

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.')

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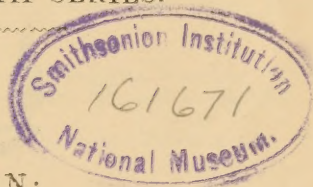
ALBERT C. L. G. GÜNTHER, M.A., M.D., Ph.D., F.R.S.,

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

AND

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

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

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

J. TAYLOR, *Norwich*, 1818.



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CONTENTS OF VOL. II.

[SEVENTH SERIES.]

NUMBER VII.

| | Page |
|--|------|
| I. On the Nomenclature and Distribution of some of the Rodents of South Africa, with Descriptions of new Species: By W. E. DE WINTON | 1 |
| II. On some West-African Squirrels, with a Description of a new Species and proposed Alteration in the Arrangement of the Groups. By W. E. DE WINTON | 9 |
| III. On the Butterflies of the Genera <i>Leptophobia</i> and <i>Pieris</i> . By ARTHUR G. BUTLER, Ph.D., F.L.S., F.Z.S., &c. | 13 |
| IV. Some new <i>Coccidæ</i> . By T. D. A. COCKERELL, Entomologist of the New Mexico Agricultural Experiment Station | 24 |
| V. On the Dissociation of the Egg into a Large Number of Distinct Individuals, and the Cycle of Development in <i>Encyrtus fuscicollis</i> (Hymenopteron). By PAUL MARCHAL | 28 |
| VI. Seasonal Dimorphism in Butterflies of the Genus <i>Precis</i> , Doubl. By GUY A. K. MARSHALL, F.Z.S. | 30 |
| VII. Descriptions of new Longicorn Coleoptera from East Africa. By C. J. GAHAN, M.A., of the British Museum (Natural History) .. | 40 |
| VIII. The Australian Scorpions of the Genus <i>Urodacus</i> , Pet. By R. I. POCKOCK | 59 |
| IX. Notes on Palæozoic Fishes.—No. II. By R. H. TRAQUAIR, M.D., LL.D., F.R.S. (Plate I.) | 67 |
| X. Descriptions of new Species of Butterflies from South America. By H. GROSE-SMITH, B.A., F.E.S., F.Z.S., &c. | 70 |
| XI. Description of a new Genus of Aglyphous Colubrine Snakes from Sumatra. By G. A. BOULENGER, F.R.S. | 73 |

| | Page |
|---|--------|
| XII. Description of a new Death-Adder (<i>Acanthophis</i>) from Central Australia. By G. A. BOULENGER, F.R.S. | 75 |
| <i>New Book</i> :—A Classified Catalogue, with Localities, of the Land-Shells of America, North of Mexico. By H. A. PILSBRY | 75 |
| Observations on <i>Scarabæidæ</i> of the Genus <i>Oniticellus</i> , by Chas. O. Waterhouse: Dates of Blainville's 'Ostéographie,' by C. Davies Sherborn | 75, 76 |

NUMBER VIII.

| | |
|---|-----|
| XIII. Further new Parasitic Copepods found on Fish in the Indo-tropical Region. By P. W. BASSETT-SMITH, Staff-Surgeon R.N., F.Z.S., F.R.M.S. (Plates III.-VI.) | 77 |
| XIV. The Species of Scorpions of the Genus <i>Broteas</i> . By R. I. POCKOCK | 98 |
| XV. Notes from the Gatty Marine Laboratory, St. Andrews.—No. XIX. By Prof. M'INTOSH, M.D., LL.D., F.R.S. (Plate II.).. | 103 |
| XVI. The Sarcostyles of the <i>Plumularidæ</i> . By C. C. NUTTING.. | 118 |
| XVII. Description of a new Bat from Lower California. By GERRIT S. MILLER, JR. | 124 |
| XVIII. Descriptions of Nine new Species of Terrestrial and Fluvial Mollusca from South Africa. By JAMES COSMO MELVILL, M.A., F.L.S., and JOHN HENRY PONSONBY, F.Z.S. (Plate VII.) | 125 |
| XIX. On a Second Collection of Reptiles made by Mr. E. Lort-Phillips in Somaliland. By G. A. BOULENGER, F.R.S. | 130 |
| XX. Descriptions of Two new Fishes from the Coast of Sind. By G. A. BOULENGER, F.R.S. | 133 |
| XXI. Descriptions of new Species of Hemiptera-Heteroptera. By W. L. DISTANT | 134 |
| XXII. Natural History Notes from H.M. Indian Marine Survey Ship 'Investigator,' Commander T. H. Heming, R.N., commanding.—Series II., No. 25. A Note on the Deep-sea Fishes, with Descriptions of some new Genera and Species, including another probably Viviparous Ophidioid. By A. ALCOCK, Surgeon-Major I.M.S., Superintendent of the Indian Museum | 136 |
| XXIII. On new Species of <i>Histeridæ</i> and Notices of others. By G. LEWIS, F.L.S. | 156 |
| XXIV. Report on the Rules of Zoological Nomenclature to be submitted to the Fourth International Zoological Congress at Cambridge by the International Committee for Zoological Nomenclature. | 181 |

| | |
|--|-----|
| <i>New Book</i> :—Rhopalocera Exotica: being Illustrations of New, Rare, and Unfigured Species of Butterflies. By H. GROSE-SMITH and W. F. KIRBY. Vol. II..... | 194 |
| Proceedings of the Geological Society | 195 |
| The Generic Name <i>Thylacomys</i> , by Edgar R. Waite | 196 |

NUMBER IX.

| | |
|---|-----|
| XXV. The Arachnida from the Province of Natal, South Africa, contained in the Collection of the British Museum. By R. I. POCOCK. (Plate VIII.)..... | 197 |
| XXVI. Descriptions of some new Species of Heterocera from Tropical America. By HERBERT DRUCE, F.L.S. &c. | 226 |
| XXVII. On a Collection of Dragonflies from the Transvaal and Nyasaland. By W. F. KIRBY, F.L.S., F.E.S., &c. | 229 |
| XXVIII. Descriptions of new Bornean and Sumatran Mammals. By OLDFIELD THOMAS | 245 |
| XXIX. The Origin of the Vertebrates. By EDMOND PERRIER .. | 252 |
| XXX. Descriptions of new Coleoptera from East Africa. By C. O. WATERHOUSE, F.E.S. | 259 |
| XXXI. Descriptions of new Mammals from South America. By OLDFIELD THOMAS..... | 265 |
| Malacostraca from Puget Sound, N.W. America, by Alfred O. Walker..... | 275 |

NUMBER X.

| | |
|--|-----|
| XXXII. On some new Earthworms in the British Museum. By DANIEL ROSA, D.Sc., Assistant in the Royal Zoological Museum, Turin. (Plate IX.) | 277 |
| XXXIII. <i>Felis chaus</i> and its Allies, with Descriptions of new Subspecies. By W. E. DE WINTON..... | 291 |
| XXXIV. Rhynchota from the Transvaal, Mashonaland, and British Nyasaland. By W. L. DISTANT..... | 294 |
| XXXV. On the Zululand Form of Livingstone's Antelope (<i>Nesotragus Livingstonianus</i>). By OLDFIELD THOMAS | 317 |
| XXXVI. Notes on various American Mammals. By OLDFIELD THOMAS | 318 |

| | Page |
|---|---------|
| XXXVII. New North-American Insects. By T. D. A. COCKERELL, Entomologist of the New Mexico Agricultural Experiment Station | 321 |
| XXXVIII. On Ostracoda from the "Cambridge Greensand." By FREDERICK CHAPMAN, A.L.S.; F.R.M.S. | 331 |
| XXXIX. Description of a new Genus of Odonata. By W. F. KIRBY, F.L.S., F.E.S. | 346 |
| XL. Descriptions of Three new Species of Spiders of the Genus <i>Selenops</i> , Latr. By R. I. POCKOCK | 348 |
| On the Geographical Distribution and the Evolution of <i>Peripatus</i> (Preliminary Note), by E.-L. BOUVIER; New Observations on <i>Peripatus</i> , by E.-L. BOUVIER; On the Presence of the Common Eel in the Open Sea, by Léon VAILLANT | 351—355 |

NUMBER XI.

| | |
|---|-----|
| XLI. Some new or rare Parasitic Copepods found on Fish in the Indo-tropic Region. By P. W. BASSETT-SMITH, Staff-Surgeon R.N., F.R.M.S., F.Z.S. (Plates X.-XII.) | 357 |
| XLII. Extraordinary Vitality of Entomostraca in Mud from Jerusalem. By EDWARD ATKINSON, F.L.S. | 372 |
| XLIII. A Revision of the <i>Pontoniidae</i> . By L. A. BORRADAILE, M.A., Lecturer in Natural Sciences at Selwyn College, Cambridge. . | 376 |
| XLIV. On the Picrine Butterflies of the Genus <i>Catophaga</i> . By ARTHUR G. BUTLER, Ph.D., F.L.S., F.Z.S., &c. | 392 |
| XLV. New North-American Insects. By T. D. A. COCKERELL, Entomologist of the New Mexico Agricultural Experiment Station. . | 401 |
| XLVI. Descriptions of Two new Species of Butterflies of the Genus <i>Thysonotis</i> . By H. GROSE-SMITH, B.A., F.E.S., F.Z.S. | 404 |
| XLVII. Notes on some Type Specimens of Cretaceous Fishes from Mount Lebanon in the Edinburgh Museum of Science and Art. By A. SMITH WOODWARD, F.L.S. | 405 |
| XLVIII. Descriptions of Two new Snakes from Queensland. By G. A. BOULENGER, F.R.S. | 414 |
| XLIX. Description of a new Silurid Fish from West Africa. By G. A. BOULENGER, F.R.S. | 415 |
| L. On the Species of <i>Polypterus</i> . By G. A. BOULENGER, F.R.S. | 416 |
| LI. Short Diagnoses of Two new Species of Coralliidae from Madeira. By JAMES YATE JOHNSON, Corr.Mem.Z.S. | 421 |

| | Page |
|--|------|
| LII. Description of a new Species of Hare from Algeria. By G. E. H. BARRETT-HAMILTON..... | 422 |
| LIII. Note on the European Dormice of the Genera <i>Muscardinus</i> and <i>Glis</i> . By G. E. H. BARRETT-HAMILTON | 423 |
| Proceedings of the Geological Society | 427 |

NUMBER XII.

| | |
|--|-----|
| LIV. The Arachnida from the Regions of Lakes Nyasa and Tanganyika contained in the Collection of the British Museum. By R. I. Pocock. (Plate XIII.) | 429 |
| LV. New and little-known Hymenoptera taken by Prof. C. H. T. Townsend and Mr. C. M. Barber in New Mexico in 1898. By T. D. A. COCKERELL, Professor of Entomology, New Mexico Agricultural College..... | 448 |
| LVI. On the Pierine Butterflies of the Genus <i>Catophaça</i> . By ARTHUR G. BUTLER, Ph.D., F.L.S., F.Z.S., &c. | 458 |
| LVII. The Entomostraca of Lake Bassenthwaite. By EDITH M. PRATT, B.Sc. With an Introductory Note by SYDNEY J. HICKSON, M.A., F.R.S., Beyer Professor of Zoology in the Owens College, Manchester | 467 |
| LVIII. Descriptions of Two new Siluroid Fishes from Brazil. By G. A. BOULENGER, F.R.S. | 477 |
| LIX. A Revision of the Pierine Butterflies of the Genus <i>Dercas</i> . By LIONEL DE NICÉVILLE, F.E.S., C.M.Z.S., &c. | 478 |
| LX. A new Species of Shrew from Ashantee. By W. E. DE WINTON..... | 484 |
| LXI. Notes on some Type Specimens of Crustaceous Fishes from Mount Lebanon in the Geneva Museum. By A. SMITH WOODWARD, F.L.S. | 485 |
| <i>New Book:</i> —The Farmer and the Birds. By EDITH CARRINGTON. With Preface by Canon TRISTRAM, F.R.S..... | 489 |
| On the Dates of Jacob Hübner's 'Sammlung europäischer Schmetterlinge,' Part I. by C. Davies Sherborn, Part II. by Jno. Hartley Durant..... | 491 |
| Index | 496 |

PLATES IN VOL. II.

- PLATE I. Palæozoic Fishes.
II. Species of Clione, Bipinnaria, Lepidonotus, and Sigalion.
III. }
IV. } New Parasitic Copepods.
V. }
VI. }
VII. New Mollusks.
VIII. New Arachnida from Natal.
IX. New Earthworms.
X. }
XI. } New Parasitic Copepods.
XII. }
XIII. Arachnida from the Regions of Lakes Nyasa and Tanganyika.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SEVENTH SERIES.]

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

No. 7. JULY 1898.

I.—*On the Nomenclature and Distribution of some of the Rodents of South Africa, with Descriptions of new Species.*
By W. É. DE WINTON.

SINCE the days of Dr. Andrew Smith, until within the last year or two no one has paid much attention to collecting the smaller mammals of South Africa, and while birds and insects have always been flowing in to the home museums, there have only been received one or two chance specimens of mammals.

The result is that several of the animals described by the old writers are very imperfectly known, and great confusion is caused by the want of fresh specimens, most of the original types having been stuffed, the skulls spoiled, and the fur faded.

Thanks to Mr. folliott Darling and Mr. F. C. Selous we know something of the fauna of Rhodesia (see P. Z. S. 1896, pp. 798–808, for description of the rodents sent home by these two collectors), but there is still much to be learned; and now I have pleasure in bringing forward fresh evidence of an awakening within the older settled districts to the realization of the wants of the home workers.

The British Museum has lately received valuable additions to the collections of small mammals from the south of Cape Colony through the exertions of Dr. Schönland, Curator of the Grahamstown Museum, and presented by that institution, and from Mr. A. Stenning, Curator of the Fish Hatchery, King William's Town; from the Transvaal through Mr. H. P. Thomasset and Dr. Percy Rendall, who have taken much trouble in obtaining specimens; from the neighbourhood of Kimberley by the help of Mr. A. Wolf Curry; and from Namaqualand by Dr. R. Broom. Thanks are due to these gentlemen, who, while busily engaged in their professions, have devoted time and money to the furtherance of science; and I think it only requires to be known how behindhand our knowledge of the mammalian fauna of South Africa is, to induce others to assist in collecting and taking notes on the habits of the small mammals of the country. I would impress on those who wish to help, that no animal is too common, for so little is known as to the distribution of any of the species, and almost nothing of their habits. Specimens are therefore required of all species occurring in different districts.

Instructions for collecting and small requisites for proper preservation may be obtained by communicating with the writer at the British Museum (Natural History), Cromwell Road, London, S.W.

With the assistance of the collections above mentioned some light has been thrown on one or two doubtful points as to the validity of several species of rodents, and it is hoped before long to clear up further questions in regard to other orders of the Mammalia.

GRAPHIURUS, F. Cuv.

(Mamm. pl. ccliv., 1829.)

Both Mr. Oldfield Thomas and myself, following the course taken by other writers when describing closely allied forms, have referred specimens of the smaller dormice of Africa to the genus *Eliomys*. On looking more closely into the matter, it has been found that all the members of the family Myoxidæ found within the Ethiopian Region belong to the genus *Graphiurus* and that *Eliomys* is confined to the Palæarctic Region. Besides the outward form there are many cranial characters which distinguish these two genera; perhaps the most obvious is the difference in the shape of the infra-orbital foramina.

Graphiurus ocularis, Smith.

Sciurus ocularis, A. Smith, Zool. Journ. iv. (Jan.-May), 1829, p. 439.

Graphiurus capensis, F. Cuv. Mamm. livr. lx. fig. 254 (Sept.) (1829).

"Autre Loir," F. Cuv. Dict. Sc. Nat. xxvii. p. 124 (1823).

Myoxus Cattoirii, Fisch. Synops. Mamm. p. 310 (1829).

Graphiurus typicus, Smith, S. A. Q. Journ. 1834, p. 145.

Graphiurus elegans, Ogilby, P. Z. S. 1838, p. 5 (juv.).

Graphiurus capensis, Smith, Ill. Zool. S. A., Mamm. pl. xxxix. (1843).

Graphiurus capensis auct.

The above being the synonymy of this animal, it will be seen that Smith's specific name must be allowed priority; this author in his later publications, however, conformed to the specific name given by Cuvier—who had made a new genus for the reception of this species—only because it was the fashion at that date to affix a fresh specific name to any species when transferred to a different genus from that in which it had been placed by the original describer.

Hab. Extreme south of Cape Colony.

Specimens of this animal are much needed, it being extremely rare in collections.

M. Lataste has divided the genus *Gerbillus* into well-marked subgenera ('Le Naturaliste,' 1882, p. 126), a most convenient mode of at once showing the form of the feet, tail, and molar teeth; this code has generally been followed by recent writers, the subgeneric name being placed in brackets, and this method is used below.

Gerbillus (Gerbillus) pæba, Smith.

Gerbillus pæba, Smith, Rep. Exped. Int. S. Afr., App. p. 43 (1836).

? *Meriones caffer*, Licht. Verzeichn. Auct. Südafr. Nat. Berlin, 1839 (5th Oct.), nomen nudum.

? *Meriones binotatus*, id. *ibid.*, nom. nud.

? *Meriones rufescens*, id. *ibid.*, nom. nud.

Gerbillus tenuis, Smith, Ill. S. Afr. pl. xxxvi. fig. 2 (1842).

? *Meriones caffer*, Wagn. Arch. für Naturg. 1842, p. 18.

Dr. Andrew Smith always thought himself justified in changing a name he had himself given if another more appropriate one suggested itself. The type of *G. pæba* and *G. tenuis* being one and the same specimen, the first name must of course stand for this species.

Hab. Transvaal and Namaqualand.

Gerbillus (Tatera) afer, Gray.

Mus sericeus, Temm. MSS. v. Sp. Mus. Leyd., nom. nud.

Gerbillus afra, Gray, Spicil. Zool. x. (1828).

Meriones Schlegelii, Smuts, Enum. Mamm. Cap. p. 41, pl. xliii. figs. 1-5 (1832).

Gerbillus africanus, F. Cuv. Trans. Zool. Sec. ii. 1836, p. 143, pl. xxvi. figs. 5, 9.

Gerbillus afer, Smith, Ill. Zool. S. Afr., Mamm. pl. xxxv. (1842).

? *Gerbillus tenuis*, var. *Schinzi*, Noack, Zool. Jahrb. iv. 1889, p. 134.

This species has a very wide range, forms which so far seem specifically inseparable from the Cape specimens occurring in Mashunaland and Nyasaland.

Gerbillus (Tatera) Brantsi, Smith.

Gerbillus Brantsii, Smith, Rep. Exped. Int. S. Afr., App. p. 43 (1836).

Gerbillus montanus, Smith, Ill. Zool. S. Afr., Mamm. pl. xxxvi. fig. 1 (1842).

Meriones (Rhombomys) maccalinus, Sundeval, (Efvers. Vet.-Ak. Stockh. 1846, p. 120.

The Museum is indebted to Mr. Thomasset for a fine series of this Gerbil, clearly proving it to be distinct from *G. afer*; the species is well figured and described by Smith (Ill. Zool. S. Afr., Mamm. pl. xxxvi.).

Hab. Transvaal.

Gerbillus (Tatera) Lobengulæ, sp. n.

In size and proportions this Gerbil closely resembles *G. afer*. The colour of the dorsal region is pale fawn, very finely grizzled with dull black; on the sides there is no grizzling and the colour pure fawn; an abrupt line divides the colour of the upper parts from the lower, which are all pure white.

The colour of this animal is very constant, and so differs from *G. afer* and *G. leucogaster*, in both of which the general colour is more rufous or chestnut and the grizzling coarser.

The skull differs from its allies chiefly in having a narrower facial portion, being very narrow across the nasals and maxillæ between the infraorbital foramina.

The first upper molars are very persistently cuspidate, the second lobe being divided into a pair of cusps—outer and inner—in fairly adult specimens; and even when the tooth is worn, so that only the separated transverse laminae appear, this second lobe is pinched together in the middle line, and the mesial bridge, showing the full laminated pattern of the tooth, does not appear until even later than in *G. afer*.

Type (♂), British Museum, no. 97. 1. 4. 11. Collector's no. 31. 5th Oct., 1895. Essex Vale, Matabeleland.

Head and body 134 millim.; tail 160; hind foot 34; ear 45.

Skull: greatest length 40; breadth 21·5; nasals, length 16, greatest breadth 4.

This specimen, with others, was collected by Mr. F. C. Selous, and was referred to *G. leucogaster* with doubt by the writer (P. Z. S. 1896, p. 807); but further comparison with younger specimens of *G. afer* and *G. leucogaster* allow of no doubt as to their distinctness, my conclusions being based on six skins and seven skulls of this species and a large number of its nearest allies.

Gerbillus (Pachyuromys) auricularis, Smith.

Gerbillus auricularis, Smith, S. Afr. Quart. Journ. ii. 1834, p. 160.

Gerbillus brevicaudatus, F. Cuv. Trans. Zool. Soc. ii. 1836, p. 144, pl. xxvi. figs. 10-13.

This curious Gerbil, with its short thick tail, is very different from any South-African member of the genus; it inhabits dry sandy districts, especially parts of Namaqualand; but several specimens have lately been received from Mr. A. Wolf Curry, taken in the neighbourhood of Kimberley—the only other member of the subgenus (*G. Duprasi*) being found in the Algerian Sahara.

OTOMYS, F. Cuv.

Otomys, F. Cuv. Dents des Mamm. p. 168, pl. lx. (1825) (nec A. Smith).

Euryotis, Brants, Muizen, p. 93 (1827).

Otomys irroratus, Brants.

Mus irroratus, Licht. MS., nom. nud.

Euryotis irrorata, Brants, Muizen, p. 94, pl. (1827).

Otomys bisulcatus, Cuv. & Geoff. Mamm. livr. lx. fig. 265 (1829).

Euryotis typicus, Smith, S. Afr. Quart. Journ. ii. p. 149 (1834).

Euryotis irroratus, Smith, Ill. Zool. S. Afr. pls. xxii., xxv. fig. 1 (1840).

Euryotis obscura, Licht. Verzeichn. Säug. u. Vögeln Kafferlands, Berlin, p. 10 (1842).

This species is widely distributed, frequenting wet or marshy places. Both upper and lower incisors are deeply grooved and the third upper molar has six enamel folds.

Otomys unisulcatus, F. Cuv.

Otomys unisulcatus, Cuv. & Geoff. Mamm. livr. lx. fig. 264 (1829).

Euryotis unisulcatus, Smith, S. Afr. Quart. Journ. ii. 1834, p. 149; Ill. Zool. S. Afr., Mamm. pl. xxiii. (1840).

Euryotis pallida, Wagner, Wieg. Arch. 1841, p. 134.

Otomys rufifrons, Rüppell, Verzeichn. Mus. Senck. i. 1842, p. 28, nom. nud.; Wagner, Schreb. Säug., Supp. iii. p. 507 (1843).

This species inhabits the southern and eastern districts of the colony, frequenting dry situations. In colour it is somewhat paler than *O. irroratus*, but unless the teeth are examined the two species may be easily confounded. While closely resembling *O. Brantsi* in the pattern of its dentition, it is readily distinguished by its colour. A sure distinction, however, is found in the skull, as described under the next species.

Otomys Brantsi, Smith.

Euryotis Brantsii, Smith, S. Afr. Quart. Journ. ii. 1834, p. 150; Ill. Zool. S. Afr., Mamm. pl. xxiv. (1840).

This species is particularly abundant in Namaqualand, inhabiting dry situations. The upper incisors only are grooved; the last upper molar has only four enamel folds. The skull may be readily distinguished from that of *O. unisulcatus* in having much larger auditory bullæ; the basioccipital and basisphenoid bones are exceedingly narrow and rounded, while in both the other species known to inhabit the Cape Colony these bones are flattened out considerably.

Succostomus campestris, Peters.

Three specimens of this species have been received, through the Grahamstown Museum, from Mrs. George White of Brak Kloof. The occurrence of this pouched mouse in the neighbourhood of Grahamstown has come as a great surprise, for hitherto the most southerly points from which any member of the genus had been recorded were Mashonaland, where the large dark grey form occurs, and Damaraland, where a pale sandy-coloured form is found*.

From what Mr. Schönland tells me, this animal is generally confused with *Mystromys albicaudatus* by South-African

* In writing on some rodents from Angola (Ann. & Mag. Nat. Hist. 1897, xx. p. 322) I referred some specimens of *Succostomus* to *S. mashonæ*; but while agreeing with that species in the size and proportion of the skull, so far as can be judged from the material at hand (consisting of three specimens of *S. mashonæ* and five Damaraland skulls of different ages), the specimens from Damaraland and Angola differ so much in colour, being of a light somewhat sandy tint, even paler than *S. campestris*, that I think it desirable to specify them under the name of *S. Anderssoni*; and I take as the type of this new species no. 69. S. 11. 4 in the British Museum, collected by Mr. C. J. Andersson in Damaraland, this being, in fact, one of the specimens mentioned by Mr. Oldfield Thomas (P. Z. S. 1882, p. 266, pl. xiv.), the figure being drawn to illustrate a new species, but afterwards changed to *S. campestris*, as it was considered wiser not to distinguish the two forms with the material then in the Museum.

naturalists. I need scarcely say that while *Saccostomus* belongs to the subfamily Murinæ, being a short-tailed mouse with cheek-pouches, *Mystromys* belongs to the Cricetinae, with only two longitudinal rows of cusps in the molars. This latter animal is of so much interest that I shall notice it separately.

Mystromys albicaudatus, Smith.

Otomys albicaudatus, A. Smith, S. Afr. Quart. Journ. ii. 1834, p. 68.

Mystromys albipes, Wagn. Wiegmann Arch. 1841, p. 133.

Euryotis lanuginosa, Licht. Verzeichn. Säug. u. Vögeln Kafferlands, p. 10, Berlin (1842).

Malacothrix albicaudata, Wagn. Schreb. Säug., Suppl. iii. p. 498 (1843).

When Dr. Smith founded his genus *Otomys* he overlooked the fact that the name had already been applied by Cuvier to another group of mammals.

The district of Albany was given as the locality from which the type specimen was obtained, and in his later writings this author gives Grahamstown as one of the localities in which he had himself met with it. Now I think it just possible that Dr. Smith confused this species, which he had no doubt obtained north of the Orange River, with *Saccostomus campestris*, a species which he did not recognize, and perhaps labelled such specimens *Mystromys* in the Cape Town Museum, and in this way the confusion may have originated.

Now that we have proof of *Saccostomus* occurring in the southern districts of the Colony, search should be made to find out whether *Mystromys* occurs there also.

Besides the type, which presumably comes from Albany, the British Museum has only specimens of this animal from the Transvaal, received from Mr. Thomasset.

Mystromys has very great interest to naturalists, being the sole representative of the subfamily Cricetinae found in the Ethiopian Region; but what gives it still higher importance is that it appears to be the living representative of the fossil *Cricetodon* of the Upper Miocene deposits of Europe.

In the absence of further palæontological evidence as to the period during which *Mystromys* has inhabited South Africa, it may be presumed that it reached that portion of the continent only in comparatively recent times, otherwise, if the genus had existed there contemporaneously with the European fossil forms, we should expect to find it in Madagascar; but so far there is no evidence of its ever having existed in that region.

Dr. Smith describes this species as frequenting dry sandy places where there are scattered bushes, and being easily

taken at night with the aid of a lantern, to the light of which it is attracted, when it may be struck with a whip or taken in the hands. It might be mentioned that it is of the greatest importance that the skull is not damaged, so death should be caused by any other means than by a blow on the head.

Malacothrix typicus, Smith.

Otomys typicus, Smith (nec Cuvier), S. Afr. Quart. Journ. ii. 1834, p. 148.

Malacothrix typica, Wagn. Schreb. Säug., Suppl. iii. p. 493 (1843).

This animal was made the type of his genus *Otomys* by Dr. Smith, a genus which consisted of this species and *Otomys albicaudatus* = *Mystromys*; as stated above, the generic name had already been used, which, under the circumstances, may be considered rather fortunate.

The genus *Malacothrix* is placed in the subfamily Dendromyinae, and this species is the only representative of the genus. Specimens are extremely rare in museums. The British Museum is indebted to Mr. A. Wolf Curry for a fine series from Kimberley.

GEORYCHUS, Illig.

(Prodr. Syst. Mamm. et Av. p. 87, 1811.)

GEORYCHUS, subgen. GEORYCHUS, Gray.

(P. Z. S. 1864, p. 123.)

This division includes only *G. capensis*, in which the molars have deep infoldings of enamel on both outer and inner surfaces, the fourth tooth or third molar only appearing in extreme age.

GEORYCHUS, subgen. CRYPTOMYS, Gray.

Georychus, subgen. *Cryptomys*, Gray, t. c. p. 124.

Georychus, subgen. *Cetomys*, id. t. c. p. 125.

Includes all the other members of the genus, in which the molars have only a vestige of an infolding of the enamel on the outer surface of the molars in extreme youth and none whatever even in early maturity, the fourth tooth or third molar appearing at a very early age.

I consider that these two forms are fully worthy of sub-generic rank, though I do not follow all the divisions proposed by Gray.

II.—On some West-African Squirrels, with a Description of a new Species, and proposed Alteration in the Arrangement of the Groups. By W. E. DE WINTON.

A NUMBER of squirrels from the French Congo territory have lately been received at the British Museum. Of the so-called *Pyrrhopus* group, besides the typical form *Funisciurus pyrrhopus*, Cuv., from the Gaboon, there are examples of *F. auriculatus*, Matschie, and four specimens of a squirrel—a description of which is given below—from the Benito River, in outward appearance closely resembling *F. anerythrus*, Thos.

The fact that these two squirrels are found in the same district is sufficient to prove that they are perfectly distinct species, and not geographical races or subspecies; the same remark applies to *F. anerythrus* and *F. Emini*, which are found together in Monbuttu.

The new species and *F. anerythrus* agree in proportions and general markings, in the want of bright colouring, and in having longer tails than any of their allies; but, as will be shown, the pattern of their molars is so different from one another, that they must be regarded as distinct species.

F. auriculatus, on the other hand, has the shortest tail of the group, being very closely allied to *F. erythrogenys*, from Fernando Po, of which species it appears to be only a local form; and seeing that these two short-tailed forms with grey legs differ so much from *F. pyrrhopus*, which has bright red legs, besides different colouring throughout, and a longer tail, it is most misleading to lump them together; it will be found more convenient to keep them apart as distinct species.

The new squirrel may be described as follows:—

Funisciurus mystax, sp. n.

The general arrangement of colours as in *F. anerythrus*, but the prevailing tone more brown than green and the face-markings, especially the moustache, more distinct; the legs washed with reddish brown; the side-stripes are so faint in some specimens as hardly to be distinguishable, and on the whole may be said to be less developed than in its near ally; the underparts are strongly washed with rufous-cinnamon or apricot-colour, the throat paler, the scrotum of the male thickly clothed with grey fur.

The form of the skull as in other members of the group.

Measurements of the skull:—

Greatest length 51·5 millim., greatest breadth 27; length

of frontals 21·5; interorbital constriction 12·1; length of nasals 14·5; greatest breadth of nasals 6; basal length 42; gnathion to back of palate 21·5; back of palate to foramen magnum 17·5; length of incisive foramina 4; diastema 12; upper molar series 9; outside molars 11; length of auditory bulla 10·5.

Mandible: length (bone only) 28·5; back of incisors to coronoid 25·3, to condyle 28·5, to angle 25; greatest height 16; lower molar series 9.

Type (♂), British Museum no. 98. 5. 4. 9. Teeth worn.

Collector G. L. Bates, no. 315. Fang name "Kwē."

Benito River, 15 miles from mouth, 6th Jan., 1898.

Specimens of different ages and sexes killed from September to January do not vary in colour.

The chief interest in this squirrel is due to the fact that the molars have a more complicated pattern than is found in any of its near allies. The accompanying figures will show the pattern of the molars of some of the group. Fig. 3 represents R. $\frac{m-1}{1}$ of *F. mystax*; it will be seen that there is an extra infolding of the enamel on the outer side; the central

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.



Fig. 1.—R. $\frac{m-1}{1}$ of *Funisciurus anerythrus*.

Fig. 2.—Ditto of *F. pyrrhopus*.

Fig. 3.—Ditto of *F. mystax*.

Fig. 4.—Ditto of *F. Jacksoni*.

cuspid is only rudimentary in the majority of the existing squirrels, but is found in *Anomalurus* and in some fossils which are not considered to belong to *Sciurus*, and it is not too much to say that had this tooth been found in a fossil state it would not have been referred to a true squirrel.

Four specimens examined have teeth of precisely the same pattern; and I think it will be interesting to palæontologists to have an accurate figure recording the occurrence in an existing species.

Although the teeth of *F. pyrrhopus* and *F. anerythrus* have been figured before in Dr. Forsyth Major's most valuable paper in the P. Z. S. 1893, pl. viii., I have thought it advisable to reproduce them in a similar manner to that of *F. mystax*

for the sake of comparison; it will be noticed that the tooth of *F. anerythrus* agrees with that of *F. pyrrhopus*, and not with that of *F. mystax*, which is the reverse of what might have been expected, seeing that these two forms agree so closely in external characters.

It may be that this middle cusp is not so rare in existing species as is generally supposed; at any rate, it is a curious fact that two squirrels which I have introduced to science—the present one and *F. Jacksoni* from British East Africa—have this character developed to a remarkable degree. The latter species having far more cuspidate teeth the central cusp is only strongly developed on the outer border, but the extra fold of the enamel is well marked even in much-worn teeth, giving the teeth a much more complicated appearance than that found in any of its allies. A figure of the tooth of this squirrel is also given of approximately the same age (fig. 4), but owing to the strongly cuspidate nature of the tooth it is difficult to do it justice in this manner of drawing. The nature of the tooth will, however, be readily understood by comparing this figure, which is only intended to show the *pattern*, with the teeth of any of its allies or with the figure of *F. cepapi* given by Dr. Major. The teeth of *F. mystax*, on the contrary, with their evenly worn surface and clearly laminated pattern, are exactly suited to this form of illustration.

Both *F. mystax* and *F. Jacksoni* have undoubtedly very near allies in their respective groups, whose teeth show no sign of the middle cusp; thus it would seem that no great value can be attached to its presence or absence as a classifying character.

ALTERATION IN THE ARRANGEMENT OF THE GROUPS.

Additions to the squirrels of the *Paraxerus* group of Dr. Forsyth Major have caused me to look into the characters of the species forming that subgenus. First I would mention *S. Nordhoffi*, Duchailu (? = *S. calliurus*, Peters). The skull of this squirrel has never been described; in general form and in the pattern of the molars it closely resembles *S. Stangeri* from Fernando Po, but the size of the infraorbital foramina is altogether unique among the Sciuridæ, the openings being 4.5 millimetres high by 3 broad, and so approaching in size within measurable distance those of *Anomalurus*.

In connexion with the form of the infraorbital foramen, another squirrel in the same collection must be mentioned: this is *S. Wilsoni*, Duchailu. Dr. Jentink, in his Mono-

graph of the African Squirrels, places this name as a synonym of *S. Ebi*, Temm.; certainly the two forms resemble one another very closely in outward appearance, but on comparing the skulls there are found so many slight differences, that I prefer to regard them as distinct species; but chiefly I wish to draw attention to the infraorbital foramina.

In *S. Ebi* the foramen is formed on the same pattern and is of nearly the same size as that of *S. Stangeri*, while in *S. Wilsoni* it is much smaller, having a prolonged outer wall, and therefore typically Sciurine. The differences in size of the opening of this foramen must not therefore be considered of too great importance, seeing that it only results from a cutting away of the outer wall and is found to be so variable in closely allied forms.

The skulls of *S. Ebi* and *S. Wilsoni* differ greatly from those of *S. Stangeri* and *S. Nordhoffi*, as also do the patterns of the molars; both in the length of the facial portion, the generally elongated skull, and in the more hypsodont molars the two former are much more *Xerus*-like. Though the lower molars certainly are more Sciurine than those of the other members of the group in which I propose to place them, I see no reason to keep them separate, and I think they should be transferred to the subgenus *Funisciurus* = *Paraxerus* of Forsyth Major; while in the shortness of the facial portion, the generally broadened skull, and in the brachyodont molars the two latter might very well be placed with the *Rufobrachiat* or true Sciurine group of African squirrels.

It is proposed therefore that the subgenus *Protoxerus* be done away with and that its members be divided between the other two groups, *S. Stangeri* and *S. Nordhoffi* being transferred to the Sciurine group *Sciurus*, sec. a, Major, = *Heliosciurus*, Trouessart, and *S. Ebi*, *S. Wilsoni*, and *S. Aubinni* to the more *Xerus*-like group *Funisciurus*, Trouessart, = *Paraxerus*, Major, lately raised to the rank of a genus by O. Thomas (P. Z. S. 1897, p. 933).

This seems to me the only place where a line can be drawn, and I believe in this manner the squirrels of Africa will be divided into two more workable groups than according to the former arrangement, for there appears to be quite as much relationship between *Funisciurus Ebi*, *F. Aubinni*, and *F. cepapi* with its allies, as exists between the latter and *F. pyrrhopus* groups.

Since Dr. Forsyth Major wrote his paper the collection of African squirrels in the British Museum has been very greatly increased, there being then no skulls of *F. Wilsoni* or *S. Nordhoffi* available, and the only skull of *F. Ebi* having

abnormally worn teeth. The squirrels of the *cepyi* group were also in an unsatisfactory state, the East-African forms being confused with *cepyi* proper, a slightly larger animal with even less hypsodont teeth; the tooth figured as belonging to *F. cepyi* in Dr. Major's paper belongs really to a squirrel from Kilimanjaro, probably *F. ganana*, which is closely allied to *F. Jacksoni*.

It is a curious and it might be said inconvenient fact, that in the pattern of their teeth and in the shape of the skull the harsher-furred squirrels approach *Sciurus*, while the softer-furred approach *Xerus*; with the exception of *S. rufobrachiatus*, the rule would almost hold good that the harsher the fur the nearer to *Sciurus*, the softer the fur the nearer to *Xerus*.

III.—On the Butterflies of the Genera *Leptophobia* and *Pieris*.

By ARTHUR G. BUTLER, Ph.D., F.L.S., F.Z.S., &c.

IN spite of adverse criticism, I have seen no reason to change my decision either as to the distinctness of *Leptophobia* or as to what should be regarded as typical *Pieris*. Strictly speaking, perhaps, *Parnassius apollo* should be regarded as the type of *Pieris*, Schrank; Scudder, however, considers *Ganoris rapæ* to be the type, regarding the closely related *G. brassicæ* as generically distinct. I have clearly proved that the trivial characters upon which these two nearly allied "cabbage-butterflies" were separated are utterly unreliable, being inconstant in the extreme. If we were, on the other hand, to make *Parnassius apollo* the type of *Pieris*, it would not only create hopeless confusion, but would necessitate giving a fresh name to the subfamily Pierinæ, a course not to be desired by any who keep in view the sole object of nomenclature.

As before, therefore, I accept Boisduval's definition of *Pieris*, taking *P. amathonte* (= *P. demophile* ♀) as its type.

In the 'Biologia Centrali-Americana' the genus *Pieris* is expanded to include *Synchloe*, *Mylothris*, *Leptophobia*, and *Glutophrissa*; but personally I prefer to keep all groups having constant structural differences, whether of neuriation or other details, as separate genera. As regards the statement that *P. protodice* (*Synchloe*) is sexually inconstant in neuriation, I can only suggest that this state of things is individual and abnormal, inasmuch as nine out of our ten male examples show the apical furca in the primaries quite as

clearly as in our six females. This, I do not for a moment doubt, the authors of the 'Biologia' will frankly admit when they have again investigated the point.

The following is a list of the species so far as they are known to me:—

LEPTOPHOBIA, Butler.

1. *Leptophobia eleone*.

Pieris eleone, Hewitson, in Gen. Diurn. Lep. pl. vi. fig. 6 (1847).

Pieris Smithii, Kirby, Trans. Ent. Soc. 1881, p. 357; Rhop. Exot. i. pl. i. figs. 3, 4 (1888).

Venezuela, Bogota, Bolivia, Quito, Ecuador. B. M.

P. Smithii is evidently a slight variation, differing only in the narrowness of the posterior portion of the outer border of the primaries; the width of this border varies a good deal in *L. eleone*.

2. *Leptophobia eleusis*.

Pieris eleusis, Lucas, Rev. et Mag. de Zool. 1852, p. 331.

Pieris suadella, Felder, Wien. ent. Monatschr. v. p. 79 (1861).

Venezuela. B. M.

I think it very doubtful whether the following is distinct from this.

3. *Leptophobia helena*.

Pieris helena, Lucas, Rev. et Mag. de Zool. 1852, p. 332.

Quito. B. M.

4. *Leptophobia aripa*.

Pieris aripa, Boisduval, Sp. Gén. Léop. i. p. 528 (1836).

Pieris balidia, Boisduval, t. c. p. 529.

Pieris elodia, Boisduval, l. c.

Rio Janeiro, Bolivia, Venezuela, Panama, Costa Rica, Guatemala, Mexico. B. M.

Our examples of *L. balidia* (from Rio Janeiro) have the under surface of the secondaries and apex of primaries more buff-coloured than Central-American examples; but the Bolivian example is somewhat intermediate.

5. *Leptophobia pinara*.

Pieris pinara, Felder, Reise der Nov., Lep. ii. p. 179 (1865).

Bogota, Bolivia, and Ecuador. B. M.

6. *Leptophobia erinna*.

Pieris erinna, Hopffer, Stett. ent. Zeit. 1874, p. 335.

Peru. B. M.

7. *Leptophobia nephthis*.

Pieris nephthis, Hopffer, Stett. ent. Zeit. 1874, p. 334.

Bolivia and Ecuador. Coll. Hewitson.

Nearly allied to the preceding species.

8. *Leptophobia stamnata*.

Pieris stamnata, Lucas, Rev. et Mag. de Zool. 1852, p. 330.

Pieris euthemia, Felder, Wien. ent. Monatschr. v. p. 80 (1861).

Venezuela. B. M.

9. *Leptophobia penthica*.

Leptalis? *penthica*, Kollar, Denkschr. Akad. Wiss. Wien, math.-nat.

Cl. i. p. 360, pl. xlv. figs. 11, 12 (1850).

Bogota and Ecuador. B. M.

10. *Leptophobia subargentea*, sp. n.

♂. Above very similar to the same sex of *L. tenuicornis*, but the base of primaries blacker, the white markings more cream-coloured, the large patch barely extending above the second median branch (so as to leave a much wider interval between it and the subapical bifid spot); secondaries much less blue, the inner bordering of the much larger creamy white patch being rather silver-grey. Primaries below with costa and fringe sulphur-yellow, apical area silver crossed by black veins; white area rather more extended basally than above and pure white, subapical white spot slightly broader: secondaries silver, with black veins; basal lobe daffodil-yellow in front, saffron behind. Body normal.

Expanse of wings 58 millim.

Pucartambo, Peru (*Whitely*). Type B. M.

Evidently related to, but distinct from, the following.

11. *Leptophobia semicæsia*.

Pieris semicæsia, Felder, Reise der Nov., Lep. ii. p. 176 (1865).

Bogota.

This species seems to approach *L. penthica*, but with no white on upper surface of secondaries; the secondaries and apex of primaries below silvery rather than nacreous. The

description almost agrees with *L. philoma*, but Felder speaks of the subapical fasciole as tripartite.

12. *Leptophobia olympia*.

Pieris olympia, Felder, Wien. ent. Monatschr. v. p. 80 (1861).

E. Peru (registered Nauta). B. M.

In the Hewitson collection a specimen, from Bolivia, stands under *L. tovaria*, from which species I think *L. olympia* very doubtfully distinct; it was described from a Venezuelan example.

13. *Leptophobia tovaria*.

Pieris tovaria, Felder, Wien. ent. Monatschr. v. p. 80 (1861).

♀, Bogota. B. M.

14. *Leptophobia subflavescens*.

Pieris subflavescens, Kirby, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 362 (1887).

New Grenada.

Near to *L. tovaria*; almost the same on upper surface.

15. *Leptophobia philoma*.

Pieris philoma, Hewitson, Equat. Lep. p. 79 (1870).

Ecuador. Type coll. Hewitson.

Should this prove to be Felder's *L. semicasia* it will have to sink; but it is possible that the species of Bogota may prove distinct.

16. *Leptophobia caesia*.

Pieris caesia, Lucas, Rev. et Mag. de Zool. 1852, p. 299; Hewitson, Exot. Butt. ii., *Pier.* pl. vi. figs. 43, 44 (1861).

Quito and Ecuador. Coll. Hewitson and B. M.

17. *Leptophobia tenuicornis*.

Leptophobia tenuicornis, Butler and Druce, Cist. Ent. i. p. 110 (1872); Lep. Exot. p. 116, pl. xliii. fig. 4 (1872).

Pieris tenuicornis, Godman and Salvin, Biol. Centr.-Am., Lep. Rhop. vol. ii. p. 137, pl. lxii. figs. 8-11 (1889).

Colombia, Chiriqui, Costa Rica. B. M.

18. *Leptophobia cinerea*.

Pieris cinerea, Hewitson, Trans. Ent. Soc. ser. 3, vol. v. p. 563 (1867).

Pieris menthe, Hopfler, Stett. ent. Zeit. 1874, p. 335.

Ecuador. Coll. Hewitson and B. M.

PIERIS, Boisduval.

This genus separates into several natural groups, the first being the *P. demophile* group, in which the females vaguely remind one of *Ithomiinæ* (such as *Sais*); the second is the *P. viardi* group, the females of which are often more like *Tithorea*, the under surface of the secondaries often richly coloured in both sexes; the third is represented by *P. phileta* (*P. monuste* auct. plur., nec Linn.) and its varieties, somewhat short-winged *Belenois*-like butterflies; the fourth and last is represented by the *P. bunia* group, and unites characteristics of *Catopsilia* and *Ganoris*, all the males exhibiting well-developed patches and streaks of thickened scaling on the wings, but combined with the long slender antennæ and style of neuration of the later types of the *Pierinæ*.

Section 1.

1. *Pieris demophile*.

♀. *Papilio demophile*, Clerck, Icones, pl. xxviii. fig. 4 (1764).

Papilio molpheæ, Cramer, Pap. Exot. ii. pl. cxvi. C (1779).

♂. *Papilio amathonte*, Cramer, l. c. A, B.

Pernambuco, St. Paulo, Tapajos. B. M.

2. *Pieris calydonia*.

Pieris calydonia, Boisduval, Sp. Gén. Lép. i. p. 439 (1836).

Venezuela, Panama, Nicaragua. B. M.

This species varies a good deal in the width of the black-brown borders, our Venezuelan examples having considerably broader borders than those from Panama and Nicaragua.

3. *Pieris leptalina*.

Pieris leptalina, Bates, Journ. Entom. i. p. 236 (1861).

Pieris pisonis, Hewitson, Exot. Butt. ii., *Pier.* pl. vi. figs. 40, 41.

E. Peru (registered "Nauta"). B. M.

4. *Pieris kiçaha*.

Pieris kiçaha, Reakirt, Proc. Ent. Soc. Phil. ii. p. 349 (1863).

Pieris notistriga, Butler and Druce, Cist. Ent. i. p. 111 (1872).

Rio Dagua, Colombia. B. M.

5. *Pieris marana*.

Pieris marana, Doubleday, Ann. & Mag. Nat. Hist. vol. xiv. p. 421 (1844); Hewitson, Exot. Butt. ii., *Pier.* pl. vi. fig. 42 (1861).

West Indies?, Panama, Chimborazo. Type B. M.

Doubleday's type was clearly collected either in the West Indies or on the coast of Central America (as evidenced by all the species from the same collection).

6. *Pieris pandosia*.

Pieris pandosia, Hewitson, Exot. Butt. i., *Pier.* pl. ii. fig. 14 (1853),
ii., *Pier.* pl. vi. fig. 39 (1861).

Venezuela. B. M.

The type is in the Hewitson collection.

7. *Pieris pylotis*.

Pieris pylotis, Godart, Enc. Méth. ix. p. 158 (1819).

Brazil. B. M.

The black spot on the primaries gives this species a somewhat aberrant aspect, but I think it is best located here.

Section 2.

8. *Pieris viardi*.

♀. *Pieris viardi*, Boisduval, Sp. Gén. Léop. i. p. 439 (1836).

♂. *Pieris habra*, Doubleday, Ann. & Mag. Nat. Hist. xvii. p. 22 (1846);
Gen. Diurn. Lep. pl. vi. fig. 1 (1847).

♂, Honduras (Doubleday's type). B. M.

In the Hewitson collection both sexes of this species stand together.

9. *Pieris laogore*.

Pieris laogore, Godman and Salvin, Biol. Centr.-Am., Rhop. ii. p. 134 (1889).

Mexico.

Differs from the preceding in the whole of the yellow markings in both sexes being replaced by orange.

10. *Pieris tithoreides*, sp. n.

♂. Above much like *P. locusta*, but usually with one or two extra white spots in the border and with the narrow part of the border, at the posterior angle of the primaries, better defined: on the under surface the differences are better marked, the border of the primaries being produced inwards upon the first and second median branches as in *P. locusta*, but not so imperfectly, the greyish diffusion of that part of the border in *P. locusta* being filled in in the present species: in the secondaries the red, orange, and yellow markings are

all less vivid and there is a broad pale belt across the wing which includes the greater part of the discoidal cell, so that the lower ramus of the dark discoidal furca is clearly seen to be bordered on both sides with chrome-yellow; the submarginal yellow spots are rather more elongated than in *P. locusta*.

