toes entirely webbed or two phalanges of fourth free.

1. Tips of fingers swollen; vomerine teeth behind level of choanæ; tympanum  $\frac{2}{3}$  to  $\frac{3}{8}$  diameter of eye; tibio-tarsal articulation reaching tip of snout or beyond; head broader than long.

No dorso-lateral fold; tympanum distinct; heels not overlapping; tibia  $1\frac{5}{8}$  to 2 times in length from snout to vent; no outer metatarsal tubercle; male without vocal sacs . . . . .

*R. tarahumaræ*, Blgr.

Dorso-lateral fold, if distinct, very broad and flat and restricted to the anterior half of the body; tympanum feebly distinct, ill-defined; heels overlapping; tibia  $1\frac{3}{5}$  to  $1\frac{1}{5}$  times in length from snout to vent; an outer metatarsal tubercle; male with internal vocal sacs . . . . .

*R. boylii*, Baird.

A moderately prominent dorso-lateral fold, extending to the hip, its distance from its fellow, on the back,  $3\frac{1}{2}$  times in length from snout to vent; tympanum very distinct; heels overlapping; tibia  $1\frac{3}{4}$  times in length from snout to vent; no outer metatarsal tubercle . . . . .

*R. pustulosa*, Blgr.

2. Tips of fingers obtuse or rather pointed; vomerine teeth between choanæ; tympanum  $\frac{1}{2}$  to  $\frac{5}{6}$  diameter of eye; tibio-tarsal articulation reaching eye or tip of snout; tibia  $1\frac{2}{3}$  to  $2\frac{1}{2}$  times in length from snout to vent; dorso-lateral fold prominent, its distance from its fellow, on the back, 4 to  $5\frac{1}{2}$  times in length from snout to vent; no outer metatarsal tubercle; head as long as broad or a little broader than long; male with internal vocal sacs . . . *R. palmipes*, Spix.

B. Loreal region vertical or nearly so; toes  $\frac{2}{3}$  to  $\frac{3}{4}$  webbed; tips of fingers swollen; tympanum  $\frac{1}{2}$  to  $\frac{2}{3}$  diameter of eye; tibio-tarsal articulation reaching eye or between eye and tip of snout; heels overlapping; tibia 5 to 6 times as long as broad,  $1\frac{2}{3}$  to 2 times in length from snout to vent; dorso-lateral fold prominent, its distance from its fellow, on the back, 5 to 6 times in length from snout to vent; no outer metatarsal tubercle; head as long as broad or a little longer than broad; male without vocal sacs . . . . . *R. caeruleopunctata*, Stdr.

The American frogs all belong to the subgenus *Rana*, agreeing with the type-species, *R. temporaria*, L., in the structure of the pectoral arch (strong horizontal clavicles, omosternal style not forked at the base). I conceive the most primitive type as with large nasal bones in contact with each other and with the frontoparietals entirely covering the ethmoid; pointed, fully webbed toes with the outer metatarsals separated by web to the base; a distinct tympanum; no glandular dorso-lateral fold\*. I therefore regard the species grouped together in division I. A. of the above synopsis as nearest to this prototype; from this group I. B. 1. and II. seem to be directly and independently derived, probably also I. B. 2. *b.*; whilst I. B. 2. *a.* is obviously connected with I. B. 1. The species under Division II. are furthest removed from the prototype; I see no reason for regarding *R. boylii* as nearly allied to the *Ranæ temporariæ*, and it is connected with *R. palmipes* by *R. pustulosa*.

### 1. *Rana catesbiana*, Shaw, 1802.

*R. hoans* (non L.), Lacep., 1788.—*R. mugiens*, Merr., 1820.—*A. scapularis*, *picipis*, Harl., 1825.—*R. conspersa*, Leconte, 1855.

North America east of the Rocky Mountains, from Canada (Quebec, Ontario) to Florida and Texas.

### 2. *Rana grylio*, Stejneger, 1901.

Florida, Mississippi, and Louisiana.

\* Cf. Bull. Soc. Zool. France, 1918, p. 111.

3. *Rana septentrionalis*, Baird, 1855.*R. sinuata*, Baird, 1855.

Southern Canada and New York to Montana and Utah.

4. *Rana clamitans*, Daud., 1801.*R. clamata*, Daud., 1803.—*R. fontinalis*, Leconte, 1825.—*R. flaviviridis*, Harl., 1825.—*R. horiconensis*, Holbr., 1842.—*R. nigricans*, Agass., 1850.—*R. nigrescens*, *clamator*, Leconte, 1855.—*R. clamitans melanota*, Rhoads, 1895.

North America, east of the Rocky Mountains, from Canada (Quebec, Ontario) to Florida and Louisiana.

5. *Rana onca*, Cope, 1875.*R. draytoni onca*, Cope, 1889.—*R. fischeri*, Stejneger, 1893.

Utah and Nevada.

6. *Rana virgatipes*, Cope, 1891.

New Jersey (Atlantic City and Lakehurst) and North Carolina (Lake Ellis).

7. *Rana montezumæ*, Baird, 1855.*R. adrita*, Troschel, 1865.—*R. montezumæ concolor*, Cope, 1887.

Plateau of Mexico, Tabasco, Tehuantepec.

8. *Rana halecina*, L., 1766 \*.*R. pipiens*, Schreb., 1782.—*R. utricularia*, Harl., 1825.—*R. oxyrhynchus*, Hallow., 1856.—*R. berlandieri*, Baird, 1859.—*R. forreri*, Boulenger, 1883.—*R. virescens*, Garm., 1884.—*R. halecina sphenoccephala*, *brachycephala*, *austriicola*, Cope, 1886.—? *R. trilobata*, Mocquard, 1899.—*R. omiltemana*, Günth., 1900.

North America as far north as 52°, not extending west of the Sierra Nevada, Mexico and Central America as far south as Costa Rica. Up to 8000 ft. altitude in Colorado, 8500 ft. in Mexico, 5000 ft. in Costa Rica.

It may be possible to define three principal varieties: *sphenoccephala*, Cope, *forreri*, Blgr., and *austriicola*, Cope (*lecontii*, Gthr., Brocchi, *nigricans*, Brocchi).\* This name, latinised by Linnæus from Kalm's 'Sillhoppertosser,' appears in the synonymy of *R. ocellata*.

9. *Rana palustris*, Leconte, 1825.*R. pardalis*, Harl., 1825.

North America, east of the Mississippi.

10. *Rana draytonii*, B. & G., 1852.*R. lecontei*, B. & G., 1853.—*R. nigricans*, Hallow., 1854.—*R. longipes*, Hallow., 1859.—*R. aurora draytonii*, Camp, 1917.

Western North America, from British Columbia to the mountains of Lower California, up to 4000 ft. altitude.

11. *Rana aurora*, B. & G., 1852.*R. temporaria aurora*, Cope, 1883.—*R. agilis aurora*, Cope, 1886.

Washington Territory, Oregon, and California.

12. *Rana pretiosa*, B. & G., 1853.*R. temporaria pretiosa*, Cope, 1889.—*R. pretiosa luteiventris*, H. B. Thomps., 1913.

North America, from the Rocky Mountains westwards, from British Columbia to California.

13. *Rana cantabrigensis*, Baird, 1854.*R. cantabrigensis latiremis*, evittata, Cope, 1886.

Western North America, from Alaska and Great Bear Lake to British Columbia, Alberta, Assiniboia, Manitoba, Minnesota, and Illinois.

14. *Rana silvatica*, Leconte, 1825.*R. pennsylvanica*, Harl., 1825.

Eastern North America, from Manitoba, Ontario, and Quebec to South Carolina.

15. *Rana godmani*, Gthr., 1900.

Costa Rica (Rio Sucio).

I cannot help thinking that *R. godmani* will prove to be



identical with *Levirana vibicaria*, Cope, 1894. Except for the presence of feebly developed vomerine teeth, the longer inner finger, and the more extensive palmation of the toes in the former, there is almost complete agreement between the descriptions of the two, which are from the same part of Costa Rica.

16. *Rana areolata*, B. & G., 1852.

*R. circulosa*, Rice & Davis, 1878.

Indiana, Illinois, Georgia, Texas.

17. *Rana capito*, Leconte, 1855.

*R. areolata æsopus, capito*, Cope, 1886.

Georgia, Florida.

18. *Rana tarahumaræ*, Blgr., 1917.

Sierra Tarahumari, N.W. Mexico, about 3000 ft.

19. *Rana boylei*, Baird, 1854.

*R. pachyderma*, Cope, 1883.—*R. boylei muscosa, sierræ*, Camp, 1917.

Oregon and California, up to 11,500 ft. altitude.

20. *Rana pustulosa*, Blgr., 1883.

Ventanas in Durango, Mexico.

21. *Rana palmipes*, Spix, 1824.

*R. juvinensis*, Tschudi, 1845.—*Ranula gollmeri*, Peters, 1859.—*R. clamata*, var. *guianensis*, Peters, 1863.—*Ranula affinis*, Cope, 1866.—*Pohlia palmipes*, Steind., 1867.—*Ranula brevipalmata, nigrilatus*, Cope, 1874.—*R. vaillanti*, Brocchi, 1877.—*Hylarana brevipalmata*, Brocchi, 1882.—*R. copii*, Bouleng., 1882.—*R. bonaccana, melanosoma*, Günth., 1900.—*R. brevipalmata rhoadsi*, Fowler, 1913.

Central and South America, from Southern Mexico to Pernambuco and Peru.

This frog is interesting as the only representative of the genus *Rana* in South America. Few species have been more misunderstood and have given rise to more discussion

than this *R. palmipes*, originally described from the Amazonian region of Brazil.

It has been made the type of a distinct genus (*Ranula*, *Pohlia*) by Peters and by Steindachner, and even referred to the Hyliidæ by Günther (1867). Peters founded the genus *Ranula* on the feeble dentition: "Die Zähne des Oberkiefers sind so schwach und wenig zahlreich dass man sie erst bei genauer Untersuchung findet und am Gaumen fehlen sie ganz." The explanation is that *Ranula gollmeri* was described from a recently transformed young, from Caracas, measuring 50 mm. from snout to vent; of this I feel sure, having examined young from Pebas of exactly the same size with a short tail and toothless upper jaw. A second, larger specimen, also from Caracas, was described at the same time by Peters as *Rana affinis*, and regarded as so closely related to *R. temporaria* that it should perhaps rank as a local variety only. A little later, however, Peters recognized that the two supposed species were identical and correctly referred them to *R. palmipes*. In 1866, Cope took up the genus *Ranula* and defined it as the American representative of *Hylarana*, differing in the "important particulars of the incompleteness of the ethmoid arch, its superior plate being represented by cartilage." Cope, who maintained the definition up to the close of his labours, can only have examined young specimens, for in the adult the ethmoid is ossified exactly as in *Rana temporaria*.

Schlegel, Tschudi, and Duméril and Bibron referred *R. palmipes* to the synonymy of *R. esculenta*; Peters described another specimen as a variety of *R. clamitans*; Brocchi's *R. vaillanti* was described as allied to *R. mugiens*; whilst Günther (1900), overlooking the small terminal discs of the toes, compared his *R. bonaccana* to *R. clamitans* and *R. draytonii*.

## 22. *Rana cæruleopunctata*, Sldr., 1864.

*Ranula cæruleopunctata*, *chrysoprasina*, Cope, 1866.—*Hylarana cæruleopunctata*, Steind., 1867.—*Tryphlopsis chrysoprasinus*, Cope, 1868.—*Hylarana chrysoprasina*, Brocchi, 1882.

Nicaragua and Costa Rica, up to 4600 ft. altitude.

XLI. — *A remarkable Cysticercus from a rare Dolphin* (Cysticercus Tæniæ Grimaldii, Moniez, 1889). By H. A. BAYLIS, M.A.

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IN May 1917 a specimen of the rare dolphin *Lagenorhynchus acutus* was stranded at Skegness, on the Lincolnshire coast. It was sent to the British Museum (Natural History), and during its dissection by Mr. W. P. Pycraft there were found under the peritoneum large numbers of cysts. These contained blood-stained fluid, and in each of them, lying free in the fluid, was what appeared to be a *Cysticercus*. In some cases there were also two or three hard calcareous concretions in the fluid, and in one cyst the fluid was milky and opaque.

A number of the cysticerci were carefully preserved by Dr. W. T. Calman, to whom I am indebted for the foregoing details of information. Dr. Calman also observed that on removal from the host (which had been dead at least eleven days) the worms still showed signs of life, and "responded by feeble but quite distinct contractions when prodded with a needle."

The worm appears to be identical with a form described by Moniez (1889) under the name of "*Cysticercus Tæniæ Grimaldii*"\*, the sexually mature form of which is unknown. Although Moniez observed the most striking feature of the animal—viz., its long neck—he does not describe the anatomy very fully, and gives no account of the important characters of the scolex. Further, no figures of this remarkable form are given. It is thought worth while, therefore, to give here a somewhat fuller description, including some account of the scolex, which has features of systematic value.

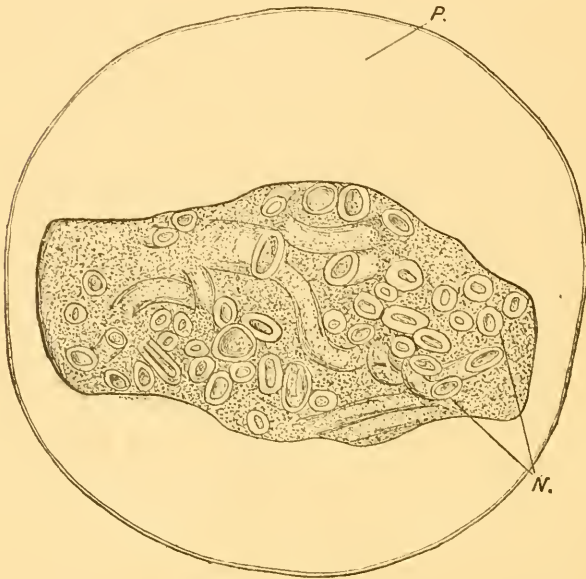
#### ANATOMY.

The cysticerci are yellowish-white in colour (in spirit) and are of very variable size and shape. The length varies from about 8 to 25 mm., according to age and state of contraction.

\* The *Cysticercus Tæniæ Grimaldii* is apparently closely similar to, if not identical with, *Stenotænia delphini*, Gervais, 1870; from this author's description it appears that he took the "neck" to be the worm itself, and the bladder of the cysticercus to be a second cyst containing it.

On the whole, the general form may be described as an elongate pear-shape, the narrower end being that at which the invagination takes place for the formation of the scolex. Frequently the "bladder" is somewhat flattened and pushed in on one side, so that the animal is then convex on one surface and concave on the other. The "anterior" end, or that at which invagination takes place, is often suddenly narrowed, forming a rather proboscis-like projection. The

Fig. 1.



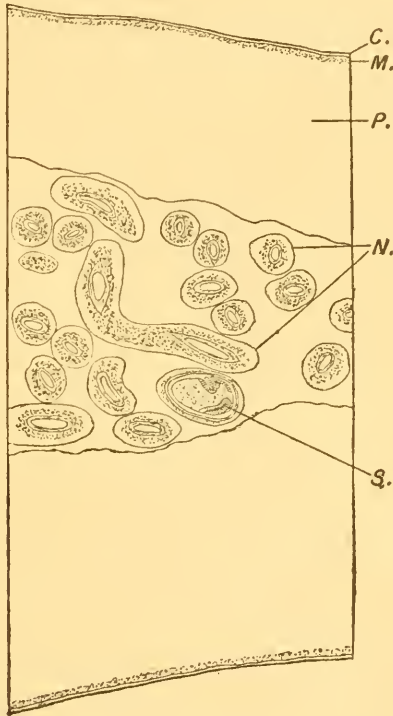
"*Cysticercus Teniae Grimaldii*." View of the animal cut through transversely at about the middle. Much magnified.

N., coils of the "neck" cut across in various directions; P., parenchyme of the "bladder."

wall of the bladder is firm in consistency, but cuts very easily. On opening a specimen, the wall is found to be very thick on two sides and comparatively thin on the other two (fig. 1, P.). The appearance of a small specimen on being thus opened is much like that of the well-known forms of *Cysticercus*, such as *C. pisiformis*, except as regards the

unusual thickness of the wall of the bladder. The larger specimens, however, show a very remarkable structure. The cavity of the bladder is almost entirely filled by an enormously long coiled tube, which on further investigation is

Fig. 2.



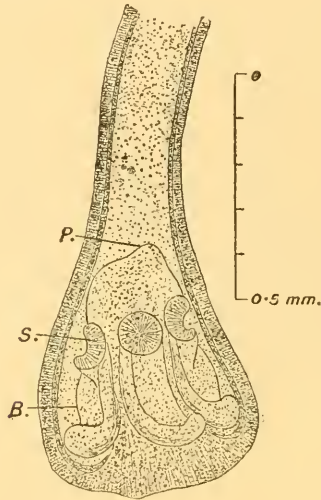
"*Cysticercus Teniae Grimaldii*." Portion of a transverse section near the hinder end, passing through the scolex.

C., cuticle; M., muscle-layers; N., coils of the "neck" cut across; P., parenchyme of the "bladder"; S., scolex.

found to be continuous at one end with the wall of the bladder at the point of invagination, and at the other end by careful search may be seen to end blindly in a slight bulbous expansion which contains a scolex. The tube, in fact, is

simply an extraordinarily elongated "neck," precociously developed within the bladder of the cysticercus. The coils of this tube run in various directions (figs. 1 & 2, *N.*), but in the main antero-posteriorly. After fixation of the worm it is impossible to straighten out this neck for the purpose of measuring it; but Moniez calculated that in one moderate-sized specimen examined by him it measured 65 centimetres, and the length was probably greater still in larger specimens. It must, at all events, be many inches in length.

Fig. 3.



"*Cysticercus Tenia Grimaldii.*" The scolex, as seen by transparency within the swollen blind end of the "neck."

*B.*, bothridium; *P.*, terminal papilla; *S.*, accessory sucker.

The structure of the scolex (fig. 2, *S.*, & fig. 3) is especially important. Moniez dismisses it with the statement that it is provided with four suckers and destitute of hooks. In reality, however, its suckers deserve special attention. They are, strictly, "bothridia" of the type seen in certain Cestodes of the family Phyllobothriidæ—*i. e.*, they have the form of elongated flaps (fig. 3, *B.*) attached to the scolex at their anterior ends and hanging freely posteriorly. Their edges are slightly curled inwards at the sides and behind,

forming a shallow cup. At the anterior end of each bothridium there is a small rounded muscular "accessory sucker" (fig. 3, *S.*). The apex of the scolex bears a slight papilla ("myzorhynchus") (fig. 3, *P.*), but there are no hooks of any kind. The scolex measures about 0.5 mm. in length and about 0.25 mm. in width at the level of the accessory suckers. The bothridia, including the accessory suckers, are about 0.3 mm. long, the diameter of the accessory suckers themselves being 0.1 mm. The neck, in a well-advanced specimen, measures 0.2 mm. in thickness and is of very nearly the same diameter throughout its length, though slightly widened here and there.

The histological structure of the animal presents some features of interest. The wall of the external "bladder," as has been mentioned, is greatly thickened, especially on two opposite sides. The groundwork of this thick envelope consists of loose parenchymatous tissue, with a few scattered muscle-fibres. There is a slight concentration of these towards the periphery, as seen in transverse sections, forming a vague circular layer. Externally the surface is covered with a delicate cuticle, immediately below which there is a thin coat of circular muscle-fibres, followed again by a thin coat of longitudinal muscles.

The parenchyme is densely crowded with calcareous bodies, showing the usual concentric structure. In addition to these there are immense numbers of fat-cells, each enclosing a large globule of fat. This fat is so abundant that it at first hindered the preparation of satisfactory serial sections, as it was found that a layer of it, partially dissolved out of the tissues by the xylol used in the process, was formed round the object when embedded in paraffin in the usual way. This difficulty was found to be easily overcome by a short immersion in ether before clearing. The fat-cells were very beautifully demonstrated by staining thin shavings of the parenchyme with Sudan III. and mounting in glycerine.

The parenchyme of the bladder-wall also contains numerous branching excretory vessels with delicate walls. These empty eventually into a wide and sinuous excretory canal, opening to the exterior by a minute pore at the posterior end of the bladder. This pore is, in some cases, just visible to the naked eye.

The structure of the long "neck" shows the same layers as have been described for the bladder, but in the reverse order, and they may be seen to pass over from one to the

other at the invagination. Thus the neck is lined by a thin cuticle, which is followed by two layers of muscles—the inner coat circular, the outer longitudinal. Outside the longitudinal muscles there is a coat of parenchymatous tissue, with very densely crowded nuclei on the inner side. The outer boundary of this layer, like the inner boundary of the wall of the bladder, is vaguely defined, and the parenchyme-cells seem to be bathed in the fluid contained in the bladder, which in the fixed material has become coagulated into a flocculent mass, containing numerous refringent granules.

#### SYSTEMATIC POSITION.

The structure of the scolex enables the affinities of this larval form to be decided with some precision. It may be assigned definitely to the genus *Monorygma*, Diesing, 1863, of the family Phyllobothriidæ. The question therefore arises whether it can be specifically determined. The worms of this genus, of which six species appear to have been described up to the present, are all parasitic, in their sexual stage, in sharks and dogfish.

The six known species are the following:—

1. *M. perfectum* (van Beneden, 1853) [*Anthobothrium perfectum*].  
Host: *Læmargus borealis*.
2. *M. gracile* (Olsson, 1869) [*Trilocularia gracilis*].  
Host: *Acanthias vulgaris*.
3. *M. elegans*, Monticelli, 1890 [originally described by Zschokke, 1889, under the name of *Monorygma perfectum*, Diesing].  
Hosts: *Scyllium catulus* and *S. stellare*.
4. *M. chlamydoselachi*, Lönnberg, 1893.  
Host: *Chlamydoselachus anguineus*.
5. *M. dentatum*, v. Liustow, 1907.  
Host: a shark (Antarctic) of unknown determination.
6. *M. rotundum*, Klaptocz, 1907.  
Host: *Notidanus* [*Hexanchus*] *griseus*.



As regards the dimensions of the scolex, the present form seems to approach most closely to *M. elegans*, which has been fairly fully described by both Zschokke\* (1889) and de Beauchamp (1905). The length of the scolex in this form is given by Zschokke as 0.4 mm.-0.8 mm., the width of the scolex as 0.3 mm.-0.4 mm., and the width of the neck as 0.1 mm.-0.25 mm. The other measurements given by both authors agree fairly well with those given above for the cysticercus.

There has been some confusion between *M. perfectum* (van Beneden) and *M. elegans*, but on comparing the original descriptions it seems highly probable, as Monticelli (1890, p. 434, footnote) and de Beauchamp (1905) contend, that the two forms are distinct. *M. elegans*, according to de Beauchamp, is 17 or 18 cm. in length, while *M. perfectum* reaches 30 to 40 cm. (van Beneden, 1853, 1861) or 12 to 15 inches (Diesing, 1863). The scolex is also very much larger in *M. perfectum*, measuring, according to van Beneden, 1-2 mm. in width, while Diesing gives it as  $\frac{1}{2}$ -1<sup>m</sup>. *M. perfectum* would appear therefore to be a considerably larger form altogether than *M. elegans*.

#### LIFE-HISTORY.

It would have been extremely interesting if the cysticercus under discussion could have been shown to belong to *Monorhynchus perfectum*, since, as Dr. S. F. Harmer informs me, the host of this species, the Greenland shark (*Læmargus borealis*) has the habit of biting out pieces of the flesh of living Cetacea, and this would have afforded a satisfying account of the life-history of the parasite. If *M. elegans* and *M. perfectum* were shown to be identical, greater plausibility might be lent to this hypothesis. For the present, however, it seems impossible to assign the cysticercus definitely to any of the species. It may very possibly be that of *M. elegans*, which is parasitic in *Scyllium* spp., and to which species, as has been seen, it approaches closely in the size and structure of the scolex. We have also to remember the somewhat remarkable fact that the cysticerci can remain alive for at least eleven days after the death of the host, and even after its removal from the water. Hence they may very well be swallowed by any species of dogfish that devours pieces of dead dolphins containing the cysts.

\* Zschokke describes it under the name of *M. perfectum*, Dies.

As regards the long neck of the cysticercus, it would appear to be one of those apparently useless structures so frequently met with in the animal kingdom, of which no satisfactory explanation is forthcoming. As Moniez remarks: "Tout ce développement se fait en pure perte, car il est bien impossible que la tête du *Ténia* puisse se dévagner." In all probability all but the portion surrounding the scolex is thrown off and lost when the animal finds its way into its final host.

The host of the *Cysticercus Tænie Grimaldii*, Moniez, though its specific name is not given, would appear to have been the common dolphin (*Delphinus delphis*), as was also the host of Gervais's *Stenotenia delphini*. The worm is now recorded for the first time in *Lagenorhynchus*.

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XLIII.—On Indo-Chinese Hymenoptera collected by R. Vitalis de Salvaza.—I. By ROWLAND E. TURNER, F.Z.S., F.E.S.

Family Siricidæ.

*Tremex smithi*, Cam.

*Tremex smithi*, Cam. Trans. Ent. Soc. London, p. 470 (1876). ♀ ♂.

One female, taken at Vieng Vai, Haut Mékong, on June 10, 1918, differs from the typical form in the total absence of yellow abdominal markings, in the more distinct blue gloss on the whole insect, and in the almost clear hyaline base of the wings, extending on the fore wing to the basal nervure and nervulus. I do not know whether these distinctions are merely individual or whether they indicate a local race. The antennæ are 22-jointed.

*Tremex flavicollis*, Cam.

*Tremex flavicollis*, Cam. Mem. Manchester Lit. & Phil. Soc. xliii. p. 3 (1899). ♀.

One female, taken at Vien Poukha, Haut Mékong, on May 11, 1918, differs from the description in having the scutellum covered with long fulvous hairs, and in having the fifth and sixth tergites broadly yellow at the base and clothed with long fulvous pubescence towards the apex. The antennæ are 21-jointed.

*Xiphydria melanopus*, Cam.

*Xiphydria melanopus*, Cam. Journ. Straits Br. R. As. Soc. xxxix. p. 90 (1903).

*Hab.* Nam Lot, Haut Mékong; May 2, 1918. 1 ♀.  
Described from Borneo.

Family Evaniidæ.

*Pristaulacus tuberculiceps*, sp. n.

♀. Ferruginea; capite fusco-ferrugineo; antennis mandibulisque nigris; alis flavis, venis ferrugineis; cellula cubitali prima macula magna sub stigmatate, cellula brachiali secunda striga obliqua basali, nervuloque macula oblonga venam basalem

attingente fuscis; cellula brachiali secunda apice leviter infuscata: capite maximo, vertice fortiter bituberculato. Long. 14 mm.; terebræ long. 12 mm.

♀. Mandibles broad, with two apical teeth, the outer one long, the inner one very short, above the inner tooth the edge of the mandible is broadly rounded. Second joint of flagellum about two and a half times as long as the first, third a little more than half as long again as the second. Clypeus rather sparsely punctured, front minutely and very closely punctured. Head massive, subquadrate, strongly produced behind the eyes, cheeks distinctly longer than the scape, temples distinctly broader than the eyes; posterior ocelli as far from each other as from the eyes and nearly three times as far from the hind margin of the head. Vertex produced posteriorly on each side into a large, upright, blunt tubercle. Behind each of the posterior ocelli, and separated from them by the same distance that separates them from the anterior ocellus, is a minute tubercle, which at first sight resembles a minute ocellus. Thorax without spines or tubercles; neck short; mesonotum and scutellum strongly transversely striated; præscutum concave in the middle anteriorly; mesopleuræ less strongly striated; postscutellum coarsely longitudinally striated, median segment coarsely and irregularly transversely striated, bluntly produced above the insertion of the abdomen. Tarsal ungues with a row of four teeth, excluding the apical tooth. Abdomen stout, the first segment very strongly broadened from the base, third and following tergites clothed with very delicate fulvous pubescence. Second abscissa of the radius half as long again as the first; second transverse cubital nervure incomplete; nervulus distinctly postfurcal; first recurrent nervure received by the first cubital cell at a distance equal to half the length of the first abscissa of the radius before the first transverse cubital nervure. Terebra and valvulæ black.

*Hab.* Vien Poukha, Upper Mekong (*R. Vitalis de Salva*), May 11, 1918. 1 ♀.

Easily distinguished from other species of the genus by the extraordinary form of the head. *Aulacus bituberculatus*, Cam., has similar tubercles on the head, and is probably related to this species, though Cameron says that it belongs to *Aulacinus*, having three cubital cells.

## Family Ichneumonidæ.

## Subfamily PIMPLINÆ.

*Pimpla vitalisi*, sp. n.

♀. Nigra; palpis tegulisque pallide luteis; scutello macula mediana pallide flava; segmentis abdominalibus apice angustissime luteo-marginatis; pedibus anticis, intermediis, coxis exceptis, tibiisque posticis dimidio basali testaceis; alis subhyalinis, flavo-suffusis, stigmatе venisque nigris.  
Long. 18 mm.; terebræ long. 6 mm.

♀. Head transverse, narrowed behind the eyes; clypeus raised at the extreme base and punctured, strongly depressed from near the base and smooth; face closely punctured, with sparse fulvous hairs; front concave, shining and almost smooth, with a narrow longitudinal groove. Eyes widely, but very shallowly emarginate. Antennæ filiform, distinctly shorter than the whole insect, the third joint about half as long again as the fourth. Thorax stout, shining; the mesonotum minutely and very closely punctured; mesopleuræ and scutellum much more strongly and rather sparsely punctured; median segment coarsely and irregularly transversely striate, the sides of the segment rugose-striate, spiracles large, elongate-ovate. Abdomen longer than the head, thorax, and median segment combined, the five basal tergites strongly and very closely punctured-granulate; first tergite not carinate, strongly excavated at the base, the middle raised and obsolete bituberculate; the three apical tergites minutely punctured; all the tergites narrowly transversely depressed at the apex, the depressed portion smooth and luteous. Valvulæ clothed with short hairs. Tarsal ungues not pectinate and without a basal tooth. Areolet sessile, outwardly incomplete on the right wing, complete on the left. Nervulus distinctly postfural.

*Hab.* Pang Tiac, Haut Mékong; May 14, 1918.

Described from a single female.

Closely allied to the South Indian *P. apollyon*, Morl., but the stigma and veins are black, not fulvous as in *apollyon*, the front is more strongly concave and has a sulcus, the mesopleuræ are more strongly and sparsely punctured and the sculpture of the abdomen is coarser. *P. apollyon* is without luteous apical margins on the abdominal segments.

*Xylonomus vitiosus*, sp. n.

♀. Nigra, opaca; palpis, facie, orbitis late, propleuris fascia horizontali, mesonoto antice macula magna utrinque fasciaque obliqua utrinque postice, tegulis, mesopleuris macula lineaque ante alas, scutello macula mediana quadrata, maculaque parva basali utrinque, segmento mediano apice late, abdomine fere toto subtus, tergitis primo, secundo, tertioque macula magna laterali triangulari utrinque, fascia anguste apicali connectis, tergitis 4-7 fascia angusta apicali, pedibusque ochraceis; antennis ante apicem late albido cinctis; alis hyalinis, venis nigris.  
 Long. 16 mm.; terebræ long. 10 mm.

♀. Clypeus extremely short; face finely and very closely punctured; front more finely and sparsely punctured; vertex shining, with a few small scattered punctures. Antennæ about 26-jointed, the ten basal joints black, the next nine whitish, the remainder black. Pronotum produced on each side into an acute tubercle; mesonotum closely punctured, with a tendency to irregular reticulation, notauli deep and crenulate, the lateral lobes separated at the apex by a strongly margined longitudinal groove. Scutellum with a deep transverse excavation at the base, the excavation is smooth and shining and divided by a longitudinal carina, the median portion of the scutellum finely and closely punctured, the sides apically depressed and obliquely striated. Pleuræ closely punctured. Median segment with an elongate triangular basal area which is immediately followed by a larger cordate area reaching to the base of the apical truncation; the spaces on each side of the central areas divided by a transverse carina and margined by a carina laterally and apically, the apical angles produced into a strong spine; the dorsal surface of the segment finely and closely punctured. First tergite half as long again as the second, irregularly rugose-reticulate, the apical portion indistinctly transversely strigose and with a low longitudinal carina. Second and third tergites very closely punctured, the second feebly reticulate at the base, both with oblique striated depressions from close to the base to beyond the middle, also with another oblique depression laterally cutting off a triangular area at the basal angles, a rounded striated groove joining the lateral grooves apically to the median impressions. Apical tergites microscopically punctured. Hind tibiæ black at the extreme base.

*Hab.* Sala San Tiot, Luang Prabang; March 10, 1918.

1 ♀.

Allied to *annulicornis*, Cam., and *elizabethæ*, Bingh., but differs in the absence of blue colouring, in the colour-pattern, in the shorter and broader second tergite, in the spines of the median segment and pronotum, in the contraction of the central area of the median segment, which in the other species is not divided into two, though narrowed in the middle, and in the shorter terebra.

Subfamily *OPHIONINÆ*.

*Dicamptus giganteus*, Szép.

*Dicamptus giganteus*, Szépligeti, Wytsman, Genera Insect. xxxiv. p. 28 (1905).

A single female of this fine species taken at Vieng Vai, Haut Mékong, on June 10, 1918, answers well to the description. The type was from Java.

Subfamily *CRYPTINÆ*.

*Vagenatha spinosa*, Cam.

*Vagenatha spinosa*, Cam. Proc. Zool. Soc. London, p. 41 (1901). ♀.

*Hab.* Pak Lay, Laos; August 2, 1918. 1 ♀.  
Described from Borneo.

Family *Braconidæ*.

Subfamily *BRACONINÆ*.

*Campyloneurus latesuturalis*, sp. n.

♀. Nigra; prothoraco, mesonoto, scutello, mesopleurisque antice rufis; mandibulis, apice nigris, palpisque testaceis; sternitis flavo-ochraceis; alis fusco-hyalinis; stigmatibus venisque nigris. Long. 8 mm.; terebra long. 6 mm.

♀. Face closely punctured and covered with short grey hairs, longitudinally elevated below the base of each antenna. Front and vertex microscopically punctured, the front with a broad, smooth, longitudinal groove below the anterior ocellus. Temples fully half as broad as the eyes; head not narrowed behind the eyes, which are as far from the posterior margin of the head as from the anterior ocellus. Antennæ 47-jointed, about 6 mm. in length. Thorax and median segment shining; the middle lobe of the mesonotum minutely punctured; notauli smooth, extending almost to the posterior margin of the mesonotum. Median segment smooth on the dorsal surface, minutely punctured and

thinly clothed with long grey hairs on the sides. First tergite rugose, the raised median portion with a longitudinal carina, the lateral depressions transversely rugulose, the segment not much longer than its apical breadth. Second tergite as long as its basal breadth, coarsely longitudinally rugose, a median carina not reaching to the apex and dilated at the base into a small, smooth, triangular area; on each side from near the basal angles a longitudinal carina curved at the base extends nearly to the apex of the segment, outside these carinæ the segment is irregularly obliquely striolate. Suture between the second and third tergites very broad, coarsely longitudinally striated; third tergite less coarsely and more closely longitudinally striated, fourth and fifth tergites punctured-rugose, crenulate at the apex. Hypopygium cultriform, extending beyond the anus. Valvula covered with very short black hairs. Cubital nervure sharply elbowed close to the base; second abscissa of the radius almost as long as the third; recurrent nervure received just before the first transverse cubital nervure.

*Hab.* Tong King, Haut Mékong, April 13, 1918. 1 ♀.

This is related to "*Bracon*" *umbratilis*, Cam., which occurs in the Khasi and Naga Hills, but the securiform articulation is much broader, the sculpture of the abdomen is coarser and different, and the median segment is smoother. The sculpture seems to be nearer to that of "*Bracon*" *firmus*, Cam., but Cameron does not mention the sculpture of the third tergite, and the calcaria in *firmus* are said to be white, not dark as in the present species.

#### Subfamily *EXOHECINÆ*.

##### *Eumorpha vitalisi*, sp. n.

♀. Ferruginea; mandibulis apice, antennis, abdomine supra pedibusque nigris; mandibulis basi, facie, pedibusque anticis intermediisque flavo-ochraceis; abdomine subtus albido-flavo, nigro-maculato; alis flavis, tertio apicali infuscatis; venis apice fuscis; stigmatibus venisque basi ochraceis.

Long. 18 mm.; terebræ long. 21 mm.

♀. Face opaque, delicately punctured-rugulose, sparsely clothed with long fulvous hairs. Antennæ about 15 mm. in length, 107 jointed. Front smooth and shining, shallowly concave, with a low longitudinal carina; vertex shining, with small sparse punctures. Head slightly narrowed behind the eyes, which are nearly as far from the posterior margin of the head as they are from the anterior ocellus. Thorax smooth and shining; notauli shallow,



extending well beyond the middle of the mesonotum ; median segment finely and rather closely punctured at the base, smooth at the apex, with a longitudinal median groove. Abdomen elongate, about half as long again as the head, thorax, and median segment combined, the four basal tergites longitudinally coarsely rugose-striolate ; the first tergite coarsely obliquely striate on the basal half, nearly half as long again as its apical breadth, rather strongly convex in the middle, the lateral grooves indistinctly transversely striated. Second tergite with a feebly convex and strongly longitudinally striated, but ill-defined, triangular basal space reaching to the middle ; the spaces at the anterior angles small, divided from the rest of the tergite by a smooth oblique groove, the tergite nearly as long as its apical breadth. Suture between the second and third tergites, also the two following sutures finely crenulate. Third and fourth tergites much broader than long ; with large smooth areas at the basal angles nearly reaching the apical angles and bounded by a finely crenulated groove. Fifth tergite rugose in the middle, the remaining tergites minutely punctured. Valvulæ clothed with short hairs which are black on the basal half, fulvous towards the apex ; terebra with four ill-defined joints on its apical third. Nervulus strongly postfureal ; radial cell not quite reaching to the apex of the wing, second abscissa of the radius as long as the third, recurrent nervure interstitial.

*Hab.* Vieng Vai, Haut Mékong ; June 10, 1918. 1 ♀.

This genus was described by Szépligeti from an Ethiopian species, *E. nigripennis*, Szép.

The present species agrees well in structural details with that insect, though the recurrent nervure is not interstitial in *nigripennis*. Both species show the curious jointed terebra. Superficially and in colour the present species resembles *Iphiaulax halyætus*, Cam.

#### Subfamily AGATHINÆ.

##### *Cremnops mekongensis*, sp. n.

♀. Testacea ; antennis, tibiis posticis apice, tarsis posticis, terebra valvulisque nigris ; alis flavo-hyalinis, venis flavis, vena basali macula ferruginea.

Long. 8 mm. ; terebræ long. 3 mm.

♀. Rostrum very long ; head smooth and shining, the front deeply excavated above the base of the antennæ, the excavation divided by a longitudinal carina ; a few small punctures on the vertex. Mesonotum finely punctured, a

distinct longitudinal furrow on the anterior portion of the median lobe; notauli deep and finely crenulate, reaching almost to the posterior margin. Scutellum convex, shining, with sparse minute punctures; a deep, broad, transverse groove at the base, in which are three longitudinal carinæ. Median segment with two strong, parallel, longitudinal carinæ in the middle, on each side of which are two rather low parallel carinæ, between the carinæ are lower transverse carinæ giving the segment a coarsely reticulate appearance; on a slightly lower level is an oblique lateral carina on each side just below the spiracle. Mesopleuræ sparsely and finely punctured. Abdomen smooth and shining. Hind legs strongly punctured and pubescent, tarsal unguis bifid. First abscissa of the radius shorter than the second; cubital nervure separating the first cubital and discoidal cells obsolete, except at the base; second cubital cell quadrate, the second transverse cubital nervure with a feeble angle above the middle. Radial cell reaching almost halfway from the apex of the stigma to the apex of the wing.

*Hab.* Vien Poukha, Haut Mékong, May 11, 1918. 1 ♀.

*Euagathis dubiosus*, sp. n.

♂. Flavo-testaceus; flagello, abdomino pedibusque posticis nigris; alis flavis, stigmatibus venisque flavis, macula parva prope basin stigmatis nigra.

Long. 10 mm.

♂. Face finely punctured, with a short median depression below the base of the antennæ, the lamellæ between the antennæ small. Front only shallowly concave; the concave area without marginal carinæ, smooth and shining; vertex sparsely and very minutely punctured. Antennæ about 12 mm. in length. Mesonotum closely and finely punctured; the median lobe obliquely depressed anteriorly; with three low carinæ extending from the anterior margin to beyond the middle, the apex of the lobe beyond the carinæ smooth and shining; notauli deep, not crenulate. A deep, broad depression, in which are three longitudinal carinæ, at the base of the scutellum; postscutellum longitudinally striated. Median segment with a longitudinal carina above and another below the large elongate spiracle, the dorsal surface with a transverse basal depression and three almost parallel longitudinal carinæ, two oblique carinæ on each side from the basal depression almost reaching the lateral carina. Abdomen smooth and shining, a small transverse depression on each side at the base of the second segment. Hind legs very closely punctured; tarsal unguis bifid. Second cubital

cell almost pointed on the radius, the second transverse cubital nervure curved. Apex of the radial cell a little further from the apex of the wing than from the apex of the stigma.

*Hab.* Houei Sai, Haut Mékong, June 6-10, 1918. 1 ♂.

Possibly a form of *Agathis maculipennis*, Brullé, which it resembles in colour, but the second fuscous spot on the fore wing is absent in the present species. Brullé's description is not sufficient to indicate whether his species should be placed in *Euagathis* or *Disophrys*.

XLIII.—*A remarkable new Ball-rolling Beetle*  
(Family Scarabæidæ). By GILBERT J. ARROW.

(Published by permission of the Trustees of the British Museum.)

A SINGLE specimen of the extraordinary insect here represented, bearing no label to record its origin or habitat, was in the collection of the late B. G. Nevinson, recently presented to the British Museum by his son. Probably, like its nearest allies, it inhabits the western part of Southern Africa, possibly the Bihé district of Angola, from which Mr. Nevinson received other interesting beetles. The specimen is a male, and the great enlargement of the fore legs is no doubt distinctive of that sex. The enormously thickened front femora seem to indicate great muscular power, and the strangely shrunken intermediate legs appear more singular by contrast. The insect is a striking example of specialization by successive atrophy of its members. The front tarsi have disappeared in all the ball-rolling Scarabæidæ; the wings also have gone in the present genus, and here we seem to be advancing towards a reduction in the number of legs from six to four.

I refrain from establishing a new genus for this species in view of the unsatisfactory character of several of those at present recognized in the group. I can find no sufficient reason for separating *Pachysoma* and *Mnematum*. Although *M. silenus*, Gray, has the middle coxæ apart, the type-species, *M. ritchii*, has not, and the features relied upon by Macleay for its severance from *Pachysoma* have been found to have no importance. Similarly, there seems no adequate ground for separating *Mnematum* from *S-basteos*.