Expanse of wings 67 millim.

♀. Curiously resembles *Tithorea Pavonii*. Above black: the primaries with a broad sulphur-yellow patch, paler externally, commencing just above the base of the median vein and divided by this vein and its first branch, at the middle of which branch it terminates; below this a diffused yellow streak traversed by the submedian vein; a slightly irregular pearly white oblique macular band beyond the cell from costa nearly to outer margin, its inner edge angulated at subcostal vein, its last inferior spot small and well divided from the remaining divisions; two spots placed subapically, the upper one bifid; a larger spot near posterior angle: secondaries with brown costal area, below which is a broad sulphur-yellow belt, whitish at each extremity, from abdominal margin to second subcostal branch, above which are a few yellow scales; this belt is deeply incised upon the veins, but especially upon what would now be called the "upper" radial; a submarginal series of white spots. On the under surface the primaries are nearly as above, excepting that there is a pale patch at apex tinted with grey-brownish and yellow, and partly enclosing the bifid subapical spot; below this and near outer border are three bifid yellow spots, the last being the terminal spot of the postmedian stripe: the secondaries nearly resemble those of the male, but are altogether more vivid in colouring, the broad belt crossing the cell being mostly white and the streak bordering the discoidal <-shaped character (false vein) bright cadmium-yellow.

Expanse of wings 71 millim.

Male and female, Ecuador; two males and one female, Quito: coll. Hewitson. Two males, Chimborazo; female, Ecuador: B. M.

The types are in the Hewitson series.

11. *Pieris mandela*.

Pieris mandela, Felder, Wien. ent. Monatschr. v. p. 80 (1861).

Venezuela. B. M.

Both sexes are in the Hewitson collection unlabelled with locality.

12. *Pieris apicalis*, sp. n.

♂. Allied to *P. mandela*, but usually considerably larger, the apical border on the primaries with more oblique inner edge, its inferior continuation on outer border distinctly narrower, the upper subapical white spot larger; secondaries with the posterior half of the outer border decidedly broader: primaries below with the apical patch and border still more reduced, only one whiter submarginal spot (or at most two); secondaries with decidedly whiter, mostly white, irregular central belt.

Expanse of wings 70–79 millim.

♀. Not unlike the female of *P. mandela*, but much larger, the secondaries above with the whole base almost to the end of the cell suffused with greyish brown: the primaries on under surface not sulphur-tinted at base and the secondaries more pink in tint, the brown portions more coffee-coloured, the submarginal spots larger.

Expanse of wings 74 millim.

Two males, Quito and Upper Amazons: in coll. Hewitson. Male, Bogota; female, E. Peru: B. M.

The type of the male is from Quito, that of the female from E. Peru (registered "Nauta")*. Hewitson referred one male of this species to *P. mandela* and the other to *P. locusta*, being guided solely by expanse of wings.

13. *Pieris locusta*.

Pieris locusta, Felder, Wien. ent. Monatschr. v. p. 81 (1861); Reise der Nov., Lep. ii. p. 175, pl. xxv. figs. 8, 9 (1865).

Two males, one female, Bogota. B. M.

The female is a good deal like *P. noctipennis*, the chief difference being that the secondaries show a greyish nebulous subcostal belt, barely visible until beyond the discoidal cell, and two sharply defined, apical, submarginal, creamy-white spots. Looking at the illustrations of both sexes in the 'Biologia Centrali-Americana,' I must admit that I greatly doubt the specific distinctness of the two forms.

14. *Pieris noctipennis*.

♀. *Pieris noctipennis*, Butler and Druce, Cist. Ent. i. p. 111 (1872); Lep. Exot. p. 118, pl. xliii. fig. 7 (1872).

♀, Nicaragua. In coll. Hewitson.

The male is represented in the 'Biologia' with rather more

* I have frequently called attention to the fact that the specimens thus registered are all believed to have been collected in E. Peru.

submarginal spots and a paler central belt across the under surface of the secondaries than exist in *P. locusta* from Bogota; the female also, from which the figure is taken, and that in the Hewitson collection both have the white area on the primaries somewhat yellower than in that sex of *P. locusta* or than in my type. I am afraid that none of these slight differences will prove to be even locally constant, but in the absence of positive proof I temporarily retain the two forms as possibly separate.

Section 3.

15. *Pieris phileta*.

♀. *Pieris phileta*, Fabricius, Syst. Ent. p. 471 (1775).

Mancipium monuste, Hübner, Samml. exot. Schmett. i. pl. cxxxiv. figs. 1-4.

Mylothris hippomonuste, Hübner, Verz. bek. Schmett. p. 91 (1816).

Pieris orseis, Godart, Enc. Méth. ix. p. 141 (1819).

Pieris virginia, Godart, l. c.

Pieris eubotea, Godart, t. c. p. 144 (1819).

Pieris feronia, Stephens, Ill. Brit. Ent., Haust. i. p. 149 (1828).

Pieris hemitheia, Hübner, Samml. exot. Schmett., Zutr. figs. 693, 691 (1832).

Pieris cleomes, Boisduval and Leconte, Lép. Am. Sept. p. 43, pl. xvi. (1833).

Pieris evonima, Boisduval, Sp. Gén. Lép. i. p. 493 (1836).

Pieris vallei, Boisduval, t. c. p. 494 (1836).

Pieris joppe, Boisduval, t. c. p. 495 (1836).

Pieris suasa, Boisduval, t. c. p. 549 (1836).

Papilio albusta, Sepp, Surin. Vlind. iii. pl. cxli. (1855).

Pieris automate, Burmeister, Deser. Rep. Arg. v. p. 85, pl. iv. fig. 11 (1878).

Southern States of N. America, the West Indies, Central America, and a great part of the Southern continent.

With so wide a range it is naturally extremely variable, a perfect series of gradations existing between typical *P. phileta* and the feebly bordered *P. automate*; these variations may be somewhat arbitrarily divided into seven grades, none of them apparently being confined to any particular region.

The species has hitherto stood in collections as *P. monuste* of Linnæus, with which some of the older authors were the first to confound it; but the description in the 'Museum Ludovicæ Ulricæ' cannot refer to this butterfly, inasmuch as, in the first place, no mention is made of the dentated character of the inner edge of the outer border of primaries, but, on the contrary, that of the secondaries is specially described as "denticulato-fuscus"; in the second place, no mention is made of the elongate subapical white spots on the primaries; and, lastly, the wings below are said to be concolorous, ex-

cepting that the borders show a greyish shade answering to those of the upper surface—"loco fusci coloris tantum cinerascens ad marginem." The description is much more likely to be intended for *Udaina cynis*, only the under surface of the primaries in the latter species is almost too strongly coloured and the dentated character of the border still obtains on the upper surface. The type being lost, it is by far the best plan to let the name lapse unless something perfectly answering to the description can be found. Possibly *Mylothris phaola* or an allied form may be intended.

Section 4.

16. *Pieris*, sp. n.?

Four specimens of a species allied to *P. sevata*, but with more produced costa and more broadly bordered outer margin to primaries; the apex of primaries and the secondaries below sericeous pink.

Four males, Panama. B. M.

I have been unable to find a description of this species, which, however, I prefer to leave for the consideration of the authors of the 'Biologia Centrali-Americana.' It vaguely resembles *Glutophrissa castalia*, but differs in structure and in the colouring of the under surface; the primaries with much straighter outer margin, all the wings with streaks of thickened scales bordering the veins, and the anal segment with no trace of the dense prominent brush projecting from the base of the clasps (the presence of the brush in both sexes being the chief character upon which I founded the genus *Glutophrissa*), a feature wholly wanting in either sex of *Pieris*.

17. *Pieris sevata*.

Pieris sevata, Felder, Wien. ent. Monatschr. v. p. 81 (1861).

Male and female, Venezuela. B. M.

Bears a curious resemblance to some of the extreme types of *P. pyranthe*.

18. *Pieris ausia*.

Pieris ausia, Boisduval, Sp. Gén. Lép. i. p. 531 (1836).

One male, Mexico: B. M. Two females, without locality: coll. Hewitson.

There are four males in the Hewitson collection from Bolivia which must, I think, represent a variety of this

species; they are individually very inconstant in the width and character of the apical border of the primaries.

19. *Pieris bunice*.

Catopaga bunice, Hübner, Samml. exot. Schmett. ii. pl. cxxv. figs. 1, 2 (1816-36).

Pieris endeis, Godart, Enc. Méth. ix. p. 158 (1819).

Brazil, Rio Janeiro. B. M.

20. *Pieris phaloe*.

Pieris phaloe, Godart, Enc. Méth. ix. p. 156 (1819); Lucas, Lep. Exot. pl. xxvii. fig. 1 (1835).

Pará, Tapajos, Venezuela. B. M.

21. *Pieris imperator*.

Pieris imperator, Kirby, Trans. Ent. Soc. 1881, p. 357; Rhop. Exot. i. Pier. pl. i. figs. 1, 2 (1888).

One male, Ecuador: coll. Hewitson. Id. male and female var.?, Obydos (*E. E. Austen*): B. M.

22. *Pieris diana*.

Pieris diana, Felder, Wien. ent. Monatschr. v. p. 81 (1861).

Two males, New Granada: coll. Hewitson. One male, Brazil: B. M.

23. *Pieris Van-Volxemii*.

Pieris Van-Volxemii, Capronnier, Ann. Soc. Ent. Belg. xvii. p. 11, pl. i. fig. 1 (1874).

Buenos Ayres.

Probably intermediate between *P. diana* and *P. amaryllis*, but smaller than either.

24. *Pieris amaryllis*.

Papilio amaryllis, Fabricius, Ent. Syst. iii. 1, p. 189 (1797); Donovan, Ins. Ind. pl. xxviii. fig. 1 (1800).

Male and female, Jamaica. B. M.

25. *Pieris Josepha*.

Pieris Josepha, Godman and Salvin, Ann. & Mag. Nat. Hist. ser. 4, vol. ii. p. 150 (1868).

One male, Guatemala. B. M.

26. *Pieris Josephina*.

Pieris Josephina, Godart, Enc. Méth. ix. p. 158 (1819); Hübner, Samml. exot. Schmett. ii. pl. cxxvi. (1819-36).

Male and female, St. Domingo, and male, Mexico. B. M. Mr. Heron and I have compared our specimens with Godart's types, now in the Edinburgh Museum.

IV.—*Some new Coccidæ*. By T. D. A. COCKERELL, Entomologist of the New Mexico Agricultural Experiment Station.

Pulvinaria ephedrae, sp. n.

Mature female about 5 millim. long, with a snow-white ovisac 11 millim. long and 4 broad.

Body of female quite soft, not at all chitinous, raspberry-pink in front, greenish on dorsum, with some minute black specks. The front part of the female is covered by a thick square patch, 2 millim. broad, of white secretion; the hind margin is also fringed with secretion, and the body has irregular patches, arranged in three longitudinal bands, of which the middle is the narrowest and most definite. Ovisac firm, not adhering to objects which may chance to touch it, ribless. Eggs greenish yellow.

♀.—When boiled in caustic potash turns the liquid pink. Mounted on a slide, 6 millim. long and $4\frac{1}{2}$ broad; legs and antennæ brown. Antennæ 8-segmented, 1 at least twice as broad as long; formula 3 4 2 5 1 6 8 7. The several segments of an antenna were found to measure as follows in $\mu\mu$:—(1) 62, (2) 70, (3) 112, (4) 81, (5) 67, (6) 56, (7) 36, (8) 47. Legs ordinary, tarsus about half length of tibia; claw-digitules rather stout, extending beyond tip of claw; tarsal digitules slender. Margin with very numerous sharp spines, placed closer together than the length of one. Anal plates yellowish brown.

Hab. On *Ephedra*, Mesilla Park, New Mexico, a short distance east of the Agricultural College, in the *Larrea* zone, May 1898.

A very beautiful and distinct species, superficially rather resembling *Icerya Rileyi*, which occurs in the same locality on *Larrea*. The characters italicized in the description are of subgeneric value, and *P. ephedrae* may be regarded as the type of a new subgenus—*Philephedra*.

Aspidiotus yuccarum, sp. n.

♀.—Scale circular to suboval, about $2\frac{3}{4}$ millim. diam., slightly convex, dark brown, rough and concentrically wrinkled, blackish towards the middle; but the central part, covering the exuviae, covered by a large round patch of white secretion; when this is rubbed off, the exuviae are exposed, shining black, subcentral. There is a thick ventral scale. Young female scales appear entirely white, or, when rubbed, white with a black spot.

♂.—Scale elongate, brown, with the exuvia at one end covered by white secretion.

♀.—Caudal region brownish; three pairs of lobes, these short, yellowish brown, notched at the end, with glandular processes at their bases much as in *Diaspidiotus*; the middle lobes especially remind one of human premolar teeth, fangs and all. Middle lobes a short distance apart, second separated by a similar distance from the first, third separated from the second by an interval about as great as the width of the former; margin beyond the third minutely crenulate, with a protuberance representing a rudimentary fourth lobe somewhat further from the third than the third is from the first. Spines very minute. No spine-like or other plates. No grouped ventral glands, but many small round or slightly elongate dorsal glands. Anal orifice a long distance from the hind end. Antennæ represented by a small tubercle bearing a single bristle.

Hab. At bases of leaves of *Yucca elata*, associated with *Dactylopius dasylirii*, Ckll. (for which the *Yucca* is a new food-plant), Mesilla Park, a short distance east of the Agricultural College, at the beginning of the *Larrea* zone, May 1898.

This very distinct species belongs to an unnamed section of the genus, allied to *Diaspidiotus*, containing *A. yuccarum*, Ckll., *A. yuccæ*, Ckll., and *A. bigeloviae*, Ckll. These species agree in having black exuviae, no plates (gland-hairs), and no grouped ventral glands. *A. yuccæ* was described from Mexico; but on May 19, 1898, Prof. C. H. T. Townsend found it at the bases of leaves of *Yucca elata* in the Mesilla Valley, New Mexico. This new find shows that the small size of the insect is in no way due to immaturity, for specimens of the size of the original types are full of eggs. The living female of *yuccæ* is dull lilac, and it turns bright lemon-yellow in liquor potassæ. What I called the spine-like plates in the original description are the true spines; they are much larger than those of *yuccarum*. The Mesilla-Valley form of

yuccæ is constantly different from the type by the considerably more produced median lobes; at some future time Prof. Townsend will probably give it a varietal name.

Aspidiotus (Chrysomphalus) lilacinus, sp. n.

♀.—Scale light grey, the colour of the bark on which it rests, about 1 millim. diam.; immature scales show a white dot and ring; old scales when rubbed show jet-black exuvia.

♀.—When living dull lilac, becomes bright green in caustic potash, and the eyes of the embryonic larvæ a rich dark blue. No grouped ventral glands. Four pairs of lobes.

Hab. On bark of oak (a species of the *Quercus undulata* group), Dripping Spring, Organ Mts., New Mexico, April 23, 1898. It is parasitized by a species of *Signiphora*.

A. lilacinus resembles *A. obscurus*, but the scales are smaller, the glandular processes at the bases of the lobes are longer, there are no circumgenital glands, and the fourth lobe is broad and serrulate. The anal orifice is a considerable distance from the hind end, as in *obscurus*, not close to it, as in *tenebricosus*, nor is the scale convex like that of *tenebricosus*. *A. lilacinus* has four pairs of lobes and long slender glandular processes, quite after the manner of the Mexican *A. calurus*; but the shape of the female is ordinary, not as in *calurus*, the median lobes are entire instead of notched, and the second lobes are only once feebly notched. The third lobes are minutely serrate, with four notches, and the fourth are serrate in the same manner. There are three little prominences beyond the fourth lobe as in *calurus*.

Melanaspis must be regarded as a section of the subgenus *Chrysomphalus*, and extended to include *A. tenebricosus*, Comst., *A. calurus*, Ckll., and *A. lilacinus*, Ckll. It is to be remarked that *tenebricosus* &c. in their longer glandular processes and absence of circumgenital glands resemble the penultimate stage of typical *Melanaspis*.

I have a new locality to record for *A. calurus*, namely Oaxaca, Mexico, where it was found by Mr. A. Koebele on a milky plant, Aug. 22, 1897.

I wish to draw attention to a curious pigment found in various Coccidæ, mentioned above in the description of *A. lilacinus*. It is of a dull lilac-colour, but when placed in liquor potassæ immediately becomes light green. My *Parlatoria thææ*, var. *viridis*, was named from this green colour; but Mr. Alex. Craw lately sent me fresh specimens on stems of "*Ilex pedunculata*" (doubtless an error for *I. pedunculosa*, Miq.) from Japan, and I found that the female was of a curious purple colour, except the mouth-parts and lobes (of

fringe), which were yellowish brown. Directly these insects were placed in liquor potassæ they turned green.

Aspidiotus transparens, Green, subsp. *simillimus*, nov.

♀.—Scale white, a little transparent, diam. $1\frac{2}{3}$ millim., flat, circular to suboval; exuviæ central, very light yellow, sometimes more or less covered with white secretion.

♂.—Scale oval, ordinary; exuviæ whiter than in the female.

♀.—After boiling yellow; transparent and colourless if the contents are lost; median lobes remaining yellowish, but hardly darker than the others. Three pairs of well-developed lobes, of the *nerii* type; median feebly notched on inner and distinctly on outer side; second narrower and practically entire; third smaller and notched on outer side. The median lobes always extend a little beyond the plane of the tips of the second, this plane being about on a level with the outer notch on median lobes. Squames as in the *nerii* group, extending beyond the tips of the lobes, those beyond the third lobe about twice its length. Six or seven long pointed squames, ramose on outer side, beyond the third lobe; a short distance cephalad of the furthest squame is a spine. Anal orifice a little nearer the caudolateral groups of glands than to the hind end. Transverse pores numerous, belonging to glands of the cylindrical type, as in *nerii* &c.; there are over 25 well-formed transverse pores on each side of the median line. Caudal region striated. Four groups of circumgenital glands, caudolaterals 7 to 9, cephalolaterals 8 to 15.

Hab. On a palm from Sydney, Australia, found by Mr. Alex. Craw, Dec. 1897, in the course of his horticultural quarantine work at San Francisco.

The scale of this insect resembles that of *A. destructor* and *transparens*. The female differs at once from *destructor* by the longer median lobes; from *transparens* it differs by the more numerous glands in the circumgenital groups, and especially in the much longer squames beyond the third lobe. Compared with some *A. transparens* on *Dalbergia* from Ceylon, sent by Mr. Green, the scales of *simillimus* are more opaque and less wrinkled. The scale of *simillimus* at once differs from *nerii*, which has smaller pale orange exuviæ; it resembles more closely the *hederæ* form of *nerii* than the scales found on oleander. The scale and exuviæ of *simillimus* are too small for *fimbriatus*, of which I have authentic material from Mr. Maskell.

Mesilla Park, New Mexico, U.S.A.,
May 19, 1898.

V.—*On the Dissociation of the Egg into a Large Number of Distinct Individuals, and the Cycle of Development in Encyrtus fuscicollis (Hymenopteron).* By PAUL MARCHAL*.

IN insects asexual reproduction may manifest itself at different stages in the ontogeny. Sometimes we find larvæ reproducing by budding forth new larvæ in the interior of their bodies (pædogenesis); sometimes it is a case of adults giving birth to new individuals which develop in the ovaries of the parents (parthenogenesis of the Aphides). We have just discovered in the parasitic Hymenoptera a new mode of reproduction which completes this series of phenomena, of which it constitutes, to some extent, the first step; in *Encyrtus fuscicollis*, which we have been studying, it is, in point of fact, at the outset of the ontogeny, in the egg itself that the dissociation of the body takes place, and it is at the expense of a single egg that we shall see the formation of a very large number of embryos, which may exceed one hundred, and are all destined to become perfect insects which, at any rate as a rule, will be of the same sex.

It had already been observed by M. Ed. Bugnion † that the caterpillars of the *Hyponomeuta* of the spindle-tree might, in the course of June, contain extremely curious chains of parasitic embryos. These chains, only one of which was usually found in each infected caterpillar, were formed on an average of from fifty to one hundred individuals arranged one behind the other, surrounded by a granular mass analogous to a vitellus, and united in a long common epithelial tube, which was closed at both ends, and floated in the lymph of the caterpillar by the side of the alimentary canal. Bugnion followed the development of these embryos, and saw that each of them produced a specimen of *Encyrtus fuscicollis*. How and where was the oviposition of the *Encyrtus* performed? Above all, what was the origin and significance of the common epithelial tube enclosing the chain of embryos? These were questions well calculated to excite the curiosity of the naturalist. In the opinion of M. Bugnion the *Encyrtus* hatched in summer hibernated, or produced a second generation, the host of which was unknown; he considered that, at all events, the insect must, during the month of May, deposit

* Translated by E. E. Austen from the 'Comptes Rendus,' t. cxxvi. no. 9 (Feb. 28, 1898), pp. 662-664.

† Ed. Bugnion, "Recherches sur le développement postembryonnaire, l'anatomie et les mœurs de l'*Encyrtus fuscicollis*" (Recueil zoologique suisse, t. v. pp. 435-535, 1891).

its eggs *in masses* in the interior of the caterpillar of the *Hyponomeuta*; as for the epithelial tube, this, according to our author, was derived from the amnions of the embryos, separated secondarily from the latter and united end to end. These conclusions, albeit legitimate enough in appearance, are nevertheless completely at variance with the actual facts.

I have observed the oviposition of *Encyrtus fuscicollis*: now the insect deposits its eggs not in the month of May, but in July, not many days after it is hatched; moreover, it is not in the caterpillar, but in the ova themselves of the *Hyponomeuta* that its eggs are laid. The little Chalcid alights on a batch of eggs and remains there for hours, piercing in succession with its ovipositor all or almost all the eggs of which the batch is composed. I reserve for a subsequent paper the details of this operation, which I have watched for a long period, and content myself with stating that the time necessary for the *Encyrtus* to deposit its egg in that of the *Hyponomeuta* varies between half a minute and two minutes; almost immediately afterwards it passes to another egg of the same batch, and so on in succession for hours at a time; then, when it has finished, it makes its way to another batch, and recommences its proceedings.

One capital fact results from the foregoing observation. Given the limited quantity of eggs contained in the ovaries of an *Encyrtus*, it is materially impossible, in the short time necessary for the process of oviposition, for it to deposit, in each egg of the moth, a number of eggs equal to that of the embryos composing one of the chains of which we have spoken. A single egg must therefore be laid in the egg of the *Hyponomeuta*, and this solitary egg must dissociate itself into a large number of embryos.

This conclusion, which forces itself upon us, is proved by direct observation. I have witnessed the commencement of the development of the egg, and have found that its amnion is at first constituted like that of the other known Chalcids; afterwards, with the rapid multiplication of its cells, it elongates in such a way as to form the epithelial tube. As for the cells lying within the amnion, instead of going to form a single embryo, as is usually the case, they become dissociated in such a way as to give rise to a whole legion of little *morule*, which later on will become organized into embryos and will arrange themselves in file, in proportion as the amniotic envelope, increasing in size, passes from the primitive vesicular form into that of a long flexuous tube. The entire product of the segmentation is not, however, devoted to

the formation of the embryos; at the very outset a mass of cells is seen to isolate itself at the periphery, in the shape of a crescent, which gradually increases in size and becomes separated off to form, in all probability, the granular mass which fills the amniotic tube and encompasses the embryos.

The result of the foregoing observation is therefore the discovery of a mode of reproduction which is entirely new among the Arthropoda, and of which it is difficult, I think, to find an equivalent among the Metazoa. Now, how are we to interpret this curious case of metagenesis? Must we consider the tube containing the chain of embryos as a nurse, of which the soma would be represented by the epithelial tube and by the internal cells which do not participate in the formation of the embryos? We cannot help thinking of the Cysticerci and the Orthonectida; but comparisons of this sort would at present be injudicious. We prefer to confine ourselves to the facts, waiting for their general interpretation until the observations which we are pursuing upon different species furnish us with more ample data.

VI.—*Seasonal Dimorphism in Butterflies of the Genus Precis, Doubl.* By GUY A. K. MARSHALL, F.Z.S.

IT is now nearly two years since I recorded my conviction (Trans. Ent. Soc. 1896, p. 557) that seasonal dimorphism of a singularly marked character existed among certain African species of the genus *Precis*. This opinion, based as it was on field observations alone and not on actual breeding experiments, did not appear to receive general acceptance; and this is perhaps hardly to be wondered at seeing how very marked are the differences between such forms as *octavia* and *sesamus*, *simia* and *cuama*, *archesia* and *pelasgis*, &c.

The only counter evidence of any importance, however, which has come under my notice is that adduced by that eminent entomologist Mr. W. L. Distant in his interesting notes on Transvaal butterflies (Ann. & Mag. N. H. (7) vol. i. p. 51). He there says, "I found *Precis octavia* var. exceedingly scarce in the Transvaal, having only secured one specimen at Pretoria. I have since received another example from Johannesburg. *P. sesamus*, on the contrary, was very abundant, and always during the wet or summer season, frequenting my small flower-garden. Hence I have found no evidence for the proposition made by Mr. Guy A. K. Marshall that the two species are identical, or, rather, that *P. octavia* is the wet-season and

P. sesamus the dry-season form." This statement, coming as it does from the pen of such an authority as Mr. Distant, would at first sight appear to entirely refute my contentions. But seasonal dimorphism is a curiously complex phenomenon, and personally I venture to think that his experience is an exceptional, and at the same time an extremely interesting, one; for, apart from my own observations, it is quite at variance with those of several thoroughly observant S.-African collectors with whom I have discussed the subject and whose acquaintance with the species is even more extensive than that of Mr. Distant. Among these the testimony of Mr. C. N. Barker is of particular importance, for he has observed *P. octavia* (*s. l.*) for many years from a dimorphic standpoint, not only in Natal, but also in Zululand, Swaziland, and Tongaland, and he has been firmly convinced that *P. sesamus*, Trim., there represents its dry-season phase, having arrived at that conclusion prior to myself and quite independently.

It therefore gives me no little pleasure to be able to indicate the accuracy of the observations of my genial friend, to whom is due the credit of having first drawn attention to the widespread occurrence of seasonal dimorphism among African butterflies. For after not a few disappointments I have at last succeeded in breeding typical *P. sesamus*, Trim., from eggs laid by three separate females of *P. octavia*, subsp. *natalensis*, Staud.—thereby establishing beyond doubt what is certainly the most remarkable instance of seasonal variation as yet known among the Lepidoptera.

As a consequence of this, the synonymy of the species will now stand as follows:—

| | |
|---|--|
| Wet-season form. | Dry-season form. |
| <i>P. octavia</i> , Cram. | =[<i>P. amestris</i> , Drury.] |
| [<i>P. octavia</i> , var. <i>natalensis</i> , Staud., = <i>calescens</i> , Butl.] |]= <i>P. octavia</i> , subsp. <i>sesamus</i> , Trim. |

The following notes on the early stages of the species may perhaps be of interest. On the 13th February of this year I took five eggs laid by a female *o.-natalensis*; of these two proved infertile and the remaining three hatched on the 19th. One larva died when quite small, but the others thrived and finally pupated, one early on the 20th, the other on the 21st. The former emerged on the 4th April as *sesamus*, the latter was unfortunately damaged by mischance and failed to emerge. On the 27th February I obtained three eggs from another female of the same form. Two of these hatched on the 5th March; the third hatched next day, but the larva died. The surviving larvæ developed somewhat unevenly,

one pupating on the 31st March, the other not till the 5th April. The former produced *sesamus* on the 15th April, and the latter emerged on the 20th, producing, curiously enough, pure *o.-natalensis*. From a third female I secured one egg on the 6th March; this hatched on the 12th; the resulting larva pupated on the 7th April and emerged on the 30th as full *sesamus*.

The females of this species, like many other *Nymphalinae*, are somewhat dilatory in their method of ovipositing and often take a long time making up their minds where to deposit an egg; indeed they seem unable to lay them in anything like quick succession, in which they differ notably from most *Pierinas*. I have seen *Belenois mesentina* lay 80 eggs straight off, with scarcely a pause and on a single leaf. The food-plant of *sesamus* in Salisbury is a low straggling plant, of almost creeping habit, which grows in somewhat matted clumps on the slopes of wooded kopjes. The egg is placed anywhere on the stem or leaves, and in one instance I saw one deposited on a piece of grass adjoining the food-plant. Compared with the size of the insect the egg seems small, the vertical axis is longer than the horizontal, the shape being that of an obtuse cone; from a circular shallow depression on the vertex radiate 13 (sometimes 12) vertical lamelli-form ridges, which under a pocket-lens appear to be delicately fluted transversely; the whole egg is glabrous and of a pale glaucous green colour. As will be seen from the dates given above, the oval stage in autumn lasts about six days. The larva on exclusion is dull sepia-brown in colour, being paler towards extremities and set with long black hairs; the head is black. The hairs develop into spines after the second moult. The description of the full-grown larva is as follows:—Length about 35 mm.; ground-colour dull velvety black (varying sometimes to very dark crimson); a narrow central black line, on each side of which are four short transverse yellow lines on each segment; these become almost obsolete anally, whereas on third segment they coalesce, forming a large dorsal yellow patch divided in its posterior half by the dark central line; second segment entirely yellow, with a short transverse central black bar; a broad macular yellow lateral stripe much dilated on thoracic segments. Each segment bears a transverse row of six long, stout, branched spines, which are black with a distinct dark blue metallic reflection, and two smaller ones placed longitudinally just above legs. Head with a deep central impression on vertex (almost bifid), testaceous yellow with a large lateral spot and a broad frontal V-shaped mark black, mouth

blackish; from the vertex spring two spines similar to those on the body but half as long again, stouter and somewhat clubbed instead of sharply pointed. Legs and prolegs shining black, the latter with apical third part light yellow. The dorsal yellow markings are variable in development and occasionally absent. The pupa also presents two forms of coloration: one, the gilded form, usually characteristic of the dry season, has already been described by Mr. Trimen (*S. Afr. Butt.* vol. iii. App. p. 401) with his wonted clearness and thoroughness of detail; the other differs only in being entirely dull brownish black, with two subquadrate shiny black patches on wing-covers.

The colouring of the larva, judging by the few examples I have examined, is not affected by season, and the greater or less development of the yellow markings does not seem to bear any intimate relation to the two forms of imago. The sharp and thickly-set branched spines are doubtless an efficient defence against certain enemies and perhaps account for the general lack of procryptic colouring in the larvæ of this and allied genera. But despite their somewhat noticeable appearance and the comparative commonness of the perfect insect, my diligent search for larvæ has met with a singular want of success. Up to the present I know of only two enemies that attack the larva: one is a small ichneumon which kills it before it is one-third grown; the other is a Hemipteron of the family Lygæidæ, which has a predilection for caterpillars of all kinds, even to hairy monsters 6 inches long. Both forms of pupa are certainly procryptic in colouring. During the moist summer months the withered leaves of the food-plant turn dark brown or black, instead of yellow as in the winter, so that in both cases the pupa is well adapted to its surroundings, looking like a bit of shrivelled leaf. In one instance I have bred the wet-season form from a golden pupa, but I have not yet reared typical *sesamus* from the dark form.

The differences between the seasonal forms of the imago are not confined to shape and colour alone, but there is likewise a very appreciable divergence in habits, which has been referred to by Mr. Trimen. Speaking broadly, the *natalensis* form frequents the highest points in any neighbourhood, especially if they be more or less open (for it is anything but a sylvan insect); whereas the *sesamus* form is more partial to shady spots, and is to be found in ravines and sprints or rocky wooded slopes, and shares with the Hesperid *Sarangesa motzioides*, Holl., a marked affection for disused mining-shafts and cuttings. This distinction must not be

taken too strictly, for true *sesamus* is occasionally found in company with its summer form in open hill-tops, but principally at the change of seasons; but *natalensis*, so far as my experience goes, is never to be found in the more shady stations frequented by *sesamus*. The latter, moreover, is distinctly warier and more difficult of approach when not feeding, and if alarmed flies off with a rapid, and often zigzag, flight, settling abruptly among rocks or herbage, when its greenish-black underside colouring is equally protective. *Sesamus* is more often observed in gardens, and not unfrequently enters human habitations in search of a shady resting-place. This difference in the stations frequented by the two forms may possibly go some way to account for Mr. Distant's experience in Pretoria—at least so far as the rarity of the wet-season form is concerned. The town is situated in a hollow "almost surrounded by high and barren hills," and it does not seem to me improbable that the *natalensis* form might only be found on the summits of the range. A somewhat parallel instance was pointed out to me by Mr. J. M. Hutchinson in the case of his own farm in Natal, which lies in an open plain between two ranges of hills. He has found *sesamus* resident on the farm, occurring fairly commonly along the banks of the sprints during the winter, whereas *natalensis* is very much scarcer and non-resident, the examples seen having always been travelling from one range of hills to the other, on both of which it is common. This I had a good opportunity of observing for myself when enjoying Mr. Hutchinson's hospitality in 1896.

The curious congregating habits of typical *sesamus* (which likewise constitute a marked distinction from its summer form) have already been recorded, but I have only had two opportunities of observing them in anything like numbers: once in April 1893, when I disturbed about 30 specimens from under the bank of the Sundays River in the north of Natal. The second occasion was at Hartley Hills in Western Mashonaland, when I found a large concourse of these insects going to roost under a projecting granite rock; I managed to number them up to eighty as they flew out, but then lost count, there being certainly over a hundred. I have observed this habit of roosting in company in species of *Euralia*, also in *Belenois*, *Herpennia eriphia*, and *Teracolus eris*, but the reason for it is not altogether evident to me.

The divergences in habits between *natalensis* and *sesamus* are, however, insignificant as compared with their radical differences in colouring. The brilliant salmon-red upperside of the wet form with its black borders and spots stands in

marked contrast to the equally striking blue, red-spotted *sesamus*; nor is this less remarkable beneath, for the underside of the former is almost as brightly coloured as its upper-side, whereas in the dry form the sombre greenish black is evidently of a procryptic nature. It is clear that some potent cause must have been at work to produce such an effect. My kind friend Prof. E. B. Poulton, in one of his interesting and instructive letters, has suggested that the colouring of all brilliant butterflies, whose undersides are not of a procryptic character, may indicate that they possess a certain amount of distastefulness—in other words, that they exhibit in a more or less incipient stage the phenomenon of warning or aposematic coloration. Although it may appear presumptuous for me to differ from such an eminent authority on these matters, yet I must admit that the habits and general behaviour of *octavia-natalensis* in its native haunts raise very strong doubts in my mind as to its inedibility even in a slight degree. Yet had I known this insect from cabinet specimens alone, I should certainly have been strongly inclined to include it in the category of aposematic butterflies, in consideration of its colouring, which is very noticeably brighter and more conspicuous on both surfaces than in several of the S.-African species known to possess distasteful qualities. It is true that I have never seen the insect attacked by birds (though this would apply to the vast majority of S.-African butterflies), but I have not unfrequently seen both forms captured by rock-frequenting lizards, particularly a dull brownish species with a bright blue tail—an admirable example, by the way, of colouring to attract attention to a non-vital part. I have also seen these reptiles capture *Precis archesia*, Cram., *Pseudonympha cigitans*, Trim., and *Durbania anakosa*, Trim., and doubtless many other rock-loving butterflies fall a prey to them. Another significant fact, pointing to an absence of inedible qualities, is the eminently procryptic underside colouring of the dry form, which is quite at variance with what we should naturally expect in a distasteful species. Moreover the activity and constant alertness of the insect is in marked contrast to the slow, laboured, or gently sailing, flight of its protected relatives; and indeed I opine that it would prove more than a match for the average insectivorous bird.

As we have already seen, *o.-natalensis* is particularly fond of bare elevated ridges and hill-tops, in which stations insectivorous birds and mammals are generally scarce or even absent. Here its chief enemies would only be the rock-lizards and such invertebrates as Asilidæ and Mantidæ. Now it is a generally recognized fact that animals, and more

particularly insects and birds, tend to develop brilliant colours whenever they are able to do so with impunity, and it is therefore quite conceivable that a strong-flying and wary insect like this should be able to indulge this tendency without unduly endangering its chances in the struggle for existence. This is more especially probable during the wet or summer season, when the lizards would be able to find a considerable amount of other food in the shape of small Coleoptera, Diptera, &c., and would therefore be less inclined to attempt the more difficult feat of stalking butterflies. But as the cold dry season advances the vast majority of these small fry disappear, either dying off or retiring to winter-quarters, and, as a consequence, those butterflies which remain on the wing during that time—and the majority of species in this country do so—would suffer far more persecution at the hands of their various foes, and would thereby be compelled to adopt protective measures in the way of procryptic colouring and greater wariness. This, in the case of *o.-natalensis*, would have resulted in the dry form *sesamus*; although why the salmon-red upperside should be changed to blue is not altogether evident, except perhaps that the latter colour is more in keeping with the shady haunts so often frequented by that form. It is instructive to note that the typical form of *octavia*, which occurs in the forest-clad regions of West Africa, has not been able to develop the brilliant hues of its eastern subspecies, being smaller and much more dully coloured; this being probably due to the keener struggle for existence in that country. At the same time its representative dry form *amestris*, Drury, shows a slightly less divergence from it than does *sesamus* from *natalensis*, which might perhaps be attributed to the less marked contrast in the general conditions of the environment at the two seasons.

It has been pointed out by Mr. L. de Nicéville, and also by Prof. Weismann, that both forms of any dimorphic species must be adaptive, otherwise the non-adaptive form would be gradually supplanted by its more favoured relative. While fully accepting the general principle of this argument, it does not seem to me necessary that we should have to assign some specially adaptive character to each form, exclusive of that general adaptation to the surrounding conditions of life without which no species could exist. For there is nothing to show that the development of a dry-season phase is not a geologically recent event, and the process of elimination of the non-adaptive wet form may be going on slowly but surely under our very eyes. Mr. Distant's observations of

sesamus at Pretoria might be adduced as corroborative evidence, and similarly the typical *octavia* would appear to be scarcer on the West Coast than its dry form; further, the typical dry form of *P. archesia* has been occasionally observed at the height of the wet season, and in the case of *P. artaxia*, Hew., the experiences of both Mr. F. C. Selous and myself appear to show that in the low-lying coast districts of Portuguese Manika the leaf-like typical form alone occurs all the year round, whereas on the plateaux of the interior the summer form is represented by *P. Nachtigalii*, Dew., the typical form occurring only in the winter, and being generally more plentiful. That this view of the subject is a necessarily correct one I would not venture to assert, but in the light of the foregoing facts it is at least probable.

On the other hand it is not impossible that the *natalensis* form may present an instance of mimetic coloration in its incipient stage; at all events it possesses some very marked potentialities for development in that direction should the stress of circumstances ever call them into play. The scheme of colouring, as a whole, very notably recalls that of an *Acrata* in certain respects, this being especially the case on the underside of the hind wings, where the basal black patch enclosing some subquadrate whitish spots, the pink discal field traversed by a transverse row of black spots, and, finally, the black hind marginal border with its row of lunules are all characters which find a close parallel in the widespread *Acrata acara*, Hew., and its various local representatives. The upperside also presents several features suggestive of *Acrata*, and it is worth noting that the red ground-colour is clearly due to a great enlargement of the common submarginal band so characteristic of the genus *Precis*; moreover, the falcation of the primaries and the anal angular projection of the secondaries is less developed in this species than in any other of the genus. I do not suppose the foregoing suggestion will find much favour with those entomologists, unfortunately not a few, who are still inclined to throw doubt on the grand theory of Batesian mimicry—a theory the truth of which is continually being brought home to the observant collector in the tropics, and with ever-increasing force.

In considering the problem of seasonal dimorphism it at once becomes evident that the directly exciting cause is a climatic one. The splendid series of experiments made by European observers, such as Prof. Weismann, Dr. Standfuss, and Mr. Merrifield, appear to leave no doubt that in that region the dimorphic tendency is brought into action by heat and cold, and that humidity plays practically no part therein.

So far as South Africa is concerned, I am strongly of opinion that the exact converse is the case, and on writing to Mr. de Nicéville he tells me that he is of entirely the same opinion as regards Indian butterflies, and cites Mr. Doherty's experiment in which, by the application of humidity, he produced the wet-season form of *Melanitis leda*, L., during the dry season. Unfortunately the few simple experiments which I have been able to make as yet are not of a sufficiently conclusive character to adduce here; but so far as they show anything they tend to support the humidity theory, and they also negative the supposition that heat—at least *dry* heat—tends to produce the summer form in this country. This state of affairs is not so contradictory as it might seem at first sight; for, in seeking for the climatic cause of dimorphism, we should naturally look to the more unstable factor in the climate of any given country. So far as temperature is concerned, the annual range in Europe is considerable, owing to the large land area; whereas S. Africa has a high diurnal and low annual range. Taking Prof. Ferrel's calculations, we find that the difference between the average temperatures for January and July on 40° N. lat. is 33° , and on 56° N. lat. it is 45° ; whereas the greatest difference in the Southern Hemisphere is 15° between 20° and 30° S. lat., and diminishes to the north and south of these parallels. The annual range of humidity exhibits an exact converse to this, being comparatively small in Western Europe; whereas in S.E. Africa, as is well known, the contrast is most marked in this respect. There is therefore strong *prima facie* evidence that humidity and not temperature is the exciting agent of dimorphism in this part of the world.

In the cases of what he terms "adaptive seasonal dimorphism," of which *P. sesamus* is an evident example, Prof. Weismann has come to the conclusion that an "alternation of the two forms is provided by nature, apart from the influences of temperature"; also "that temperature in general does not here take part as the actual cause, but that it is a question of a process of selection which goes on independently of the temperature, and gradually alters some of the ids." This does not appear to be an altogether satisfactory conclusion to my mind, for if the alternation in these cases were due entirely to selection apart from climatic causes, it seems evident that artificial temperatures could not in any way influence the appearance of either form. But Prof. Weismann has himself abundantly proved that artificial temperatures have a very potent influence in the case of *Vanessa prorsa-*

levana, and all his experiments clearly show that the climatic is the primary, and the selective the secondary cause; that is to say, the tendency to variation in certain directions was initiated by climatic agencies, and subsequently utilized and developed to a more or less high degree by natural selection for protective purposes. In cases of adaptive seasonal dimorphism selection can have only come into play in order to enable a given species to adapt itself to the varying conditions at two different seasons; but if these climatic changes were eliminated, it seems evident that natural selection alone would be incapable of producing seasonal dimorphism as we now see it. It is true that in certain cases Prof. Weismann found that certain pupæ out of a number experimented on produced the form that would have appeared in nature in spite of artificial temperatures, and it is on these exceptions that he founded the above propositions. But the more we investigate the matter the more clear it becomes that the actual cause which induces the change in a well-marked case of dimorphism is of a highly complex character: the vastly preponderating cause is either temperature or humidity, or both, as the case may be; but there is something beyond this of which we as yet know nothing. This is evidenced by such cases as that I have already quoted, where two larvæ reared from the egg under precisely similar conditions produced the full wet and full dry forms respectively; and not a few similar instances have come under my notice. I am not therefore inclined to attach very great importance to the exceptions found by Prof. Weismann in his temperature-experiments, for I doubt the possibility of artificially producing *all* the factors necessary to induce the transition from one seasonal form to another in every case; and, moreover, I am of opinion that the personal equation, if one may apply such a term to insects, must be taken into account.

We can, as a general rule, obtain a very fair idea as to how far natural selection has taken part in the production of any given case of seasonal dimorphism by taking into consideration the amount of difference between the two extreme forms and the rapidity of transition from one to another, for the more highly differentiated they are and the more abrupt the transition the greater has been the influence of selection. Indeed one could almost trace a scale of development from a species like *Acras anemosa*, Hew., where the slight change in the black markings is probably due entirely to climatic causes; through the *Teracoli*, whose seasonal differences are part climatic, part selective; and culminating in *Precis sesamus*,


in which selection has been by far the more potent factor, so much so that the intermediate grades between the two forms have been so far eliminated as to be on the verge of extinction.


Salisbury, Mashonaland,
May 1898.

POSTSCRIPT.—I have previously (Proc. Zool. Soc. 1897, p. 6) suggested that the application of a distinctive scientific name to each seasonal form of a dimorphic species is hardly more reasonable than in the case of sexual forms, and that the difficulty might be met by the general adoption of a set of signs, similar to those used for the sexes, to represent the extreme and intermediate stages. As I am not aware that any such signs have yet been proposed, I make bold to suggest the following, which I have found very useful in my own notes:—

Wet-season or summer ♂ = 

Dry-season or winter ♂ = 

Intermediate ♂ = 

and similarly for the ♀. Should it be desired to mention only the form without reference to sex the circle and internal sign alone might be used, *e. g.* dry-season form = . The system doubtless has its drawbacks, but these, I venture to think, would be outbalanced by the advantage gained in preventing the continual repetition of such cumbersome phrases as wet-season form and summer form, neither of which cover the facts of the case, and further in checking the undue multiplication of varietal names.

VII.—*Descriptions of new Longicorn Coleoptera from East Africa.* By C. J. GAHAN, M.A., of the British Museum (Natural History).

THE new species of Longicorn beetles described in the following paper are, with a few exceptions, from the collections made by Dr. J. W. Gregory during his expedition to Mount Kenya and by Mr. C. S. Betton in the tract of country traversed by the railway running inland from Mombasa.

Xystrocera Ansorgei, sp. n.

Capite, prothorace et corpore inferiore brunneo-testaceis; clytris osseis, fusco punctatis et maculatis; pedibus brunneo-testaceis

plus minusve infuscatis, clavis femorum subtus nigris; antennis rufo-brunneis, apicibus articularum infuscatis, articulo 1^o antice ad apicem fortiter angulato.

Long. 25, lat. 5½ mm.

Hab. Uganda (*Dr. W. J. Ansorge*). One female specimen.

Head, prothorax, and underside of body reddish brown in colour, the two former with a thin greyish pubescence, which on each side of the pronotum is condensed to form two sericeous spots—one larger, on the dilated middle region, the other smaller, placed close to the anterior margin. Pronotum with a deep arcuate impression anteriorly, and with two shallow oblique depressions on the disk. Elytra bone-white in colour, but marked with a large number of small rounded fuscous spots, from which the anterior sixth of the disk is free with the exception of a single spot close to the base of each elytron; the side of each elytron for some distance from the base and the apical border are dark brown in colour; apices sharply rounded, but not spined; the surface of the elytra presents a number of minute granules, each of which bears a short seta, while close to each granule is a small shallow puncture.

This species of *Xystrocera* may be easily recognized by the peculiar and unusual colour of the elytra.

Margites lineatus, sp. n.

Rufo-piceus, griseo-fulvescente subtiliter pubescens; elytris utrinque lineis quatuor vel quinque denudatis notatis; prothorace rugoso-granulato; antennis (♂) quam corpore multo longioribus, (♀) corpore longitudine æqualibus, articulis 3^o 4^oque (♂) apice incrassatis, 5^o quam 1^o vel 4^o sesqui-longiore; elytris apice rotundatis.

Long. 11–17, lat. 3–4 mm.

Hab. Samburu, Brit. E. Africa (*C. S. Betton*), and Murchison Range, Transvaal (*C. R. Jones*).

This species is allied to *Margites humilis*, Gah., from which it is to be distinguished by the less close and less silky pubescence of the elytra and the four or five denuded lines which run along each elytron (these lines are, however, only well seen in fresh and unrubbed specimens). The antennæ also are longer; the third joint is half as long again as the first, the fourth is scarcely longer than the first, the fifth equal in length to the third, the sixth and succeeding joints subequal to one another, each longer than the fifth.

Plocederus Peelei, sp. n.

Piceus: clytris, pedibus antennisque rufo-brunneis, griseo subtiliter pubescentibus; prothorace transversim rugoso, haud longitudinaliter impresso: clytris crebre punctulatis, et punctis parum majoribus sat sparse dispersis impressis, apice quadrispinosis; antennis (σ) quam corpore multo longioribus, articulo 1^o piceo, crasso, rugoso et punctulato, articulo 3^o ad apicem noduloso, antice haud angulato, articulis 4^o ad 10^{um} apice antice dentato-productis.

Long. 25, lat. 7 mm.

Hab. Samburu, Brit. E. Africa (*C. S. Betton*) and Somali-land (*C. V. Peele*).

Head, thorax, and underside of body dark brown, covered with a thin greyish pubescence. Prothorax armed with a conical tubercle on each side, transversely wrinkled above, without longitudinal impressions or smooth spaces on the disk. Elytra reddish brown, closely and finely punctured, with some larger punctures rather thickly spread on the basal region, but becoming sparser towards the middle and almost entirely absent from the posterior area; surface covered with a greyish pubescence, not sufficiently dense to conceal the punctures or the colour of the derm; each elytron bispinose at the apex. Antennæ much longer than the body in the male, a little longer than the body in the female; first joint stout, rugose, and slightly curved; third joint thickened, but not angulate at the apex; fourth and following (the last excepted) each produced into an acute angle at the apex.

Three examples of this species have been seen—two collected by Mr. Betton, the third by Mr. Peele.

APIOCEPHALUS, gen. nov. (*Toxotides*).

Head strongly but gradually narrowed behind the eyes, the latter prominent, coarsely faceted, and very feebly emarginate in front. Antennæ longer than the body; first joint slightly curved, gradually thickened from base to apex, and equal in length to the second and third united; fourth joint a little shorter than the third and distinctly shorter than the fifth; succeeding joints subequal to one another and to the fifth. Prothorax much narrower in front than at the base, furnished with an acute conical tubercle at the middle of each side, and with four tubercles on the disk—two smaller just in front of, and two larger just behind, the middle. Elytra with the sides nearly parallel in the anterior two thirds, thence converging more strongly towards the apex, where each elytron

is truncate. Spurs of tibiæ rather short; first joint of middle and posterior tarsi about equal in length to second and third joints united. Anterior coxal cavities closed in behind by the junction of the epimera with the prosternal process.

This genus seems best placed near *Otteissa*, Pasc., from which it differs chiefly in having a much shorter front to the head, a distinct conical tubercle on each side of the prothorax, the anterior coxal cavities closed in behind, and the fourth joint of the antennæ shorter than the third.

Apioccephalus punctipennis, sp. n.

Capite supra rufo-testaceo, fulvo-pubescente, subtus nigro, rugoso-punctato; antennis rufo-testaceis, subtiliter griseo-pubescentibus; prothorace lateraliter nigro, sparsim fulvo-pubescente; disco inter tuberculos pube fulvo-cinerea dense vestito; elytris cervino-pubescentibus, maculis nigris, glabris, fortiter crebreque punctatis notatis, maculis utrinque ante medium dense aggregatis; corpore subtus pedibusque hic illuc infuscatis, pube griseo-fulva tenuiter vestitis.

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

Hab. Brit. E. Africa (*C. S. Betton*).

Head rugosely punctured and black underneath, reddish testaceous above, with a black spot in front, and having a scattered fulvous pubescence. Prothorax with a cinereous pubescence covering middle of disk; the sides black, with a scattered tawny pubescence. Elytra with a fawn-coloured pubescence, interrupted by glabrous black spots, which are seen to be strongly and very closely punctured; these spots are closely crowded on each side in front of the middle, where they form an almost complete black patch. Body underneath and legs partly testaceous, partly dark brown in colour, the whole thinly clothed with tawny pubescence.

Compsomera Ansorgei, sp. n.

Nigra; elytrorum dimidio posteriore et vittis duabus utrinque antice viridi-metallicis.

Long. 26, lat. 7 mm.

Hab. Uganda (*Dr. W. J. Ansorge*).

This species is very closely allied to *C. nigricollis*, Gah., which it resembles exactly in the markings of the elytra, with the exception that the metallic-blue colour in the type of *C. nigricollis* is here replaced by metallic green. It differs chiefly from *C. nigricollis* in having the head, legs, and antennæ quite black in colour.

Hypargyra similis, sp. n.

Atra, opaca; prothoracis lateribus argenteo-sericeo vittatis, disco omnino nudo, creberrime punctato; elytris viridi-metallicis, fortiter creberrimeque punctatis, ad apicem obtuse rotundatis; metasterno abdomineque in medio sparse punctatis et setosis, ad latera argenteo-sericeis; femoribus tibiisque pedum quatuor anteriorum et basibus femorum posteriorum rufo-testaceis; antennis (σ) quam corpore paullo longioribus, versus apicem leviter dilatatis.

Long. 12–15 mm.

Hab. Samburu, Brit. E. Africa (*C. S. Betton*).

Closely allied to *H. cribripennis*, but somewhat smaller in size, with the disk of the prothorax quite destitute of pubescence and the middle of the hind breast and abdomen almost naked, being furnished only with very short scattered setae arising from the punctures.

In colour and sculpture this species has considerable resemblance to certain species of *Helymus*, Thoms., but is easily distinguished by the following characters:—Antennae scarcely dilated towards the apex; sides of the prothorax very feebly rounded; apices of the elytra obtusely rounded and not truncate. It is, however, a transitional form, and seems to show that *Hypargyra* is more nearly allied to *Helymus* than to the genus *Sonthodes*, with which I at first associated it.

Syndere apicalis, sp. n.

Nigra, subopaca; corpore subtus tenuiter griseo-sericeo; elytris flavo-testaceis, plaga communi apicali marginem anteriorem haud attingente, nigra; prothorace disco basin versus crebre punctato, apicem versus minus dense, et lateraliter sparsim punctato; elytris dense punctatis, apice quadridentatis, dentis exterioribus longioribus; antennis medium elytrorum haud superantibus, articulo 3^o quam 4^o fere duplo longiore, 5^o, 4^o æquali, ceteris ad 10^{um} gradatim decrescentibus.

Long. 7 mm.

Hab. Samburu, Brit. E. Africa (*C. S. Betton*).

Black; elytra yellowish testaceous, with an oblong black patch on each at the apex touching both the apical and sutural border, but not reaching the outer margin. Prothorax longer than broad, slightly rounded in the middle at each side; the disk closely punctured near the base, less closely in front, and sparingly towards the sides. Middle tibiae carinate along the antero-ventral edge.

DITYLODERUS, gen. nov.

Female.—Head rather broadly concave between the antennary tubercles. Epistome distinct. Last joint of palpi narrowed towards the apex. Eyes rather small, emarginate, with the lower lobes somewhat oblique. Prothorax bispinose on each side, binodose on disk. Elytra subovate, fused together, each with a short basal crest, a stronger mid-dorsal crest, and a subserrate lateral carina, which reaches from the shoulder almost to the beginning of the posterior third of the elytron; apices obliquely truncate and enclosing an angle. Legs of moderate length; posterior femora scarcely reaching to the tip of the abdomen; middle tibiæ with an oblique groove below the middle of their length; claws of tarsi divergent. Prosternal process simply archel, gradually expanded behind, with its posterior margin slightly bowed in. Metasternum very short. Intercoxal process of abdomen triangular in form. Antennæ scarcely reaching beyond the middle of the elytra; scape without cicatrix, reaching as far as the anterior lateral spine of prothorax; third joint about equal in length to the scape, the rest gradually shortening; anterior face of the fourth joint near its apex and of each of the succeeding joints along its whole length presenting poriferous depressions.

The species for which this genus is constituted has some resemblance to species of *Phrissoma*, but it is excluded from the group Phrissomides owing to the absence of a cicatrix from the scape of the antennæ, and according to Lacordaire's system of arrangement must be placed in the group Parmenides.

Dityloderus fuliginosus, sp. n.

Niger, indumento fuliginoso obtectus; prothorace utrinque bispinoso, supra nodis duobus magnis instructo; elytris utrisque cristis duabus—una basali, secunda pone medium—et carina laterali subserrata a humero ad partem tertiam posteriorem extensa instructis.

Long. 18, lat. ad humerum 6 mm.

Hab. N'Giriama, Brit. E. Africa (*Dr. J. W. Gregory*).

Black, covered with a dark brown indumentum. Prothorax armed on each side with two spines arising from a common elongated base, the larger spine at about the middle of the length of the prothorax, the smaller between the middle and the anterior margin; disk furnished with two large obtuse knobs, somewhat oblong-ovate in outline, and

placed almost wholly in front of the middle. Each elytron furnished at the base with a short crest, which is more raised behind than in front, and behind the middle with a second more prominent crest, which is less raised anteriorly, where it is preceded by a row of small tubercles. The somewhat serrated lateral carina extends from the shoulder almost up to the beginning of the posterior third of the elytron. The tibiæ are annulated with an obscure greyish pubescence above and below the middle of their length.

Idactus Bettoni, sp. n.

Capitis fronte genisque cinereis, fronte inter oculos fusco-bifasciata, lateribus occipiteque fulvescentibus; prothorace supra griseo-fulvescente lateraliter fusco-vittato, discò tuberculis quinque, quarum quatuor minimis, instructo, ad basin signatura fusca, litera Y-inversa simulante, notato; elytris antico late cinerascenscentibus, postice fulvescentibus, lateribus prope basin et fascia obliqua prope medium infuscatis; utroque elytro pone basin crista brevi longitudinali, et pone medium fasciulis quatuor vel quinque, instructo; corpore subtus cum pedibus cinerascenscentibus. Long. 9-13, lat. 3-4½ mm.

Hab. Samburu and Voi, Brit. E. Africa (*C. S. Betton*).

Head with a dense ashy-grey pubescence on the cheeks and front, the latter marked between the lower lobes of the eyes with two narrow, transverse, fuscous bands. Prothorax with a broad and distinct tubercle on each side and with five tubercles on the disk, of which one, placed in the middle, is much larger than the rest; the disk covered with greyish or tawny pubescence, and having between the median tubercle and the base a dark brown mark resembling an inverted letter Y. A dark brown band runs along each side of the prothorax just below the lateral tubercle. The pubescence covering the elytra is of a greyish or fawn-colour over the whole of the anterior part of the disk and yellowish tawny over the posterior part; between these two differently coloured parts there is an oblique fuscous band, sharply limited in front, and continued along the side of each elytron up to the base. Behind the base of each elytron there is a short longitudinal crest, while at the anterior border of the fuscous band there are three or four small tufts of hair, a few similar tufts being placed a little further back. The elytra are strongly and closely punctured towards the base, especially at and around the shoulders, and are somewhat broadly depressed behind the basal crests. The legs and the underside are of a yellowish or testaceous colour, covered over with an ashy-grey

pubescence. Antennæ a little longer than the body in the male; first joint grey, third fuscous at apex, the rest almost entirely fuscous, each having but a narrow grey ring at the base.

Idactus lateralis, sp. n.

Pube fulvo-grisea brunneo-commixta vestitus; elytris lateribus fusco-velutinis; prothoracæ lateraliter in medio leviter tuberculato, supra haud tuberculato, antice posticeque transversim bisulcato; elytris utrisque prope basin tuberculo parvo et fasciculo minuto fusco instructis, disco inter basin mediumque vix depresso; antennis (♀) quam corpore paullo longioribus.

Long. 14, lat. 5 mm.

Hab. N'Giriama, Brit. E. Africa (*Dr. J. W. Gregory*).

Head rather convex in front; the occiput with two small fuscous Λ -shaped marks. Prothorax with a feeble tubercle at the middle of each side; the disk without tubercles, but marked just in front of the middle with an impressed arcuate line, which is seen only when the covering pubescence is rubbed away. Elytra each with a small tubercle and small tuft of fuscous hairs near the base, with a dark brown band running along the side from the base to the apex, the upper border of the band not being straight, but somewhat sinuous near the base, and angularly emarginate at one or two other points.

PARIDACTUS, gen. nov.

Allied to the genus *Idactus*, from which it is to be distinguished by its cylindrical thorax, the sides of which are almost straight and quite unarmed. The elytra are parallel-sided for some distance from the base, and evenly convex above, except near the base, where each carries a short feebly raised crest. The tarsi are broadly dilated.

Paridactus tarsalis, sp. n.

Capitis fronte cinerea, inter oculos transversim fusco-bifasciata, capite supra pronotoque et elytris flavo-griseo-pubescentibus; prothoracæ lateraliter utrinque fusco-vittato, supra tuberculo mediano instructo; elytrorum lateribus a basi usque ad medium, et vitta arcuata pone medium disci, infuscatis; corpore subtus cum pedibus flavo-testaceis, cinereo tenuiter pubescentibus; tarsis late dilatatis, supra nigris, pube cinerea tectis; antennis (♀?) quam corpore paullo longioribus, griseis, articulis a tertio apice fusco-annulatis.

Long. 9, lat. 3 mm.

Hab. Voi, Brit. E. Africa (*C. S. Betton*). Two examples, which appear to be females.

In general shape this species resembles several species of the genus *Eunidia*, to which, however, it is by no means closely allied.

Prosopocera marmorata, sp. n.

Albido-cinereo pubescens; clytris cinereo et brunneo-griseo marmoratis; antennis (σ) articulis 3^o 4^oque crassis, griseis, articulis 5^o ad 10^{um} prope apicem fusco-annulatis; processu frontali (σ) (interdum parvo vel nullo) antice concavo, versus apicem curvato, et ad apicem bifido.

Long. 18-25, lat. 6-8½ mm.

Hab. Samburu, Brit. E. Africa (*C. S. Betton*).

Head, thorax, legs, and underside of body covered with an ashy-white pubescence, which also forms numerous small spots and one or two larger patches on the elytra. First four joints of the antennæ with a grey pubescence, the third and fourth having each a narrow glabrous fuscous ring near the apex; the joints from the fifth to the tenth are cinereous, with a broad fuscous ring on each near the apex; mesosternum very feebly tubercled.

In the male the third and fourth joints of the antennæ are thickened; the frontal process, which in small male specimens is very small or even entirely wanting, reaches in large specimens a length of about 3 millim.; it is concave and densely hirsute in front, slightly curved upwards and deeply notched at the extremity.

In general structure this species most nearly approaches *P. Dejeani*, Gah., and *P. cornifrons*, Gah., but is readily distinguishable by its coloration.

PROTOMOCERUS, gen. nov.

Head with strongly raised and divergent antennary tubercles, each of which is slightly emarginate at the apical border, with a small projecting angle on the inner side. Front of the head furnished with a cariniform tubercle in its upper part in both sexes and with a similar tubercle in its lower part in the female. In the male a large process projects obliquely downwards from the lower part of the front, and towards its free end curves slightly forwards. Prothorax furnished on each side with a large median conical tubercle, preceded by two smaller and more obtuse tubercles, one of which is close to the anterior margin; pronotum feebly

bisinate at the basal margin, somewhat produced and rounded in the middle at the anterior margin. Prosternal process rather narrow, nearly vertical in front, thence gradually sloping and expanding behind. Mesosternal process with a small tubercle at about the middle of its length. Middle tibiæ with an oblique groove on the outer edge. Claws of tarsi divergent. Antennæ with a short fringe of hairs underneath, about twice as long as the body in the male; the scape stout, with an open cicatrix at the apex; third joint longer than the first and shorter than the fourth, fourth to sixth subequal or slightly increasing in length, seventh to tenth gradually shortening; third joint thickened in the female.

This genus seems best placed in Lacordaire's group *Proso-pocerides*, though the head cannot, as in the definition of that group, be described as "broadly but moderately concave between the antennary tubercles, with the latter short," &c., for the head is, in fact, strongly concave between the prominent and diverging antennary tubercles.

Protomocerus Gregorii, sp. n.

Pube albido-cinerascente vestitus; capite, antennis, prothoracis plaga magna laterali utrinque, et elytrorum humeris subfuscis; elytris fasciulis brevibus fulvis sat dense ornatis; pedibus brunneo canoque variegatis, tarsis supra griseis.

Long. 24, lat. 8-8 $\frac{3}{4}$ mm.

Hab. Bagamoyo, and Brit. E. Africa (*Dr. Gregory*).

General pubescence of an ashy-white colour. On the head, the antennæ, the shoulders of the elytra, and over a large area on each side of the prothorax, as well as spots on the legs, especially of the two hinder pairs, the pubescence is somewhat dark brown or fulvous brown in colour, while numerous small tufts of fulvous hairs are scattered over the elytra. The ashy-white area on the disk of the pronotum between the lateral brown areas is in the form of a triangle, with its apex in front and marked by a small elevation; small granular elevations are scattered over the central part of the disk. The prothorax is marked on each side anteriorly with an oblique groove, which, commencing at the side of the median elevation, curves slightly backwards and then outwards between the two anterior tubercles on the side.

In the male the frontal process projects downwards and is curved slightly forwards at the extremity; it is concave in front and is covered with tawny hairs except along the median line.

The antennæ of the female are scarcely half as long again as the body; the third joint is but slightly longer than the first, and is shorter and distinctly thicker than the fourth.

Protomocerus socius, sp. n.

Præcedenti similis et affinis: sed fasciculis fulvis elytrorum bis numerosis, prothorace fere omnino cinereo, punctis paucis adspersis ad discum et macula parva utrinque pone tuberculum medium, fuscis, notato: antennis pallidioribus, densius pilosis et plus distincte fusco-annulatis.

Long. 26, lat. $8\frac{1}{2}$ mm.

Hab. Ntumbi in Agoniland, Brit. C. Africa. One female example.

This species is so like the preceding one that it may possibly prove to be only an extreme variety. The much greater number of the small tufts of hairs scattered over the elytra seems, however, to be a valid specific difference, and must be so regarded until it can be shown that the character is variable.

The female type of *P. socius*, as well as the male type of the preceding species, are in the collection of the Hon. Walter Rothschild at Tring Museum.

Alphitopala assimilis, sp. n.

Pube cretacea vestita: pedibus antennisque brunneo testaceis griseo tenuissime pubescentibus; prothorace basi constricto et bisulcato, lateraliter in medio minute tuberculato; intercoxale mesosterni paullo protuberante, antice verticali: antennis (♀) quam corpore vix longioribus.

Long. 20, lat. $6\frac{3}{4}$ mm.

Hab. Samburu, Brit. E. Africa (*C. S. Betton*).

Covered above and below with a dense chalk-white pubescence; legs and antennæ with a much fainter greyish pubescence, through which the reddish-brown colour of the derm is easily seen. Prothorax almost as wide in front as at the middle, narrowed at the base, where also it is marked by two distinct transverse grooves, furnished on the middle of each side with a very small black tubercle.

The antennæ in the female scarcely reach beyond the apex of the elytra, and by means of this character the species may be distinguished from *A. lactea*, Thoms., which it closely resembles in coloration, though differing by its somewhat more elongated form, its broader interocular face, its more convex elytra, and the absence of brown spots from the base of the elytra.

Alphitopola ventralis, sp. n.

Capite, pronoto elytrisque pube luteo-fulva vestitis; scutello, corpore subtus cum pedibus albido-pubescentibus; antennis griseis; mesosterno paullo protuberantio.

Long. 18, lat. $5\frac{1}{2}$ mm.

Hab. Samburu, Brit. E. Africa (*C. S. Betton*). One female example.

Head, pronotum, and elytra closely covered with a yellowish-brown pubescence; scutellum white; the whole of the underside of the body and the legs with a whitish pubescence, that on the legs being less dense and less distinctly white in colour. Prothorax with a very minute tubercle on each side. Elytra visibly punctured at the base and along the sides as far as the middle; the derm where rubbed bare of pubescence is seen to have a reddish-brown colour. Antennæ in the female a little longer than the body.

Alphitopola antennalis, sp. n.

Fulvo-cinereo-pubescentis; utroque elytro plagis fuscis tribus vage notato; prothorace utrinque breviter tuberculato; antennis (♂) quam corpore sesqui-longioribus, cinereis, articulis 4^o, 5^o 6^oque utrisque subtus macula elongata, elevata, fusca notatis.

Long. 20, lat. $6\frac{1}{2}$ mm.

Hab. Samburu, Brit. E. Africa (*C. S. Betton*). One male example.

Clothed with a pubescence which is partly ashy grey, partly tawny in colour. Each elytron with three ill-defined patches of a dark brown colour—the first behind the shoulder, the second behind the middle, the third (which is the smallest) near the apex. Prothorax with a small but distinct tubercle on each side; the two anterior and two posterior transverse grooves distinct, the second anterior groove bowed backwards in the middle. Elytra strongly but somewhat sparingly punctured.

Antennæ about half as long again as the body in the male, cinereous grey in colour; joints fourth, fifth, and sixth each having an elongated dark brown area underneath. This area is slightly raised and almost nude; it runs along almost the whole length of the fifth joint, but is confined to the distal half of the fourth and the proximal half of the sixth joint. Similar areas to these (which are possibly of a sensory nature) are present also on the corresponding joints of the male antennæ in *A. bipunctata*, Th., but in the latter are slightly more pubescent, and therefore less easily seen.

Alphitopola Bettoni, sp. n.

Piceo-brunnea, griseo-pubescent; prothoracis lateribus et vitta media dorsali postice abbreviata, albis, vitta dorsali ad medium disci nigro-ocellata, lateribus utrisque medio nigro-maculatis: clytris maculis plagisque albis ornatis, viz. macula in depressione humerali, macula ad suturam paullo pone scutellum, plaga obliqua nigro-biocellata ante medium, macula rotunda nigro-ocellata pone medium, et macula minore paullo ante apicem; mesosterno medio tuberculato: pectore abdominque lateraliter albo-maculatis.

Long. 10-12, lat. 3-4 mm.

Hab. Samburu, Brit. E. Africa (*C. S. Betton*).

In general shape and in style of marking this species somewhat resembles *A. vitticollis*, Gah., but is easily distinguished by the number and position of the white spots and bands.

Alphitopola unicolor, sp. n.

Pube fulvo-cinerea omnino vestita: antennis griseis, quam corpore (♀) paullo longioribus: prothorace lateraliter inermi, supra sulcis duobus glabris—uno pone apicem, altero ante basin—impresso.

Long. 13, lat. 4½ mm.

Hab. Samburu, Brit. E. Africa (*C. S. Betton*).

Covered with a rather dense pubescence of a yellowish-grey colour. Antennæ grey. Prothorax unarmed at the sides, marked above with two distinct transverse black lines—one a little behind the apex, the other a little in front of the base. Intercostal process of the mesosternum feebly tubercled, with its anterior face vertical.

Tragiscoschema ornata, sp. n.

Atria, flavo-ornata: capite punctis duobus in fronte, fascia utrinque ad genam, et vittis duabus vertice flavis; prothoracis disco utrinque late flavo-vittato: clytris utrisque macula oblonga medio-basali, maculis duabus parvis ad marginem externam, macula subrotunda ante medium, et macula transversa vel fascia pone medium flavis ornatis.

Long. 11-12 mm.

Hab. Samburu, Brit. E. Africa (*C. S. Betton*).

Black, with yellow spots and bands as follows:—a transverse band on each side of the head below the eye; a small spot on each side of the front close to the inner margin of the eye; two vittæ on the vertex of the head; a broad band on each side of the prothorax just above the lateral spine; an

oblong spot on the disk of each elytron near the base, a round spot just in front of the middle, a transverse band between the middle and apex of each elytron, and two small spots at the outer margin—one just under the shoulder, the other placed a little further back from the base; four spots on each side of the abdomen and spots at the sides of the breast and prosternum.

Eumimetes brevicornis, sp. n.

Pube grisea brunneo variegata vestita: pronoto vittis tribus fuscis interdum haud distinctis ornato; corpore subtus pedibusque punctis nigris glabris sat dense notatis; prothorace utrinque pone medium sat valde tuberculato, supra sparsim nigro-granulato; elytris versus basin fortiter denseque punctatis, humeris prominulis; antennis (σ) quam corpore paullo brevioribus, cinereis, articulis a tertio late fusco-annulatis.

Long. 13-15, lat. 6-7 mm.

Hab. Samburu, Brit. E. Africa (*C. S. Betton*).

Head with a grey pubescence, interrupted by glabrous punctured spots. Prothorax rather strongly tubercled behind the middle of each side, evenly convex above, and marked with three more or less distinct fuscous vittæ and numerous small scattered black granules. Scutellum short and broad, truncate behind. Elytra with prominent shoulders, and each with a prominence at the base close to the scutellum; strongly and rather closely punctured, especially towards the base; covered with a grey pubescence, indistinctly spotted with brown. Legs and underside with an ashy-grey pubescence, changing to yellowish grey towards the sides of the body; marked with numerous small glabrous black points.

Crossotus validus, sp. n.

C. plumicorni (Serv.) similis, sed antennis subtus sparse breviterque fimbriatis, utroque latere prothoracis bituberculato; elytris utrisque pone basin crista brevi longitudinali summo fulvo-pilosa instructis.

Long. 17, lat. $7\frac{1}{2}$ mm.

Hab. Machuma, Taru Desert, Brit. E. Africa (*C. S. Betton*).

In colour and punctuation this species resembles *C. plumicornis*, Serv., and *C. robustus*, Jord., from both of which it may be distinguished by the short longitudinal crest, surmounted with fulvous hairs, which is placed a little behind the base of each elytron. From *C. plumicornis* it is further

distinguished by having a second tubercle on each side of the prothorax and a dark brown spot and small tuft of hairs at the extreme base of each elytron. It resembles *C. plumicornis* in having three glabrous black lines on the vertex of the head.

Crossotus basalis, sp. n.

Pubes grisea dense vestitus: prothorace lateraliter pone medium sat valde tuberculato, disco utrinque tuberculis duobus parvis instructo; clytris a basi ad medium fortiter subseriatim punctatis, interstitiis leviter costatis; corpore subtus cum pedibus nigro vel fusco punctatis; antennis (σ) corpore longitudine æqualibus, subtus usque ad apicem sat dense fimbriatis, (ρ) medium elytrorum vix superantibus, subtus versus basin dense, versus apicem sparsissime ciliatis.

Long. 9-10, lat. 4-4½ mm.

Hab. Taru Desert and Voi, Brit. E. Africa (*C. S. Betton*).

With a greyish pubescence, mottled in places with fulvous brown, especially on the front of the head, on the legs and underside. Prothorax with a distinct tubercle on each side behind the middle, lying in front of which is another very small tubercle; disk with four small tubercles forming with these of the sides two transverse series. Elytra strongly punctured in somewhat irregular rows from the base to the middle, beyond which some of the rows may be traced, but with the punctures much smaller in size; the intervals between the rows of punctures slightly raised, and sometimes covered with a brownish pubescence contrasting with the grey colour of the rest of the surface; each elytron with a small tawny tuft of hairs near the base and another behind the middle. Intercostal process of prosternum raised in a simple arch; that of the mesosternum truncate in front, with its anterior face almost vertical.

Male. Antennæ about as long as the body, with a fringe of hairs underneath which is pale grey in colour towards the base, blackish brown towards the apex.

Female. Antennæ scarcely reaching beyond the middle of elytra, with the fringe of hairs underneath becoming gradually thinner from the third to the sixth joint, and with the last three or four joints very sparsely ciliate underneath.

PLECTROPYGUS, gen. nov.

With the characters of the group *Heceyridides* of Lacordaire, but distinguished from the other genera of this group as follows:—Head as broad as the prothorax, the latter very

feebly tubercled on the sides and disk; antennæ much shorter than the body in both sexes; intercoxal process of the prosternum simply arched, not truncate in front; intercoxal process of the mesosternum gradually sloping in front, and broadly canaliculate along the middle.

Plectropygus mucoreus, sp. n.

Pubes nigra ferrugineo variegata vestitus; elytris ad basin apicemque concoloribus sed in area intermedia albido-flavescente dense pubescentibus, maculis prope medium et ad marginem externam nigris; antennarum articulis a tertio nigris, utrisque basi angustim cinereis, apice angustim fulvis, subtus sparse nigro-fimbriatis.

♂. Antennis medium elytrorum paullo superantibus, segmento ultimo ventrali abdominis apice transversim excavato et fusco-fimbriato.

♀. Antennis medium elytrorum vix superantibus; segmento ultimo ventrali ad apicem paullo depresso et ad basin linea media brevissima impresso; pygidio apice valde emarginato et uncinis duobus, uno alterum adverso, armato.

Long. 19-22, lat. 6-7 mm.

Hab. Mbuyuni, Brit. E. Africa (*C. S. Betton*); Nyasaland (*A. Whyte*).

Head, prothorax, legs, and the underside of the body with a blackish-brown indumentum interspersed with small patches of rust-red pubescence; anterior and posterior fourths of the elytra coloured like the body, but the intermediate half thickly covered with yellowish-white pubescence interrupted by a transverse black patch near the middle of each elytron, and a few spots alongside the outer margin. Prothorax with four feebly raised tubercles above, and two small obtuse tubercles on each side, with some rather large shallow punctures scattered over the disk. Elytra strongly punctured, with the punctures over the pale-coloured intermediate area almost entirely hidden by the pubescence; with two small tufts of black hairs on each near the base, one just within the shoulder, the other placed farther back and nearer to the suture.

Antennæ (slightly longer in the male than in the female) reaching a little beyond the middle of the elytra, with a thin fringe of dark brown hairs underneath; third joint the longest, fifth joint much shorter than the fourth, the sixth and following joints decreasing in length.

Male with a transverse excavation, somewhat oval in outline, at the apex of the last ventral segment, and with a

fringe of black hairs projecting slightly over the excavation from its anterior border.

Pygidium of the female deeply emarginate at the apex, and furnished with two hooks which turn inwardly towards the middle line.

BIOBESSA, gen. nov. (*Hecyridides*).

Allied to the preceding genus. Head as wide as the prothorax; the latter broader in front than at the base, furnished with a small conical tubercle behind the middle of each side. Antennæ much shorter than the body in both sexes, third joint twice as long as the first and a little longer than the fourth, fifth and following joints gradually diminishing in length, and, taken together, scarcely longer than the third and fourth united. Eyes divided. Prosternal process strongly arched, and furnished with two small tubercles in the middle; mesosternal process nearly vertical in front, horizontal behind, with two small tubercles at the edge between the two faces.

Biobessa beatrix, sp. n.

Pube brunneo-grisca dense vestita; capitis vertice fasciculis duobus fulvis minutis instructo; prothoracis disco utrinque tuberculis duobus parvis instructo, medio prope basin paullo elevato; elytris versus basin subrugosis. prope basin et inter medium apicemque fasciculis minimis fulvis nonnullis instructis.

Long. 13-15, lat. $4\frac{1}{2}$ -5 mm.

Hab. Taru Desert, Brit. E. Africa (*C. S. Betton*).

Covered above and below with a dense drab or tawny grey pubescence. Head with a finely impressed median line reaching from the clypeus to the occiput; crown with two small tufts of tawny hairs placed on two feeble elevations. Prothorax with two small tubercles on each side of the disk, the two hinder ones being in a line with the lateral tubercles, with a broader but more feebly raised tubercle in the middle, a little in front of the base. Elytra somewhat rugose towards the base, but with the rugosity scarcely evident, owing to the closeness of the pubescence. Legs and first joint of the antennæ slightly mottled with brown or tawny. Each of the abdominal segments with a short fringe of tawny setæ at the hind margin. Last ventral segment in the male with a deep but very narrow transverse excavation at the apex.

Eunidia mucorea, sp. n.

Capite et elytrorum tertia parte apicali fuscis. pube cinerea ferru-

gineo-commixta sparse vestitis; prothorace dense albido-pubescente, lateraliter in medio obtuse angulato; scutello fusco; elytris a basi ad partem tertiam posticam dense albido-cinereo-pubescentibus, prope basin maculis parvis ferrugineis; corpore subtus pedibusque cinerascens; antennis griseis, articulis 1^o-3^{um} et 11^o fuscis.

Long. 8, lat. 2½ mm.

Hab. Samburu, Brit. E. Africa (*C. S. Betton*).

Head and a little more than the posterior third of the elytra dark brown, with small scattered patches of grey and rust-red pubescence. Prothorax and the anterior two thirds of the elytra covered with a dense ashy-white pubescence; with the shoulders of the elytra slightly fuscous, and one or two spots on each elytron near the base rusty red. First three joints of the antennæ blackish brown, with some scattered greyish hairs, the eleventh joint and the apex of the tenth fuscous, rest of the antennæ grey.

Eunidia plagiata, sp. n.

Corpore subtus pedibusque et capite pube grisea dense vestitis; prothorace elytrisque albo-cinereis, his fusco-plagiatis; prothorace lateraliter utrinque obtuse tuberculato; tarsis supra infuscatis.

Long. 12, lat. 3½ mm.

Hab. Samburu (*C. S. Betton*).

Head, the underside of the body, and the legs covered with a dense greyish pubescence; prothorax and elytra with a paler, almost white, pubescence. Elytra each with a fulvous-grey patch at the base, a dark brown patch at the middle, and three dark brown spots between the middle and the apex. Prothorax with an obtuse tubercle placed high up on the middle of each side, with a slight constriction in front of and behind the base of the tubercle.

Eunidia piperita, sp. n.

Prothorace pone apicem et ante basin leviter constricto et sulcato, lateraliter in medio obtuse tuberculato; corpore subtus, prothorace et elytris pube fulva maculis fuscis albisque interspersa vestitis; pedibus fulvo-griseis, femoribus tibiisque macula fusca ad medium notatis; antennarum articulis 1^o 3^{um} griseis, ceteris fuscis.

Long. 8-11 mm.

Hab. Samburu, Brit. E. Africa (*C. S. Betton*).

Prothorax with a distinct rounded tubercle or swelling placed high up on the middle of each side, with a slight con-

striction before and behind the tubercle and corresponding grooves across the upper surface. Underside, prothorax, and elytra clothed with a tawny pubescence, with small scattered spots—some dark brown, others white in colour, the latter being sometimes aggregated to form a large white patch near the base. Legs tawny grey, with a fuscous spot at the middle of each of the femora and tibiae.

This species together with the two preceding form a section in the genus characterized by a relatively rather broad prothorax having an obtuse tubercle on each side.

Eunidia subfasciata, sp. n.

Capite in fronte griseo, supra et lateraliter plus minusve ferrugineo-pubescente: prothorace quam longitudine latiore, lateribus in medio leviter rotundato, disco pube grisea brunneo-mixta et maculis ferrugineis interspersa vestito; elytris pube grisea brunneaque vestitis, plaga apicali albida, fulvo-commixta, utrisque fasciis tribus fuscis parum distinctis notatis—prima paullo pone basin, secunda leviter arcuata mediana, tertia ad marginem anticam plagae apicalis posita: corpore subtus cum pedibus griseo-pubescentibus, illo maculis brunneis ferrugineisque dispersis, clavis femorum sub pube nigris.

Long. 12–13, lat. $3\frac{1}{2}$ –4 mm.

Hab. Samburu, Brit. E. Africa (*C. S. Betton*).

Head with a pubescence which is greyish in front, and more or less rusty red around the eyes, on the crown, and on the sides. Prothorax broader than long, slightly rounded in the middle on each side; its pubescence grey mixed with brown, and with the anterior margin and a few spots on the disk rusty red. Elytra with a mixed grey and light brown pubescence, with some tawny patches at the base, and a well-marked white and tawny area at the apex; each with three dark brown bands: the first, which is the least distinct, at a short distance from the base, the second at the middle, the third forming an anterior border to the pale posterior area. Legs and underside grey; the abdomen with some dark brown and rusty-red patches. Seen through the pubescence, the derm of the legs is yellowish testaceous, except at the clubs of the femora, where it is black. Joints of the antennae from the third dark brown at the apex.

Sophronica Bettoni, sp. n.

Testacea, fulvo-pubescentis; prothorace elytrorumque sutura et plaga laterali utrinque pone medium cinereis: elytris utrinque prope

basin macula obliqua fusco-nitida notatis; antennis (♂) corpore longitudine æqualibus.

Long. 10, lat. $3\frac{1}{2}$ millim.

Hab. Samburu, Brit. E. Africa (*C. S. Betton*).

Reddish brown, clothed with fulvous pubescence and with long erect setæ. The pubescence on the prothorax, on the sutural borders of the elytra from a little behind the base almost up to the apex, and on a lateral plaga behind the middle of each elytron is of an ashy-grey colour. Each elytron has an oblique nude spot near the base, the derm of this spot, as well as beneath the ashy-grey areas, being black in colour, whereas on the remaining parts of the elytra it is reddish brown. The elytra are strongly and somewhat thickly punctured, the punctures being irregularly spread, except along the middle, where two more or less regular rows may be distinguished.

Sophronica testacea, sp. n.

Testacea, subnitida. dense profundeque punctata; antennis ultra medium infuscatis.

Long. 9, lat. $3\frac{1}{4}$ millim.

Hab. Mpwapwa, E. Africa (*Dr. Kirk*).

Head and pronotum reddish testaceous; elytra, legs, and underside yellowish testaceous. Head, pronotum, and elytra thickly and deeply punctured, with the punctures of the elytra rather larger towards the base, and gradually diminishing in size towards the apex.

This species agrees pretty closely in structural characters with *S. carbonaria*, Pasc., but is relatively somewhat broader in form; the eyes are larger, with the upper lobes more approximate, and the scape of the antennæ is a little shorter and more thickened towards the apex. In colour it somewhat resembles *S. calceata*, Chevr., which is, however, a relatively narrower and more elongated species, having longer and more slender antennæ.

VIII.—*The Australian Scorpions of the Genus Urodacus, Pet.*

By R. I. POCCOCK.

THE genus *Urodacus* is the sole member of the family Scorpionidæ which is confined to Australia. It may be readily distinguished from the remaining members of the order that occur in this area by the possession of the following features:—

(1) a single, movable, claw-like spur on the articular membrane at the base of the foot; (2) a pentagonal sternum; (3) a pair of lateral eyes on each side of the carapace; (4) a median keel on the lower surface of the first four caudal segments. The pentagonal sternum and the single pedal spur are also found in the genus *Hormurus*; but in the latter there are three lateral eyes on each side of the carapace and a pair of crests or keels on the lower side of the first four caudal segments.

These two genera are the only representatives of the Scorpionidæ that occur in Australia. *Hormurus*, however, is certainly a later immigrant than *Urodacus*, for it is only met with in the north-eastern parts of the country, and belongs essentially to the Indo- and Austro-Malayan area.

Urodacus, on the contrary, has not, so far as I am aware, been recorded from Queensland at all, though it not improbably spreads into the southern parts of that province. Up to the present time, including those described as new in this paper, twelve species have been established, with ten of which I have the good fortune to be acquainted from an actual examination of specimens. The others, described by Dr. Thorell as *Loctonus manicatus* and *L. orthurus*, were referred by that author to a different genus, owing, according to Kraepelin, to an error of observation with respect to the number of crests on the lower side of the tail. Again, according to Kraepelin, *manicatus* is specifically identical with the type of the genus, *U. nova-hollandia*, which occurs in the neighbourhood of Perth. The identity of *L. orthurus* still remains in doubt. Lastly, the form that I described as *U. Keyserlingii* proves upon the examination of fresh material to be identical with a species previously established as *U. abruptus*; so that the total number of species now to be reckoned with amounts to ten of which the characters are known, and one (*orthurus*) of which the characters are doubtful.

A glance at the species and localities mentioned below shows that two species have been described from Arnhem Land in North Australia; two from the central parts of West Australia; two from the south-western corner in the neighbourhood of Perth; one from South Australia; and from Victoria and New South Wales one species, which spreads as far westward as Adelaide. It is noticeable that, with the exception of the New South Wales species and the two here recorded from the neighbourhood of the Murchison Goldfields, all the species have been met with at various points on the coast of Australia. It cannot be doubted therefore that at the present

time we know but a small fraction of the species of the genus that actually exist.

It may be added that Prof. Kraepelin, in his recent attempt at a "Revision" of the Scorpions, makes a bold effort, qualified by the liberal use of interrogation marks, to reduce the species known at the time he was writing to two. I am unable to find any justification for his opinion; and since he refrains from all mention of the localities whence the specimens he examined were obtained, it is not possible even to suggest whether one or more than one species were described by him under the title *U. novae-hollandiae*, Peters.

The species that stand apart from the rest in their structural features are the two from Arnhem Land. One of these, namely *U. Darwinii*, has considerable claims to rank as a distinct genus, as I at first considered it to be before the species named *planimanus* came upon the scene.

Urodacus Darwinii (Poc.).

Iodacus Darwinii, Pocock, Ann. & Mag. Nat. Hist. (6) viii. p. 245 (1891).

Loc. North Australia, Port Darwin in Arnhem Land (*J. J. Walker*).

This northern species, like *U. excellens*, occupies an isolated position in the genus *Urodacus*. It is characterized by its short and slender tail, by the absence of a median keel on the dorsal surface of the flattened hand, &c.

Urodacus planimanus, Poc.

Urodacus planimanus, Poc. Ann. & Mag. Nat. Hist. (6) xii. p. 321 (1893).

Loc. West Australia, 30 miles from Perth (*H. W. J. Turner*).

This species has the hands flattened as in *U. Darwinii*, but in other respects more approaches *U. novae-hollandiae*, though easily to be distinguished from that species by its narrow tail, deeply excised frontal border, &c.

Prof. Kraepelin placed this species as doubtfully synonymous with *U. Darwinii*, supposing that it was perhaps based upon a male example of a species of which *U. Darwinii* is the female. Unfortunately for this view, the types of the two species are females, and it may be added that, even if they were of opposite sexes, there could be no justification for the opinion that they are specifically identical.

Urodacus excellens, Poc.

Urodacus excellens Poc. Ann. & Mag. Nat. Hist. (6) ii. p. 170, pl. viii. fig. 2 (1888).

Loc. North Australia, Port Essington in Arnhem Land (*Dr. Richardson*).

Urodacus novae hollandiae, Peters.

Urodacus novae-hollandiae, Peters, Mon. Berl. Ak. 1861, p. 511; Pocock, Ann. & Mag. Nat. Hist. (6) ii. p. 170, pl. viii. fig. 1 (1888).

Loc. Western Australia (Freemantle, Perth, Swan River).

In the monograph of the species of this genus published in 1888 I referred to some specimens of what I supposed, and still suppose, to be *novae-hollandiae*, Peters, in the British Museum, ticketed "Ceylon." That the locality is erroneous has been to my mind settled conclusively by the subsequent discovery in the Museum of some specimens of a Centipede (*Cormocephalus aurantiipes*, Newp.), which is apparently not uncommon near Perth, also bearing the label "Ceylon," accompanied by the same register number as that under which the scorpions were entered.

I am not acquainted with any evidence that this species ranges far from the south-western corner of Australia. A specimen from Port Lincoln that I at one time referred to it is the young of another species.

Urodacus granifrons, sp. n.

♂.—*Colour* a tolerably uniform ochre-yellow.

Carapace with frontal lobes transversely truncate and separated by a shallowish median emargination as in *novae-hollandiae*; the interocular triangle covered with fine close-set granulation.

Tergites finely and closely granular.

Tail nearly five times as long as the carapace, the sides of the segments convexly rounded, the second a little longer than broad, the fifth more than twice as long as broad; the superior crests weakly granular, not posteriorly elevated; inferior crests of segments 1-3 smooth; lateral surface of segments 2-4 very finely granular; vesicle as wide as fifth segment.

Legs with finely granular femora; 5 spines on outer side of protarsus of first and second leg.

Pectinal teeth 16-18.

Measurements in millimetres.—Total length 54, length of carapace 6, of tail 29.

Loc. Chapman River, 10 miles from Geraldton, W. Australia (*E. H. Saunders*).

This species, based upon a single male example, differs from *U. novæ-hollandiæ* in having the anterior portion of the carapace finely granular, instead of smooth and finely punctured.

Urodacus abruptus, Poc.

Urodacus abruptus, Pocock, Ann. & Mag. Nat. Hist. (6) ii. p. 174, pl. viii. fig. 4 (1888).

Urodacus Keyserlingii, Pocock, Ann. & Mag. Nat. Hist. (6) viii. p. 245 (= *novæ-hollandiæ*, Keyserling, not Peters).

Loc. South and South-eastern Australia, Adelaide, type (59. 52); Ballarat and Bendigo, in Victoria (*W. W. Froggatt*); Cooma, Bathurst, Maitland, Yass, in New South Wales (*W. W. Froggatt*); New England District of New South Wales (*J. Macpherson*).

Since I described this species the British Museum has received a very fine series of it from Mr. Froggatt and Mr. Macpherson from the localities mentioned above.

Urodacus Woodwardii, Poc.

Urodacus Woodwardii, Poc. Ann. & Mag. Nat. Hist. (6) xii. p. 322, pl. xiv. fig. 8 (1893).

Loc. Darling Range, north of Perth, W. Australia (*B. H. Woodward*).

This species is most nearly related to *U. abruptus*, but is recognizable from all the examples of the latter that I have seen in having the segments of the tail more convexly rounded and lower, with less elevated upper crests, so that the areas between these crests and the superior lateral crests are noticeably narrower than in *abruptus*. Moreover the vesicle is distinctly more globular, its width excelling that of the fifth segment.

Urodacus armatus, Poc.

Urodacus armatus, Poc. Ann. & Mag. Nat. Hist. (6) ii. p. 172, pl. viii. fig. 3 (1888).

Loc. S. Australia, Port Lincoln, on the west of Spencer Gulf.

This species, of which only a single male example is known, is most nearly related to the Perth species, but may be at once recognized from the male of it by the strong armature and greater slenderness of the tail-segments.

Urodacus hoplurus, sp. n.

♂.—*Colour* a uniform ochre-brown, with the digits, the tergites, and the median area of the sternites blackish.

Carapace as long as the first and nearly half the second caudal segments, shorter than the fifth, its frontal lobes coarsely rugose and granular, its lateral portions finely granular.

Tergites closely granular posteriorly and laterally, very finely granular in front, the last with two subdenticulate keels on each side; sterna smooth and polished, with the exception of the first, second, and third, which are irregularly and (? pathologically) tubercular mesially.

Tail long, about five times as long as the carapace; all the segments wider behind than in front, especially the first, second, and third; first more than one third longer than broad, fifth about four times as wide as long; the intercarinal spaces smooth; three inferior keels of segments 1-4 smooth, the superior and superior lateral keels of these segments weakly denticulate, their superior keels ending posteriorly in a large triangularly spiniform tooth; keels of fifth segment denticulate, the inferior more strongly so than the superior; *resicle* large, its width equal to the width of the third segment, its height slightly greater than width of fourth segment, granular below and strongly bisulcate; *aeuleus* slightly curved.

Palpi.—*Humerus* coarsely granular above, its anterior and posterior crests strong and coarsely granular; anterior surface coarsely but sparsely granular; inferior surface weakly granular at the base; *brachium* finely granular above and below, smooth in front, and smooth but with coarse scattered punctures behind, the upper and lower keels bounding its anterior surface coarsely granular, with a row of 12 or 13 pores on its lower surface posteriorly; *hand* with keels normal in number, but not so strong as in *U. novae-hollandiae* and *armatus*; covered above externally and below with a reticulation of fine granules; length of *hand-back* equal to width of *hand*, shorter than *movable digit*; lower surface of *hand* furnished with a series of about 16 pores running along the inner edge of the keel to the inner angle of the *movable digit*.

Legs with *femora* and *patellæ* weakly granular; *protarsi* of first and second with five external spines.

Pectinal teeth 27.

Measurements in millimetres.—Total length 103; length of

carapace 12; length of tail 60, of its fifth segment 14; width of hand 8.

Loc. Lawlers, East Murchison Goldfields, West Australia (*W. O. Mansbridge*).

The following table may help others to identify the species of this genus known to me:—

- a.* Hands low, flat above, height of their outer surface less than half its length measured along the inferior keel; tail slender, its segments parallel-sided.
- a*¹. Hands without an upper median keel; carapace widely and deeply emarginate in front, smooth; tergal plates and first four segments of tail also smooth, the superior crests of the latter alone being feebly granular; a row of 11 pores on the brachium below and 14 on the hand; tail about 3½ times as long as carapace, which is longer than its first and second segments; 6 spines on outer side of protarsus of first and second legs and 3 on the tibia *Darwini*, Poc., ♀.
- b*¹. Hands with a strong upper median keel; carapace deeply but narrowly emarginate, granular; tergites and tail granular, the superior crests of the latter stronger and posteriorly spiniform; 8-9 pores on brachium and 9-10 on hand; tail a little more than 4 times as long as carapace, which is shorter than its first and second segments; 5 spines on outer side of second protarsus and only setiform spines on the tibia *planimanus*, Poc., ♀.
- b.* Hands high, convex above, height of their outer surface more than half its length.
- a*². Hands practically keelless; 15 pores on lower surface of brachium and 19 on hand; of large size, up to 114 mm. in length, carapace about 17 mm. long; carapace smooth, deeply emarginate, with rounded frontal lobes; 7 protarsal and 3 tibial spines on first and second leg *excellens*, Poc., ♀.
- b*². Hands strongly keeled; about 9, rarely 12, pores on lower side of brachium, 9-12, rarely 15, on the hand; smaller, except *hoplurus*, less than 90 mm. in length, carapace not exceeding 12 mm. in *hoplurus*, usually less than that; 4-6 protarsal spines on first and second legs; carapace laterally granular.
- a*³. Upper keels of caudal segments 1-4

ending behind in a large triangular spiniform process (true to a less extent of ♂ of *abruptus*).

- a*⁴. Spines on caudal segments directed obliquely backwards and upwards; frontal portion of carapace not roughened with tubercles, carapace as long as fifth caudal segment; vesicle small, its width less than that of fifth segment, its height less than width of fourth; hands smooth above; a single row of about 10 pores on brachium and 10 on hand; 6 protarsal spines on first and second legs . . . *armatus*, Poc., ♂.
- b*⁴. Spines on caudal segments vertical; frontal portion of carapace tubercular, carapace considerably shorter than fifth caudal segment; width of vesicle exceeding that of fifth caudal segment, its height exceeding width of fourth; hands granularly reticulate above; brachium with about 12, hand with about 16 pores in a line below, with additional pores near the base of the finger; 5 protarsal spines on first and second legs . . . *hoplurus*, sp. n., ♂.
- b*³. Upper keels of first four caudal segments either not elevated or but little elevated, at all events less strongly elevated than in *armatus* and *hoplurus*.
- a*⁵. Tergal plates of abdomen in adult covered with fine granulation.
- a*⁶. Frontal lobes of carapace rounded and separated by a deeper emargination; upper crests of first, second, and third caudal segments more elevated; sides of segments less convex *abruptus*, Poc., ♂.
- b*⁶. Frontal lobes of carapace more squarely truncate, separated by a shallower excision; upper crests of tail not elevated; sides of segments more markedly convex.
- a*⁷. Area of carapace in front of median eyes covered with fine close-set granules *granifrons*, sp. n., ♂.
- b*⁷. Area of carapace in front of median eyes smooth and finely punctured *novæ-hollandiæ*, Pet., ♂ ♀.
- b*⁵. Tergal plates of abdomen smooth and polished in the middle, the anterior closely and finely granu-

lar laterally; frontal lobes rounded.

- a*^s. Upper crests of anterior caudal segments more elevated, sides of segments straighter, much less noticeably convex; vesicle narrower *abruptus*, Poc., ♀.
- b*^s. Uppercrest of tail scarcely noticeably elevated; sides of segments convexly rounded; vesicle wider *Woodwardii*, Poc., ♀.