*Mnematum cancer*, sp. n.

Nigrum, nitidum, glabrum, corpus depressum, latissimum, capite antice 6-dentato, supra haud dense tuberculato, pronoto hic et illic minute punctato, lateribus serratis, basi leviter sinuato,

utrinque obtuse angulato; elytris brevissimis, subtiliter obsolete striatis, haud punctatis; pedibus anticis validissimis, femoribus fortiter incrassatis, antice acute tridentatis, coxis anticis etiam acute dentatis, tibiis elongatis, extus post medium dentibus sat brevibus 4 armatis, intus serratis, apice leviter incurvato, pedibus intermediis mirabile reductis, tibiis brevibus, apice calcare spatulato munito, tarsis ad horum extremitates vix attingentibus, pedibus posticis modice elongatis, tibiis gracilibus, leviter arcuatis, apice calcaribus spatulatis quam tarsis dimidio brevioribus praeditis, extus hirtis nigris dense ordinatis bis cristatis, crista interiori integra, exteriori interrupta; unguibus minutis, haud curvatis aut divergentibus.

Long. 48 mm.; lat. max. 32 mm.

This has no close relationship with any other known species. Not only is it much larger, but the conformation of the legs is very different. Their hairy fringes are much



*Mnematum cancer*, sp. n., natural size.

shorter and more compact, and the swollen and strongly toothed front femora and the greatly reduced middle pair of legs have no counterpart in any other species. The shape of the head is as in the species of *Sebasteos*, very broad and sparsely studded with tubercles. The pronotum is distinctly broader than the elytra and bears only a few small clusters of minute punctures. There is a short upturned fringe of hairs near the middle of the serrated lateral margins, which meet

the regularly curved basal margin in an obtuse angle on each side. The very short elytra are shining, like the pronotum, and show traces of fine striæ but no punctures. The pygidium is smooth but for a few scattered punctures. The front femora are almost like those of the male *Pachylomera femoralis*, having a tooth near the base connected by a serrated carina with one of the two sharp teeth situated near the articulation with the tibia, and the coxa is also toothed in front. The great broad front tibia is armed with four teeth along the anterior half of the outer edge, the inner edge is serrated and above it is an upturned fringe of short hairs, while the upper face has also two small brushes of similar hairs upon its anterior half. The middle and hind tibiæ each bear a blunt spatulate terminal spur, extending beyond the tarsus in the middle legs, but only half its length in the hind ones. The hind tibia has two parallel fringes of stiff hairs directed upwards, the inner one continuous and the outer interrupted. Both pairs of tarsi are rather broad and the claws are minute, short, straight, and not divergent.

## PROCEEDINGS OF LEARNED SOCIETIES.

### GEOLOGICAL SOCIETY.

December 4th, 1918.—Mr. G. W. Lamplugh, F.R.S.,  
President, in the Chair.

The following communication was read:—

‘The Carboniferous Succession of the Clitheroe Province.’ By Lt.-Col. Wheelton Hind, M.D., B.S., F.R.C.S., F.G.S., and Albert Wilmore, D.Sc., F.G.S.

The tectonic structure of the province consists of three dissected parallel anticlinal folds in beds of Carboniferous-Limestone, Pendle-side, and Millstone-Grit age. The general direction of the axes of these folds is east-north-east and west-south-west. Dissection has exposed the lower beds of Z, C, and S age, as the tectonic axes and beds of D, P, and Millstone-Grit age occur on the flanks.

The Limestone sequence shows all the zones from Z to D. *Modiola* and *Cleistopora* phases have not been exposed, the base of the Carboniferous not being seen. The Z beds are much thickened, and not so fossiliferous as in the Bristol Province. C and S beds are, as a rule, well-bedded, with shales intercalated between beds of limestone. There are crinoidal beds of considerable thickness in places, and shell-breccias are common in S. *Zaphrentis omaliusi* indicates an important horizon in Lower C, and these

beds are characterized by numerous large gasteropods. *Productus humerosus (sublævis)* marks an equally important horizon in Upper C, as it does in the Belgian Province.

D beds are peculiar in the western part of the Clitheroe Province, and are largely represented by shales, mudstones, and thin earthy limestones; but in the north and north-east, in the Settle and Burnsall districts, thick, fossiliferous, obscurely-bedded limestones with a rich brachiopod and molluscan fauna occur.

The Pendleside Series is well developed, and practically the whole sequence is exposed on the north-western flank of Pendle Hill. This series can be subdivided into life-zones by the Goniatites.

The lower 300 feet consists of well-bedded earthy limestones with much chert, characterized by the presence of *Prolecanites compressus*. As a rule, there is a well-marked limestone horizon, which the Authors name the Ravensholme Limestone (from a farm of that name at the north-eastern end of Pendle); this limestone contains *Zaphrentis amplexoides*, *Cyathaxonia rushiana*, *Michelelinia tenuisepta*, and *M. parasitica*, and the fauna is a very important and constant feature throughout the whole province. The Ravensholme Limestone is an important part of the 'Pendleside Limestone' of the late Mr. R. H. Tiddeman.

The Pendleside Limestone is succeeded by hard, black, calcareous shales with *Glyphioceras striatum*, *Nomismoceras rotiforme*, and *Posidonomya becheri*; and these in turn by the Bowland Shales of Phillips, which contain the zones of *Glyphioceras spirale* and *Glyphioceras bilingue*.

The Upper Pendle Grit succeeds the zone of *Glyphioceras bilingue*, and is the homotaxial equivalent of Farey's Grit of the Peak Country.

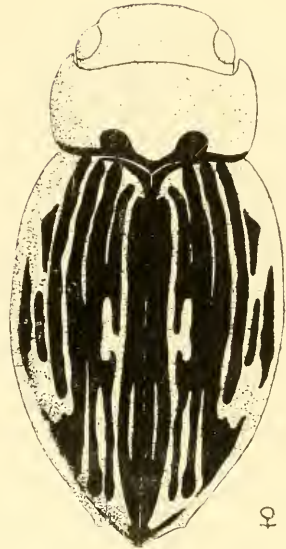
An important horizon occurs between the Kinderscout and the Millstone Grit—Sabden Shales—characterized by a rich fauna with *Glyphioceras beyrichianum* and *Glyphioceras reticulatum*. It is considered probable that the well-known fossiliferous Hebden-Bridge Beds may be on this horizon rather than in the Pendleside Series.

TABLE OF GONIATITE ZONES.

	'Middle' Coal Measures.	<i>Gastrioceras carbonarium</i> von Buch.
	Lower Coal Measures.	<i>Gastrioceras carbonarium</i> von Buch.
	Upper Millstone Grit.	<i>Gastrioceras listeri</i> Martin.
	Sabden Shales.	<i>Glyphioceras diadema</i> Beyrich.
Zones of the Pendleside Series.	Shales below Millstone Grit.	<i>Glyphioceras bilingue</i> Salter.
		<i>Glyphioceras reticulatum</i> Phillips.
	Bowland Shales.	<i>Glyphioceras spirale</i> Phillips.
		<i>Glyphioceras striatum</i> Phillips.
	Posidonomya becheri Shales.	<i>Nomismoceras rotiforme</i> Phillips.
Carboniferous Limestone D <sub>2</sub> .	<i>Prolecanites compressus</i> Sowerby.	
		<i>Glyphioceras crenistria</i> Phillips.



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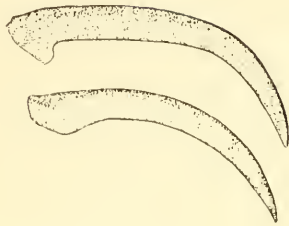
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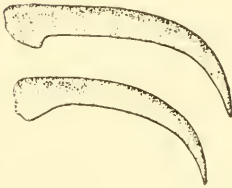




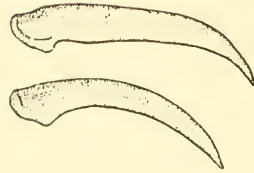
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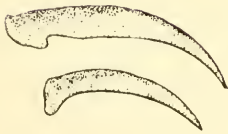
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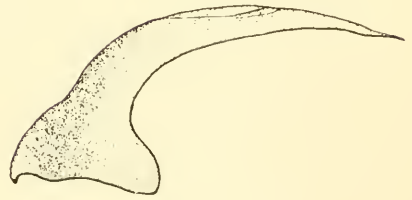
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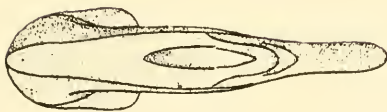
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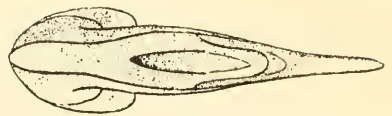
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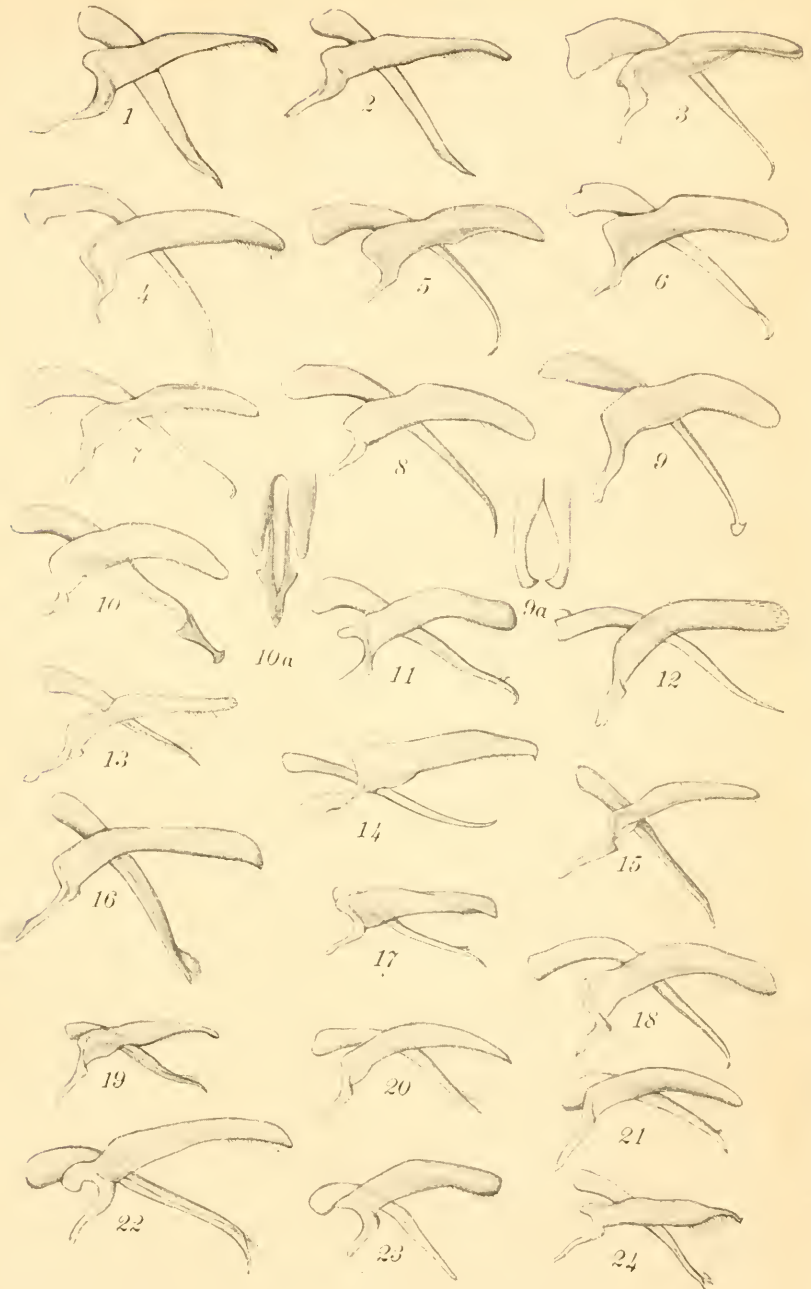
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Roruer Knight, del.

Figs. 1-24. Genital armature,  $\sigma$ , of species of *Prionocerus* and *Idgia*.







Horace Knight, del.

FIGS. 25-49. Genital armature, ♂, of species of *Idgia*.  
 FIG. 49A. Sixth ventral segment of *I. pallidicolor*. ♀.  
 FIG. 50. Apices of elytra of *I. uncigera*, ♀.



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	Page
XXIX. On <i>Deronectes depressus</i> , Fab., and <i>elegans</i> , Panzer. By FRANK BALFOUR-BROWNE, M.A. (Oxon. et Cantab.), F.R.S.E., Lecturer in Entomology in the Department of Zoology, University of Cambridge; Staff Lecturer in Entomology in France; Capt. R.A.M.C.T. Reserve. (Plates VII. & VIII.)	293
XXX. On the Geographical Distribution of the Genus <i>Cosmophila</i> , a Noctuid of the Family <i>Gonopteridæ</i> . By Colonel C. SWINHOB, M.A., F.L.S., &c. (Plates IX. & X.)	309
XXXI. New Lycenids and Hesperids and Two new Species of the Noctuid Family <i>Acontiidæ</i> . By Colonel C. SWINHOB, M.A., F.L.S., &c.	314
XXXII. The Status of <i>Parabates</i> , Foerster, and <i>Parabatus</i> , Thomson [Hymenoptera, <i>Ichneumonidæ</i> ]. By J. CHESTER BRADLEY, Ph.D., Cornell University, Ithaca, N.Y.	319
XXXIII. The Malacoderm Genera <i>Prionocerus</i> and <i>Idgia</i> , and their Sexual Characters [Coleoptera]. By G. C. CHAMPION, F.Z.S. (Plates XI. & XII.)	325
XXXIV. A Note on the Egg-burster of Eucephalous Fly-larvæ. By F. W. EDWARDS	372
XXXV. The Amphipod <i>Orchestia tucurana</i> , Fritz Müller, of Brazil, redescribed from New Zealand Specimens. By CHAS. CHILTON, M.A., D.Sc., LL.D., C.M.Z.S., Hon. Memb. Roy. Soc. N.S.W.	376
XXXVI. North Pacific <i>Zoroasteridæ</i> . By WALTER K. FISHER, Director, Hopkins Marine Station of Stanford University, California.	387
XXXVII. Notes on Fossorial Hymenoptera.—XXXVII. On some <i>Sphecinae</i> in the British Museum. By ROWLAND E. TURNER, F.Z.S., F.E.S.	393
XXXVIII. New Australian Diplopterous Hymenoptera. By ROWLAND E. TURNER, F.Z.S., F.E.S.	398
XXXIX. Remarks on the Age of some Arctic and North-Atlantic Starfishes. By JAMES A. GRIEG, Curator of the Bergen Museum, Bergen, Norway	400
XL. Synopsis of the American Species of <i>Rana</i> . By G. A. BOULENGER, F.R.S.	408
XLI. A remarkable <i>Cysticercus</i> from a rare Dolphin ( <i>Cysticercus Tænicæ Grimaldii</i> , Moniez, 1889). By H. A. BAYLIS, M.A.	417
XLII. On Indo-Chinese Hymenoptera collected by R. Vitalis de Salvaza.—I. By ROWLAND E. TURNER, F.Z.S., F.E.S.	425
XLIII. A remarkable new Ball-rolling Beetle (Family <i>Scarabæidæ</i> ). By GILBERT J. ARROW	433

PROCEEDINGS OF LEARNED SOCIETIES.

Geological Society	435
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XLIV.—*Descriptions of New Pyralidæ of the Subfamilies Crambinæ and Siginæ.* By Sir GEORGE F. HAMPSON, Bart., F.Z.S., &c.

[Continued from p. 292.]

(169 d) *Crambus acyperas*, sp. n.

♀. Head white with a dorsal brown streak; antennæ fuscous; sides of frons, maxillary palpi at base, and palpi except above towards tips brown; thorax cupreous with a dorsal white stripe; abdomen white suffused with brownish ochreous; legs suffused with brown. Fore wing cupreous rufous; a silvery white fascia from base through the cell confluent with an oblique wedge-shaped mark from apex, defined above and below by dark streaks; a silvery white fascia from base of inner margin to termen at vein 1, defined below by a dark streak and leaving some rufous on inner margin except towards base; an indistinct curved rufous subterminal line defined on outer side by silvery whitish, interrupted by the white fascia, the area beyond it whitish finely pencilled with brown and with blackish streaks in the interspaces from below the fascia to below vein 2; the apex strongly produced and acutely falcate; cilia silvery white with some red-brown at tips. Hind wing silvery white faintly tinged with brown. Underside of fore wing and costal area of hind wing suffused with red-brown.

*Hab.* BR. E. AFRICA, Uganda Ry., Mile 478 (*Betton*), 5 ♀ type, E. Quaso (*Betton*), 1 ♀. *Exp.* 24–26 mm.

*Ann. & Mag. N. Hist.* Ser. 9. Vol. iii.

(169f) *Crambus chilianellus*, sp. n.

Head, thorax, and abdomen whitish suffused with red-brown, the head and thorax with some blackish scales; antennæ white tinged with cupreous brown; palpi, pectus, and legs suffused with cupreous brown. Fore wing white tinged with rufous; the costal edge black to end of cell; a silvery white fascia below medial part of costa; a silvery white fascia from base through the cell to termen where it is met by an oblique bar from apex, its terminal half defined above and below by slight dark streaks and with a fine black streak below it in submedian fold to end of cell; the apex strongly produced and acute; a fine black line on termen towards apex and minute black points below veins 5, 4, 3; cilia silvery white with a rufous line near base at middle and some rufous at tips. Hind wing silvery white tinged with brown, the cilia pure white. Underside of fore wing and costal area of hind wing suffused with red-brown except on terminal areas.

*Hab.* CHILI, Mulchen (*Elwes*), 1 ♂, 3 ♀ type. *Exp.* 30 mm.

(169g) *Crambus vittiterminellus*, sp. n.

Head, thorax, and abdomen whitish suffused with cupreous brown; palpi and fore legs more fuscous brown. Fore wing whitish suffused with cupreous brown especially on costal area; a white fascia on median nervure from near base to the postmedial line, defined above and below by diffused blackish streaks; postmedial line slight, cupreous brown, very oblique from costa to discal fold at end of the fascia, then defining its lower edge to origin of vein 2 where it terminates; subterminal line cupreous brown defined on outer side by white, oblique to discal fold, then inwardly oblique and very slightly sinuous; an oblique wedge-shaped white mark from apex, then a series of minute elongate black spots defined by white to submedian fold; cilia silvery white with a cupreous line near base and some cupreous at tips. Hind wing silvery white tinged with brownish ochreous, the cilia pure white. Underside of fore wing and costal area of hind wing suffused with brown.

*Hab.* BR. C. AFRICA (*Coryndon*), 1 ♀, Mlanje Plateau, 6500' (*Neave*), 2 ♂, 3 ♀ type. *Exp.* 24 mm.

(173a) *Crambus mesombrellus*, sp. n.

♂. Head and thorax pure white, the sides of palpi, tegulæ, and patagia red-brown; abdomen white dorsally tinged with ochreous; fore legs red-brown in front. Fore wing silvery white; a diffused red-brown fascia in submedian fold to beyond end of cell. Hind wing silvery white tinged with reddish brown except on inner and terminal areas. Underside suffused with red-brown except on terminal areas.

*Hab.* N. NIGERIA, Borgu, Yelwa Lake (*Migeod*), 1 ♂ type. *Exp.* 24 mm.



(193 a) *Crambus peralbellus*, sp. n.

Head and thorax pure white; antennæ fulvous below; palpi with a fuscous band near extremity of 2nd joint and spot below 3rd; abdomen white, tinged with yellow towards base and brown towards extremity and on ventral surface; fore tibiæ and tarsi yellow, the tarsi black at extremities. Fore wing pure white, the costal edge brownish towards base; a slight fulvous yellow striga on upper discocellular, placed on a sinuous pale brown line with an orange-yellow mark before it on costa; an orange-yellow post-medial point on costa; subterminal line pale brown, excurved to vein 4, then incurved, a fine orange-yellow line beyond it from costa to vein 6; the termen with slight black striæ from below apex to below vein 5 and three points between vein 4 and submedian fold; cilia metallic silver. Hind wing pure white with a slight brown terminal line. Underside of fore wing suffused with brown except on terminal area, a curved brown postmedial line.

*Hab.* GOLD COAST, Bibianaha (*Spurrell*), 5 ♂, 4 ♀ type, Kumasi (*Sanders*), 1 ♂; S. NIGERIA, Lagos (*Sir G. Carter*), 1 ♂. *Exp.* 16 mm.

(193 b) *Crambus argenticilia*, sp. n.

Head and thorax silvery white; abdomen white tinged with brown; antennæ brownish below; palpi with fuscous bands near extremity of 2nd joint and base of 3rd; fore legs suffused with golden cupreous, the tarsi banded with cupreous. Fore wing silvery white, the costal edge brownish to end of cell; a sinuous brown medial line with a black discoidal point on it; subterminal line pale brown, excurved to vein 4, then incurved, a small wedge-shaped rufous mark beyond it on costa, narrowing to a point at apex; a black-brown terminal line from just below apex to above tornus; cilia metallic silver with a golden tinge. Hind wing silvery white with a fine dark terminal line from just below apex to vein 2. Underside of fore wing suffused with brown except on inner and terminal areas, a curved brown postmedial line.

*Hab.* SIERRA LEONE, 1 ♂ type; GOLD COAST, Kumasi (*Sanders*), 2 ♀; S. NIGERIA, Yaba (*Simpson*), 1 ♀. *Exp.*, ♂ 14, ♀ 16 mm.

(193 d) *Crambus fulvinotellus*, sp. n.

♀. Head and thorax silvery white, the antennæ and palpi except above bright fulvous, the tegulæ with subdorsal bright fulvous stripes and the dorsum of thorax fulvous; abdomen white suffused with brown, the anal tuft bright fulvous at tips; fore tibiæ and tarsi and the mid and hind tarsi at extremities golden fulvous. Fore wing silvery white; the costa bright fulvous, expanding into a small triangular mark above end of cell and into a mark rounded below and bisected by a white striga towards apex, defined below by dark fulvous on terminal half; a small triangular fulvous spot at middle of inner margin with a streak beyond it on

the margin expanding into a slight tooth towards tornus; a rather lunulate deep fulvous terminal line; cilia bright fulvous with a deep fulvous line near base. Hind wing silvery white. Underside of fore wing white, the costal area tinged with brown except at apex.

*Hab.* LOUISIANDES, St. Aignan (*Meek*), 3 ♀ type. *Exp.* 14 mm.

(204 e) *Crambus endoxantha*, sp. n.

♂. Head and thorax fulvous yellow; antennæ white tinged with yellow; abdomen white suffused with fulvous yellow towards base and on ventral surface; pectus and legs white, the tibiæ and tarsi tinged with fulvous yellow. Fore wing with the costal area to discal fold bright rufous, the costal edge white; a silvery white fascia through the cell, ending rather diffusely before termen, the area below it fulvous yellow with a white streak defined above and below by dark scales along vein 2 to towards termen; the veins beyond upper angle of cell with slight pale streaks; a terminal series of slight dark points; cilia white mixed with some red-brown especially at middle. Hind wing silvery white with a faint yellowish tinge. Underside white, the fore wing and costal area of hind wing suffused with pale rufous.

*Hab.* TRANSVAAL, Pretoria (*Janse*), 1 ♂ type. *Exp.* 28 mm.

(204 h) *Crambus leucorhabdon*, sp. n.

♀. Head, thorax, and abdomen grey-brown with a slight cupreous gloss, the head and prothorax with some white; pectus with some white. Fore wing grey-brown with a cupreous gloss; the costal edge white except towards base; a silvery whitish fascia through the cell, narrowing beyond the cell, then expanding towards termen to above vein 6, and whitish streaks on veins 5 to 2 and in basal half of submedian fold and terminal half of vein 1; a terminal series of slight dark points; cilia silvery white tinged with brown and with a slight brown line near base. Hind wing pale reddish brown, the cilia white with a brown line near base. Underside pale reddish brown.

*Hab.* U.S.A., Colorado, Florissant (*Cockerell*), 1 ♀ type. *Exp.* 38 mm.

(205 b) *Crambus mediofasciellus*, sp. n.

♀. Head and thorax cupreous brown, the vertex of head whitish; antennæ brown; palpi dark brown mixed with white especially above; abdomen whitish suffused with rufous. Fore wing cupreous brown mixed with some white especially on inner medial area; a rather ill-defined white fascia along median nervure with a fine black streak below it, and slight whitish streaks on the veins beyond the cell defined by dark scales; some indistinct blackish points before and beyond end of cell; a curved subterminal series of blackish points on the inner side of a whitish line with a slight yellowish shade before it; a terminal series of black points; cilia

white tinged with brown and with a fine brown line near base. Hind wing white with a faint red-brown tinge. Underside of fore wing and costal area of hind wing suffused with reddish brown.

*Hab.* BR. E. AFRICA, Nairobi (*Anderson*), 2 ♀ type, Kabeto (*Anderson*), 1 ♀. *Exp.* 22 mm.

(205 c) *Crambus atratellus*, sp. n.

♀. Head and thorax black-brown with a silvery leaden gloss; abdomen dark reddish brown; pectus and legs dark reddish brown. Fore wing dark cupreous brown with a silvery leaden gloss; an indistinct dark discoidal spot; a terminal series of small rather triangular black spots; cilia glossed with silver and with a dark line near base. Hind wing greyish suffused with cupreous brown; a fine dark terminal line and line near base of cilia. Underside greyish suffused with cupreous brown, the costal area of fore wing darker.

*Hab.* BRAZIL, Castro Paraña (*D. Jones*), 1 ♀ type. *Exp.* 26 mm.

(206 a) *Crambus argyrostola*, sp. n.

♀. Head, thorax, and abdomen pure white; palpi at sides, antennæ, and legs pale yellowish brown; wings silvery white. Fore wing irrorated with a very few black scales; the base of costa blackish; two black points on termen above tornus; the apex produced and acute. Underside of fore wing suffused with fuscous to beyond middle.

*Hab.* NATAL, Karkloof (*Marshall*), 1 ♀ type. *Exp.* 36 mm.

(206 c) *Crambus neurellus*, sp. n.

♀. Head, thorax, and abdomen white, the tegulæ and abdomen tinged with pale rufous; antennæ, palpi, pectus, and legs tinged with pale rufous. Fore wing white mixed with pale rufous leaving the veins white, the medial area below the cell with some rather deeper rufous mottlings; a black discoidal point defined by white; a fine black terminal line to vein 2 formed by almost conjoined striæ and a black point at extremity of submedian fold; cilia white with a fine black line at middle. Hind wing white with a fine red-brown terminal line to vein 2. Underside white, the fore wing and costal area of hind wing tinged with rufous.

*Hab.* BR. C. AFRICA, Fort Johnston (*Rendall*), 1 ♀ type. *Exp.* 18 mm.

(206 d) *Crambus digrammellus*, sp. n.

*Crambus ligonellus*, Druce, Biol. Centr.-Am., Het. ii. p. 292 (nec Zell).

Head, thorax, and abdomen ochreous white; palpi irrorated with brown; pectus, legs, and ventral surface of abdomen white. Fore wing ochreous white slightly irrorated with red-brown, the terminal

area finely striated with fuscous, the costal edge brownish towards base; postmedial line red-brown, oblique, arising at vein 7, incurved beyond lower angle of cell and somewhat angled outwards in submedian fold; subterminal line red-brown, excurved to vein 4, below which it is incurved, then again excurved; a terminal series of black points to vein 2. Hind wing ochreous white. Underside pale ochreous.

*Hab.* MEXICO, Presidio (*Forrer*), 1 ♂, 2 ♀ type, Godman-Salvin Coll. *Exp.*, ♂ 16, ♀ 18 mm.

(206 e) *Crambus chionostola*, sp. n.

♂. Head, thorax, and abdomen silvery white; antennæ tinged with brown; palpi rufous at sides; legs tinged with rufous, the tarsi ringed with white. Fore wing silvery white sparsely irrorated with red-brown; an indistinct rather diffused oblique sinuous red-brown line from median nervure near lower angle of cell to inner margin; postmedial line red-brown, rather punctiform, excurved to vein 4 and angled inwards at vein 2; a terminal red-brown line formed by almost conjoined striæ and points. Hind wing silvery white with a faint red-brown tinge. Underside of fore wing suffused with red-brown, the hind wing with the costal area tinged with red-brown.

*Hab.* CEYLON, N. Province, Mankulam (*Pole*), 1 ♂ type. *Exp.* 18 mm.

(206 g) *Crambus brunneisquamatus*, sp. n.

♀. Head, thorax, and abdomen white tinged with ochreous; palpi irrorated with brown. Fore wing narrow, the costa arched; pale ochreous irrorated with brown; traces of a sinuous brown medial line from cell to inner margin, of a slightly waved postmedial line excurved to vein 4, then incurved, and of a curved subterminal line; terminal black points at veins 3 and 2; cilia with a fine brown line before the tips which are white. Hind wing white. Underside of fore wing and costal area of hind wing tinged with rufous.

*Hab.* BR. C. AFRICA, Ruo Distr., Muona (*Old*), 1 ♀ type. *Exp.* 28 mm.

(208 a) *Crambus albiradialis*, sp. n.

♀. Head and thorax fuscous brown with a silvery leaden gloss; abdomen white tinged with brown; palpi whitish at base; pectus, legs, and ventral surface of abdomen white suffused with red-brown. Fore wing fuscous brown with a golden cupreous gloss; the costal edge white; a silvery white fascia through the cell narrowing to points at base and termen; a slight white streak above vein 6 from end of cell to towards termen; a terminal series of black points;

cilia glossed with silver. Hind wing white tinged with brown, the cilia nearly pure white. Underside white, the fore wing and costal area of hind wing suffused with red-brown.

*Hab.* BRAZIL, Rio Janeiro (*Fry*), ♀ type. *Exp.* 32 mm.

Genus CONOCRAMBUS, nov.

Type, *C. atrimictellus*.

Proboscis fully developed; palpi porrect, typically extending about twice the length of head and fringed with hair above and below; maxillary palpi triangularly dilated with hair; frons with small pointed conical prominence; antennæ of male somewhat laminate and minutely ciliated. Fore wing with the apex hardly produced; vein 3 from before angle of cell; 4, 5 from angle and approximated for a short distance; 6 from upper angle; 7, 8, 9 stalked; 10, 11 from cell. Hind wing with vein 3 from angle of cell; 4, 5 shortly stalked; 6, 7 from upper angle, 7 anastomosing with 8.

(1) *Conocrambus atrimictellus*, sp. n.

♂. Head, thorax, and abdomen pale ochreous, palpi at sides and antennæ black-brown, thorax with brown slightly mixed. Fore wing pale ochreous; the costal area black-brown; a large diffused somewhat triangular black-brown patch on inner basal area; the end of median nervure and veins beyond the cell streaked with black; an ill-defined black postmedial line very acutely angled beyond lower end of cell and expanding into a large patch on inner area, its angle joined by a minutely dentate subterminal line from costa; terminal area white irrorated with black scales and with short diffused black streaks on the veins; a terminal series of black points; cilia white with black line through them and black tips. Hind wing fuscous, the costal and inner areas and cilia whitish.

♀. With the ground-colour of fore wing whitish, the markings fuscous, much less distinct and more blurred.

*Hab.* DUTCH N. GUINEA, Obi I. (*Doherty*), 1 ♀; NEW GUINEA, Humbolt Bay (*Doherty*), 2 ♀ type; D'ENTRECASTEAUX IS., Woodlark I. (*Meek*), 1 ♂; LOUISIADE IS., St. Aignan (*Meek*), 1 ♂. *Exp.* 20 mm.

(3) *Conocrambus calamosus*, sp. n.

♀. Head and thorax white suffused with brownish ochreous, the antennæ browner; abdomen white tinged with brown. Fore wing uniform brownish ochreous with a terminal series of slight dark points. Hind wing silvery white. Underside of fore wing silvery white with a faint ochreous brown tinge.

*Hab.* TRANSVAAL, Lydenburg, 1 ♀ type. *Exp.* 30 mm.

(4) *Conocrambus obliqua*, sp. n.

Silvery white; a double fulvous orange stripe on sides of tegulae and thorax; palpi fulvous orange at sides; pectus and legs marked with brown. Fore wing with the costal edge dark towards base; an oblique orange band with darker outer edge from costa before apex to middle of inner margin with a fine streak from it on inner margin towards base, its outer edge bent outwards and connected by a fascia with tornus; termen orange with minutely waved darker line on inner side; cilia orange. Hind wing slightly tinged with fuscous.

*Hab.* BRAZIL, Amazons, 1 ♂, Castro Paraña (*D. Jones*), type in Coll. Rothschild. *Exp.* 16 mm.

(21) *Diptychophora natalensis*, sp. n.

♂. Head, thorax, and abdomen white tinged with ochreous. Fore wing white irrorated with brown and suffused with ochreous leaving some white on inner basal area, defining the lines, and beyond the antemedial and before the postmedial lines towards costa; the lines fuscous and minutely dentate, the antemedial angle below costa, the postmedial at vein 6; a dark-edged yellow figure-of-eight-shaped discoidal spot; a prominent white subapical spot and subterminal series of black points. Hind wing white tinged with ochreous and with terminal brown line towards apex; cilia white tipped with brown in parts on fore wing, with fuscous line through them towards apex of hind wing.

*Hab.* NATAL, Estcourt (*Hutchinson*), 2 ♂ type. *Exp.* 14 mm.

(22) *Diptychophora minimalis*, sp. n.

♂. Head, thorax, and abdomen white tinged with rufous; pectus, legs, and ventral surface of abdomen ochreous white. Fore wing white tinged in parts with rufous, the inner half of medial area and the postmedial area except towards costa irrorated with black; antemedial line white defined on outer side by black scales, slightly sinuous; an ill-defined yellow discoidal spot; an indistinct curved white postmedial line defined on inner side by black scales; a fine black terminal line from apex to vein 4; cilia black at tips towards apex, wholly white at the indentation. Hind wing white with an ochreous tinge on apical area. Underside of fore wing white, the costal area tinged with rufous except a spot beyond middle.

♀. Head, thorax, and abdomen rufous mixed with black; fore wing almost wholly suffused with rufous and irrorated with black, the antemedial line almost medial defined on each side by black and straight, the postmedial line distinctly defined on each side by black; hind wing suffused with fuscous; underside suffused with fuscous, the fore wing tinged with rufous, the hind wing with curved postmedial line.

*Hab.* SIERRA LEONE (*Clements*), 2 ♂, 1 ♀ type. *Exp.* 10 mm.

(26) *Diptychophora argenticilia*, sp. n.

♀. Head, thorax, and abdomen red-brown tinged with greyish fuscous; pectus, legs, and ventral surface of abdomen brownish white. Fore wing deep rufous mixed with some whitish and fuscous, the medial area whiter; a curved blackish medial line; postmedial line blackish, excurved to vein 4, then oblique; a terminal series of slight dark points; cilia deep fiery red at base, with a black line at middle and silvery white tips with some fuscous at tips towards apex. Hind wing white tinged with fuscous; the cilia whiter with a dark line near base. Underside white suffused with fuscous, the fore wing with oblique black bar from costa, the cilia with a black line near base.

*Hab.* JAMAICA, Runaway Bay (*Walsingham*), 1 ♀ type. *Exp.* 12 mm.

(1 a) *Argyria latifasciella*.

(Sect. *Eurhythma*, Turner.) Antennæ of male bipectinate.

Head black with white lines above eyes and at neck; thorax cupreous, abdomen ochreous. Fore wing black suffused with brazen yellow; ante- and postmedial erect white bands with waved edges, the latter broad, its outer sides strongly indented beyond the cell; a terminal black band with series of black points on it. Hind wing white with subterminal blackish band obsolete towards anal angle and with the area beyond it slightly suffused with fuscous.

*Hab.* N. AUSTRALIA, Port Darwin, 1 ♂, 1 ♀ type. *Exp.*, ♂ 12, ♀ 14 mm.

(14 b) *Argyria mesozonalis*, sp. n.

♂. Head and thorax silvery white, the sides of head, subdorsal stripes on tegulæ, and the metathorax bright rufous; abdomen ochreous, tinged with brown except the anal tuft; antennæ rufous; maxillary palpi rufous, white at tips; palpi yellow tinged with rufous; fore femora dark brown above, the tibiæ and tarsi red-brown; pectus, mid and hind legs and ventral surface of abdomen ochreous white. Fore wing silvery white; a bright rufous fascia on costa expanding into a patch at base; a medial rufous band forming a quadrate discoidal patch with a small yellowish spot on it, then narrowing, waved, and slightly irrorated with yellow; a truncate conical patch from the costal fascia before apex, its lower edge produced to a slight oblique tooth; a rufous terminal band with waved inner edge narrowing to a point at apex; cilia paler rufous with a deeper rufous line near base and a silvery gloss at tips. Hind wing silvery white with a faint reddish ochreous tinge; a terminal series of minute dark points to vein 2. Under side of fore wing suffused with red-brown.

*Hab.* PERU, La Oroya (*Ockenden*), 1 ♂ type. *Exp.* 20 mm.

(15 a) *Argyria eromenalis*, sp. n.

♂. Head, thorax, and abdomen white suffused with red-brown, the ventral surface of abdomen pure white. Fore wing white tinged and irrorated with pale red-brown; a rather diffused red-brown medial line defined on inner side by white, incurved below submedian fold; subterminal line white defined on each side by rather diffused red-brown, curved; a terminal series of black points. Hind wing white tinged with red-brown. Underside of fore wing and costal area of hind wing suffused with red-brown.

*Hab.* SUMBAWA, Tambora (*Doherty*), 1 ♂ type. *Exp.* 10 mm.

(18 b) *Argyria bicuspidalis*, sp. n.

♂. Head, tegulæ, and prothorax black-brown, the rest of the thorax red-brown; abdomen whitish suffused with rufous; palpi white below towards base; pectus and legs whitish suffused with rufous; ventral surface of abdomen creamy white. Fore wing yellowish strongly suffused with rufous; a silvery white fascia occupying the cell and bidentate beyond it, the upper tooth short, the lower extending to the subterminal line, the fascia defined below by a black streak on median nervure and to the subterminal line at discal fold; an oblique red-brown postmedial striga from costa to the upper tooth of the fascia; subterminal line red-brown defined on outer side by white and oblique to vein 6, then blackish and angled inwards to near lower angle of cilia, then excurved and again angled inwards above discoidal fold in which it terminates; the terminal area black irrorated with white, narrowing to apex, towards which it is defined on inner side by white, and narrowing to tornus; cilia rufous, black-brown at tips towards apex. Hind wing whitish suffused with red-brown, darker towards termen; cilia whitish tinged with rufous. Underside whitish, the fore wing and costal area of hind wing suffused with red-brown.

*Hab.* BR. C. AFRICA, Mt. Mlanje (*Neave*), 1 ♂; PORTUGUESE E. AFRICA, E. of Mt. Mlanje (*Neave*), 1 ♂ type. *Exp.* 22 mm.

(18 d) *Argyria quadricuspis*, sp. n.

*Platytes* sp., Longstaff, Butterfly-hunting in many Lands, pl. ii. f. 11.

♂. Head red-brown and whitish; thorax red-brown; abdomen ochreous white; antennæ brown; palpi pale red-brown, the maxillary palpi white at tips; pectus and legs ochreous white, the tarsi dark brown ringed with white. Fore wing grey-white suffused and thickly irrorated with reddish brown; a silvery white fascia defined by blackish through the cell extending from just below costa to discal fold where it is produced to a tooth just beyond middle, then narrowing and produced to three teeth well beyond the cell, the middle tooth rather longer, the area beyond its medial part more distinctly irrorated white and dark brown; subterminal line



white defined on each side by red-brown, very oblique from costa to vein 6, waved to vein 4, then oblique and strongly angled inwards just above submedian fold and outwards at the fold; a black terminal line; cilia white at base, then with brown line, the tips pale red-brown intersected with white. Hind wing white with a faint red-brown tinge, the termen deeper brown, rather broadly at apex and narrowing to vein 2; cilia white with a slight red-brown line near base to discal fold. Underside white tinged with red-brown, the fore wing with the costa deeper red-brown towards apex.

*Hab.* RHODESIA, Zambezi, Victoria Falls (*Longstaff*), 1 ♂ type.  
*Exp.* 22 mm.

(22 a) *Argyria obliquistrialis*, sp. n.

♂. Head, thorax, and abdomen creamy white, the last dorsally tinged with rufous towards base; palpi irrorated with black-brown at sides; legs tinged with red-brown. Fore wing creamy white tinged in parts with rufous and irrorated with rather large black-brown scales except on terminal half of costal area; very oblique medial and postmedial rufous striæ from costa; a double rufous subterminal line, oblique towards costa, then curved; a terminal series of black points; cilia white with a fuscous line near base and the tips brown. Hind wing silvery white faintly tinged with brown except on inner area. Underside of fore wing and costal area of hind wing suffused with red-brown.

*Hab.* ARGENTINA, Gran Chaco, Florenzia (*Wagner*), 2 ♂ type.  
*Exp.* 16 mm.

(23 a) *Argyria albiceps*, sp. n.

♂. Head and thorax white, the tegulæ at sides and patagia tinged with red-brown, the vertex of head and thorax with slight dark streak; palpi white mixed with brown; abdomen whitish suffused with dark brown, the anal tuft white tinged with rufous; pectus, legs, and ventral surface of abdomen white tinged with brown. Fore wing whitish suffused with reddish brown leaving the veins white, the area below the cell from before middle and the area beyond the cell except towards costa irrorated with blackish; a black terminal line; cilia white with a black line at middle and some brown at tips. Hind wing brown; a slight dark terminal line; cilia white with a brown line at middle and the tips tinged with brown. Underside suffused with brown.

*Hab.* TRANSVAAL, Bultfontein (*Janse*), 2 ♂ type. *Exp.* 18 mm.

(23 b) *Argyria unipunctalis*, sp. n.

Head and thorax white, the tegulæ at sides and streak through middle of patagia tinged with pale red-brown; abdomen white, dorsally suffused with pale red-brown towards base; palpi, pectus, and legs tinged with pale red-brown. Fore wing white tinged

with pale red-brown and slightly irrorated with darker brown, the veins and costal edge white; a black discoidal point; a terminal series of black points; cilia white with a brown line near base and the tips tinged with brown. Hind wing almost pure silvery white. Underside of fore wing except the costal edge and the costal area of hind wing suffused with pale red-brown.

*Hab.* TRANSVAAL, Tweefontein (*Janse*), 1 ♂, Van der Merwe's Farm (*Janse*), 1 ♂, 3 ♀ type, Pretoria (*Distant, Janse*), 2 ♂. *Exp.* 20-22 mm.

(23 e) *Argyria aræalis*, sp. n.