The remaining species of this genus, described under the name *Ioctonus*, are:—

Urodacus manicatus, Thorell (Ann. & Mag. Nat. Hist. 1876, xvii. p. 14; id. Act. Soc. Ital. Sci. Nat. xix. p. 261 &c.), from Australia, which, according to Kraepelin, is identical with *U. novæ-hollandiæ*, Peters.

Urodacus orthurus, Thorell (Act. Soc. Ital. Sci. Nat. xix. p. 190), of which the locality is unknown.—Kraepelin suggests that this species may be identical with *Darwini* or *planimanus*, or both. I have no hesitation in saying that with *Darwini* it is certainly not identical, if any value is to be placed upon its description, and that the evidence as to its identity with *planimanus* is stronger on the negative than on the positive side.

IX.—Notes on *Palæozoic Fishes*.—No. II.*
By R. H. TRAQUAIR, M.D., LL.D., F.R.S.

[Plate I.]

HITHERTO the remarkable plates known as *Psammosteus* have been found only in strata of Upper and Middle Devonian age in Scotland and in Russia. Through the kindness of Dr. Woodward, F.R.S., Keeper, and Mr. A. Smith Woodward, Assistant-Keeper, of the Geological Department in the British Museum, I have now the privilege of describing and figuring a new species from the Lower Old Red Sandstone of the West of England.

Psammosteus anglicus, sp. n. (Pl. I. figs. 1, 2.)

This plate is represented, natural size, in Pl. I. fig. 1. It is oblong-ovate in shape, $3\frac{3}{4}$ inches in length by $2\frac{1}{2}$ in

* For No. I. see Ann. & Mag. N. H. ser. 6, 1894, vol. xiv. pp. 368-374.

breadth; one extremity, which we shall assume to be the posterior, is truncated, making a "side" of $1\frac{3}{10}$ inch in extent, the other (anterior) is not quite perfect, but seems to have been evenly rounded. The surface which is here exhibited is the *inner*; it is posteriorly nearly flat, being only very gently concave, but in the anterior half it is more hollowed, there being here an oblong depression, the bottom of which is again slightly convex or raised. On the posterior part slight concentric furrows of growth may be seen.

The inner surface of the plate is composed of dense lamellated tissue, as in other species of the genus, and the vascular structure of the middle layer exhibited in fracture at the anterior part also corresponds, so far as can be ascertained by the use of the lens. A portion of the impression of the outer surface is seen in front, showing that the external ornament consisted of coarse stellated tubercles, which tend to assume an elongated form. The apices of the tubercles are broken off and remain in the matrix of the impression, a small portion of which, magnified five diameters, is shown in fig. 2.

The specimen figured is in the Weever-Jones Collection, British Museum, no. P. 194. It is believed to be from Herefordshire or Worcestershire, but the exact locality is unknown. However, there is also a fragment in the collection from Maindee, in Monmouthshire, which apparently belongs to the same species.

From Goldleps, Monmouthshire, there is also a fragment of a plate of another species, which will be described and figured in my next paper of the present series.

Protodus scoticus (E. T. Newton). (Pl. I. fig. 3.)

Onychodus scoticus, E. T. Newton, Geol. Mag. (3) vol. ix. 1892, p. 51.

This specimen, consisting of an antero-posterior row of eight conical, recurved, sharp, two-edged teeth, united by their bases in the form of an arc of a circle, was correctly described by Mr. E. T. Newton, F.R.S., six years ago, but I think wrongly attributed by him to the genus *Onychodus* of Newberry, which is apparently referable to the *Crossopterygii*. The fractured surfaces of the teeth show that their substance is formed of vascular dentine like those of *Selachii*, and there is no central pulp-cavity, whereas in *Onychodus* the dentine is solid and there is a very large pulp-cavity extending almost to the very apex of the tooth. The teeth of *Onychodus* are also round or oval in transverse section, those of the present specimen have lateral cutting-edges—in fact, each individual tooth in form closely resembles the teeth of *Protodus Jexi*, a *Selachian* described from the Lower Devonian of Canada by

Mr. Smith Woodward some years ago*. All doubt as to the Selachian character of Mr. Newton's specimen is, however, removed from my mind by the occurrence of similar-looking whorls of teeth in a small Selachian head in the Powrie collection in the Edinburgh Museum, this head being also from Turin Hill, Forfarshire, the same locality as that from which the specimen in question is supposed to have been procured.

The only difference which I can see between these teeth and those of *Protodus* is the anchylosis at their bases of the teeth in antero-posterior succession—a difference precisely like that which distinguishes *Pleuroplax* from *Helodus*. A new genus might properly be created for this interesting form, but it may be advisable to defer doing so for the present.

I may also add that I strongly suspect Mr. A. Smith Woodward's *Onychodus anglicus* from Herefordshire † to belong to the same category; certainly the specimen in the British Museum does, though the original type in Oxford requires re-examination.

My best thanks are due to Sir A. Geikie and Mr. E. T. Newton for their kind permission to re-examine this specimen, which is in the Museum of Practical Geology, Jermyn Street.

Farnellia tuberculata, gen. et sp. n. (Pl. I. fig. 4.)

One half of the remarkable specimen on which this new genus is founded was exhibited by the late Rev. Hugh Mitchell at the British Association at Aberdeen in 1885, and is now in the British Museum; the other side is in the Powrie collection in the Edinburgh Museum of Science and Art. It is difficult to say which of the two should be considered as the "counterpart."

Accompanying the British Museum specimen is a label in Mr. Mitchell's handwriting with the name "*Cosmiolepis antiquus*," the locality being given as Farnell. But the name was never published, and, owing to its rather too close resemblance to *Cosmiolepis*, preoccupied in 1858 by Sir Philip Egerton for a Liassic Pakeoniscid, it can scarcely now be adopted.

The specimen is a mere fragment, showing a portion of a vertebral column about 2 inches in length, most of the vertebrae, about twenty in number, being seen only in impression; but those which remain show the ring-like centrum which is characteristic of so many Palæozoic fishes, such as *Palæospondylus*, *Chondrenchelys*, &c. Associated with this

* Geol. Mag. (3) vol. ix. 1892, pp. 1-2, pl. i. figs. 1, 1a.

† Geol. Mag. (3) 1888, vol. v. p. 500; Cat. Foss. Fishes British Museum, pt. ii. 1891, p. 392.

remnant of a vertebral column are a number of impressions of polygonal angular scutes, best seen in the London half of the specimen, three of which are represented in Pl. I. fig. 4, magnified three diameters, and which display the imprint of a characteristic ornament, namely of finely tuberculated ridges radiating from the centre of each plate.

It is difficult to give any opinion as to the true zoological position of this remarkable fish-fragment, though desirable to name and record it, in the hope that additional specimens may at a future time turn up to throw more light on its nature. Meanwhile the specimen is interesting as showing the oldest vertebral centra as yet known. It is also of special interest to geologists to know that the genus apparently existed also in Upper Silurian times, as Mr. Smith Woodward recently kindly showed me a portion of Ludlow "Bone Bed" (T. T. Lewis Coll. Brit. Mus. P. 8929) on which a little scute is seen which, generically at least, cannot be distinguished from the scutes of the Farnell specimen, the principal difference being that the latter are squeezed quite flat, while the Ludlow specimen is elevated in the centre.

I must here also thank Dr. Woodward and Mr. Smith Woodward for their kindness in allowing me to make use of the specimens in the British Museum.

EXPLANATION OF PLATE I.

Fig. 1. *Psammosteus anglicus*, Traq., natural size.

Fig. 2. Impression of sculpture of outer surface of the same plate, magnified five diameters.

Fig. 3. *Protodus scoticus* (E. T. Newton), magnified three diameters.

Fig. 4. Impressions of outer surfaces of three of the scutes of *Farnellia tuberculata*, Traq.

X.—*Descriptions of new Species of Butterflies from South America.* By H. GROSE-SMITH, B.A., F.E.S., F.Z.S., &c.

Heliconius molina.

Male.—*Upperside.* Both wings brownish black, suffused with shining dark blue. Anterior wings with an oblique crimson band at the end of the cell, which it partially invades, crossing the middle of the disk to a little below the lowest median nervule, on which it is rather widest. Posterior wings with the costal margin broadly pale cinereous brown.

Underside. Both wings dark brown. Anterior wings with

the band dull rufous and intersected by three irregular bands of brown scales between the veins; the area below the lowest median nervule and median nervure to the inner margin pale cinereous brown. On the posterior wings is a faint indication of a broad paler band crossing the disk horizontally a little before the middle.

Exp. of wings $2\frac{1}{4}$ inches.

Hab. Valdivia, Colombia (Pratt).

Nearest to *H. cyrbia*, Godt., and *H. cythera*, Hew., but on the posterior wings without the white outer margin and with only a faint indication of the middle pale band.

Adelpha juanna.

Male.—*Upperside.* Both wings crossed by brown bands as in *A. leuceria*, Druce, but wider throughout. On the anterior wings the inner branch of the brown band, where it becomes bifid towards the costa, is much wider, being of equal width with the lower part of the band, and the brown spots in the outer branch are smaller and do not curve inwardly. The posterior wings are more convex on the outer margin.

On the *underside* differences occur similar to those on the *upperside*.

Exp. of wings $2\frac{1}{4}$ inches.

Hab. Valdivia, Colombia (Pratt).

It is very close to *A. leuceria*, but a larger insect.

Adelpha nahua.

Male.—*Upperside.* Both wings resemble those of *A. cythera*, Linn., but on the posterior wings the discal white band is bordered outwardly by a very broad fulvous band which crosses the disk from the costal margin before the apex to the anal angle; the white band is narrower and terminates more acutely and further above the anal angle than in *A. cythera*. On the *underside* of the posterior wings the fulvous area outside the white discal band is brighter and less distinctly traversed by the irregular dark band on *A. cythera*, there being only an indistinct indication of it; the submarginal row of white lunules is almost obsolete.

Exp. of wings $1\frac{5}{8}$ inch.

Hab. Merida.

Symmachia miron.

Male.—*Upperside.* Anterior wings resemble those of *S. jugurtha*, Stgr., but the yellow semihyaline space beyond the black

bar at the end of the cell is widest on the costal margin, instead of being narrowest, beyond which are five semihyaline elongate white spots on the disk, the uppermost and lowest of which are minute; the orange-rufous bar on the inner margin is wider and more elongate. The posterior wings are orange-rufous, bordered all round rather narrowly by black.

Underside.—Anterior wings as on the upperside, except that the inner marginal rufous band is represented by a pale buff streak. Posterior wings black, with a triangular spot near the base of the cell; two subcostal spots on the disk, another elongate spot at the end of the cell; a broad, more elongate streak near the inner margin, reaching to the base; two spots above the anal angle; an elongate bar across the median nervules before the margin, and a minute subapical spot, all of which are shining pale stramineous; palpi black, front of the head between the eyes orange-rufous; thorax and abdomen black in the middle, bordered by orange-rufous, with stramineous rings underneath.

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

Hab. Ecuador (*Buckley*).

A very remarkable insect; on the underside it is nearest to *S. accusatrix*, Westwood.

Lucilla aterra.

Male.—*Upperside*. Anterior wings dark shining blue, with the middle of the disk crossed by a broad, oblique, suboval crimson band, which extends into the outer part of the cell and below the lowest median nervule. Posterior wings rather paler shining blue, with seven elongate, triangular, pale greyish-blue streaks on the disk between the veins, those in the middle the most elongate and gradually becoming shorter towards the apex; the bases of these streaks do not quite reach the outer margin.

Underside dull bluish black; the band on the anterior wings is coloured orange; on the posterior wings the pale blue streaks of the upperside are steel-blue, become linear, and extend as far as the cell, towards the end of which is a short steel-blue marking.

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

Hab. Colombia (*Pratt*).

Nearest to *Lucilla camissa*, Hew., but quite distinct.

Aricoris Buckleyi.

Male.—*Upperside*. Both wings dark blue, except the apex of the anterior and the costal margin of the posterior wings, which are rather broadly black.

Underside. Both wings bronzy brown. Anterior wings with a pale streak extending along the basal two thirds of the cell, and a basal diffused orange patch below the cell; four submarginal conical white spots on the disk between the veins, the lowest of which near the outer angle is bifid. Posterior wings with three basal orange streaks, one on the costal margin the shortest, the second in the cell and extending a little beyond it, the third the longest, in the interspace between the lowest median nervule and submedian nervure; five submarginal conical white spots on the disk between the veins, of which that nearest the anal angle is bifid and the most elongate.

Female.—*Upperside* bronzy brown. Anterior wings with the disk crossed beyond the cell by a broad oblique orange band, extending from near the middle of the costa, which it does not quite reach, and where it is rather paler, to the lowest median nervule, but not reaching the outer margin; the outer edge of the band is rather sinuate.

The *underside* is paler bronzy brown. On the anterior wings the band is pale tawny, and towards the outer angle is an indication of the bifid conical spot in that position on the underside of the anterior wings of the male. Posterior wings with a submarginal row of white conical spots as in the male, but much less distinct.

Exp. of wings, ♂ $1\frac{3}{4}$, ♀ 2 inches.

Hab. Ecuador (*Buckley*).

Nearest to *A. velutina*, Bates.

XI.—Description of a new Genus of Aglyphous Colubrine Snakes from Sumatra. By G. A. BOULENGER, F.R.S.

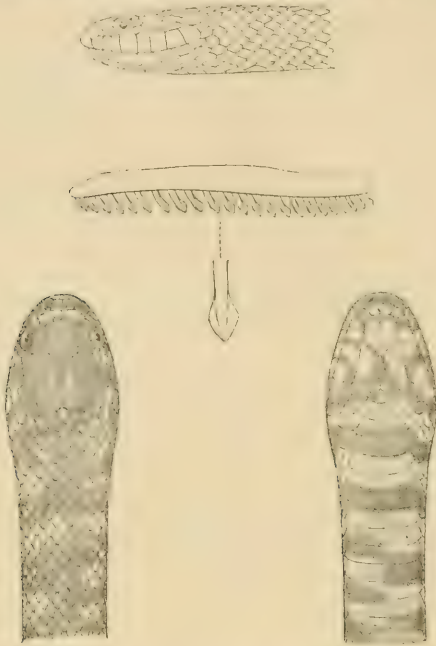
IGUANOGNATHUS.

Maxillary, palatal, and mandibular teeth with spatulate crowns ribbed along the outer side, subequal in size, 23 in each maxillary. Head small, slightly distinct from neck; eye rather small, with round pupil; nostril directed upwards, pierced between two nasals; no loreal. Body cylindrical; scales smooth, in 19 rows, without apical pits; ventrals rounded. Tail moderate; subcaudals in two rows. Posterior præcaudal vertebræ without hypapophyses.

This genus is founded on a most remarkable snake, the dentition of which is unparalleled among the Ophidia. For the unique specimen, stated to be from Sumatra, I am indebted to Dr. F. Werner, of Vienna, whose name I have great pleasure in connecting with the discovery of so interesting a new type.

Iguanognathus Wernerii.

Snout very short, broad, rounded. Rostral twice as broad as deep, just visible from above; internasals small, trapezoid, as long as broad; prefrontals as long as internasals, but twice as broad; frontal once and one third as long as broad, twice as



l broad as the supraocular, longer than the distance from the tip of the snout, shorter than the parietals; three praoculars, the middle one in contact with the posterior nasal; three postoculars; temporals 2 + 2; eight upper labials, fourth entering the eye; four lower labials in contact with the anterior chin-shields, which are much shorter than the posterior; latter separated from each other by scales. Scales in 19 rows, smooth on the body, striated and feebly keeled on the ischiadic region and on the tail. Ventrals 136; anal divided; subcaudals 53. Dark brown above, sides lighter, with vertical black bars spotted with whitish; head with whitish markings, viz. a line across the snout, an oblique streak behind the eye, widening towards the mouth, a pair of dots on the parietal shields near the median suture, and a small spot on each of the five anterior labials; ventrals whitish, with black cross-bars, mostly interrupted and alternating, prolonged from the bars on the sides; subcaudals black, each with a whitish spot.

Total length 350 millim.; tail 87.

The specimen is a female.

XII.—*Description of a new Death-Adder (Acanthophis) from Central Australia.* By G. A. BOULENGER, F.R.S.

A SINGLE specimen recently received from Station Point, Southern Central Australia, appears to represent a new species of Death-Adder, since it differs not only in its more elongate form and brick-red coloration, but also in the number and shape of the head-shields and in the strongly keeled scales. I propose to call it

Acanthophis pyrrhus.

Head-shields very rugose; internasals longer than broad; præfrontals broken up into two pairs of shields; frontal as broad as the supraocular, longer than the parietals; one præocular, two postoculars, two suboculars; temporals 3+4; six upper labials. Scales in 21 rows, dorsals strongly keeled. Ventrals 146; anal entire; subcaudals 50, the 29 last divided. Brick-red above, with very indistinct traces of numerous darker cross-bars; a dark oblique temporal streak; upper lip speckled with brown; lower parts cream-colour; end of tail black above, lemon-yellow below.

Total length 530 millim.; tail 85.

The male specimen from Charlotte waters noticed by Lucas and Frost in the 'Report of the Horn Expedition' as *Acanthophis antarcticus* will no doubt prove to belong to the new species here described from a single female example.

BIBLIOGRAPHICAL NOTICE.

A Classified Catalogue, with Localities, of the Land-Shells of America, North of Mexico. By H. A. PILSBRY. Philadelphia. Svo. 1898.

THIS Catalogue of 35 pages is practically a reprint, with corrections, from 'The Nautilus' of August 1897 to April 1898. As stated in the title, it consists of a mere classified list of species, with localities, but without synonymy, references, or figures. The total number of species listed amounts to 375, of which rather more than 20 are European, mostly introductions into the States. As an up-to-date catalogue, in which the latest style of nomenclature is adopted, it will be of much use to the student and collector. For full details, however, and illustrations of the American terrestrial Mollusca, reference must be made to the works of Binney, Bland, and Tryon.

MISCELLANEOUS.

Observations on Scarabæidæ of the Genus Oniticellus.

By CHAS. O. WATERHOUSE.

I HAVE had occasion to transfer the Museum collection of the genus *Oniticellus* to a fresh drawer; and although I have not made any critical examination, I think it may be well to call attention to the following species:—

In our European catalogues and in Gemminger's Catalogue of Coleoptera *Oniticellus pallipes*, Fabr., is given as a European species, with *O. pallens*, Oliv., as a synonym.

Fabricius gives Coromandel as the habitat of his *O. pallipes*, and I think this locality will prove to be correct. The type in the Banksian collection measures 6½ millim. in length. It much resembles *O. concinnus*, but the punctures on the thorax are not at all crowded; the head has two ridges a little in front of the middle, the posterior one shorter than the other and slightly angulated; the anterior margin is scarcely thickened.

Oniticellus pallens, Oliv., is said to be from Senegal, and as there are several species of the genus which occur in that locality, I see no reason for assuming that Olivier's species is *concinnus* or any other European species.

Dates of Blainville's 'Ostéographie.'

The dates of publication of the parts of this book do not present any especial difficulty; but as most copies of the work are bound up without the wrapper-titles, and misquotation is common, I append a list of dates taken from Wiegmann's 'Archiv für Naturgeschichte' and other sources:—

| | | | |
|------------|----------------------|----------|------------------|
| | Généralites | Pp. 1-47 | 1839 |
| Livr. 1-3. | { Pithecius | 1-52 | (14 June) " |
| | { Cebus | 1-48 | " " |
| | { Lemur | 1-40 | (23 Nov.) " |
| | { Primates | 1-68 | 1840 |
| 4. | Bradypus | 1-64 | " " |
| 5. | Vespertilio..... | 1-104 | " " |
| 6. | { Insectivores | 1-115 | " " |
| | { Carnassiers | 1-85 | " " |
| 7. | Phoca | 1-51 | " " |
| 8. | Ursus..... | 1-94 | 1841 |
| 9. | Subursus | 1-123 | " " |
| 10. | Viverra | 1-100 | 1842 |
| 11. | Mustela | 1-83 | " " |
| 12. | Felis | 1-196 | 1843 |
| 13. | Canis | 1-160 | " " |
| 14. | Hyæna | 1-84 | 1844 |
| 15. | Manatus..... | 1-140 | " " |
| 16. | Elephas | 1-367 | 1845 |
| 17. | Dinotherium | 1-64 | " " |
| 18. | Daman (Hyrax) | 1-47 | " " |
| 19. | Tapir | 1-52 | 1846 |
| 20. | Rhinoceros | 1-232 | " " |
| 21. | Paléotherium..... | 1-196 | (Dec.) " |
| 22. | { Hippopotamus | 1-104 | } (20 Nov.) 1847 |
| | { Sus..... | 105-248 | |
| 23. | Anoplotherium | 1-155 | (1 June) 1849 |
| 24. | Camelus..... | 1-131 | (1 May) 1850 |
| ? 25. | Life of Blainville. | | |
| 26. | Equus | 1-80 | 1864 |

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SEVENTH SERIES.]

No. 8. AUGUST 1898.

XIII.—*Further new Parasitic Copepods found on Fish in the Indo-tropical Region.* By P. W. BASSETT-SMITH, Staff-Surgeon R.N., F.Z.S., F.R.M.S.

[Plates III.-VI.]

DURING the past year, owing to H.M.S. 'Cossack' having visited a variety of harbours in the Indo-tropical region, the opportunity has been given me of adding considerably to what I had already seen at Bombay of these curious little parasites; continued research has shown very clearly that they are abundantly represented. In most cases, when inspecting any number of well-grown fish (for it is certainly more common to find the mature fish infested with one or more parasites than the younger ones), careful examination would bring to light some actively moving *Caligus* in the gill-cavity, or perhaps a more bizarre and anomalous form, attached to the lips, body, or elsewhere. One point has been very strongly impressed on my mind, namely the constancy with which most of them are found on any particular kind of fish; and one can predict with almost certainty the form that will be found, though at the same time it appears that one species may at times be taken on two or more distinct "hosts." As is only to be expected when the fish in this region are comparatively so little known, very few of these small parasites

have been described. I have therefore in this paper brought forward a few more of the best-marked forms, following "Gerstaecker's" classification, as before, having, however, to add to his genera a new one in the family Dichelesthiina.

It is very pleasing to be able to bring to light second species of two genera, both of which were created by Dr. Heller in 1865, my specimens having been obtained in localities considerably removed from that whence the original ones came; in the case of *Hermilius*, though the species differ, the genus of both host and parasite remains constant.

At present there are a large number of known species belonging to the genus *Caligus*, some of which have been described from single specimens, or even from the male alone; this should evidently be avoided as much as possible, for in different stages of growth they vary considerably in outward conformation, especially with regard to the shape of the genital segment; true differentiation can only be carried out by detailed examination of the articulate organs, maxillary and swimming-feet, &c. Since describing *C. hirsutus** many larger specimens of this species have been taken; in these the genital segment became broader and more winged, but the characteristic condition of the fourth peraeopods is always present, as also the dilated appearance of the abdominal portion.

The work of collecting is difficult, for in a native market the crowds of moving, gesticulating, dirty, odoriferous men and women, though picturesque, render close inspection and examination of the fish almost impossible, besides the dislike the natives mostly have of a "sahab" touching anything they may want to eat; again, no doubt a large number of those parasites that live on the external surface get washed off before the fish are taken to the market.

Ergasilidæ.

BOMOLOCHUS, Nordm.

Bomolochus denticulatus, sp. n. (Pl. III. fig. 1.)

A series of specimens of this species were taken in small numbers at a time from the gill-cavities of a "Barracouda" (*Sphyræna jello*) from Trincomalee and Colombo, as well as from the gills of a "garfish" (*Hemirhamphus far*), also at Trincomalee, often together with a small *Caligus* not yet described.

* Ann. & Mag. Nat. Hist., Jan. 1898, p. 6.

This animal resembles very much *B. scomberesocis*, Kr., but after the examination of a number of specimens I believe it to be distinct, chiefly distinguished by the character of the "frontal processes" and the structure of the claws on the outside of the outer branches of the true legs, which here are strongly dentate, so markedly so that it appears impossible that "Kröyer" could have omitted to note the fact, especially as he makes such a point of the curious spur found at the end of each of these claws; the single specimen from which his description is taken was found in the tropical Atlantic, those of mine in the Indian Ocean and on different kinds of fish.

Female. — Body elongate. *Cephalothorax* five-partite; first segment much broader than long, convex above; third segment very globose in shape, projecting considerably dorsally as seen from the side (Pl. III. fig. 1 a). First segment rounded in front, giving off the frontal plates by narrow pedicles a short distance on each side of the middle line, where the frontal border is deeply cut out, presenting a fossa and a semilunar process as described by Kröyer*.

The *frontal plate* bears on each side on its anterior edge about fourteen delicately ciliated setæ; the inner two are large and curve over the central fossa, the outer three are longest and straight, directed outward; there are also from the upper surface three slender bristles, directed forward, placed nearly equidistant from one another, the outer being the shortest and most slender; on the dorsal surface on each side of the central fossa are two horny processes with strong muscular attachments, each bearing three very short obtuse-ended bristles of about equal length, pointing forward; these appear to be shorter and thicker than those of *B. scomberesocis*, Kr.

Anterior antennæ long, slender, three-jointed, minute hairs at the joints and a bunch at the end of the terminal joint.

Posterior antennæ biarticulate, each antenna folding on itself; the second joint is of peculiar structure, it terminates in two short crenate processes, between which are three small hairs; on the inner border is a tubercle with a strongly dentate surface, the whole inner face of the limb being covered with minute teeth. *Hamulus* placed laterally; it is two-jointed, the basal joint being broad and flattened, the second of equal length in the form of a strong claw, with a plumose appendage at its base.

* 'Bidrag til Kundskab,' 1863, pp. 217-219.

Mouth-organs are much the same as *B. megaceros*, *B. triceros*, &c., but between the basal joints of the first peræopods is seen an oval cavity with a ciliate margin.

First peræopod with a strong basal joint bearing two branches, the outer two-jointed, the inner three-jointed, carrying plumose hairs.

Second, third, and fourth peræopods two-branched, each with three joints, the outer of irregular shape, from the outer border of which spring short claws, on the upperside of these one sees five to seven very strong teeth, and at the end a short spur; the terminal joints and inner borders have plumose hairs as usual.

Fifth peræopod single-branched, three-jointed, terminating in three simple hairs, the middle being the longest; there is also a fine hair placed halfway up this joint.

Genital segment and caudal joints one third the total length, slender and tapering, four in number, each joint wider than long; the terminal joint bears two elongated caudal plates, giving off from the end one very long and one short bristle; also a minute hair on the outer side.

Egg-sacs very large, as long as the whole animal; eggs round, three in the diameter of sac.

Length 3-4 millim.

Caligidæ.

HERMILIUS, Hell.

Hermilius longicornis, sp. n. (Pl. III. fig. 2.)

This is the second known species of this genus, which was formed by Dr. Heller in describing an animal with a peculiar bivalve-shaped cephalothorax*. His specimens were found on the gills of a "cat-fish" (*Arius acuta*), Java; mine were taken in quantity from the gills of another "cat-fish" (*Arius acutirostris*) at Trincomalee. From almost all the fish examined some specimens were obtained, the parasite being very abundant; it firmly clasps the gills with its folding-up cephalothorax, being anchored by the strong hooks of the second antennæ; on examining the fish only the egg-sacs are visible, their light colour causing them to be easily detected.

This species is readily separated from *H. pyriventris*, Hell., by the great size of the posterior antennæ and by the oblong form of the genital segment.

* 'Crustaceen: Reise der Fregatte Novara,' 1865.

Female.—The *cephalothorax* being folded up as a mussel is deeply notched in front and behind, the length of each valve is much greater than the breadth, and equals about two fifths of the total length; it has a rounded, somewhat lobed border, and fringing the margin is a wide band of lineate structure, which on higher magnification is seen to be due to minute parallel canals, and no doubt assists in the holding power of the valve; on the dorsal surface the chitinous ribs are seen as described by Heller.

Frontal plate narrow, with a straight border, from the outer and under side of which rises the *anterior antennæ*; these are small, two-jointed, the basal being longer than the second, having on its front border about ten ciliated setæ; the second joint is rod-shaped, terminating in a few fine bristles.

Posterior antennæ placed some distance back from the frontal border; they are very long and strong, the claw-like ends projecting well in front of the anterior border; each is composed of three joints—the basal is short, thick, and muscular, carrying a small sharp-pointed spur directed backwards, as in many of the “*Caligidæ*”; the second joint is short and thick, bearing the long terminal claw-joint on a firm articulation; it is widely curved, sharp-pointed, and has on its concave border one third from the point a secondary sharp hook, rather less long, but not articulate.

Rostrum of moderate size, three times as long as broad, tapering to the point.

First maxilliped very small, two-jointed, with a sharp-pointed palp near its base.

Second maxilliped very long, two jointed, the first being oval and muscular, the second slender, curved, chitinous, terminating in a short sickle-shaped point, with a minute tooth at its base.

Furcula very small, with a short dilated base, bearing straight, pointed, slightly divergent branches; the distance between the points equals the length of the branch.

First pereopod three-jointed, the basal short and thick, with a small lobe from the inferior border; the second joint is about twice as long, the third is short, bearing on the under border three long plumose hairs; at the extremity are seen three long straight bristles, the upper being the longest, equalling the whole length of the limb; at the angle is a very short bristle.

Second pereopod of the usual form; *third* as in “*Caligus*”; the two branches are here placed close together and are very

small; the *hamulus* is very small, slightly curved, and just overlaps the border.

Fourth pereopod very short, not reaching as far as the border of the genital segment; it terminates in three short simple hairs, with a fourth halfway down the lower border.

Genital segment large, oblong, lobed posteriorly, slightly narrower in front.

Abdomen small, as broad as long, about one sixth the length of the genital segment. Caudal plates longer than broad, bearing three short terminal *plumose* setæ and two short hairs on the outer border.

Egg-sacs long, as in *Caligus*.

Length 5 millim.

CALIGUS, Müll.

Caligus arii, sp. n. (Pl. IV. fig. 1.)

This species was found in greater or smaller numbers on every example of a "cat-fish" (*Arius acutirostris*) examined at Trincomalee, Ceylon. During the month of October 1897 both sexes were present in various stages of maturity, and appear never to attain any considerable size: during life they were very active; the "lunulæ" were very marked, projecting in front of the frontal border, the carapace markedly vaulted, and colour quite transparent, without spots; the posterior lobes of the genital segments in the immature females were strongly marked.

These animals were taken in company with *Hermilius longicornis* and *Lepcophtheirus longipalpus* on the inside of the operculum and on the roof of the mouth. This species seems to be nearest allied to *C. monacanthi*, Kr., taken in the West Indies, differing, however, entirely in the details of the swimming-feet, caudal plates, &c.

In the female the *cephalothorax* was almost circular in shape, slightly longer than broad, considerably shorter than the remaining portion of the animal, narrowing rapidly anteriorly; the posterior central lobe, which is broad, is separated from the posterior lateral angles by a deep cleft, the whole being strongly arched upwards and having the outer circular edge bordered with a strip of very fine short parallel tubes. Frontal plates of moderate size, somewhat indented in the centre. Lunulæ very large and prominent.

Anterior antennæ: first joint equal in length with breadth of lunule, bearing about twenty small plumose hairs; second joint club-shaped, with fine terminal hairs.

Posterior antennæ placed well to the outer side of the

rostrum, large, three-jointed, the terminal joint being unusually long, with oblique curved claw.

No *hamulus* detected.

First maxilliped of the usual form. *Mandible* slender, with the last third of the concave border strongly dentate. *Palp* short, sharp, slightly curved.

Second maxilliped: basal joint short and thick, the second a short curved simple claw, bearing a minute hair on the concave border one third from the point; this means of attachment is peculiarly small compared with that of the strong posterior antennæ. *Purculla* very prominent and strong; the base is broad, with straight sides, bearing large, divergent, simple branches with blunted ends, the width of the opening being equal to the length of the arms. The first of the swimming-feet (*perceopoda*) has from the short basal joint a long plumose hair equal in length to that of the second joint; the third joint or palm bears three short hooked claws on its outer end of about the same length, a fine slender hair at the angle, and three long plumose hairs from the under edge. *Second perceopod* of usual character, the third is peculiar; the *hamulus* is distinctly two-jointed, the spur being almost straight, not projecting beyond the border of the first joint of the outer branch; these two articulate branches are placed close together and are very large, the surface of the terminal joints being finely granular; the outer bears seven and the inner six plumose hairs. *Fourth perceopod* of moderate size, four-jointed, the three claws of the terminal joint and that of the penultimate being placed close together, of nearly equal length, a fifth being placed higher up; the last joint of the cephalothorax, from which these spring, is elongated and of a diamond shape.

Genital segment oblong, with a rounded anterior border and strongly lobed posterior angles, from between which rises the extremely elongated abdominal segment; this is biarticulate, the second joint being very short, its breadth equal to its length, its posterior border giving off two minute sessile caudal plates, which are broader than long; there are three terminal plumose setæ, two minute ones on the outer side, and a single one on the inner.

Length 5-6 millim.

Caligus platytarsis, sp. n. (Pl. IV. fig. 2.)

This animal was obtained in great numbers on a species of *Mugil* at Muscat, found in the gill-cavity; only females, more or less mature, were taken.

This species is remarkably characteristic in form by its rounded carapace, squarely cut genital segment, bearing at the angle the fifth peraeopods, and elongated abdomen, the whole being spotted with pink; the form of the furcula and fourth peraeopods are quite distinct, separating it from *C. isonyx*, Steen. & Lütk.*, to which species it bears a resemblance; these authors lay great stress on the excavated condition of the front border of the frontal plate, and the secondary spur on the palp, which are not present in this species; their specimens were taken on a *Sphyræna* in the West Indies.

Female.—*Cephalothorax* rounded, as broad as long; frontal plates narrow. Lunulæ very shallow. *Anterior antennæ*: first joint twice as long as the breadth of the lunule, the front border provided with about fourteen fine plumose hairs, the second joint is rather short and slender, with fine hairs at the end. *First maxilliped* of the usual form, the second of moderate size, the terminal claw without hair on the concave border. *Hamulus anterior* not detected. *Furcula* quite peculiar, rising from a broad base; instead of ending in the usual elongated branches, there appear to be two thickened knob-like processes; this condition was found in all the specimens, and therefore was not due to fracture. I have not met with this condition in any other species. *First peraeopod*: the basal joint bears a small lobe on the lower border, the second has a minute spur on the outer extremity, and the third carries three claws at the extremity of nearly equal length and three long plumose setæ from under border. *Second peraeopod*: the first and second joints of the outer branch each carry a small spur-like claw on the upper border, the third or terminal has three of smaller size, with six long feathered hairs beneath; the inner branch is three-jointed as usual. *Third peraeopod* has the paddle-branches placed some distance apart; the outer border of the second joint of the outer branch bearing three short simple hairs, the inner border four long plumose ones. *Hamulus* small and almost straight. *Fourth peraeopod* of moderate length, four-jointed, the last three joints as usual welded together, terminating in a minute spur; the last joint carries on the outer side a moderately strong sharp simple claw, placed close to it equally distant from one another are four flattened "toes," covered with minute hairs like the tongue of a fly—two rising from the last joint, one from the third, and one from the second.

Genital segment flask-shaped, the posterior border cut off

* 'Bidrag til Kundskab,' 1861, pp. 18-19.

quite squarely with the abdomen; at the outer angle on either side one sees a small process carrying three fine hairs (rudimentary fifth peræopods), also a longer one placed just internal to it. *Abdomen* single-jointed, long, equal in length to that of the last segment of the cephalothorax and the genital one. *Caudal plates* much longer than broad, on a narrow base, carrying three long plumose hairs posteriorly—a shorter one on the inner border and two minute ones on the outer.

Length 6 millim.

Caligus Cossackii, sp. n. (Pl. IV. fig. 3.)

This species was taken from the gill-cavities of *Chryso-phorys sarba* at Bunder Abbas, in the Persian Gulf, in some quantity, both sexes; the male had also been taken before from the same fish at Colombo, together with a second undetermined species and *Lernanthropus atrox*.

These were very active, living for some time in a glass tube, showing great fondness for creeping up the glass out of the water, as Dana described, when they were with difficulty dislodged, at other times swimming briskly about; during life the genital segment showed a very corrugated edge and the intestine was clearly seen to pass down to the extremity of the abdomen between the caudal plates.

This species bears a considerable resemblance to *C. productus* of Steen. & Lütk., which varies considerably from the *C. productus* of Krøyer*, but is differentiated from them both by the character of the hamulus anterior, first peræopods, and by the caudal plates, &c.

Female.—*Cephalothorax* oval, much longer than broad, equal to one half the total length; frontal plate deeply excavated in the centre, having on the outer portion the very large and prominent lunulæ which extend to the back border of the plate. *Anterior antennæ*: first joint not quite so long as the breadth of the lunule; it is provided with about seventeen plumose hairs, these being longest at the outer end; second joint of moderate length. *Posterior antennæ* terminating in a very slender hook. *Hamulus anterior* very large, with a widely dilated base and a strongly recurved blunt hook. *First maxilliped* of usual form, the second having a short thick basal joint and a moderately large terminal claw with a minute hair on the concave border.

Furcula with a narrow base, giving off two pointed divergent branches, which again approach towards the extremity,

* 'Bidrag til Kundskab,' 1863, pp. 64-66.

the width of the opening being less than the length of the branch. *First peræopod*: the palm-joint is provided with three small simple claws of equal length; a fine hair at the angle and three long plumose setæ from the under border. *Third peræopod* carrying the two branches some distance apart, the first joint of the outer branch having on the outer side a single short spur, the second having three, with four plumose hairs on the inner border. *Hamulus* small, claw slightly bent. *Fourth peræopod* three-jointed, bearing at the extremity three curved simple claws, the outer being slightly the longest; on the centre of the inner border is a fourth, and from the end of the penultimate joint a fifth slightly shorter.

The *genital segment* is elongated, narrowing gradually anteriorly, broadest in the centre, slightly narrower and rounded posteriorly. *Abdomen* rather long, equal to the length of the last segment, divided into two parts, more or less well marked, of about equal lengths.

Caudal plates longer than broad, bearing three terminal plumose hairs and a smaller one on the outer border.

Length 5 millim.

Male.—Differs in its much more elongate form and oval genital segment; the terminal hook of the posterior antennæ is very small, but that of the hamulus anterior is very long and strong; the basal joint of the second maxilliped carries on the inner border a double-crowned tubercle, to which the point of the second joint approximates; the caudal plates are longer and profusely ciliated.

Length 3 millim.

The species described by Heller as *C. constrictus* is evidently a male, being very like this; but he states "the lunulæ are minute."

LEPEOPHTHEIRUS.

Lepeophtheirus rotundiventris, sp. n. (Pl. V. fig. 1.)

A single female specimen of this species was obtained from the gill-cavity of a species of *Lutjanus* at Colombo; a male was found on a *Serranus* at Muscat: though not taken at the same time, place, or on the same host, yet the occurrence of the distinctive characters in both of them, especially that of the fourth peræopod, justify me, I believe, in placing them in one and the same species. There is a resemblance of this animal to *C. brachyurus*, Hell., taken at Java, but they differ in important details; the peculiarly rounded genital segment and the very large last thoracic joint of this species at once draw the attention of the observer.

Female.—Carapace as broad as long, narrowing rapidly in front, where is seen the rather deep frontal plate, excavated considerably in the middle.

Anterior antennæ: first joint short and thick, with many plumose hairs on the anterior border; the second much longer, cylindrical, with a tuft of hairs at the end and one near the middle of the lower border. *Posterior antennæ* of moderate size. *Hamulus* has a rather dilated base, with short curved claw. *Palp* with two slightly divergent branches, both sharply pointed, the inner being the longer. *Maxillipeds* not remarkable. *Furcula* small, with very short, pointed, slightly divergent, simple branches, the base strong and broad, on either side having a double root.

First pereopod: the basal joint is short, the second cylindrical, and the palm bears three short end-claws, a long bristle at the angle, and three long plumose hairs from the lower border.

Second pereopod: the upper border of the first two joints of the outer branch bears each a single short spur, the third or last joint has two.

Third pereopod: the lamellar plate is large, the branches are placed close to one another, but not overlapping.

Hamulus posterior of moderate size, claw slightly bent. Last thoracic segment very large.

Fourth pereopods long and strong, distinctive of the species, consisting of four joints: the first long, cylindrical, and muscular; second to fourth fused, long, narrow, with parallel borders, the under being finely ciliated; from the last joint are three long curved hook-claws, the outer being much the longest, from the third joint a fourth, but less long, and from the second an extremely short one is visible.

Genital segment almost a perfect sphere; near the posterior edge are seen the rudiments of the fifth feet in the shape of a small tubercle with three hairs from it. Abdomen very short, one quarter the length of the genital segment, single-jointed, broadest near the centre, narrowing posteriorly. Caudal plates small, broader than long, with three terminal plumose hairs, and a shorter one on the outer border.

Length 4-5 millim.

Male.—*Cephalothorax* large, more than two thirds the length of the whole, oval, widest posteriorly, last thoracic joint not so large as in the female. *Genital segment* deeply excavated behind, causing the appearance of two lobe-like prolongations, each of these terminating in a long papilla, ending in a strong bristle, with two smaller ones on the inner border.

Abdomen near its termination broadens considerably, the caudal plates being widely separated. The *posterior antennæ* are of great size, the terminal hook extending nearly to the edge of the carapace; but the hamulus anterior is not proportionately increased. The other parts are as in the female.

Length 5-6 millim.

Lepeophtheirus longipalpus, sp. n. (Pl. V. fig. 2.)

A single well-grown female specimen of this species was obtained from the gills of *Arius acutirostris* at Trincomalee, with *Hermilius longicornis* and *Caligus arii*; the species is distinctly characterized by the peculiar structure of the maxillary palps and that of the fourth pair of legs.

Cephalothorax robust, a long oval; posterior lateral angles obtusely rounded; last thoracic segment well marked, diamond-shaped, with a secondary lobe at the juncture with the genital segment; the frontal plates are long, with a straight border, having a deep notch in the centre.

Anterior antennæ small, basal joint carrying about seventeen fine plumose hairs; second joint of equal length, with a terminal tuft.

Posterior antennæ: the first joint bears a strong spur directed backwards; the last joint long, forming a strongly bent claw.

Mandible of the usual form. *Palp* rising from below the base of the posterior antennæ, and inside the first foot-jaw is in the form of a long blunt curved horn directed inwards and backwards towards its fellow, and reaching almost as far as the furcula; this condition is quite peculiar, destroying a point which one had looked upon as almost of generic value, viz. the bifid palp.

Maxillipeds of the usual form. *Furcula* large, prominent, base broad, with slightly spreading roots; branches long, almost parallel to one another, blunted at the extremities, the width of the opening being about equal to two thirds the length of the branches.

First peraeopod with a short basal joint, bearing a lobe on the under border; the palm with three minute terminal claws and three long plumose setæ from the under border.

Second peraeopod of the usual form, but the upper border of each joint of the outer branch carries a single claw, the outer one being the longest.

Third peraeopod: the two branches are placed close together, each distinctly two-jointed, the terminal joint of the outer carrying six hairs, short, but progressively increasing

in length from without inwards; the first joint of the inner branch has one, the second six short hairs. Hamulus very small.

Fourth pereopod of considerable size and robust form, consisting of four joints, the last terminating in a minute spur, close to which are placed three end-claws, two others being placed at the inner end of the second and third joints; each of these five is seen to have a minutely crenate edge, which on higher magnification shows a beautifully serrated border, transversely striated; an abortive fifth limb is found at the angle of the genital segment in the form of a small tubercle, giving rise to three short plumose hairs.

Genital segment oval, with a truncated posterior border; equals half the length of the cephalothorax.

Abdomen elongated, as long as the last segment, consisting of a prolonged first joint and a second of a square form.

Caudal plates small, slightly longer than broad, with three long terminal plumose hairs and two minute ones on the outer border.

Length 6-7 millim.

ANURETES, Hell.

Anuretes perplexus, sp. n. (Pl. V. fig. 3.)

This genus was formed by Heller, and has been retained by Gerstaecker, the original specimen having been described by Kröyer as *Lepeophtheirus Heckelii*; it is distinguished by "the entire deficiency of separate tail-segments," all other parts agreeing with the genus *Lepeophtheirus*. The first specimen was obtained from *Ephippus gigas* in the Brazilian sea, described by "Koller" as *Caligus Heckelii*, being preserved in the Vienna Museum. A second specimen was taken from the same species of fish off New Orleans by Kröyer; he states that "this species has a moderately wide diffusion." I have been fortunate enough in a far removed locality—namely at Trincomalee, Ceylon—to find on a species of *Lutjanus* about a dozen specimens of a second form of this peculiar animal, though the necessity for making for it a distinct genus seems to me rather doubtful, for in some the position of the caudal plates is as Kröyer describes, but in a few these project a little beyond the posterior edge of the genital segment, though in none does "the abdomen appear drawn out."

Female. — *Cephalothorax* rather broader than long, narrowing in front; the posterior lateral angles obtuse, not

reaching so far backwards as the middle lobe; the frontal plate is narrow, convex forward, with a shallow median notch.

Anterior antennæ equal in length to half the frontal plate, of the usual form.

Posterior antennæ three-jointed, the basal with a well-marked sharp spur directed backwards, the end claw of moderate size. *Hamulus anterior* in the form of a very minute hook, with a dilated base, placed well towards the border near the extremity of the posterior antennæ. *Rostrum* not of unusual length (as in *A. Heckelii*), but less broad than long; the palp is simple, slender, sharp-pointed, and slightly curved, placed near the base of the first foot-jaw and the trunk, the point reaching a little in front of the latter.

First maxilliped of the usual form, but near the middle of the convex border of the second joint a minute hair is seen. *Second maxilliped* quite distinctive, forming a very powerful holding-organ, the basal joint being thick and muscular, having at the inner end of the concave border a strong triangular process, against which the large claw-like second joint is opposable; on the inner margin of the latter near the base is a strong bristle. *Furcula* very small, the branches being short, thick, and almost parallel; their length equals the breadth between the points.

First peræopod: first joint short, the second long, the lower border fringed with fine hairs, the palmar carrying at the end three hook-like hairs, the upper being the longest; at the angle there is a long fine bristle, on the inferior border three long plumose hairs of the usual form. Second of the usual form: the third has, on the large flap-like basal joint, the two small articulate branches placed close together at the edge, but not overlapping one another; they are of small size. The hamulus is small, but well-marked, the claw being almost straight. *Fourth peræopod* three-jointed, at the extremity of the last joint are three slightly curved claws, placed close together, of nearly equal length; at the juncture of the second and third joints is a fourth claw.

Genital segment about two thirds the length of the cephalothorax, almost round in outline, except for being cut away in the middle line posteriorly, forming there a shallow triangular depression; on the posterior border outside of this is seen a very prominent plate projecting beyond the genital segment, carrying three long plumose hairs terminally and one on the outer border—these are the fifth peræopods; there is also a strong bristle from the genital segment, external to these; rising from the under surface of the genital segment, in the middle line, are the true *caudal plates*, which are short,

giving off four plumose hairs, the second from the inside being very long, always projecting beyond the border. These caudal plates are sometimes quite hidden, at others they are just visible beyond the border; between them are two small bilobed tubercles, divided from one another by the extremity of the alimentary tube.

Egg-sacs as in *Caligus*, often long.

Length 3 millim.

Dichelesthiina.

LERNANTHROPUS, Nordm.

Lernanthropus atrox, Hell. (Pl. VI. fig. 3.)

At Bunder Abbas, in the Persian Gulf, attached to the gills of *Chrysophorys sarba*, a large number of specimens, both male and female, of a *Lernanthropus* were taken, the female so closely resembling *L. atrox* described by Heller, taken from a "*Pagrus*" in Australian waters, that I have felt justified in coming to the conclusion that they are the same, though in the one described by him the anterior antennæ are stated to be two-jointed only, which, though it may be presumptuous to say, as I have done in my last paper*, is probably due to an error of observation on his part, as invariably in my experience, and from descriptions and plates of Kröyer and Beneden, the anterior antennæ have at least six joints—a generic guide. As the unnecessary multiplication of species is to be deplored, I have referred my specimens to this species, giving here a representation of the animal as seen from the back and side, also a more enlarged drawing of the antennæ, as well as of the newly found male.

Female.—*Anterior antennæ* seven-jointed, the fourth joint being the longest, bearing a small lobe-like process from the lower border, the joints decreasing in size to the last, which carries a bundle of fine hairs.

Posterior antennæ with a long muscular basal joint and a strong terminal hook.

Length 4 millim.

Male.—Caput oblong in shape, cut off squarely in front; side margins infolding equally, about one third the length of the whole excluding the caudal processes.

Anterior antennæ seven-jointed, as in the female.

Posterior antennæ with very strong, curved, grasping-hooks, which project far beyond the cephalic border.

Rostrum pointed, but short; on either side are seen the

* Ann. & Mag. Nat. Hist., Jan. 1898, p. 2.

minute mouth-organs, a slender mandible, straight and sharp-pointed; outside this is the maxillary palp, with a thickened base, and a cylindrical second joint, ending in two short blunt hairs, the outer being much the shorter.

First maxilliped placed close behind the rostrum; it is two-jointed, the first extending to near the border of the head, muscular, the second a slender curved claw, having the concave border near the point markedly serrated.

Second maxilliped equal in size to that of the first, but having the terminal point simple.

First pair of thoracic feet minute, placed close under the cephalic border, two-branched, springing from a broad thickened basal plate, the outer branch bearing five short thick hairs, the inner branch more slender, terminating in a single long bristle. The second pair are placed a little posterior to the first and of like structure, the outer branch having, however, only three short hairs.