Head, thorax, and abdomen white tinged with ochreous, the last long and slender; antennæ fuscous at sides; palpi long; fore femora and tibiæ fuscous on inner side. Fore wing long and narrow, the apex produced, ochreous white irrorated with reddish brown; a black discoidal point defined by white; a terminal series of black points; cilia tinged with brown and with a blackish line through them. Hind wing silvery white. Underside of fore wing and costal area of hind wing tinged with red-brown.

*Hab.* MASHONALAND (*Dobbie*), 3 ♂, 3 ♀ type. *Exp.* 16-20 mm.

(24 a) *Argyria albivenalis*, sp. n.

♀. Head, thorax, and abdomen white faintly tinged with rufous, the last with some fulvous yellow at base of dorsum. Fore wing white suffused with rufous leaving the veins white, the interspaces of terminal half slightly irrorated with brown; a slight brown terminal line. Hind wing silvery white. Underside of fore wing and costal area of hind wing tinged with rufous.

*Hab.* PARAGUAY, Santa Cruz (*S. Moor*), 1 ♀ type. *Exp.* 22 mm.

(26 g) *Argyria atrisparsalis*, sp. n.

*Diatræa newricella*, Druce, Biol. Centr.-Am., Het. ii. p. 295 (nec Zell).

Head, thorax, and abdomen white tinged with rufous. Fore wing white tinged with rufous and sparsely irrorated with black-brown, the submedian fold pure white; a minute antemedial black-brown spot on inner margin and black discoidal point; a terminal series of prominent black points slightly defined on inner side by white. Hind wing white faintly tinged with red-brown. Underside white tinged with red-brown.

*Hab.* MEXICO, Vera Cruz, Atoyac (*H. H. Smith*), 1 ♂ type, Tobasco, Teapa (*H. H. Smith*), 1 ♀, Godman-Salvin Coll. *Exp.*, ♂ 26, ♀ 30 mm.

(26 i) *Argyria tumidicostalis*, sp. n.

Hind wing of male with glandular swelling at base of costa.

♂. Head and thorax whitish suffused with red-brown, the palpi at sides and patagia irrorated with black-brown; abdomen white tinged

with red-brown; pectus, legs, and ventral surface of abdomen white tinged with rufous. Fore wing whitish suffused with red-brown; a rather diffused dark red-brown fascia below median nervure to just beyond end of cell and a few black-brown scales beyond the cell; a terminal series of minute black spots with silvery white points in centres; cilia silvery white with a red-brown line at base. Hind wing white, the costal area tinged with red-brown; a red-brown terminal line from apex to vein 2. Underside of fore wing and costal area of hind wing suffused with red-brown.

*Hab.* BENGAL, Patna, 2 ♂ type. *Exp.* 24 mm.

*Larva* in sugar-cane.

(26 j). *Argyria sticticraspis*, sp. n.

♀. Head and thorax greyish ochreous suffused with red-brown; palpi irrorated with dark brown; abdomen greyish ochreous with some rufous at base of dorsum; pectus, legs, and ventral surface of abdomen white tinged with ochreous brown. Fore wing greyish ochreous suffused with red-brown, the cell and areas just below and beyond it irrorated with darker red-brown; a curved post-medial series of small red-brown spots in the interspaces from below costa to above vein 1; a terminal series of minute black spots defined on inner side by slight white spots; cilia with slight red-brown lines near base and at middle. Hind wing pure white. Underside of fore wing white tinged with rufous.

*Hab.* MADRAS, Coimbatore (*B. Fletcher*), 1 ♀ type. *Exp.* 30 mm.

*Larva* in sugar-cane.

(26 k) *Argyria conioarta*, sp. n.

♂. Head and thorax pale red-brown; antennæ ringed black and white; palpi whitish mixed with dark brown; abdomen whitish dorsally suffused with brown towards base; pectus, legs, and ventral surface of abdomen white tinged with red-brown. Fore wing pale red-brown mixed with some whitish and irrorated with blackish especially along median nervure and in and beyond end of cell; a medial series of slight black spots, incurved below the cell and sometimes reduced to the spot below the cell; two blackish discoidal points, the lower one sometimes defined on outer side by white; a more or less distinct curved blackish subterminal line; a terminal series of minute black spots defined on inner side by minute white spots; cilia with two dark lines through them. Hind wing almost pure white. Underside of fore wing and the costal area of hind wing suffused with reddish brown.

*Hab.* SIKKIM, 1800' (*Dudgeon*), 1 ♂; BENGAL, Behar, Pusa, 4 ♂ type. *Exp.* 20-26 mm.

*Larva* in sugar-cane.

(26 l) *Argyria argyropasta*, sp. n.

♂. Head and thorax red-brown mixed with some dark brown; abdomen white tinged with brown; pectus, legs, and ventral

surface of abdomen white tinged with red-brown. Fore wing pale red-brown mixed with whitish and irrorated with fuscous and a few silvery scales; a white streak below basal half of submedian fold and a streak below basal half of vein 5; a curved subterminal series of slight silvery points and slight dark streaks in the interspaces towards termen; cilia brown glossed with silver. Hind wing almost pure white. Underside of fore wing and costal area of hind wing tinged with red-brown.

*Hab.* CAPE COLONY, Annshaw (*Miss F. Barrett*), 1 ♂ type. *Exp.* 1½ mm.

(26 m) *Argyria poliella*, sp. n.

♀. Head and thorax white with a slight brownish tinge; abdomen white with fulvous yellow dorsal patch on 2nd segment. Fore wing white slightly tinged with brown and with greyer streaks in and below cell and between the veins of terminal area; a minute discoidal black point; a very indistinct brown postmedial line, strongly excurved from costa to vein 5 then very oblique; a terminal series of black points. Hind wing white.

*Hab.* BR. C. AFRICA, Upper Shiré R., Zomba (*Rendall*), 1 ♀ type. *Exp.* 26 mm.

(26 n) *Argyria psammathis*, sp. n.

♀. Head and thorax pale red-brown mixed with whitish; palpi irrorated with black; abdomen white tinged with pale red-brown and with some fulvous yellow towards base of dorsum. Pectus, legs, and ventral surface of abdomen white tinged with pale red-brown. Fore wing whitish suffused with pale red-brown and slightly striated with blackish especially on inner half of medial area; a slight dark spot on upper discocellular; postmedial line indistinct, dark, excurved to vein 4, then oblique and slightly sinuous; a terminal series of minute black spots defined on outer side by silvery spots on the cilia. Hind wing almost pure white with a slight dark terminal line from apex to vein 4. Underside of fore wing and the costal area of hind wing tinged with red-brown.

*Hab.* GOLD COAST, Bibianaha (*Spurrell*), 1 ♀; N. NIGERIA, Bida (*Macfie*), 1 ♀ type, Minna (*Macfie*), 1 ♀. *Exp.* 24 mm.

(26 o) *Argyria bipunctalis*, sp. n.

♀. Head and thorax white irrorated with brown; palpi irrorated with large black scales; abdomen, pectus, and legs white tinged with red-brown. Fore wing white irrorated with brown except along median nervure and the base of the veins beyond the cell; two obliquely placed black discoidal points; a black terminal line; cilia silvery white with some blackish at tips. Hind wing silvery white. Underside of fore wing and costal area of hind wing faintly tinged with red-brown.

*Hab.* N. NIGERIA, Zungeru (*Macfie*), 2 ♀ type. *Exp.* 26 mm.

(28 a) *Argyria vittatalis*, sp. n.

♂. Head white, the antennæ tinged with red-brown, the frons at sides and palpi red-brown; thorax red-brown with a cupreous tinge and white dorsal stripe; abdomen white tinged with red-brown; pectus and legs white tinged with red-brown. Fore wing cupreous brown, the area below submedian fold white with some cupreous brown suffusion at base of inner margin and dark irroration above middle of inner margin; the costa pale rufous towards apex with an obliquely curved white fascia from below apex to above median nervure at origin of vein 2, its upper edge somewhat diffused; a slight dark discoidal spot; a dark terminal line with a narrow white band before it ending in a point above submedian fold; cilia white tinged with cupreous. Hind wing pale cupreous brown; a dark terminal line with some white before it except towards tornus; cilia white tinged with cupreous. Underside red-brown, the hind wing with indistinct curved dark subterminal line.

♀. Fore wing without the cupreous brown at middle of inner margin; hind wing white faintly tinged with brown and with a rather darker subterminal band.

*Hab.* BRAZIL, São Paulo (*D. Jones*), 1 ♂, 4 ♀ type; PARAGUAY, Sapucay (*Foster*), 1 ♀. *Exp.* 32-36 mm.

(28 c) *Argyria endochralis*, sp. n.

♀. Head and thorax whitish tinged with red-brown, the tegulæ at sides and patagia bright red-brown; palpi red-brown; abdomen, pectus, and legs whitish tinged with red-brown. Fore wing pale rufous, the area below submedian fold white tinged with rufous and with some dark irroration below medial part of vein 1; a slight brown discoidal lunule; an oblique brown streak from apex to vein 5 beyond the cell; a dark terminal line except towards tornus; cilia with a brown line near base. Hind wing whitish tinged with rufous; a fine brown terminal line except towards tornus. Underside whitish tinged with rufous, the terminal areas rather whiter.

*Hab.* ARGENTINA (*Leech*), 3 ♀ type. *Exp.* 36 mm.

(28 d) *Argyria leucomeralis*, sp. n.

Head white, the antennæ and palpi at sides tinged with rufous; thorax and abdomen white with a golden tinge; fore legs red-brown on inner side. Fore wing with the costa pure white, the wedge-shaped area from just below it to the discal fold red-brown with a golden tinge; the area between discal and submedian folds pure white with some red-brown irroration towards termen; the inner area white tinged with rufous; an indistinct double brown post-medial line filled in with white from submedian fold to inner margin, excurved just above vein 1, then strongly incurved; a silvery white subterminal line slightly defined on outer side by blackish on the red-brown area, then on each side by rufous, oblique towards costa, then excurved and slightly incurved at submedian fold; a dark

terminal line with a black point below submedian fold; cilia white, brown at base at apex and tinged with brown towards tornus. Hind wing silvery white. Underside of fore wing with the costal half red-brown, the inner half white tinged with red-brown; hind wing with the costal area suffused with red-brown.

*Hab.* SIERRA LEONE (*Clements*), 3 ♂, 1 ♀ type. *Exp.* 16-22 mm.

(29 a) *Argyria retractalis*, sp. n.

♂. Head and thorax cupreous brown mixed with white; antennæ, frons, and palpi cupreous brown; abdomen white suffused with red-brown on basal half and with red-brown subdorsal spots on terminal half; pectus, legs, and ventral surface of abdomen white, the tarsi brown at extremities. Fore wing with the basal area white with the costal edge cupreous brown and a patch of cupreous brown suffusion from subcostal nervure to vein 1; antemedial line black defined on inner side by white, arising at subcostal nervure, excurved at median nervure and strongly incurved at vein 1; medial area cupreous brown with a white streak below costa; postmedial line black, minutely waved and defined on outer side by white to vein 3, then retracted upwards to below costa, then with an inward curve to middle of inner margin, its retracted part cupreous brown above discal fold, a white patch before it on costal area and its retracted part with a strong white band on its outer side, a cupreous brown band beyond it and below it from vein 3 to inner margin; the terminal area white with rather dentate inner edge; a punctiform dark cupreous brown terminal line; cilia white. Hind wing silky white with a slight cupreous brown terminal line from vein 7 to below 4. Underside of fore wing and costal area of hind wing suffused with cupreous brown.

*Hab.* BR. GUIANA, Demerara (*Rodway*), 1 ♂ type. *Exp.* 16 mm.

(31 a) *Argyria undulalis*, sp. n.

Head and thorax creamy yellow tinged with rufous; abdomen ochreous with a rufous tinge towards base of dorsum; pectus and legs white, the latter slightly irrorated with brown. Fore wing ochreous suffused with rufous; a rather diffused blackish antemedial line, angled outwards below costa, then waved; an oblique blackish discoidal striga with a waved shade formed by dark scales from it to vein 1; postmedial line blackish with some silvery scales on it, dentate, obliquely excurved to discal fold, then incurved and excurved below submedian fold; a terminal series of minute black points; cilia red-brown at base, silvery white at tips. Hind wing ochreous white with a slight rufous tinge; a terminal series of black points to vein 2; the cilia white. Underside creamy white, the costal areas irrorated with black; both wings with slight curved black postmedial line from costa to vein 4.

*Hab.* BENGAL, Pusa (*Lefroy*), 2 ♂, 2 ♀ type; MADRAS, Bangalore (*Minchin*), 1 ♂. *Exp.*, ♂ 14, ♀ 16 mm.

(31 b) *Argyria conisphoralis*, sp. n.

♂. Head and thorax grey tinged with brown and irrorated with black; antennæ tinged with white; sides of frons with white lines; palpi white below except towards tips; abdomen white suffused with brown; pectus and ventral surface of abdomen white; legs white and brown. Fore wing white almost entirely suffused with red-brown and irrorated with black; antemedial line black, wavy; two black points at middle of costa and two discoidal points on a whitish spot; postmedial line black, excurved from below costa to vein 4, then oblique, sinuous and defined on each side by white; a slight wavy blackish subterminal shade; a fine black line before termen and a terminal line; cilia white with a strong black-brown line through them. Hind wing brown tinged with grey; a blackish terminal line; cilia white, brown at base and with brown line through them. Underside white; fore wing suffused with brown except on costal and inner areas, a blackish mark at middle of costa and curved postmedial line from costa to vein 3; hind wing with the costal area tinged with brown and irrorated with black, a brown postmedial line from costa to vein 2.

*Hab.* C. CHINA, Tientsin (*Thomson*), 1 ♂ type. *Exp.* 14 mm.

(32 a) *Argyria molybdoграмма*, sp. n.

Head, thorax, and abdomen pale creamy yellow, the shoulders tinged with rufous, the base of abdomen more fulvous yellow; palpi tinged with rufous; pectus and legs white, the fore legs tinged with rufous in front. Fore wing pale creamy yellow suffused with rufous, the costal edge blackish towards base; antemedial line black suffused with silver and rather diffused on inner side, excurved below costa and slightly incurved at middle; a pale yellow patch in end of cell defined on outer side by a curved brown line and with a black streak above it on costa; postmedial line black suffused with silver, strongly excurved below costa and slightly above inner margin, slight white marks before and beyond it on costa followed by a short black streak; a terminal series of minute blackish points; cilia creamy white with two strong fuscous lines through them. Hind wing whitish, the terminal area tinged with rufous except towards costa; a curved brownish postmedial line; a slight brown terminal line and line through the cilia interrupted at submedian fold. Underside yellowish white; both wings with the costal areas irrorated with brown, a small brown discoidal spot and postmedial line excurved below costa.

*Hab.* QUEENSLAND, Townsville (*Dodd*), 1 ♂, 1 ♀ type. *Exp.*, ♂ 14, ♀ 16 mm.

(32 b) *Argyria calamockroa*, sp. n.

Head and thorax ochreous tinged with rufous; abdomen ochreous white with a more orange-yellow patch near base of dorsum; pectus and legs ochreous white, the hind tibiae blackish at extremity and

the spurs ringed with black, the ventral surface of abdomen with some black scales. Fore wing ochreous tinged with rufous and irrorated with dark brown; antemedial line represented by blackish spots in the interspaces and black spot at costa, excurved below costa; two slight dark discoidal spots; postmedial line blackish with a small black spot at costa, excurved below costa and slightly above inner margin; a terminal series of black points and striæ; cilia with a black line through them. Hind wing ochreous white; a diffused brownish postmedial line from costa to vein 4; a terminal series of black points with a rather maculate brownish shade before them; cilia with brown mixed. Underside of fore wing ochreous, the costal area whitish irrorated with blackish, antemedial and medial black points on costa; a small discoidal spot with striga above it from costa, and curved brown postmedial line; hind wing ochreous white, the costal half irrorated with blackish, a wedge-shaped patch of black irroration below terminal half of submedial fold, a brown postmedial line from costa to vein 3, excurved below costa.

*Hab.* N. NIGERIA, Zungeru (*Macfie*), 2 ♀; BR. E. AFRICA, Gwelil (*Betton*), 1 ♂ type, Eb Urru (*Betton*), 2 ♀; BR. C. AFRICA, Likoma (*de Jersey*), 1 ♂, Shire Valley, Mwanza (*Neave*), 1 ♀; PORTUGUESE E. AFRICA, Mt. Chiperone (*Neave*), 1 ♂; CAPE COLONY, Annshaw (*Miss F. Barrett*), 2 ♂. *Exp.* 18 mm.

(34 c) *Argyria duplicilinea*, sp. n.

Head white; thorax white mixed with cupreous brown; abdomen fuscous brown with some whitish at base; antennæ black; maxillary palpi at base and palpi below black; pectus, legs, and ventral surface of abdomen brown and white, the tarsi banded brown and white. Fore wing white, tinged in parts with brown and irrorated with a few black scales especially on costal area except towards apex; a minute blackish annulus in middle of cell; medial line black, angled outwards at discal and submedian folds; subterminal line double, black, oblique towards costa, excurved at discal fold and slightly above inner margin, black streaks from it to termen above and below vein 6 and some cupreous brown suffusion at discal fold; a terminal black line towards apex and point below vein 3; cilia with a black line through them towards apex and some cupreous brown at discal fold. Hind wing white suffused with fuscous, the cilia whiter with a black line near base. Underside suffused with fuscous.

*Hab.* SIERRA LEONE (*Clements*), 1 ♂; GOLD COAST, Bibianaha (*Spurrell*), 1 ♀ type. *Exp.* 16 mm.

(34 e) *Argyria leucopsumis*, sp. n.

♂. Head white tinged with rufous; thorax and abdomen rufous mixed with black; antennæ pale rufous; pectus, hind legs, and ventral surface of abdomen white tinged with rufous, the fore and mid legs dark brown, the tarsi ringed with white. Fore wing



whitish suffused with rufous and black-brown, the costal area black-brown irrorated with blue-white; antemedial line black-brown defined on inner side by white, very oblique to median nervure towards end of cell, and strongly incurved at vein 1, a white fascia below costa from it to above end of cell; a rounded black discoidal spot; subterminal line white defined on inner side by black-brown, curved; cilia white at base, tinged with rufous at tips. Hind wing cupreous brown, the cilia creamy white with a slight brown line at middle. Underside of fore wing dark red-brown, a curved whitish subterminal line with streaks beyond it in the interspaces; hind wing suffused with red-brown, a curved dark subterminal line with whitish streaks beyond it in the interspaces.

*Hab.* ASSAM, Khásis, 1 ♂ type. *Exp.* 24 mm.

(34f) *Argyria bostralis*, sp. n.

♀. Head, thorax, and abdomen red-brown tinged with grey, the vertex of head and base of abdomen reddish ochreous; palpi whitish below; pectus, legs, and ventral surface of abdomen whitish tinged with brown. Fore wing red-brown tinged with grey; an indistinct oblique blackish antemedial line; a slight whitish discoidal lunule; postmedial line indistinct, blackish, excurved from below costa to vein 3, then incurved; a terminal series of blackish points. Hind wing grey suffused with brown. Underside grey suffused with red-brown, the terminal areas paler; both wings with indistinct curved dark postmedial line.

*Hab.* BR. E. AFRICA, Uganda Ry., Kibwezi (*Neave*), 1 ♀ type. *Exp.* 22 mm.

(4) *Eudorina semifascia*, sp. n.

♀. Head, thorax, and abdomen whitish strongly suffused with deep rufous, the ventral surface of abdomen whiter, the tarsi ringed with whitish. Fore wing deep rufous; a minute white spot at upper angle of cell; a narrow inwardly oblique white postmedial band from costa to vein 4, defined on outer side by rather diffused dark brown; an indistinct rather diffused dark subterminal line; a dark terminal line; cilia with rather maculate white line at base. Hind wing whitish suffused with rufous. Underside of fore wing rufous with rather diffused inwardly oblique postmedial dark line from costa to vein 4.

*Hab.* DUTCH N. GUINEA, Fak-fak (*Pratt*), 1 ♀ type. *Exp.* 16 mm.

(5) *Eudorina diffusa*, sp. n.

♂. Head, thorax, and fore wing dark red-brown, palpi at base and throat white; legs ringed with white. Fore wing irrorated with some white scales on medial area; a diffused oblique patch from costa to lower angle of cell; an oblique line from apex to vein 6 where it nearly joins a diffused band extending to just

above inner margin; a terminal series of black and white points. Hind wing and abdomen paler.

*Hab.* BR. NEW GUINEA, Milne Bay (*Meek*), 2 ♂; D'ENTRE-CASTEAUX Is., Ferguson I. (*Meek*), 2 ♂ type. *Exp.* 20 mm.

(6) *Eudorina triangulifera*, sp. n.

♂. Head and thorax dark red-brown with whitish stripe on vertex; abdomen paler. Fore wing dark red-brown with slight dark streaks in and below middle of cell; a triangular blackish patch on middle of inner margin with broad whitish edge extending nearly to the cell, a similar postmedial patch on costa extending down to vein 5; an oblique obscure whitish subterminal line. Hind wing paler.

*Hab.* BR. NEW GUINEA, Milne Bay (*Meek*), 1 ♂; D'ENTRE-CASTEAUX Is., Fergusson I., N. Guinea (*Meek*), 1 ♂ type. *Exp.* 20 mm.

(10) *Eudorina ocellata*, sp. n.

♀. Dark red-brown; palpi white below; legs ringed with white. Fore wing with oblique pure white, black-edged subbasal spot; the orbicular and reniform rufous and black-edged, the latter with its edge incomplete above and connected with costa by an oblique white bar; a short oblique white streak from apex; a subterminal dark line with some white scales on its inner edge from just below the apical streak to inner margin. Hind wing paler rufous.

*Hab.* MOLUCCAS, Batchian (*Doherty*), type ♀ in coll. Rothschild. *Exp.* 22 mm.

(11) *Eudorina leucoselene*, sp. n.

♂. Head and thorax deep rufous; abdomen paler rufous; palpi below towards base and pectus in front and at sides white. Fore wing deep rufous; a dark brown antemedial spot with two white points on it below median nervure, a red-brown line from it, oblique to above inner margin and with some diffused whitish before it; a slight whitish spot on upper part of middle of cell; a small white discoidal lunule defined by rather diffused dark brown; a curved punctiform whitish postmedial line, almost obsolete from below costa to discal fold; a fine dark terminal line; cilia with a series of minute white spots at base. Hind wing whitish suffused with rufous especially towards termen; a slight faint dark discoidal spot; cilia with a fine whitish line at base. Underside of fore wing and costal area of hind wing rufous, the hind wing with oblique rather diffused postmedial dark line from costa to beyond lower angle of cell.

♀. Fore wing with small white spot below base of cell, elliptical subbasal spot in the cell, rather quadrate antemedial spot on median nervure, the discoidal lunule larger and oblique, two minute

spots below the costa before a distinct postmedial spot and a rather conical spot before termen below apex, all defined by darker brown; a terminal series of small dark spots.

*Ab.* 1, ♀. Fore wing without the white spots below base of cell and apex, a subterminal series of minute dark spots between discal and submedian folds.

*Hab.* DUTCH NEW GUINEA, Mimika R. (*Wollaston*), 1 ♀; BR. NEW GUINEA, Milne Bay (*Meek*), 1 ♂, 1 ♀ type. *Exp.*, ♂ 22, ♀ 24 mm.

[To be continued.]

#### XLV.—*Some new Entozoa from Birds in Uganda.*

By H. A. BAYLIS, M.A.

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THROUGH the kindness of Dr. G. A. K. Marshall I have been enabled to examine a collection containing examples of eight species of Nematodes and Cestodes from birds in Uganda. These were collected and forwarded to the Imperial Bureau of Entomology by Mr. C. C. Gowdey in 1917.

The collection includes three species of Nematodes and five of Cestodes, all of which are probably new to science. Two of the Nematodes and one of the Cestodes unfortunately cannot be fully described, owing to paucity of material, but of the remainder Mr. Gowdey has been remarkably successful in obtaining complete and well-preserved specimens.

The types will be deposited in the helminthological collection of the British Museum (Natural History).

#### NEMATODA.

##### 1. *Ascaris colura*\*, sp. n.

*Host*: *Lophoaëtus occipitalis*.

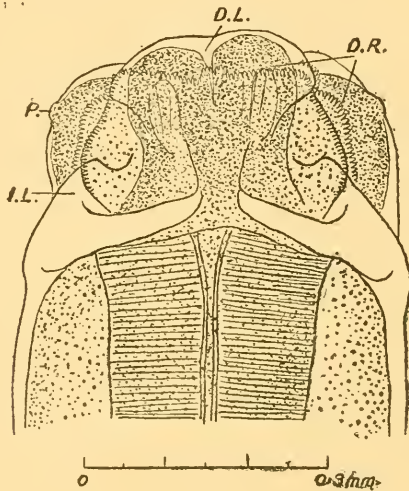
Two female specimens of an Ascarid from this host occur in the collection. Both are of about the same dimensions: length 46 mm., maximum thickness 1 mm. The transverse striations of the cuticle are very fine and not very distinct. The body tapers gradually anteriorly and very suddenly posteriorly. Just behind the lips the thickness of the neck is 0.5 mm. There is practically no tail, the posterior end

\* κολουρος, dock-tailed, stump-tailed.

being quite rounded and the anus situated at only 0·23 mm. from the extremity. The thickness at the anus is 0·55 mm.

The lips (fig. 1) are large and roughly hexagonal in outline. There are three small interlabia (fig. 1, *I.L.*). As seen from the front, each lip has two sharp projecting longitudinal ridges internally, with an indentation between them. Dentigerous ridges (fig. 1, *D.R.*) are well developed on the inner surface of the lips. The "pulp" of each lip is produced anteriorly into two large rounded lobes. The ventro-lateral lips have each a pair of very slightly raised papillæ (fig. 1, *P.*); the dorsal lip apparently has none.

Fig. 1.



*Ascaris colura*; the head, seen from the dorsal side.

*D.L.*, dorsal lip; *D.R.*, dentigerous ridges; *I.L.*, interlabium;  
*P.*, papilla of ventro-lateral lip.

The oesophagus is slender and of nearly uniform thickness throughout. Its length is about 7 mm. From the point where it enters the chyle-intestine a long intestinal diverticulum runs forward to about 1·6 mm. from the anterior end. There is apparently no oesophageal appendage.

The vulva is situated at about 17 mm. from the anterior end. The two uterine branches run backwards parallel to each other. The coils of the ovaries extend back almost to the posterior end of the body. The eggs are oval and have

a thin, rough shell. They measure  $112 \times 70 \mu$ — $125 \times 75 \mu$ . They do not contain a formed embryo at the time of laying.

*Note.*—The presence of an intestinal diverticulum, according to the view of some authors, necessitates the formation of a distinct family, or, at least, subfamily, for the three-lipped nematodes possessing it [see Railliet and Henry, 1912, 1915\*]. The genera comprised in this "family," however, do not seem to have been very clearly defined up to the present. The species under discussion is therefore named only provisionally *Ascaris*, sens. lat.

## 2. *Subulura plotina*, sp. n.

Host: *Plotus rufus*. (Darter.)

The male (of which there is only one example) measures 8.2 mm. in length and 0.34 mm. in maximum thickness. The female (largest of four specimens) is 14.2 mm. long and 0.46 mm. thick. The worms are of slender build, tapering gradually at either end. In both sexes the neck bears a pair of lanceolate cuticular alæ at the sides, extending from the anterior end to about the beginning of the œsophageal bulb. The opening of the mouth is apparently hexagonal in outline. There is a small mouth-capsule with three very small teeth at the entrance to the œsophagus, as is usual in this genus. There are no lips, but the mouth is surrounded by six (?) very small papillæ. The excretory pore is situated at 0.45 mm. from the anterior end in the male and at 0.55 mm. in the female.

The œsophagus has an oval posterior bulb, which is distinctly marked off from the anterior portion, and has its hinder end pushed in, as it were, into the beginning of the intestine. The length of the œsophagus (including the bulb) is 1.25 mm. in the male and 1.5 mm. in the female.

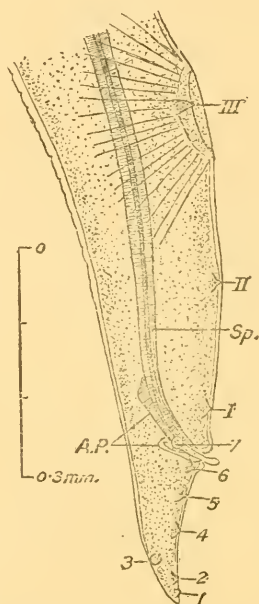
In the male the tail (fig. 2) measures only 0.2 mm. in length, and has no alæ. The preanal sucker, which is elongated in shape and has no chitinous border, is situated at about 0.4 mm. in front of the anus. The spicules (fig. 2, *S $\mu$* ) are equal in length (about 0.9 mm.) and accompanied near the anus by an accessory piece (? two accessory pieces) (fig. 2, *A.P.*), the longest portion of which measures 0.15 mm. There are ten pairs of papillæ—six postanal (fig. 2, 1-6), one paranal (fig. 2, 7), and three preanal (fig. 2, I-III). Of these the third postanal (counted from the tail-tip) and the paranal are more laterally situated than the rest. The most

\* Bull. Soc. Path. exot. v. no. 4, 1912, p. 256, and viii. no. 5, 1915, p. 270.

anterior of the preanal papillæ are situated at the sides of the sucker, a little in front of its middle.

In the female the tail is 0·8 mm. in length. The vulva is situated in the middle third of the body, at 5·8 mm. from the anterior end. The ova measure  $65 \times 52\cdot5 \mu$ — $75 \times 55 \mu$ . The uterus extends back beyond the anus into the cavity of the tail.

Fig. 2.



*Subulura plotina*; tail of male, lateral view.

A.P., accessory piece; Sp., Spicules; 1-6, postanal papillæ; 7, paranal; I-III, preanal papillæ.

### 3. *Filaria* sp.

Host: *Merops albicollis*. (Bee-eater.)

Of this form there is only one specimen, a female. The total length is 31 mm., the maximum thickness about 0·5 mm. The mouth is apparently without lips or papillæ. A pair of 3-lobed glands open into the cavity of the mouth laterally. The vulva is situated at 0·4 mm. from the anterior end. The position of the anus has not been made out.

The tail is bluntly rounded at the tip. Almost the whole of the body-cavity is filled by the uterus, which contains enormous numbers of eggs. The latter measure  $57 \times 37 \mu$ – $62 \times 40 \mu$ . They have a rather thick shell and contain a coiled embryo.

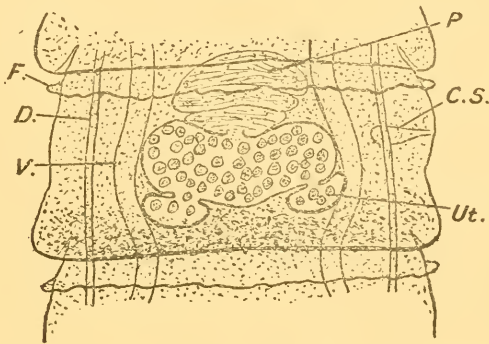
## CESTODA.

4. *Biuterina ugandæ*, sp. n.

Host: *Cinnyris gutturalis*. (Sunbird.)

This is a small species, attaining a length of about 2 cm. upwards. The maximum width of the strobila is about 0.7 mm. The scolex measures 0.4 mm. across, and the suckers have a diameter of 0.2 mm., with a large forwardly-directed aperture. The rostellum has a muscular cushion at its apex,

Fig. 3.



*Biuterina ugandæ*; a gravid segment (from a whole preparation).

C.S., cirrus-sac; D., dorsal excretory vessel; F., cuticular frill; P., paruterine organ; Ut., uterus; V., ventral excretory vessel.

looking almost like a fifth sucker. This measures 0.12 mm. in diameter and bears two rows of about twenty-two hooks each. The hooks of the anterior row are about  $20 \mu$  in length, those of the posterior row a little shorter. All the hooks are of the triangular shape characteristic of the genus.

Segmentation begins almost immediately behind the scolex. Each segment has a slightly raised fold or frill of cuticle running round it transversely near its anterior end (see fig. 3, F.).

The genital pores are irregularly alternating. The cirrus-sac is pear-shaped and measures 0.125 mm. long and 0.04 mm. in thickness at its widest part, which is near the inner end.

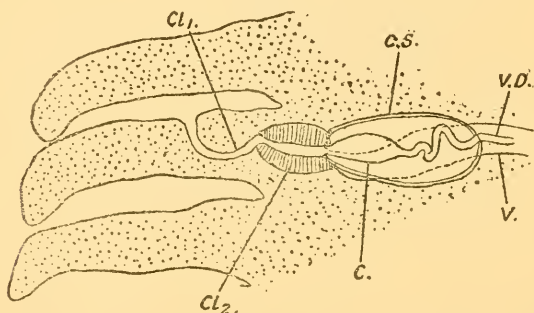
There are twelve or more testes in a compact group in the middle of the segment. The female genital apparatus calls for no special comment: the uterus (fig. 3, *U.*) shows the usual more or less complete division into two lateral portions, and a well-developed paruterine organ (fig. 3, *P.*) is present in front of it in the posterior segments. The ova do not appear to pass into the paruterine organ until after the separation of the segments from the strobila. The onchospheres measure 28  $\mu$  in diameter.

#### 5. *Davainea debilis*, sp. n.

Host: *Anastomus lamelligerus*. (Open-bill Stork.)

Of this species the collection contains only one specimen, which measures about 45 mm. in length. The posterior segments are much contracted, and the length actually

Fig. 4.



*Davainea debilis*; diagram of the genital cloaca and terminal portions of the genital ducts. (Reconstructed from horizontal sections.) The overlapping lateral borders of three consecutive segments are seen.

*C.*, cirrus; *Cl.*<sub>1</sub>, distal non-muscular portion of genital cloaca; *Cl.*<sub>2</sub>, proximal muscular portion of same; *C.S.*, cirrus-sac; *V.*, vagina; *V.D.*, vas deferens.

attained would probably be much greater. Anteriorly the worm is extremely slender, but it increases rapidly in width until the posterior segments measure about 3 mm. across.

The scolex measures only 0.2 mm. across and is very feebly developed. The suckers appear as mere cushion-like thickenings. They were apparently armed with hooks about



12  $\mu$  long, nearly all of which, however, have been lost. The rostellum measures 0.08 mm. in diameter and bears an enormous number of extremely minute hooks, the length of which is about 8  $\mu$ .

The neck, which is well extended, is unsegmented for a distance of about 1.2 mm. behind the scolex. The mature segments (much contracted) are extremely short and broad, and have greatly overlapping margins posteriorly and laterally. The longitudinal musculature is very powerfully developed dorsally and ventrally, consisting of a thick layer of irregularly anastomosing fibres.

The ventral excretory vessels are connected at every segment by a transverse vessel, which is about half as wide as the medullary portion of the segment itself.

There are twenty or more testes in each mature segment, extending in a series right across the medullary parenchyme. The cirrus-sac and vagina open into a common genital cloaca (fig. 4, *Cl.*), the proximal portion of which has a very thick muscular wall, and the distal portion is non-muscular. The muscular portion is about 0.06 mm. long, the non-muscular about 0.05 mm. The dimensions of the cirrus-sac are 0.125 mm.  $\times$  0.06 mm.

The gravid segments contain numerous egg-capsules enclosing four or five eggs each. The onchospheres measure only about 15  $\mu$  in diameter.

#### 6. *Davainea* sp.

Host: *Bleda pallidigula*.

There is a single fragmentary specimen from this bird, to which, owing to its incompleteness, it is not proposed to attach a specific name.

The length of the fragment is about 15 mm. and its greatest width 0.9 mm. The scolex (contracted, and with retracted rostellum) measures 0.25 mm. across. The diameter of the suckers is 0.075 mm. and that of the rostellum about 0.1 mm. The size of the hooks on the rostellum has not been made out; those on the suckers are about 13  $\mu$  long.

The neck (rather contracted) is unsegmented for about 0.4 mm. behind the scolex. The segments are broader than long throughout the fragment, which, however, lacks gravid segments.

The earliest rudiments of genital organs appear at about the ninetieth segment. The genital pores are strictly unilateral. The testes number twenty to twenty-five, and are arranged mainly in two lateral groups, with a single row

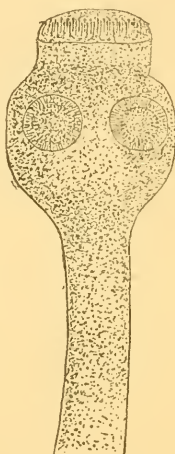
behind the female glands. The cirrus-sac measures about 0.1 mm.  $\times$  0.038 mm., and curves from the genital pore towards the front of the segment. The ovary is divided into two more or less distinct portions, the vagina passing between them. The yolk-gland is posterior in position and is rather deeply lobate.

7. *Davainea vaganda*, sp. n.

Host: *Haliaeetus vocifer*. (Sea-Eagle.)

This is a very slender little form, with a comparatively large scolex. In general it approaches closely to *D. sphaeroides*, Clerc, 1903\*, which is also parasitic in birds of prey, but it does not appear to be identical with that species.

Fig. 5.



*Davainea vaganda*; the scolex, highly magnified.

The present examples measure 2-3 cm. in length and have a maximum width (near the posterior end) of 0.55 mm. The scolex (fig. 5) measures 0.3-0.35 mm. across, and the diameter of the suckers varies from 0.11-0.15 mm. The latter are sometimes elongated in a transverse direction. The rostellum measures 0.22 mm. in diameter and is armed with numerous hooks 25  $\mu$  in length, arranged in two rows. The hooks on the suckers, which are also very numerous, measure 15  $\mu$  in length.

\* Rev. Suisse Zool. xi. p. 359.

The neck is very slender and is unsegmented for from 0.4–1.0 mm., according to the state of contraction. The segments are broader than long throughout the strobila, except in some cases the last three or four gravid segments.

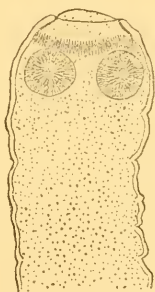
Rudiments of genital organs begin to appear at about the hundredth segment. The genital pores are strictly unilateral. The cirrus-sac measures 0.1 mm.  $\times$  0.05 mm. The testes are very large and six to eight in number.

#### 8. *Davainea bycanistis*, sp. n.

Host: *Bycanistes subquadratus*. (Hornbill.)

This species reaches a length of about 14 cm. and has a maximum width of 2 mm. The scolex (fig. 6) measures 0.27 mm. across, and the diameter of the suckers is 0.088 mm. The latter are armed with several rows of hooks, 13  $\mu$  in

Fig. 6.



*Davainea bycanistis*; the scolex, highly magnified.

length. The rostellum is 0.15 mm. in diameter and bears a double crown of hooks 15  $\mu$  long.

Segmentation begins at about 1 mm. behind the scolex. The segments are broader than long throughout the strobila, except the last few gravid segments. The genital pores are strictly unilateral. There are twelve to fourteen large testes in each mature segment, their diameter being about 0.075 mm. The cirrus-sac is rather elongate, has a muscular wall, and contains a very muscular cirrus. The dimensions of the sac are about 0.2 mm.  $\times$  0.062 mm. The female glands form a small compact mass in the middle of the segment. Each gravid segment contains some thirty egg-capsules, which measure about 0.1 mm. in diameter, and contain each four to

five onchospheres. The latter (without their envelopes) measure  $15\ \mu$  in diameter.

This appears to be only the second species of *Davainea* met with in this family of birds (Bucerotidæ); the one hitherto described is *D. emperus*, Skrjabin, 1914\*, from *Buceros seratogynina*. The present species differs from *D. emperus* in the number of its testes, the absence of the well-developed sphincter-muscle of the genital cloaca, and other details. The scolex unfortunately cannot be compared in the two species, as that of *D. emperus* is unknown.

XLVI.—*Ethiopian Heteroptera: some new Species of Reduviidæ belonging to the Genera Pysttala and Platymeris.*  
By W. L. DISTANT.

PYSTTALA.

*Pysttala*, Stål, Öfv. Vet.-Akad. Förh. 1859, p. 187.

*Platymeris*, Lap. (part.), Stål, *ibid.*; Hem. Afr. iii. p. 123 (1865).

“Thoracis lobo postico quadrispinoso, antico multispinoso, hemelytris spinulis armatis.”

Type, *P. ducalis*, Westw.

Although Stål subsequently relegated *Pysttala* to a section of the genus *Platymeris*, it is clearly entitled to generic rank, and I am now able to add four more species to it. Of the type, *ducalis*, Westw., I can only refer to Westwood's figure and description, for the type cannot be traced by Prof. Poulton at Oxford; and although Westwood stated that another specimen was contained in the British Museum from Sierra Leone, no such example is now to be found in the National Collection.

*Pysttala samwelli*, sp. n.

Head, pronotum, corium, body beneath, and legs black; membrane dark ferruginous brown, especially on its apical area; a subquadrate spot near middle of corium, a broad subapical fascia to the femora, and somewhat large marginal spots to the abdomen sanguineous; antennæ with the first joint black, moderately stout, not quite reaching base of head, second joint ferruginous, about three times as long as first, third more ochraceous in hue, both second and third

\* C.B. Bakt., Jena (orig.), lxxv. p. 69.

joints longly pilose; anterior lobe of pronotum with six long spines on discal area, two short spines near anterior margin, the anterior angles obtusely spinous, and a short spine near middle of lateral margins; posterior pronotal lobe with six spines, three on each lateral area, the lateral angles also strongly spinous; scutellum with long and robustly curved spines—one apical and one on each lateral margin; corium with six moderately short spines—four lateral and two sublateral; connexivum with some spines at the segmental angles.

Long. 38 mm.

*Hab.* W. Africa; Coomassie (*N. Samwell*).

Allied to *P. ducalis*, Westw., but differing by the much less spinous anterior marginal area of the pronotum; red annulations to the femora also shorter.

*Pysttala incognita*, sp. n.

In general colour and markings allied to the preceding species, but the anterior lobe of pronotum with only six spines, three on each lateral area, and the posterior lobe with four short spines, the posterior lateral angles longly spinous; corium with four sublateral and two inner spines.

Long. 37 mm.

*Hab.* West Africa (no precise locality).

*Pysttala johnstoni*, sp. n.

Head, pronotum, corium, body beneath, and legs black; membrane piceous; a subquadrate spot near middle of corium; a broad subapical fascia to the femora and somewhat large marginal spots to the abdomen ochraceous; antennæ with the first joint black, not quite reaching base of head, second joint ferruginous, about three times as long as first, moderately pilose; anterior lobe of pronotum with six long spines on discal area, the anterior angles obtusely spinous, posterior pronotal lobe with four spines, two on each lateral area, the lateral angles also strongly spinous; scutellum with long and robustly curved spines—one apical and one on each lateral margin; corium with three lateral and five or six sublateral spines; connexivum with some spines at the segmental angles.