Genital segment an elongated oval shape, giving off on either side two pairs of lancinate foliaceous processes, equalling in length two thirds that of the whole animal.

Abdomen short, rounded, broader than long. Caudal plates simple, lancinate.

Length 3 millim., excluding processes.

PSEUDOCLOVELLA, gen. nov.

Body elongate, without dorsal plates or lateral processes; head obtusely rounded. Anterior antennæ setaceous, indistinctly three-jointed. Posterior antennæ two-jointed, terminating in a powerful simple hook. First maxilliped minute, three-jointed. Second maxilliped two-jointed, long, projecting beyond the cephalic margin. Thorax showing one distinct segment dorsally. Four pairs of limbs are present, the first and second biramose, the third and fourth from the genital segment minute, papilliform; genital segment four times as long as head and thorax. Abdomen short, caudal plates lamellar. Egg-tubes long, ovules flattened.

This genus may be known by its single free thoracic segment, by the absence of any lateral plates, by the presence of two pairs of well-formed thoracic limbs, by the oval genital segment, from the sides of which rise the third and fourth pair, stump-like and rudimentary, by the setaceous indistinctly jointed anterior antennæ, and by the long slender second maxillipeds. It has a near relationship to *Clavella*, "Oken"; but in all cases the presence of four pairs of limbs was found (though easily shrivelled up and overlooked in

mounted specimens), the thorax only shows as one ring, the genital segment is proportionately much shorter, and the anterior antennæ, though setaceous, appear to be only tri-articulate.

Gerstaecker separates the *Dichelesthina* thus :—

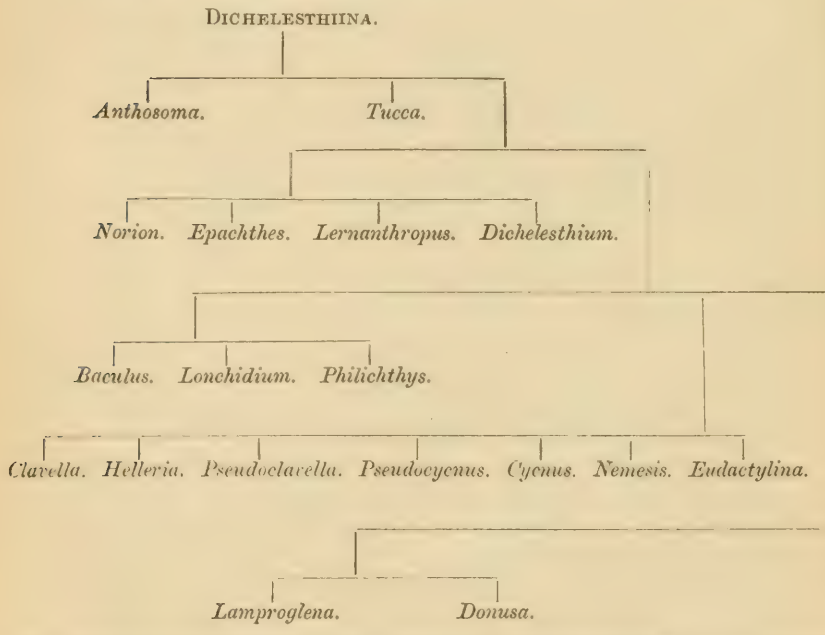
- A. Abdomen with two large dorsal plates *Anthosoma*, Leach.
- B. Abdomen without dorsal plates.
 - a. Ambulatory leg suppressed *Tucca*, Kr.
 - b. Posterior legs or all changed into lamellar plates
 - Norion*, Nordm.
 - Epachthes*, Nordm.
 - Lernanthropus*, Nordm.
 - Dichelesthium*, Herm.
 - c. Posterior legs neither bigger than front nor lamellar.
 - a'. Posterior antennæ with cheliform end-claw.
 - a''. All four pairs of limbs 2-branched.
 - a'''. Anterior antennæ 8-jointed *Lonchidium*, Gerst.
 - b'''. Anterior antennæ 4-jointed *Baculus*, Lubb.
 - b''. Only two first pairs 2-branched *Philichthys*, Stp.
 - b'. Posterior antennæ with single end-claw.
 - a''. Anterior antennæ single, posterior projecting.
 - a'''. Only two pairs of limbs formed; genital segment five or six times as long as head and thorax; anterior antennæ 6-jointed. *Clavella*, Oken.
 - b'''. All four pairs of limbs formed.
 - a⁴. Anterior antennæ 15-jointed; second to fourth legs 2-branched, 1-jointed *Nemesis*, Roux.
 - b⁴. Anterior antennæ 6-jointed; all limbs 2-branched. *Cygnus*, Edw.
 - c⁴. Anterior antennæ 3-jointed; only second pair 2-branched, the others stump-like. *Pseudocygnus*, Hell.
 - b''. Anterior antennæ with hooked basal joint; the posterior short, with three claws. *Eudactylina*, Bened.
 - c'. Posterior antennæ without end-claw; the point provided with hairs.
 - a''. Anterior antennæ 10-jointed; true legs single-jointed *Lamproglena*, Nordm.
 - b''. Anterior antennæ 5-jointed; true legs 3-jointed *Donusa*, Nordm.

In accordance with the two new genera which I have described, the classification of the latter portion has to be somewhat altered, as follows :—

- b'. Posterior antennæ with single end-claw.
 - a''. Anterior antennæ single, posterior projecting.
 - a'''. Only the two anterior pairs of limbs formed; genital segment

- five or six times as long as head and thorax; anterior antennæ 6-jointed *Clavella*, Oken.
- δ''' . Only three pairs of limbs formed, first biramose, second uniramose, third stump-like; anterior antennæ 6-jointed *Helleria*, B.-S.*
- ε''' . All four pairs of limbs formed.
 - a⁴ . Anterior antennæ 3-jointed; first and second pairs of legs biramose, third and fourth stump-like; genital segment four times as long as head and thorax *Pseudoclavella*, g. n.
 - b⁴ . Anterior antennæ 6-jointed; all four pairs of legs biramose *Cycnus*, Edw.
 - c⁴ . Anterior antennæ 15-jointed; second, third, and fourth legs biramose, 1-jointed, first uniramose *Nemesis*, Roux.
- b'' . Anterior antennæ with hooked basal joint; posterior antennæ short, with three claws *Eudactylina*, Bened.

Expressed diagrammatically, thus :—



* Ann. & Mag. Nat. Hist., Jan. 1898, p. 10.

Pseudoclavella ovalis, sp. n. (Pl. VI. fig. 1.)

The gills of a *Serranus*, sp., captured at Muscat, were found to be crowded with these small parasites, which held very firmly on to the delicate margins of the gills by their strong posterior antennæ; the long dark-coloured ovarian tubes projecting considerably outwards made their detection easy; altogether there were hundreds of them in the one fish.

Female.—Caput of an oval shape, with a slight central lobe anteriorly, and somewhat broadened behind, where it unites with the single free thoracic segment, which is broader than long. The genital segment is of an elongated oval shape, robust in form, about four times as long as the cephalothorax. Abdominal segment small, broader than long, giving off two foliate caudal plates, each bearing three short, fine, terminal hairs and a fourth of smaller size on the outer border; on each side of the abdominal tubercle are seen the comparatively large egg-tubes filled with large flattened ovules in a single row.

Anterior antennæ rise from the head a little behind the anterior border; they appear to be three-jointed, but the divisions are very indistinct; from the basal joint, which is long and thickened, rise two pairs of short strong hairs on the front border; from the second, which is shorter, there are two short hairs above and one below; the last joint, which is longer, bears two short hairs near the base, one above and one below; a very long, strong, deeply rooted one on the upper border near the middle, with a tuft of smaller terminal bristles.

Posterior antennæ placed a little further back; it is two-jointed, the first being broad and stout, the second in the form of a strong, short, recurved, claw, with a thickened tuberculate base; this does not project beyond the cephalic border.

Rostrum short, blunt. *Palp* very minute, slender, straight. Outside this is seen a very small representative of the *first maxilliped*; it is three-jointed, the terminal joint in the form of a claw.

Second maxilliped large, the extremity of the basal joint projecting well beyond the border of the head; the second joint is very slender, longer than the basal, terminating in a curved sharp point.

Rising from the posterior border of the carapace on either side underneath are seen the first pair of thoracic limbs; there is a broad basal joint, giving off two small branches, the inner is single-jointed, terminating in two hairs, the outer

consists of two joints, the first having a minute hair on the outer side, the last with three small terminal ones. Placed a little more backward on the posterior outer angle of the thoracic segment are found the second pair of limbs, more distinctly visible than the first, being larger, the basal joint being strongly lobed, giving off two branches, each of two small joints, ending with a strong bristle. The next two limbs are rudimentary, the third being placed about one third down the side of the genital segment, in the form of an elongated tubercle terminating in three simple bristles. Two thirds down is seen the fourth pair of like character, but rather smaller.

Length 3 millim.

Lernæopodidæ.

BRACHIELLA, Cuv.

Brachiella multifimbriata, sp. n. (Pl. VI. fig. 2.)

This animal does not appear to correspond with any yet described; in outward form it is so characteristic, I venture here to describe it as a new species.

On a large *Serranus* at Muscat I found one of these attached to the inside of the operculum; but on opening the mouth the lips, tongue, palate, and cheeks were seen to be thickly studded with them, especially the inner fold of the lower lip; they were attached so firmly that the mucous membrane had to be cut away with them. Afterwards on careful examination of these I was disappointed to find only one pigmy male; this minute creature was hooked on to the cephalic portion of a female, as shown in Pl. VI. fig. 2*a*. I only succeeded in making a rough drawing of this, unfortunately losing the specimen while preparing it for mounting; it shows, however, distinctly the *Brachiella* form.

Female.—Colour pale, translucent, except for the ovaries and ovarian sacs, which are opaque white. Head and neck generally recurved forwards, equal very nearly in length to that of the genital segment. Arms of attachment (second maxillipeds) placed close to the latter, distinctly separated from one another in the middle portion, not quite equal in length to the neck; organ of adhesion a sucking-disk (as distinct from the drill usually found in *Anchorella*).

Genital segment: this from the back appears as an irregular elongated hexagon with concave sides, giving off from each of the two lateral points four filiform semitransparent processes; from the posterior angle on each side of a short

abdominal tubercle are two more processes, the dorsal being the longer.

Genital sac full of large round eggs.

Length about 7 millim. without processes.

Male minute, about 1 millim. long (Pl. VI. fig. 2 e).

Cephalothorax oval, distinctly divided off from the segmented caudal portion, which appears to consist of three joints, terminating in two lancinate plates.

Anterior antennæ placed close to the posterior, which spring from the upper and anterior border of the cephalothorax; the first is three-jointed, ending in three short hairs; the posterior has a thickened basal joint and a short square second, also terminating in three hairs.

First maxillipeds very large and strong, the root-joint very muscular, its upper border being much lobed; the claw is very strongly bent, thick at the base, and sharp at the point, with a short curved tooth about the centre of the concave border.

EXPLANATION OF THE PLATES.

PLATE III.

Fig. 1. *Bomolochus denticulatus*, ♀, sp. n., from the back, magnified.

1 a. Seen from the side. 1 b. Hamulus anterior. 1 c. Terminal joint of posterior antennæ. 1 d, e, f, g, h. First to fifth peræopods. 1 i. Last two joints of abdomen and caudal plates. 1 k. Spur on outer side of outer branch of peræopod, showing dentation, highly magnified.

Fig. 2. *Hermilius longicornis*, ♀, sp. n., from back, magnified.

2 a. Seen from the side, with valves closed. 2 b. Carapace seen from beneath. 2 c. Anterior antennæ. 2 d. Terminal joint of first maxilliped. 2 e. Third peræopod, much magnified. 2 f. Last joint of fourth peræopod. 2 g. Abdomen and caudal plates.

PLATE IV.

Fig. 1. *Caligus arii*, ♀, sp. n., enlarged, seen from the back.

1 a. Carapace from underside, much magnified. 1 b. Third peræopod. 1 c. Fourth peræopod. 1 d. Abdomen and caudal plates.

Fig. 2. *Caligus platytarsis*, ♀, sp. n., enlarged, seen from back.

2 a. Fourth peræopod, hairy toe of same highly magnified. 2 c. Fifth peræopod. 2 d. Furcula. 2 e. Caudal plate.

Fig. 3. *Caligus cossackii*, ♀, sp. n., seen from the back.

3 a. Carapace from below. 3 b. Third peræopod. 3 c. Fourth peræopod. 3 d. Caudal plate. 3 e. Male, much enlarged. 3 f. Second maxilliped of the same.

PLATE V.

- Fig. 1. Lepeophtheirus rotundiventris*, ♀, sp. n., seen from the back.
 1 *a.* From beneath, much enlarged. 1 *b.* Terminal portion, with caudal plates. 1 *c.* Male.
- Fig. 2. Lepeophtheirus longipalpus*, ♀, sp. n., seen from back.
 2 *a.* Organs round the mouth. 2 *b, c.* Third and fourth peræopods. 2 *d.* Claw of fourth peræopod, much magnified. 2 *e.* Rudimentary fifth. 2 *f.* Caudal plate.
- Fig. 3. Anuretes perplexus*, ♀, sp. n., from the back.
 3 *a.* Cephalothorax from beneath. 3 *b, c.* Third and fourth peræopods, enlarged. 3 *d.* Terminal portion of genital segment, showing fifth peræopods and caudal plates. 3 *e.* The same in varied form.

PLATE VI.

- Fig. 1. Pseudoclavella ovalis*, gen. et sp. n.
 1 *a.* Seen from the back, much enlarged. 1 *b.* Side view of head and thorax. 1 *c.* Underside of cephalothorax. 1 *d, e, f, g.* First to fourth limbs.
- Fig. 2. Brachiella multifimbriata*, ♀, sp. n., seen from the back, with processes spread out.
 2 *a.* Same, seen from the side. 2 *b.* Fixing-organ of second maxilliped. 2 *c.* Under surface of head, much enlarged, showing organs. 2 *d.* Palp, more highly magnified. 2 *e.* Male, highly magnified. 2 *f.* A. 1 and A. 2 of the same. 2 *g.* Strong first maxilliped of the same.
- Fig. 3. Lernanthropus atrox*, ♀, Heller, seen from the back.
 3 *a.* Seen from the side. 3 *b.* Anterior and posterior antennæ of the same, much enlarged. 3 *c.* Male, enlarged, seen from below. 3 *d.* Maudible and maxillary palp. 3 *e, f.* First and second thoracic limbs.

N.B.—The line to the right of the figure gives the natural length of the animal.

XIV.—*The Species of Scorpions of the Genus Broteas.*

By R. I. POCOCK.

ON page 173 of his recent 'Revision of Scorpions' Professor Kraepelin reduces the five species of *Broteas* that had been established to one, which he calls *maurus*, Herbst. As I have already pointed out, this name is, in my opinion, invalid; nevertheless the question of the name is of little importance as compared with the identity of the scorpions to which Prof. Kraepelin applies it. Being by no means satisfied as to the correctness of this author's synonymy, I wrote to M. Simon to beg for his types of *B. granulatus* and *B. paransis* and for an example of the species he considered to be

B. Herbstii (= *maurus*, Linn., Herbst). His kind compliance with my request enabled me to satisfy myself that the species *granulatus* and *paraensis* are perfectly valid and easily recognizable forms, and that the species he had identified as *Herbstii* is not identical with the one I regarded as *Herbstii*, but is the same as my *Gervaisii*. The conclusions which I think it right to draw from these discoveries form the basis of the present paper, to which has been added the description of a well-marked new species recently received from Dutch Guiana.

Broteas granulatus, Simon.

Broteas granulatus, Simon, Ann. Soc. Ent. Fr. 1877, p. 241; id. *op. cit.* 1880, p. 382 (cited by error as *granulosus*).

Loc. Maroni, in French Guiana.

I at one time thought that the type of this species might prove to be identical with the male of the British Guiana species previously referred by me to *B. Herbstii*, Thorell, but here described as *B. subgranosus*.

An examination of the type, however, kindly submitted to me by Mons. Simon, shows that it is a female presenting features which mark it off as a very distinct form from the rest of the species of the genus, as Mons. Simon originally maintained.

Broteas paraensis, Simon.

Broteas paraensis, Simon, Ann. Soc. Ent. Fr. 1880, pp. 381-382.

Loc. Pará.

The type of this species is a female and represents a species easily distinguishable from the remaining species of the genus known to me.

Broteas Gervaisii, Poc.

Broteas Herbstii, Thor., Simon, Ann. Soc. Ent. Fr. 1877, p. 240 id. *op. cit.* 1880, p. 383, ♂ (? *Herbstii*, Thor.).

Broteas Gervaisii, Pocock, Ann. & Mag. Nat. Hist. (6) xii. p. 78, ♀; id. Ann. & Mag. Nat. Hist. (6) xix. p. 366.

Loc. Amazon Valley (? La Plata).

This species was based upon a couple of adult female examples for which no special locality was known. A young female was subsequently obtained by Messrs. Austen and Cambridge at Gurupá on the Lower Amazons, and the British Museum has recently received another of apparently the same species and also a young female from Rio Jurua, Amazons (*Dr. Bach*).

Judging from the example which M. Simon has kindly sent to me for examination, the specimen, which he identified as *B. Herbstii*, Thorell, is the male of *B. Gervaisii*.

In connexion with *B. Herbstii* of Simon, I ventured to suggest (Ann. & Mag. Nat. Hist. (6) xii. p. 79, 1893) that in the description of the first caudal segment the word *dessus* might prove to be a misprint for *dessous*. An examination of an actual specimen establishes the correctness of the supposition.

Broteas granimanus, sp. n.

Colour.—Body, palpi, and tail nearly black; vesicle and legs blackish brown.

Carapace covered with close-set scale-like granules, finer on the interocular triangle.

Tergites coarsely coriaceous and beset with granules in their posterior half; the last more coarsely granular than the others, its keels represented by a few granules.

Sternites mesially polished, finely punctulate, granular external to the stigma, the last smooth in the middle, granular at the sides.

Tail rather more than four times as long as the carapace; first segment punctured below in the middle, the median keels obsolete; the rest of the keels and the intercarinal spaces granular; vesicle serially granular below and at the sides, smooth and punctured above, as wide as or slightly narrower than fifth caudal segment.

Palpi granular above and below, less coarsely below than above; hand closely granular throughout; length of hand-back less than width of hand; movable digit a little shorter than carapace.

Legs externally granular.

Pectinal teeth 11–12.

Measurements in millimetres.—Total length 57, of carapace 8, of tail 35.

Loc. Upper Surinam River, Dutch Guiana (*C. W. Ellacombe*).

The males of this species differ from the males of all the species known to me in having the uppersides of the hands covered with bead-like granules.

Broteas subgranosus, sp. n.

Broteas Herbstii, Thor., Pocock, Ann. & Mag. Nat. Hist. (6) xii. p. 79 (1893); id. *op. cit.* (6) xix. p. 367 (? *B. Herbstii*, Thorell).

Closely related to *B. granimanus*, but with legs, vesicle, and

palpi paler reddish brown; much less distinctly granular, the tergites in the female densely punctured, in the male coarsely coriaceous or very finely and closely granular; granulation of carapace not extending on to interocular triangle, which is coriaceous. Lower surface of first caudal segment granular, the median keels granular.

Palpi substantially as in *granimanus*, but upperside of hand in both sexes densely punctured, not granular.

Pectinal teeth 9-10 (♂), 7-8 (♀).

Measurements in millimetres.—Total length 50, of carapace 7, of tail 32.

Loc. British Guiana (*W. L. Slater*, type); Vryheids Lust, Demerara (*Turner*).

The characters of the species, of which I have examined the types, may be summarized as follows:—

- a. Pectines narrow, width of shaft at base less than half its length; four inferior keels on first and second caudal segments absent, very weak on the third; intercarinal spaces of caudal segments 1-4 smooth, not granular; abdominal terga smooth, the keels of the seventh represented by four tubercles, one for each keel; sterna smooth and polished, finely punctulate at the sides; carapace not granular, at most rugose, with close-set punctuation; upperside of humerus of palp scarcely visibly granular; pectinal teeth 11 *paraensis*, Sim., ♀.
- b. Pectines broad at the base, the width of the shaft more than half the length at least in ♀; second caudal segment with four inferior keels, first usually with four, but the medians sometimes obsolete; intercarinal spaces of caudal segments 1-4 always more or less granular, except the lower surface of the first, which may be nearly smooth (*Gervaisii*); terga and carapace always more or less granular, the crests on the seventh represented by a series of coarse granules or small tubercles; upperside of humerus visibly granular.
 - a¹. Carapace and terga coarsely and uniformly granular throughout, though the granules are a little smaller on the anterior portion of the terga; abdominal sterna coarsely punctured throughout, the fifth granular throughout; anteocular portion of carapace strongly sloped, at least to the same extent as in *Teuthraustes*; tail coarsely and closely granular throughout, the inferior median keels of the first not traceable amongst the granules; hand punctured, not granular; pectinal teeth 7 *granulatus*, Sim., ♀.

- b*¹. Carapace and terga much less coarsely and closely granular, granulation not extending on to the anterior portion of the terga, and only rarely (*granimanus*) on to the anteocular area of the carapace; sterna not coarsely punctured throughout, the fifth not mesially granular.
- a*². Upperside of hand entirely covered with close-set granules; anteocular portion of carapace distinctly though finely granular, lower surface of first caudal segment mesially almost smooth, with weak median keels; pectinal teeth 11-12 *granimanus*, sp. n., ♂.
- b*². Upperside of hand not granular, smooth, but closely punctulate; anteocular portion of carapace rugose, but scarcely granular.
- a*³. Inferior surface of first caudal segment smooth or nearly so, the median keels weak, not granular, punctured; pectinal teeth 8 (♀), 10 (♂) *Gervaisii*, Poc., ♂ ♀.
- b*³. Inferior surface of first caudal segment distinctly granular, the median keels strong and granular. *subgranosus*, sp. n., ♂ ♀.

The following four species, which are unknown to me in nature, may be referable to either or neither of the foregoing:—

Broteas maurus, De Geer.

Scorpio maurus, Linn., De Geer, Mém. &c. vii. p. 337, pl. xl. figs. 1-8, 1778.

Loc. America.

Broteas maurus, Herbst.

Scorpio maurus, Linn., Herbst, Nat. ungeflügelt. Insekten, pt. iv. p. 52, pl. vi. fig. 4.

Loc. Africa.

Broteas Herbstii, Thorell.

Brotheas maurus, Linn., C. Koch, Die Arachniden, iv. p. 109, fig. 319 (1838) (not *Scorpio maurus*, Linn.).

Broteas Herbstii, Thorell, Ann. & Mag. Nat. Hist. (4) xvii. p. 14 (1876).

Loc. Cayenne (French Guiana).

Dr. Thorell applied the name *Herbstii* to the species wrongly identified as *Scorpio maurus* by De Geer and later writers, including Herbst, Gervais, C. Koch, &c., without considering the possibility of more than one species being involved. I have consequently suggested (Ann. & Mag. Nat. Hist. (6) xix. p. 367) that the name be applied to the

species from Cayenne which C. Koch determined as *maurus*, and made the type of the genus *Broteas*.

Since the species from British Guiana which I have hitherto regarded as *Herbstii* is not specifically identical with the one referred to *Herbstii* by M. Simon, and since I am not able to say which of the two species, if indeed either, is identical with what I consider to be the true *Herbstii*, it appears to me that the least harmful course to follow in the matter will be to give a new name to the British Guiana form pending an examination of the type that C. Koch had before him. In such doubtful cases as these I am convinced that it is better to give a new name to a species than a wrong one.

Broteas Alleni (Wood).

Scorpio Alleni, Wood, J. Ac. Sci. Philad. (2) v. p. 360 (1863).

According to Dr. Marx (Proc. Ent. Soc. Washington, i. p. 91, 1888) this species is identical with *Broteas Herbstii*, Thorell; but since neither Dr. Marx nor anyone else appears to know exactly what *Broteas Herbstii* of Thorell is, the statement has no very great value except in so far as it is possible to conclude from it that the *Scorpio Alleni* of Wood belongs to the genus *Broteas*. Lastly, since the locality assigned to the species is Lower California, it is to my mind in the highest degree improbable that *Alleni* is identical with any of the South-American species mentioned above.

XV.—Notes from the Gatty Marine Laboratory, St. Andrews.—
No. XIX. By Prof. M'INTOSH, M.D., LL.D., F.R.S.

[Plate II.]

1. On some Larval Stages of *Clione limacina*, Phips.
2. On *Bipinnaria asterigera*, M. Sars (Larval Stage of *Luidia*).
3. On *Lepidonotus Wahlbergi*, Knbg., and its Relation to *L. clava*, Mont.
4. On *Sigalion squamatum*, Delle Chiaje, and its Relationships with *S. Mathildæ*, Aud. & Ed., and *S. Buskii*, McL.
5. The Nemerteans in British Text-books of Zoology.

1. On the Larval Stages of *Clione limacina*, Phips.

IN the Ann. & Mag. Nat. Hist. for August 1887 a note on the occurrence of specimens of this species in St. Andrews Bay is recorded, and they have since been found both there

and in the Forth—generally in the bottom-net by day, for it is curious that none have yet been obtained in the surface-nets at night. Besides the points already mentioned, it may be stated that the labial tentacles were pale and the odontophore, which often projected outwards, was yellowish. The adult *Clione* of our shores would appear to be much smaller than that of the Arctic Ocean, for the largest obtained were only about 10 or 12 millim. In regard to the occurrence of an example at Falmouth, Pelsener* seems to think this remarkable, from its southern position. Boas† also is of opinion that it is mainly limited to the Arctic seas, though examples have been found at Portland, Maine, by Gould, and on the west coast of Norway by Sars.

Though Hermann Fol's beautiful memoir‡ on the development of the Pteropoda includes *Clione aurantiaca*, yet he does not give the intermediate stages between the shell-bearing period and that with the lateral fins, and the shape of this species differs considerably. The early stages of *Clione limacina*, indeed, seem to have been rarely met with, for Pelsener§ adds little to the descriptions of Boas||, and yet the latter figures only a stage in which the lateral fins are present with the three rings of cilia.

On the 3rd of November, 1897, several examples of a larval mollusk (Pl. II. fig. 1) were captured in the bottom-nets. Each showed a head-segment with a ring of cilia (non-continuous) in front of the odontophore, a large median region of the body with a central ring of cilia, and a median (alimentary) region with many yolk-globules, and, lastly, a ring of cilia posteriorly, with the pygidium behind. In the figure the oocyst is indicated. In another example (Pl. II. fig. 2) a row of large globules (yolk?) occurred in front of the median ring of cilia, the size, regularity, and refraction of which were striking features. In these specimens the epidermis is clearly differentiated from the deeper layers. The odontophore and the teeth of the lateral sacs are shown in Pl. II. fig. 7. The teeth at this stage of development seem to be incomplete, as no median series is present. The lateral eversible sacs, however, have a formidable armature. These young larvæ were evidently the product of eggs discharged by adults in the neighbourhood.

As the mollusk grows older the body becomes more elon-

* Pteropoda of the 'Challenger,' p. 47 (1887).

† "Spolia Atlantica."

‡ Archiv. Zool. Expér. iv. (1875).

§ Pteropoda of the 'Challenger,' p. 47 (1887).

|| "Spolia Atlantica," Vidensk. Selsk. Skr. Kiøbenhavn, 1886.

gated (Pl. II. fig. 3), and the prominent median lobe of the foot appears behind the cephalic region.

Somewhat later, viz. on the 18th February, 1898, two other stages, apparently of the same form, occurred. The younger has a bifid snout, a cephalic, a median, and a terminal ring of cilia (Pl. II. fig. 4). Each half of the bifid snout is rounded and flattened, with palpcils at the tip. From the dorsal surface the outline is quite symmetrical, but when viewed laterally (Pl. II. fig. 5) a lamellar process on each side and behind these an awl-shaped process like a tentacle are apparent. Such probably represent the median and lateral lobes of the foot. The epipodia are not yet visible. The central region is opaque whitish.

In the same net on the latter date a further stage (Pl. II. fig. 6) was met with. It measured 1.257 millim. in length and had a pinkish streak in the centre. The lateral fins were now fairly developed, so that they were useful to the animal in swimming, while the median and posterior rings of cilia were still present. When the proboscis was evaginated the radula formed a bluntly conical hispid process, and the widely diverging hook-sacs ("jaws" of Eschricht, *olim* "fore foot" of Ray Lankester) occupied each lateral region. The slightly curved spinigerous processes of all these organs projected freely, and even at this early stage seemed to be well adapted for a predaceous existence.

2. On *Bipinnaria asterigera*, M. Sars (*Larval Stage of Luidia*), at St. Andrews.

In his 'Beskrivelser og Iagttagelser' the able Norwegian naturalist Michael Sars presented in 1834 a series of rare and remarkable animals from the waters adjoining Florøe, where he then resided. Amongst forms ranging from polyps to chordates there was none more novel than the larval starfish which he describes and figures under the above name*. He characterizes the genus as having a long, cylindrical, flattened body, with two pinnæ—one posterior, cordate in shape, and another, somewhat triangular, in the middle of the body. The mouth is surrounded by a series of lanceolate appendages or arms. He distinguishes the species by the fact that there are twelve arms. His figures show a somewhat more elongated outline and narrower arms than the form at St. Andrews. Sars procured his examples in the month of May amidst other pelagic organisms such as Medusæ.

Koren and Danielssen †, in October 1846, had the good

* *Op. cit.* p. 37, pl. xv. figs. 40 a-d.

† *Ann. d. Sc. nat.* 3^e sér. vii. p. 347, pl. vii. figs. 7-9.

fortune to meet with many examples amongst hordes of *Salpæ* which appeared in the harbour of Bergen, and they made advances on the observations of Sars, especially in regard to the relationship of the asterid to its pelagic apparatus. Their specimens did not quite reach the length of the examples of Sars, being 30 millim. long. They pointed out the lancet-like anterior region for swimming and the arrangement of the arms, which they termed tentacles, and they noticed that when swimming they were continually agitated. They also described circular and longitudinal muscles under the integument of the *Bipinnaria*. Their figures represent nearly the same stage as those procured by Sars, J. Müller, and those from St. Andrews, though the figure of the entire form is too small for minute criticism. The enlarged region with the arms is carefully represented.

Johannes Müller next published a careful account with figures of a similar form from Helsingör and Marseilles, aided by specimens from Norway, and originally transmitted by Danielssen, who, along with Koren, again alluded to the larva in the 'Fauna Littoralis Norvegiæ'*

Younger forms of a *Bipinnaria* without the larval starfish were procured by Mr. Garstang † off Plymouth, and he gives a minute account of the structure, with two excellent figures. The stage represented is a comparatively early one—intermediate, as he says, between that of the *Bipinnaria* of Sars and the ordinary one of *Asterias*. The size, about 3 millim., shows that its development was far from being complete, and if we add the fin-like expansions to the anterior end of the preoral lobe and to the sides of its median fin, together with the grouping of the arms around the larval starfish in the later stages, the resemblance, generically at any rate, is complete.

The structure of the same larva was utilized by Mr. H. Bury ‡ in his important paper on the morphology of Echinoderms. His specimens came from Naples and Messina, and in the earlier stages seem to differ in the form of the preoral lobe, to judge from the figure §.

In St. Andrews Bay, on the 30th September, 1896, a form closely allied (Pl. II. figs. 8, 9), if not identical with, the foregoing was procured in the bottom-net in 5-6 fathoms about half a mile from the pier, along with various larval starfishes and young swimming crabs. A west wind had succeeded

* Part II.

† Quart. Journ. Micr. Sci. xxxv. p. 451, pl. xxviii. (1894).

‡ Quart. Journ. Micr. Sci. vol. xxxviii., n. s.

§ *Op. cit.* pl. v. fig. 18.

a stormy period of E. and N.E. winds. In size they were about 13 or 14 millim. long, and thus were much smaller than the examples of Sars, which reached about 34 millim. The long diaphanous preoral lobe was in several curved towards the central fin, so as to bring the attached starfish near the latter. The preoral lobe widened abruptly at the body posteriorly, the longitudinal grooves contracting and bending over, with prominent, frilled, slightly tinted processes, to join the grooves on the arms. The *Bipinnaria* is narrowed towards the attached *Luidia*, which is fixed to it by the ochre-coloured gullet and intestine, and bends towards the frills. The ridges and grooves on the arms are continuous with the longitudinal ridges and grooves on the preoral lobe (Pl. II. fig. 10). None of the examples were quite perfect, but ten or eleven arms were visible, so that in all probability there were twelve, as in the examples from Norway. These organs are delicate, and occasionally portions of the tip were constricted off. The margins of the grooves on each arm are thickened throughout, and the tissue is corrugated and granular, as in the ordinary *Bipinnaria*.

The preoral lobe is contractile and often shows numerous closely arranged transverse wrinkles on the convex side (Pl. II. fig. 10), which alter as waves of contraction pass to and fro over it. Previous authors, indeed, describe circular and longitudinal muscular fibres in its wall. The latter is minutely areolar and granular. Of the two ridges on the preoral lobe one passes up each side of the median fin, the other on each side extending to the tip anteriorly, which forms a fan-shaped expansion with two lateral flaps, the lobe tapering off and forming a somewhat pointed axis, with a slight enlargement within the tip in the centre of the fin-like structure. The median fin has a similar structure, the central axis, however, being larger in proportion. No movement of contained fluid or corpuscles was visible in the enterocœle of the preoral lobe, which disintegrated from the front*.

The young starfish (*Luidia*) had reached an advanced stage and appeared to be nearly ready for separation. Groups of granules moved to and fro in the tube-feet, which had thickened cushion at the rounded tips. The paxillæ were

* Dr. E. Metschnikoff (Q. J. Micros. Sc., n. s. vol. xxiv. p. 96, 1884) likewise noticed the tips of the arms breaking off. Besides observing the morphogenetic functions of the wandering cells of the mesoderm (which give rise to the cutis, the skeletal structures, and the oral musculature), he found they had the power of acting on the spherules of milk which he had injected. The rapid disappearance of the parts of the *Bipinnaria* is probably due to the same agency.

visible under a lens in all the specimens. Fragments of the carapace of copepods adhered to the tube-feet, apparently after digestion.

This remarkable *Bipinnaria* has thus been procured in various European waters, from Norway to the Mediterranean. The earlier stages would seem to occur in August and the later in September and October. The development of the lateral webs on the median and terminal fins would appear to occur as the *Bipinnaria* increases in age and size. There is considerable variety, indeed, in regard to the shape of the terminal fin, some being simply notched, while others are broadly lobate. Mr. Bury * informs me he was led by the remarks of Sig. Lo Bianco at Naples to associate the larval starfish with *Luidia*, a conclusion fully borne out by an examination of the specimens at St. Andrews, even before the literature was consulted.

The adults of both *Luidia ciliaris*, Johnst., and *L. Sarsi*, Düb. & Kor., occur off St. Andrews Bay, the former east of the Isle of May and the latter near the Bell Rock. The ovaries of *L. Savignii* are nearly ripe in the beginning of July, forming arborescent organs dichotomously divided and of a rich orange inclining to red. Perfect specimens are obtained on the fishing-grounds by at once dropping them from the hooks into strong spirit.

3. On *Lepidonotus Wahlbergi*, Kinberg, and its Relation to *L. clava*, Montagu.

Kinberg, in 1858, gave a recognizable account, with figures, of a *Lepidonotus* from the Cape and Port Natal, under the above specific name. Amongst other distinctive characters he alluded to the tuberculated scales which had smooth edges. His figures of the dorsal and ventral bristles differed from those of any other species, the former having moderately elongated tips, with numerous rows of spikes and a sharp point, and the latter a proportionally longer tip with a longer row of spikes than in *Lepidonotus clava*, Mont. Kinberg pointed out that his species was probably in part the *Aphrodita squamata* of Pallas, who conjoined the European form as figured by Baster with the foregoing.

The same form was procured by the 'Challenger' at Sea Point, near Cape Town, and it is described in the volume devoted to the Annelids. It is possible that Schmarda's

* I am indebted to Mr. Bury for references to various communications on the subject.

Polynoë trochiscophora may be the same form, but, as stated in the 'Challenger' volume, the vagueness of the description and figures left room for doubt. Into the details of the description it is unnecessary to enter fully, but instead of the palpi being smooth, as Kinberg had said, they are densely papillose. The first pair of scales are closely covered with prominent chitinous spines, which in the scales immediately succeeding become shorter, and then the rest are tuberculated—that is, the spines become transformed into solid processes. There are also various smaller spines, some of which are hispid. The structure of the dorsal and ventral bristles was carefully figured. The shorter stiffer examples are females laden with ova, the longer forms males. Moreover the segmental (nephridial) papillæ are longer in the males, a feature best seen posteriorly. In the female they are tulip-shaped, with about four lobes surrounding the central cavity at the tip.

A comparison with *Lepidonotus clava*, Mont., during the preparation of the 'Challenger' Report showed the essential differences. Yet it has often been pointed out that previous authors occasionally left descriptions from which all the vital characters had been omitted, and gave no figures or inadequate ones. Hence their successors were often sorely puzzled to identify the forms described, and could not avoid errors which only a reference to the original specimen could have prevented. When therefore it was found that Baron de Saint-Joseph, in a paper just published, had included as a synonym under *Lepidonotus clava*, Mont., *Lepidonotus Wahlbergi* as described by Kinberg, myself, and Malaquin, a review of these forms was made, fortunately with the actual specimens in hand.

Baron de Saint-Joseph gives as his main reasons for joining the British and the South-African species that the figure of the scale in the 'Challenger' volume exactly agrees with that of *Lepidonotus clava*, and that in the same work it has been shown that the palpi are papillose, a feature also characteristic of *L. clava*.

Now, in the first place, accurate figures of the entire dorsum, of the scale, of the dorsal and ventral bristles, with the description, were at the disposal of the French author. In the drawing of the dorsum* every scale has numerous large tubercles, quite visible with the unaided eye and in the preparations under a lens, whereas in *Lepidonotus clava* only the first four scales are furnished with these large processes, the

* 'Challenger,' xii. pl. xi. fig. 1.

rest having them so reduced in size as to appear for the most part smooth. Such a scale when enlarged (as in the figure * alluded to by Baron de Saint-Joseph) could only be compared with an anterior scale of *L. clava*, yet it was an average one of *L. Wahlbergi*. Further, the minute structure of each quite diverges. In *L. Wahlbergi* several of the anterior scales are hispid, with prominent acute spines (Pl. II. fig. 11), the tips of which are minutely nodular, so that the surface in some views presents a somewhat areolar or "scaled" appearance, resembling that of the tissue of the scale itself, and which enters the base of the spine. Moreover, the nodular tip is slightly bent. On the other hand, the truncated capstan-like tubercle characteristic of the first scale of *L. clava* has its terminal "boss" minutely and somewhat regularly nodular, the tip of each process having a spine (Pl. II. fig. 12). When viewed from above the rim of the "boss" is thus minutely hispid. A glance at the respective figures in Pl. II. will indicate the essential differences better than any description, and they are drawn precisely to the same scale. The arrangement and structure of the other papillæ on each scale also diverges. It has been frequently observed that where allied forms differ from each other specifically, the bristles, as well as the minute structure of the scales, differ. Accordingly it is found that the dorsal bristles of *L. Wahlbergi* have a stouter tip, with a definite curve, and much less elongated and tapered than in *L. clava*. The ventral bristles again have a more elongated tip, with a longer row of spinous ridges. From point to point therefore the European and South-African forms diverge, even the scales in the latter being distinctly smaller.

Baron de Saint-Joseph has the credit of first publishing the description of the minute structure of the anterior scales of *Lepidonotus clava*, though the term scales ("écailles") applied to the hispid tips is apt to mislead. I am in doubt also about their special sensory function. His figure (pl. xiii. fig. 4 †) of one of the smaller processes of course differs from the condition in the larger capstan-like tubercles. The smaller tubercles are simply hispid, with tapering chitinous spines which are proportionally larger than in the prominent tubercles.

* *Ibid.* pl. xviii. fig. 8.

† *Op. cit.*

4. On *Sigalion squamatum*, Delle Chiaje, and its Relationships with *S. Mathildæ*, Aud. & Ed., and *S. Buskii*, M'Intosh.

In his recent valuable papers on the Annelids of the shores of France *S. squamatum* of Delle Chiaje * has been confused by Baron de Saint-Joseph with *S. Mathildæ*, Audouin and Milne-Edwards. Thus in the "Annélides Polychètes des Côtes de Dinard" †, under the title of *Sigalion squamatum*, D. Ch., De Saint-Joseph gives descriptions and figures applicable to *S. Mathildæ*, Aud. & Ed. A glance at figure 27, pl. xii., of this paper would alone be conclusive, since the papilla on the dorsal edge of the ventral division of the foot is characteristic of *S. Mathildæ* and is absent in *S. squamatum*. He also points out the agreement of the pinnate papillæ of the edges of the scales with those figured by Claparède, and this is fortunate, as his own figure ‡ of these is diagrammatic, though he correctly observes that the pinnæ are about twenty in number (Pl. II. fig. 14) on each side, a feature wholly at variance with the condition in *S. squamatum*, D. Ch., which has about eight pinnæ of quite a different shape on each side (Pl. II. fig. 13). The characteristic curve of the main nerve-branch and the arrangement of its twigs to the pinnate papillæ, as shown by Claparède, meets with De Saint-Joseph's approval. It is interesting that in this respect *S. Mathildæ* differs from *S. squamatum*. He gives but two "coussinets vibratiles" (ctenidia), whereas three occur both in this species and in *S. squamatum*. The short papilla on the upper border of the ventral division of the foot is diagnostic of *S. Mathildæ*. The bristles of the two species are as characteristic as are the pinnate processes of the scales, for the stouter bifid forms of the ventral division of the foot with but a single bifid terminal appendage are absent in *S. Mathildæ*. In his more recent paper on the "Annélides Polychètes des Côtes de France" § he inserts *S. Mathildæ*, Aud. & Ed., as a synonym of *Sigalion squamatum*, Delle Chiaje, and makes certain "additions and modifications" to his former account. Amongst these is the remarkable statement and accompanying figure to the effect that the dorsal bristles are bifid at the tip under a power of 465 diam. These finely tapered serrated bristles end in a simple hair-like point as in

* Descriz. e not. v. pp. 58 and 107, tav. xxvi. figs. 3, 11, and 12.

† Ann. d. Sc. nat. 7^e, sér. xx. p. 203 (1895).

‡ Pl. xi. fig. 21.

§ Ann. d. sc. nat. 8^e, sér. v. p. 239 (1897).

allied forms. The author has apparently been deceived by a broken example, for such a condition as he figures is at variance with the morphology of the group as well as experience, though occasionally the shorter forms at the internal edge of the tuft show such a condition from injury. He rightly describes the superior group of the ventral bristles with the tapering tips and whorled spines, though his figures of this and the other forms are indefinite. While he gives a correct account of the forms with a single terminal (bifid) appendage which commence the inferior group of ventral bristles, he omits to show the essential differences in the structure of the bristles immediately above the spine of the ventral division of the foot in the two species. In *S. squamatum*, D. Ch., the process for the spine projects more prominently, and above it, besides the stronger forms with the ends of the shafts closely serrated, there are several stout bristles with a single terminal (bifid) appendage. In *S. Mathilde*, besides the presence of the dorsal papillæ on the inferior division of the foot, the tip differs in outline, being obliquely truncate. Moreover all the bristles above the spine have slender, articulated, tapering tips, minutely bifid. Both species have four eyes, so that no weight is to be placed on their absence in indifferent preparations.

It is not remarkable that the acute and accomplished Claparède *, who worked at Naples, should have been puzzled by the form actually meant by Delle Chiaje, for in the descriptions of the latter author there is nothing definite, and certainly his peculiar figure of the pinnate processes of the scales might pass for either species, so that the blame does not really rest with the author first mentioned. It is the inaccurate figure in most cases which has been so disastrous in the history of the Annelids, and the failure to give in a few words the vital points of distinction. *S. squamatum* is a larger species than *S. Mathilde*, which Claparède appears to have had before him when making his descriptions and figures. The curve of the great nerve-cord to the outer edge of the scale, its size, and the thickness and brevity of the large branches to the pinnate papillæ, without reference to the other points, make it clear that it was not *S. squamatum*, D. Ch., but *S. Mathilde*, Aud. & Ed., that the Swiss author described.

While therefore there can be no dubiety between *S. squamatum*, Delle Chiaje, and *S. Mathilde*, Aud. & Ed., there

* Annél. Chét. Nap. p. 100, pl. iii. fig. 3, and *ibid.* Suppl. p. 20, pl. ii. fig. 3.

yet remains the closely allied and nearly as large *Sigalion* (?) *Buskii*, McL.*, procured by Dr. Gwyn Jeffreys in Shetland, with which to contrast the Italian author's species. Neither the northern habitat (for only a single example has yet been procured) nor the absence of eyes in this deep-water form is of essential value. The head, however, differs in being proportionally larger and more ovoid, and without the posterior narrowing of *S. squamatum*. Instead of the two lateral minute tentacles (like papillæ) only a single small median one occurs in this form, a remarkable condition in the genus. The scales in *S. Buskii*, as a rule, have the transverse diameter shorter than in *S. squamatum*, and the pinnate papillæ along the outer edge have no constriction at the base and taper more distinctly towards the tip (Pl. II. fig. 15), being somewhat lanceolate, to the number of ten or twelve on each side in the largest. The simple papillæ along the outer and posterior edge of the scale at the bases of the foregoing are shorter and more numerous. Moreover the central granular region above the stem is more distinctly expanded than in the Neapolitan form. Occasionally a pair of pinnae on opposite sides of the stem branch into two or three points. The pinnae of the papillæ of *S. squamatum* are fewer in number and have a slightly fusiform or lobate shape, that is with a tendency to constriction at the base, and they are also, as a rule, fewer in number than in *S. Buskii*, six being common. Very little dilatation of the axis occurs above the bare stem, which is generally longer than in *S. Buskii*. The nerve-strand to the pinnate papillæ of the scales is somewhat more distinctly curved than in *S. squamatum*, and the secondary twigs to the stems are shorter. The foot in *S. squamatum* is slightly larger as a whole than in *S. Buskii* and the ventral cirrus longer and more tapered. The dorsal lobe has a much longer terminal papilla (cestode), and the bristles are longer and apparently, judging from the preparation, more delicate. The ventral lobe of the foot is similar to that of *S. Buskii*, though in the latter the stronger series at the upper edge of the lowest group have a longer terminal process (bifid) than in *S. squamatum*. The Italian specimens, apparently from their mode of preparation, had their bristles considerably injured, so that an accurate comparison in every detail could not be carried out. The two species *S. squamatum* and *S. (?) Buskii* certainly approach each other much more than do the former and *S. Mathildæ*; but there are sufficient reasons for separating them, as the descriptions and figures show.

* Trans. R. S. E. xxv. 3, p. 409, pl. xii. fig. 12, and Trans. Z. S. ix. 7, p. 391, pl. lxx. fig. 14.

5. *The Nemerteans in British Text-books of Zoology.*

To those familiar with the Schnurwürmer (Nemertini) of Gustav von Hayek's 'Handbuch der Zoologie'* in the "seventies," the treatment of the group in most books of zoology intended for instruction and reference in our country, in or bordering on the "nineties," offers a subject for comment. Indeed, after a perusal of some recent works (especially certain university practical ones) and their illustrations, the experienced reader arises with a hazy notion as to whether he has not again mentally visited the period when CErsted described the proboscidian sheath as "canalis in quo penis est" and the views of Della Chiaje, Johnston, Leuckart, Dugès, De Quatrefages, Huschke, De Blainville, Blanchard, Grube, Gaimard, Kölliker, Williams, J. P. Van Beneden, Max Schultze, Claparède, Keferstein, Marion, and others held the field in perplexing variety. Observers so accurate as Kölliker, Frey, and Leuckart, and especially Keferstein, might well marvel, or have marvelled, at the plight of the group in Britain in the year 1898. They would have considered that to the writers of these books English was little known, and that they were unaware of the correct anatomy of the group—in regard to the structure of the body-wall, the relations of the nerves to the muscular layers, the minute anatomy of the proboscis and its sheath, the digestive and circulatory systems, and other features—as first clearly described (and as it now remains) in their own country. They would be surprised to find illustrations after Max Schultze, who, however, did valuable work on some points, installed as the model from which the young anatomist is to learn the general structure. For instance, such figures give expression to the erroneous view that the terminal ribands of the proboscis are attached to the body-wall. The stylet-region of the organ appears to be composed of disconnected fragments, and, it may be, the tube overrides the commissures of the ganglia instead of going between them, while the circulatory and excretory organs are much behind date. Other figures carry the proboscis-sheath forward to the tip of the snout, though it is not clearly explained how the proboscis is to hang on to its owner. Another, by a bolder flight, even makes the aperture for the proboscis the mouth. In displaying the structure of this remarkable organ (quite unnecessarily called "introvert" or, it may be, "the hollow eversible anterior end of the animal") nature is eschewed, and by a series of mechanical diagrams,

* Wien, 1877.

one of which closely resembles a cricket-bat, the student is confused, not instructed. Those familiar with the anatomy of the Nemerteans would fail to recognize any resemblance to the beautiful organs they misrepresent. Some recent authors have apparently been so impressed with descriptions (*sui generis*) of the mechanics of the proboscis, that they have barely alluded to the digestive system, and omit to point out the crucial point in regard to the opening of the mouth respectively in the Enopla and the Anopla—one of the most striking features in classification. Perhaps by-and-by a remark is made that the opening of the mouth is *beneath* or behind the ganglia, or that the ventral commissure of the ganglia lies between the proboscidian sheath and the œsophagus; but neither is a complete statement for the group. While it may be interesting to go into the suppositions that the proboscis is the “hypophysis cerebri” and its sheath the “notochord,” it is well, if not better, to emphasize facts about which there can be no dubiety.