Long. 38 mm.

*Hab.* W. Africa; Liberia (*Sir H. H. Johnston*).

*Pysttala dudgeoni*, sp. n.

Head, pronotum, corium, and membrane black, extreme base of corium and a small spot near its middle sanguineous; body beneath and legs fuscous brown, subapical annulations to femora, apical halves of tibiæ, and the whole of the tarsi paler in line; connexivum ochraceous, with segmental quadrate black spots, posterior lobe of pronotum with two spines, one on each lateral area, the lateral angles also strongly spinous, anterior pronotal lobe with six prominent spines—three on each lateral area; scutellum with long and robustly curved spines—one apical and one on each lateral margin; corium with four sublateral but no inner spines; connexivum with some spines at the segmental angles.

Long. 39 mm.

*Hab.* W. Africa; Gold Coast, Volta River (*Dr. Dudgeon*).

## PLATYMERIS.

*Platymenis*, Lap. Ess. Hém. p. 80 (1832); Stål (part.), Hem. Afr. iii. p. 124 (1865).

“Thoracis lobo antico spinis longis destituto; hemelytris margineque abdominis inermibus.”

Type, *P. (Reduvius) biguttata*, Fabr.

*Platymenis lavicollis*, sp. n.

Black; a prominent spot near middle of corium and annulations to femora sanguineous, apices of tibiæ and the tarsi more or less reddish ochraceous; antennæ with the basal joint black, remaining joints obscure dark ochraceous.

Long. 35–38 mm.

*Hab.* North Nyasa (*Farler*); Zanzibar (*Dr. W. M. Aders*); East Africa (German), Mpuapua.

Allied to *P. rhadamanthus*, Gerst., from which it differs by the smoother and much less rugosely striated anterior lobe of the pronotum.

*Platymenis swirei*, sp. n.

Black, head and pronotum glossy black; head before eyes, rostrum, legs, and connexivum ferruginous; a large pale greyish spot on disk of corium; antennæ ferruginous, basal joint about as long as from apex of head to eyes; head and rostrum distinctly longly pilose; pronotum sparingly longly pilose, the posterior angles distinctly spinous and moderately

recurved; scutellum with the basal and apical spines well developed; legs and sternum distinctly, somewhat longly pilose; anterior area of pronotum with a few short robust tubercles on each lateral area.

Long. 35 mm.

*Hab.* Gold Coast; N. Territory (*W. Swire*).

Somewhat allied to *P. guttatipennis*, Stål, but easily distinguished by the uniform and distinct coloration of the legs and the tuberculate anterior area of the pronotum &c.

#### CORRECTION.

By a curious though careless error in the title of my previous paper in the *Ann. & Mag. Nat. Hist.* (*ante*, p. 218) for "Heteropterous Family" Pyrrhocoridæ I wrote "Homopterous Family," and, more strangely also, did not observe the error in "proof."

#### XLVII.—*Papers on Oriental Carabidæ*.—I.

By H. E. ANDREWES.

IN constructing a Catalogue of *Oriental Carabidæ* I have come across a number of questions requiring further elucidation, among which I may mention cases of erroneous identification, synonymy both of genera and species, attribution of species to wrong genera, etc. I propose in this paper to give some notes and a few new descriptions to clear these points up.

#### SCARATINI.

*Oxylobus costatus*, Bates (not Chaud.), *Ann. & Mag. Nat. Hist.* (5) xvii. 1886, p. 71 = *O. minor*, Tchit. Hor. Soc. Ent. Ross. xxviii. 1894, p. 227.

Tchitcherin's species may prove, when more material is available, to be only a local form of *O. costatus*.

*Crepidopterus favrei*, Maindr. Bull. Soc. Ent. Fr. 1904, p. 264, fig. = *Scaritoderus loyolæ*, Fairm. Bull. Soc. Ent. Fr. 1883, p. 55.

*Scarites boucardi*, Chaud. Mon. des Scaritides, *Ann. Soc. Ent. Belg.* xxiii. 1880, p. 98.

Chaudoir did not know the locality of this species. I have  
*Ann. & Mag. N. Hist.* Ser. 9. Vol. iii. 31

seen two examples from Upper Assam taken by Mr. H. Stevens, and there are three examples in the British Museum labelled respectively Burma, Manipur (*Doherty*), and Tenasserim.

*Distichus sexpunctatus*, Ménét. Cat. Rais. i. 1832, p. 103.

Ménétries would probably be surprised to find how constantly this name, invented by somebody else, but attributed to him, has been cited as a synonym of *D. planus*, Bon. Ménétrés says of his example of *D. planus*:—"Il diffère de la description qu'en donne le Comte Dejean, en ce que les jambes postérieures n'ont qu'une seule dent, et je n'ai pu compter que trois points imprimés sur chaque élytre." There is no mention of the word "*sexpunctatus*." *D. planus* can well afford to dispense with one of its numerous synonyms.

*Clivina chlorizans*, Bates, Ann. Mus. Civ. Gen. 1892, p. 282  
= *Coryza chlorizans*, Bates.

*Clivina debilis*, Bates, Ann. Mus. Civ. Gen. 1892, p. 278.

This name is preoccupied by *C. debilis*, Blackb. Proc. Linn. Soc. N.S.W. 1889, p. 720. For Bates's species I propose the new name *C. invalida*.

*Dacca*, Putzeys. Postscr. ad Cliv. Mon. Mém. Liège, xviii. 1863, p. 68 = *Clivina*.

The only characters given to differentiate this genus from *Clivina* are the length and acuteness of the maxillæ and mandibles and the short scutellary striole—all variable in this genus, and insufficient to render a separate one necessary. I have seen a number of examples from Bengal.

#### SIAGONINI.

*Siagona depressa*, F.

This species was described by Fabricius in 1798 (Suppl. Ent. Syst. p. 56) as *Carabus depressus*, and following the description are the words "Habitat in Mauretania Dom. Schousboe, in India Orientali Daldorff, Mus. Dom. de Sehestedt." In 1801 (Syst. Eleuth. i. p. 24) the species reappears as *Galerita depressa*, but "Habitat in Mauretania Dom. Schousboe" has disappeared, and we have only "Habitat in India Orientali—Dom. Daldorff."

In 1813 Bonelli (Obs. Ent. ii. p. 458) described quite another species as *Siagona plana*. Dejean in 1825 (Spec.



Gen. i. p. 361) described as *S. depressa*, F., an Indian specimen which was in fact identical with Bonelli's *S. plana*, and in the following year (Spec. Gen. ii. p. 468) he described another species from the Mediterranean as *S. europea*.

Chaudoir, in his Monograph on the genus (Bull. Mosc. 1876, i. p. 90), followed Dejean in identifying *S. depressa*, F., with *S. plana*, Bon., and he gives the habitat of *S. europea*, Dej., as extending from Senegal to Bengal.

In 1887 Mr. Bedel (Ann. Soc. Ent. Fr. p. 195) expressed the view that *S. europea*, Dej. = *S. depressa*, F. (not Dej., not Chaud.), and that the latter name should stand for the species, as in fact it does in his 'Catalogue raisonné des Coléoptères du Nord de l'Afrique,' 1897, p. 108. There the matter rests at present, and Mr. Bedel would be quite right if the Mediterranean and Indian species were identical. I have taken Indian specimens myself in considerable numbers, and have specimens or records from over thirty different localities all over India. I have also examined specimens from various countries bordering the Mediterranean and from Arabia. The conclusion I arrive at is that the two species are distinct. Fabricius evidently had both before him when drawing up his description, and, as Dejean has since described one of them as *S. europea*, I think the Mediterranean species should bear that name, the name *S. depressa* being reserved for the Indian one.

*S. depressa* is on average wider than *S. europea*, joints 1 and 2 of the antennæ are rather more dilated and joint 1 is more rounded off at the apex, the strangulation of the neck is deeper, the ocular ridges are stronger and practically reach the hind margin of the eye (they stop at two-thirds diameter of eye in *europea*). Prothoracic furrows rather deeper, puncturation of disk much stronger, sides more rounded and more contracted in front. Elytra rather more oval, less parallel, and a little more coarsely punctate; the smooth area along the raised suture much less evident, the pubescence rather longer and yellower in colour. Underside more closely punctate.

I wrote recently about the types to the University Museum of Copenhagen, and Dr. Lundbeck has very kindly examined the collection there and written me in reply. He tells me that the handwriting of Fabricius is not to be found in the Lund and Sehestedt collections, and he believes the labels to have been written by Sehestedt. There should be examples of *S. depressa* from Mauretania (*Schousboe*) and India (*Dal-dorff*), but the latter is not to be found. There are, however, two examples which have always been regarded as types,

one of which bears the label "Tanger. Schousboe, Mns. T. L. & S., *Carabus depressus*, F." The name Schousboe does not refer to a collection, but to a collector.

If the Indian type is not at Copenhagen, it is unlikely to turn up elsewhere, and must be regarded as lost.

## B E M B I D I I N I.

*Bembidium europs*, Bates, Ann. & Mag. Nat. Hist. (5) xvii. 1886, p. 156.

This species, founded upon a single specimen taken by Mr. George Lewis in Ceylon, is widely distributed throughout India. I consider it identical with *B. opulentum*, Nietn. (Ann. & Mag. Nat. Hist. (3) ii. 1858, p. 420), but Bates thought that Nietner's species was synonymous with *B. niloticum*, Dej. Spec. Gen. v. 1831, p. 73. Dejean described his species from Egypt, whence it ranges through Mesopotamia and China to Japan, and extends southwards into Indo-China. I have seen a solitary specimen from India taken by Mr. H. G. Champion in W. Almora (Himalayas). On distribution, therefore, *B. opulentum* is more likely to be *europs* than *niloticum*, and Nietner's description, though inadequate, fits *europs* better. Bates does not say that he has seen any authentic specimen of *B. opulentum*.

*Bembidium xanthotelum*, Bates, Ann. Mus. Civ. Gen. 1892, p. 287 = *B. xanthacrum*, Chaud. Bull. Mosc. 1850, iii. p. 175 (note).

*Tachys euglyptus*, Bates, Trans. Ent. Soc. Lond. 1883, p. 268 = *T. klugi*, Nietn. Ann. & Mag. Nat. Hist. (3) ii. 1858, p. 423.

*Elaphropus*, Motsch.

The pectinate claws are difficult to see, but I have been able to detect them in several Oriental species. The following should, I think, be referred to this genus, in addition to Motschulsky's *E. gracilis* and *E. latissimus*:—

*Tachys ampliatus*, Bates, Ann. & Mag. Nat. Hist. (5) xvii. 1886, p. 155.

— *haliploides*, Bates, Ann. Mus. Civ. Gen. 1892, p. 289, and var. *contractulus*, l. c. p. 290.

— *perlutus*, Bates, Trans. Ent. Soc. Lond. 1873, p. 299.

## HARPALINI.

*Acrogeniodon*, Tchit. Abeille, xxix. 1897, p. 65 = *Chydæus*,  
Chaud. Bull. Mosc. 1854, ii. p. 343.

Two species were described by Tchitcherin, viz., *A. bedeli* (*l. c.* p. 66), from Moupin, and *A. semenowi* (Hor. Soc. Ent. Ross. xxxii. 1899, p. 660), from Darjiling. Neither of these appears to be identical with the genotype, *C. obscurus*, Chaud. (*l. c.* p. 344), for a specimen of which I am indebted to Mr. T. G. Sloane.

*Platymetopus interpunctatus*, Dej. Sp. Gen. iv. 1829, p. 71.

The locality is given as Coromandel, which is almost certainly erroneous. The species inhabits Madagascar and the Seychelles.

## KAREYA, gen. nov.

In Compt. rend. Soc. Ent. Belg. 1891, and Ann. Mus. Civ. Gen. 1892, Bates described a number of species under the generic name *Platymetopus* (?), and at p. 332 of the latter volume he makes some remarks upon it. The general appearance of these insects is widely different from that of typical *Platymetopi*, and the size is larger. In *Platymetopus* the ligula is short and bisetose, the paraglossæ small, extending a little beyond and enveloping it, with a fringe of hairs on the outer margin. In *Kareya* both ligula and paraglossæ are larger, the former bisetose but free at the apex, the latter wider, glabrous except for one or two minute hairs on the sides towards base. Mentum edentate, but with the middle of the emargination generally thickened; penultimate joint of labial palpi plurisetose; head with a fine suture on each side, extending from the frontal fovea to the eye. Both head and prothorax smooth, the latter finely punctate over the basal area, its form as in *Gnathaphanus*. Elytra minutely punctulate and very finely pubescent, one or more odd intervals (third always) seriate-punctate. Tarsi hairy on upper surface; front and intermediate tarsi in ♂ with four moderately dilated joints, biserially squamose beneath and fringed with long hairs; hind tarsi with joint 1=2+3.

All the known species were described by Bates. The genotype is *K. erebius*, Bates, Ann. Mus. Civ. Gen. 1892, p. 331, from Burma; the other species to be included are *K. edentatus*, *gnathaphanoides*, *grandiceps*, *major*, and *sublevis*.

The generic name is derived from a Kanarese word meaning "black, dirty."

## PRAKASHA, gen. nov.

In Ann. Mus. Civ. Gen. 1892, p. 333, Bates described *Platymetopus* (?) *amariformis*, but remarked at the end of the description, "The head is small and presents none of the peculiarities of the typical *Platymetopi*." The genus is nearer *Dioryche* than *Platymetopus*, but the form of the head and some other characters render a new genus necessary. The ligula and paraglossæ are as in *Dioryche*, mentum without tooth, but with the emargination thickened in middle; penultimate joint of labial palpi plurisetose. Form broad, surface smooth, colour æneous. Head small, smooth, convex, not depressed in front, clypeus only slightly emarginate, not exposing basal membrane of labrum; frontal fovæ small, curving outwards behind and continuing as a fine line to the eye; antennæ hardly reaching base of prothorax, very finely pubescent from middle of joint 3; eyes prominent. Elytral intervals 3, 5, and 7 with a row of punctures. Tarsi smooth on upper surface; front and intermediate tarsi in ♂ with four moderately dilated joints, 1 rectangular, 2, 3, and 4 triangular, biserially squamose beneath.

The generic name is derived from a Kanarese word meaning "lustre."

*P. amariformis*, Bates, from Kawkareet (Tenasserim) and Taun-ngu, is the genotype and sole representative of the genus.

*Amblystomus vittatus*, Bates, Ann. Soc. Ent. Belg. 1892, p. 231.

The name is preoccupied by *A. vittatus*, Gestro, Ann. Mus. Civ. Gen. 1875, p. 885, and for Bates's species I propose the name of *A. bivittatus*.

*Anoplogenius patinalis*, Bates, Ann. Mus. Civ. Gen. 1892, p. 346 = *Lepithrix foliolosus*, Nietn. Journ. As. Soc. Beng. 1857, ii. p. 152 = *Anoplogenius discophorus*, Chaud. Bull. Mosc. 1852, i. p. 90.

*Acupalpus marginatus*, Bates (not Lucas), Trans. Ent. Soc. Lond. 1883, p. 241.

A note by Mr. Bedel, in his Cat. rais. des Col. du Nord de l'Afr. 1899, p. 158, note (2), induced me to examine the example in the British Museum, which I find to be *A. dorsalis*, F.

*Tachycellus lamprus*, Bates, Ann. & Mag. Nat. Hist. (5) xvii. 1886, p. 80 = *Trichotichnus lamprus*, Bates.

This species, labelled in Bates's handwriting, differs in so many respects from the description, that I think the author must have had some other insect before him. I cannot, however, find anything agreeing with the description among the Carabidæ taken by Mr. Lewis in Ceylon, and I can only mention the discrepancies I have noted. The upper surface is glossy and reluctant, as mentioned, but blue-black rather than ænescent. The penultimate joint of the labial palpi is plurisetose, not bisetose; I am unable to detect the punctured fovea on the first segment of the abdomen in the ♂ (characteristic of *Tachycellus* and its allies); interval 3 of the elytra with a well-marked puncture just behind middle. I cannot at present see any reason why this species should not be included in Morawitz's genus *Trichotichnus*, though all those hitherto described are confined to N.E. Asia.

#### ANCHOMENINI.

*Pristonychus kashmirensis*, Bates, Proc. Zool. Soc. 1889, p. 214 = *P. spinifer*, Schauf. Sitzungsab. Ges. Isis, Dresden, 1862, p. 66.

*Anchomenus politissimus*, Bates, Proc. Zool. Soc. 1878, p. 719  
= *A. lissopterus*, Chaud. Bull. Mosc. 1854, i. p. 136.

#### ODACANTHINI.

*Casonia ægrota*, Bates, Trans. Ent. Soc. Lond. 1883, p. 278  
= *Oducantha ægrota*, Bates.

*Ophionea*, Klug. Ent. Braz. Spec. 1821, p. 298.

This genus was formed for the three species, 1. *O. pennsylvanica*, L., 2. *O. cyanocephala*, F., 3. *O. surinamensis*, L. In No. 1 the fourth tarsal joint is simple, and in No. 2 it is bilobed. Of No. 3 I have no personal knowledge, but it is evidently quite a different insect from the others, and de Geer, in Mém. iv. 1774, p. 79, formed for it the genus *Colluuris*. Klug mentions the fourth tarsal joint twice over, but his remarks are contradictory: under "Characteres" we read "tarsi articulo quarto elongato," but under "generis descriptio" this becomes "tarsi articulo . . . quarto brevissimo." A year later Latreille and Dejean, Hist. Nat. & Icon. d'Eur. 1822, p. 77, published the genus *Casonia*, which was not,

and did not profess to be, other than identical with Klug's *Ophionea*. When, in 1825, Dejean published the first volume of his 'Species Général,' he introduced the genus *Casnonia* at p. 170, and, referring to the species included in it, he writes "Latreille les avait d'abord placés parmi les *Agra*, et il en a fait ensuite un genre particulier que je lui ai conservé; Klug, n'ayant pas connaissance de son travail, l'avait établi dans son *Entomologie brasilienne specimen*, sous le nom d'*Ophionea*." Klug could not in 1821 have any knowledge of a work published in 1822, and Dejean must therefore refer to some earlier work of Latreille. I have searched for this in vain, nor can I find any references anterior to 1822 in the works of other authors. The name was undoubtedly known, for it appears (under the guise of *Cosnania*) in Dejean's first Catalogue (1821). I think *Casnonia* must be ruled out as a pure synonym.

In 1829 Eschscholtz, Zool. Atl. ii. p. 5, in introducing his genus *Rhagocrepis*, gives a table differentiating this and allied genera. *Ophionea* figures in this table as having tarsi with a bilobed fourth joint; the actual species, *O. cyanocephala*, F., is not mentioned, but it is none the less made the genotype, and the fact that *Casnonia* is included in the same table (with a different signification) does not seem to me to invalidate this conclusion. *Ophionea* in this sense was recognized both by Schmidt-Goebel, Faun. Col. Birm. 1846, p. 20, and Lacordaire, Gen. Col. i. 1854, p. 73, though both of them were inclined to attribute the genus to Eschscholtz. Another genus, also for *O. cyanocephala*, F., was formed by Castelnau, Et. Ent. 1834, p. 40, under the name of *Casnoidea*, but this merely provides another synonym for *Ophionea*.

Mr. Bedel has already drawn attention, Bull. Soc. Ent. Fr. 1910, p. 72, to some of the details given above, but he does not come to the same conclusion. He makes *pennsylvanica* the type of *Ophionea*, and puts all the species with a cleft fourth tarsal joint under Castelnau's genus *Casnoidea*. In this he has been followed by Commandant Dupuis, Ann. Soc. Ent. Belg. 1913, p. 270. Mr. Sloane, on the other hand, in his table of the Australian Odacanthini, Proc. Linn. Soc. N.S.W. 1917, p. 414, retains *Ophionea* as defined by Eschscholtz, and also, like me, considers Motschulsky's genus *Lachnothorax*, Et. Ent. 1862, p. 48, as distinct from the other genera cited\*.

\* I may mention here that on a separate of his paper kindly sent me by Mr. Bedel there is a note to the effect that *cyanocephala*, F. = *Atteblabus indicus*, Thunb. Nov. Ins. Spec. part 3, 1784, p. 68, fig. 81, described from "Ind. Orient." This I have confirmed, as far as the slender description allows of confirmation.

The upshot of the above is that *pennsylvanica* and its Eastern allies are at present, according to my view, without a genus. My lack of knowledge of American Carabidæ prevents me from proposing a new genus for *pennsylvanica*, but I think that its elongate head, bordered prothorax, and the smooth apical area of the elytra separate it generically from all the Eastern species known to me. For some of the latter I propose the new genus *Arame*, though this will not include all of them. The type of this genus is described further on under the name of *A. macra*.

#### ARAME, gen. nov.

Ligula short, fairly wide, truncate in front, a little arcuate in centre, quadrisetose, the two inner setæ much longer than the outer ones; paraglossæ linear, membranous, free, glabrous, curving inwards, and rather longer than the ligula. Mentum with a short fairly sharp tooth in the emargination, about half as long as the lobes; epilobes evident, projecting in front of the lobes in the form of an acute tooth.

Maxillæ sharp, hooked at tip, with a row of strong bristles on inner side. Maxillary palpi glabrous, joints 2 and 4 half as long again as 3; last joint a little inflated, tapering and truncate at extremity. Labial palpi glabrous, except for the two setæ on inner margin of penultimate joint; joints equal, last one as in maxillaries.

Mandibles short, a small tooth on the right one at about middle, none on left, without seta in scrobe.

Antennæ reaching beyond base of thorax, first three joints glabrous, joint 1 inflated, with only one seta, joint 2 very short, joint 3=1, rest a little longer.

Eyes moderately prominent, a little removed from buccal fissure.

Labrum truncate, sexsetose.

Head subglobose, much inflated behind eyes, with two supraorbital setæ, strongly constricted behind, condyliform.

Prothorax subglobose, lateral margins obsolete or indicated by a very fine line only.

Elytra fully striate, but striæ generally becoming faint towards apex. Odd intervals—or, at least, interval 3—with some setiferous pores.

Last ventral segment in ♂ with one, in ♀ with two setiferous pores on each side; in the ♂ the margin is distinctly notched, in the ♀ only faintly so.

Tarsi smooth on upper surface, joint 4 entire but emarginate, joint 5 very long, with setæ beneath; in the hind legs

joint 1 is not much longer than 2. In the ♂ the first three joints of the front tarsi are faintly dilated and biserially squamose beneath. Claws simple, much dilated at base.

The name is derived from a Kanarese word meaning "very small."

The above characters are largely those of *Odacantha*, but in that genus the paraglossæ are wider, hardly longer than the ligula, adnate, though separated at apex from the ligula by a deep emargination. The chief difference, however, is in the thorax, which in *Odacantha* is very distinctly margined at sides over the front two-thirds. The elytra of this genus, too, are less convex and the striæ more finely punctate. The two genera are evidently closely allied, but the characters I have just mentioned seem to render them sufficiently distinct.

*Arame macra*, sp. n.

Length 6-6.5 mm. ; width 1.6-1.8 mm.

Piceous. Palpi, first three joints of antennæ (2 and 3 sometimes infusate), legs (except coxæ and front trochanters), epipleuræ of elytra, and an ill-defined spot at apex (sometimes the whole of the apical third) reddish testaceous.

Head about 1 mm. in width (length behind eye =  $1\frac{1}{2}$  times diameter of eye), convex, shiny, frontal foveæ well-marked, clypeus smooth, with a seta at each side, surface sparsely covered with coarse setiferous punctures, more closely in front, only a few behind level of eyes.

Prothorax barrel-shaped, without front or hind angles, shiny, about as long as head and a little narrower, widest in middle, contracted at each extremity, but more so in front than behind, slightly constricted just before base, which has a smooth border ; side-margins obsolete, median furrow wide but not deep, surface covered with setiferous punctures, less closely on disk, the puncturation rather more dense than on head.

Elytra moderately convex, parallel, as long as head and thorax taken together, joining prothorax by a short peduncle, shoulders a little oblique, apex nearly squarely truncate, punctate-striate, less strongly towards apex ; intervals 3, 5, and 7 each with a series of numerous small setiferous pores, the hairs standing out very clearly on unrubbed specimens viewed sideways.

On the underside the abdomen is smooth, head with a few large punctures, all sterna (except middle of metasternum) densely and very coarsely punctate, prosternal process smooth,



glabrous, unbordered, metepisterna three times as long as wide.

Very closely allied to *A. hæmorrhoidalis*, Motsch., if I have correctly determined that species, but the latter has the head less narrowly constricted, the back of the head (behind the level of hind margin of eyes) quite smooth, and only three or four setiferous pores on interval 3, none on 5 or 7. Bates thought that *hæmorrhoidalis* had pores on interval 5 as well as on 3 (*vide* Ann. Mus. Civ. Gen. 1892, p. 382).

Ceylon, Colombo, on coast-level, 7-27. ix. 1882 (*G. Lewis*). Other specimens taken in Ceylon by Dr. Thwaites. Type in British Museum. The specimens taken by Mr. Lewis are those determined by Bates, Ann. & Mag. Nat. Hist. (5) xvii. 1886, p. 199, as *Casnonia hæmorrhoidalis*, Motsch.

I cannot at present give more than a provisional list of the species which appear to belong to this genus. The list is as follows:—*A. macra* (type), *albicolon*, Bates, *celebensis*, Gestro, *bimaculata*, Schm. Goeb. (*distigma*, Chaud.), *flavicauda*, Bates, *fuscipennis*, Chaud., *graciliceps*, Bates, *hæmorrhoidalis*, Motsch., *latifascia*, Chaud., *litura*, Schm. Goeb., *metallica*, Fairm., *punctata*, Nietn., *subapicalis*, Oberth., *tetraspilota*, Schm. Goeb., *virgulifera*, Chaud., *xanthe*, Bates.

#### LACHNOPHORINI.

##### LOMASA, gen. nov.

Ligula short, wide, sides almost parallel, apex slightly arcuate, bisetose.

Paraglossæ membranous, very narrow, glabrous, rounded at apex, attached to ligula at base only, curving inwards and reaching a little beyond its apex.

Mentum with an emarginate tooth, half as long as side lobes, epilobes narrow, reaching a little beyond lobes, rather sharp, but with apex rounded.

Palpi setose, joints cylindrical, elongate, the last rather shorter, truncate at apex.

Mandibles short, hooked and pointed at apex, without seta in scrobe.

Labrum truncate, sexsetose. Eyes prominent, distant from buccal fissure.

Antennæ pubescent, filiform, two-thirds as long as body, joint 2 very short, 3 half as long again as the rest, which are about equal.

Body covered with a dense short pubescence. Thorax strongly cordate. Elytra short, slightly emarginate at apex.

Legs pilose, front tibiæ with a spine at apex and another at base of emargination.

The front tarsi in the ♂ with three squarely dilated joints, each with a pad of hairs beneath; joint 4 emarginate and furnished at apex with a tuft of very long hairs. Claws simple, long, and very thin.

The name is derived from a Sanskrit word meaning "hairy."

There is only one known species, which has already been twice described, viz.:—

*Chlœnius xanthacrus*, Wied. Zool. Mag. ii. 1, 1823, p. 51 =  
*Chlœnius hügelii*, Redt. Reis. Novar. ii. Col. 1867, p. 9.

Chaudoir thought that this species, on account of its pubescent palpi, belonged to the Lachnophorini. I accept this view provisionally, as the group, which has few representatives in Asia, is not at present well known to me.

#### GALERITINI.

*Galerita birmanica*, Bates, Ann. Mus. Civ. Gen. 1892, p. 385  
= *G. peregrina*, Dohrn. Stett. Ent. Zeit. 1880, p. 291.

#### *Planetes puncticeps*, sp. n.

*Planetes bimaculatus* (MacL.), Bates, Trans. Ent. Soc. Lond. 1873, p. 304; Putz. Compt. rend. Soc. Ent. Belg. 1875, p. 52; Heyd. Deutsch. Ent. Zeit. 1879, p. 329.

Length 12·0–14·5 mm.

Piceous; base of palpi, joint 1 of antennæ, femora, tibiæ, and a spot on each elytron testaceous; rest of palpi, joints 2 and 3 of antennæ, labrum, and tarsi reddish brown. The whole surface (except where impunctate) covered with a fine short yellowish pubescence.

Head (2·0–2·5 mm. wide) moderately convex and shiny, frontal foveæ wide and shallow, surface densely and finely punctate (smoother in middle of front), a number of large punctures mingled with the small ones, especially at back and sides; neck moderately constricted.

Prothorax (2·75–3·50 mm. wide) moderately shiny, slightly transverse, widest at a third from apex, a little emarginate in front, base bisinuate, with sides advancing to meet hind angles, sides rounded more sharply in front than behind, a seta at a third from apex, another at hind angle, extremities equally contracted, front angles rounded, hind angles nearly

right, sharp, projecting slightly laterally; transverse impressions inconspicuous, median line faint, basal foveæ deep (making hind angles appear reflexed), the whole surface densely punctate.

Elytra (3.75-4.75 mm. wide) parallel, rather rectangular, more than twice as long as thorax, shoulders advanced, apex nearly squarely truncate; each elytron with nine primary narrow ridges, of which the first is close to the suture and the ninth (flatter and wider than the others) not far from margin, two secondary rather finer ridges between the primary ones, a row of setiferous punctures running between each primary and secondary ridge, but not between the secondary ones, a row of large pores inside the ninth ridge, from which emerge a few long setæ, chiefly visible near base and apex; the testaceous spots, more or less rounded, placed a little before middle, and extending from primary ridges 2 to 6.

Underside, except middle of head and a small space on each side near base of ventral surface, densely punctate and pubescent; prosternal process not bordered, metepisterna elongate, last ventral segment in both sexes slightly emarginate, with half-a-dozen setæ, longer than the general pubescence, on each side.

Tarsi setose on upper surface, joint 1 of hind tarsi=(very nearly) 2+3+4; front tarsi in ♂ with three joints moderately dilated, densely fringed with long yellowish hairs and with a row of ragged whitish scales along outer margin beneath.

Closely allied to *P. bimaculatus*, Macl., but distinguished by the much denser puncturation of the head, with large and small punctures mingled together, prothorax more transverse, wider in front, and more contracted behind, hind angles sharper and projecting a little laterally, basal foveæ deeper, puncturation coarser and closer, occasionally confluent, propisterna more evidently punctate (in *bimaculatus* nearly smooth).

Japan: Nagasaki and Yokohama (*G. Lewis*); Tsushima. China: Tchusan; Port Hamer. Type in the British Museum.

#### PERICALINI.

*Catascopus cupricollis*, Chaud. Col. Nov. i. 1883, p. 24.

This name is preoccupied by *C. cupreicollis*, C. O. Waterh. Trans. Ent. Soc. Lond. 1877, p. 1. I suggest *C. ænicollis*. The species seems very closely allied to *C. aruensis*, Saund.

*Catascopus elongatus*, Saund. Trans. Ent. Soc. Lond. 1863, p. 466, t. xviii. fig. 5 = *Holcoderus elongatus*, Saund.

*Catascopus gracilis*, Oberth. Notes Leyd. Mus. v. 1883, p. 220 = *Holcoderus gracilis*, Oberth.

*Catascopus rugicollis*, Saund. Trans. Ent. Soc. Lond. 1863, p. 464, t. xviii. fig. 6.

This is apparently a malformation of *C. aculeatus*, Chaud.

#### SFITAKANTHA, gen. nov.

Ligula moderately long, narrow, subcarinate at base, quadrisetose, apex free; paraglossæ membranous, adnate, nearly parallel, a little wider than ligula, extending very little beyond it.

Palpi glabrous; maxillaries with joint 2 incrassate = 4, which is cylindrical, slightly tapering and rounded at apex, 3 about two-thirds of 4, tapering towards base; labials with equal cylindrical joints, the last truncate at apex, penultimate with a single seta on inner margin.

Mentum transverse, quadrately emarginate, edentate, but base thickened in middle, lobes oblique and pointed, but rounded at apex, epilobes wanting.

Maxillæ curved, very sharp at apex, densely ciliate on inner margin.

Mandibles short, with a blunt tooth at base, right mandible with a small median tooth.

Labrum porrect, as long as wide, narrowed anteriorly, emarginate in front, with rounded angles, sexsetose, but the outside seta is placed far back, quite a third from apex.

Antennæ filiform, half as long as body, joint 1 short, incrassate, 2 very short, rest approximately equal, pilose from apex of 4.

Eyes moderately prominent, reaching buccal fissure.

Head with two supraorbital setæ, neck tumid.

Prothorax very strongly emarginate in front, a seta midway between base and apex and another at hind angle, both on margin.

Elytra very short, quadrate, a few large pores on interval 9, from which issue very long setæ; interval 3 with a single fine pore at a fourth from apex; margin with a series of minute hairs, as in *Stenotelus*, but no denticulation is perceptible. In *Peripristus* and *Sinurus* the denticulation is evident.

Tarsi glabrous above; front tarsi in ♂ with three slightly

dilated joints, clothed beneath with a few whitish scales; first joint of hind tarsi nearly equalling the succeeding three joints. Claws simple, but with faint traces of denticulation at base.

The generic name means in Sanskrit a "swollen neck."

The type of the genus is *Thyreopterus impressus*, Schm. Goeb. Fann. Col. Birm. 1846, p. 80. This is the only Oriental species described under the genus *Thyreopterus*, and its generic characters do not accord with those of the African species of that genus.

#### CALLIDINI.

*Crossoglossa*, Chaud. Mon. des Callidides, Ann. Soc. Ent. Belg. xv. 1872, p. 177 = *Phlæodromius*, W. Macleay, Trans. Ent. Soc. N.S.W. ii. 1871, p. 85.

Mr. T. G. Sloane pointed out to me the identity of these two genera, but I do not think he has published any note on it.

*Saronychium inconspicuum*, Blackb. Ent. Month. Mag. xiv. 1877, p. 142 = *Endynomena pradieri*, Fairm. Rev. et Mag. Zool. 1849, p. 34.

#### LEBIINI.

*Cymindis pictula*, Bates, Trans. Ent. Soc. Lond. 1873, p. 310 = *Anomotarus (Cymindis) stigmula*, Chaud. Bull. Mosc. 1852, i. p. 57.

The genus *Uvea* was proposed by Fauvel (Bull. Soc. Ent. Fr. 1881, p. 118; id. Rev. d'Ent. i. 1882, p. 257) for Chaudoir's species, but Mr. T. G. Sloane, Proc. Linn. Soc. N.S.W. 1917, pp. 435-6, does not consider it as "more than, at most, a subgenus of *Anomotarus*."

XLVIII.—On Indo-Chinese Hymenoptera collected by R. Vitalis de Salvaza.—II. By ROWLAND E. TURNER, F.Z.S., F.E.S.

#### Family Tenthredinidæ.

##### Subfamily ARGINÆ.

##### *Arge vitalisi*, sp. n.

♀. Lutea; mandibulis apice nigris; mesopleuris, tergitis 1-3 macula transversa mediana, quarto fere toto, 5-7 fascia lata

mediana, octavo macula magna mediana, sternito quarto macula laterali utrinque, coxis posticis, apice excepto, femoribusque posticis, basi luteis, nigro-purpureis; alis flavo-hyalinis, stigmatate venisque nigris, sub stigmatate late transverse brunneo-fasciatis.

Long. 13 mm.

♀. Head not narrowed behind the eyes; clypeus and face finely punctured; a carina running downward from the base of each antenna, the two joining about halfway between the antennæ and the base of the clypeus and enclosing a raised elongate-ovate area, from the apex of which a low carina runs to the base of the clypeus. Antennæ as long as the head and thorax combined; the third joint long, compressed and broadened towards the apex. Front above the antennæ with a deep longitudinal groove; vertex very finely and rather sparsely punctured. Vertical area slightly convex, nearly three times as broad as long, not sharply defined laterally. Thorax smooth and shining; the mesonotum anteriorly minutely and rather sparsely punctured. The space between the basal nervure and the origin of the cubitus is scarcely as long as the intercostal nervure; the nervulus is received at about two-fifths from the base of the discoidal cell. Hind tibiæ with spine.

*Hab.* Ban Thiou, Luang Prabang; March 18, 1918. 1 ♀.

This fine species is very distinct in colour from most species of the genus, but does not differ structurally or in neurulation.

#### Subfamily *TENTHREDININÆ*.

##### *Conaspidia fasciatipennis*, sp. n.

♀. Ochracea, nitida; mandibulis apice, vertice maculis tribus magnis, mesonoto antice lateribusque, tergitis tertio sequentibusque, tibiis apice extremo, femoribusque posticis linea supra, nigris; alis hyalinis, vix flavo-suffusis, anticis sub stigmatate late fusco-fasciatis, apice in cellula cubitali quarta infuscatis, stigmatate venisque fuscis, costa ochracea.

Long. 11 mm.

♀. Clypeus widely and rather deeply emarginate, rugosely punctured. Eyes separated from the base of the mandibles by a distance not exceeding one-third of the length of the second antennal joint. Antennæ as long as the abdomen, filiform, the third joint nearly four times as long as the second, the joints beyond the third gradually decreasing in length. Front finely rugose; vertex shining, shallowly and

sparsely punctured, vertical area longer than its greatest breadth, slightly narrowed anteriorly; the head swollen behind the eyes. Mesonotum obsoletely punctured, the median lobe divided from base to apex by a deep groove in which lies a low carina. Scutellum coarsely punctured, raised into a conical tubercle; mesopleuræ coarsely rugulose. Abdomen smooth. The apical fuscous mark on the fore wing is paler than the median fascia and occupies almost the whole of the fourth cubital cell and the extreme apex of the radial cell. The median fascia crosses the wing from the basal half of the stigma and does not extend apically beyond the second transverse cubital nervure. The discoidal nervure is separated from the base of the cubital nervure by a distance about equal to the length of the first transverse cubital nervure.

*Hab.* Tong Lap, Haut Mékong; April 30, 1918. 1 ♀.

Differs very strongly in colour from *C. sikkimensis*, Konow, the only other known species of the genus, especially in the fasciate wings; but the venuration and structure do not differ appreciably.

*Macrophya extrema*, sp. n.

♀. Nigra; clypeo, labro, mandibulis basi, antennis articulis tertio quartoque intus, pronoto, tegulis basi, mesopleuris fascia lata mediana, scutello macula magna, cenchris, metanoto linea angusta apicali utrinque, propodeo fascia apicali lateribus fortiter dilatata, tergito apicali, coxis posticis supra, trochanteribus, femoribus anticis intermediisque, supra nigro-lineatis, femoribus posticis, apice nigris, tibiis basi, tarsisque, unguiculis exceptis, albo-flavidulis; alis fusco-hyalinis, basi fere hyalinis, stigmatibus venisque nigris.

♂. Feminæ similis.

Long., ♀ 11-13, ♂ 11 mm.

♀. Clypeus convex, very widely and shallowly emarginate, strongly punctured. Front very closely punctured-rugulose, vertex more coarsely and sparsely punctured, the front clothed with short white pubescence; vertical area punctured-rugulose, a little broader posteriorly than long, strongly narrowed anteriorly, the oblique lateral grooves smooth and shining. Antennæ with joints 5-7 thickened and somewhat compressed, the third joint as long as the fourth and fifth combined. Thorax closely punctured, the middle lobe of the mesonotum much more coarsely punctured than the lateral lobes and divided by a longitudinal groove nearly reaching the apex; mesopleuræ very coarsely punctured in front,

rugulose posteriorly. Abdomen smooth and shining, propodeum rather closely punctured; hind coxæ, femora, and tibiæ closely punctured. Humeral cell divided far before the middle by a very short nervure.

*Hab.* Vien Poukha, Haut Mékong; May 11, 1918. 1 ♀, 3 ♂♂.

Somewhat related to the European *M. rustica*, Linn., but the antennæ are much longer than in that species, the clypeus less strongly emarginate, the puncturation coarser, and the humeral cell more contracted.

### Family Ichneumonidæ.

#### Subfamily CRYPTINÆ.

#### *Mansa funerea*, sp. n.

♀. Nigra; antennis dimidio basali, palpis, abdominis segmento tertio sequentibusque, valvulis terebræ, pedibusque, coxis exceptis, fulvo-ferrugineis; mandibulis basi, oculorum orbitis internis late, abdominisque segmento secundo fusco-ferrugineis; alis fuscis, venis nigris.

Long. 16 mm.; terebræ long. 6 mm.

♀. Head strongly narrowed behind the eyes and towards the clypeus; checks long, about equal in length to the fourth antennal joint. Mandibles narrowed to the apex, ending in two very small teeth. Clypeus broadly truncate at the apex, closely and minutely punctured and clothed with fuscous hairs; face coarsely punctured-rugose. Antennæ inserted nearly as far from the anterior ocellus as from the apex of the clypeus, 39-jointed, scape produced beneath so as to form a partial sheath for the second joint; the third joint the longest, the fourteen basal joints fulvo-ferruginous, the antennæ gradually thickened to about the twentieth joint. Front and vertex finely rugulose, the space above the base of the antennæ smooth and shining and feebly concave. Thorax opaque, very closely and rather strongly punctured; the pleuræ rugosely punctured, with a broad oblique band on the middle of the mesopleuræ smooth and shining. Median segment coarsely punctured-rugose; the spiracles large and elongate, enclosed in an elongate triangular lateral area; on each side of the dorsal surface of the segment at the base is an area enclosed by the upper side of the lateral area, the base of the segment, and a curved carina which reaches the base a little on the outer side of the middle. Abdomen rather indistinctly microscopically punctured; first segment petiolate, the spiracles nearer to the apex of the segment than



to each other; the apical quarter of the segment rather strongly broadened, the whole segment as long as the hind coxa and trochanters combined. Areolet very large, about half as long again on the radius as on the cubitus, the second abscissa of the radius fully as long as the first and very little shorter than the third. Second recurrent nervure received just beyond one quarter from the base of the second cubital cell.

*Hab.* Vieng Vai, Haut Mékong; June 10, 1918. 1 ♀.

Easily distinguished by the dark fuscous wings from all other known Oriental species of the genus. The name *Mansa*, Tosq. (1896), has priority over *Colganta*, Cam. (1902), which must sink as a synonym.

Family Braconidæ.

Subfamily HELCONINÆ.

*Helcon unicornis*, Turn.

*Helcon unicornis*, Turn. Ann. & Mag. Nat. Hist. (9) ii. p. 172 (1918).  
♀.

*Hab.* Tong Lap, Haut Mékong; April 30, 1918.

This species seems to resemble closely *Wroughtonia cornuta*, Cam., placed by that author among the Evaniidæ, and I think it quite possible that my name may have to sink as a synonym. Cameron's description is not very clear, and was taken from a specimen with broken antennæ. But, on the whole, I think there can be no doubt that the genus *Wroughtonia* belongs here, and should sink as a synonym.

XLIX.—*Description of a new Genus and Two new Species of Heterocera.* By Lord ROTHSCHILD, F.R.S.

*Spilosoma ignivagans*, sp. n.