The figures employed to illustrate structure are perhaps the most clamant feature. Mere inversion of a figure (which occurs) is not so serious as some other cases, since it has perhaps the correct parts somewhere. A figure copied from Prof. Hubrecht is perplexing. It shows the proboscis extruded, but its internal attachment is the cerebral commissures, whilst the proboscidian sheath has wholly disappeared. One of the same author's schematic figures does duty for the proboscis *in situ* and is at variance with nature. The very indifferent and, in some respects, inaccurate representation of the stylet-region in its normal position in the body and in extrusion may be contrasted with Hayek's figs. 558 and 559 with advantage. A retrograde step to the period alluded to in the opening paragraph has generally been made. One author, who copies the accurate figure, does not acknowledge its authorship, and, inspired by continental works, is unaware that the observations quoted are those of a countryman.

Prof. Hubrecht's diagram of the anterior end of a Nemertean, showing the attachment of the proboscidian sheath near the commissures, is less instructive than the older figure shown by Hayek (fig. 556), and, besides, the reader is left to infer that the position of the mouth shown is typical for all Nemerteans, instead of being informed that it only stands for the Anopla. For the general structure of a Nemertean Prof. Moseley's *Pelagonemertes* is used; yet this somewhat aberrant type is scarcely suited for such a purpose, even if it had always been correctly copied, which it is not, for the

proboscidian sheath, which is shown in Hubrecht's figure, has been omitted, to the confusion of the student.

Besides the foregoing, the text-books omit reference to the lateral vessels of the proboscidian sheath in certain forms, the remarkable structure of the proboscis of the various groups in section, the acid reaction of the skin in many, and other points. The assertion that the proboscis is clearly an offensive organ, on the faith of the problematical "nematocysts," while nothing is said as to its being so readily thrown off and so slowly regenerated, requires modification. That the Nemerteans "extract" tubicolous worms by this organ is a statement in need of confirmation, especially in view of Prof. Hubrecht's notion of the "large amount of nervous tissue in its walls." So far as my experience goes, the tubicolous worm would more readily "extract" the proboscis. The statement (after Hubrecht) that the albuminoid material embedding all the layers of the body is of the nature of the jelly of *Medusæ* demands a dissenting note, as also the remark that the small specimens swim freely. What of *Cerebratulus angulatus*, a yard long and an inch broad? No fish more deftly cleaves the water. The remark that the central stylet of the proboscis is either pointed or serrate is too indefinite, though perhaps less in error than that clause which asserts that the aperture for the proboscis is close to the mouth. Even for the *Euopla* the latter will not hold, while for the three groups of the *Anopla* it is wholly at variance with fact.

In changing systems of classification it is usual to give reasons for laying aside those already established, *e. g.* either the prevalence of error or the advance of discovery which upsets the foundation on which the older superstructure was raised. In the case of the Nemerteans neither the one nor the other has a substantial basis. The essential anatomical features on which the classification of 1869 and 1873 was based remain to-day as they were then. Yet we have had the run of Prof. Hubrecht's *Palæonemertes*, *Schizonemertes*, and *Hoploneemertes*, to the confusion of the student; and now Dr. Bürger's *Protonemertini*, *Mesonemertini*, *Metanemertini*, and *Heteronemertini*, by way of ringing new changes, sweep the former out of sight. It is immaterial, for there is little to choose between them. Both simply give new and complex names to the same groups which were formed on structural grounds in 1869, and every anatomical fact of primary importance in which remains unassailed to-day. There is no need to alter either figure or description now. Yet it seems to be necessary for all these old facts to be incorporated more

than a quarter of a century afterwards (it may be with a new and imposing title) in foreign papers before they can be utilized by the modern text-book in our country. With all deference to my friend Prof. Hubrecht and to Dr. Bürger and other able observers, I see no valid reason for altering the old, yet simple and satisfactory, classification indicated by Dr. George Johnston and used by Max Schultze, resting securely, as it does, on structural foundations. No student can misunderstand the fact that the proboscis of the Nemerteans is either armed (*Enopla*) or unarmed (*Anopla*). None will mistake those which fall under the first group. Under the second group are three great divisions (be they suborders or families is immaterial), viz. the *Lineidæ*, *Carinellidæ*, and *Cephalotrichidæ*, and as each bears the name of its type, the arrangement also has the merit of simplicity and perspicuity. When systems of classification rest on data that are unsound or are liable to be misunderstood, few will gainsay the propriety of making a change; but when new and confusing names simply cover the old yet unassailable facts, the process seems to be both unnecessary and perplexing, as well as one that tends in no way to the advancement of zoology.

EXPLANATION OF PLATE II.

- Fig. 1.* Larval *Clione*, with three rings of cilia, armature of odontophore and lateral sacs, and an otocyst. 3rd Nov., 1897. $\times 50$.
- Fig. 2.* A younger form of the same species, with a row of globules in front of the median ciliated ring. 3rd Nov., 1897. $\times 50$.
- Fig. 3.* A somewhat older and more elongated form of same date. $\times 50$.
- Fig. 4.* A more advanced stage of the same species with bifid anterior region. 18th Feb., 1898. $\times 60$.
- Fig. 5.* The same viewed laterally so as to show the middle and posterior lobes of the foot, *a* and *b*. $\times 60$.
- Fig. 6.* An older example of *Clione limacina* with lateral fins. $\times 40$.
- Fig. 7.* Teeth of the odontophore and lateral sacs *in situ* of fig. 1 (3rd Nov., 1897) under compression. In nature they were placed widely apart, but the blank has been omitted to save space. $\times 250$.
- Fig. 8.* *Bipinnaria asterigera*, Sars, showing the asterid from the side, with the gullet and intestine passing to the *Bipinnaria*. The ridges and grooves of the preoral lobe are fairly evident. Enlarged under a lens.
- Fig. 9.* View of another example exhibiting the ambulacral feet of the asterid. Similarly enlarged.
- Fig. 10.* Specimen having a more complete series of arms and ciliated ridges. Enlarged under a lens.
- Fig. 11.* Acute spine from the first scale of *Lepidonotus Wahlbergi*, Kbg. $\times 230$.
- Fig. 12.* Capstan-like tubercle—minutely spinous—from the first scale of *Lepidonotus clava*, Mont. $\times 230$.

- Fig. 13. Pinnate papilla from the scale of *Sigalion squamatum*, Delle Chiaje. $\times 150$.
 Fig. 14. Pinnate papilla from the edge of the scale of *Sigalion Mathilde*, Aud. & Ed. $\times 200$.
 Fig. 15. Pinnate papilla from the scale of *Sigalion* (?) *Buskii*, McL. $\times 150$ diam.

XVI.—*The Sarcostyles of the Plumularidæ.*
 By C. C. NUTTING*.

THERE is no little confusion regarding the nomenclature involved in morphological discussions concerning the Hydroida, and nowhere is this fact more evident than in connexion with certain interesting structures found in the Plumularidæ and variously called nematophores, protoplasmic processes, defensive zooids, sarcodal processes, Machopolyps, "Wehrthiere," and Nesselpolypen by the numerous writers who have investigated them. The first mention that I have been able to find of these structures is by Busk in Hunterian Lectures (MSS.), London, 1857, who called them "Nematophores"—a name subsequently used by various writers. Hincks afterwards applied the name "sarcotheca" to the chitinous receptacle, and "sarcostyle" to the sarcodal contents, or rather defensive persons, inclosed within it. Without further discussion on this point, I will state that I use the word nematophore for the receptacle without necessary reference to its contents, and sarcostyle for the organ or person within, and it is to the latter that I invite attention at present.

The hydroids have been carefully studied by so few zoologists that it may not be amiss to define the sarcostyle more explicitly before discussing it. A careful investigation of any plumularian hydroid will disclose the fact that, beside the hydrothecæ containing the hydroid polyps or hydranths, there are numerous usually minute chitinous cups containing an exceedingly interesting structure, which in life is characterized by amazing extensibility. Allman, in 1864, described it as "a soft granular mass which could send forth very extensible processes capable of being greatly protruded, and then so completely retracted as to apparently disappear. These processes have the power of sending forth pseudopodia, as does the amœba, and act in many respects as do certain rhizopods."

* From 'The American Naturalist,' April 1898, pp. 223-230. Read before Section F at the Detroit meeting of the American Association for the Advancement of Science.

This author considered that these processes were composed of protoplasm, pure and simple.

When, however, the more refined and modern histological technique was applied by Hamann to the investigation of the sarcostyles, it was discovered that they were much more complicated structures than was at first supposed; that they were made up of several histological elements, namely, an ectodermal layer surrounding an axial portion composed of endodermal cells, the ectoderm and endoderm being separated by a structureless membrane or "Stutzlamelle." The distal part of the sarcostyle contains nematocysts or nettling cells. This author (Hamann *) concluded that the enormous extensibility of the sarcostyle was due to muscle-fibrillæ, and regards the entire sarcostyle as a degraded person or hydroid polyp in which the mouth and body-cavity have been obliterated.

In the same year (1882) C. de Merejkowsky † announced that the histological elements were ectoderm and endoderm with a dividing membrane, and that the motile part was composed of ectoderm alone, the ectodermal cells being *immersed in a contractile structureless protoplasm*. To this latter substance he attributed the enormous extensibility of the sarcostyle and the pseudopodia-like processes originally described by Allman. This author regards the sarcostyles as degenerate individuals of the hydroid stock, serving the purpose of defensive organs, and possibly also as aid in the nourishment of the colony.

Weismann, in his 'Die Entstehung der Sexualzellen bei den Hydromedusen,' denies the presence of the interstitial protoplasm in the ectodermal portion, and contends that the pseudopodia are from the ectoderm cells themselves.

In the same year (1883) von Lendenfeld ‡ made a very elaborate study of the sarcostyles. In addition to the ectoderm, endoderm, and "Stutzlamelle" already mentioned, he found a differentiated ectodermal muscle-layer, in which are large ganglion-cells in *Plumularia*. In certain species of *Aglacphenia* and *Plumularia* he found sarcostyles furnished with adhesive cells similar to those found in ctenophores, but differing from them in not having a spirally rolled thread.

Dr. Carl F. Jickeli § agrees with most of the other writers concerning the histology of these structures, but has a unique

* "Der Organismus der Hydroidpolypen," Jenaische Zeitsch. f. Naturw. Bd. xv. pp. 17, 18, 65.

† Arch. de Zool. exp. et gén. vol. x. pp. 583-610.

‡ "Ueber Wehrpolypen und Nesselzellen," Zeit. f. wiss. Zool. Bd. xxxviii. pp. 355-371.

§ Morphol. Jahrb. Bd. viii. pp. 580-680.

idea of their homology. He thinks that the sarcostyles are homologous with the capitate tentacles of many species of hydroid polyps. I believe that he has no supporters in this view.

No other investigations of sufficient importance to discuss in this connexion have been made, so far as I know, with the exception of my own work in 1895 at Plymouth, England*, and at Naples, where I made careful studies of these structures in the living plumularians and by means of serial sections.

The histology of the sarcostyles, as held by most of the above writers, shows an outer layer of ectoderm and an inner layer of endoderm, these two layers being separated by an apparently structureless membrane called by the German writers the "Stutzlamelle." The endodermal layer appears to be a solid core in stained and sectioned preparations, and is so described by most writers. Under favourable conditions living specimens may be examined under a high power, and by a proper management of light the cell-boundaries, muscle, and indeed almost every histological detail may be distinctly seen and the movements followed. It was while making such examinations of living sarcostyles at Naples in 1895 that I found an unexpected proof that the axis of the sarcostyle is not a solid rod, but a delicate collapsible tube, the cavity of which is strictly homologous with the body-cavity of the hydranth. While studying a living sarcostyle under a $\frac{1}{2}$ oil-immersion lens, the endodermal axis, as it is called, was very sharply defined, being separated from the ectodermal layer by the "Stutzlamelle." Much to my surprise, I saw an amœboid cell pass quickly along the exact centre of the axis. The cell was largely composed of highly refractive granules and exhibited very active amœboid movements, sending forth well-marked pseudopodia and constantly changing form. This mysterious cell appeared to be engaged in travelling back and forth between the distal and proximal end of the axial cavity of the sarcostyle. Its progress was unimpeded, and completely demonstrated to my mind the presence of an axial cavity in the sarcostyle. After having once seen this cell, I looked for them in other sarcostyles, and found them in nearly every one examined. The species under observation was *Aglaophenia Helleri*. I afterward found similar cells in the endoderm of various parts of the plumularian colony, particularly in the stem. In such

* See C. C. Nutting, "Notes on Plymouth Hydroids," Journ. Marine Biol. Assoc., February 1896, p. 153.

localities, however, they did not move from place to place, but nevertheless sent forth numerous pseudopodia and exhibited amœboid change of form.

This demonstration of an axial cavity in the sarcostyle is of considerable interest, in view of the fact that it furnishes the last and much-desired link in the evidence needed to demonstrate the homology of the sarcostyle. It can no longer be doubted, it seems to me, that the sarcostyle is the homologue of the hydranth—that it is, in fact, a true “person” of the hydroid colony, being composed of ectoderm, “Stutzlamelle,” endoderm, and body-cavity. It lacks only tentacles to make it a hydranth; but we know that certain hydroids, *e. g.* *Protohydra*, have undoubted hydranths without tentacles.

Curiously enough, one of the earliest observers of nematophores published in 1863 a figure of a sarcostyle which was represented as having a body-cavity. The author referred to is Semper, and the figure is found in the ‘*Zeitschrift für wiss. Zoologie*,’ Bd. xiii. pl. xxxviii. fig. 4 a.

The conclusion that sarcostyles are morphological persons of the colony is borne out by almost every known fact concerning them. Embryological investigation shows that they are formed in almost exactly the same manner as the hydranths, and that they make their appearance as early as the latter, and often earlier. It is possible, moreover, to point out a series of forms leading from the so-called “fighting zooids” of *Hydractinia* to the typical nematophores of the Plumularidæ. In the genus *Ophiodes* we find organs or persons almost exactly intermediate between the *Hydractinia* and true sarcostyles. Prof. Baldwin Spencer has lately described a new family of Hydroida, called the Hydroceratenidæ, evidently closely allied to the Plumularidæ, with numerous fighting persons which are histologically almost identical with true nematophores; the extreme extensibility, however, of the latter has not as yet been observed in the former.

There appears also to be a curious cross-relation between the dactylozooids of the *Millipora* and the sarcostyles, if such they be, of the Hydroceratenidæ.

Among the many perplexing questions in this connexion is the one raised by Professor Allman, who very strongly urges the relationship between the nematophores and the denticles of the graptolites. His argument would lead to a belief that the ancestors of the Plumularidæ may be the graptolites; that the nematophores of the former are the homologues of the denticles of the latter; that we have in the sarcostyle the

original type of the hydranth; and that the present hydranth is really a very highly specialized sarcostyle.

As before indicated, the sarcostyles often precede the hydranths in the development of the colony, and would thus appear to be an older structure in phylogeny.

I was unable to confirm Merejkowsky's statement that the extensible part of the sarcostyle was composed of ectodermal cells immersed in free protoplasm. Indeed, it appears that no other author has been able to demonstrate this certainly unique and surprising arrangement. Neither could I find the muscle-bundles and ganglionic cells of von Lendenfeld, although this purely negative evidence should not be allowed to have much weight. The adhesive cells were found in several species of *Aglaophenia*, and observed in action; the observations confirm very decidedly the description given by their original describer, von Lendenfeld.

There has been considerable discussion concerning the probable use of the sarcostyles. My own observations on the living organisms would indicate that they serve several distinct functions.

1st. *Defence*.—In many cases, especially in the genera *Aglaophenia*, *Lytocarpus*, and *Cladocarpus*, the distal part of the sarcostyle contains a battery of very large and formidable nematocysts or stinging-cells. The threads of these cells are projected all together when a large or dangerous enemy approaches too near the adjacent hydranth. It is probable that the cnidocils of these nematocysts must be touched before the battery is discharged. Some species of *Lytocarpus* have such effective batteries that their sting is severely felt through the human cuticle, a very unusual thing among the Hydroida. The nematocysts themselves do not leave the nematophores when their threads are projected.

2nd. *Prehension of food*.—This is effected by the adhesive cells, which are situated on the extensible part of the sarcostyles of many species. Von Lendenfeld gives an excellent description of the capture of small crustacean zoæa. From his account it appears that the prey is first paralyzed by the nematocysts in the tentacles of the hydranths, and then secured by the adhesive parts of the adjacent sarcostyles, which stick firmly to the smooth chitinous covering of the crustacean. After this attachment is formed, the contraction of the sarcostyle brings the victim again within the reach of the tentacles, which convey it to the mouth of the hydranth.

3rd. *The removal of refuse or decomposing organic matter*.—This function of the sarcostyles has been suggested by several writers. I have on many occasions noted that the sarcostyles

are very active after certain parts of the colony have been mutilated or where the hydranths are undergoing disintegration. While studying *Plumularia pinnata* at Plymouth I saw astonishing exhibitions of activity on the part of the sarcostyles in the vicinity of mutilated gonangia. Their extensibility was incredible and apparently without limit. They would climb over the top of the gonangia and scour the inside, they would wind round and round the stem and branches in a perfect maze of apparently protoplasmic threads, and yet be able to unsnarl themselves with the greatest ease, and afterward disappear entirely. Dead hydranths seemed particularly attractive to them, and it appeared as if they actually devoured or in some way absorbed the organic matter of the disintegrating polyps, so that not a trace remained within the hydrothecæ in a very short time after the sarcostyles attacked them.

4th. *Holding together adjacent corbula-leaves until their edges unite.*—This is a novel use of the sarcostyle, discovered by myself while working out the embryology of the corbula, or fruit-receptacle, of *Aglaophenia pluma* at Plymouth. The corbula is a pod-shaped structure, made up of a number of ribs or leaves, which are separated first, but afterwards coalesce to form the mature corbula. Along the edges of these leaves are rows of nematophores.

While examining a young corbula of a living colony, I noticed that the sarcostyles along the edges of the leaves were exceedingly active, and that they were stretching across from one leaf to the next, to which they adhered by their adhesive ends. "It appeared as if these sarcostyles served as a temporary attachment to hold the edges of the two leaves together, while the edges themselves were connected by trabeculæ of cœnosarc which rapidly formed a stronger and permanent connexion. The perisarc of the edges of the leaves seemed exceedingly thin and in places appeared to be wanting. A contact having been established between the adjacent leaves, the permanent attachment was soon formed and the cœlomic cavities of the leaves established connexions at these points. A little later currents of water bearing granules were seen to flow in active streams from one leaf to the other" *.

In this case it appeared as if the sarcostyles served to hold the edges of the leaves together while the permanent connexion was being established, after which the sarcostyles loosened their hold and retracted into their respective nematophores.

* C. C. Nutting, "Notes on Plymouth Hydroids," Journ. Marine Biol. Assoc., February 1896, p. 153.

XVII.—Description of a new Bat from Lower California.

By GERRIT S. MILLER, Jr.

MR. OLDFIELD THOMAS has recently sent me for determination ten bats of the genus *Myotis*, taken in the extreme southern part of Lower California, and forming part of the Coolidge collection, which has already furnished so many novelties. Four of the specimens—three from Santa Anita and one from San José del Cabo, the latter essentially a topotype of *Vespertilio obscurus*, H. Allen—prove to be typical *Myotis californicus*; the others, all from San José del Cabo, represent a species related to *M. velifer*, J. A. Allen, but distinct from any hitherto described. The new form may be known as

Myotis peninsularis, sp. n.

Type adult ♀ (skin and skull), in the British Museum*, collected at San José del Cabo, Lower California, August 12, 1896, by Loye Miller. Coolidge collection, number 718.

Specific Characters.—Skull and teeth essentially as in *Myotis velifer*, J. A. Allen. General size considerably smaller than in *M. velifer* (about the same as in *M. lucifugus*) and tail-vertebræ relatively much shorter. Colour (in tawny phase) paler and more fulvous than in *M. velifer* and closely resembling that of *M. californicus* and *M. thysanodes*.

Colour.—The specimens represent two distinct colour phases. In the type and two other females the whole body is wood-brown, the back slightly darker than Ridgway's plate ('Nomenclature of Colours,' pl. iii. fig. 19), the belly as much paler. In the three other specimens, all of which are males, the back is hair-brown and the belly pale Isabella colour. One of the males, however, is clearly intermediate in colour, so that it is unlikely that the phases are purely sexual.

Skull and Teeth.—The skull and teeth exactly resemble those of *Myotis velifer*, except that they are a trifle smaller in size. The skull of the type measures: greatest length 15 mm.; zygomatic breadth 10; interorbital constriction 3·8; breadth of rostrum at anterior root of first molar 6; mandible 11·8; upper tooth-row (exclusive of incisors) 6·4; lower tooth-row 8.

Measurements.—Type: total length 91 mm.; tail 34; tibia 14·6; foot (with claws) 10; forearm 39; longest finger 61;

* [Since registered as 98, 3, 1, 59.—O. T.]

ear from meatus 15. Averages and extremes of the six specimens: total length 88·5 (86–96); tail 32·7 (30–36); tibia 15 (14·6–16); foot (with claws) 9·4 (8·5–10); forearm 39 (38·6–39·4); longest finger 62·3 (61–64).

Remarks.—The membranes, feet, wings, and ears of *Myotis peninsularis* agree closely with those of *M. velifer* so far as can be determined from skins alone. The extremely short tail of the new species appears to be its most strongly marked character. The measurements of the tails, together with the total length, foot, and ear, were taken in the flesh by three different collectors (Loye Miller, J. F. Abbott, and D. Coolidge), and their uniformity under these circumstances precludes any likelihood of error.

In the brown phase the colour is much like that of *Myotis velifer*, but in the tawny phase it much more closely resembles *M. californicus* and *M. thysanodes*.

The five paratypes of *Myotis peninsularis* have been presented by the British Museum to the United States National Museum, where they are catalogued as numbers 93552 to 93555.

XVIII.—*Descriptions of Nine new Species of Terrestrial and Fluvial Mollusca from South Africa.* By JAMES COSMO MELVILL, M.A., F.L.S., and JOHN HENRY PONSONBY, F.Z.S.

[Plate VII.]

IN this, the fourteenth communication we have offered on this subject during the past few years, we are especially gratified to be able to record a second species of *Hapalus*. A very minute, but beautifully sculptured *Cyclophorus* is likewise included, and others which, though small, will all be of interest to students of the South-African terrestrial fauna.

We should like to take this opportunity of mentioning that a contribution towards a Catalogue of the non-Marine Molluscan Fauna of this region has been prepared by us, and will shortly be published in the 'Proceedings of the Malacological Society of London'; and we may be permitted to indulge the hope that such a list may help to pave the way for a more comprehensive and critical work on the subject.

Trachycystis lignicola, sp. n. (Pl. VII. fig. 1.)

T. testa depresso-globosa, umbilicata, tenui, cornea, supra subplanata; anfractibus sex, ventricosis, undique longitudinaliter

Ann. & Mag. N. Hist. Ser. 7. Vol. ii. 10

arctissime et tenuissime sub lente striatis, apud suturas multum impressis, ultimo permagno; apertura lunari; peristomate tenui, marginem apud columellarem breviter triangulatum reflexo. — Long. 3·50, lat. 6 mm. (spec. maj.).

Hab. Fish River, Cradock.

The form is depressedly globular, umbilicate, thin, horny, apparently smooth, but when examined with a lens beautifully and very closely longitudinally striate. The upper whorls are ventricose and deeply impressed at the sutures, and almost in the same plane. The last whorl is very large; aperture lunate; outer lip thin, shortly triangularly reflexed over the narrow umbilicus at the columellar margin.

Several examples, found in decaying wood; hence the specific name.

Ennea elliptica, sp. n. (Pl. VII. fig. 2.)

E. testa cylindræca, nitida, lævigata, pellucida, apice obtusissimo; anfractibus sex, lævibus, ultimo dorsaliter leniter longitudinaliter striato; apertura rotundo-ovata; peristomate paulum incrassato, albo, dentibus plicisve quinque instructo, videlicet, plica parietali magna, prominente, dente labiali acuto, dentibus columellaribus duobus, approximatis, et intus plica columellari planata, valde intrante.

Long. 3·25, lat. 1·75 mm.

Hab. Maritzburg.

A very shining, almost completely smooth species, of which we have seen four examples, all agreeing in size and detail. The whorls are six, the last dorsally finely longitudinally striate; the substance pellucid and white; aperture roundly oval; peristome thickened, white, with five plaits or teeth, namely—a large extended parietal plait, an acute labial tooth, two contiguous columellar teeth, and a flattened deep-seated columellar plait.

Ennea formosa, sp. n. (Pl. VII. fig. 3.)

E. testa anguste rimata, breviter cylindræca, dolioliformi, nitidiuscula, fere lævigata, semipellucida, apice obtusissimo; anfractibus octo, infra suturas impressis, juxta suturas obliquostriatis, ad medium et infra evanidis, ultimo apud basin et circa rimam basalem conspicue striato; apertura subrotunda; peristomate incrassato, albo, nitido, reflexo, plicis dentibusque intricatis prædito, plica parietali magna, oblique intrante, dentibus labialibus duobus, effusis, dente basali acuto, intus extenso, dente

columellari superficiali, obtuso, intus plica columellari bipartita, longe producta, fere faucem ipsam claudente.

Long. 8·0, lat. 3 mm. (spec. maj.).

Long. 6·0, lat. 2·50 mm. (spec. min.).

Hab. Durban, Natal (*Quekett*).

Seven examples, of which we take the largest for the type; the remaining six are all much of a size. A very remarkable and beautiful *Ennea*, tun-shaped, narrowly rinate basally, shining, almost smooth; whorls eight, apex very obtuse, the whorls being impressed at the sutures; just at and below these for a very short distance oblique striations are discernible with a lens; the sculpture soon becomes obliterated, and the body of the shell is smooth. At the base and round the perforation the striations reappear. The aperture is roundish; peristome white, shining, peristomatal processes various and conspicuous, being as follows:—

- (i.) An oblique large parietal plait.
- (ii.) Two labial teeth, effuse and prominent.
- (iii.) One basal tooth, acutely produced.
- (iv.) A rounded columellar simple tooth.
- (v.) An internal bipartite columellar plait, much produced and almost closing the aperture.

Succinea piscinalis, sp. n. (Pl. VII. fig. 4.)

S. testa ovato-acuminata, tenui, semipellucida, ochracea, apice submamillato; anfractibus quatuor, apud suturas declivibus, impressis, rapide supra attenuatis, ultimo amplo; apertura ovata, labro paullum effuso, haud incrassato, simplici.

Long. 11, lat. 5 mm.

Hab. Fish River (*Farquhar*, in coll. *T. Rogers*).

Several examples of a *Succinea*, normal in its outlines, which nevertheless hardly agrees with any other species known to us. It is ovate, much acuminate, and becoming rapidly attenuate towards the apex, four-whorled, including the almost mamillate apical whorl, the last being, as usual, very much the largest; the aperture is oval, outer lip slightly effuse, simple.

We are indebted for this shell to Mr. Thomas Rogers, of Manchester, who, as stated above, received it as collected by Mr. Farquhar.

Buliminus zuluensis, sp. n. (Pl. VII. fig. 5.)

B. testa alba, fusiformi, anguste umbilicata, paullum nitente; anfractibus septem, ventricosulis, unicoloribus, ultimo caeteros magni-

tudine longe superante; apertura oblonga; peristomate paullum incrassato, margine columellari triangulatim reflexo.
Long. 22, lat. 10 mm.

Hab. Inseyi River, Zululand.

This shell is comparable with *B. damarensis*, though widely differing from it, the latter being the more cylindrical and with more whorls than seven. White, slightly shining, with ventricose whorls, the last far exceeding the others in length (14 millim.); aperture oblong, outer lip thickened, columellar margin triangularly reflexed over the umbilicus, which is narrow.

Hapalus globosus, sp. n. (Pl. VII. fig. 6.)

H. testa cinereo-alba, nitida, tenui, inflata, ovata; anfractibus sex, quorum apicali obtuso, cæteris ventricosulis, fere lævibus, sub lente longitudinaliter irregulariter striatulis, ultimo magno, inflato; apertura ovata; peristomate tenui, regionem apud umbilicarem cuneato, anguste reflexo.
Long. 6, lat. 3 mm. (spec. maj.).

Hab. Stella Bush.

This discovery of a second South-African *Hapalus* is interesting. From *H. catarractæ*, described by us in June 1897*, it differs in substance, colour, greater inflation of whorl, and one or two other particulars.

The shell is whitish, shining, thin, ovate, inflated, six-whorled, all somewhat ventricose, and almost smooth, the last whorl large, conspicuously swollen; aperture ovate; peristome thin, with a wedge-shaped narrowly reflexed process over the umbilicus, which is very narrow.

Two specimens.

Pupa Farquhari, sp. n. (Pl. VII. fig. 7.)

P. testa valde perforata, recta, cylindræa, obtusapicali, brunnea, tenui; anfractibus octo, apud suturas impressis, ventricosulis, undique obscurissime sub lente longitudinaliter obliqui-striatis; apertura ovata; peristomate albo, reflexo, nitente, plica parietali acinaciformi, acuto, intrante prædita, margine columellari ad medium incrassato.
Long. 4, lat. 2 mm.

Hab. Elandsberg Mountain, Cradock (*Farquhar*, in coll. *T. Rogers*).

Ten or eleven examples of a much-perforate, straightly cylin-

* Ann. & Mag. Nat. Hist. ser. 6, vol. xix. p. 635.

dricul, delicate brown *Pupa*, eight-whorled, the apex being very obtuse, the whorls impressed suturally and somewhat ventricose, longitudinally very obscurely obliquely striate. Mouth ovate; peristome white, reflexed, shining, furnished with an acute scimitar-shaped parietal plait, deep-seated, white, the columellar margin also being, though plain, somewhat thickened, as with an incipient process, towards the centre.

Physa gradata, sp. n. (Pl. VII. fig. 8.)

P. testa parva, cornea, subpellucida, ovata; anfractibus quatuor vel quinque, apicali obtuso, cæteris infra suturas uniangulatis, pulchre gradatis, undique longitudinaliter arcte liratis; apertura oblonga; peristomate tenui, paullulum reflexo, margine columellari crassiusculo.

Long. 4.50, lat. 2 mm.

Hab. Brickfields, Grahamstown (*Furquhar, in coll. T. Rogers*).

A small, horny, subpellucent shell, oval in form, four- or five-whorled, the whorls below the suture one-angled, gradate, and longitudinally closely lirate; aperture oblong, outer lip thin, slightly reflexed, columellar margin sinuous, somewhat thickened.

Four examples.

Cyclophorus minimus, sp. n. (Pl. VII. fig. 9.)

C. testa depressa, planorbiformi, tenui, nitidiuscula, omnino epidermide cornea contacta, apice mamillato; anfractibus quatuor, ventricosis, arctissime longitudinaliter tenui-liratis, ultimo multiseriatim sed sparsim setigero, setis tenuissimis; apertura rotunda; peristomate tenui, continuo, regione umbilicali patula, depressa, lata.

Alt. 1, lat. 2 mm.

Hab. Maritzburg.

Very small, yet full of detail. The shell is planorbiform and much depressed, thin, somewhat shining, covered with a thin corneous epidermis. Whorls, including the mamillate apex, four, the last being much the largest; they are ventricose and entirely concentrically closely lirate, the last whorl possessing scattered bristly hairs, evidently arranged in several rows, but which have either worn off or only occur sparsely. The aperture is round; peristome thin, continuous; umbilicus open, wide, and depressed.

Ten specimens, collected by Mr. Burnup.

We have not seen the operculum.

EXPLANATION OF PLATE VII.

- Fig. 1. *Trachycystis lignicola*.
 Fig. 2. *Ennea elliptica*.
 Fig. 3. — *formosa*.
 Fig. 4. *Succinea piscinalis*.
 Fig. 5. *Buliminus zuluensis*.
 Fig. 6. *Hapalus globosus*.
 Fig. 7. *Pupa Farquhari*.
 Fig. 8. *Physa gradata*.
 Fig. 9. *Cyclophorus minimus*.

XIX.—*On a Second Collection of Reptiles made by Mr. E. Lort-Phillips in Somaliland.* By G. A. BOULENGER, F.R.S.

SINCE the publication in these 'Annals' * of a report on a small collection of Reptiles made by Mr. Lort-Phillips at Berbera and in the Goolis Mountains the British Museum has received a second collection made by the same gentleman in the same district in 1896-97. It contains examples of most of the Reptiles mentioned in the first report, and, in addition, of eight species, two of which are new, enumerated in the following list.

LIZARDS.

1. *Hemidactylus mabuia*, Mor.

Goolis Mountains.

2. *Agama Rueppellii*, Vaill.

Goolis Mountains.

3. *Agama (Xenagama) batillifera*, Vaill.

Found in holes on the Sogsoda plain, Goolis Mountains, at an elevation of about 2000 feet.

4. *Latastia Hardeggeri*, Steind.

Latastia Hardeggeri, Steindachner, Ann. Hofmus. Wien, vi. 1891, p. 371, pl. xi.

Eremias heterolepis, Boettger, Zool. Anz. 1893, p. 115.

This species is very closely allied to *L. Neumanni*, Matschie, from Aden, recently described by J. Anderson (P. Z. S. 1895,

* Ser. 6, vol. xvi. 1895, p. 165.

p. 643, pl. xxxvi. fig. 1). In fact nothing but a smaller number of scales across the body (about 30, exclusive of the ventrals) distinguishes it from the latter. As noticed by Steindachner, the series of granules between the supraoculars and the frontal is not constant; these granules are absent in the single specimen brought home by Mr. Lort-Phillips from Berbera. The specimen is a young one, measuring 42 millim. from snout to vent. 34 scales across the middle of the body, exclusive of the ventrals, which form 6 longitudinal and 29 transverse series. A narrow rim separates the nostril from the first labial, as in *L. Neumanni*. Back black, sides spotted with black, with six white longitudinal lines, the two median bifurcating on the nape; tail red.

5. *Latastia Phillippii*, sp. n.

Head rather small; snout short, obtuse. A single post-nasal; frontal narrowed posteriorly, scarcely grooved; two large supraoculars, preceded and followed by a few small shields, and separated from the supraciliaries by a series of granules; interparietal very narrow, separated from the small triangular occipital; a band-like shield borders the parietal externally and another, curved one, the ear supero-anteriorly; temporal scales granular, smooth; no auricular denticulation; subocular bordering the lip, between the fourth and fifth upper labials. Gular scales moderate, gradually increasing in size towards the collar, which is curved and formed of 8 or 9 plates; the three anterior pairs of chin-shields in contact. Scales roundish rhomboidal, flat or subtectiform, subimbricate; two series of strongly enlarged smooth scales, twice as broad as long, along the spine; 28 or 30 scales across the middle of the body. Ventral plates in 6 longitudinal and 26 transverse series; the plates of the median and outer series narrower than the others, but much broader than long; no small pectoral scales. Two median præanal plates enlarged. Femoral pores 13. Tail very long. Grey above, with three lemon-yellow longitudinal streaks, the median bifurcating on the nape; sides and limbs dotted with black; lower parts white; tail red in the young.

| | ♂. |
|--|---------|
| | millim. |
| Total length | 156 |
| Head | 10 |
| Width of head | 6 |
| From end of snout to fore limb | 16 |
| " " vent | 42 |
| Fore limb | 16 |
| Hind limb | 29 |
| Tail | 114 |

Two specimens from Berbera.

This species is very closely allied to *L. spinalis*, Ptrs. Apart from the coloration, fundamentally different in the light stripes being in odd number, it may be distinguished by the longer foot, the fourth toe measured from the base of the fifth exceeding the distance between the fore limb and the anterior border of the orbit.

6. *Chamæleon basiliscus*, Cope.

Goolis Mountains.

SNAKES.

7. *Typhlops cuneirostris*, Ptrs.

Goolis Mountains.

ÆLUROGLENA, gen. nov.

Maxillary teeth 11, increasing in size posteriorly, forming an uninterrupted series; mandibular teeth subequal. Head elongate, slightly distinct from neck; eye moderate, with vertically elliptical pupil; nostril pierced between two nasals and the supranasal. Body slender, cylindrical; scales smooth, with apical pits, in 21 rows. Ventrals rounded. Tail moderate; subcaudals in 2 rows.

This genus should be placed not far from *Zamenis*.

8. *Æluroglena cucullata*, sp. n.

Snout rather long, slightly prominent. Rostral much broader than deep, not visible from above; internasals as long as the præfrontals; frontal bell-shaped, once and a half as long as broad, broader than the supraocular, as long as its distance from the end of the snout, shorter than the parietals; loreal twice as long as deep; a single large præocular, narrowly separated from the frontal; two postoculars; temporals 1 + 2; eight upper labials, fourth and fifth entering the eye; five lower labials in contact with the anterior chin-shields, which are shorter than the posterior; latter separated from each other by scales. Scales in 21 rows. Ventrals 216; anal divided; subcaudals 67. Pale buff above; head dark brown above, speckled with whitish, shading into a blackish blotch on the nape; two large cream-coloured spots on the upper lip, in front of and behind the eye; lower surface of head dark brown, with a cream-coloured spot on each side of the chin, and a band of the same colour below

each mandibular ramus, sending up a process to meet the præocular labial spot; the brown is prolonged as a median stripe along the throat; lower parts cream-colour.

Total length 375 millim.; tail 75.

A single female specimen from the Goolis Mountains.

XX.—*Descriptions of Two new Fishes from the Coast of Sind.*

By G. A. BOULENGER, F.R.S.

THE fishes here described were found among a collection made at Kurrachee by Mr. F. W. Townsend, and presented by him to the British Museum.

Epinephelus Townsendi.

Teeth in rather broad bands, in three series on the sides of the mandible; canines small. Depth of body equal to length of head, $2\frac{3}{4}$ to 3 times in total length. Snout rather pointed, as long as diameter of eye, which is $4\frac{1}{2}$ to 5 times in length of head; interorbital width 6 to 7 times in length of head; lower jaw strongly projecting; maxillary extending to below posterior border of eye or a little beyond, the width of its distal extremity $\frac{2}{3}$ to $\frac{3}{4}$ diameter of eye; præopercular border rounded, finely serrated behind, the serræ slightly enlarged towards the angle; opercular spines equidistant, lower further back than upper; opercular flap pointed, upper border feebly curved; head covered with cycloid scales, maxillary naked. Gill-rakers moderate, 16 or 17 on lower part of anterior arch. Dorsal XI 16-17, originating above base of pectoral; spines increasing in length to the third or fourth, which is $\frac{1}{3}$ length of head and not, or but slightly, longer than the last, and a little shorter than longest soft rays. Pectoral $\frac{2}{3}$ length of head. Ventral shorter, not reaching vent. Anal spines strong, second and third equal, nearly $\frac{1}{3}$ length of head. Caudal rounded. Scales strongly ciliated, 95-110 $\frac{13-15}{36-40}$; l. l. 67-76. Olive-brown above, whitish beneath; one or two more or less distinct dark streaks on the cheek and gill-cover; dorsal, anal, and caudal edged with blackish.

Total length 250 millim.

Four specimens.

This species is nearest allied to *E. merra*, Bl.

Pseudochromis caudalis.

Depth of body 4 times in total length, length of head $3\frac{3}{4}$. Snout as long as diameter of eye, which is $4\frac{1}{2}$ times in length of head and slightly exceeds interorbital width; maxillary extending to below centre of eye; 6 series of small scales on the cheek; large scales on the opercle. Dorsal III 27; longest soft rays $\frac{1}{2}$ length of head. Pectoral $\frac{3}{5}$ length of head, a little longer than ventral. Anal III 16. Caudal truncate. Caudal peduncle as long as deep. Scales $55\frac{2}{15}$; lat. l. $\frac{40}{15}$. Olive above, yellowish beneath; a black spot on the opercle, close to the upper extremity of the præopercular border; fins greyish white; two black streaks on the caudal, near the upper and lower borders.

Total length 100 millim.

A single specimen.

I seize this opportunity for pointing out that the *Salarias* named by me, in a recent note on Mr. Townsend's collections, *S. curtus*, has been described twice before, viz. as *S. opercularis* by J. A. Murray (Journ. Bomb. N. H. Soc. ii. 1887, p. 48) and as *S. Neilli* by Day (Proc. Zool. Soc. 1888, p. 263). The species is common at Kurrachee, and its range extends to the Persian Gulf.

XXI.—*Descriptions of new Species of Hemiptera-Heteroptera.*
By W. L. DISTANT.

Pentatomidæ.

PHYLLOCEPHALINÆ.

Storthogaster Junodi, sp. n.

Bright golden yellow; membrane and connexivum pale dull ochraceous. Antennæ yellow, with the apex of the last joint black. Head with a small elongate black spot at the apex of central lobe, eyes piceous. Pronotum with a broad purplish-red basal fascia, strongly indented at centre and narrowing towards outer angles, containing coarse black punctures, which are confluent on its anterior margin; outer angles acute and marked with a linear black fascia; two small black spots on anterior margin near head. Scutellum

with a purplish-red basal patch. Corium with a large spot near inner basal margin, connected with a broad lateral (not extending to base) and apical margin, purplish red, containing some darker spots; membrane sparingly but prominently spotted with black; connexivum marked with linear black spots. Body beneath and legs unicolorous.

Long. 15 millim.; lat. pronot. angl. 9 millim.

Hab. Delagoa Bay (*Junod*).

This extraordinary Hemipteron, of which I was allowed to abstract a single specimen in the possession of the Rev. H. A. Junod, when visiting Delagoa Bay in 1895, was generically described by Karsch in 1892, the genus being founded on a West-African specimen, *S. hieroglyphicus* (Berl. ent. Zeitschr. xxxvii. p. 484, fig. 2).

Coreidæ.

Bardistus superbus, sp. n.

Head black, with a central ochraceous fascia; ocelli red; antennæ black. Pronotum bright ochraceous, with three broad central fasciæ, the lateral and humeral margins black. Scutellum bright ochraceous, with a broad central black fascia, narrowed posteriorly. Corium piceous, with the veins dull ochraceous, membrane shining cupreous. Connexivum above and beneath black, with large red spots, one on each segment. Body beneath and legs black; femora annulated with red near apex; lateral and basal margins and a streak at anterior margin of prosternum, two spots on each lateral area of meso- and metasternum, and the costal bases pale ochraceous.

Antennæ with the fourth joint longest, second a little shorter than the first, longer than the third. Lateral and humeral margins of the pronotum strongly crenulated, the apex of the posterior angles with a short but distinct spine; the pronotum is subrugulose and tessellate, with coarse punctures. Scutellum transversely rugulose. Corium coarsely punctate.

Long. 30 millim.

Hab. Costa Rica, Guaitil de Pirris (Pacific coast).

This beautiful species is allied in structure to *B. eremita*, Stål.

XXII.—*Natural History Notes from H.M. Indian Marine Survey Ship 'Investigator,' Commander T. H. Heming, R.N., commanding.*—Series II., No. 25. *A Note on the Deep-sea Fishes, with Descriptions of some new Genera and Species, including another probably Viviparous Ophidioid.* By A. ALCOCK, Surgeon-Major I.M.S., Superintendent of the Indian Museum.

CONTENTS.

- § 1. Introduction.
- § 2. On some Geographical Relations of the Deep-sea Fish-fauna of India.
- § 3. General Composition of the Deep-sea Fish-fauna of India.
- § 4. Descriptions of new Species, including another probably Viviparous Species of *Diplacanthopoma*.

§ 1. Introduction.

IN the Ann. & Mag. Nat. Hist. for November and December 1889, September and October 1890, January, July, and August 1891, November 1892, and August 1895, and in the 'Journal of the Asiatic Society of Bengal' for 1893, 1894, and 1896, I have described the fishes dredged by the 'Investigator' in depths ranging from 100–1800 fathoms during the twelve years 1885–1896.

In the present paper some noteworthy species dredged since 1896 are recorded; though two of these (*Raja Powellii*, sp. n., and *Monocentris japonicus*, C. V.) were taken at a depth less than 100 fathoms, yet the occurrence of a temperate genus like *Raja* close to the Indian shores, and the addition of another singular Japanese species to the Indian fauna, are sufficiently interesting to be noticed here.

§ 2. On some Geographical Relations of the Deep-sea Fish-fauna of India.

In my earliest paper (Ann. & Mag. Nat. Hist., Nov. 1889, p. 379) on the deep-sea fishes of the Indian region I drew attention to the fact that several of our species were common, on the one hand to the deeper waters of Madeira, the Mediterranean, and the Atlantic coasts of America, and, on the other hand, to the seas of Japan.

As Dr. Günther had, long before, noticed the correspondences between (1) the Madeiran, Mediterranean, and West-Indian fish-fauna, and (2) the fish-fauna of Japan, and as at

the time I wrote our observations were only beginning, it did not then seem either necessary or advisable to pursue this subject further.

But our investigations are now perhaps sufficiently full to enable us to form an idea of the geographical relations of the deep-sea fish-fauna of India, and sufficiently numerous to be used as a test of certain theories of past geography and zoological distribution that are based on other and various kinds of evidence. I may therefore briefly summarize them.

The total number of species of fishes, exclusive of incidental shore-fishes, at present known to exist in the seas of India at depths over a hundred fathoms is 159, of which 120 have not, so far as is known, been found elsewhere.

Of the 39 previously-known species, the following 6 probably belong to the fauna of the "Necton," and are not therefore made use of in this paper in any argument based on the facts of geographical distribution:—

- | | |
|--|---|
| 1. <i>Argyrolepeus hemigymnus</i> , <i>Cocco.</i> | 4. <i>Gonostoma microdon</i> , <i>Gthr.</i> |
| 2. <i>Sternoptyx diaphana</i> , <i>Herm.</i> | 5. ——— <i>elongatum</i> , <i>Gthr.</i> |
| 3. <i>Polyipnus spinosus</i> , <i>Gthr.</i> | 6. <i>Chauliodus Sloanii</i> , <i>Bl. Schn.</i> |

Of the remaining 33, 6 more may possibly belong to the nectic fauna, though I do not think that they do, and shall not here treat them as if they did. They are:—

- | | |
|---|---|
| 1. <i>Hoplostethus mediterraneum</i> , <i>C. V., Gthr.</i> | 4. <i>Antigonia capros</i> , <i>Lowe.</i> |
| 2. <i>Polymixia nobilis</i> , <i>Lowe.</i> | 5. <i>Neoscopelus macrolepidotus</i> , <i>Johns.</i> |
| 3. <i>Trachichthys Darwinii</i> , <i>Johns.</i> | 6. <i>Macrurus lævis</i> , <i>Lowe.</i> |

Of the remaining 27, 15 appear to be identical with species that were dredged, chiefly by the 'Challenger,' at corresponding depths in the basins of the East-Indian Archipelago and neighbouring Western Pacific. These hardly call for further notice.

Of the remaining 12, 1 (*Scyllium canescens*, *Gthr.?*) appears to be identical with a 'Challenger' species from the Patagonian fjords (Pacific side). Singular as this distribution may seem, it is shared by several species among the Echinoderma, Crustacea, Pycnogonida, and Mollusca. And if genera, rather than species, are considered, it will be found that quite a considerable number are common to Indian seas and the Pacific slopes of South America—from Panama to Patagonia.

There are left 11 previously-known species that share with

the 6 species classed as just possibly belonging to the nectic fauna a curious and most suggestive geographical distribution. These are:—

Chiasmodes niger, Johns., known from the West Indies and Atlantic coasts of the United States; from the mid-Atlantic and Madeira; and from the Bay of Bengal.

Chaunax pictus, Lowe, known from the West Indies and the Atlantic coast of the United States; from Madeira, Cape Verd Islands, and neighbourhood; from Japan and Fiji; and from the Bay of Bengal and the Gulf of Manár.

Dirolene intronigra and *Bathygadus longifilis*, G. & B., known from the West Indies and neighbouring coasts of North America, from the Atlantic coast of North-western Africa, and from the Malabar coast and Andamans.

Diplacanthopoma brachysoma, Gthr., known only from off the coast of Brazil (Pernambuco) and from the Andaman Sea.

Macrurus (Mystacourus) cavernosus, G. & B., known only from the Gulf of Mexico and from Ceylon and the Andaman Sea. (Specimens from both regions compared.)

Bathytroctes microlepis, Gthr., known only from the Mediterranean gate of the Atlantic and from the Andaman Sea. (Our specimen is in bad preservation, and its identification is therefore doubtful.)

Platytroctes apus, Gthr., known only from the mid-Atlantic and from off the Malabar coast.

Leptoderma macrops, Vaillant, known only from the Atlantic coasts of North-western Africa and from the Bay of Bengal.

Uroconger vicinus, Vaillant, known only from the Atlantic coasts of North-western Africa and from the Laccadives and Bay of Bengal.

Synaphobranchus pinnatus, Gray, Gthr., known from the Atlantic coasts of the United States and Brazil; from the Azores, Canaries, and Cape Verd Islands; from the Philippines and Japan; and from off the Maldives and Cape Comorin. (Compared with a 'Challenger' duplicate.)

Let us compare now the distribution of the 6 species above referred to as possibly, but not probably, oceanic. These are:—

Hoplostethus mediterraneum, C. V., Gthr.: Atlantic coasts of the United States, Madeira and neighbouring coasts and islands of that part of the Atlantic, Mediterranean Sea, Japanese Seas, Malabar coast, and Bay of Bengal.

Polymixia nobilis, Lowe: West Indies, Madeira and neigh-

bouring parts of the Atlantic, Japan, Mauritius, Andaman Sea.

Trachichthys Darwinii, Johns.: Madeira, Japan, Bay of Bengal.

Antigonia capros, Lowe: West Indies, Madeira, Arafura Sea, Japan, Bay of Bengal. (Compared with 'Challenger' duplicate.)

Neoscopelus macrolepidotus, Johns.: West Indies and neighbouring coasts of the United States, Madeira, Australasian Seas, Andaman Sea. (Compared with a 'Challenger' duplicate.)

Macrurus (Malucocephalus) lavis, Lowe: North and South Atlantic, seas of Northern Europe, Mediterranean, Hawaiian Islands, Andaman Sea.

From the above list we see that of the 33 species of deep-sea fishes (excluding the undoubted nectic species) that India is known to share with other parts of the world, 17 species, or 51 per cent. (and 10 per cent. of the whole fish-fauna in question), are found in certain very suggestive areas of the North Atlantic, namely off the West Indies and neighbouring coasts of America and in the approaches to the Mediterranean Sea.

This of itself would be almost enough to suggest a former direct connexion between those waters and the seas of India; and the fact that so many of the species under consideration also occur in Japan is suggestive of still further-reaching sea-connexions.

So far as the Japanese seas are concerned, this idea has long been familiar to Dr. Günther, who, in the 'Journal of the Linnean Society' for 1874-76 (Zoology, vol. xii.), pp. 107-139, gives a list of 29 Japanese shore-fishes, of which 22 also belong to the Mediterranean and 18 to the West-Indian fauna, and 11 are common to all three regions, and who, in the 'Introduction to the Study of Fishes,' p. 270, says, in comparing the shore-fishes of Japan with those of the Mediterranean:—"We can only account for the singular distribution of these shore-fishes by assuming that the Mediterranean and Japanese seas were in direct and open communication with each other within the period of the existence of the present Teleosteous fauna."

It is not, however, alone, or even principally, from the Fishes that the zoological evidence* in support of a former

* "Zoological," because I understand that the *geological* evidence in favour of a former (Eocene or Miocene) open-sea connexion between the

connexion, by way of the Mediterranean Sea, between the Tropical Atlantic and the Indo-Pacific is to be derived; corroborative evidence appears to be furnished by every group among the 'Investigator' collections that has been examined.

(a) Among the Hexactinellid Sponges, which have been determined for us by Professor F. E. Schulze, we find:— (1) *Aphrocallistes Bocagei*, P. Wright, which is known from the West Indies, from Spain, Portugal, and the Cape Verd Islands, from the North-eastern Atlantic, and from Japan, and has been dredged by the 'Investigator' in 130–265 fath.; and (2) *Parrea occa*, Carter, which occurs in the West Indies, in Japan and the Philippines, and also off the Andamans at 220–240 fath.

(b) Among the Madreporarian Corals are *Caryophyllia communis*, Seg. Mos., and *Flabellum laciniatum*, Phil. These two Atlantic species are frequently found in Indian Seas at depths between 200 and 700 fath. As they occur fossil in the Tertiary deposits of Sicily and Southern Italy, they have here a special interest. We also find in the Andaman Sea a *Deltocyathus* that seems to be nothing more than a variety of the *Deltocyathus italicus* (Mich.), E. & H., of the North Atlantic and of the Miocene of Northern Italy.

(c) Among the Echinoderms, which have been named by Dr. J. H. T. Walsh (Holothurians), Prof. R. Koehler (Ophiuroids), and myself (Starfishes), the following are common to the Atlantic and the seas of India:—*Porcellanaster ceruleus*, Wy. Thoms., *Nymphaster basilicus*, Sladen, *Nymphaster protentus*, Sladen, *Ophiomusium validum*, Ljungmann, *Ophiernus adspersus*, Lyman, *Ophiocamax fasciculata*, Lyman, *Astronyx Loveni*, M. & T. (also occurs in Japan), *Eupyrgus scaber*, Lütke. (also occurs in Arctic Seas). None of these are true abyssal forms.

(d) Among the Crustacea the following, four of which were determined by the late Prof. J. Wood-Mason, are common to the seas of the East and West Indies and neighbourhood:—*Bathynomus giganteus*, A. M.-Edw. (not found elsewhere), *Pontophilus gracilis*, S. I. Smith (not found elsewhere), *Phoberus cæcus*, A. M.-Edw. (? also in the Araçura Sea), *Uroptychus nitidus*, A. M.-Edw. (not elsewhere),

West Indies and Mediterranean on the one hand, and in favour of a former (Cretaceous and Eocene) open-sea connexion between Europe, across the Sahara and Arabia, far into India, on the other hand, is very strong. My object here is simply to show how certain geological generalizations appear to be in some way confirmed by the zoological facts recorded in this series of papers.

Lithodes Agassizii, S. I. Smith (also from the Azores),
Pylocheilus Agassizii, A. M.-Edw. (not elsewhere).

And the following are common to the northern parts of the North Atlantic and the Indian seas:—*Nephropsis atlantica*, Norman, and *Calocaris Macandreae*, Bell, the latter having been also found at New Zealand.

No nectic or abyssal species are included in this list.

(e) Among the Mollusca, which have been identified by Mr. E. A. Smith and Mr. E. S. Goodrich (Cephalopods), 4 out of 20 deep-sea species that are known to occur elsewhere are common to India and the North Atlantic. They are:—*Solariella infundibulum*, Watson (also occurs off the Crozets), *Puncturella asturiana*, Fischer, *Lucina spinifera*, Montagu, and *Octopus januarii*, Ststp., which last has also been taken in the Eastern Pacific.

Altogether, of the species that inhabit the moderate depths (100–1000 fathoms) of the Indian seas and are also known from corresponding depths elsewhere, $\frac{4}{11}$, $\frac{2}{13}$ ths are known from the Atlantic north of 10° S., and $\frac{3}{11}$, $\frac{8}{13}$ ths are identical with species that also belong either to the deep fauna of the West Indies and neighbouring coasts of America, or to the deep fauna of the Atlantic approaches to the Mediterranean.

This—which expressly excludes all true abyssal as well as “Necton” species—is, so far as we know, a larger number of thus limited deep species than the seas of India have in common either with the basins of the East-Indian Archipelago or with the seas of Japan, although it is interesting to note that the affinities of the Indian with the Japanese deep fauna are very well marked—28 species being common to the moderate depths of the two regions.

For fuller details I would refer to a Report, now in the press, upon the deep-sea Madreporaria dredged by the ‘Investigator,’ and to a paper (to be shortly published in the ‘Scientific Memoirs of the Medical Officers of the Army of India’) summarizing the zoological observations of the ‘Investigator’ between the years 1884 and 1897.

To the list of Fishes common to the West Indies and the Bay of Bengal and Andaman Sea must be added

Bembrops gobioides (Goode) [= *Hypsicometes gobioides*, Goode,
 = *Bembrops platyrhynchus*, Alcock].

In the Indian Museum there is one of the ‘Albatross’ (?) duplicates of *Hypsicometes gobioides*, presented to us by the

Smithsonian Institution, and it is identical with the species that I had described and figured as *Bembrops platyrhynchus*.

Bembrops gobioides (Goode), which appears to be a common species in the Caribbean Sea and Gulf of Mexico at depths of from 68 to 324 fath., has been dredged by the 'Investigator' off the Madras coast in 128 fath., and in the Andaman Sea at 185 and 194 fath.

I take this opportunity of giving the synonymy of the genus and species:—

BEMBROPS, Steindachner.

Bembrops, Steindachner, SB. Ak. Wien, lxxiv. 1877, i. p. 211; Alcock, Journ. As. Soc. Bengal, vol. lxxiii. 1894, pt. 2, p. 118, and vol. lxxv. 1896, pt. 2, p. 316.

Hypsicometes, Goode, Proc. U.S. Nat. Mus. iii. 1880, p. 347; Günther, 'Challenger' Deep-sea Fishes, p. 85; Jordan and Gilbert, Bull. U.S. Nat. Mus. xvi. p. 808; Goode and Bean, Oceanic Ichthyology, p. 290.

Bathypereis, Alcock, Journ. As. Soc. Bengal, vol. lxxii. 1893, pt. 2, p. 177.

Bembrops gobioides (Goode).

Hypsicometes gobioides, Goode, *loc. cit.*; Günther, *loc. cit.*; Jordan and Gilbert, *loc. cit.*; Goode and Bean, *loc. cit.* fig. 263.

Bathypereis platyrhynchus, Alcock, *loc. cit.* pl. ix. fig. 1.

Bembrops platyrhynchus, Alcock, *loc. cit.*

I have only to add that my description and figure were made from a young individual; in the adult, of which we have lately received several specimens from the 'Investigator,' the proportions of the body are different.

§ 3. General Composition of the Deep-sea Fish-fauna of India.

As regards the composition of the deep-sea fish-fauna of India, so far as our present knowledge goes, it is made up as follows:—

| | | | |
|------------------|-------|-----|-----------|
| Chondropterygii, | about | 4 | per cent. |
| Acanthopterygii, | " | 24 | " |
| Anacanthini, | " | 35 | " |
| Physostomi, | " | 36 | " |
| Plectognathi, | " | 0.6 | " |

In these, as in other seas, certain families are characteristic of the depths. They are:—

| | | | | |
|-----------------|-------------------|-------|-----------|---------------|
| Ophidiidæ, | which form nearly | 15 | per cent. | of the whole. |
| Macruridæ, | " | " | 13 | " " |
| Murænidæ, | " | about | 10 | " " |
| Scopelidæ, | " | " | 7·5 | " " |
| Alepocephalidæ, | " | " | 6·5 | " " |

The family Pediculati is particularly well represented in these seas, where, between 128 and 1260 fathoms, we find twelve species (*i. e.* about 7·5 per cent. of the whole), belonging to eight genera. Among them it is interesting to notice three forms (*Dibranchus*, *Malthopsis*, *Halicometus*) in which more or less marked degeneration of the locomotor organs is correlated with a more than ordinary reduction in the number of gills.

§4. Descriptions of new Species.

Ten new species are described; they will all be figured in an early issue of the "Illustrations of the Zoology of the 'Investigator.'"

Among the new forms two, besides the two already mentioned, are specially interesting; they are:—(1) *Benthobatis*, a blind torpedo perhaps more nearly allied to the Eastern Pacific *Discopyge* than to any other member of the family; and (2) a new species of *Diplacanthopoma* that is evidently, like one of its congeners, viviparous. This is the third species of *Diplacanthopoma* discovered in these seas; the type of the genus was dredged by the 'Challenger' in a moderate depth off Pernambuco.

PLAGIOSTOMATA SELACHOIDEI.

Family Spinacidæ.

CENTROPHORUS, M. & H., Gthr.

Centrophorus Rossi, sp. n.

Near *C. calceus* (Lowe), *C. foliaceus*, Günther, and *C. obscurus*, Vaillant.

Snout spatulate, much produced, its preoral portion (measured from the most convex point of the upper jaw) being at least twice the distance between the angle of the mouth and the first gill-opening, and more than 2½ times the distance between the nostrils.

The labial fold extends considerably more than halfway between the angle of the mouth and the middle of the lower jaw.

Teeth of upper jaw erect, triangular, very acute, in two series; teeth of lower jaw acute, very oblique, in a single series.

The posterior borders of all the fins are frayed or fringed, this not being due to abrasion. The angle of the pectoral is rounded; the extremity of the ventral is almost in the perpendicular with the after limit of the base of the second dorsal. The dorsal spines (measured obliquely as they stand) are not much more than half the greatest height of their fins, but their points project well beyond the skin; the second dorsal is a little larger than the first.

Scales minute, acutely tridentate.

Colour uniform jet-black.

A single specimen, 10 inches long, from off the Travancore coast, 430 fath.

Named in memory of Captain Daniel Ross, who, according to Sir Clements Markham, was the first Indian "Marine Surveyor-General" (1823-1833) who introduced a really scientific method into marine surveying in India.

PLAGIOSTOMATA BATOIDEI.

Family Torpedinidæ.

BENTHOBATIS, gen. nov.

The whole animal invested in a loose, soft, naked, glandular skin.

Tail very distinct from the oval disk and *without distinct lateral folds*. Two dorsal fins on the tail; caudal fin well developed.

Nasal valves confluent into a quadrangular curtain.

Teeth flat, rhomboidal, with the posterior angle acutely produced.

Spiracles large, situated immediately behind the *inconspicuous and quite rudimentary eyes*.

A large electric organ between the head and either pectoral fin.

This curious blind torpedo differs from all other members of the family in having the eyes quite rudimentary and in the absence of lateral folds of skin on the tail. In general form it resembles *Narcine*, though the disk is not quite so broad. The teeth, like those of *Discopyge*, have the posterior angle produced, but more acutely than in *Discopyge*, judging from Tschudi's figure.

Benthobatis Moresbyi, sp. n.

The disk is oval, its long axis, which is fore and aft, is a little shorter than the tail. The large, flat, semicircular snout occupies a good deal more than a third the whole length of the disk.

The eyes are represented by two small unpigmented spots, each not much bigger than the head of a pin, situated one in front of either spiracle; a slender optic nerve passes to each, and expands into a vesicle so small as to need a lens for its recognition.

The mouth is small and protractile; the teeth are small rhomboidal plates, with the posterior angle strongly and acutely produced, and are arranged in mosaic in oblique series. The gill-openings are large and well-spaced.

The dorsal fins are placed rather close together behind the level of the ventrals, and, like the caudal, are thick and fleshy. The ventrals are of the usual shape; though they are separate, the skin between them is loose and copious. The whole animal is covered with a perfectly smooth, soft, glandular, purplish-black skin; scattered on the disk and round the edge of it are some small white pores, not much smaller than the eyes; in one specimen part of the tips of the second dorsal and caudal fins are white.

Two males (each about 14 inches long) and a young one, from off the Travancore coast, 430 fath.

Named in memory of Capt. Moresby, of the Indian Navy, whose surveys (1834-38) in the seas where this curious fish is found are known to all readers of Darwin's 'Coral-Reefs.'

Family *Rajidæ*.

RAJA, Cuv., Gthr.

Raja Powellii, sp. n.

Near *R. Murrayi*, Gthr., but has a more produced snout and, sex for sex, is much smoother.

The preoral portion is a little more than a third the entire length of the disk, and ends in a projecting snout, the length of which beyond the nostrils is somewhat more than the distance between the outer angles of the latter.

The antero-lateral margins of the disk, from the snout to the rounded pectoral angles, are broadly sinuous. The width of the interorbital space is hardly more than the length of the orbit. There are several spines on the anterior edge of the orbit and one near its posterior angle, and there are numerous

little spicules on the dorsal surface of the snout, as well as on parts of both the dorsal and ventral surfaces of the antero-lateral margin. There is a row of three large spines on the middle line of the nape, and there are at least two rows of smaller spines on the posterior fourth of the disk, in the middle line.

The tail is as long as the disk and is armed, both on the dorsal surface and on the sides, with rows of spines, those on the sides being smaller and more numerous than those on the dorsum.

The caudal fin, which is present on the dorsal surface only, is confluent with the second dorsal.

The teeth form a pavement; in the female in the upper jaw they are indistinctly tricuspid (the lateral cusps very small and blunt), in the lower jaw they are more distinctly tricuspid.

Colours: upper surface warm brown, with a pair of large, light-centred, light-edged, chocolate ocelli near the middle of the back.

A female, $12\frac{1}{2}$ inches long, from the Gulf of Martaban, 67 fath. (Temperature *probably* about 62° Fahr.)

Named in memory of Lieutenant Powell, of the Indian Navy, Captain Moresby's colleague.

PHYSOSTOMI.

Family Scopelidæ.

BATHYPTEROIS, Günther.

Bathypterois atricolor, Alcock.

Bathypterois atricolor, Alcock, Journ. As. Soc. Bengal, vol. lxx. pt. ii. 1896, p. 306, and Illustrations of the Zoology of the 'Investigator,' Fishes, pl. xvii. fig. 6.

This species was described and figured from a single injured specimen.

The number of dorsal and anal rays is sometimes less than in the type specimen; the number of pectoral rays is altogether 14, and the two detached rays reach at least as far as the end of the caudal fin.

The curious notch at the ventral base of the caudal fin is present in every specimen dredged.

This species appears to come nearest to *B. dubius*, Vaillant.

Off Laccadives, 891 fath.; off Maldives, 459 fath.; off Cape Comorin, 824 fath.

Family Stomiatiidæ.

THAUMASTOMIAS.

Thaumastomias atrox, Alcock.

Thaumastomias atrox, Alcock, Ann. & Mag. Nat. Hist., Sept. 1890, p. 220, pl. viii. fig. 7.

Lütken (Dansk. Vid. Selsk. Skr. 6 Række, Nat. Math. Afd. vii. 6, p. 281, 1892) and Collett (Poissons des Campagnes du yacht 'l'Hirondelle,' p. 131) consider that this species is identical with *Photostomias Guernei* of the latter author. If it were so, it would be very interesting to find another species common to the Azores and the Andamans and Bay of Bengal.

But, although the two forms are possibly congeneric, they are specifically quite distinct. Our two specimens, which are unusually perfect and well-preserved, have neither lingual teeth nor barbel, and have only a single short row of teeth on either palatine. The luminous organs also are different in the two species.

Family Sternoptychidæ.

DIPLOPHOS, Günther.

Diplophos corythæolum, sp. n.

B. 12. D. circ. 11. A. circ. 24. P. 10. V. 7.

Length of head about one fourth, height of body between one fifth and one sixth of the total without the caudal.

The snout, which has the lower jaw prominent, is hardly longer than the eye, which is not quite a fourth the length of the head. The eyes are not quite a diameter apart.

The maxillary almost reaches to the preopercular angle. There is a single row of small, rather distant, acicular fangs of unequal size in either jaw, and a row of close-set acicular teeth on part of the palatines; the whole surface of the mesopterygoids is studded with sharp little denticles.

Gill-openings extremely wide; four gills with short laminae; gill-rakers, especially those on the first arch, long and bristle-like.

The body has evidently been covered with large thin and deciduous scales.

The dorsal fin arises about an eye-length behind the base of the ventrals, and its last few rays are just above the first few anal rays; its first ray is slightly nearer to the snout

than to the base of the caudal. The long anal fin approaches within less than half a head-length of the base of the caudal. The pectorals are on almost the same plane as the ventrals, and these arise about midway between the base of the former and the origin of the anal.

The luminous organs are in two series on either side, and are of the "bull's-eye" type (a white ball in a black silver-lined pocket); the upper row extends from the basihyal to the base of the caudal fin, but the lower row extends only to the beginning of the anal fin; each of those of the upper row is surmounted by a tiny accessory organ. In addition there are some luminous organs on the head, notably one at the anterior angle of either orbit, and the whole crown of the head (from the snout to the occiput) appears to have been luminous.

Andaman Sea, 405 and 185 fath.

The largest specimen is 5 inches long.

Family Alepocephalidæ.

XENODERMICHTHYS, Günther.

Xenodermichthys squamilaterus, sp. n.

B. 6. D. 20. A. 18. P. 6. V. 6.

Body elongate, compressed, covered with jet-black skin in which scattered granular luminous organs are embedded. The lateral line is a salient tube which runs straight down the middle of the body and is stiffened by thin subcutaneous equidistant scales; in each interspace between the scales is a pore resembling a luminous organ.

Head about $3\frac{3}{4}$, greatest body-height about $5\frac{1}{2}$ in the total without the caudal. Snout about two thirds the length of the eye and about equal to the width of the interorbital space; eye about a fourth the length of the head. Lower jaw slightly prominent, with the symphysis acute. Mouth-cleft wide, the maxilla nearly reaching to the level of the posterior border of the orbit. A close-set row of extremely minute teeth in either jaw only.

Gill-openings wide, the membranes quite separate; four gills, with long close-set gill-rakers; pseudobranchiæ present.

The anal fin lies entirely in the posterior third of the body (measured without the caudal), but the first few dorsal rays are in advance of this. The ventrals are in the after half of

the body and the small pectorals lie close to the ventral profile.

The general structure and arrangement of the stomach, pyloric appendages, and intestine are as described in *X. Guentheri*.

A single specimen, 6 inches long, from off the Andamans, 370-419 fath.

This species is extremely closely related to *X. socialis*, Vaillant ('Travailleur' et 'Talisman' Poissons, pp. 162-165, pl. xiii. fig. 1), and to *X. Guentheri*, mili (Ann. & Mag. Nat. Hist., Nov. 1892, p. 359, pl. xviii. fig. 3), but is readily distinguished from both by the conspicuous lateral line.

Family Halosauridæ.

HALOSAURICHTHYS, Alcock.

Halosaurichthys nigerrimus, sp. n.

B. 12. D. circ. 12. P. circ. 9. V. 8.

This species very closely resembles *Halosaurichthys carinicauda* (Alcock, Ann. & Mag. Nat. Hist., Dec. 1889, p. 454; Illustrations of the Zoology of the 'Investigator,' Fishes, pl. vii. figs. 2, 2a), but may be recognized by the following specific characters:—(1) The maxilla reaches to the level of the anterior edge of the pupil; (2) the dorsal fold is simply a low fold of skin, which begins at an enlarged scale about two thirds of a head-length behind the dorsal fin and is not continued to the end of the tail; (3) the pectoral fins are extremely narrow and reach much more than halfway to the origin of the ventrals; (4) the colour is uniform jet-black.

Off Maldives, 459 fath.

Family Murænidæ.

NETTENCHELYS, gen. nov.

Nettenchelys is closely related to *Nettastoma* and *Saurenchelys*, but the tail does not taper to a point and the teeth are very different.

Body stout; tail longer than the combined head and trunk. Muciferous cavities of head well developed; snout much produced, broad, depressed; mouth-cleft very wide, broad bands of small conical teeth in jaws and vomer; tongue not free; a tubular nostril situated dorsally near the tip of the snout on either side. Gill-openings of moderate size, well

separated, four gills with wide clefts. No scales; the lateral line, which consists of a single row of pores, is very indistinct in the greater part of its extent. Dorsal and anal fins well developed, confluent with the broad caudal only in the basal half of the latter. No pectoral fins. An air-bladder; no pyloric appendages.

Nettenchelys Taylora, sp. n.

Head, measured to gill-opening, one seventh the total, and half as long as the distance between the gill-openings and the vent; the tail is thus a good deal more than half the total. Snout a third the length of the head (measured to the gill-opening), elongate, broad, depressed, bill-like, the upper jaw overlapping the lower. There is a series of large pores along the upper lip, as also along each side of the lower jaw and along the top of the snout on either side, but the only undoubted nostrils are a largish tubular pair at the tip of the snout. Eyes subcutaneous, not much more than a fourth the length of the snout and not much more than half a diameter apart.

The mouth-cleft reaches behind the eye; the dental surface of both jaws is broad and is crowded with row upon row of close-set conical teeth, which are little more than villiform, though the innermost row in either jaw is slightly enlarged. On the vomer is a long broad convex band of similar teeth—about six longitudinal rows of them. The tongue is large and thick and tapers to a point; it is firmly adherent to the floor of the mouth.

Gill-openings of moderate size, lateral, well separated.

No scales. Although the mucous system and pores of the head are so well developed, those of the lateral line, which are in a single row, very soon become distant, small, and inconspicuous, though they are continued to the end of the tail.

Though the tail tapers it does not end in a point, but in a broad caudal fin, the outer rays of which are confluent only in their basal half with the dorsal and anal fins; these latter are well developed, the dorsal beginning immediately behind the gill-opening. No pectorals.

The stomach forms a *cul de sac* of great length; the air-bladder extends a long way behind the vent.

Colours: dark lavender-grey; dorsal and anal fins with basal half whitish and free half blackish.

A ripe female, 22 inches long, from off the Travancore coast, 430 fath.

Named after Commander A. Dundas Taylor, late Indian Navy, who, in the year 1874, was chiefly instrumental in reviving the Marine Survey of India.

SYNAPHOBRANCHUS, Johns.

Synaphobranchus pinnatus (Gronov.), Gthr.

Synaphobranchus pinnatus. Günther, 'Challenger' Deep-sea Fishes, p. 253, pl. lxii. fig. A (ubi synonym.); Vaillant, Exp. Sci. 'Travailleur' et 'Talisman,' Poissons, p. 88, pl. vi. figs. 2-2 c; Goode and Bean, Oceanic Ichthyology, Mem. Mus. Comp. Zool. xxxvi. 1896, p. 143, pl. xlv. fig. 164.

Two specimens, identical with a 'Challenger' duplicate of this species—one from off the Maldives, 459 fath., the other from off Cape Comorin, 824 fath.—are the first recorded from Indian waters.

This species has a most suggestive range:—Off Madeira (*Johnson*), 740 fath.; off Morocco and neighbouring coasts, Azores, Canaries, and Cape Verd Islands ('*Travailleur*' and '*Talisman*'), 405-3200 metres; off Brazil, 1200 fath., and in the seas of Japan and the Philippines, 345-565 fath. ('*Challenger*'); off the Atlantic coasts of North America up to 1000 fath. ('*Fish-Hawk*,' '*Albatross*,' and '*Blake*').

ACANTHOPTERYGII.

Family Berycidae.

MONOCENTRIS, Cuv. & Val.

Monocentris japonicus (Houtt.), Cuv. & Val.

Monocentris japonicus, Cuv. & Val. Hist. Nat. Poiss. iv. 461, pl. xvii.; Temm. & Schleg. Faun. Japon., Poiss. p. 50, pl. xxii. fig. 1; Günther, Catalogue of Fishes, vol. i. p. 9.

See also Castelnau, P. L. S. New South Wales, vol. iii. 1878, p. 365; Hilgendorf, SB. Ges. nat. Freunde, Berlin, 1879, p. 22; Macleay, P. L. S. N. S. Wales, vol. v. 1880-81, p. 510; Steindachner and Döderlein, Denk. Ak. Wien, lxxvii. 1883, p. 217; Nyström, Bihang Svensk. Vet.-Akad. Handl. xiii. iv. no. 4, 1887, p. 4.

A fine specimen, 6 inches long, was taken in the Gulf of Martaban (Andaman Sea) at 67 fath.

This species, common in the seas of Japan, is said to have also been taken at Port Jackson. It is only one of several singular forms that the recent observations of the 'Investigator' have shown to be common to Indian and Japanese waters at moderate depths.

Family **Pediculati.****MALTHOPSIS, Alcock.***Malthopsis lutea*, Alcock.

Malthopsis lutea, Alcock, Ann. & Mag. Nat. Hist., July 1891, p. 26, pl. viii. figs. 2, 2 a; and Journ. As. Soc. Bengal, pt. 2, 1896, p. 319.

In the description of this species it is stated that the curious striated tubercles that take the place of scales are small, distant, and sunken on the ventral surface of the body. As a matter of fact, in several individuals lately dredged in the Andaman Sea at 185 and 405 fath., these plates in the middle line of the thorax and belly are particularly large and are in close contact.

Family **Cataphracti.****PERISTETHUS, Kaup.***Peristethus investigatoris*, sp. n.

Peristethus Murrayi, Alcock (nec Günther), Ann. & Mag. Nat. Hist., July 1891, p. 28.

D. 7/20. A. 21. L. lat. (from occiput) 35-36. L. tr. 4.

Head, measured from tip of preorbital process to hinder angle of operculum, $2\frac{2}{3}$ in the total, greatest body-height a little less than $6\frac{1}{2}$ in the total, without the caudal; greatest breadth of head equal to the length of the combined snout (including processes) and eye.

Preopercular processes short, broadly triangular, their length is not quite a third the distance between their tip and the eye. Preopercular ridge trenchant, ending in a sharp spine, which is about two thirds as long as the eye.

A spine at the posterior angle of the orbit, one on either side of the occiput, one on either post-temporal region, one at the upper angle of the operculum; in young specimens *only* there are three small inconspicuous tubercles, disposed in a triangle, on the forehead.

Interorbital space concave, less than the major diameter of the eye, which is not quite half the length of the snout (processes included).

The large labial tentacles, when laid back, reach beyond the base of the preopercular spine.

All the shields of the body carry a stout recurved spine—eight rows in all.

The anterior ventral plates are irregular in shape, their

greatest length, measured diagonally, is nearly twice their breadth, and is half again as much as the greatest length of the posterior ventral plates.

Colours in life : adults red, young dusky violet ; pectorals, first dorsal, and distal half of labial tentacles black, second dorsal with a black edge.

Andaman Sea, 188–220 fath. (1891) and 405 fath. (1896).

The largest specimen is a little over 6 inches long.

This species appears to be near to *P. platycephalum*, Goode and Bean, from Barbados.

Peristethus serrulatum, sp. n.

D. 7/22. A. 21. L. lat. 33. L. tr. 4.

Head, measured from tip of preorbital process to hinder angle of operculum, a little less than $2\frac{1}{2}$ in the total, greatest body-height a seventh of the total, without the caudal ; greatest breadth of head equal to greatest length of snout.

Preorbital processes long and narrow, their length is nearly half the distance between their tip and the eye. Preopercular ridge sharply serrulate, ending in a curved rather narrow spine, which is nearly as long as the eye. All the bony ridges of the head are finely serrulate or serrate ; in addition there are, on either side, a preorbital, a postorbital, and occipital, a post-temporal and an opercular spine, and on the forehead there are at least five small spines.

Interorbital space concave, less than the major diameter of the eye, which is somewhat less than a third the greatest length of the snout.

The large labial tentacles, when laid back, reach to the after limit of the orbit.

All the shields of the body carry a stout recurved spine—eight rows in all ; those of the posterior third of the lateral line are not simple spines, but are acutely produced both forwards and backwards. The anterior ventral plates are nearly twice as long as broad and nearly twice as long as the posterior ventral plates.

Colours in spirit : flesh-colour, rather dusky dorsally ; distal half of pectorals and edges of vertical fins blackish.

Andaman Sea, 185 fath. (1897).

Two specimens, each about 6 inches long.

ANACANTHINI.

Family Ophidiidæ.

DIPLACANTHOPOMA, Günther.

Diplacanthopoma raniceps, sp. n.

B. 8. D. circ. 110. A. circ. 75. V. 1. L. lat. circ. 74.

The tail (excluding the long tapering caudal fin) is not quite half the total length, and the length of the head is equal to that of the rest of the trunk; the height of the body is contained about $4\frac{2}{3}$ times in the total, without the caudal.

The head (including the branchiostegal rays and a large part of the isthmus, but excluding the occiput) and the greater part of the bases of the dorsal and caudal fins are invested in a thick, glandular, scaleless skin; the head is unarmed, except for two spines, one at the upper, the other at the lower angle of the operculum; these, however, hardly project through the thick loose skin; it is depressed and is very broad, its breadth being considerably more than the length of its post-ocular portion.

The snout is singularly broad, about twice as broad as long, and this, with the broad flat head, gives a very frog-like appearance. The eyes are subcutaneous, large, their major diameter being about two ninths the length of the head, and a good deal more than a diameter apart. Although the mouth is large, the maxilla hardly reaches to the hinder level of the eye, and is much less than half the length of the head. Villiform teeth in bands in the jaws, palatines, and vomer, the band on the premaxilla (only) being interrupted at the symphysis.

Gill-openings extremely wide, the branchiostegal membranes being quite free; gill-rakers short, except for three on the outer border of the first arch; no pseudobranchiæ.

Body covered with small deciduous scales; the lateral line is extremely inconspicuous, and is apparently present only in the anterior part of the body.

The dorsal fin begins immediately above the base of the pectoral; it and the anal are confluent with the caudal, which is almost as long as the post-rostral portion of the head and a little longer than the pointed pectorals. The ventrals are a little more than half the length of the head, each consists of at least two intimately fused rays.

The peritoneum in the male is very thick, and is as tough as a piece of leather, to strengthen and support the copulatory

organ, which it lines. The intestine is much coiled, and there are no pyloric cæca.

The copulatory organ of the male is massive, and is almost as long as the snout; it is hollow and lined by the peritoneum; the intestine opens at its base, and the testes are prolonged far into it; its free end has almost the consistence of cartilage, and is thrown into deep and intricate folds, from the innermost (anterior) of which a pair of tactile papillæ, one of which is of large size, project, the testes opening by a common orifice into the bottom of the outer (posterior) fold.

The corresponding organ of the female is smaller than that of the male, but still is large; it is a hollow cone lined by peritoneum and containing the ends of the ovaries, which have a common orifice of large size at its free end, which is spongy.

Two males and a female with ripe ova, from the Andaman Sea, 405 fath. (1897).

The largest male is nearly 7 inches long, the female not quite 6 inches.

This species is at once distinguished from *D. brachysoma*, Gthr., and *D. Rivers-Andersoni*, mihi, by the broad frog-like head and snout; in those species the occiput is high and the snout is much depressed, with an upturned tip, but in this



Male organ of *Diplacanthopoma raniceps*, $\times 4$.

species the head is broadly conical and gently and evenly declivous from occiput to tip of snout. Another difference is that in this species the two spines of the operculum are hidden beneath the skin, whereas in both the other species they are very sharply prominent.

From *D. Rivers-Andersoni* this species also differs in its much smaller size.

Family **Pleuronectidæ.****PÆCILOPSETTA, Günther.***Pæcilopsetta praelonga*, Alcock.

Pæcilopsetta praelonga, Alcock, Journ. As. Soc. Bengal, vol. lxxiii. pt. 2, 1894, p. 130, pl. vii. fig. 1; and Illustrations of the Zoology of the 'Investigator,' Fishes, pl. xv. fig. 2.

Boopsetta umbrarum, Alcock, Journ. As. Soc. Bengal, vol. lxxv. pt. 2, 1896, p. 305; and Illustrations of the Zoology of the 'Investigator,' Fishes, pl. xvii. fig. 5.

A series of specimens lately dredged from off the Andamans, 185 fath., shows that the fish I described as *Boopsetta umbrarum* is the adult of a fish that I had previously described as *Pæcilopsetta praelonga*.

This certainly differs from *P. colorata*, Günther, and from *P. maculosa*, mihi, not only in the form of the body, but in the relations of the eyes, which are larger and are in close contact, the upper one bulging far more into the dorsal profile. I do not, however, think that the differences are sufficient to justify their generic dissociation.

XXIII.—*On new Species of Histeridæ and Notices of others.*
By G. LEWIS, F.L.S.

LAST year two papers on Histeridæ appeared in this Magazine, one in August, the other in October; these papers included 34 new species, the greater part of which were of African origin. The present memoir treats of 14 African, 11 from the New World, and 2 Asian new species. Of the African species Mr. Guy A. K. Marshall has again contributed some which are very interesting, notably *Pachycræus princeps* and *Pelorusus carinatus*, and I am again much indebted to him for giving me extracts from his journal which record the habits and indicate the situations where his captures were found.

The *Saprinus* I describe is a very remarkable and pretty species; it has been found by Mr. L. Péringuey in the mounds of refuse formed outside the galleries of termites. The termites bring out from their burrows vegetal and other matter which are undesirable within the precincts of their colony, and these as they accumulate set up fermentation and attract stercoraceous and other species on which the *Saprinus* as an insectivorous species apparently feeds. The *Saprinus* is similar to several Indian species, *S. elegantulus*, Mars.,

orobites, Lew., &c.; but whether the Indian species are in any way associated with termites is not known at present.

Of the American species noticed in this paper, *Terapus carinatus* and *Termitoxenus strigicollis* are the most remarkable.

List of Species.

| | |
|---------------------------|------------------------------|
| Hololepta paropsis. | Hister tunicatus. |
| — africanæ. | Epiurus festivus. |
| — malaris, Lew. | — Wickhami. |
| Placodes ebeninus, Lew. | Carcinops tenuistriata. |
| Apobletes tuberculifrons. | Monoplius pinguis, Lew. |
| Platysoma pinnigerum. | Pelorusus carinatus. |
| — extrarium, Lew. | — costipennis. |
| Anaglymma verula. | Heterius tristriatus, Horn. |
| — punctipennis. | — brunneipennis, Rand. |
| Pachycrærus princeps. | Termitoxenus strigicollis. |
| — octostriatus. | Discoscelis amazonis. |
| — euphorbiæ. | Homalopygus annicola. |
| — verulamii. | Terapus bicarinatus. |
| Homalodes fortunatus. | — Marseuli, Westw. |
| Hister tardigradus. | Saprinus beatulus. |
| — sedulus. | Teretriosoma conigerum, Lew. |
| — Flohri. | Abreus cohæres. |
| — sarcinatus. | |

Hololepta paropsis, sp. n.

Elongata, depressa, nigra, nitida; fronte leviter impressa, haud striata; pronoto impunctato, stria laterali integra; elytris striis 2 dorsalibus brevissimis, 1^a appendiculata, fossa subhumerali lævi utrinque abbreviata; propygidio sulco arcuatim completo; pygidio inflexo, opaco, impunctato.

L. 7 mill. (absque mandibulis).

Elongate, depressed, black and shining; the head impunctate and without striæ, feebly impressed between the mandibles; the thorax (♂) slightly emarginate at the anterior angle, and the lateral stria ends anteriorly in a small circular fovea behind the emargination; the elytra have two short basal striæ and the first has a short apical appendage, the subhumeral sulcus is smooth and not very wide and is abbreviated before and behind; the propygidium has a complete arched sulcus, and there are a few small points along its posterior border; the pygidium is reflexed, acutely terminated on each side, opaque and impunctate; the prosternum broad and sinuous laterally; the mentum in the male is carinate, but the carination is extremely small and inconspicuous.

This is the only species of African origin known with an impunctate pygidium, and it is the only one at present

described in which the arched sulcus of the propygidium is complete. I only know the male. The species should be placed near *H. arcitenens*, Mars.

Hab. Usambara, East Africa, 1898.

Hololepta africanæ, sp. n.

Late ovata, depressa, nigra, nitida; fronte impressa; pronoto lateribus parce punctato; clytris stria dorsali 1^a brevi, appendiculata, 2^a brevissima; propygidio haud sulcato; pygidio dense punctato.

L. 12 mill. (absque mandibulis).

Broadly oval, depressed, black and shining; the head, ocular tubercles rather strong and depressed, with two extremely fine bent striæ behind the mandibles and only seen in certain lights, impressed anteriorly; the thorax, anterior angles in male emarginate, with a deep circular fossa immediately behind them, the marginal stria is very fine and apparently abbreviated before the posterior angle, inner stria abbreviated at the base and anteriorly not reaching the angle (this character is the better seen in the female, as the angle is without the fossa), there are a few punctures on the lateral border, more in the female than male, the anterior edge is almost straight behind the neck, base bisinuous near the scutellum; the elytra, the subhumeral furrow is wide in the middle and reaches the base, but not the apex of the elytra, the first stria is short and basal, with an appendage about its own length, second basal and very short; the propygidium has an impression on either side on the posterior edge, impressions punctate, also the lateral borders, posterior edge and disk smooth, there are no sulci; the pygidium is densely and coarsely punctate; the prosternum is wide, especially at the base, where it widens out triangularly, and bisinuous between the coxæ; the mesosternum has a rather fine stria on the anterior margin on each side; the anterior tibiæ are 4-dentate. The mentum of the male is rather feebly carinate.

In size this species is larger than *H. sternincisa*, Mars., and it is relatively broader.

Hab. Mikindani, East Africa.

Hololepta malaricæ, Lew.

Hololepta malaricæ, Lewis, Deutsche ent. Zeitschr. p. 261 (1895).

I find the thoracic fovea I mentioned (*l. c.* p. 262) as belonging to this insect is seen only in my first specimen, and is not a characteristic of the species. The anterior angle

of the thorax in the male is rather widely emarginate and without a fossette; prosternum very broad, shorter and broader, but similar in outline to *H. elongatus*, Er., and the mentum in the male is simply excavated and smooth, without any carina.

Three very similar African species may be distinguished from it as follows:—

H. arcifera, Mars.—Male anterior thoracic angle minutely emarginate; mentum with a well-marked median carina and the pygidium densely punctured.

H. arciteneus, Mars.—Male anterior thoracic angles rounded off; body elongate, with a feeble median elevation on the mentum, shortened before and behind.

H. semicincta, Mars.—Male with a thoracic fossette; anterior angles within the fossette feebly and minutely emarginate; mentum with a distinct median carina.

Placodes ebeninus, Lew.

Placodes ebeninus, Lewis, Ann. & Mag. Nat. Hist. (5) xv. p. 458 (1885).

On examining further specimens of this species, I find that the prosternum is constantly broader than that of *P. caffer*, Er., and that the prosternal striæ are always wanting.

Apobletes tuberculifrons, sp. n.

Oblongus, subquadratus, subdepressus, niger, nitidus; fronte in medio tuberculata, antice parum concava; pronoto, stria antice interrupta, ad angulos impresso, punctato; elytris striis tenuibus, 1^a subintegra, 2^a completa, 3^a late interrupta; pygidio utrinque depresso, in medio convexo, punctato; prosterno levi, bistriato; mesosterno late emarginato, antice haud striato.

L. 7 mill.

Oblong, but somewhat quadrate, rather depressed, black and shining; the head has a small, not highly raised tubercle in the middle, and is concave in front of it; before the eye the head projects in a well-marked acumination, and beyond the projection the outline of the head is bisinuous, the lateral stria stops at the first sinuosity, but posteriorly it continues as a fine stria round the back of the head, along the fine line there is a row of detached points; the thorax, the lateral stria is very fine and difficult to see, it is only visible from above at the angles and it is interrupted behind the head, the anterior angles are impressed and punctured and a few points are also seen at the posterior angles, scutellar point small and shallow; the elytra, humeral stria very fine, short, basal, and oblique, first stria very fine, shortened

apically, and almost evanescent in the middle, second more distinct and complete, third widely interrupted in the middle; the propygidium is transversely punctate; the pygidium is laterally depressed, convex in the middle, punctures clear and well-defined within the depressions, fine and less close on the convex area; the prosternum is smooth and bistriate, striae feebly sinuous and not quite reaching the base; the mesosternum is widely emarginate and has no anterior stria; the anterior tibiae 5-dentate.

The species in size and outline resembles a small specimen of *Platysoma ovatum*, Er., but the thoracic stria and the form of the sterna are similar to *Apobletes fossistoma*, Mars.

Hab. Usambara, East Africa.

Platysoma pinnigerum, sp. n.

Elongatum, subparallelum, convexum, nigrum, nitidum; fronte impressa, stria integra, pronoto disco bipunctato, stria marginali lateralibus valida, antico integra, basi in medio vix interrupta; elytris striis 1-3 integris, 4-5 dimidiatis; propygidio pygidioque planis, punctatis; prosterno angustato haud striato; mesosterno emarginato, stria marginali integra; tibiis late dilatatis.

L. $7\frac{1}{2}$ mill.

Elongate, somewhat parallel, convex, black and shining; the head smooth, stria well-marked over the eyes, complete anteriorly, but fine and irregular, sinuous in the middle, impressed anteriorly; the thorax, marginal stria strong at the sides, fine but complete behind the head, and at the base it is continued until it is narrowly interrupted before the scutellum, on the disk are two small but very distinct punctures, which with the antescutellar point form a triangular arrangement, thus—∴; the elytra, the epipleural striae are cariniform and complete, humeral short, fine, and oblique, striae 1-3 strong and complete, 4 apical and dimidiate, 5 similar but a little shorter; the propygidium and pygidium are flat and rather densely punctate; the prosternum impunctate, keel narrow except at the base; the mesosternum emarginate anteriorly, marginal stria complete and well defined; the tibiae are all greatly dilated, anterior pair 4-dentate, intermediate and posterior 4-spinose.

Platysoma palmipes, Lew., and *P. extrarium*, Lew., are somewhat similar to the species above, but they are less elongate. In *P. palmipes* the tarsi are short, but in *P. extrarium* and *P. pinnigerum* they are of normal length and not very dissimilar to those of *P. ovatum*, Er.

Hab. Lawang, East Java.

Platysoma extrarium, Lew.

Platysoma extrarium, Lewis, Ann. & Mag. Nat. Hist. ser. 6, vol. xx. p. 357 (1897).

I observed two discal punctures on the thorax of this species similar to those noticed above in *P. pinnigerum*; but I thought at the time the points were abnormal. They are probably constant.

Anaglymma verula, sp. n.

Breviter ovalis, depressa, picca, nitida; fronte sparse sed irregulariter punctata, stria laterali valide impressa; pronoto, stria laterali basi valida; elytris striis 1-4 integris, 5 et suturali utrinque abbreviatis; propygidio pygidioque parum dense et profunde punctatis; prosterno bistriato, striæ antico leviter divergentibus.

L. 2 mill.

Shortly oval, depressed, piceous, shining; the head anteriorly impressed, punctuation somewhat sparse, the largest points are near the centre of the head, in the impressed area the points are smaller, and extremely fine points are intermixed with the others over the whole surface, lateral stria short and deep like that of *A. punctipennis*; the thorax, marginal striæ complete, fine and rather widely crenulate anteriorly, laterally strong on the basal half, and behind the middle the interstice widens, the disk, a rather wide scutellar region, and a narrow space behind the neck are microscopically pointed, opposite the third dorsal stria is a cluster of punctures, which extend more or less along the border to the anterior angle; the elytra, striæ, outer humeral fine and complete, inner humeral complete and cariniform, 1-4 dorsal, strong and complete, 1, 2, 3 deepest at the base, crenulate apically, 4 finer and more crenulate, all are bent inwards at the base, 5 and sutural straight and equal in length, little shortened behind, more shortened in front, both feebly crenulate, dorsal region with microscopic points, apical margin with a band of punctures of varying sizes; the propygidium and pygidium with larger and deeper punctures somewhat closely set; the prosternum bistriate, striæ a little divergent anteriorly from the coxæ, keel microscopically pointed, anterior lobe with a cluster of rather large punctures on each side at the base, but otherwise with points of varying sizes; the meso- and metasterna, the arched stria is rounded off anteriorly, not at all angulate, and the crenulations anteriorly are wider and more distinct, although fine, than those of *A. punctipennis*.

The anterior tibiæ of all the species in this genus are 3-dentate on the outer edge, and afford no specific differences of importance.

Hab. Cameroon.

Anaglymma punctipennis, sp. n.

Breviter ovalis, depressa, picea, nitida; fronte punctata, stria utrinque valide impressa; elytris striatis, punctatis (basi excepta); propygidio pygidioque minutissime punctulatis, punctis grossis intermixtis; prosterno bistriato, striis subparallelis.

L. 2 mill.

Shortly oval, depressed, piceous, shining; the head anteriorly impressed, somewhat closely punctured with fine and coarse points evenly intermixed, lateral stria strong and nearly straight and anteriorly ends abruptly over the eye, there is a transverse fine stria at the base of the head (seen when the head protrudes); the thorax, marginal stria very fine and continued behind the head, surface evenly covered with large and small points not densely set; the elytra, striæ, inner humeral fine and shortened before the apex, outer stronger, apical, and dimidiate, 1-3 sinuous and complete, 4 turns towards the fifth at the base and from the middle to the apex is punctiform, 5 sinuous at the base and posteriorly is punctiform before the middle and apically is lost in the punctured surface, sutural is markedly shortened before the base and continued as points nearly to the apex, on the middle of the dorsum on the inner side of the sutural stria is a regular row of punctures, which seem to represent a double stria (a double stria is frequent in this genus), all the interstices are punctulate except those between the inner humeral and fourth stria, which are free of points on their basal half; the propygidium and pygidium are punctured similarly to the thorax; the prosternum, anterior lobe sparsely punctured, keel striate laterally, striæ nearly parallel, but incurved at the tips and feebly divergent at the base; the meso- and metasterna have the usual wide arched stria of the genus feebly angulate in the middle and vaguely crenulate anteriorly.

The prosternal striæ in being almost parallel distinguish this from any other described species; the punctuation of the elytra is also characteristic.

Hab. Zambé, Congo Free State.

Pachycrærus princeps, sp. n.

Oblongus, subcylindricus, viridi-cyaneus, nitidus; fronte grosse punctata; pronoto stria marginali integra, lateribus punctato;

elytris striis dorsalibus 1-4 integris, 5 nulla, humerali externa suturalique dimidiatis; propygidio pygidioque punctatis; prosterno bistriato, striæ posticis parum abbreviatis; mesosterno antice acuto producto, immarginato.

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

Oblong, somewhat cylindrical, greenish blue, shining; the head, surface rather closely and coarsely punctured, with a few very fine points on the interstices, marginal stria well marked over and in front of the eyes, but indistinctly continued across the epistoma, epistoma slightly excavated; the thorax, lateral border rather broadly punctate, punctures less closely set than those on the head and become scattered on approaching the disk, on the disk the points are very minute, marginal stria strong at the sides, especially at the anterior angle, and clearly continued behind the neck, there is a fine scutellar point at a little distance from the margin; the elytra, striæ 1-4 complete, 5 wanting, sutural well marked from the apex to the middle of the dorsum, thence just traceable to the base, humeral external dimidiate and apical, internal basal and very faint; the propygidium and pygidium are clearly and coarsely punctate and in density similar to those of the thoracic border; the prosternum, anterior lobe with a few large punctures intermixed with fine ones, keel bistriate, striæ abbreviated at the base and anteriorly bending towards each other, surface with fine scattered points; the mesosternum is somewhat acute anteriorly and is without a marginal stria; the legs are black, anterior tibiæ 5-dentate.

This species is the largest known in the genus; it is less cylindrical than *P. viridis*, Mars., and *P. Raffrayi*, Lew., but more cylindrical than *P. chalybeus*, Fähr.