♂. Very closely allied to *erythrophleps*, Hmps., but with less red on fore wings and fewer pale markings on hind wings.

Antennæ black, pectus and legs sooty-slate, frons and vertex rufous-orange; thorax rufous-orange, with a sooty dot on tegulæ and sooty streaks on patagia; abdomen above rufous-orange ringed with sooty black, below white.

Fore wing slate-brown with orange-scarlet nervures; three ill-defined orange-scarlet patches on basal half of costa; two rufous-orange spots in cell and one beyond; four irregular

bands of rufous-orange below median to inner margin, much angled, waved, excised, and partially joined. Hind wings sooty slate-grey, with white veins; a broken irregular post-median band, broader between vein 2 and abdominal margin; some white spots at end of veins.

Length of fore wing 26 mm.; expanse 56.5 mm.

*Hab.* Tali, Yunnan.

#### DEPALPATA, gen. nov.

This genus is nearest to *Burgena*.

Proboscis minute; palpi with second and third joints aborted, minute, and curved downwards; frons smooth; antennæ almost simple; tibiæ smooth, the spurs minute, the hind tibiæ with terminal spurs only.

*Fore wing*: vein 2 from long before angle of cell, 3 from close to angle, 4 and 5 from angle, 6 from upper angle; 7, 8, 9, 10 stalked; 11 from cell. *Hind wing*: 2 from well before angle of cell; 3, 4 from angle; 5 obsolescent from middle of discocellulars; 6, 7 stalked; 8 anastomosing with the cell near base only; underside with whole inner area clothed with rough androconia extending into lower end of cell and to vein 7.

#### *Depalpata mirabilis*, sp. n.

♂. Antennæ black; pectus orange-yellow; frons and vertex black; thorax velvety black; collar and edges of tegulæ yellow; abdomen black, strongly glossed with greenish steel-blue; anal tuft golden-orange.

Fore wing velvety black, an oblique creamy antemedian band. Hind wing black, intensely shot and glossed with blue; a large pure white subbasal patch in cell and a smaller one below cell; large tufts of rough sooty-black hair on each side of vein 1*b*; tornus whitish.

Underside: abdomen as above, but with a large white patch on third segment. Fore wing sooty-black with dull blue gloss; antemedian band as above, but divided into two, and with an irregular white expansion distad below vein 2; on the base of the cell and on costa a white dot; beyond the discocellulars an irregular large white patch extending from subcostal to vein 3. Hind wings sooty-black glossed with dull blue; whole area below vein 7 covered with a dense felting of rough whitish androconia except a patch of white and a spur of dark colour in cell.

Length of fore wing 29 mm.; expanse 65 mm.

*Hab.* Hydrographer Mts., S.E. British New Guinea, 2500 ft., March 1918 (*Eichorn Bros. Coll.*).

L.—On small Mammals from "Otro Cerro," North-eastern Rioja, collected by Sr. L. Budin. By OLDFIELD THOMAS.

(Published by permission of the Trustees of the British Museum.)

AFTER making the collection at Chumbicha, Catamarca, of which an account is given in the 'Annals' for January 1919, Sr. Budin travelled westwards some 30 miles, over the Cerro de Ambato to "another hill," or range of hills, for which he could find no recognized name, but which, after consultation with the authorities of the Geographical Society, I suppose to be an unnamed range running southward from the Cerro Nunorca. Although Sr. Budin considered himself to be still in Catamarca, and labelled the specimens accordingly, the distance and direction from Chumbicha show that he must have crossed the frontier into Rioja.

Under these circumstances I have decided to use Sr. Budin's fancy name of "Otro Cerro," as put on his labels, but with correction as to the province. If more exact definition can be obtained from him it will be published later, but for the present the locality may be stated as 45 kilometres west of Chumbicha, the specimens being taken at an altitude of about 3000 metres.

The collection contains quite a number of interesting species, of which the most striking are the new *Lagidium*, the skunks, and tuco-tuco, while the good series of such forms as *Phyllotis* and *Graomys* have enabled me to make further study of these difficult groups.

Like all Sr. Budin's recent specimens, the skins are beautifully prepared, and thus together form a very valuable addition to the National Collection.

Arising out of a suggestion by Sr. Budin, I should like to propose that certain Spanish and other colloquial terms should be definitely restricted to particular genera, so as to be available for vernacular names. The native words used as names by Mr. Perry Simons, Sr. Budin, and others have generally been rather vaguely applied, but might easily be pinned down to special genera, where they would be of great convenience.

Thus I would take Azara's name of "Hocicud," for the species of *Oryzomys* and "Laucha" for *Hesperomys*. Then *Andinomys* might be "Chozchorito," *Phyllotis* "Pericote," and *Oryzomys* "Coludo," which equals "Long-tail." Other colloquial names are already well known, but where there are none I shall hope, with Sr. Budin's assistance, to suggest some which might be suitable and convenient.

In this collection there is an interesting amount of geographical isomorphism. Thus there are two species of skunks, both with white tails, being almost the only white-tailed skunks known. And there are no less than *five* different Murines (*Andinomys edax*, two species of *Phyllotis*, and two of *Graomys*) so similar *inter se* externally that they might all be mistaken for a single species at different stages of age. So striking a case of local resemblance between different animals I do not remember ever to have seen before.

1. *Conepatus budini*, sp. n.

♂. 334.

A rather small skunk with a conspicuous bushy white tail. The upper molar large.

Size a little less than in *C. gibsoni*, therefore distinctly less than in any other S.-American species except the much smaller *C. proteus*. Fur thick and abundant, with the usual woolly underfur; direction of nape-hairs in the type absolutely normal, without whorls or reversed hairs. White stripes of body about an inch or a little less in breadth, united on the forehead by a junction of about the same breadth, and evenly divergent posteriorly, the black median area about 1-1½ inch broad on the nape, widening to 2½ on the posterior back; the white bands dying away on the hip, about 2 inches before the white of the tail commences. Tail very fine and bushy, the hairs attaining about 100 mm. in length; a little white on each side of the tail-base, then a small black median patch on its upper base; the whole remainder of the tail white, apart from the presence of a few isolated and scarcely perceptible black hairs intermixed with the white.

Skull alone exceeding that of *C. proteus* in size, its breadth, especially its mastoid breadth, rather greater than usual in proportion to its length, though the specimen is not very old. Mesopterygoid fossa comparatively broad. Upper molar large, subquadrangular, with its antero-posterior diameter exceeding the outer length of *p*<sup>4</sup>.

Dimensions of the type:—

Head and body 340 mm.; tail\* 240; hind foot 55; ear 30.

Skull: greatest (diagonal) length 71.5; condylo-basal length 66.5; zygomatic breadth 45; interorbital breadth 23; intertemporal breadth 18.5; mastoid breadth 39; palatal length 28; breadth across *m*<sup>1</sup> 28; breadth of mesopterygoid

\* The tail, apparently perfect, is now barely 200 mm. in length. Perhaps 240 is a *lapsus calami* on the part of the collector.

fossa 8.5; maxillary tooth-row 22.5; length of  $p^4$  7.2;  $m^1$ , greatest antero-posterior length\* 8.0, transverse breadth\* 8.2.

*Type.* Adult male (basilar suture closed, but teeth not much worn and crest not developed). B.M. no. 19. 2. 7. 1. Original number 334. Collected 21st August, 1918.

This handsome animal, which I have much pleasure in naming after Sr. Budin in recognition of the excellent work he has done, is readily distinguishable from all hitherto described South-American species by its conspicuous white tail and the proportions of its skull and teeth. *C. tropicalis trichurus*, Thos., from Panama, also has a white tail, but is larger and is otherwise wholly different.

In the present collection there are three specimens of this genus—one larger with large teeth, and two smaller with very small molars,—but all with white tails, and it was natural to assume that the two smaller were females and the larger one a male. On investigation, however, not only of Sr. Budin's labels, but of the skins themselves, damped and pliable, I find that all are certainly males, and are therefore clearly not of the same species. Consequently I am compelled further to describe

## 2. *Conepatus calurus*, sp. n.

♂. 330, 361.

A white-tailed skunk with narrower skull and smaller molars than in *C. budini*.

Size slightly less than in *C. budini*, but still exceeding that of *C. proteus*. Fur long and thick. Hairs of nape either reversed or with an inclination to have twisted whorls. General pattern of colour much more white than in *budini*, for instead of two comparatively narrow white stripes running down the black back, the whole nape and back may be said to be white, with merely a narrow black line ( $\frac{1}{4}$  to  $\frac{1}{2}$  inch in breadth, attaining  $\frac{3}{4}$  inch on the loins) along its centre, this line altogether failing in some parts. Posteriorly the white narrows, but is continuous with that of the tail. Tail bushy, white, with a few black hairs intermixed.

Skull about as long as that of *C. budini*, but narrower in proportion, the mastoid breadth, in a specimen with sagittal crest and worn teeth, disproportionately less than in that animal. Mesopterygoid fossa narrow.

\* In describing *C. ajax* (Ann. & Mag. Nat. Hist. (8) xi. p. 137, 1913) the diagonal measures of this tooth were given, and one of these was misprinted 9 instead of 6.9. The above measurements are sounder, if less easy to take, and in the type of *C. ajax* are 8.3 and 7.0 respectively.

Molars conspicuously smaller than in *C. budini*, their antero-posterior diameter less than the outer length of  $p^4$ .

Dimensions of the type:—

Head and body 320 mm.; tail 190; hind foot 57; ear 25.

Skull: greatest (diagonal) length 69.5; condylo-basal length 66.5; zygomatic breadth 43; interorbital breadth 21.2; intertemporal breadth 15.6; mastoid breadth 36; palatal length 28; breadth across outer corners of  $m^1$  26; breadth of mesopteryoid fossa 6.5; maxillary tooth-row 21.5; outer length of  $p^4$  6.7;  $m^1$ , antero-posterior diameter 6, transverse diameter 8.

*Type.* Old male, with worn teeth and well-developed crests. B.M. no. 19. 2. 7. 3. Original number 361. Collected 28th September, 1918.

As with *C. budini*, the white tail and small size distinguish this skunk from all earlier-described species. From that animal it is separable by the less bulky skull and much smaller molars, in addition to the different pattern of the dorsal markings. In comparing the skull-measurements of the two note must be taken of the fact that the broad skull of the type of *C. budini* is distinctly less aged than the narrow one of *C. calurus*.

### 3. *Oryzomys* sp.

♂. 320, 348, 375, 383; ♀. 329, 331, 376.

### 4. *Andinomys edax*, Thos.

♂. 342.

“‘Chozchorito.’ Rare.”—E. B.

The striking external resemblance that *Andinomys* bears to *Phyllotis* is shown by the fact that Sr. Budin, usually so quick to detect the finest specific distinctions, united with no. 342 several examples of the larger *Phyllotis* of the same region.

This forms a considerable extension of the known range of the species, which was first described from Potosi, and was again found by Sr. Budin in Central Jujuy.

### 5. *Phyllotis tucumanus*, Thos.

*Phyllotis darwini tucumanus*, Thos. Ann. & Mag. Nat. Hist. (8) x. p. 408 (1912).

♂. 343, 344, 349, 352, 354, 364, 370; ♀. 337, 365, 367, 371.

In view of the complication caused by the many local forms of this genus, it seems best to use a trinomial term for this animal.

Bullæ small, nasals unusually narrow and pointed behind, ears and tail short, all as compared with the next species.

The bullæ are about 4 mm. in longitudinal diameter as measured along a line parallel with the middle line of the skull. Ears as measured by collectors 21 or 22 mm. in length. Tail usually 100-110, rarely 115 mm. In two very old specimens, however, nos. 349 and 364, of whose determination I do not feel quite sure, these dimensions are exceeded, the ears and tail reaching to lengths normal in *Ph. ricardulus*.

6. *Phyllotis ricardulus*, sp. n.

♂. 332, 355, 366, 372; ♀. 346, 351, 373.

Like *P. tucumanus*, but with larger bullæ, larger ears, and longer tail.

Size about as in *tucumanus*. General colour above olive-grey, varying, as do all the species of *Phyllotis*, in the extent to which buffy is suffused in the colour. Sides, when in adult pelage, with a well-marked buffy band running from cheeks to base of tail. Under surface soiled grey, the hairs very dark slaty basally, broadly washed with whitish or buffy whitish. Ears decidedly longer than in *tucumanus*, but much smaller than in *vaccarum* or *wolffsohni*, their proectote blackish, the rest grey. Hands and feet pure white. Tail longer and more heavily pencilled than in *tucumanus*, its length rarely less than 130 mm.; blackish proximally and black terminally above, white below.

Skull with the nasals not so markedly narrowed behind as in *tucumanus*. Supraorbital edges sharply square, not ridged. Palatal foramina reaching to the level of the first lamina of *m*<sup>1</sup>. Bullæ comparatively large, distinctly larger and more fully inflated than in *tucumanus*, though smaller than in *vaccarum*, their antero-posterior length on a line parallel with the middle axis of the skull 5 mm. or more. Molars averaging smaller than in *tucumanus*, though rather variable.

Dimensions of the type:—

Head and body 112 mm.; tail 145; hind foot 26; ear 23.

Skull: greatest length 30; condylo-incisive length 27.5; zygomatic breadth 15.8; nasals 12.5; interorbital breadth 4.2; breadth of brain-case 14; palatine foramina 7.2; post-foraminal palate 5.3; bullæ (measured as described above) 5.1; upper molar series 5.

*Type.* Adult female. 'B.M. no. 19. 2. 7. 27. Original number 346. Collected 31st August, 1918.

Although undoubtedly closely allied to *Ph. tucumanus*, this species may be distinguished by its longer ears, its longer

and more heavily tufted tail, and its larger bullæ. Comment has already been made on the number of species, superficially resembling each other, which live in this region, and the occurrence of these two closely allied Pericotes in the same locality is very remarkable. But it has a parallel in Europe, in the relationship to each other of *Apodemus sylvaticus* and *A. flavicollis*.

These latter, however, are inclined to segregate themselves from each other locally, and it is not improbable that a closer study of the actual places where the two Pericotes are found will similarly show that they also are not both to be caught absolutely on the same ground.

### 7. *Graomys cachinus*, Allen.

♂. 321, 323, 350, 378.

[In naming these specimens I have re-examined the undetermined series referred to in my Chumbicha paper, which series I then supposed to belong to but a single species.

To my surprise I now find that those specimens belong to no less than three species—large, middle, and small,—distinguishable almost entirely by size, though, as is not unusual in such cases, the development of ears, tail, and tail-tufts are in proportion to the general size, the larger species being finer animals throughout, with more handsomely tufted tails. There are no specimens of a size to make determination difficult, and the series of each of the three species contains examples with fully worn teeth. The largest species, *G. cachinus*, has a skull-length of 33·5–35 mm. Following this we have

#### *Graomys medius*, sp. n.

Size less than in *G. cachinus*, greater than in the next species. Colour about as in *cachinus*, but there is rather less development of the buffy band along the sides. Under surface white, the hairs either wholly white or slaty at base, this character proving to be absolutely variable in all these species of *Graomys*. Tail rather shorter and less tufted than in *cachinus*.

Skull in all ways less developed than in *cachinus*, smaller, with shorter nasals, supraorbital edges sharply angular, but with less distinct beads than in *cachinus*; bullæ smaller.

Dimensions of the type:—

Head and body 124 mm.; tail 150; hind foot 27; ear 25.



Skull: greatest length 31·2; condylo-incisive length 28·5; zygomatic breadth 16·1; nasals 11·8; interorbital breadth 5·2; breadth of brain-case 14·2; palatilar length 14·1; palatal foramina 7; antero-posterior length of bulla on a line parallel with the middle axis of the skull 6·4; upper molar series 5·2.

*Hab.* (of type). Chumbicha, Catamarca. No specimens in the Otro Cerro collection.

*Type.* Adult male. B.M. no. 18.11.11.23. Original number 262. Collected 6th July, 1918, by E. Budin. Presented by Oldfield Thomas. Ten specimens examined.

Finally, the third and smallest species is represented by half a dozen specimens from Chumbicha; but as the oldest and best is in the Otro Cerro collection, it may be described as an integral part of the present paper, as follows:—]

### 8. *Graomys edithæ*, sp. n.

♂. 380.

Size again smaller than in *G. medius*, making it the smallest known species of the genus. Colour about as in that animal, a buffy wash on the sides rarely present. Under surface white, the hairs either slaty basally or white to their roots. Tail shorter than in *medius*, and less heavily haired terminally; brown above, white on sides and below.

Skull a miniature of that of the other species; supra-orbital edges without beading.

Dimensions of the type:—

Head and body 108 mm.; tail 127; hind foot 25; ear 20.

Skull: greatest length 28·5; condylo-incisive length 26·5; zygomatic breadth 15; nasals 10·5; interorbital breadth 4·5; breadth of brain-case 13·5; palatilar length 12·8; palatal foramina 6·7; length of bullæ 6; upper molar series 4·7.

*Hab.* (of type). Otro Cerro; other specimens from Chumbicha.

*Type.* Old male with worn teeth. B.M. no. 19.2.7.34. Original number 380. Collected 26th September, 1918. Eight specimens examined.

This interesting little *Graomys* agrees with the larger species in all the essential characters of the group, and by the study of the whole series I am strongly confirmed as to the advisability of recognizing *Graomys* as a genus distinct from *Phyllotis*, a point on which Mr. Osgood has expressed some doubt.

9. *Akodon simulator*, Thos.

♂. 326, 363, 377, 379, 381, 382 ; ♀. 322, 368, 369.

These specimens appear to agree absolutely with the type-series of *simulator* from Tucuman, and equally to differ from the Chumbicha *glaucinus*, to which they are geographically so much nearer.

10. *Akodon alterus*, sp. n.

♂. 325, 327, 353, 359.

Closely allied to *A. spegazzinii*, but drabby brown instead of buffy olive.

Size as in the allied species. General colour above drabby brown (between "buffy brown" and "Saccardo's umber" of Ridgway). Under surface dull soiled buffy throughout, the hairs broadly slaty at base, drabby or dull buffy terminally ; hairs of inguinal region tipped with ochraceous. Ears coloured like head. Hands and feet dull drabby whitish ; claws of normal development, the anterior slightly shorter than the posterior. Tail of moderate length, blackish above, dull whitish below, the two colours generally well contrasted.

Skull of the same narrow shape and with the same little swollen brain-case as in *A. spegazzinii*, this narrowness of skull distinguishing the two species from the members of the *arenicola* group. Zygomatic plate well projected forward, its anterior edge often tending to be slightly concave. Palatal foramina very long, reaching to the level of the second re-entrant angle on the inner side of  $m^1$ . Bullæ of normal size.

Molars narrow, early worn down, those of the youngest specimen too worn to say if a definite anterior notch is or is not present on  $m^1$ .

Dimensions of the type:—

Head and body 83 mm. ; tail 68 ; hind foot 20 ; ear 14.

Skull : greatest length 25 ; condylo-incisive length 23.5 ; zygomatic breadth 12.6 ; nasals 9.4 ; interorbital breadth 4.6 ; breadth of brain-case 11 ; palatilar length 10.4 ; palatal foramina 6.3 ; postforaminal palate 2.9 ; upper molar series 4.3.

*Hab.* (of type) as above. Other specimens from Chumbicha.

*Type.* Adult male. B.M. no. 19. 2. 7. 44. Original number 359. Collected 6th September, 1918.

*A. spegazzinii* was described on a specimen from Cachi skinned out of spirit, and the coloration therefore could not

have been trusted for purposes of distinction. But fortunately a topotype skin has since been received, and this is of the same buffy olive colour as the specimens from Potosi referred to that species in 1902\*.

*A. alterus* is readily distinguishable from the older-known species by the absence of the strong yellowish or buffy suffusion in the fur.

No. 228, from Chumbicha, erroneously referred to *A. arenicola* in my previous paper, also proves to belong to this species, while an additional specimen, no. 317, has also come from that locality.

### 11. *Akodon orbus*, sp. n.

♀. 324.

A proodont *Akodon* allied to *A. lactens*.

General characters very much as in *A. lactens*, the colour practically the same except that there is no white patch on the chin. The tone is slightly duller and more drabby, but the difference amounts to little. Ears slightly shorter, coloured like the head. Fore-claws similarly elongated, as long as those of the hind feet. Tail blackish above, dull drabby on sides and below, the difference but little marked.

Skull of lighter build, with markedly narrower muzzle than in *lactens*. Upper outline more bowed. Brain-case smooth, unridged.

Incisors similarly thrown forward (proodont), the incisive angle of the type  $86^{\circ}$ ; they are light-coloured, as in *A. lactens*, but are distinctly more slender in a specimen as old as or older than the type of that animal. Molars rather narrower, of similarly high solid structure.

Dimensions of the type:—

Head and body 97 mm.; tail 59; hind foot 21; ear 14.

Skull: greatest length (bone only) 26.4; condylo-incisive length 25.2; zygomatic breadth 14.6; breadth of muzzle 4.2; nasals 9.1; interorbital breadth 5; breadth of brain-case 12; palatine foramina 6.4; postforaminal palate 4; upper molar series 4.8.

*Type.* Old female. B.M. no. 19. 2. 7. 45. Original number 324. Collected 21st August, 1918.

This species is evidently closely related to *A. lactens*, discovered by Sr. Budin at Leon, Jujuy, but differs by its markedly more slenderly built muzzle, thinner incisors, and

\* Ann. & Mag. Nat. Hist. (7) ix. p. 226 (1902).

by the absence of the prominent white patch on the chin, a character generally fairly constant.

The two species form rather a special group of the genus, but without specimens with less worn dentition it is difficult to make sure of their true relationship.

## 12. *Ctenomys knighti*, sp. n.

♂. 336, 338, 357; ♀. 328, 332, 335, 339, 340, 341, 345, 360, 362.

Allied to *C. budini*, Thos., of Jujuy.

Size about as in *budini*, the skulls of the males a little larger than male *budini*, but the females about the same. Colour above nearly as in that animal, or a little darker, rather paler than "Mars brown"; flanks, especially posteriorly, distinctly clearer buffy, no such clearing of the general grizzled colour being present in *budini*; under surface uniform, without collar across throat, the whole distinctly more ochraceous than in *budini*, the ends of the hairs "cinnamon-buff" or "pinkish cinnamon." Muzzle, both on top and sides of nose and tip of chin, blackish—no darkening being present in *budini*. Tail slightly longer than in *budini*, the longest in four specimens of that species 70 mm., while in *knighti* it ranges from 73 to 84 mm.

Skull of about the same general shape as in *budini*, or slightly more elongate, nasals rather narrower. Parietal region without trace of separate interparietals, even in the youngest specimen, these bones being present in all four examples of *budini*. Palatine foramina longer, in a groove leading forward and enclosing the incisive fissures; in *budini* the foramina end abruptly on the general surface of the palate and the fissures are quite distinct from them. Bullæ of the same general shape, but rather larger, and, as viewed from behind, their smooth postero-superior portion is much more conspicuous owing to its being less covered over by the plastering bones of the occipital series.

Teeth as in *C. budini*, except that *m*<sup>3</sup> has a more obliquely elongate section at all ages.

Dimensions of the type (male) and of an adult female (no. 340):—

Head and body 203, 180 mm.; tail 82, 74; hind foot 36, 30; ear 7, 7.

Skull: greatest median length 49·5, 44; condylo-incisive

length 50·5, 43 ; zygomatic breadth 30·2, 27 ; nasals 17·5, 14·7 × 8, 6·6 ; interorbital breadth 12, 9·8 ; least breadth across brain-case 19·8, 17·8 ; bi-meatal breadth 31·3, 27 ; palatilar length 23·7, 20 ; length of bullæ 17, 15·2 ; upper-tooth-series (alveoli) 11·1, 10, (crowns) 10, 9·6.

*Type.* Adult male. B.M. no. 19. 2. 7. 47. Original number 338. Collected 27th August, 1918.

This tuco-tuco is no doubt nearly allied to *C. budini*, but may be distinguished externally by its dark muzzle, more buffy sides, and absence of collar, and in the skull by the various details above described, and notably by the absence of a separate interparietal.

It is named in honour of Col. C. Morley Knight, by whom, in conjunction with his partner Col. J. J. Porteous, the explorations of Messrs. Kemp and Budin have been so much facilitated in various ways.

"Found on stony ground."—*E. B.*

### 13. *Lagidium lockwoodi*, sp. n.

♀. 333.

Size comparatively large, about as in *L. cuscus*.

General colour nearest to that of *L. cuscus*, of a similar deep grey colour, but not quite so dark ; darker than in *L. tucumanum*. Dorsal dark line well defined, distinct, running from nape to rump. Under surface broadly washed with buffy ochraceous ; no axillary white patches present. Feet grizzled grey, scarcely lighter terminally. Tail distinctly black along its under surface, its long crest mixed black and dull buffy whitish, the end black.

Skull decidedly larger than in *L. tucumanum*, the only species geographically near ; muzzle larger ; nasals little inflated anteriorly, and owing to the great breadth of the premaxillaries the latter are visible outside them from above. Bony islet above meatus fairly large, nearly square ; oblong transversely in *tucumanum*. Posterior line of occiput almost straight transversely, scarcely bulging backwards in the centre, as it does markedly in every specimen of *tucumanum*. Incisive fissure unusually large and open, 2 mm. in breadth. Palatal foramina also widely open posteriorly, in decided contrast with those of *tucumanum*. Bullæ much larger than in the Tucuman species.

Incisors yellow in front, unusually large, and heavier,

thicker and more strongly curved than in any other member of the genus, the incisive angle  $83^{\circ}$ . Molars broad and heavy, the series more bowed out mesially than in other species.

Dimensions of the type:—

Head and body 400 mm.; tail 350; hind foot 95; ear 74.

Skull: greatest length 88.5; condylo-incisive length 81; zygomatic breadth 46.5; nasals  $32.7 \times 11.3$ ; suprameatal islet  $6 \times 6$ ; palatal foramina  $15.5 \times 4.6$ ; diameter of bullæ at right angles to their longest axis 13; upper tooth-series, length (alveoli) 20, greatest breadth across the two series 22; breadth of  $m^1$ , on lamina, 5.6.

*Type.* Adult female (basilar suture closed, but its position perceptible). B.M. no. 19.2.7.57. Original number 333. Collected 24th August, 1918.

The members of this genus appear to be more constant in their skull-characters than has been supposed, and I find that five adult skulls of *L. tucumanum* agree closely among themselves and equally differ from the present specimen in the characters above referred to. *L. cuscus*, from Bolivia, more distant in locality, has a skull rather more similar to that of *L. lockwoodi*, but has smaller bullæ and no tendency towards the abnormally heavy incisors of the new form.

Philippi's *L. crassidens*, without locality, named incidentally in his description of *L. lutescens* \* (itself apparently referable to *L. cuvieri*), would appear to be the ordinary Chilean form *L. viscaccia*, Mol., and is certainly not *L. lockwoodi*, as the visibility from below of the nasals outside the premaxillæ is especially insisted on, this being in distinct contrast to the conditions in *L. lockwoodi*, while it is not infrequently found in *L. viscaccia*.

In naming this fine mountain chinchilla after Mr. Charles Lockwood I may again refer with gratitude to the great assistance he has been in arranging all the financial and business details of the Budin expedition, an assistance without which we should have found great difficulty in carrying it on.

#### 14. *Galea* sp.

♂. 358 (immature).

\* Ann. Mus. Chili, pt. 13, p. 8 (1896).

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Edited by

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BRITISH AND FOREIGN.

Edited by

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CONTENTS OF NUMBER 17.—*Ninth Series.*

	Page
XLIV. Descriptions of new <i>Pyralidæ</i> of the Subfamilies <i>Crambince</i> and <i>Sigince</i> . By Sir GEORGE F. HAMPSON, Bart., F.Z.S., &c. . .	437
XLV. Some new Entozoa from Birds in Uganda. By H. A. BAYLIS, M.A. . . . .	457
XLVI. Ethiopian Heteroptera: some new Species of <i>Reduviidæ</i> belonging to the Genera <i>Pysttala</i> and <i>Platymeris</i> . By W. L. DISTANT. . . . .	466
XLVII. Papers on Oriental <i>Carabidæ</i> .—I. By H. E. ANDREWES. . . . .	469
XLVIII. On Indo-Chinese Hymenoptera collected by R. Vitalis de Salvaza.—II. By ROWLAND E. TURNER, F.Z.S., F.E.S. . . . .	483
XLIX. Description of a new Genus and Two new Species of Heterocera. By Lord ROTHSCHILD, F.R.S. . . . .	487
L. On small Mammals from "Otro Cerro," North-eastern Rioja, collected by Sr. L. Budin. By OLDFIELD THOMAS . . . . .	489

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[NINTH SERIES.]

No. 18. JUNE 1919.

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LI.—*A Collection of Entozoa, chiefly from Birds, from the Murman Coast.* By H. A. BAYLIS, M.A.

(Published by permission of the Trustees of the British Museum.)

THE material to be described in this paper was collected by Surg.-Lieut. E. A. Cockayne, R.N., while in H.M.S. 'Intrepid' (then serving off the Murman coast), and kindly presented by him to the British Museum. The collection consists chiefly of parasites of birds shot by Dr. Cockayne and his fellow-officers at localities on the Murman coast, Kola Peninsula, Arctic Russia.

18 species of Cestodes are represented (excluding larval forms), 3 of Nematodes, and 1 of Acanthocephala. Of the Cestodes, 5 appear to be new species or varieties, while of several the specific determination remains doubtful.

CESTODA.

A. PSEUDOPHYLLIDEA.

**Bothriocephalidæ.**

*Bothriocephalus bipunctatus* (Zed.) (?).

Host: Cottid fish. Yukanski, 29. vi. 1917.

The material consists only of fragments of the strobila, unfortunately without scolices. The width of the segments

*Ann. & Mag. N. Hist.* Ser. 9. Vol. iii. 33

is rather small for *B. bipunctatus*, and the determination is somewhat uncertain.

*Abothrium infundibuliforme* (Rud.).

Host: Salmon. Yukanski, 11. vii. 1917.

A large number of specimens of this species were found hanging out of, and blocking up, the pyloric appendages of the intestine of the fish.

*Plerocercoid Larvæ.*

Hosts: Cottid fishes. Yukanski, 29. vi. 1917 and 22. vii. 1917.

Larval forms, apparently of two species of Bothriocephalidæ, occurred in two of the fishes examined. One form (A) has a distinct head with pronounced lateral grooves; two examples of this were found at the surface of the liver. In the other form (B) the head is not distinctly marked off and the suckers are obscure.

B. CYCLOPHYLLIDEA.

Tetrabothriidæ.

*Tetrabothrius intrepidus*, sp. n. (Figs. 1 & 2.)

Host: *Uria grylle* (black guillemot). Yukanski, 27. vi. 1917.

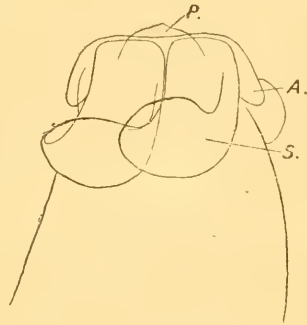
This species is represented only by a single scolex and some fragments. The length of a complete specimen is unknown. The maximum width is 3 mm. The scolex (fig. 1) is 0.6 mm. in width. The suckers are large, dependent, and widely open, curling outwards posteriorly, and resembling shallow basins. Auricular appendages are represented only by a slight finger-shaped lobe (fig. 1, *A.*) at either side of the scolex, between the dorsal and ventral suckers. Anteriorly the scolex bears a slight papilla (fig. 1, *P.*).

Segmentation begins close behind the scolex; the segments are much wider than long throughout. The genital pores are all situated on the right side. The male and female ducts open at the base of a large muscular cloaca (fig. 2, *Cl.*), on a papilla which projects into it. The cirrus-sac (fig. 2, *C.S.*) is squat, triangular in horizontal section, and has a thick muscular wall.

The testes number about fifty, extending across the dorsal

side of the segment and down on either side of the female organs. The ovary consists of a double rosette of lobes, symmetrically arranged in the middle of the segment. It is transversely elongated, and measures 0.35 mm. across. The yolk-gland is compact and lies in front of the ovary, exactly in the middle line. The shell-gland lies behind the ovary, a

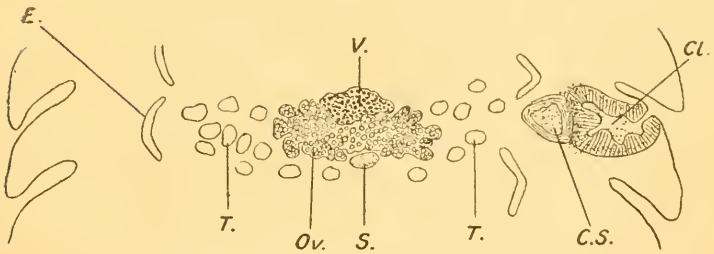
Fig. 1.



*Tetrabothrius intrepidus*; the scolex.

A., auricular appendage; P., apical papilla; S., sucker.

Fig. 2.



*Tetrabothrius intrepidus*; horizontal section through a mature segment.

Cl., genital cloaca; C.S., cirrus-sac; E., longitudinal excretory canal; Ov., ovary; T., T., testes; V., yolk-gland.

little towards the pore side. In gravid segments the uterus forms an irregular sac.

Both dorsal and ventral excretory vessels are present, but there appear to be no transverse vessels. The longitudinal musculature is powerfully developed, consisting of more than

fifty stout bundles dorsally and a similar number ventrally. There is no very clear distinction into outer and inner layers. The genital ducts pass between the dorsal and ventral excretory vessels and ventrally to the longitudinal nerves.

This form differs from *T. erostris* (Lönnerberg), which occurs in the same host, in the larger size of the scolex, the slight development of the auricular appendages, the larger number of testes, and other details.

#### Mesocestoididæ.

##### *Mesocestoides litteratus* (Batsch).

Host: *Vulpes vulpes* (red fox). Yukanski, 23. vii. 1917.

This species occurred in considerable numbers in the upper part of the small intestine.

#### Davaineidæ.

##### *Davainea tetragona* (Molin), var. *lagopodis* (var. n.).

Host: *Lagopus mutus* (ptarmigan). Murmansk, Kola Inlet, 2. vi. 1917.

Two specimens of a *Davainea* closely resembling *D. tetragona* (Molin) were found in a ptarmigan killed at Kola Inlet. This species is stated by Clerc\* to occur in *Lagopus albus* † in the Ural, but the present examples show certain peculiarities that seem to indicate a distinct variety.

The length of a complete specimen is about 20 cm. and the maximum width 5 mm. The scolex measures 0.3 mm. across. The suckers are oval, their longest diameter (antero-posterior) being about 0.14 mm. The diameter of the rostellum is 0.055 mm. It is armed with a single row of minute hooks, 8  $\mu$  long. The suckers are armed with several rows of very small hooklets.

There is a considerable unsegmented neck, as in the typical *D. tetragona*. The segments are much broader than long, except the gravid ones near the posterior end. The transverse excretory vessels are very wide, often appearing as wide as the medullary portion of the segments between them.

The genital pores are unilateral; the cirrus-sac is small (0.15 mm. long), but muscular. The vas deferens is considerably coiled, but, as a whole, pursues a fairly straight

\* Bull. Soc. Oural. Sci. nat. xxx. 1910, p. 123.

† The bird referred to as *L. albus* seems more likely to have been *L. mutus*. The former, as I am informed by Mr. C. Chubb, is an American form, though it ranges into Scandinavia and Northern Russia.

course towards the middle of the segment. The testes are very numerous (about one hundred), extending throughout the medullary parenchyme on either side of the female glands. The ovary consists of two symmetrical bunches of lobes situated in the middle of the segment. The yolk-gland is situated at the back of the segment. The shell-gland is a conspicuous organ lying between the ovary and the yolk-gland. The vagina runs fairly straight from the genital pore to the middle of the segment, its inner end, functioning as a receptaculum seminis, persisting in the gravid segments after most of the other organs have disappeared. The oviduct becomes very wide before opening into the uterus, running vertically for the last portion. The uterus appears at first as a transverse tube, but afterwards disappears, and numerous egg-capsules are formed.

The most important character distinguishing this form from the typical *D. tetragona* is the much larger number of testes (twenty to thirty in *D. tetragona*, about one hundred in the present variety).

#### Dilepinidæ.

*Lateriporus teres* (Krabbe), Fuhrmann, 1907.

Host: *Somateria mollissima*. Yukanski, 8. vi. 1917; Pet-schenga, 24. ix. 1917.

This species seems to be fairly common in the eider-ducks in this region. It was met with in two individuals obtained at the first-given locality, and in another at the second.

*Choanotenia paradoxa* (Rud.), Clerc, 1903.

A single specimen, probably referable to this species, was obtained from a red-necked phalarope (*Phalaropus lobatus*) at Yukanski, 10. viii. 1917.

*Choanotenia* sp. (?).

(Not *Ch. borealis* (v. Linst., 1905), Fuhrmann, 1908.)

Host: *Clanquula hyemalis* [= *Harelda glacialis*] (long-tailed duck). Yukanski, 8. vi. 1917 and 10. vi. 1917.

There are several fragments of what appears to be a species of *Choanotenia*, or possibly *Anomotenia*, obtained on different occasions from two long-tailed ducks. Unfortunately, however, there is only one scolex, and this has lost its rostellum, so that the characters of the hooks, so important

for diagnosis, are unknown. The species differs from *Ch. borealis* (v. Linst.) in having forty-five to forty-eight testes, instead of twenty-five, in each segment, and also in having a smaller scolex (0.43 mm. across at the suckers, instead of 0.67 mm.).

*Anomotænia campylacantha* (Krabbe), Zschokke, 1903.

Host: *Uria grylle*. Yukanski, June and July 1917.

Numerous examples of a worm which may be referred to this species occurred in several black guillemots, associated in one case with *Tetrabothrius intrepidus*. They usually occupied the upper part of the intestine, just below the gizzard.

*Anomotenia micracantha* (Krabbe), Zschokke, 1903.

Host: *Uria grylle*. Yukanski, 22. x. 1917.

A second and rather larger species, which I refer to *A. micracantha*, occurred in considerable numbers in one of the same birds in a similar position to the preceding form.

*Monopylidium arcticum*, sp. n. (Figs. 3 & 4.)

Host: *Tringa maritima* (purple sandpiper). Yukanski, 7. viii. 1917.

This is a slender little worm, about 3.5 cm. long when fairly extended. The maximum width (at the posterior end of the strobila) is about 0.5 mm. A peculiar feature is the tendency of the neck to be very much contracted in the longitudinal direction (fig. 3, **B**) and very wide just behind the scolex. Nearly all the specimens show this contraction, which gives them, to the naked eye, the appearance of having a very large, flattened scolex.

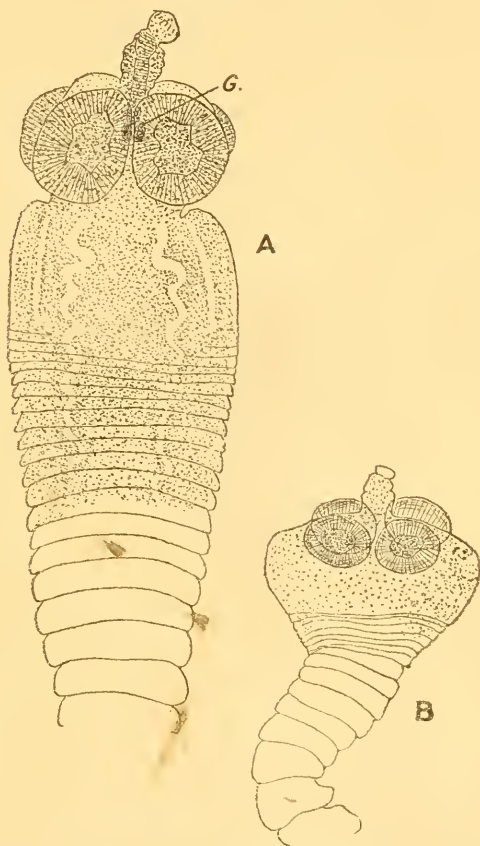
The scolex (fig. 3, **A**) measures about 0.24 mm. across the suckers, the diameter of the latter being 0.12 mm. The rostellum has a mushroom-shaped end and a fleshy and muscular stalk. There is a single row of about thirty (?) hooks, measuring about 15  $\mu$  in length. There is a pair of glandular (?) structures (fig. 3, **A**, *G*.) at the base of the rostellum, in the substance of the scolex.

The strobila contains some eighty segments, which are considerably longer than broad, except those near the anterior end. They gradually increase in length towards the posterior end, some of the gravid segments being fully three times as long as broad. The longitudinal musculature is very well developed. Mature segments (fig. 4) begin to appear at



about the fiftieth. The genital pores are situated near the front of the segment and irregularly alternating. There is a muscular genital atrium (fig. 4, *G.A.*) into which the cirrus-

Fig. 3.



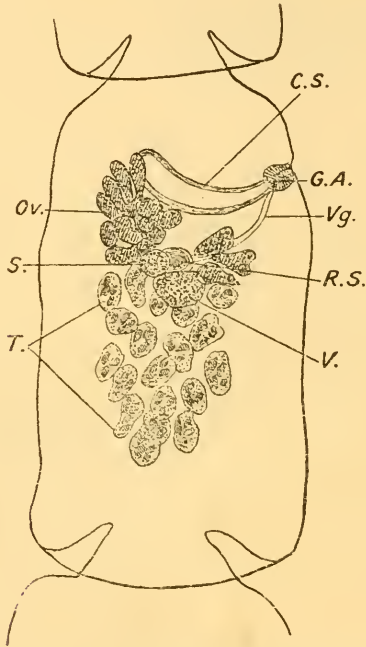
*Monopylidium arcticum*; the scolex and anterior end of the strobila.

- A.** An example with moderately contracted neck; *G.*, paired glands (?) at base of rostellum.  
**B.** An example (less highly magnified) showing marked contraction of the neck.

sac and vagina open. The cirrus-sac (fig. 4, *C.S.*) is very long and narrow, measuring 0.175 mm. in length and 0.035 mm. in width. It curves forwards from the genital

atrium towards the anterior border of the segment, and ends at, or even beyond, the middle line. The testes (fig. 4, *T.*) number about twenty, and occupy the posterior half of the segment. There is a much-coiled vas deferens. The ovary consists of two groups of lobes, the larger group being on the aporal side. Between the two portions of the ovary there is a large rounded receptaculum seminis (fig. 4, *R.S.*); close to

Fig. 4.



*Monopylidium arcticum*; semi-diagrammatic drawing of a mature segment (from a whole preparation).

*C.S.*, cirrus-sac; *G.A.*, genital atrium; *Ov.*, ovary; *R.S.*, receptaculum seminis; *S.*, shell-gland; *T.*, testes; *V.*, yolk-gland; *Vg.*, vagina.

this is the shell-gland (fig. 4, *S.*), and behind both these the compact yolk-gland (fig. 4, *V.*). There are only a few ripe segments at the posterior end of the strobila. There is no definite uterus, the ova being embedded singly in the parenchyme. The onchospheres are about  $20\ \mu$  in diameter.

This form differs from *M. cinguliferum* (Krabbe) in a number of points, notably in its smaller number of testes,

while it is readily distinguished from *M. macracanthum*, Fuhrm., by the much smaller size of its hooks. Both these species occur in closely related hosts.

*Monopylidium stercorarium*, sp. n. (Figs. 5-7.)

Host: *Stercorarius pomarinus* (pomatorhine skua). Yulkanski, 22. vi. 1917.

This is a comparatively short worm, measuring 2.5-3 cm. in length. The maximum width is about 0.8 mm. (near the posterior end). The number of segments is rather small (about ninety).

Fig. 5.

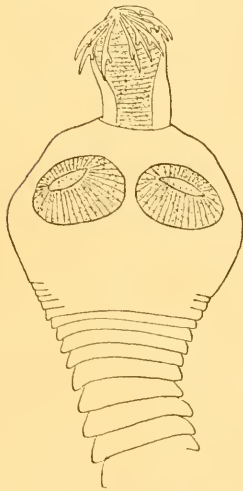


Fig. 6.

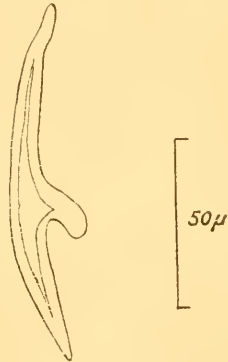


Fig. 5.—*Monopylidium stercorarium*; the scolex.  
Fig. 6.—Ditto; hook from the rostellum.

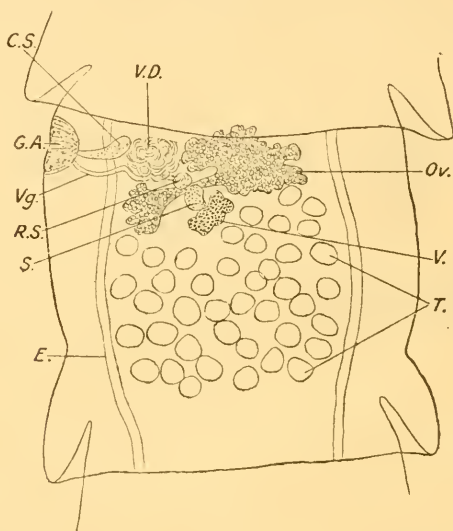
The scolex (fig. 5) measures about 0.4 mm. across, and the suckers are 0.18 mm. in diameter. The rostellum is rather long and stout, and is armed with a single crown of fourteen (?) very large hooks, 110  $\mu$  in length (fig. 6). The long roots of the hooks meet at the apex of the rostellum.

Segmentation begins immediately behind the scolex. The anterior segments are broader than long; soon, however, they become squarish, and posteriorly they are much longer than broad. Rudiments of genital organs begin to appear at

about the thirtieth segment, and young mature segments begin at about the sixtieth. There may be about eight or nine gravid segments at the posterior end, but the number is never large.

In a mature segment (fig. 7) there are about forty testes, occupying the posterior two-thirds of the segment, and extending forwards on the aporal side of the ovary. The genital pores are irregularly alternating and situated near

Fig. 7.



*Monoplylidium stercorarium*; semi-diagrammatic drawing of a mature segment (from a whole preparation).

C.S., cirrus-sac; E., excretory canal; G.A., genital atrium; Ov., ovary; R.S., receptaculum seminis; S., shell-gland; T., testes; V., yolk-gland; V.D., vas deferens; Vg., vagina.

the anterior corner of the segment. There is a muscular atrium (fig. 7, G.A.) into which the male and female ducts open. The cirrus-sac is small, measuring  $0.15 \times 0.037$  mm. The vas deferens is long and much coiled, a large mass of its coils (fig. 7, V.D.) just between the cirrus-sac and the ovary functioning as a seminal vesicle. The ovary consists of a larger and a smaller portion, the former being on the aporal side. Behind it is the yolk-gland, and between this and the

narrow middle portion of the ovary is a rather large shell-gland. Just in front of the shell-gland is a small rounded receptaculum seminis.

There is no definite uterus in the gravid segments, the ova being scattered singly in the parenchyme. The onchospheres measure about  $25\ \mu$  in diameter.

This species bears an exceedingly close resemblance to *Choanotenia porosa* (Rud.) in many respects, but the hooks are of a slightly different shape, the cirrus-sac is much smaller, and the uterus is not sac-like. The small number of segments is also a feature not characteristic of *Choanotenia*.

### Hymenolepinidæ.

*Hymenolepis microsoma* (Crepl.), Cohn, 1901 (?).

Host: *Eidemia nigra* (common scoter). Yukanski, S. vi. 1917.

A number of fragments, unfortunately without scolices, which probably belong to this species, were the only parasites found in this bird.

### *Hymenolepis* spp. A and B.

Host: *Clangula hyemalis* [= *Harelda glacialis*] (long-tailed duck). Yukanski, S. vi. 1917.

The collection includes portions of about three specimens of species of *Hymenolepis* from this bird. Apparently at least two species are represented, but the material is too fragmentary for precise determination. One specimen has a very small scolex, with a little button-like rostellum, apparently unarmed. The scolex measures 0.096 mm. across and the suckers only 0.03 mm. in diameter. This may be called species A. In the mature segments the three testes are arranged in a transverse row, and the fan-shaped ovary lies between the middle and aporal testes. The entire specimen is about  $4\frac{1}{2}$  cm. in length, and the maximum width is about 1.5 mm.

Another specimen, which may be called species B, has a larger scolex with a more typical rostellum, which was apparently provided with hooks; these, however, have all been lost. The ovary, in this case, lies between the middle testis and that on the pore side.

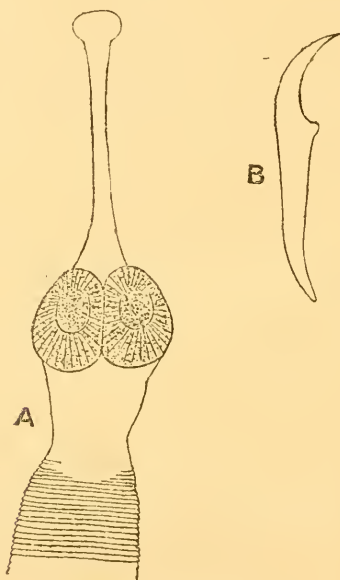
*Hymenolepis* sp.

Some fragments of the strobila of a *Hymenolepis* also occurred in one of the eider-ducks (*Somateria mollissima*) at Yukanski, together with an *Aploparaksis* to be described below; but the absence of a scolex makes determination difficult or impossible.

*Aploparaksis filum* (Goeze), Clerc, 1902.

A headless fragment, perhaps referable to this species, was taken from a purple sandpiper (*Tringa maritima*) at Yukanski, 5. vi. 1917.

Fig. 8.

*Aploparaksis murmanica*.

**A.** The scolex, with extended rostellum.

**B.** Hook from the rostellum, much more highly magnified.

*Aploparaksis murmanica*, sp. n. (Fig. 8.)

Host: *Somateria mollissima*. Yukanski, 8. vi. 1917; Petschenga, 24. ix. 1917.

This is a very small and delicate species, which was

present, usually in considerable numbers, in all the eider-ducks examined.

An entire specimen measures 1 to  $1\frac{1}{2}$  cm. in length, with a maximum width of 0.36 mm. The scolex (fig. 8, **A**) is flattened dorso-ventrally, and measures 0.22–0.27 mm. across at the suckers and about 0.15 mm. in thickness dorso-ventrally. The suckers are very large, meeting in the middle line. The rostellum is long, slender, and proboscis-like, measuring about 0.35 mm. in length when fully extended. At the end it expands into a bulb. The hooks (fig. 8, **B**), which were only seen in specimens with the rostellum retracted, are ten in number and measure  $65\ \mu$  in total length. They are of an unusual shape, having a very long "dorsal" and a greatly reduced "ventral" root.

Segmentation begins close behind the scolex. In a complete specimen there are some three hundred segments, which are broader than long throughout. The cirri, which are usually extruded, are spiny, and, when fully extended, measure about 0.05 mm. in length. The onchospheres measure about  $20\ \mu$  in diameter.

Of the species of *Aploparaksis* hitherto recorded from Anseriform birds, this species is easily distinguished from *A. furcigera* (Rud.) and *A. birulai*, v. Linst., by the size and shape of its hooks. The hooks of *A. fuligulosa*, Solowiow, 1911, are undescribed, but the latter form has a smaller scolex and much longer cirri, among other points of difference. The description of *A. elisæ*, Skrjabin, 1915, I have unfortunately been unable to consult. *A. cirrosa* (Krabbe), which occurs in Lariformes, has hooks only  $22\ \mu$  in length.

## NEMATODA.

### Ascaridæ.

#### *Ascaris capsularia*, Rud.

Hosts: Cottid fishes. Yukanski, June 1917.

This immature Ascarid, according to views put forward elsewhere by the writer\*, is the larval form of *Ascaris de-cipiens*, Krabbe, which occurs as an adult in seals. The young forms are found in fishes of various genera and families, usually coiled up like watch-springs in capsules under the peritoneum.

The present examples came from various Cottid fishes, the precise determination of which is unknown. They agree in almost all respects with the description previously given\*,

\* 'Parasitology,' viii. no. 3, 1916, p. 360.

but the two portions of the œsophagus are, relatively to the whole body, considerably shorter, especially the anterior portion, which is only about half the length there given. Thus, in a specimen about 14 mm. long the anterior part of the œsophagus measures only 1.02 mm., the posterior part 0.78 mm., and in a 37 mm. specimen the two parts measure 1.8 mm. and 0.8 mm. respectively. This seems to indicate that a good deal of variability exists.

Dr. Cockayne informs me that these worms were not found, as usual, in capsules, but were embedded in the liver of the fishes or just under its covering membrane. When the liver was placed in a dish, they sometimes wriggled out quite freely.

#### *Ascaris* sp.?

From one of the fishes, among examples of *A. capsularia*, there is one small larval Ascarid of another species. It is about 10 mm. long, having a head with three rudimentary lips and a boring-tooth, and a gradually tapering tail about 0.2 mm. long, without a tail-spike. There is a conspicuous excretory cell running back to about 1.8 mm. from the anterior end. The œsophagus is about 1 mm. long, and there appear to be no œsophageal or intestinal diverticula.

#### Spiruridæ.

*Streptocara* sp. [? *S. pectinifera* (Neumann)].

Host: *Uria grylle*. Yukanski, 27. vi. 1917.

Neumann, in 1900, described a small nematode from the common fowl and guinea-fowl under the name of *Spiroptera pectinifera*. This has been made the type of a new genus—*Streptocara*—by Railliet and Henry\*.

The present collection contains a single female specimen of a worm which evidently belongs to the same genus, and answers so closely to the description of *S. pectinifera* that it may be specifically identical. The absence of a male, however, renders determination uncertain and description comparatively worthless. The specimen in question was found in the crop of the host: If the species is identical with *S. pectinifera*, it is remarkable that it should occur in hosts so distantly related as the common fowl and the black guillemot.

\* Compt. rend. Soc. Biol. lxxiii. 1912, p. 622.



## ACANTHOCEPHALA.

*Polymorphus minutus* (Goeze), Lühe, 1911  
[= *Echinorhynchus polymorphus*, Bremser].

Hosts: *Somateria mollissima*, Petschenga, 24. ix. 1917.  
*Uria grylle*, Petschenga, 22. x. 1917.

The latter bird appears to be a new host for this species, which occurs chiefly in various species of ducks and in some other aquatic birds.

LII.—*The Classification of the Mongooses* (Mungotidæ).  
By R. I. POCKOCK, F.R.S.

IN 1916 (Proc. Zool. Soc. 1916, pt. i. pp. 349-374) I published a comparative study of the principal external characters of the mongooses, granting this group the rank of a family Mungotidæ of the Æluroid, Herpestoid, or Mungotoid section of the Carnivora\*.

In this paper I restored to use certain generic names, such as *Atilax* †, *Ichneumia*, and *Ariela*, which do not appear in their generic significance in modern treatises on the group, the two first being regarded as synonyms of *Mungos* (*Herpestes*) and the last as a synonym of *Crossarchus*. Since the justification for their resuscitation was not definitely stated in systematic form, and since the reason for thinking the mongooses should rank as a family of the Mungotidæ rather than as a subfamily of the Viverridæ, according to the generally adopted practice, was not declared at all, I propose in this paper to make good those defects.

\* The term Herpestoidea was proposed by Winge to replace Æluroidea on the grounds that the generic name *Ælurus* unfortunately stands for one of the Procyonidæ belonging to the Cynoid or Arctoid section of the order. But since *Herpestes*, being preoccupied, no longer stands for the typical mongooses, *Mungos* is used instead. Similarly, Mungotinæ has taken the place of Herpestinæ. Logically, therefore, Mungotoidea should be preferred to Herpestoidea if, in accordance with Weber, we follow Winge in discarding the title Æluroidea.

† *Atilax*—or *Athylax*, as it should have been spelt—means pouchless, and was given by Cuvier to the marsh-mongoose, on the supposition that this animal has no anal sack. As I have shown, however (*op. cit.* p. 366), the sack is well developed in this genus.

## Family Mungotidæ.

Mungotoid Carnivora distinguished by the combination of a number of positive and negative characters, of which the principal are:—

The secretion of the *anal glands*, the orifices of which are outside the anus, is discharged into a nearly naked, glandular, cutaneous sack capable of being closed by the juxtaposition of the upper and lower halves of its thickened rim.

*Perineal scent-gland* absent in both sexes.

*Vulva* close beneath lower rim of anal sack.

*Prepuce* close to scrotum.

*Glans penis* short, with orifice on its lower surface; baculum present.

*Feet* with fossorial, non-retractile, usually long claws, and pollex and hallux, when present, arising just above the plantar pad.

*Ear* rounded, small or moderate, without marginal bursa, and with antero-internal ridge (intratragus) curving abruptly backwards beneath the supratragus, and high above the intertragal notch.

Resembling the Hyænidæ and Cryptoproctidæ in the possession of an anal sack and the absence of preputial scent-gland, but differing from them in the smallness of the penis, the proximity of the prepuce to the scrotum, etc. The last character mentioned and the absence of the preputial gland distinguish them from the Viverridæ (*Viverra*, *Paradoxurus*, etc.). They approach the Galidictidæ in the structure of the feet and in cranial characters, but differ in the presence of the anal sack, the absence of the perineal gland and of the bursa in the ear, and in the presence of an alisphenoid canal or of a groove representing it.

*Characters and Classification of the Genera of Mungotidæ.*

In 1864, and in papers published after that date, Gray made use of the presence and absence of the naked area of skin cleaving the upper lip as a character of primary importance in classifying the mongooses. He even divided them into two families—the Herpestidæ and Rhinogalidæ—on that basis.

Thomas also chose this as the leading feature in grouping the genera of African mongooses, the number of toes coming next in order, then the premolar teeth, and, finally, the hairiness of the sole of the hind foot (P. Z. S. 1882, pp. 62-63). But whether the analytical key compiled on those lines

expressed his views regarding the true affinities of the genera, or whether the arrangement, in its entirety or in part, was merely a matter of convenience for the determination of the genera, I am not sure.

Mivart's classification was published in the same year as that of Thomas (P. Z. S. 1882, p. 185). He pointed out that the genera may be arranged in various ways, *i. e.*, according to the number of anal glands, the number of digits, the number of teeth, and the presence or absence of the sub-nasal groove; and it is quite clear, I think, that Mivart had no preference for one category over another. The use he made of the anal glands has already been discussed (P. Z. S. p. 366, 1916). With regard to the other groups, by the number of toes *Suricata* is ranged alongside *Bleogale*, by the character of the upper lip it falls with *Rhinogale* and *Crossarchus*, by the number of premolar teeth it is associated with *Helogale* and *Crossarchus*.

*Suricata* has been selected here as a test of Mivart's proposed classification, because, in my opinion, the simple structure of the ear in that genus shows that it cannot be closely affiliated with any other genera of mongooses, all of which have complicated highly specialized ears; and this conclusion further suggests that the suppression of the divisional line of the upper lip may be an independently acquired resemblance between *Suricata* and *Crossarchus* or *Rhynchogale*.

From a comparison of the genera, admitted in my paper in 1916, both mutually and with those of the subfamilies of the Viverridæ, it may be assumed as a working hypothesis that the immediate ancestor of the mongooses possessed the following characters:—

1. The snout was of moderate length, and a naked grooved strip of skin (*philtrum*) extended from the rhinarium, which had a deep infranarial portion, to the edge of the upper lip.

2. The cheek-teeth, consisting of four premolars and two molars above and below on each side, were of a crushing and cuspidate rather than of a shearing and piercing type, with the upper carnassial (*pm*<sup>4</sup>) set well in front of the posterior angle of the cheek where the inferior edge of the zygoma rises, thus leaving space behind for two well-developed molars, the last molar of the mandible being also well developed\*.

\* If it be claimed, as it may be claimed, that the ancestral form had the specialized carnivorous dentition of the kind seen in *Mungos*, then that genus, setting aside the ear, differs but little from the hypothetical progenitor of the group, and the more generalized omnivorous dentition of such forms as *Ichneumia* and *Crossarchus* has been secondarily acquired. A similar argument applied to the subfamilies of Viverridæ will involve

3. The ear had the external portion of the pinna small as compared with the depression containing the cartilages, and there was no marginal bursa. Of the cartilages, the supratragus was rod-like and the prominence of the antero-internal ridge (*intratragus*) ended high above the intertragal notch leading to the inferior auditory meatus.

4. The feet were semiplantigrade and pentadactyle, with the pollex and hallux inserted above the plantar pad, which was trilobate, not quadrilobate; the four main digits, armed with long fossorial claws, were united by interdigital webs extending to the proximal ends of the small digital pads; the fore feet were naked back to the carpal pad and the hind feet up to and possibly including the heel.

5. The orifices of the anal glands were outside the anus, and their secretion was discharged into a nearly naked glandular cutaneous sack with a thickened rim and capable of being closed by the juxtaposition of the upper and lower halves of this rim.

6. The vulva was only a short distance below the lower edge of the anal sack and the penis was short and situated close to the scrotum, there being no trace of a preputial gland between the penis and scrotum in the male or between the anal sack and the vulva in the female.

None of the existing genera conforms precisely to this type. Apart from *Suricata*, to be considered later, all of them have ears more complex in construction, owing to the formation of the two valvular laminae.

Of the genera with complex ears, *Mungos* (type *mungo*), in a broad sense, with its pentadactyle naked feet, well-webbed digits, and cleft upper lip and moderate snout, agrees with the primitive type, but it differs therefrom in its carnivorous dentition, the upper carnassial ( $pm^4$ ) being large and set back

the conclusion that the specialized carnivorous dentition of *Genetta* and *Linsang* preceded in evolution the generalized omnivorous dentition of *Paradoxurus* and *Fossa* respectively. Also that the similarity between the teeth of *Genetta* and *Mungos* in number, position, and form is a character inherited almost unchanged from a common *Æluroid* ancestor. I believe, on the contrary, that it is a purely adaptive resemblance, and that the carnivorous type of dentition, attested more particularly by the retrogression of the upper carnassial ( $pm^4$ ), accompanied by reduction in the size and importance of the two molars behind it and of the first premolar, has been independently acquired several times over within the limits of the *Æluroides*; and that the extraordinarily varied types of dentition met with in this group have been derived sometimes by elaboration, sometimes by degeneration from some such type as that of the typical Canidae, in which the upper carnassial is set far forwards, leaving space for two fairly large molars behind it.

almost to the angle of the cheek, the two molars being reduced so as to fit into the short dental area behind it. The lower carnassial ( $m^1$ ) is correspondingly large and the last molar quite small. The first premolar, always small and sometimes absent, is evidently a practically functionless tooth, but, when absent, its former position is marked by the persistence of the space between the canine and the second premolar.

*Helogale* (type *parvula*) may be regarded as a dwarfed *Mungos*, in which the diastema has closed up by the shortening of the jaw.

*Atilax* (type *paludinosus*) is related to *Mungos*, but has very specialized feet, as is testified by the suppression of the interdigital webs. The slightly more forward position of the upper carnassial and the larger size of the two molars suggest its being an offshoot from the *Mungos* + *Helogale* stem before the retrogression of the carnassial was completed. The exceptional massiveness of the teeth and jaws are probably an adaptation for crushing the shells of the river-crabs on which it feeds to a great extent.

*Ichneumia* (type *albicauda*) has teeth\* of a more generalized type than *Mungos*, and in that particular comes nearer the hypothetical primitive form, but it differs therefrom at least in the hairiness of the hind feet and more digitigrade gait. The depth of the upper lip below the rhinarium is also no doubt a specialized feature.

*Bdeogale* (type *crassicauda*) shows many dental resemblances to *Ichneumia*, as Thomas pointed out †. Specialization of the feet, however, is carried a stage further than in that genus, as is shown by the shortening of the four main digits and the suppression of the hallux and pollex.

\* Of the teeth of *Ichneumia albicauda* Thomas wrote in 1882:—“Teeth more rounded than in the members of the typical subgenus [*Mungos*]. Last molars above and below proportionately much larger . . . the lower one with a well-marked extra cusp between the usual ones, so that there are five cusps in all.” To this it may be added that the first molar of the upper jaw is nearly as large as the carnassial ( $pm^1$ ), though lower crowned, and occupies the position of the carnassial in *Mungos*, being inserted well in front of the superjacent base of the zygomatic arch.

† He wrote, “Of all the mongooses *H. albicauda* [*Ichneumia*] seems to be most nearly allied to true *Bdeogale*, strongly resembling the species of that genus in . . . the proportionally large size of the last molar, and, most of all, in the presence of the median middle external cusp to the last molar, a character in which *Bdeogale* differs from all other mongooses except the present species and those of the very distinct genus *Crossarchus*.”

*Rhynchogale*\* (type *melleri*) was associated by Gray with *Crossarchus* and *Suricata*, and provisionally left in that category by Thomas. It appears to me to be more nearly related to *Ichneumia* and *Bdeogale*, despite the suppression of the groove on the upper lip.

In position and relative size the teeth are not at all unlike those of *Ichneumia* and *Bdeogale*, although the upper carnassial is a little more forward. Their chief peculiarity lies in the flatness of the crowns of the molars, probably an adaptation to a frugivorous diet †. The twist of the lower dental row is not much, if at all, more marked than in *Bdeogale*, and the same is true of the concavity of the palate. The mesopterygoid fossa is more forward than in *Ichneumia* and *Bdeogale*, but the bullæ, which are more inflated posteriorly than in *Bdeogale*, do not surpass those of *Ichneumonia* in that respect. The feet are pentadactyle and hairy as in *Ichneumia*. The absence of the groove below the rhinarium is a distinctive feature of *Rhynchogale*, which appears also to have a longish snout; but this latter feature seems to be foreshadowed by the long upper lip of *Ichneumia*. On the evidence I think the genus may be regarded as a specialized form of the *Ichneumia* + *Bdeogale* group of genera.

The exact position of *Cynictis* (type *penicillata*) and *Paracynictis* (type *selousi*) is doubtful, but there are indications perhaps of closer kinship with *Ichneumia* than with any other genus, although the relationship is not close. Nevertheless, the large ears of *Cynictis* are foreshadowed in *Ichneumia*, and, as in that genus, the fore foot is hairy down to the carpal pad and the hind foot down or almost down to the plantar pad; but the suppression of the hallux in *Cynictis* and of both pollex and hallux in *Paracynictis*, and the reduction in depth of the interdigital webs mark the feet as more specialized than in *Ichneumia*, though possibly in the greater length of the claws they are more primitive. Specialized features in the skull are its shortness, a character correlated, judging from *Suricata*, with stronger postorbital bars and

\* I have seen no fresh or spirit-preserved material of this genus apart from a newly born kitten found by White at Zomba and preserved in the British Museum. The anal sack is well developed, but the most remarkable feature about the specimen is the enormous depth of the upper lip beneath the rhinarium, giving an unusually thick aspect to the muzzle. The rhinarium, moreover, is set upon the summit of the muzzle, and has an upward, not a forward aspect, almost as in *Cynogale*. Since I do not know the condition of the muzzle in the young of other genera of mongooses, a simple record of the facts must suffice.

† White found the stomachs of *Rhynchogale* filled with fruit (P. Z. S. 1894, p. 139).

more arched zygomata, and the inflation of the anterior chamber of the bulla, coupled with the large perforation close to the tympanic bone.

As in *Ichneumia*, *Mungos*, and others, the *foramen rotundum* opens into the alisphenoid canal, probably a primitive feature. The teeth of the upper jaw are somewhat more sectorial than in *Ichneumia*, as is shown more particularly by the narrower palatal portions of the two molars.

*Ariela* (type *fasciata*), with some points of resemblance to *Mungos* in its semiplantigrade pentadactyle feet, has nevertheless a more generalized dentition. The highly developed anal sack and absence of groove on the snout are specialized features. In one character connected with the skull it differs from all the genera hitherto considered (? *Rhynchogale*)—namely, in the opening of the *foramen rotundum* direct into the temporal fossa and not into the alisphenoid canal, the anterior aperture of the latter being situated alongside that orifice and separated therefrom by a narrow bony partition.

*Crossarchus* (type *obscurus*), resembling *Ariela* in the particular last mentioned, has a less specialized anal sack and a more specialized snout.

*Suricata* (type *suricata*) has always been admitted to hold an isolated position amongst the mongooses, and the now ascertained differences in the structure of its ear enhance the isolation.

Generically it may be distinguished from the rest of the family by a complex of associated characters, like the general form of the skull, the elongated snout, undivided upper lip, tetradactyle feet, and naked tarso-metatarsus. The shape of the skull, with its bowed zygomata and complete and stout postorbital bars, recalls in a measure that of *Cynictis*; but the great difference in the form of the bullæ, apart from other features, precludes the idea of near affinity between the two genera. The long snout and undivided upper lip, resembling those features in *Crossarchus*, are likely enough to be purely adaptive resemblances; but in the skull there is one significant similarity, namely, the situation of the *foramen rotundum* alongside the anterior orifice of the alisphenoid canal and close to the sphenoidal fissure—a character restricted to *Ariela*, *Crossarchus*, ? *Rhynchogale*, and *Suricata*, so far, at all events, as mongooses are concerned. I think it is a tenable hypothesis that *Suricata* is a highly specialized offshoot of the *Ariela* + *Crossarchus* stock of this family. In that case, the ear of *Suricata* may be regarded as secondarily simplified. Nevertheless, a comparison between this ear and that of the Mascarene Galidictine genera forcibly suggests

simplification from that type of organ found in the latter group. In the present state of our knowledge it seems to me that no satisfactory conclusion can be reached on this point. But even if kinship between *Suricata* and *Crossarchus* be admitted, it must be remembered that the former differs from the latter more than *Crossarchus* differs from other genera of mongooses.

The main characters peculiar to the skull of *Suricata* are the following:—

1. The plane of the base of the skull is inclined at an obtuse angle to the plane of the palate. In other genera these two planes are subparallel.
2. The bullæ are nearly as wide as long, very flat, and project only slightly below the occipital condyles, which are situated between their postero-superior portion. In other genera the bullæ are much longer than wide, inflated, and project some distance below the condyles.
3. The ridge of the mastoid extends on the outer side of the bulla below the inferior edge of the auditory meatus.

These characters, coupled with the difference in the structure of the ear, justify the erection of *Suricata* to the rank of a subfamily—the Suricatinæ,—the rest of the genera constituting the Mungotinæ.

#### *Analytical Key to the Genera of Mungotidæ.*

The construction of an analytical key to the genera of this family is simplified by giving a foremost place to the number of digits and to the structure of the upper lip; but since the adoption of that course leads, in my opinion, to artificial affiliation, I have attached a secondary importance to those characters:—

- |   |                     |
|---|---------------------|
| A. Supratragus a simple ridge with no valvular flap above it; skull-characters as enumerated above . . . . .  | Subfam. SURICATINÆ. |
| Teeth as under <i>a'</i> below, pollex and hallux suppressed, upper lip unclift by philtrum . . . . .   | <i>Suricata</i> .   |
| B. Supratragus large and valvular, with a valvular flap just above it. . . . .  | Subfam. MUNGOTINÆ.  |
| a. Dentition sectorial, upper carnassial ( $\rho m^4$ ) dominant, set back so that its posterior angle is close to the base of the malar arch, its outer edge forming an obtuse angle with that of $m^1$ , most of which is |                     |



- behind that point; (upper lip shallow, cleft; digits 5—5).
- b. Digits 2 to 5 always united by a web which projects beyond the margin of the plantar pad.
- c. Either a space or  $pm^1$  intervening between the upper canine and  $pm^2$ . *Mungos* \*.
- c'. No space between upper canine and  $pm^2$ ,  $pm^1$  suppressed . . . . . *Helogale*.
- b'. Digits 2 to 5 separated down to plantar pad, owing to suppression of the webs present in other genera . . . . . *Atilax*.
- a'. Dentition more generalized, rather crushing than sectorial, upper carnassial ( $pm^4$ ) set forwards so that its posterior angle is well in advance of the root of the malar arch, the whole or practically the whole of  $m^1$  being also in advance of that point, the line of the cheek-teeth forming a much more even curve at the junction of  $pm^4$  and  $m^1$ .
- d. Webs deeper as compared with length of digits; ears moderate or small, with no pocket behind the antitragal ridge; skull elongated, lower; inner portions of upper  $m^1$ ,  $m^2$  thick and strong; last lower molar with median external cusp or flat-crowned.
- e. Legs short, semiplantigrade, fore paws broad, with very long claws; at most the heel of the hind foot hairy, ears small and rounded (no groove on upper lip).
- f. Snout short as in *Mungos*, infranarial portion of rhinarium shallow; anal sack complex . . . . . *Ariela*.
- f'. Snout long, infranarial portion of rhinarium deep; anal sack simple. *Crossarchus*.
- e'. Legs long, digitigrade, fore paws narrow, claws shorter, metatarsus covered with hair almost to the plantar pad, ears longer.
- g. Upper lip grooved, posterior cheek-teeth cuspidate; mesopterygoid fossa set further back.
- h. Pollex and hallux retained . . . *Ichneumia*.
- h'. Pollex and hallux suppressed . . *Bdeogale*.
- g'. Upper lip ungrooved, posterior cheek-teeth flat-crowned; mesopterygoid fossa set more forwards. *Rhynchogale*.
- d'. Webs very shallow as compared with length of digits, especially between digits 3 and 4, 4 and 5; ears very large for the group, with a small

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\* I suspect this genus will prove to be divisible into three or more genera when better known.

pocket behind the antitragal ridge \* ; skull short and high ; inner portions of upper  $m^1$  and  $m^2$  slender and weak ; last lower molar without median external cusp ; (upper lip grooved ; metatarsus hairy down to plantar pad ; hallux absent).

- i. Pollex retained ..... *Cynictis*.  
 i'. Pollex suppressed ..... *Paracynictis*.

LIII.—On Two new Parasitic Mites (*Myocoptes hintoni* and *Psoroptes natalensis*). By STANLEY HIRST.

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*Myocoptes hintoni*, sp. n.

♀. The minute little *scutum* (at the extreme anterior end of the *dorsum*) angular posteriorly in the middle, but not ending in a slender, median, spine-like process, as in *M. musculinus*, Koch, and *M. tenax*, Michael. The new species can also be readily recognized by the four very long hairs (a pair on each side) that are present (on the venter) at the posterior end of the body, instead of only two long hairs in this position (one on each side), as in *M. musculi*, *M. tenax*, etc.

Length of body 340  $\mu$ , its width 170  $\mu$ .

Host: English Squirrel (*Sciurus vulgaris*), Exeter, October 1918.

*Psoroptes natalensis*, sp. n.

♂. Second hair from each side on abdominal lobe fairly long and shaped like a very fine lance, the distal half being distinctly flattened (blade-like), instead of cylindrical as in *P. ovis*, *P. capræ*, *P. cuniculi*, *P. equi* (and also *P. bovis*, according to Berlese's description and figure). Middle hair on lobe long and fine. Outermost hair quite short. Innermost hair very fine and comparatively long.

Length of body (including capitulum and posterior lobes) 420  $\mu$ , its width 290  $\mu$ .

Material. A number of specimens found on cattle at Richmond, Natal, 1896 (C. D. Soar's collection).

Note.—In the genus *Chorioptes* (including *C. bovis*) the central hairs on the abdominal lobes of the male are modified in much the same way as in this new species, but the flattened portion is very much wider and the pedicles of the tarsi bearing the pulvilli are quite short instead of elongated and segmented, as in *Psoroptes natalensis*, etc.

\* The characters of the feet and ear need verification in the case of *Paracynictis*, only dried skins of the genus being available for examination.

LIV.—*The Selection of Helix nemoralis by the Song-Thrush* (*Turdus musicus*). By MAUD D. HAVILAND, Hon. Mem. B.O.U., and FRANCES PITT.

SECTION I. By MAUD D. HAVILAND.

AN article on "Shell-banding as a Means of Protection," by A. E. Trueman, appeared in the *Ann. & Mag. Nat. Hist.*, October 1916, and is of considerable interest, for it deals with the striking habit of the song-thrush (*Turdus musicus*) to break small shells habitually upon certain stones or "anvils," and this habit is rare among birds. At first sight, the author's conclusions seem to give proof of natural selection in operation; but when the matter is examined more closely, it is not so clear, and some of Mr. Trueman's methods invite criticism.

It would have been well if he had given a detailed account of the wide area in which his "anvil" and "control" collections were made. The area is described only as a belt of country on the Magnesian Limestone, some 3 miles long, between certain named localities. *Helix nemoralis* varies almost from one ditch to another, as, indeed, is exemplified in Mr. Trueman's paper, and, unless the control collections were made immediately round their respective anvils, they may be very misleading. In a collection made at Quy Fen, Cambridgeshire—a piece of marshy pasture-land interspersed with clumps of willow and bramble-bushes,—it was found, although exact figures were not kept, that lightly banded snails were more abundant on the open spaces among the short herbage, while the heavily banded specimens predominated in the bushes. If a collection had been made, for instance, only in the open, it would not have been really representative of the snails in the locality in general.

Another weak spot in Mr. Trueman's control collection is that it was formed of dead shells. How can one be sure that the shells were in the same situations and positions as when they were alive? It is much to be doubted whether protective devices are of much avail to any creatures that are preyed upon by ground-feeding birds. Striped coloration is inconspicuous only when viewed from a distance; the pied striping on the snout of the badger or on the neck of the black-throated diver are cases in point. But when a bird sees a snail among herbage at a distance of only a few inches the bands of black and yellow will be clearly defined.

Certainly thrushes seem to destroy plenty of *Helix aspersa*, whose shell appears to be more inconspicuously coloured than that of *H. nemoralis*.

Mr. Trueman's tables do not give an exact idea of the "conspicuousness" of a given shell. For instance, a "two-banded" specimen might answer to the formula (123)(45) and appear nearly black; or it might be described as 00230 and look almost yellow. This would make all the difference to its conspicuousness. But the figures given are certainly curious, and two explanations suggest themselves:—

- (a) The possibility admitted by Mr. Trueman himself in his last paragraph, when he says: "The figures appear to show that banded shells are less liable to be seen—or, at least, to be eaten." The italics are mine.
- (b) That the darker varieties predominate in bushy places and the lighter in the open, where the thrushes generally feed. Hence the birds would find a larger proportion of unbanded shells.

With these ideas in view I made two series of observations in the summer of 1917; I had hoped to continue them in 1918, but circumstances prevented this, and unfortunately neither of them are as complete as they should be.

The first experiments were made on Maidenhead Thicket, in an open grassy place surrounded by bushes, between June 25th and July 2nd. The snails were tethered to pegs by black threads, varying from 6 to 12 feet in length, passed through a hole drilled in the lip of the shell, and the numbers were checked every evening. Snails disappeared on the second and succeeding days, but I did not obtain positive proof that they were taken by thrushes until June 30th. I found a four-banded shell, still fastened to its thread but unmistakably smashed by a thrush, and some yards away was a second four-banded shell, also broken, beside a stone. On the following day, in addition to two three-banded shells which had been carried off altogether, I found three four-banded shells which, with the threads still attached, were lying each beside a stone with the shell smashed, but with the animal uneaten.

For convenience in working, the snails, whose tethering threads became much entangled, were put out in five groups—A, B, C, D, E. Each group consisted of from four to six snails tied to one peg and selected quite haphazard. The groups were all within an area of 25 yards, but A and B were much overhung by bushes, C was a little more exposed, and D and E were quite in the open. Four snails were

taken from A, none from B, three from C, five from D, and five from E, although the two latter groups were not put out until four days after the others. Unfortunately it was not possible to make longer observations, but, as far as they go, they suggest: (a) that the thrushes, so far from choosing the lightly banded shells, actually preferred the four-banded variety, although this was not the most numerous form provided; (b) that thrushes may break snails which for some reason they do not eat; (c) that there is a tendency for snails to be taken from the more exposed places. If the distribution of *H. nemoralis* at Quy Fen obtains elsewhere, the latter factor alone might account for the large proportion of unbanded shells at the "anvils" recorded by Mr. Trueman.

A second series of observations was carried out near Cambridge round an artificial piece of water. The place, which is of about 4 acres area and surrounded by fields, is lush-grass thickly interspersed with cypress, privet, and bramble-bushes. In the season in question it was inhabited by one pair of thrushes, who reared two broods there. Collections were made at intervals, with the results set out in Table II. On July 31st anvil I. only was taken. On August 13th it was emptied again, and II., III., and IV. were found. Therefore the numbers for anvil I. on this date represent a proportion of the thrushes' takings for a fortnight. The large proportion of *Helicella cantiana* found broken may possibly be accounted for by the dry weather that prevailed at the time. In August attempts were made to form a control collection, but owing to the drought they were unsuccessful, and further opportunity did not arise until October 15th-21st, when, after long search, living (mostly immature) specimens were found, as recorded on Table III.

While the control collection is thus so small, judgment must be suspended; but so far there seems no ground for supposing that the banded shells were taken less frequently than the unbanded, nor that, when taken, they were not eaten. After my observations on the tethered snails, I was prepared to find that the heavily banded shells were distasteful to the birds; but the later observations dispose of this idea, and as these anvils were made in the summer, when insect food was plentiful, it could hardly be that hunger drove the birds to eat unpalatable food.

I should like here to express my indebtedness to Mr. H. H. Brindley, M.A., of St. John's College, for his assistance in forming these collections and for much helpful criticism and advice.

TABLE I.  
*Snails tethered in Maidenhead Thicket.*

Number of Bands.	Number of Snails.	Number of Snails taken.
1 band .....	7	1
2 bands .....	7	3
3 " .....	23	4
4 " .....	12	6
5 " .....	20	1
Vars. <i>rubella</i> and <i>castanea</i> (unbanded) .....	11	2
Total .....	80	17

TABLE II.  
*Cambridge.*

Formulae.	Anvils.												Total.
	July 30th.				August 13th.				October 21st.				
	I.	II.	III.	IV.	I.	II.	III.	IV.	I.	II.	III.	IV.	
12345 <sup>1</sup> .....	11	..	..	1	2	1	10	27	5	..	..	..	57
123(45) <sup>2</sup> .....	10	..	..	2	1	..	5	3	..	..	..	..	21
(12)345 <sup>3</sup> .....	1	..	..	4	1	1	..	4	..	..	..	..	11
(12)3(45) <sup>3</sup> .....	1	..	..	3	..	..	..	17	1	..	..	..	22
(12)(345) <sup>3</sup> .....	2	..	..	5	..	2	..	9	..	..	..	..	18
(12345) <sup>3</sup> .....	..	..	..	6	..	1	..	2	1	..	..	..	10
12340 <sup>4</sup> .....	11	..	..	7	..	..	..	..	..	..	..	..	18
(12)340 <sup>4</sup> .....	1	..	..	8	..	..	..	..	..	..	..	..	9
12305 <sup>4</sup> .....	1	..	..	9	..	..	..	..	..	..	..	..	10
12300 <sup>4</sup> .....	11	..	..	10	..	..	..	..	..	..	..	..	21
00345 <sup>4</sup> .....	..	..	..	17	4	2	1	10	..	..	..	..	34
(12)300 <sup>4</sup> .....	1	..	..	11	..	..	..	..	1	..	..	..	13
10345 <sup>5</sup> .....	..	..	..	13	..	..	1	..	..	..	..	..	14
02345 <sup>5</sup> .....	..	..	..	15	..	2	7	10	..	..	..	..	34
023(45) <sup>5</sup> .....	..	..	..	16	..	..	11	5	..	..	..	..	32
103(45) <sup>5</sup> .....	..	..	..	14	..	..	1	..	..	..	..	..	15
00340 <sup>5</sup> .....	..	..	..	18	..	1	..	1	..	..	..	..	20
00345 <sup>5</sup> .....	..	..	..	17	4	2	1	10	..	..	..	..	34
Unbanded var. <i>li-</i> <i>bellula</i> <sup>6</sup> .....	13	..	..	19	2	2	8	8	1	..	..	..	53
Unbanded vars. <i>ru-</i> <i>bella</i> and <i>cas-</i> <i>tanea</i> <sup>6</sup> .....	9	..	..	20	1	..	4	2	..	..	..	..	36
<i>Helicella cantiana</i> <sup>7</sup> .....	9	..	..	..	16	..	..	..	..	..	..	..	25
Total .....	81	..	..	215	31	13	49	118	9	..	..	..	507

<sup>1</sup> 5 separate bands = 11·2 per cent.

<sup>2</sup> 5 bands with 4+5 fused = 4·1 per cent.

<sup>3</sup> 5 bands with fusions = 12·0 per cent.

<sup>4</sup> "Plain below" = one or more of bands 3, 4, 5 absent = 20·7 per cent.

<sup>5</sup> "Plain above" = one or more of bands 1, 2 absent = 29·3 per cent.

<sup>6</sup> Unbanded = 17·5 per cent.

<sup>7</sup> *Helicella cantiana* = 4·9 per cent.

TABLE III.

Control Collection for comparison with Table II.

Formula.	Number.	Per cent. of total.
12345 <sup>1</sup> .....	8	13.5
123(45) <sup>2</sup> .....	3	5.0
(12)3(45) <sup>3</sup> .....	1	1.7
00340 <sup>4</sup> .....	1	1.7
12340 <sup>4</sup> .....	1	1.7
02300 <sup>4</sup> .....	1	1.7
00300 <sup>4</sup> .....	1	1.7
00000 ( <i>libellula</i> ) <sup>6</sup> .....	4	17.1
Vars. <i>rubella</i> and <i>castanea</i> .....	6	
<i>H. cantiana</i> .....	33	55.9
Total .....	59	

SECTION II. By FRANCES PITT.

At the request of Miss M. D. Haviland, I obtained a young song-thrush in the spring of 1918, and reared it by hand, in order to ascertain whether the thrush has a preference for a particular variety of *Helix nemoralis*, and also if the habit peculiar to the thrush of breaking snail-shells on an "anvil" is instinctive or acquired through experience by each young bird.

When the bird was fully fledged I offered it two examples of *Helix nemoralis*, of formulæ 00000 and 12345 respectively. The thrush paid no attention to them unless they moved, and then it pecked at the protruding tentacles until the snails withdrew into the shells, after which the bird ignored them.

The experiment was repeated the next day, with the same result, except that the bird pecked the shells sharply two or three times.

On the third day four snails were offered—two 12345 and two 00000. This time, when the bird's attack caused the snail to retract, the thrush turned one shell over, looked into the cavity, and shook it vigorously before casting it aside.

At the fourth trial, two days later, five *nemoralis* were offered—two 00000 and three 12345. This time the thrush carried one of the former variety round the cage, and struck it on the ground until it fell from his grasp, whereupon he picked it up again and battered it on a stone. As it did not crack readily, he seized each of the others in turn, and tried in vain to break them. Finally, he took the first snail again, and ultimately broke it open and ate it.

From the foregoing observations I am inclined to believe that the only part of the snail-cracking habit which is

inherited is the impulse to beat living prey on some hard object, although in one instance I saw the thrush hammer a snail on a sofa-cushion. The habit can be perfected by time and practice, and as it grew older the bird became increasingly expert, for the work requires considerable effort, especially when dealing with strong mature shells.

As regards the selection of a particular type of shell, my experiments gave negative results. I never offered more than three snails at one time—formulae 00000, 12345, and (12345). The results, which are summarized in Table IV., seem to show that the snails were selected quite at random, so that any preponderance of unbanded types at “anvils” is not due to selection by thrushes. I offered specimens of both *castanea* and *rubella* to the bird, and the results show that, although a greater number of *castanea* were left unbroken than of other hues, this was due to the stouter shell. As it became more practised, the bird learnt to break them as readily as the more thin-shelled varieties.

Table V. shows the contents of three “anvils” found near Bridgenorth in Shropshire on a roadside bank in a wooded district, and Table VI. shows a control collection made in the vicinity.

From the evidence afforded by this captive thrush, and by the “anvils” in this district, I conclude that the proportions of varieties of *Helix nemoralis* found at the breaking-stones is influenced chiefly by the proportions present in the locality.

TABLE IV.

*Helix nemoralis offered to and eaten by Thrush.*

Formula.	Offered.	Eaten.	Per cent.
00000.....	56	26	46·4
12345.....	49	21	42·8
(12345).....	39	23	56·4

TABLE V.

*“Anvil” Collection from Bridgenorth, Shropshire.*

Formula.	Number.	Per cent.
00000.....	5	17·7
12345.....	13	28·8
12(345).....	1	2·2
123(45).....	4	8·8
1(23)(45).....	1	2·2
(12)(345).....	1	2·2
(123)(45).....	7	15·5
(12345).....	10	22·2



TABLE VI.  
Control Collection to Table V.

Formula.	Number.	Per cent.
00000.....	14	22·2
00300.....	1	1·5
12345.....	17	26·5
123(45).....	8	12·5
1(23)(45).....	10	15·6
(12345).....	14	25·0

## SUMMARY.

The conclusions drawn from the foregoing observations are :—

The selection of snails by thrushes is entirely haphazard, and the evidence does not suggest that one form is more palatable than another.

There is some evidence that many-banded specimens of *H. nemoralis* are more abundant in bushy shaded places.

As the thrushes as a rule prefer open feeding-grounds, it is possible that this may account for the higher proportion of unbanded shells at certain "anvils."

The young thrush does not recognize and crack snail-shells instinctively, but each individual probably learns to do so by personal experience.

LV.—On the Genus *Lepidobatrachus*, Budgett.  
By G. A. BOULENGER, F.R.S.

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THE British Museum has recently received, by way of exchange with the Cambridge Museum of Zoology, the type-specimens of the problematic Paraguayan Frogs discovered by the late J. S. Budgett, and very shortly described by him in the 'Quarterly Journal of Microscopical Science,' xlii. 1899, p. 329, under the names of *Lepidobatrachus asper* and *L. levis*. I seize this opportunity for expressing an opinion on their systematic position, which had not been dealt with by the author, and for correcting some errors in which he had fallen.

I can see no reason for maintaining the genus *Lepidobatrachus* (etymological justification not stated). On comparing Budgett's diagnosis with that of *Ceratophrys*, one

might think the absence of vomerine teeth and the presence of "two large teeth in dentaries of lower jaw" in the former sufficient ground for generic separation, but both these statements are incorrect. Vomerine teeth are present, forming two small groups between the choanæ, and the supposed teeth in the lower jaw are simply bony processes at the symphysis such as are known in several species of *Rana* and *Ceratophrys*. The teeth in the upper jaw are considerably larger than usual, but the same is the case in *Ceratophrys ornata*, *Rana adspersa*, and other Frogs with biting propensities. "Fontanelles in the parietal region" seems in contradiction with the "great development of membrane bones in the head"; I am unable to explain what the author had in view.

Budgett thought his *Lepidobatrachus levis* might be the same species as his *L. asper*, but I have no doubt the two are perfectly distinct, as may be seen from the following notes:—

*Ceratophrys aspera*, *Budg.*

Tongue a little broader than long, entire, moderately free behind, with a round central papillose area. Vomerine teeth in two small rounded groups between the choanæ; maxillary teeth large; a pair of large, acutely pointed tooth-like processes at the symphysis of the lower jaw. Habit very stout, arm and thigh enclosed in the integument of the body. Head very convex, much broader than long; a rough bony casque surrounding the orbits; snout rounded, profile descending abruptly from the nostrils to the mouth; nostrils close together, 3 times as distant from the tip of the snout as from the eye; latter small, its diameter one-half its distance from the mouth; interorbital space concave, nearly as broad as the upper eyelid; tympanum moderately distinct, as large as the eye, from which it is two diameters distant. Fingers rather slender, pointed, without subarticular tubercles, first shorter than second. Hind limb very short, as long as or slightly longer than head and body; tibia shorter than the foot,  $3\frac{1}{2}$  times in length from snout to vent; toes short, pointed, half-webbed, without subarticular tubercles; a narrow tarsal fold and a very large oblique, compressed, sharp-edged inner metatarsal tubercle, the length of which is much greater than that of the inner toe. Upper parts with numerous small warts of unequal size; a narrow, spindle-shaped, granulate dermal bone, about half the length of the head, at a short distance from the latter, above the

anterior vertebræ; lower parts smooth; metatarsal tubercle and tips of toes with black horny sheaths.

Budgett described the colour (in life?) as "dull leaden" above; it is now dark brown, with darker vertical bars on the sides of the head and ill-defined spots and marblings on the body; lower parts white or brownish white, mottled with pale brown on the throat and on the sides.

The two female specimens measure 70 mm. and 60 mm. from snout to vent respectively.

*Ceratophrys lævis*, Budg.

Differs from the preceding in the perfectly smooth head and body, the absence of the bony dorsal shield, the broader and flatter interorbital region, which exceeds the width of the upper eyelid, the longer tibia, which is  $3\frac{1}{3}$  times in the length from snout to vent, and the broader membrane between the toes, which may be described as two-thirds webbed.

A single female specimen, measuring 68 mm. from snout to vent.

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LVI.—*Descriptions of New Pyralidæ of the Subfamilies Crambinæ and Siginæ.* By Sir GEORGE F. HAMPSON, Bart., F.Z.S., &c.

[Continued from p. 457.]

(12) *Eudorina leucosticta*, sp. n.

Brassy ochreous; head, thorax, and abdomen tinged with reddish brown. Fore wing with the veins streaked with brown; dentate brown subbasal and antemedial lines with whitish diamond-shaped marks between them in and below the cell and a similar smaller mark in the cell before the subbasal line; an obliquely curved discoidal white lunule and a short streak beyond upper angle of cell; the postmedial line oblique, double with whitish marks in interspaces between its two portions, arising from apex and strongly dentate inwards on vein 2; a fine subterminal line, the cilia intersected with brown. Hind wing paler with whitish patch beyond upper angle of cell.

*Hab.* BR. N. GUINEA, Humboldt Bay (*Doherty*); D'ENTRE-CASTEAUX Is., Fergusson I. (*Meek*), 1 ♂ type. *Exp.*, ♂ 20, ♀ 28 mm.

Subsp. 1. Head, thorax, and fore wing more uniform red-brown, *Ann. & Mag. N. Hist.* Ser. 9. Vol. iii. 35

the last with the white spots much more prominent and additional specks above middle of inner margin and on termen below apex; the lines almost obsolete, the outer edge of the postmedial line appearing as a series of dark points; abdomen and hind wing pale in male, rufous in female.

*Hab.* MALAY STATES, Padang Rengas; AMBOINA, in Coll. Rothschild.

(5a) *Ommatopteryx discopis*, sp. n.

♀. Head white, slightly mixed with brown; thorax pale brown with a white dorsal fascia on tegulae, the patagia white with brown fascia at middle, the metathorax white behind; abdomen whitish tinged with brown; palpi pale red-brown, white at base and the maxillary palpi white at tips; pectus, legs, and ventral surface of abdomen white slightly mixed with pale red-brown. Fore wing whitish tinged with brown and irrorated with blackish, the postmedial area irrorated with elongate black scales except towards costa and inner margin; a slightly sinuous pale yellow medial band just before end of cell, slightly defined at sides by dark brown, with a narrow white band before it from subcostal nervure to vein 1, and a small black spot in the cell; a small round white spot with black centre at discal fold beyond the cell; subterminal line fine, brown, excurved to discal fold and with some pale yellow before it below costa, below discal fold defined on each side by white; a terminal series of eight minute quadrate black spots from discal fold to tornus, the cilia beyond them metallic cupreous at base and with a metallic cupreous line near base to apex. Hind wing white tinged with red-brown, the cilia white with a red-brown line at middle to vein 2. Underside white, the fore wing faintly tinged with red-brown except on inner area; both wings with faint brown subterminal line to vein 2.

*Hab.* TRANSVAAL, Pretoria (*Janse*), 1 ♀ type. *Exp.* 18 mm.

(6a) *Ommatopteryx corsicalis*, sp. n.

♂. Head, thorax, and abdomen pale red-brown mixed with some whitish; antennae pale red-brown; maxillary palpi brown at base, white at tips; palpi white, tinged with rufous except below; pectus, legs, and ventral surface of abdomen white tinged with rufous. Fore wing whitish suffused with red-brown and irrorated with blackish on basal area and just beyond the medial band which is yellow defined at sides by diffused brown and with a narrow white band before it, slightly bent inwards to inner margin; a narrow white subterminal band defined at sides by brown lines, slightly incurved below costa, then oblique to discal fold where it is angled outwards to termen, then inwardly oblique, a small blackish spot beyond it below costa with a slight oblique dark line from it across apical area to near termen; the apex whitish with an oblique dark subapical mark on it; three pairs of minute black terminal spots from vein 5 to above tornus with the cilia beyond them metallic silver at base, the rest of cilia

white with a brown line near base to vein 5. Hind wing white tinged with red-brown, the cilia white with a brown line near base. Underside of fore wing suffused with red-brown, the apical area and termen white.

*Hab.* CORSICA, Vizzavona (*Walsingham*), 1 ♂ type. *Exp.* 20 mm.

(13) *Ommatopteryx micralis*, sp. n.

♀. Head, thorax, and abdomen fulvous yellow mixed with some white; pectus, legs, and ventral surface of abdomen white. Fore wing white thickly irrorated with fulvous yellow; a narrow inwardly oblique white medial band defined on each side by slight fuscous lines with diffused fulvous yellow beyond them; a narrow curved white band slightly defined by fulvous yellow from costa beyond middle to termen at vein 5; five black points on a slight white band on termen between vein 4 and tornus; cilia with a brown line near base, faint on apical half and some brown at tips. Hind wing white; a slight yellow mark minutely irrorated with black on termen at vein 2; cilia with some black at tips to vein 2 and the hair on inner margin tipped with black and yellow on tornal half. Underside of fore wing suffused with red-brown except on inner area.

*Hab.* PHILIPPINES, Luzon, Benguet Prov., Irizan, 1 ♀ type. *Exp.* 10 mm.

(14) *Ommatopteryx delicatalis*, sp. n.

♀. Head, thorax, and abdomen white tinged with fulvous yellow, the back of head with a black point, the thorax with a few large black scales; palpi with some blackish towards tips; pectus, legs, and ventral surface of abdomen fulvous yellow, the tarsi banded with brown. Fore wing creamy white irrorated with large black scales, the postmedial area rather more thickly irrorated except at costa which is without black scales; an oblique metallic silver medial line defined on outer side by a bright yellow band, slightly incurved in the cell; a metallic silver discoidal lunule; a metallic silver subterminal line, obliquely excurved and defined on inner side by a bright yellow band from costa to discal fold and with the apical area beyond it suffused with yellow; seven black spots on termen between vein 5 and tornus, rather smaller above and a slight black line on termen towards apex, the cilia metallic silver beyond the spots. Hind wing silvery white. Underside of fore wing tinged with red-brown.

*Hab.* BR. C. AFRICA, Mt. Mlanje (*Neave*), 1 ♀ type. *Exp.* 22 mm.

(16) *Ommatopteryx brunnealis*, sp. n.

Head, thorax, and abdomen red-brown, the ventral surface of abdomen with some whitish. Fore wing red-brown with a cupreous

gloss and mixed with some whitish especially before and beyond the inwardly oblique rather ill-defined narrow red-brown medial band; an oblique ill-defined whitish band across apical area and a curved whitish mark just before termen towards apex; five black points defined by white on termen between vein 4 and tornus; cilia white with a brown line at middle and some brown at tips. Hind wing white faintly tinged with red-brown, a brown terminal line and a red-brown line through the cilia. Underside of fore wing suffused with red-brown, the costal area deeper red-brown.

*Hab.* PHILIPPINES, Negros I. (*Whitehead*), 6 ♂, 1 ♀ type.  
*Exp.* 14 mm.

(1 i) *Erupa plumbealis*, sp. n.

Head and thorax dark red-brown glossed with leaden grey; abdomen slightly paler red-brown. Fore wing dark glossy red-brown; an indistinct red-brown antemedial line faintly defined on inner side by greyish, arising at subcostal nervure and strongly incurved between discal and submedian folds; an indistinct red-brown discoidal bar with a slight greyish mark before it at upper angle of cell; an indistinct slightly waved red-brown subterminal line somewhat angled inwards at the veins, defined on outer side by greyish, then by rather diffused red-brown; a series of prominent rather triangular pure white points just before termen from below apex to above tornus; cilia with a whitish line at base. Hind wing rather paler red-brown with a whitish line at base of cilia. Underside dark glossy red-brown; both wings with indistinct curved dark postmedial line.

*Hab.* COLOMBIA, Choko, Rio Siato, 2 ♂ type, Pueblo Rico, 1 ♀. *Exp.*, ♂ 42-46, ♀ 60 mm.

(2 a) *Erupa puncticiliaris*, sp. n.

♀. Head and thorax dark glossy red-brown; abdomen rather paler red-brown with slight whitish dorsal segmental lines; pectus with some whitish below the wings. Fore wing glossy red-brown with a series of prominent white points at base of cilia. Hind wing white, the terminal area suffused with red-brown except towards tornus; cilia with a series of slight white spots at base to below vein 2 and some white at tips. Underside red-brown, the hind wing with the cell and inner area white.

*Hab.* ARGENTINA, Gran Chaco, Florenzia (*Wagner*), 1 ♀ type.  
*Exp.* 40 mm.

(4 b) *Erupa digrammica*, sp. n.

♂. Head, thorax, and abdomen ochreous white suffused with rufous. Fore wing ochreous white suffused with rufous and slightly irrorated with dark brown; a discoidal lunule indistinctly defined by dark red-brown and with an oblique line from it to inner margin with a rather whiter shade before it and oblique

rufous shade beyond it from costa; a slightly erenulate dark red-brown subterminal line with a whiter shade before it and dark points on the veins, excurved below costa; a terminal series of dark brown striæ; cilia with a red-brown line near base and dark tips. Hind wing glossy ochreous tinged with rufous; an indistinct curved red-brown subterminal line and terminal series of dark red-brown striæ. Underside yellowish suffused with rufous; both wings with chocolate-brown discoidal points, curved punctiform postmedial line and terminal series of points.

*Hab.* PERU, La Oroya (*Ockenden*), 2 ♂ type. *Exp.* 28–30 mm.

(6 a) *Erupa schænobina*, sp. n.

♀. Head, thorax, and abdomen pale ochreous; pectus and ventral surface of abdomen white. Fore wing with the apex produced and acute; a rather diffused oblique red-brown line from vein 2 near its origin to inner margin before middle; a diffused slightly waved and very oblique postmedial red-brown line arising near apex and with darker points at the veins; a faint diffused red-brown subterminal line arising from the costa at the postmedial line; a terminal series of dark points. Hind wing white tinged with ochreous especially on inner area; postmedial dark points on veins 6 to 4, then a slight line with a faint diffused subterminal line beyond it; a terminal series of dark points to vein 2. Underside white; both wings with dark discoidal points; fore wing with oblique waved dark postmedial line from costa to vein 4; hind wing with slightly waved subterminal line.

*Hab.* PERU, Yahuar Mayo, 2 ♀ type. *Exp.* 46–60 mm.

(6 c) *Erupa unipunctalis*, sp. n.

♂. Head, thorax, and abdomen grey-white tinged with purple-brown. Fore wing grey-white tinged with purple-brown and irrorated with dark brown; a prominent black discoidal point and terminal series of small blackish points. Hind wing glossy whitish tinged with brown; a terminal series of slight brown points to submedian fold. Underside of fore wing and costal area of hind wing strongly suffused with brown.

*Hab.* BRAZIL, Castro Paraña (*D. Jones*), 1 ♂ type. *Exp.* 38 mm.

(6 d) *Erupa arenalis*, sp. n.

♂. Head and thorax whitish tinged with brown; abdomen white tinged with brown except towards base and with some ochreous on dorsum towards base; antennæ brownish except above; palpi white, strongly irrorated with dark brown above; pectus, legs, and ventral surface of abdomen white, the tarsi tinged with flesh-red. Fore wing ochreous white suffused with brown and strongly irrorated with dark brown, the costal edge pure white; a dark brown discoidal point; a postmedial series of dark brown points

between veins 6 and 1, very oblique from vein 4 to middle of vein 1; a curved punctiform brown subterminal line from below costa to submedian fold; a terminal series of slight brown points. Hind wing silvery white, the costal area slightly tinged with brown except towards apex; an indistinct curved brown subterminal line from costa to vein 2. Underside of fore wing and costal area of hind wing suffused with brown except on terminal areas and on terminal half of costa of fore wing.

♀. Palpi irrorated with paler brown above; fore wing much less strongly irrorated with brown and with hardly a trace of the postmedial series of points on the punctiform postmedial line; hind wing wholly white with the subterminal line; underside with the disk of fore wing only tinged with red-brown.

*Hab.* ARGENTINA, Gran Chaco, Florenzia (*Wagner*), 2 ♂, Santa Fé, Ocampo (*Wagner*), 2 ♂, 1 ♀ type. *Exp.*, ♂ 30-36, ♀ 42 mm.

(8c) *Erupe carnealis*, sp. n.

♀. Head and thorax ochreous white tinged with rufous; abdomen white tinged with ochreous; palpi white, slightly irrorated with brown above; pectus, legs, and ventral surface of abdomen white tinged with ochreous. Fore wing ochreous tinged with rufous and slightly irrorated with dark brown scales except on costal area, the costal edge white; a prominent black discoidal point; a terminal series of slight dark points. Hind wing silvery white with a faint ochreous tinge. Underside white, the fore wing and costal area of hind wing tinged with red-brown.

*Hab.* PARAGUAY, Sapucay (*Foster*), 1 ♀ type; ARGENTINA, Santa Fé, Ocampo (*Wagner*), 1 ♀. *Exp.* 34-42 mm.

Genus HYPIESTA, nov.

Type, *H. argyrogramma*.

Proboscis aborted and minute; palpi downcurved, extending about twice the length of head and fringed with rough hair; maxillary palpi triangularly dilated with scales; frons smooth; antennæ of male laminate and minutely ciliated. Fore wing with the apex rounded, the termen evenly curved; vein 3 from before angle of cell; 4, 5 from angle; 6 from below upper angle; 7 from angle; 8, 9, 10 stalked; 11 becoming coincident with 12. Hind wing with vein 3 from angle of cell; 4, 5 stalked; 6, 7 from upper angle, 7 anastomosing with 8.

(1) *Hypiesta argyrogramma*, sp. n.

♂. Head, thorax, and abdomen white tinged with brown; palpi whitish irrorated with dark brown; pectus, legs, and ventral surface of abdomen whitish suffused with brown. Fore wing whitish irrorated with dark brown to end of cell, the postmedial area



slightly irrorated with red-brown, the terminal area suffused with red-brown; an almost straight red-brown line at end of cell with a minute black discoidal spot on its outer edge; a metallic silvery subterminal line defined on each side by red-brown, excurved below costa; a terminal series of minute black points bisected by white; cilia red-brown and metallic silver. Hind wing white faintly tinged with red-brown. Underside of fore wing and costal area of hind wing suffused with red-brown.

*Hab.* BR. E. AFRICA, Kikuyu, Nairobi (*Crawshay*), 1 ♂ type. *Exp.* 16 mm.

(2) *Hypieta flavirufalis*, sp. n.

♀. Head and thorax yellowish white suffused with rufous; abdomen creamy white, tinged with rufous at base; palpi white irrorated with brown; pectus, legs, and ventral surface of abdomen white suffused with rufous. Fore wing pale yellow tinged and irrorated with rufous, the terminal area strongly suffused with rufous; obscure red-brown streaks in discal and submedian folds; an oblique yellow fascia from apex to lower angle of cell defined on each side by diffused red-brown; two oblique slightly waved brown subterminal lines from vein 6 to inner margin; a punctiform dark terminal line; cilia pale yellow at base with dark line at middle and the tips tinged with red-brown. Hind wing glossy white. Underside white, the fore wing and costal area of hind wing tinged with rufous.

*Hab.* BR. E. AFRICA, Teita (*Jackson*), 2 ♀ type. *Exp.* 20-24 mm.

Genus *PARERUPA*, nov.

Type, *P. diagonalis*.

Proboscis aborted and minute; palpi downcurved, extending about twice the length of head and clothed with rough hair; maxillary palpi triangularly dilated with scales; frons smooth; antennæ of male laminate and almost simple. Fore wing with the apex somewhat produced, the termen obliquely curved; vein 3 from well before angle of cell; 4, 5 from angle; 6 from below upper angle; 7 from angle; 8 and 10 stalked; 9 absent; 11 anastomosing with 12. Hind wing with vein 3 from just before angle of cell; 4, 5 stalked; 6 from just below upper angle and somewhat obsolescent; 7 anastomosing with 8.

*Parerupa diagonalis*, sp. n.

Head, thorax, and abdomen white tinged with brown especially the thorax; palpi white irrorated with dark brown; pectus, legs, and ventral surface of abdomen white tinged with red-brown, the last irrorated with dark brown. Fore wing creamy white thickly irrorated with dark reddish brown; two obliquely placed black discoidal points; postmedial line double, brown, slightly waved,

excurred to vein 4 just beyond the cell, then very oblique to inner margin before middle, an oblique diffused brown streak to it at vein 6 from apex; an oblique diffused slightly waved dark brown line from termen below apex to inner margin beyond middle and a slightly waved red-brown line from below it before termen; a red-brown terminal line with a series of prominent black points on it; cilia white with a red-brown line at middle. Hind wing glossy white. Underside of fore wing except on inner area and the costal area of hind wing suffused with red-brown.

*Hab.* BR. E. AFRICA, Athi R. (*Betton*), 3 ♀ type, Machakos (*Crawshay*), 1 ♂; "GERM. E. AFRICA," L. Meru (*Sjöstedt*), 1 ♀. *Exp.* 24-26 mm.

#### Genus CONIESTA, nov.

Type, *C. aræalis*.

Proboscis aborted and minute; palpi downcurved, extending about twice the length of head and clothed with rough hair; maxillary palpi triangularly dilated with scales; frons with pointed conical prominence; antennæ of male laminate and minutely ciliated. Fore wing with the apex somewhat produced, the termen obliquely curved; vein 3 from well before angle of cell; 5 from just above angle; 6 from below upper angle; 7 from angle; 8, 9, 10 stalked; 11 anastomosing with 12. Hind wing with vein 3 from before angle of cell; 4, 5 from angle; 6, 7 from upper angle, 7 anastomosing with 8.

#### (1) *Coniesta aræalis*.

*Chila aræalis*, Hmps. J. Bomb. Nat. Hist. Soc. xxi. p. 1250 (1912).

MADRAS, Nilgiris, Palni Hills.

#### (2) *Coniesta undilinealis*, sp. n.

♂. Head white; thorax white suffused with brown; abdomen white tinged with brown and with some fulvous at base of dorsum; antennæ, palpi, pectus, legs, and ventral surface of abdomen white tinged with brown. Fore wing white tinged with reddish brown and irrorated with brown; a minute black discoidal spot; post-medial line dark brown, waved, arising at discal fold and strongly incurved below the cell to inner margin before middle; an obliquely curved waved dark brown subterminal line; a terminal series of black points, almost obsolete towards apex. Hind wing glossy white. Underside of fore wing and costal area of hind wing suffused with reddish brown.

♀. Abdomen creamy white; fore wing with the discoidal spot at lower angle of cell, the subterminal line bent inwards to join the postmedial line above inner margin, the fore wing and hind wing to vein 2 with terminal series of black points.

*Hab.* BR. C. AFRICA, Mt. Mlanje (*Neave*), 4 ♂, 3 ♀ type. *Exp.*, ♂ 18, ♀ 22-28 mm.

(3) *Coniesta rufifusalis*, sp. n.

♀. Head and thorax yellowish suffused with rufous; abdomen creamy white with some fulvous at base of dorsum; palpi rufous; pectus and legs white tinged with rufous. Fore wing yellowish suffused with rufous; an oblique slightly waved brown antemedial line from cell to inner margin; a black discoidal point; post-medial line brown, slightly waved, arising below the costa, excurved to vein 4, then incurved to middle of inner margin; an obliquely curved waved brown subterminal line with another line beyond it below vein 2; a terminal series of black points. Hind wing glossy white. Underside of fore wing and costal area of hind wing suffused with brown.

*Hab.* BR. C. AFRICA, Mt. Mlanje (*Neave*), 3 ♀ type *Exp.* 20-22 mm.

## Genus ADELPHERUPA, nov.

Type, *A. flavescens*.

Proboscis aborted, minute; palpi downcurved, extending about three times length of head and clothed with rough hair; maxillary palpi triangularly dilated with scales; frons smooth; antennæ of male minutely serrate and fasciculate. Fore wing with the apex rounded, the termen evenly curved; vein 3 from before angle of cell; 4, 5 from angle or very shortly stalked; 6, 7 from cell or shortly stalked; 8, 9, 10 stalked; 11 from cell. Hind wing with vein 3 from before angle of cell; 4, 5 from angle or shortly stalked; 6, 7 from upper angle, 7 anastomosing with 8.

(1) *Adelpherupa flavescens*, sp. n.

♂. Head and thorax ochreous yellow suffused with red-brown; abdomen ochreous yellow slightly tinged with red-brown. Fore wing ochreous yellow suffused with red-brown especially on costal and terminal areas; two minute black-brown spots in submedian fold on medial area; an indistinct oblique dark streak from apex to beyond lower angle of cell; a terminal series of black points. Hind wing pale ochreous yellow faintly irrorated with brown; a terminal series of black points to vein 2. Underside yellow, the fore wing suffused with red-brown, the hind wing tinged and irrorated with red-brown.

♀. Fore wing much less suffused and more strongly irrorated with red-brown except at costa, a single medial point in submedian fold, the oblique streak more distinct.

Ab. 1. ♀. Head, thorax, abdomen, and fore wing ochreous white with hardly any red-brown tinge, the last slightly irrorated with brown, the medial points absent, the oblique streak very indistinct; hind wing creamy white.

*Hab.* N. NIGERIA, Lokoja (*Dudgeon*), 1 ♂, Borgu, Yelwa Lake, (*Migeod*), 1 ♀; BR. E. AFRICA, Shambe (*Betton*), 1 ♂, 3 ♀ type; UGANDA, Gondokoro (*Reymes-Cole*), 3 ♀; "GERM. E.

AFRICA," Dar-es-Salaam, 1 ♀; BR. C. AFRICA, Karonga (*Grogan*), 1 ♀, Mt. Mlanje (*Neave*), 1 ♀; PORTUGUESE E. AFRICA, Mt. Chipirone (*Neave*), 1 ♂. *Exp.* 22-34 mm.

(2) *Adelpherupa albescens*, sp. n.

♀. Head, thorax, and abdomen creamy white, the sides of head and outer edge of patagia faintly tinged with red-brown; palpi and legs suffused with dark red-brown. Fore wing creamy white slightly irrorated with blackish, the costal half tinged with red-brown; a minute black spot in submedian fold below middle of cell and another below end of cell; an oblique dark streak from apex to beyond end of cell; a terminal series of black points. Hind wing creamy white with a terminal series of black points to vein 2. Underside of fore wing and the costal area of hind wing suffused with red-brown.

*Hab.* BR. E. AFRICA, Alis (*Betton*), 1 ♀; BR. C. AFRICA, Mt. Mlanje (*Neave*), 8 ♀ type. *Exp.* 30-36 mm.

Genus PARATRÆA, NOV.

Type, *P. plumbipicta*.

Proboscis aborted and minute; palpi downcurved, extending about twice the length of head and clothed with rough hair; maxillary palpi triangularly dilated with scales; frons with large pointed conical prominence; antennæ of female almost simple. Fore wing with the apex rounded, the termen obliquely curved; vein 3 from well before angle of cell; 5 from above angle; 6 from below upper angle; 7 from angle; 8, 9, 10 stalked; 11 anastomosing with 12. Hind wing with vein 3 from near angle of cell; 4, 5 coincident or strongly stalked; 6, 7 from upper angle, 7 anastomosing with 8.

(1) *Paratræa plumbipicta*, sp. n.

♀. Head and thorax glossy black-brown with a red-brown tinge; abdomen red-brown suffused with dark brown and with some deep fulvous at base of dorsum. Fore wing fulvous yellow suffused with deep rufous except on costal area to end of cell and a broad oblique band before the subterminal line from vein 6 to inner margin, the terminal area deep rufous suffused with dark brown; a diffused black fascia on basal part of median nervure with silvery leaden scales beyond it in the cell and below it at base; an indistinct oblique waved black line from beyond upper angle of cell to below lower angle with some silvery leaden scales before it; an oblique slightly waved black subterminal line from below apex to inner margin with diffused silvery leaden scales beyond it; cilia suffused with leaden grey. Hind wing glossy ochreous white suffused with brown. Underside uniformly suffused with red-brown.

*Hab.* N. NIGERIA, Zungeru (*Macfie*), 2 ♀ type. *Exp.* 26 mm.

(2) *Paratræa griseifasciata*, sp. n.

♀. Head and thorax white tinged with yellow; abdomen ochreous yellow, whitish at base; palpi, pectus, legs, and ventral surface of abdomen ochreous yellow. Fore wing pale yellow, the costal edge white; a grey-brown fascia below base of median nervure and through terminal half of cell; a narrow oblique grey-brown band from lower angle of cell to inner margin before middle; a diffused oblique grey-brown postmedial band from vein 7 to middle of inner margin; a narrow grey-brown subterminal band excurved below costa, then oblique; a terminal series of minute fuscous spots; cilia whitish at tips. Hind wing glossy white with a yellowish tinge. Underside of fore wing and costal area of hind wing tinged with yellow.

*Hab.* TRANSVAAL (*Janse*), 1 ♀ type. *Exp.* 34 mm.

(1 a) *Diatræa obliqualis*, sp. n.

Both wings with veins 4, 5 stalked.

♀. Head and thorax whitish suffused with ochreous brown; abdomen white, the 2nd and 3rd segments dorsally fulvous; pectus and legs white, the latter tinged with ochreous. Fore wing ochreous tinged with rufous and slightly irrorated with brown; a minute fuscous discoidal spot; an obliquely curved brownish line from apex to inner margin before middle; an obliquely curved reddish brown line from vein 5 before termen to inner margin beyond middle; a terminal series of prominent black points. Hind wing glossy white. Underside of fore wing and costal area of hind wing tinged with rufous.

*Hab.* ARGENTINA, Corrientes, Goya (*Perrins*), 1 ♀ type. *Exp.* 22 mm.

(1 b) *Diatræa cashmirensis*.

♂. Head and thorax ochreous brown, the frons and patagia except on outer side towards base white; abdomen ochreous white, dorsally suffused with reddish brown towards base; palpi and legs ochreous suffused with brown; pectus white. Fore wing pale ochreous yellow thickly irrorated with large dark reddish brown scales tending to form streaks in the interspaces; traces of a silvery subterminal line; a terminal series of minute black-brown spots. Hind wing white tinged with pale brown, the cilia pure white. Underside suffused with pale red-brown.

*Hab.* KASHMIR, Dras (*Leech*), 1 ♂ type. *Exp.* 30 mm.

(8) *Diatræa ustalis*, sp. n.

♀. Head and thorax greyish suffused with brown, the frons white; abdomen ochreous tinged with red-brown; palpi, pectus, and legs pale red-brown. Fore wing greyish ochreous suffused with red-brown and irrorated with dark brown; a faint curved dark subterminal line; a terminal series of black-brown points.

Hind wing ochreous tinged with pale red-brown; a fine brown terminal line; cilia brownish white with a slight brown line near base. Underside greyish suffused with red-brown.

*Hab.* CACHAR, Kanny Koory, 1 ♀ type. *Exp.* 36 mm.

(9) *Diatræa flavalis*, sp. n.

♀. Head, thorax, and abdomen ochreous yellow; palpi above and legs slightly tinged with red-brown. Fore wing ochreous yellow slightly irrorated with red-brown, the terminal area faintly tinged with rufous; a terminal series of dark brown points; cilia with red-brown mixed except at base. Hind wing ochreous white slightly tinged with brown. Underside strongly suffused with red-brown.

*Hab.* CEYLON (*de Mowbray*), 1 ♀ type. *Exp.* 40 mm.

(10) *Diatræa endothermalis*, sp. n.

♂. Head creamy white with some rufous behind, the antennæ and palpi pale rufous; thorax and abdomen yellowish suffused with rufous, the latter with the 2nd segment dorsally deep rufous, the anal tuft creamy white; legs suffused with rufous; pectus and ventral surface of abdomen yellowish white. Fore wing very pale yellow sparsely irrorated with red-brown, the inner area tinged with rufous; a minute dark brown discoidal spot; a rufous point on vein 5 beyond the cell and oblique striga from vein 2 below end of cell; an oblique sinuous rufous subterminal line from vein 2 to inner margin; a terminal series of black-brown points; cilia tinged with rufous at tips. Hind wing creamy white, the inner area slightly tinged with rufous; some dark points on termen towards apex. Underside creamy white.

*Hab.* PERU, Yahuar mayo, 1 ♂ type. *Exp.* 40 mm.

(11) *Diatræa calamina*, sp. n.

♀. Head and thorax ochreous suffused with rufous; abdomen whitish suffused with rufous. Fore wing ochreous suffused and slightly irrorated with rufous; some brownish in terminal half of cell and a slight spot below middle of cell; an indistinct curved red-brown subterminal line; a terminal series of black striæ defined on inner side by whitish. Hind wing glossy white. Underside of fore wing and costal area of hind wing tinged with rufous.

Ab. 1. Head, thorax, abdomen, and fore wing paler and less strongly tinged with rufous, the last without markings except on termen.

Ab. 2. Fore wing with oblique dark brown shade from apex to below end of cell, then erect to inner margin.

*Hab.* PUNJAB, Cawnpore (*Betton*), 1 ♀, Moghal Sarai (*Betton*), 1 ♀; BENGAL, Behar, Pusa 1 ♀; UP. BURMA, Kinyua (*Bingham*), 5 ♀ type. *Exp.* 26-34 mm.

The larva forms a "cage gall" on maize.

(12) *Diatræa diaperalis*, sp. n.

♀. Head, thorax, and abdomen ochreous tinged with red-brown; palpi darker brown. Fore wing ochreous tinged and slightly irrorated with red-brown; an oblique brown shade from apex to vein 3, diffused to termen; a faint curved pale subterminal line slightly defined on each side by red-brown; a terminal series of black points. Hind wing ochreous white slightly tinged with red-brown; a faint curved red-brown subterminal line. Underside of fore wing suffused with red-brown, the terminal area more ochreous; hind wing with the costal area tinged with red-brown.

*Hab.* BHUTÁN (*Dudgeon*), 1 ♀ type. *Exp.* 30 mm.

(14) *Diatræa louisiadalis*, sp. n.

♂. Head, thorax, and abdomen reddish ochreous mixed with some white; palpi irrorated with brown. Fore wing ochreous white suffused and irrorated with pale reddish brown tending to form streaks in the interspaces which are more distinct in and beyond the end of cell and on costal and terminal areas; an indistinct brownish medial spot in submedian fold and a minute black spot at lower angle of cell; a terminal series of minute blackish points. Hind wing white tinged with ochreous; a terminal series of slight blackish points to vein 2. Underside of fore wing and the costal area of hind wing suffused with reddish brown, the former with the costal edge dark brown to beyond middle.

*Hab.* LOUISIADÉ IS., St. Aignan (*Meek*), 1 ♂ type. *Exp.* 22 mm.

(15) *Diatræa lunilinealis*, sp. n.

♂. Head and thorax ochreous suffused with rufous, abdomen creamy white with some fulvous yellow on dorsum of 2nd segment. Fore wing ochreous white suffused with rufous; an indistinct waved brown antemedial line from cell to inner margin; a black discoidal point; a rather lunulate brown postmedial line, excurved from costa to beyond lower angle of cell, then incurved to middle of inner margin; subterminal line formed by brown lunules, indistinct and excurved to discal fold, then obliquely curved to inner margin beyond middle and with traces of another lunulate line beyond it before termen; cilia rufous. Hind wing white with an ochreous tinge. Underside of fore wing and costal area of hind wing ochreous tinged with rufous.

*Hab.* CEYLON, Nawalapitiya (*Pole*), 1 ♂ type. *Exp.* 22 mm.

(16) *Diatræa ignefusalis*, sp. n.

♀. Head, thorax, and abdomen suffused with fiery rufous. Fore wing ochreous suffused with fiery rufous, the veins with whitish streaks, the interspaces beyond the cell with deeper rufous streaks, the costal edge white; the medial area with two slight

brown spots below the cell and two on vein 1, the latter with very oblique rufous striæ from them to inner margin; a minute brown discoidal spot; an indistinct obliquely curved annulate brownish postmedial line; a slight brown terminal line; cilia with a dark brown line near base and white tips. Hind wing silvery white. Underside of fore wing and costal area of hind wing tinged with rufous.

*Hab.* N. NIGERIA, Borgu, Yelwa Lake (*Migeod*), 3 ♀ type; SUMATRA, Soekar, 1 ♀. *Exp.* 24–30 mm.

(17) *Diatræa lentistrialis*, sp. n.

♂. Head white with a brownish ochreous streak on frons, the palpi suffused with ochreous brown except above; thorax white suffused with ochreous brown; abdomen white with some fulvous yellow on base of dorsum. Fore wing creamy white irrorated with reddish brown, the veins and the interspaces beyond the cell with fine reddish brown streaks; a black discoidal point; an oblique reddish brown line from lower angle of cell to inner margin before middle; postmedial line reddish brown, indistinct and excurved to discal fold, then very oblique; a brown terminal line with series of prominent black points on it; a brown line near base of cilia. Hind wing creamy white. Underside of fore wing suffused with red-brown, the interspaces of terminal area with white streaks; hind wing with the costal half tinged with red-brown.

*Hab.* ARGENTINA, Gran Chaco, Florenzia (*Wagner*), 1 ♂ type. *Exp.* 16 mm.

(18) *Diatræa albivenalis*, sp. n.

Head, thorax, and abdomen white, the sides of head and the thorax suffused with rufous, the abdomen with the two basal segments dorsally fulvous yellow; antennæ, palpi at sides, legs, and ventral surface of abdomen suffused with rufous. Fore wing white suffused and irrorated with rufous leaving the veins white, the terminal half of cell and the inner area to beyond middle whiter; a fine black terminal line; cilia fulvous yellow at base, with black line near base and some dark scales at tips. Hind wing glossy white. Underside of fore wing and costal area of hind wing tinged with rufous.

*Hab.* GAMBIA, Bathurst (*Sir G. Carter*), 1 ♂ type; N. NIGERIA, Minna (*Macfie*), 1 ♀. *Exp.*, ♂ 14, ♀ 18 mm.

(19) *Diatræa metaphæalis*, sp. n.

♂. Head and thorax whitish mixed with brown especially the sides of head and tegulæ and the patagia; abdomen whitish suffused with brown; pectus and legs suffused with brown. Fore wing whitish strongly suffused and irrorated with brown leaving the vein white;



a fine black terminal line ; cilia white with black line at middle and some brown at tips. Hind wing greyish suffused with brown ; a fine dark terminal line ; cilia white with a brownish line near base. Underside strongly suffused with brown.

*Hab.* TRANSVAAL, Bultfontein (*Janse*), 2 ♂ type. *Exp.* 16 mm.

(21) *Diatræa subterminalis*, sp. n.

♀. Head and thorax white slightly mixed with ochreous ; abdomen white tinged with ochreous brown ; pectus, legs, and ventral surface of abdomen white tinged with ochreous. Fore wing creamy white slightly tinged with rufous, the terminal area more suffused with rufous ; a slight black discoidal point ; a fine red-brown subterminal line, bent inwards to costa ; a terminal series of black points, more prominent towards tornus. Hind wing creamy white tinged with ochreous. Underside of fore wing and costal area of hind wing tinged with rufous.

*Hab.* UGANDA, Gondokoro (*Reymes-Cole*), 1 ♀ type. *Exp.* 20 mm.

(22) *Diatræa ochrileucalis*, sp. n.

♀. Head and thorax pale reddish ochreous ; abdomen white tinged with reddish ochreous ; pectus, legs, and ventral surface of abdomen pale reddish ochreous. Fore wing pale reddish ochreous ; a minute black point at lower angle of cell ; a terminal series of prominent black points ; cilia with a slight brownish line near base. Hind wing glossy white. Underside of fore wing and costal area of hind wing tinged with reddish ochreous.

*Hab.* QUEENSLAND, Cooktown, Cedar Bay (*Meek*), 1 ♀ type. *Exp.* 26 mm.

(23) *Diatræa rufistrigalis*, sp. n.

♀. Head and thorax white slightly mixed with rufous ; abdomen white with some fulvous yellow at base of dorsum ; antennæ dark brown, the shaft white above ; palpi dark brown above ; tarsi tinged with brown. Fore wing silvery white striated with rufous ; the terminal area with diffused orange-yellow streaks on the veins and traces of a yellow subterminal line ; a fine black terminal line ; cilia with a black line at middle and some dark brown at tips. Hind wing silvery white with a fine blackish terminal line to vein 2. Underside slightly tinged with red-brown except on inner area of hind wing ; the fore wing with slight brownish discoidal spot and faint curved postmedial line.

*Hab.* BR. C. AFRICA, Mt. Mlanje (*Neave*), 2 ♀ type. *Exp.* 20 mm.

[To be continued.]

LVII.—Description of a new *Dyscophid* Frog from Yunnan.  
By G. A. BOULENGER, F.R.S.

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THE family *Dyscophidæ*, with Madagascar as its headquarters, was known to be scantily represented in Burma and Siam (*Calluella*, Stol.), and Borneo (*Colpoglossus*, Blgr., *Calliglutus*, Barbour & Noble). Yunnan may now be added to the range of its distribution in Asia.

*Calluella yunnanensis*, sp. n.

Habit rather stout, similar to *Microhyla rubra*, Jerd. Head much broader than long; snout rounded, not projecting beyond the mouth, as long as the eye; canthus rostralis feeble; loreal region very oblique; nostril equally distant from the eye and from the tip of the snout; interorbital space as broad as the upper eyelid. Pupil round. Fingers with obtuse tips, first shorter than second, half as long as third; subarticular tubercles moderately large, feebly prominent; three carpal tubercles, median smallest. The tibio-tarsal articulation reaches the shoulder or the temple; heels feebly overlapping when the limbs are folded at right angles to the body; tibia shorter than the foot,  $2\frac{1}{3}$  to  $2\frac{1}{2}$  times in length from snout to vent; toes moderately long, with slightly swollen tips, the web reaching the tips, but deeply emarginate; subarticular tubercles moderately large, feebly prominent; two metatarsal tubercles, inner oval, somewhat compressed and very prominent,  $\frac{3}{4}$  the length of the inner toe, outer smaller, round and flat. Skin smooth, except for some feebly raised glandular ridges which correspond with the outlines of the markings. Pale greyish or pinkish brown above, with a symmetrical vase-shaped brown marking, edged with darker and lighter, from between the eyes to the sacral region; a dark lateral band from the eye to the groin, bordered above by a series of more or less confluent black spots, which extends forwards to the canthus rostralis; limbs with dark cross-bars, one or two on the tibia; lower parts white, mottled with brown, especially on the throat.

From snout to vent 29 mm.

Two specimens from Yunnan Fou, from the collection of Mr. J. Graham.

LVIII.—On a new Variety of *Acanthodactylus boskianus*, Daud., from the Euphrates. By G. A. BOULENGER, F.R.S.

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I AM indebted to my son, Capt. C. L. Boulenger, for examples of a lizard, referable to *Acanthodactylus boskianus*, caught by himself and Capt. Harrison at Ramadieh on the Euphrates front in 1918, that are of special interest not only as extending the known range of a widely distributed species (Syria, Arabia, North Africa, and the Soudan), but as differing from all other specimens, of which I have examined about two hundred, by a character to which a great importance was formerly attached in distinguishing the species of *Acanthodactylus* and *Eremias*: in 7 out of the 8 specimens collected, the subocular borders the mouth instead of its lower edge forming an angle wedged in between the fourth and fifth or fifth and sixth upper labials; otherwise they agree with the typical form, the *Lacerta boskiana* of Daudin, in the number of scales (38 to 43 across middle of body, 14 or 16 between hind limbs) and of femoral pores (23 to 27 on each side\*). The scales round the base of the tail are more numerous (23 to 27 in the fourth or fifth whorl, instead of 18 to 22). The first supraocular shield is divided into 2 or 3 parts, and in four of the specimens there is an agygos shield between the prefrontals. There is nothing special to note concerning the coloration, except the absence of a light vertebral streak; the young has 4 white streaks on the upper surface of the body, 6 on the nape, and one on each side, separated by broader black streaks, each of which may bear a series of round white spots.

The largest male measures 81 mm. from snout to vent, the largest female 80.

The condition of the subocular shield points to this form, which I propose to call var. *euphraticus*, being the nearest to the hypothetical primitive *Acanthodactylus*, according to the views expressed by me in recent papers dealing with the evolution of the Lacertidæ. The three forms into which *A. boskianus* may be divided, although not sharply definable, constitute a highly suggestive gradational series:—

1. Var. *euphraticus* (Euphrates). Subocular usually bordering the mouth; 38 to 43 scales across middle of body,

\* In one of the males there are 2-3 additional pores, forming a second series behind the other at the distal end of the thigh.

14 to 16 between the hind limbs ; 23 to 27 femoral pores on each side.

2. Forma *typica* (N. Egypt). Subocular not bordering the mouth ; 34 to 52 (usually 38 to 43) scales across middle of body, 10 to 16 between the hind limbs ; 21 to 31 (usually 22 to 28) femoral pores on each side.

3. Var. *asper* (Palestine, Arabia, Saharan region and Soudan). Subocular not bordering the mouth, 23 to 38 (usually 25 to 35) scales across middle of body, 8 to 14 between the hind limbs ; 15 to 27 (usually 17 to 24) femoral pores on each side.

LIX.—Notes on the Ichneumonidæ in the British Museum.—I. By ROWLAND E. TURNER, F.Z.S., F.E.S.

Subfamily PIMPLINÆ.

Tribe PIMPLINI.

*Certonotus tasmaniensis*, sp. n.

♀. Brunneo-ferruginea ; mandibulis nigris, antennis 40-articulatis, articulis 29-38 pallide flavis ; clypeo, labro, facie lateribus late, orbitis, mesonoto macula utrinque antice maculaque magna quadrata post medium, tegulis basi, mesopleuris fascia sub tegulis macula antice, fascia angusta margine postico, maculaque angulis inferioribus posticis, scutello apice lateribusque, postscutello lateribus, segmento mediano apice late, tergitis 1-6 fascia angusta apicali, coxis apice, trochanteribus, femoribus apice, tibiis apice, tibiis posticis basi anguste, tarsisque anticis flavis ; tarsis intermediis posticisque tibiisque posticis in medio nigris ; alis subhyalinis, iridescentibus, venis fuscis ; terebra valvulisque nigris. Long. 17 mm. ; terebræ long. 17 mm. ; antennarum long 12 mm.

♀. Clypeus very short, transverse ; eyes separated from the base of the mandibles by a distance scarcely equal to half the length of the scape. Face finely and shallowly punctured, with a few delicate transverse striæ below the base of the antennæ and a groove along the inner margin of the eyes ; front microscopically punctured ; vertex smooth and shining. Pronotum not produced at the angles ; mesonotum irregularly and coarsely transversely striated, with a well-marked longitudinal lateral groove on each side ; scutellum finely punctured ; mesopleuræ shining, finely and sparsely punctured, smooth in the middle. Median segment smooth and shining,

without a basal area, with a broad upper area on each side ; spiracle large and elongate, the carinæ enclosing the lower and posterior areas not very strongly defined. Abdomen smooth and shining, the emargination of the seventh tergite deep and triangular. Hind tibiæ without any trace of a fovea, but with a very minute spine. Areolet triangular ; second recurrent nervure sharply bent inwards in the middle, forming a sharp angle. Nervellus geniculate and intercepted above the middle.

*Hab.* Fern Tree, Mt. Wellington, S. Tasmania, 1300 ft. ; January 1913 (*Turner*). 1 ♀.

The antennæ are much shorter proportionately than in other species of the genus ; the areas of the median segment closely resemble those of *C. similis*, Krieg., as shown in his figure ; it also resembles that species in the unarmed angles of the pronotum. In colour this closely resembles *C. nitidulus*, Morl., and may possibly prove to be identical, but Morley gives no clue to the locality of the species, and his type is not in the British Museum ; the length given for his species is, however, only 11 mm., and he states that there is a series of foveæ on the hind tibiæ, not a minute spine as in the present species. The spine is, however, so minute that it might easily be overlooked, but the statement as to foveæ could not correctly be applied to the present species. I have been unable to detect the spine on the hind tibiæ of *C. annulatus*, Morl., and *C. apicalis*, Morl., though in Morley's table it is said to be present in these species.

*Certonotus hinnuleus*, Krieg.

*Certonotus hinnuleus*, Krieg. Zeitschr. Hym. Dipt. i. p. 123 (1901). ♀.

I took a female of this species at Kuranda, N. Queensland, in May 1913 ; it answers almost exactly to the description. The specimen assigned by Morley to this species with some doubt (*Rev. Ichneum.* ii. p. 32, 1913) is utterly distinct.

*Certonotus leeuwinensis*, sp. n.

♂. Niger ; orbitis late, genis, facie fascia longitudinali nigra, pronoto lateribus, propleuris fascia supra coxas, tegulis, scutello fascia apicali, postscutello macula, segmento mediano macula minuta apicali, tergitis 1-6 fascia angusta apicali lateribusque, tergito septimo apice trimaculato, trochanteribus anticis intermediisque, femoribus anticis intermediisque apice, tibiis anticis subtus, calcariisque albido-flavis ; antennis 33-articulatis, articulis 23-31 albidis ; mesonoto, lateribus nigris, propleuris, mesopleuris, segmento mediano lateribus, coxis posticis, femoribusque

rufo-ferrugineis; tarsis anticis testaceis; alis hyalinis, leviter infuscatis, iridescentibus, venis fuscis.

♀. Mari simillima; scutello in medio, segmento mediano apice, pronotoque lateribus rufo-ferrugineis.

Long., ♂, 8 mm.; antennarum long. 5.5 mm.; ♀, 8.5 mm.; terebræ long. 9 mm.

♂. Clypeus very short; face closely and minutely punctured; front and vertex smooth and shining; eyes separated from the base of the mandibles by a distance nearly equal to the length of the third joint of the antennæ. Hind angles of the pronotum scarcely prominent; mesonotum coarsely transversely striated in front, more obscurely posteriorly, the median lobe with a shallow longitudinal median groove; pleuræ closely and finely punctured. The small basal area of the median segment is much broader than long, with a much larger area broadened from the base beyond it and two large lateral areas on each side, the apical median area being rather indistinctly divided from the apical lateral areas, the whole segment minutely punctured. Abdomen slender, smooth and shining. Hind tibiæ with a minute spine at about one-third from the apex. Nervulus almost interstitial; nervellus straight, without an intercepting vein.

*Hab.* Yallingup, S.W. Australia, October (Turner); 1 ♂, 1 ♀. Swan River (*Du Boulay*); 1 ♀ in very bad condition. The male is the type.

This is allied to *C. hinnuleus*, Krieg., but the colour is very different and the angles of the pronotum are much less prominent and the mesonotum longer and narrower. The group is well distinguished from others of the genus by the neururation of the hind wing.

### Tribe LISSONOTINI.

#### *Phytodietus celsissimus*, sp. n.

♀. Nigra; antennis fusco-ferrugineis, articulis 10 basalibus nigris; pedibus anticis intermediisque rufo-testaceis, coxis flavis; mandibulis, apice excepto, clypeo, facie in medio latissime, macula parva utrinque oculos vix attingente, orbitis internis prope ocellos, mesonoto macula parva post medium, tegulis, mesopleuris macula parva sub alis, scutello antice lateribusque nigro-sinuato, postscutello in medio, metapleuris macula elongata, segmento mediano fascia transversa apicali in medio interrupta, coxis posticis macula basali, trochanteribus posticis, femoribus posticis basi atque apice angustissime, tibiisque posticis basi anguste flavis; segmentis abdominalibus 1-7 fascia angusta apicali albido-flava; alis subhyalinis, iridescentibus, stigmatibus venisque fuscis.

Long. 8 mm.; terebræ long. 3 mm.; antennarum long. 8 mm.

♀. Antennæ 39-jointed, the third joint half as long again as the fourth. Clypeus and face very finely and closely punctured, the upper part of the face with a deep longitudinal groove on each side near the inner orbits. Front, vertex, and thorax subopaque, smooth; the parapsidal furrows distinct anteriorly; median segment only half as long as the mesonotum, without carinæ, the spiracles small and round. Abdomen smooth and shining, the apical segments minutely punctured on the sides; first tergite about half as long again as its apical breadth, longer than the second segment, second tergite narrowed to the base. Hypopygium not reaching the apex of the abdomen. Valvulæ reddish brown at the extreme apex. Areolet triangular, very shortly petiolate; the inner side of the areolet straight, forming a right angle with the cubitus; the recurrent nervure received close to the apex of the areolet. Nervulus interstitial; nervellus intercepted far below the middle. Tarsal ungues pectinate.

*Hab.* Mt. Wellington, S. Tasmania, 2300 ft., March 25, 1913 (*Turner*); 1 ♀.

The second tergite is longer and more narrowed to the base than in *P. coryphæus*, Grav., and other Palearctic species, the first tergite is also much more slender; otherwise the species does not differ in any important structural point. In these points it comes very near to *P. astutus*, Grav., which appears to be its nearest ally.

### Tribe XORIDINI.

#### *Xylonomus crudelis*, sp. n.

♀. Nigra; facie, antennis articulis 11-18, orbitis late ocellum anteriorem non superantibus, vertice macula magna orbitali utrinque, propleuris postice latissime, mesopleuris postice late, scutello macula magna quadrata, postscutello macula transversa, segmento mediano macula triangulari utrinque angulis basalibus, segmento abdominali primo basi, segmentis 1-7 fascia apicali, coxis anticis intermediisque supra, tarsisque posticis, articulo apicali excepto, albidis; terebra pedibusque testaceis, posticis trochanteribus, tibiis apice, tarsisque articulo apicali nigris; alis hyalinis, iridescentibus, venis fuscis, stigmatibus basi albomaculato. Long. 7 mm.; terebræ long. 4 mm.

♀. Clypeus very short, finely punctured; face smooth and shining. Antennæ 24-jointed, joints 3-6 subequal, the five apical joints inserted at a sharp angle to the preceding joints. Eyes parallel on the inner margin; head smooth and shining, cubical and not narrowed behind the eyes. Mandibles short, simple at the apex, not bidentate, eyes separated from

the base of the mandibles by a distance distinctly greater than the basal breadth of the mandibles. Pronotum produced into a distinct acute spine on each side; mesonotum shining, sparsely punctured, notauli deep and crenulate. Median segment with an elongate and rather narrow median area, which is bordered by a transverse carina a little before one-third from the apex of the segment, the basal portion of the area narrowed from the base and strongly contracted at about one-third from the base, the apical portion (or areola) elongate-ovate, truncate at the apex, petiolar area broader than long, lateral carinae well marked; spiracles small and rounded; sides of the segment rugose, produced into a short spine on each side at the apical angles. Abdomen opaque, the dorsal surface very finely and closely punctured-granulate; the first segment petiolate at the base, about three times as long as its apical breadth; second and third tergites with an oblique sulcus on each side from the base to the middle of the lateral margin, and also with an indistinct curved depressed line on each side from the middle of the base to the middle of the lateral margin. Nervulus slightly prefurcal; second recurrent nervure strongly curved outwards and joining the cubitus distinctly beyond the transverse cubital nervure; nervellus elbowed and intercepted close to the middle.

*Hab.* Kuranda, N. Queensland, May 3-June 20, 1913 (Turner); 1 ♀.

Closely allied to *X. abaddon*, Morley, from Assam, but differs in the colour, especially in the broad interruption of the white of the outer orbits and the apically black median segment, in the narrower first abdominal segment, and in the much less strongly impressed second and third tergites.

#### Subfamily OPHIONINÆ.

#### Tribe ANOMALINI.

#### *Exochilum perniciosum*, sp. n.

♀. Ferruginea; capite, antennis, prothorace, mesonoto, mesosterno, scutello basi, tibiis posticis dimidio apicali metatarsisque posticis dimidio basali nigris; mandibulis, apice ferrugineis, palpis, facie, orbitis internis infra, orbitis externis linea angusta in parte superiore, vertice macula orbitali utrinque, coxisque anticis flavis; pedibus anticis intermediisque tarsisque posticis, basi excepta, flavo-ochraceis; alis subhyalinis, iridescentibus, venis fuscis.

Long. 14 mm.; antennarum long. 9 mm.

♀. Clypeus and front rather strongly punctured; clypeus subtruncate at the apex; the face with a shallow longitudinal



groove on each side; mandibles bidentate at the apex. Third joint of the antennæ twice as long as the fourth; front rather coarsely rugose, vertex closely punctured. Eyes convergent towards the clypeus, very narrowly separated from the base of the mandibles. Mesonotum very closely rugosely punctured; propleuræ and mesopleuræ closely punctured, the latter rather coarsely reticulate above. Median segment coarsely reticulate, longitudinally depressed in the middle, with lateral marginal carinæ. Abdomen very slender, compressed laterally from the middle of the second segment; first segment very long, the second shorter than the first but nearly twice as long as the third. Basal joint of the hind tarsus a little more than twice as long as the second joint. Second recurrent nervure not interstitial with the transverse cubitus nervure; the external cubital nervure not in a line with the internal; nervulus distinctly postfurcal; nervellus intercepted close to the middle.

*Hab.* Yallingup, S.W. Australia, October (Turner); 2 ♀ ♀.

Allied in neuration to *E. scaposum*, Morley, from Queensland, but differs in the black scape, in the somewhat shorter antennæ, and in the ferruginous colour of the median segment and mesopleuræ. In both species the brachial cell is as long as the discoidal. The only other Australian species known to me in which the neuration is similar is *E. atrichiosoma*, Morley, which is closely allied. The hind metatarsi in the present species are shorter than in *scaposum* or *atrichiosoma*. I do not understand why Morley separates these two species so widely in his table; his statement that the "submarginal nervure is opposite or scutellum pale" in *atrichiosoma* is not accurate. In the other Australian species described by Morley under *Exochilum* the discoidal cell is longer than the first brachial, and in *E. australasiæ*, Morley, the second recurrent nervure is interstitial with the transverse cubital nervure, and the external and internal cubital nervures also continuous, thus contradicting the statement in Morley's table "submarginal nervure antefurcal." I have no doubt that *E. australasiæ* has been placed in the wrong genus; it answers well to the characters of *Habronyx*, Först.

*Habronyx australasiæ*, Morley.

*Exochilum australasiæ*, Morl. Revis. Ichneumon. ii. p. 75 (1913).

*Trichomma elegantula*, sp. n.

♂. Niger; mandibulis, apice excepto, clypeo, facie, orbitis late, scapo subtus, linea ante alas, macula parva infra alas, tegulis, scutello, coxis, trochanteribusque, posticis supra ferrugineis, flavis; pedibus anticis intermediisque, tibiis posticis prope basin late, tarsisque posticis articulis tribus basalibus flavo-ochraceis; abdomine lateribus, segmento primo apice, femoribus posticis, tibiisque posticis basi extrema ferrugineis; alis hyalinis, venis fuscis, stigmate pallide testaceo.

Long. 8 mm.

♂. Clypeus not distinctly divided from the face; eyes strongly convergent towards the clypeus; face slightly convex, almost smooth, orbits smooth and shining; eyes almost touching the base of the mandibles. Antennæ about 30-jointed, 5 mm. in length; front finely obliquely rugulose; vertex smooth and shining; eyes as far from the posterior margin of the head as from the posterior ocelli. Mesonotum very closely and rather finely punctured, without notauli; mesopleuræ delicately longitudinally striate; scutellum smooth and shining. Median segment coarsely rugose-reticulate, with a shallow longitudinal groove from near the base to the apex, an obscure longitudinal carina on each side laterally, the sides of the segment coarsely reticulate. Abdomen long and very slender; first segment slightly swollen at the apex, scarcely as long as the second, which is linear, the segments from the third onward strongly compressed laterally. Hind femora slender at the base, reaching their greatest thickness at about two-thirds from the base. Subdiscoideus originating just above the middle of the apical margin of the first brachial cell; nervulus very slightly postfurcal; nervellus straight, without an intercepting nervure.

*Hab.* Kuranda, N. Queensland, May-June 1913 (*Turner*);  
2 ♂ ♂.

This is much smaller than the New Guinea species *T. clavipes*, Krieg., and differs in details of colouring, especially in the face and hind tarsi, but in sculpture and neuration there seems to be little difference. I have not seen *T. clavipes*.

## Tribe CAMPOPLEGINI.

*Nothanomalon meridionalis*, sp. n.

♀. Nigra; palpis pedibusque anticis intermediisque ochraceis, coxis nigris; segmentis abdominalibus primo apice, secundo subtus lateribusque, tertio, quarto quintoque omnino, sexto

subtus, terebra pedibusque posticis, coxis exceptis, brunneo-ferrugineis; valvulis ochraceis, apice nigris; alis hyalinis, stigmatate venisque nigris; scapo subtus ferrugineo.

Long. 17-19 mm.; antennarum long. 10 mm.

♂. *Feminæ simillimus, alis leviter infuscatis.*

♀. Clypeus, face, and front finely punctured-rugose; vertex opaque, microscopically punctured. Eyes narrowly separated from the base of the mandibles; very little further from each other on the vertex than on the clypeus, widely subemarginate on the inner margins. Antennæ 54-jointed, the third joint distinctly longer than the fourth. Mesonotum very closely and not strongly punctured; notauli shallow, only developed anteriorly; mesopleuræ closely punctured, with a few striæ posteriorly above, the hind margin above smooth and shining; scutellum finely punctured, broadly rounded at the apex. Median segment very long, produced posteriorly as far as the apex of the hind coxæ, rugulose, sparsely covered with white pubescence, deeply longitudinally depressed in the middle; spiracles small and elliptic. Abdomen elongate, laterally compressed; the first segment swollen at the apex and distinctly shorter than the second. Areolet petiolate; second recurrent nervure strongly bent inwards in the middle; nervulus very slightly postfurcal; nervellus straight, not intercepted.

*Hab.* Eaglehawk Neck, S.E. Tasmania, February 1913 (*Turner*); 1 ♂, 1 ♀. Mt. Wellington, Tasmania, 2300 ft., April 2-6, 1913 (*Turner*); 2 ♀ ♀.

This genus was founded by Szépligeti for a New Guinea species. It is remarkable that I did not take any species of the genus in North Queensland.

#### Subfamily CRYPTINÆ.

##### Tribe CRYPTINI.

##### *Mansa volatilis*, Sm.

*Cryptus volatilis*, Sm. Journ. Proc. Linn. Soc., Zool. vii. p. 7 (1863). ♀.

##### Subsp. *fumipennis*, nov.

♀. Differs from the typical Austro-Malayan form in the colour of the wings, the fore wings being crossed by a broad pale fuscous cloud from the stigma to the anal angle, occupying the whole of the second discoidal and second brachial cells. The stigma is margined with black, not wholly fulvous as in *volatilis*.

*Hab.* Kuranda, N. Queensland, February 1902 (*Turner*); 1 ♀.

The name *Colganta*, Cam., must sink as a synonym of *Mansa*, as pointed out by Morley.

*Cryptus exul*, sp. n.

♀. Nigra; antennis 32-articulatis, basi rufo-testaceis; articulis 6-10 albido-flavidulis; articulis apicalibus nigris; mandibulis in medio, clypeo, orbitis, segmentis abdominalibus quinto sequentibusque, aliquando quarto etiam, femoribus, tibiisque rufo-ferrugineis; tarsis posticis articulis secundo tertio quartoque flavescens; stigmatibus basi tegulisque albo-flavidulis; alis hyalinis leviter infumatis, venis fuscis.

♂. Femine similis; antennis nigris, scapo flavo-testaceo; segmento abdominali quarto aut toto aut dimidio apicali rufo-ferrugineo.

Long., ♀, 9 mm., terebræ long. 3 mm.; ♂, 8 mm.

♀. Antennæ filiform, the apical joint strongly excavated beneath; third and fourth joints about equal in length. Clypeus truncate at the apex; mandible short, ending in two equal teeth. Face closely and finely punctured; front and vertex opaque, finely shagreened. Mesonotum deflexed anteriorly, finely shagreened; the parapsidal furrows distinct, but very shallow; pleuræ finely granulate. Median segment with two transverse carinæ, both somewhat arched in the middle, the basal portion of the dorsal surface before the first carina subopaque and almost smooth; the apical and smaller portion between the two carinæ finely longitudinally striate-rugulose; the posterior angles produced into a stout, rounded, lamelliform spine on each side; spiracles small and round; the apical slope finely granulate. Abdomen smooth and shining; second tergite as long as its apical breadth; valvulæ broad and flattened. Areolet rather large, the transverse cubital nervures parallel, the cubital margin slightly bent in the middle at the point of reception of the recurrent nervure. Outer angle of the discoidal cell blunt; nervulus interstitial; nervellus intercepted far below the middle.

♂. Apical antennal joint not excavated beneath; spines at the apical angles of the median segment absent; first tergite long and slender, second nearly twice as long as its apical breadth.

*Hab.* Mt. Wellington, S. Tasmania, 2300 ft., March 12-April 6, 1913 (*Turner*); 9 ♀♀, 10 ♂♂.

This is not a typical *Cryptus*, differing in the small round spiracles of the median segment and the parallel-sided areolet. The lamelliform spine at the apical angles of the median segment is a sexual character in this species.

## LX.—Two new Gerbils from Sinai.

By OLDFIELD THOMAS.

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I owe to the kindness of the authorities of the Egyptian Zoological Service at Giza the opportunity of examining a number of small mammals from Egypt and Sinai, and among these there are examples of the two following new species of *Gerbillus* :—

*Gerbillus floweri*, sp. n.

A large species, with comparatively broad skull and large bullæ.

Size of the type, which is old, about as in average specimens of *G. pyramidum*, not so large as the largest examples of that rather variable species. General colour the usual pale "gerbil-colour," the back finely speckled with the minute brown tips to the dorsal hairs; white under surface extending high up on shoulders, and including the whole of the limbs. Soles completely hairy, except just under the heel. Usual postorbital and postauricular white patches distinct. Tail buffy above, white on sides and below; tip missing in type.

Skull proportionally broad, as broad as in a considerably longer skull of *G. pyramidum*. Palatal foramina well open, extending back to the level of the front of the roots of  $m^1$ . Bullæ larger than in any of the Egyptian or Syrian species, longer but less broadly swollen than in the peculiar *G. valinus* of S.W. Africa.

Dimensions of the type (measured on skin) :—

Head and body 127 mm.; tail (?); hind foot 35.

Skull: greatest length 34; condylo-incisive length 30; greatest breadth 19; nasals  $13.6 \times 3.3$ ; interorbital breadth 6.7; breadth of brain-case 16; bi-meatal breadth 18.2; palatine foramina 6.5; bullæ, diagonal length 11.8, breadth at right angles to last (exclusive of meatus) 6.8; upper tooth-row (considerably worn) 4.5.

*Hab.* (of type). Wadi Hareidin, extreme northern Sinai, a few miles south of El Arish, about  $31^\circ$  N.,  $34^\circ$  E.

*Type.* Old male. B.M. no. 19. 5. 7. 4. Giza Museum no. 8042. Collected 24th December, 1918, by Capt. S. S. Flower, and presented by the Giza Zoological Service. One specimen.

This gerbil is probably most nearly related to the large Egyptian species *G. pyramidum*, but is distinguished by its broader skull and larger bullæ. It is decidedly larger than the Tripoli *G. tarabuli*.

Named in honour of its discoverer, the well-known Director of the Giza Zoological Museum.

*Gerbillus bonhotei*, sp. n.

Near *G. andersoni*, but with larger bullæ.

Size and other essential characters as in *andersoni*, but, as compared with specimens from the Nile delta, the coloration throughout of the more bright "gerbil-colour" type, the dorsal colour clear light buffy, less brown, and the white, whether of ear-spots, belly, or feet, more vividly white and more extended in area. Soles well covered with hair except on a small spot under the heel. Upper surface of tail buffy.

Skull very much as in *andersoni*, but the bullæ decidedly and uniformly larger.

Dimensions of the type:—

Head and body 97 mm.; tail 123; hind foot 27; ear 16.

Skull: greatest length 29·8; condylo-incisive length 26; zygomatic breadth 16·6; nasals 11·1; interorbital breadth 6; breadth of brain-case 14·4; palatal foramina 5·1; bullæ (measured as in the previous species) 11·1 × 6·3; upper molar series 4.

*Hab.* Northern Sinai. Type from Khabra Abu Guzour, S.E. of El Arish. One specimen from Wadi Hareidin.

*Type.* Adult female. B.M. no. 19. 5. 7. 5. Original number 887 (8046 of Giza Museum). Collected 25th December, 1918, by Capt. S. S. Flower, and presented by the Giza Zoological Service. Four specimens in all.

This species is evidently the representative from a more strongly desert area of the *G. andersoni* of Lower Egypt, and is readily distinguishable by its larger bullæ. In its brightness of coloration it differs from typical *andersoni*, but is imitated by specimens from the Wadi Natron, which are also brighter than those from the dark soil of the delta. All the Egyptian specimens, however, have the same comparatively small bullæ.

It is named after Mr. J. L. Bonhote, Capt. Flower's colleague at Giza, who has done so much to forward our knowledge of the small mammals of Egypt.

## INDEX TO VOL. III.

- ABROTHRIX, new species of, 202.  
 Acanthodica, new species of, 167.  
 Achæa, new species of, 178.  
 Acontia, new species of, 318.  
 Acontiidæ, notes on, 314.  
 Adelpherupa, characters of the new genus, 541.  
 Agonista, new species of, 169.  
 Akodon, new species of, 116, 204, 213, 496.  
 Amphipoda, remarks on, 376.  
 Andrewes, H. E., on Oriental Carabidæ, 469.  
 Anua, new species of, 173.  
 Arame, description of the new genus, 477.  
 Arge, new species of, 483.  
 Argyria, new species of, 445.  
 Arrow, G. J., a remarkable new ball-rolling Beetle, 433.  
 Artiodactyla, on some external characters of ruminant, 101.  
 Arunena, characters of the new genus, 317.  
 Ascaris, new species of, 457.  
 Asilidæ, notes on, 44.  
 Aves, new, 250, 273.  
 Aynthia, characters of the new genus, 43.  
 Balfour-Browne, F., on *Deronectes depressus*, Fab., and *elegans*, Panzer, 293.  
 Batopora, remarks on, 79.  
 Baylis, H. A., on a remarkable *Cysticercus* from a rare Dolphin, 417; on new Entozoa from birds in Uganda, 457; on Entozoa from the Murman coast, 501.  
 Biuterina, new species of, 461.  
 Boulenger, G. A., on the American species of *Rana*, 408; on the genus *Lepidobatrachus*, Budgett, 531; on a new *Dyscophid* frog from Yunnan, 548; on a new variety of *Acanthodactylus boskianus*, 549.  
 Brachyderinæ, new genera and species of, 1.  
 Bracon, new species of, 231.  
 Brade-Birks, H. K., & Rev. S. G., notes on Myriapoda, 253.  
 Bradley, J. C., on the status of *Parabates*, Foerster, and *Parabatus*, Thomson, 319.  
 Bradybamon, characters of the new genus, 9.  
 Bryozoa, remarks on, 79.  
 Buodias, new species of, 235.  
 Calluella, new species of, 548.  
 Campyloneurus, new species of, 429.  
 Carabidæ, papers on, 469.  
 Ceratina, new species of, 195, 244.  
 Certonotus, new species of, 550.  
 Champion, G. C., on the Malacoderm genera *Prionocerus* and *Idgia*, 325.  
 Chaudhuria, note on, 198.  
 Chilton, C., on the amphipod *Orchestia tucurauna*, Fritz Müller, 376.  
 Chionæma, new species of, 165.  
 Chironomidæ, on some parthenogenetic, 222.  
 Chubb, C., notes on the family *Dendrocolaptidæ*, 273.  
 Cicadidæ, new genus and species of, 43.  
 Cockerell, T. D. A., descriptions and records of bees, 118, 191, 240.  
 Cœlioxys, new species of, 196.  
 Coleoptera, notes on, 293, 325.  
 Conaspidia, new species of, 484.  
 Conepatus, new species of, 490.  
 Coniesta, characters of the new genus, 540.  
 Conocrambus, description of the new genus, 443.

- Corynoneura*, new species of, 226.  
*Cosmophila*, new species of, 311.  
*Crambus*, new species of, 279, 437.  
*Cremnops*, new species of, 431.  
*Crocisa*, new species of, 191, 240.  
 Crustacea, notes on, 125.  
*Cryptus*, new species of, 558.  
*Ctenomyia*, new species of, 117, 210, 498.  
*Culladia*, new species of, 276.  
*Cyanopterus*, new species of, 230.  
*Cychrotonus*, new species of, 25.  
 Cyrén, O., & Lantz, L. A., on *Lacerta praticola*, Eversm., 28.  
*Cysticercus*, notes on, 417.  
*Davainea*, new species of, 462.  
*Delacampius*, new species of, 220.  
*Depalpata*, characters of the new genus, 488.  
*Deronectes*, notes on, 293.  
*Dianthidium*, new species of, 194.  
*Diatræa*, new species of, 543.  
*Dindymellus*, characters of the new genus, 221.  
 Diptera, new, 222.  
*Diptychophora*, new species of, 444.  
 Distant, W. L., on a new genus and species of *Cicadidæ*, 43; on new species of *Pyrrhocoridae*, 218; on Ethiopian *Heteroptera*, 466.  
*Ditomyia*, remarks on the larvæ of, 33.  
*Dysmorodrepanis*, new species of, 251.  
 Edwards, F. W., on some parthenogenetic *Chironomidæ*, 222; on the egg-burster of eucephalous fly-larvæ, 372.  
*Eirone*, new species of, 236.  
*Enmonodia*, new species of, 171.  
*Ercheia*, new species of, 176.  
*Erupe*, new species of, 536.  
*Euagathis*, new species of, 432.  
*Eudorina*, new species of, 455, 533.  
*Eufernaldia*, new species of, 278.  
*Eumorpha*, new species of, 430.  
*Euneomys*, new species of, 202.  
*Evania*, new species of, 230.  
*Exochilum*, new species of, 554.  
 Fisher, W. K., on North Pacific *Zoroasteridæ*, 387.  
*Galea*, new species of, 211.  
 Geological Society, proceedings of the, 435.  
*Geoxus*, new species of, 208; characters of the new genus, 209.  
*Gerbillus*, new species of, 559.  
*Gonopteridæ*, notes on, 309.  
*Graomys*, new species of, 494.  
 Grieg, J. A., on the age of some Arctic and North-Atlantic starfishes, 400.  
*Halictus*, new species of, 122.  
 Hampson, Sir G. F., on new *Pyralidæ* of the subfamilies *Crambiniæ* and *Siginæ*, 275, 437, 533.  
 Haviland, M. D., and Pitt, F., on the selection of *Helix nemoralis* by the song-thrush, 525.  
*Heliconius*, new species of, 217.  
*Heliguoneura*, new species of, 74.  
*Helix nemoralis*, selection of, by the song-thrush, 525.  
*Henicospilus*, new species of, 234.  
*Heterocera*, new, 487.  
*Heteroptera*, new, 218, 466.  
 Hirst, S., on two new parasitic mites, 524.  
*Homogyna*, new species of, 190.  
*Homoptera*, new, 43.  
*Hyblæa*, new species of, 188.  
*Hymenoptera*, new, 118, 191, 229, 240, 393, 398, 425, 483; notes on, 319.  
*Hypanthidium*, new species of, 193.  
*Hypiesta*, characters of the new genus, 538.  
*Ichneumonidæ*, new, 550.  
 Idgia, notes on, 325.  
*Irenomys*, characters of the new genus, 201.  
 Kareya, description of the new genus, 473.  
 Kaye, W. J., on new South-American butterflies, 215.  
 Keilin, D., on larvæ &c. of *Mycetobia*, *Ditomyia*, and *Symmerus*, 33.  
*Lacerta*, new species of, 28.  
*Lagidium*, new species of, 499.  
*Lagoptera*, new species of, 172.  
 Lantz, L. A., & Cyrén, O., on *Lacerta praticola*, Eversm., 28.  
 Leigh-Sharpe, W. H., on *Pleurocystis cuénoti*, Hesse, 256.  
*Lepidoptera*, new, 165, 215.  
*Leurops*, characters of the new genus, 18.  
*Lithurgus*, new species of, 195.  
 Lomas, description of the new genus, 479.  
*Lycænomis*, new species of, 314.  
*Machimus*, new species of, 45.  
*Macrophya*, new species of, 485.



- Mammals, new, 32, 101, 115, 199, 213, 263, 489, 515, 559.  
 Mansa, new species of, 486, 537.  
 Marshall, G. A. K., on African genera of wingless Brachyderinæ, 1.  
 Maurilia, new species of, 317.  
 Megachile, new species of, 196.  
 Melissodes, new species of, 119.  
 Meriones, notes on, 263.  
 Mimaulodes, characters of the new genus, 5.  
 McIntosh, Prof., notes from the Gatty Marine Laboratory, St. Andrews, 125.  
 Mnematum, new species of, 433.  
 Morpho, new species of, 215.  
 Mycetobia, remarks on the larvæ of, 33.  
 Mycoptes, new species of, 524.  
 Myriapoda, notes on, 253.  
 Myxoderma, new species of, 392.  
 Neargyria, new species of, 275.  
 Neerupa, description of the new genus, 278.  
 Neoitamus, new species of, 60.  
 Nomia, new species of, 121.  
 Nothanomalon, new species of, 556.  
 Nyctipao, new species of, 170.  
 Nymphidium, new species of, 215.  
 Odontopus, new species of, 218.  
 Ommatopteryx, new species of, 534.  
 Orchestia, notes on, 376.  
 Parabates, on the status of, 319.  
 Parabatus, on the status of, 319.  
 Paralastor, new species of, 398.  
 Parallelia, new species of, 184.  
 Paratræa, characters of the new genus, 542.  
 Parerupa, characters of the new genus, 539.  
 Perkins, R. C. L., on a new bird from the Hawaiian Islands, 250.  
 Phyllotis, new species of, 493.  
 Phytodietus, new species of, 233, 552.  
 Pieris, new species of, 216.  
 Pimpla, new species of, 427.  
 Pisces, note on, 198.  
 Pitt, F., and Haviland, M. D., on the selection of *Helix nemoralis* by the song-thrush, 525.  
 Planetes, new species of, 480.  
 Platymeris, new species of, 468.  
 Pleurocystis cuénoti, observations on, 256.  
 Pocock, R. I., on some external characters of ruminant Artiodactyla, 101; on the classification of the mongooses, 515.  
 Pomphus, characters of the new genus, 7.  
 Prakasha, description of the new genus, 474.  
 Pronocerus, notes on, 325.  
 Pristaulacus, new species of, 425.  
 Proscopus, characters of the new genus, 13.  
 Protostrophus, characters of the new genus, 14.  
 Prout, L. B., on moths in the Joicey collection, 165.  
 Pseudoblosyrus, characters of the new genus, 21.  
 Psoroptes, new species of, 524.  
 Ptilothrix, new species of, 119.  
 Ptochostola, new species of, 276.  
 Pyralidæ, new, 275, 437, 533.  
 Pysttala, new species of, 466.  
 Quedara, characters of the new genus, 316.  
 Rana, on the American species of, 408.  
 Regan, C. T., note on Chaudhuria, 198.  
 Reptiles, new, 408, 531, 548, 549.  
 Ricardo, G., notes on the Asilidæ, 44.  
 Rothschild, Lord, on new Heterocera, 487.  
 Scarabæidæ, note on, 433.  
 Sceliphron, new species of, 393.  
 Scolia, new name of, 237.  
 Scopula, new species of, 189.  
 Sittakantha, description of the new genus, 482.  
 Speiredonia, new species of, 171.  
 Sphecodes, new species of, 118.  
 Sphex, new species of, 395.  
 Spilosoma, new species of, 487.  
 Sponges, notes on freshwater, 94.  
 Spongilla, new species of, 95.  
 Starfishes, new, 387; remarks on, 400.  
 Stephens, J., on new African freshwater sponges, 94.  
 Subulura, new species of, 459.  
 Swinhoe, Col. C., on the geographical distribution of the genus *Cosmophila*, 309; on new Lycaenids and Hesperids, 314.  
 Symmerus, remarks on the larvæ of, 33.

- Synechops, characters of the new genus, 23.
- Theronia, new species of, 233.
- Thomas, A., on the white-toothed shrew of Palestine, 32; on some small mammals from Catamarca, 115; on small mammals from north-western Patagonia, 199; on two new Argentine species of Akodon, 213; on Gerbils referred to the genus Meriones, 263; on small mammals from north-eastern Rioja, 489; on two new Gerbils from Sinai, 559.
- Tolnaodes, new species of, 187.
- Trichomma, new species of, 536.
- Trigona, new variety of, 241, 242.
- Turner, R. E., on Hymenoptera collected in New Caledonia, 230; notes on Fossorial Hymenoptera, 393; new Australian Diplopterous Hymenoptera, 398; on Indo-Chinese Hymenoptera, 425, 483; on the Ichneumonidæ in the British Museum, 550.
- Waters, A. W., on Batopora and its allies, 79.
- Xylonomus, new species of, 428, 553.
- Xynias, new species of, 215.
- Zoroaster, new species of, 390.

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CONTENTS OF NUMBER 18.—*Ninth Series.*

	Page
LI. A Collection of Entozoa, chiefly from Birds, from the Murman Coast. By H. A. BAYLIS, M.A. ....	501
LII. The Classification of the Mongooses ( <i>Mungotidae</i> ). By R. I. POCOCK, F.R.S. ....	515
LIII. On Two new Parasitic Mites ( <i>Myocoptes hintoni</i> and <i>Pso-roptes natalensis</i> ). By STANLEY HIRST ....	524
LIV. The Selection of <i>Helix nemoralis</i> by the Song-Thrush ( <i>Turdus musicus</i> ). By MAUD D. HAVILAND, Hon. Mem. B.O.U., and FRANCES PITT ....	525
LV. On the Genus <i>Lepidobatrachus</i> , Budgett. By G. A. BOULENGER, F.R.S. ....	531
LVI. Descriptions of new <i>Pyralidae</i> of the Subfamilies <i>Cram-bine</i> and <i>Sigineæ</i> . By Sir GEORGE F. HAMPSON, Bart., F.Z.S., &c. . .	533
LVII. Description of a new Dyscophid Frog from Yunnan. By G. A. BOULENGER, F.R.S. ....	548
LVIII. On a new Variety of <i>Acanthodactylus boskianus</i> , Daud., from the Euphrates. By G. A. BOULENGER, F.R.S. ....	549
LIX. Notes on the <i>Ichneumonidae</i> in the British Museum.—I. By ROWLAND E. TURNER, F.Z.S., F.E.S. ....	550
LX. Two new Gerbils from Sinai. By OLDFIELD THOMAS . . . . .	559
Index . . . . .	561

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