Hab. Umgeni (8269) and Verulam (8182), Natal (*Marshall*). Found, in company with *P. cyanipennis*, Fähr., under the bark of decaying *Euphorbia*.

Pachycrærus octostriatus, sp. n.

Oblongo-ovatus, parum convexus, nigro-violaceus vel nigro-purpureus, nitidus; fronte haud excavata, stria late interrupta; elytrorum striis omnibus integris; prosterno bistriato, striis (basi excepta) parallelis; mesosterno stria antice integra; tibiis anticis 5-6-dentatis.

L. $5\frac{1}{3}$ mill.

Oblong-oval, somewhat convex, colour above rich dark violet, changing to purple in certain lights, beneath black, legs obscure reddish brown; the head, surface somewhat densely but minutely punctured, stria a little interrupted over the eyes and anteriorly scarcely passing the bases of the

mandibles, there is a shallow round impression behind the epistoma and two faint impressions, one on each side, close to the points where the striæ terminate; the thorax, marginal stria slightly interrupted behind the middle of the neck, surface punctuation very similar to that of the head, but there are a few larger points on the sides and along the basal edge, before the scutellum is a small puncture; the elytra, the two humeral striæ are complete, the fifth stria is somewhat evanescent at the base, otherwise all the dorsal striæ are complete, rather fine, and crenulate; between the first stria and the inner humeral stria near the base the interstice is crossed by an oblique stria (this stria represents the basal appendage of the inner humeral when not complete as in this species), interstices minutely punctulate; the propygidium has two rather large, but shallow and round impressions on either side of the apex, surface very minutely punctulate, with larger shallow oval points interspersed; the pygidium has the larger-sized punctures smaller and more round than those of the propygidium; the prosternum is bistriate, striæ fine and almost parallel, but widening out slightly behind the coxæ, the striæ are not turned inwards anteriorly, base sharply incised; the metasternum is correspondingly prominent, stria complete and arched in outline; the metasternum has a fine median line; the anterior tibiæ are 5-6-dentate.

This species is very similar in form and sculpture to *P. elegans*, Lew.

Hab. Cameroon.

Type Mus. Royal, Stockholm.

Pachycærus euphorbiæ, sp. n.

Oblongo-ovatus, convexus, niger, nitidus; fronte stria integra, ocellato-punctata, cum punctis minutis intermixtis; pronoto stria laterali antice interrupta; elytris striis 1-4 integris, 5 dimidiata, suturali basi abbreviata; propygidio ocellato-punctato; prosterno bistriato, striis lateralibus subparallelis.

L. $3\frac{2}{3}$ mill.

Oblong-oval, convex, black and shining, tibiæ and tarsi reddish brown, thighs darker; the head convex between the eyes, flat anteriorly, stria complete and well-marked, nearly semicircular in front, continuing as a fine stria along the base of the head, surface not closely punctured, with points of varying sizes, some ocellate, some very small, others intermediate; the thorax, lateral stria complete and close to the edge, interrupted behind the neck, punctured like the head, but the ocellate punctures are chiefly behind the head and

within the lateral border, except in the scutellar area there are large punctures along the basal edge, scutellar spot very small; the elytra, outer humeral stria apical and dimidiate, inner basal, oblique anteriorly and very close to the first dorsal stria, posteriorly it gradually becomes finer and disappears before the middle, 1-4 entire, first three deepest at their bases, 5 dimidiate, sutural abbreviated before the base, the fourth turns slightly inwards near the base, all the striæ are a little crenulate, apical border with a few ocellate punctures, apical rim brownish; the propygidium rather closely punctured, punctures ocellate, with fine points on the interstices; the pygidium similarly punctured at the base, points gradually evanescent to the apex, which is smooth; the prosternum, anterior lobe very minutely strigose and punctured like the head, keel bistriate, striæ cariniform, joining indistinctly in front, nearly parallel at the sides, widening out behind the coxæ; the mesosternum sinuous on either side anteriorly, stria complete, feebly sinuous in the middle and not following the outline of the segment at the sides, surface and that of metasternum with a very fine sparse punctuation; the anterior tibiæ 5-dentate, two centre teeth set together.

Hab. Umgeni (8272), Natal (*Marshall*). Under bark of decaying *Euphorbia*.

Pachycrærus verulamii, sp. n.

Oblongus, parum convexus, niger, nitidus; fronte stria integra; pronoto stria marginali abbreviata, laterali integra basi sinuata, antice interrupta; elytris striis 1-3 integris, 4 brevi, 5 brevissima, suturali dimidiata, margine apicali punctato.

L. $3\frac{1}{2}$ mill.

Oblong, rather convex, black and shining, the head feebly convex between the eyes and very feebly impressed behind the stria, stria complete and rather fine, almost straight anteriorly, punctuation not close, and like that of the thorax consists of fairly large points and fine ones intermixed; the thorax, marginal stria very fine and existing only from the anterior angle to a point before the middle, lateral stria turns inwards at basal angle and is widely sinuous at the sides, leaving a fairly wide margin, and becomes deeper from the middle to the anterior angle, and then passes along the anterior edge until it ends beyond the eye, the scutellar spot is a very fine point; the elytra, outer humeral wanting, inner humeral short at the base and somewhat oblique, with an appendage about its own length before the apex, 1-3 entire, 4 about one third of the elytral length, 5 half length of fourth, sutural

dimidiate and parallel to the suture, last three are apical, along the apical margin there is a rather broad band of points a little more thickly set than those of the thorax; the pygidium is pointed like the elytral border, but the punctuation of the pygidium is finer and seen chiefly at the base, at the apex the points are very fine and sparse; the prosternum, lobe transverse and punctured, keel smooth, bistriate, striae very slightly wider apart at the base, nearly parallel along their course; the mesosternum obtusely acuminate anteriorly, marginal stria following in the middle the course of the outline, it is well-marked and complete, surface and that of the metasternum smooth; the anterior tibiae 5-dentate and the interval between the three basal and the two apical is the widest; legs obscure brown or pitchy.

The thoracic marginal stria is peculiar in this species, and so is the lateral one, in being away from the edge. The inner humeral stria is formed like one of the short elytral striae in *Hololepta*.

Hab. S. Africa. Found at Verulam (8162) and Umgeni (8173), Natal, by Mr. Guy A. K. Marshall under the bark of decaying *Euphorbia*.

Homalodes fortunatus, sp. n.

Ovatus, convexiusculus, niger, nitidus; fronte impressa, stria integra, in medio retrorsum acuminata utrinque sinuata; elytris stria humerali externa integra, 1-2 dorsalibus integris, 3 dimidiata, postice punctata; mesosterno stria integra; pygidio dense punctato.

L. 7 mill.

Oval, little convex, black, shining; the head, surface with an extremely fine punctuation, frontal stria complete, anteriorly sinuous on either side, acuminate in the middle, on either side of and behind the acumination the forehead is impressed and the impressions are clearly punctate; the thorax laterally with a band of punctures, points clearest behind the anterior angles, less clear before the hinder angles, but continuing faintly a little along the base, marginal stria complete and markedly sinuous behind the eyes, antescutellar fovea small but clear; the elytra, striae, external humeral complete, internal fine and oblique at the base, punctiform in the middle, and continuing is shortened before the apex, 1-2 dorsal nearly complete and finely crenulate apically, 3 fine and crenulate at the base, but behind the middle punctiform, on either side of the suture, behind the middle, is a row of fine punctures which represent apical sutural striae; the

propygidium is rather densely punctured at the sides, the points becoming finer and less close in the middle, especially behind the base; the pygidium is evenly and densely punctured; the prosternum is very finely punctulate, and the points are most visible at the base; the mesosternum emarginate, marginal stria complete and well-marked.

The facies of this species resembles *H. punctistrius*, Mars. *H. tuberculipygus*, Sch., *H. fortunatus*, *H. Marseuli*, Sch., and *H. ebenninus*, Er., are the only species I know in this genus in which the mesosternal stria is complete, and the generic name *Diospyros* has been used for the last two species.

Hab. Chapada, Matto Grosso (*H. H. Smith*).

Hister tardigradus, sp. n.

Ovalis, subconvexus, niger, nitidus; fronte leviter convexa, stria antice recta, labro semicirculatum inciso; pronoto lateribus nigro-ciliato, stria interna antice, externa pone oculos, interruptis; elytris, striis 1-3 integris, 4 basin leviter abbreviata, 5 et suturali brevissimis punctiformis; pygidio densissime punctato; tibiis anticis tridentatis.

L. 12 mill.

Oval, rather convex, black and shining; the head, labrum is cut out on the middle of the anterior edge in the form of a semicircle, and the parts adjacent on each side of the incision project a little, the incision occupies rather less than a sixth part of the edge, frontal stria straight anteriorly, not deep but clearly marked, surface feebly convex, not impressed; the thorax ciliate laterally, outer lateral stria terminating behind the eye, inner stria interrupted behind the neck, within the inner stria on the basal edge is a small oblique impression; the elytra, striæ 1-3 complete, 4 slightly shortened at the base, 5 and sutural very short and consisting of only a few apical punctures, the apical margin of the elytra where the four dorsal striæ end is irregularly strigose; the propygidium has a small transverse smooth space on either side near the base and opposite to the fourth stria, sides densely punctate and feebly foveolate, median area less closely punctured; the pygidium is very densely punctate; the prosternum, anterior lobe obtusely pointed and marginate; the mesosternum is smooth, anteriorly emarginate, with the marginal stria interrupted behind the emargination; the anterior tibiæ are strongly 3-dentate.

The species most similar to the above is *H. robusticeps*, Mars. Marseul does not describe the propygidium of his species, but there are two small circular spaces on it which correspond as regards their position with those of *H. tardi-*

gradus, and the segment is punctured like the latter species, except that the posterior area is transversely smooth. Both species have similar strigosities on the elytral border.

Hab. Loulouaburg, Congo Free State.

Hister sedulus, sp. n.

Ovatus, convexus, niger, nitidus; fronte stria integra utrinque valida, labro antice minute tuberculato; elytris, striis 1-3 integris, 4-6 anticis abbreviatis; pygidio subopaco; tibiis anticis 4-dentatis.

L. $6\frac{1}{4}$ mill.

Oval, convex, black and shining; the head, labrum with a small tubercle on the middle of the anterior edge, frontal stria entire, deep laterally, anteriorly straight, surface impunctate; the thorax, marginal stria fine and terminating anteriorly behind the eye, outer stria short and bent and confined to the region of the anterior angle, inner stria complete, sinuous at the base, deep laterally, finer and feebly crenulate behind the head; the elytra, striæ, outer humeral wanting, inner apical strong and straight, reaching just beyond the middle, 1-3 complete, rather strong and feebly crenulate, 4-5 apical, the first reaching the middle, the second a little shorter, sutural apical and extending for two thirds of the elytral length, and widens out a little apically; the propygidium has a scattered fine punctuation, with microscopic points interspersed, the punctuation is scarcely seen along the apical border; the pygidium is but feebly shining and has a microscopical punctuation only; the prosternum, anterior lobe obtusely pointed, keel without sculpture; the mesosternum emarginate, stria complete and sinuous at the emargination; the tibiæ, anterior with two strong teeth and two small ones near the base, the apical tooth is much larger than the second, intermediate and posterior spinose.

The pygidium appears semiopaque and impunctate, but very fine points are seen with a good lens. The fine marginal stria terminating behind the eye is also an unusual character.

Hab. Usambara, East Africa.

Hister Flohri, sp. n.

Ovatus, perconvexus, niger, nitidus; elytris rubris, apice maculaque scutellari nigris; pronoto striis lateralibus integris; elytris striis 1-2 integris, 3 postice late abbreviata, suturali ante basin abbreviata; propygidio pygidioque sparse punctulatis.

L. $3\frac{1}{3}$ mill.

Oval, very convex, black, shining; the head, a few scat-

tered points are visible under a good lens, feebly convex within the stria, stria complete; the thorax, lateral internal striæ complete and continuing behind the head, external terminating anteriorly after passing the angle, interstices of equal breadth throughout, the antescutellar point is round, small, and close to the edge, there are rather long flavous hairs on the lateral edge; the elytra, the only humeral stria is short, basal, and oblique, almost touching the base of the first stria, 1-2 dorsal complete, 3 basal, almost reaching the middle, then interrupted, with a short apical appendage, 5 apical and very short, sutural shortened before and behind, the black scutellar marking widens out a little at the base; the propygidium is impressed on either side posteriorly and the punctuation, like that of the pygidium, is sparse; the prosternum without striæ, surface microscopically strigose; the mesosternum rather widely emarginate, stria follows the outline anteriorly; the suture between the meso- and metasterna is acuminate in the middle, the acumination pointing backwards; the fore tibiæ are relatively more dilated than in any other American species, the outer edge is entirely occupied by two blunt teeth, corresponding closely to those of *H. instratus*, but wider and smooth, the intermediate and posterior legs resemble those of *H. sellatus*, Lec., and are not unlike those of a species of *Pachylopus*.

Hab. Vera Cruz. Two examples were taken by Mr. Julius Flohr in December 1889. The second example is probably now in the Berlin Museum.

Hister sarcinatus, sp. n.

Oblongo-ovatus, convexus, niger, nitidus; fronte leviter impressa, stria integra antice recta, subinterrupta; pronoto, stria laterali externa brevi, interna integra; elytris partim rubris, striis 1-3 integris, 4-5 brevissimis, suturali ante medium abbreviata; propygidio pygidioque perspicuis punctatis; mesosterno vix late emarginato, stria integra; tibiis anticis 3-dentatis, dente apicali bifido.

L. $5\frac{1}{4}$ mill.

Oblong-oval, convex, black and shining; the head rather wide and slightly impressed in front, stria straight anteriorly and apparently broken in the middle, mandibles finely punctulate; the thorax, marginal stria conspicuously ending after passing a point behind the eye, outer lateral short, bent, and limited to the area of the anterior angle, inner lateral rather strong, not reaching the base, feebly sinuous, leaving the margin widest in the middle and continuing with crenulate

edges behind the head, surface with very fine almost microscopic points; the elytra, inner humeral stria fine, basal, and oblique, apically some darkish points are seen, which are not quite on the surface, dorsal striæ 1-3 complete, 4-5 apical and very short, the sutural does not enter the apical black band, and terminates after passing the middle of the dorsum; the elytra are red, with an apical black band, which continues along the suture and joins the scutellar spot, the scutellar maculation is rectangular at the base, but posteriorly it widens out in a lobe-shaped form and nearly touches the third stria; the propygidium and pygidium are clearly, not closely punctate, except at the apex of the pygidium, where the punctures gradually become fine; the prosternum, keel and median area of the anterior lobe with a few fine scattered points, sides more or less with coarse shallow punctures (all the species of this group have the prosterna very similar in structure and not striate); the mesosternum is rather widely emarginate and the marginal stria is complete and exactly follows the anterior outline; the anterior tibiæ are 3-dentate, apical tooth bifid.

This species should be placed next to *H. militaris*, Horn. In the allied species *H. biplogiatus*, Lec., *instratus*, Lec., and *Ulkei*, Horn, the mesosternal stria does not follow the anterior outline.

Hab. Winslow, Arizona (*Wickham*).

Hister tunicatus, sp. n.

Oblongo-ovatus, convexus, niger, nitidus; fronte impressa, stria integra antice recta; pronoto stria laterali externa brevi, interna integra, pone oculos sinuata; elytris, striis 1-3 integris, 4 late interrupta, 5 brevi, suturali utrinque abbreviata; mesosterno emarginato, stria integra; tibiis anticis 3-dentatis, dente apicali minute bifido.

L. $4\frac{1}{2}$ mill.

Oblong-oval, convex, black and shining; the head impressed anteriorly, stria complete, well-marked, and straight in front; the thorax, marginal stria ending after passing behind the eye, external very short (similar to that of *H. sarcinatus*, but shorter), internal complete, distinctly sinuous behind the eye, not sinuous laterally, margin rather broad; the elytra, striæ, inner humeral basal, short, and oblique, dorsal 1-3 complete, 4 apical, in length about one third of the length of the elytra, with a short appendage well behind the base, 5 shorter than the fourth and apical, the sutural apically is slightly shortened and anteriorly ends in the middle of the

black maculation, the colour is red, with a narrow band along the base, a broader apical band and a scutellar spot black, the scutellar maculation is shaped like that in *H. sarcinatus* and widens out behind to the third stria; the pygidia are much less clearly punctured than those of the last species, but the pygidium has a relatively finer and more scattered punctuation at the apex; the prosternum is similar to that of *H. sarcinatus*, but the mesosternum has a deeper and less wide emargination and the stria does not follow the anterior outline, behind the emargination the stria is feebly angulate and on either side leaves a slightly wider margin, in which respect it corresponds with *H. instratus*, Lec.; the tibiæ, anterior 3-dentate, apical tooth minutely bifid.

Hister militaris, Horn, *H. sarcinatus*, and *H. tunicatus* all agree in having a short external thoracic stria. Of these three species, *H. militaris* is oblong, the others oval.

Hab. Canon City, Colorado (*Wickham*).

Epiurus festivus, sp. n.

Ovalis, parum convexus, supra cæruleo-metallicus, pedibus piceis; fronte impressa, stria integra, inter oculos distincte punctata; elytris striis 1-4 et suturali integra, 5 basi abbreviata; mesosterno tristriato; prosterno bistriato, striæ antice hamatis, basi parum abbreviatis.

L. 3 mill.

Oval, rather convex, rich blue above and metallic, legs pitchy; the forehead distinctly impressed anteriorly, stria complete, surface with fine points anteriorly, but larger ones behind, and some between the eyes are ocellate, punctures closest near the neck; the thorax, marginal stria complete, disk with extremely fine and scattered points, punctuation externally more distinct; the elytra, external humeral striæ wanting, internal basal and short, sometimes with an appendage, dorsal 1-4 and the sutural complete, 5 well shortened before the base, apices punctured sparingly; the propygidium and pygidium finely punctulate; the prosternum with a very few scattered points on the keel, bistriate, striæ not touching the base and slightly hamate at the tips; the mesosternum has two anterior marginal striæ, then, after a narrow interstice, is an arched crenulate stria, and behind it is one stria (sometimes two) broken in the middle. It is probable, however, that the broken striæ belong to the metasternum.

This species belongs to the same section of the genus as *E. Waterhousei*, Mars., and *E. smaragdinus*, Mars., but the

head, fifth elytral stria, prosternal and mesosternal striæ are very different.

Hab. Santarem (*H. H. Smith*).

Epiurus Wickhami, sp. n.

E. italicus simillimus, sed pronoto stria marginali haud interrupta; elytris, striis impunctatis; prosterno striis laterali basi connexis. L. $2\frac{3}{4}$ mill.

This species is extremely like *E. italicus*, Payk.; the points of difference are:—the outline is a little more circular, the thoracic punctuation a little finer and closer, the lateral thoracic stria less strong and not interrupted at the anterior angle, the elytral striæ are more clearly impressed and without punctures, and, above all, the prosternal striæ meet at the base, inclosing a truncate space at the posterior end of the keel, and the meso- and metasterna are more evenly and more closely punctured.

It is the only American species of *Epiurus* known in which all the elytral striæ are complete and in which the fifth and sutural are joined at the base.

Hab. Indiana (*Wickham*).

Carcinops tenuistriata, sp. n.

Ovalis, convexicula, nigra, nitida; fronte punctulata; pronoto stria marginali integra, versus latera distincte punctato; elytris, striis punctulatis, 1-4 integris, 5-6 antice abbreviatis, leviter impressis. L. 2 mill.

Oval, somewhat convex, black and shining; the head punctulate, lateral stria terminating behind the mandibles; the thorax, marginal stria complete, disk finely punctulate, towards and at the sides the points are closer and larger, along the basal edge is a row of irregular punctures, the scutellar spot is rather larger than the punctures near it; the elytra, striæ, inner humeral best marked at the base, and after an interval continues as a very fine stria almost to the apex, outer humeral is median and very fine, only visible in certain lights, dorsal 1-4 complete, 1-3 best marked at their bases, 5 and sutural apical and shortened by one third, and like the fourth lightly impressed, the surface is punctulate, points scattered, at the base of each elytron is a linear puncture, which is apparently an appendage to the fifth stria; the propygidium is distinctly punctured; the pygidium has finer and less distinct points; the prosternum bistriate; the mesosternum widely sinuous anteriorly, stria complete.

The small stature and lightly impressed dorsal striæ suffice to distinguish this species from *U. consors*, Lec., to which it is in many ways similar.

Hab. Brownsville, Texas (*Wickham*).

Monoplius pinguis, Lewis.

It is only recently I have seen the female of this species. In well-developed specimens the female has an acute tooth on the fourth abdominal segment and there is a strong denticiform ridge on either side of the propygidium. In smaller examples these characters are less observable. The apex of the pygidium also has two blunt processes. Marseul only knew the male of *Monoplius inflatus* when he described and figured it; the female has a less conspicuous ridge on the propygidium, but the apex of the pygidium is of similar form to that of *M. pinguis*. The two species of *Monoplius* known occur in the mounds of stercoraceous and vegetal matter brought out of the galleries by the workers of an underground termite, *Hodotermes Havilandi*, Sh. In such places the larvæ as well as the imago have been found by Mr. L. Périn-guey.

Pelorurus carinatus, sp. n.

Ovalis, convexus, piceo-niger, parum nitidus; capite lato punctulato; pronoto stria marginali integra, sed antice leviter impressa; elytris multicarinatis; pygidio compresso, in medio carinato; prosterno angustato, bistriato; mesosterno, stria marginali obsoleta, in medio stria arcuata perspicua; tibiis anticis 10-12-dentatis, posticis multispinis.

L. $4\frac{1}{2}$ mill.

Oval, convex, nearly black, somewhat shining; the head widest anteriorly, epistoma also wide, surface punctulate, stria well-marked over the eyes, not continued anteriorly; the thorax punctured like the head, marginal stria complete, but crenulate and feeble behind the head; the elytra, humeral and subhumeral striæ cariniform and complete, dorsal stria represented by 13 carinæ, complete, between the sixth and seventh carinæ the interstice widens out at the base, along the outer edge of the sutural carina there are irregular marks which apparently represent an obsolete carina, the interstices are punctured similarly to the thorax; the propygidium and pygidium are also punctured in like manner, the latter is compressed longitudinally, leaving the centre line carinate especially near the apex; the sternal plates are densely and rugosely punctured; the prosternum narrow, the striæ are close

and parallel to each other for more than half their length and then at the base become widely divergent, anteriorly they are obliterated by the surface-sculpture; the mesosternum has no apparent marginal striæ, but there is a somewhat narrowly arched stria occupying the median area; the metasternum widens out very much at the base; the first segment of the abdomen is margined at the sides and densely sculptured; the anterior tibiæ have 10 or 12 long pale denticles on the outer edge, intermediate and posterior tibiæ have many pale spinosities.

Hab. Cape of Good Hope.

Pelorurus costipennis, sp. n.

Ovalis, parum convexus, obscure æneo-niger, subnitidus; fronte punctata, in medio concava; pronoto punctato, stria marginali integra; elytris multicostatis, intervallis carinulatis; pygidio apice carinato: prosterno margine antice bistriato; antennis pedibusque obscure brunneis.

L. $3\frac{1}{4}$ mill.

Oval, a little convex above, especially on the dorsum, black with a faint æneous tinge, feebly shining; the head somewhat closely punctate, concave in the middle; the thorax, stria complete and fine behind the head, punctured, punctures fine and not closely set before the scutellum, somewhat close and large at the sides, and those behind the anterior angle are sometimes confluent; the elytra, the costæ which represent the 1-5 striæ are markedly elevated, especially the first, second, and third, the sixth is indistinguishable amongst four carinæ next to the suture, in each of the intervals between the five costæ are two striæ with a carina between them, the striæ have somewhat irregular edges, the four sutural carinæ have a few punctures along their edges, the elytral rim resembles the first costa; the propygidium and pygidium are somewhat closely punctate, the latter is apically carinate; the prosternum, anterior edge of the anterior lobe has two deep marginal striæ with somewhat crenulate edges, surface with rather large scattered points, but these do not extend to the base of the keel, keel bistriate, striæ feebly sinuous in the middle and divergent at and near the base; the metasternum has a fine marginal crenulate stria and a transverse crenulate stria slightly bowed; the metasternum has a band of scattered punctures along its base and similar points behind the anterior angles, disk and anterior median area with microscopic points.

This curious species is one of Mr. Guy A. K. Marshall's

recent captures: the two deep marginal striæ on the anterior lobe of the prosternum are very peculiar.

Hab. Salisbury, Mashonaland, in cow-dung, December 1897.

Heterius tristriatus, Horn.

This species occurs in Colorado at an elevation of 8000 feet; the ant-host is *Formica obscuripes*, Forel (*Wickham*).

Heterius brunneipennis, Rand.

This species has been found in Iowa by Mr. H. F. Wickham with *Formica subsericea*, Say, *F. exsectoides*, Say, and another ant which is probably *F. fuscogagates*, Forel.

Termitoxenus strigicollis, sp. n.

Ovatus, parum convexus, piceus, nitidus, sparse setulosus; fronte lateribus carinatis; pronoto longitudinaliter undique strigoso; elytris in medio profunde foveolatis; propygidio basi bituberculato et dense ocellato-punctato; pygidio apice bi-impresso, fortiter rugoso.

L. $3\frac{1}{4}$ mill.

Ovate, rather convex, especially in the dorsal region, piceous, shining, and sparingly setose; the head, marginal stria cariniform, not meeting anteriorly, nor following the sinuous edge, surface striate, striæ sometimes reticulate with a puncture in the interspace; the thorax, hind angles smoothly excavated, anterior angles obliquely truncate, surface wholly strigose, striæ long and clear, about 20 in number, and mostly crossing from the anterior edge to the base, a few bifurcate and those in front of the scutellum turn inwards and are partly interrupted or broken, there are a few fine punctures on the interstices, along the basal edge are some ocellate punctures, the marginal stria is cariniform and is double behind the head, with a row of irregular punctures on the interstice; the elytra, striæ, humeral and subhumeral are cariniform and complete and join apically, 1-4 are fine, irregular and shortened at both ends, along the outer edge of the first striæ there are detached fine broken lines, but these do not apparently represent a true stria, the fifth is wanting and the sutural is arched at the base turning towards the fourth stria, posteriorly it terminates in the dorsal hollow, in the middle of the dorsum there is a large hollow with nearly circular edges, in the centre of this pit there is a circular smooth puncture with three others behind it, the first two of which are somewhat transverse, the last

one is the smallest, along the apical edges of the elytra is a broad band of an intricate sculpture somewhat similar to that of the mesosternum, this gives way to simple points on the dorsal area, a fine marginal stria, which apparently arises in the dorsal pit, continues close to the edge round the apical margin; the propygidium has two smooth tubercles on its basal edge and the surface otherwise is densely and clearly ocellately punctate; the pygidium, the lower half is bi-impressed, apex has a small concave smooth space surrounded by conspicuous irregular ridges which occupy the impressed area, the upper half has an irregular sculpture somewhat resembling that of the mesosternum; the prosternum, anterior lobe with an elevated margin, keel feebly concave with lateral cariniform striæ, which indistinctly meet in front and are slightly sinuous near the coxæ; the mesosternum, anterior edge strongly bisinuous, with a line of punctures across the projecting centre, marginal stria fine and clear, but it does not follow the sinuosities, surface-sculpture (with that of the metasternum, between which there is no visible suture) consists of small crescent-shaped striæ with a puncture within each, these half-circles bend towards the head and as they are fairly closely set give an imbricate appearance to the surface. The mesosternum and metasternum are bistriate laterally. There are eight well-developed spines on the anterior tibiæ and other smaller ones, the larger are divided in the middle by a rather wide interval.

Hab. Para (H. H. Smith).

Discoscelis amazoniæ, sp. n.

Oblongo-ovata, supra convexa, undique punctulata, picco-brunnea, parum nitida; fronte depressa, stria integra; thorace margine laterali conspicue depresso, ante scutellum foveolato; elytris, striis completis, 4^a cum suturali basi conjunctis; mesosterno transversim bistriato.

L. $3\frac{1}{2}$ mill.

Oblong-oval, convex above, pitchy-brown, somewhat shining, densely punctulate; the head, frontal stria fine and widely sinuous anteriorly, strong before the eyes and semi-circular in outline, median anterior area and base of the epistoma depressed; the thorax punctulate like the head, with an ante-scutellar fovea, the lateral rim is finely raised and carried on behind the head as a stria, within a very narrow and convex interstice is a stria which reaches from the base to a point behind the anterior angle, inside this stria there is a broad somewhat irregular depression, narrowest at

the base, widest behind the anterior angle; the thorax is deeply cut out to receive the head; the elytra, the two humeral and six dorsal striæ are all complete, the third dorsal is bent in the middle, the fourth is bow-shaped and joined to the sutural at the base, the interstices between the sutural and fourth striæ are wide, the elytral surface is densely punctulate and under the microscope each puncture is seen to be joined to others by very fine striæ; the propygidium and pygidium, the punctuation consists of fine points intermixed with larger ones, some of the latter are minutely ocellate; the prosternum, keel narrow, striæ joined anteriorly, parallel at the sides but diverging before the base; the mesosternum, the marginal stria is bisinuous following the outline of the anterior edge, a second transverse stria is oblique at the sides and forms an angle in the middle; the metasternum and mesosternum are alike evenly, not closely, punctulate; the first abdominal segment is margined anteriorly and laterally and has large shallow punctures on the anterior border.

This species is somewhat similar to *Phylloscelis Arechavalete*, Mars., which is, as Herr Schmidt states, a species of *Discoscelis*.

Hab. Santarem (*H. H. Smith*).

Homalopygus amnicola, sp. n.

Oblongo-ovatus, parum convexus, undique punctatus, piceus, nitidus; antennis pedibusque rufo-brunneis; fronte dense subocellato-punctata; pronoto utrinque bistriato, stria post capitem in medio interrupta; elytris, striis 1 3 posticis abbreviatis, 4 antice curvata, suturali basi abbreviata; propygidio pygidioque distincto punctatis; prosterno bistriato, striis anticis conjunctis; mesosterno, stria integra leviter impressa; metasterno utrinque bistriato.

L. 3 mill.

Oblong-ovate, rather convex, piceous, shining; antennæ and legs reddish brown; the head wholly punctate, punctures large and somewhat ocellate but shallow, obsolete striate over the eyes; the thorax punctured, points on the outer borders smaller than those of the head, and they gradually become smaller and fewer nearer the disk, on the disk they are fine and sparse, the sides are bistriate, outer stria well away from the margin, very fine, and bending inwards anteriorly, internal stria also very fine and shortened anteriorly, interstice widest anteriorly, both striæ are rather oblique at their bases, behind the head is a transverse stria interrupted in the middle which appears to be an appendage

to the inner stria, the marginal stria is complete behind the head, but extremely fine and laterally cannot be seen from above; the elytra, striae, outer humeral complete and cariniform, inner humeral fine and complete and sinuous before the apex, 1-3 dorsal shortened posteriorly, interstices rather wide, that between the first and second widest at the base, fourth and sutural finer, fourth more shortened apically and at the base turning towards the suture, sutural stria shortened before the base and bent at the tips, the punctuation of the elytra is similar to, but rather less close than, that of the thoracic disk; the propygidium and pygidium are clearly and rather closely punctate; the prosternum is bistrate, striae joining anteriorly, sinuous between the coxæ and very feebly divergent at the base; the mesosternum has a fine marginal stria and the metasternum two lateral ones; the anterior tibiæ are moderately dilated.

The superficies of this species is closely similar to *H. commensalis*, Lew., but it is a little less convex, the thoracic punctuation less dense and pygidia more strongly punctate. In *H. commensalis* the outer humeral stria is fine and feebly cariniform, inner humeral fine and somewhat vague and evanescent in the middle. In *H. cavifrons*, Lew., the outer humeral is wanting and the inner humeral short, basal, and vague.

Hab. Rio Janeiro (*H. H. Smith*).

Terapus bicarinatus, sp. n.

Oblongus, postice gibbus, cinereo-brunneus; antennis tarsisque rufis; fronte punctata, margine extus elevata; thorace utrinque profunde excavato; elytris in medio longitudinaliter carinatis.
L. $2\frac{1}{2}$ mill.

Oblong, gibbous behind, ashy-brown, somewhat shining; the forehead, surface closely and evenly covered with large shallow rugose punctures, with the interstices smoother and slightly raised, margin elevated, angular before the eyes, with an emargination on the anterior edge; the thorax punctured like the forehead, but the interstices are wider and flat, lateral edges raised and continued obscurely as a stria behind the head, within the margin on either side are two irregular deep pits, the limits of these cavities are thin and transparent and distinctly reddish brown, anterior angles somewhat rounded off, with the edge behind the head simply but widely emarginate, not bisinuous like that of *Terapus Mniszechi*, Mars.; the elytra have large shallow spaces (in lieu of punctures), a few of which are confluent, with their

interstices raised and irregular, and those bordering the suture are cariniform, the lateral margin is carinate with a short basal subhumeral carina, and down the middle of each elytron is a well-marked carina commencing at the base and terminating before the apex, behind the middle the carinæ bend towards each other but do not approach the suture; the propygidium, the sculpture is somewhat similar to that of the head, the posterior margin is thickened and projecting, and has a median and two lateral impressions; the pygidium is sculptured like the propygidium; the prosternum, keel concave, with corresponding carinate edges, base smooth, anterior lobe with large shallow punctures, which spread half-way down the keel; the mesosternum, anterior and lateral edges carinate, surface with large and clear punctures not very closely set; the metasternum similarly sculptured and carinate laterally; the fore legs are rather less angular than those of *T. Mniszechi*, Mars., the intermediate and hinder tibiæ are not angulate, but project a little at the end of the tarsal groove, and the tarsi are relatively much shorter than those of Marseul's species. The posterior thighs have a conspicuous projecting obtuse process pointing towards the coxæ and close to the base or constricted part; in Marseul's species this process is very conspicuous and truncate, but it is not shown in Marseul's figure.

Hab. Santarem (*H. H. Smith*).

Terapus Marseuli, Westw.

Terapus Marseuli, Westw. Thesaurus, Ent. Oxon. p. 67, t. 3. fig. 9 (1874).

“Niger, nitidissimus, minute punctatissimus; pronoto angulis anticis rotundatis, lævissimis, dorso sulco lato profundo medio, angulis posticis elevatis, sulco transverso e parte antica separatis; elytris breviter ovatis, sutura depressa, singuli medio disci elevato, podice sinuato; pedibus elongatis; tibiis omnibus extus pone medium angulatis, apice extus sulcatis pro receptione tarsorum recurvorum.

“Long. corp. lin. 2.”

From the above it will be noticed that the front tibiæ are acutely angulate in this species.

Hab. Amazonia (*Bates*).

Saprinus beatulus, sp. n.

Breviter ovatus, cupreus, nitidus; pedibus antennisque obscure brunneis, clava rufa; fronte parum dense punctata; pronoto elytrisque cum spatiis lævibus nitidis; prosterno basi minuto strigoso.

L. 2-2 $\frac{1}{4}$ mill.

Shortly oval, convex, coppery and shining; the head transverse, rather densely and subocellately punctured, stria complete, carinate anteriorly, straight in the middle, sinuous on either side; the thorax, punctate like the head, marginal stria complete, before the scutellum is a cone-shaped smooth area which extends to the middle of the disk, on either side there are two basal, two median, and one anterior smooth spaces, the last is behind the eye, the inner spaces are irregular and sometimes join; the elytra punctate like the thorax, with a smooth space at the base between the sutural and fourth striæ and there is an irregular transverse smooth band behind it, the apical border is smooth and there is a space between the second and third striæ smooth, the smooth area is truncate anteriorly and posteriorly widens out across the third and fourth striæ, a small humeral boss is smooth, and near the apex in a line with it is an irregular small smooth space; the propygidium is wholly punctate; the pygidium has two longitudinal smooth median bands, the bands touch the base only; the prosternum, keel strigose at the base, striæ join behind and inclose a lobe-shaped punctate surface, before the coxæ the striæ are close together and parallel to each other, on either side of the keel is a strong bent carina, anterior lobe roughly punctured; the mesosternum widely sinuous anteriorly, surface clearly and rather densely punctate, marginal stria obliterated in the middle; the metasternum is smooth, with a band of punctures along the base which widens out in the middle towards the disk, and there is also a cluster of punctures on each side behind the anterior angles; the first abdominal segment has somewhat similar punctures, but they continue laterally as a broad even band.

This species belongs to the same group as *S. elegantulus*, Mars., but its outline is less oval.

Hab. Cape of Good Hope. Discovered by Mr. L. Péringuey associated with *Hodotermes Havilandii*, Sh.

Teretriosoma conigerum, Lew.

Teretriosoma conigerum, Lew. Biol. Cent.-Amer., Col. vol. ii. pt. 1, p. 223, pl. vii. figs. 2, 2 a, 2 b (1888).

The original specimen of this species came from Guatemala, but recently examples have been taken in Texas, "under bark of decaying posts and by beating heavy tangled masses of vines and bushes where a good many dead branches were intertwined" (*Wickham*).

Abræus cohæres, sp. n.

A. bonzico similis, sed multo minor, fronte leviter impressa; metasterno haud canaliculato.

L. $1\frac{3}{4}$ mill.

Circular in outline, convex, black and somewhat opaque, densely punctate, with short slightly club-shaped setæ; the head densely and coarsely punctured, with a feeble median frontal impression; the thorax and elytra are similarly punctate, except that the thorax has large punctures along the basal edge, and the elytra for the posterior half are longitudinally rugose; the propygidium is punctured like the disk of the thorax, but the punctuation of the pygidium is smaller, more even and clear; the prosternum and mesosternum are somewhat irregularly punctured, the punctures varying in size; the metasternum has an extremely fine longitudinal median line, and the punctures on the surface are more closely set than those of the mesosternum; along the anterior edge of the first abdominal segment is a row of large punctures.

This species resembles *A. bonzicus*, Mars., but it is about half its size. *A. bonzicus* has a straight, shallow, but well-marked median channel down the middle of the metasternum; this character is not noticed by Marseul. It is probable both species are of stercoraceous habits, as I found *A. bonzicus* in great profusion in horse-dung at Otaru, on the west coast of Yezo, on the 4th August, 1880.

Hab. Hongkong (*J. J. Walker*). Several examples.

XXIV.—*Report on the Rules of Zoological Nomenclature to be submitted to the Fourth International Zoological Congress at Cambridge by the International Committee for Zoological Nomenclature**.

1898.

INTRODUCTION.

THIS Report is "informal," in the sense that while the Committee has discussed the subject-matter herein contained, and has agreed to submit to the next International Zoological Congress the views expressed below, it has not yet had an opportunity to discuss in detail the exact arrangement of the various rules and recommendations. In its final sessions at Cambridge the Committee will

* The International Committee, which was appointed at the Leyden Meeting of the Congress in September 1895, consists of Dr. R. Blanchard of Paris, Prof. J. Victor Carus of Leipzig, Dr. F. A. Jentink of Leyden, Mr. P. L. Sclater of London, and Dr. C. W. Stiles of Washington. The English edition of the Report has been prepared by Dr. Stiles.

undoubtedly make certain changes of an editorial nature, and will naturally consider the sequence of the various articles.

In the French edition* of the proceedings Prof. Blanchard has followed as closely as possible the original sequence of the Paris-Moscow Code. Certain changes in this sequence are, however, advisable. I have thought best for the present to adopt the order suggested by Prof. Carus.

The Committee has decided to recommend to the next Congress the appointment of a Permanent International Committee of not less than seven members, whose duty it shall be to examine and report upon all propositions of nomenclature submitted to the Fifth or any succeeding International Zoological Congress.

It is the unanimous opinion of the present International Committee that no proposition for change, amendment, or addition to the International Code of Zoological Nomenclature should be allowed to come before the Fifth or any succeeding International Zoological Congress for consideration unless the said proposition shall have been in the hands of the Permanent International Committee at least one year before the date of meeting of the Congress.

Any person receiving copies of this Report, and desiring to express any opinion, favourable or otherwise, upon any principle contained therein, is invited to communicate personally by letter with any member of the Committee. The Members of the Committee cannot, however, at present enter into any public discussion in the scientific journals.

C. W. STILES †.

A.—RULES.

I. GENERAL PROPOSITIONS IN ZOOLOGICAL NOMENCLATURE.

1.

Zoological nomenclature is binomial. Every animal (living and fossil) is designated by a generic name followed by a specific name.

Example: *Corvus corax*.

These names must be either Latin or Latinized, or considered or treated as such, in case they are not of Latin origin.

2.

In certain cases, where it is desirable to distinguish subspecies or varieties, this may be done in the manner hereinafter provided.

3.

Zoological nomenclature is independent of botanical nomenclature. (At the same time it is well to avoid the introduction into Zoology as generic names of such names as are already in use in Botany.)

* Bull. Soc. Zool. France, 1897, pp. 173-185.

† Present address: United States Embassy, Berlin, Germany.

4.

A generic name is to be rejected when it has previously been used for some other genus of animals.

5.

A specific name is to be rejected when it has previously been used for some other species or subspecies of the same genus.

6.

Rejected homonyms* can never again be used. Rejected synonyms* can never again be used except in cases of the restoration of erroneously suppressed groups.

Examples: *Tenia Giardi*, Moniez, 1879, was suppressed as a synonym of *T. ovilla*, Rivolta, 1878; later on it was discovered that *T. ovilla* was preoccupied (*T. ovilla*, Gmelin, 1790). *T. ovilla*, 1878, is suppressed as a homonym, and can never again be used; it was superfluous, and cannot be employed, even if the species is placed in another genus (*Thysanosoma*). *T. Giardi*, 1879, which was suppressed as a synonym, becomes valid upon the suppression of the homonym *T. ovilla*.

7.

A name once published cannot be rejected even by its author because of inapplicability.

8.

Majority (BLANCHARD, CARUS, SCLATER):

All grammatical errors must be corrected; at the same time hybrid names are to be retained without emendation.

Examples: correct *Cuterebra* to *Cutiterebra*, *Glossiphonia* to *Glossosiphonia*, but do not change *Fernipsylla* to *Helminthopsylla*.

Minority (JENTINK, STILES):

Barbarisms and solecisms shall be construed (under B. 35*k*) as arbitrary combinations of letters, and cannot be rejected or emended because of faulty construction. Hybrid names are to be avoided, but when once published are not to be rejected.

II. GENERIC AND SUBGENERIC NAMES.

9.

A generic name must consist of a single word, preferably a noun, simple or compound, but always written as one word in the nominative singular (see Rule 1).

* A homonym is one and the same name for two or more different things. A synonym is one of two or more different names for one and the same thing. In the example given, *T. ovilla*, 1878, and *T. ovilla*, 1790, are homonyms, while *T. ovilla*, 1878, and *T. Giardi*, 1879, are synonyms. Rule 6 is simply a more detailed wording of the poorly expressed and too often misinterpreted "Once a synonym, always a synonym." "Once a homonym, always a synonym," is correct, but "Once a synonym, always a synonym," is inexact.—C. W. S.

10.

Generic and subgeneric names are subject to the same rules and recommendations, and from a nomenclatural standpoint they are coordinate.

III. SPECIFIC NAMES.

11.

Specific names, whether substantives or adjectives, must in every case be uninominal. This does not, however, exclude the use of compound proper names indicating dedication or compound words indicating a comparison; such words are written as one word with or without the hyphen.

Examples: *Sanctæ-Catharinæ*, *Jan-Mayeni*, *cornu-pastoris*, *cor-anguinum*, *cedo-nulli*.

12.

Specific names are of three kinds:—

a. Adjectives which must agree grammatically with the generic name.

Examples: *Carabus auratus*, *Felis marmorata*, *Emys Belliana*.

b. Substantives in the nominative in apposition with the generic name.

Examples: *Felis leo*, *Sphinx elpenor*.

c. Substantives in the genitive, such as those given in dedication to persons or groups of persons.

The genitive is formed by adding an *i* to the exact name of the person if a man, an *æ* in case the person is a woman. In case the name in question is one which was employed and declined in Latin, it follows the rules of declination. It is placed in the plural when the dedication is made to a group of persons.

13.

Majority (BLANCHARD, JENTINK, STILES):

While it is desirable to avoid the repetition of the generic name as a specific name (*Perdia perdia*, *Trutta trutta*), such repetition is not sufficient grounds for rejecting or changing either the generic or the specific name. The same principle applies to the repetition of the specific name as subspecific or varietal name (*Amblystoma Jeffersonianum Jeffersonianum*).

Minority (CARUS, SCLATER):

Specific names, when used as generic, must be changed.

14.

Specific and subspecific names are subject to the same rules and recommendations, and from a nomenclatural standpoint they are coordinate.

IV. THE MANNER OF WRITING GENERIC AND SPECIFIC NAMES.

15.

Generic and subgeneric names are to be written with a capital initial letter.

16.

While specific names derived from persons may be written with a capital initial letter, all other specific names are to be written with a small initial letter.

Examples: *Rhizostoma Cuvieri*, *Francolinus Lucani*, *Æstrus bovis*.

17.

Majority report (BLANCHARD, JENTINK, SCLATER):

The author of a species shall be that person who

- a. First describes and names the species in conformity with Rule 1.
- b. Names a described but unnamed species.
- c. Substitutes a name given according to Rule 1 in place of one given contrary to that article.
- d. Suppresses a preoccupied name and substitutes a new name in its place.

The name of the author of the species is written in the same type as the text and immediately after the specific name, without the interposition of a comma; if the text is Roman, the generic and specific names are placed in italics; if the text is italics, the binominal is placed in Roman.

Minority report (CARUS, STILES):

- a. The author of a species or other group is the author of the name of that species or group.
- b. The author of the name of a species or other group is he who first published that name in a recognizable manner—except that where the publishing author has had access to the manuscript statements of another author, as in a posthumous work or a borrowed manuscript, the authority which he gives for the name shall be considered correct and accepted, unless it shall be proved afterwards to be incorrect. In this case it shall be considered that the writer of the manuscript publishes the name in the article of the author that quotes him.

$c=b$
 $d=c$
 $e=d$

} of the Majority.

- f. The authority for the specific or other name is written after that name, and is not separated from it by any mark of punctuation, except—
 1. In cases of specific names which are transferred to another than the original genus, or combined with another than the original generic name with which they

were first published, the author of the specific name is to be placed in parentheses.

2. Where a genus is reduced to subgeneric rank, or a subgenus is raised to generic rank, the name of the author of the name is to be enclosed in parentheses.

18.

When it is desirable to cite the name of a subgenus, this name is to be placed in parentheses between the name of the genus and that of the species.

Example: *Vaessa (Pyrameis) cardui* Linné.

19.

a. If it is desired to cite the name of a variety or subspecies, such name is written immediately following the specific name.

b. The citation of a variety or subspecies in binominal form (as *Corvus kamtschaticus* instead of *C. corax kamtschaticus*) is not permitted (see Rule 33). The introduction of the words "varietas" or "subspecies" or their abbreviations "var." or "subsp." is therefore not necessary.

Examples: *Rana esculenta marmorata* Haliwell, but not *Corax kamtschaticus* instead of *Corvus corax kamtschaticus*. On hybrids see Rule 34.

V. SUBDIVISION AND UNION OF GENERA AND SPECIES.

20.

When a genus is divided into two or more restricted genera, the original name must be retained for one of the restricted genera; if a type species has been proposed, the division containing that species must retain the (otherwise valid) generic name.

The name of the typical subgenus must be the same as the name of the genus.

21.

If the original type of the genus is not clearly indicated, the author who first subdivides the genus may apply the original generic name to such restricted genus as he may judge advisable, and such assignment is not subject to subsequent modification.

In no case, however, can the original name be transferred to a group containing none of the species originally included in the genus or which the author of the original genus doubtfully referred to it.

22.

The division of a species into two or more restricted species is subject to the same rules as the division of a genus. But a specific name which undoubtedly rests upon an error of identification cannot be retained, even when the species are afterwards placed in different genera.

Example: *Tænia pectinata* Goeze, 1782 = *Cittotonia pectinata* (Goeze) Raill., while "*Tænia pectinata* Goeze" von Zeder, 1800 = *Andrya rhopaloccephala* (Riehm). *Andrya pectinata* (Zeder) could not be admitted.

23.

When a species is divided, the restricted species to which the original specific name of the primitive species is attributed may receive a notation indicating both the name of the original author and the name of the reviser.

Example: *Tænia pectinata* Goeze partim, Riehm.

By application of Rule 22 both the name of the original author and of the reviser are placed in parentheses if the species is transferred to another genus.

Example: *Monieza pectinata* (Goeze partim, Riehm) Blanchard.

24.

A genus formed by the union of several genera takes the oldest valid generic or subgeneric name of its components. If the names are all of the same date, that selected by the first reviser shall be retained.

25.

The same rule is applicable when several species or subspecies are united to form a single species.

26.

When, in consequence of the union of two genera, two different animals having the same specific or subspecific name are brought into one genus, the more recent specific or subspecific name falls as a synonym.

VI. FAMILY AND SUBFAMILY NAMES.

27.

The name of a family is formed by adding the ending *idae*, the name of a subfamily by adding *ina*, to the root of the name of its type genus.

28.

The name of a family or subfamily should be changed when the generic name serving as a type is changed.

VII. THE LAW OF PRIORITY.

29.

The name of a genus or species can only be that name under which it was first designated, on the condition:

- a. That this name was published and clearly defined or indicated.
- b. That the author has properly adopted the principles of binominal nomenclature.

30.

The tenth edition of the 'Systema Naturæ,' 1758, is the date of the consistent general application in Zoology of the binary system of nomenclature. This date therefore is accepted as the starting-point of zoological nomenclature and of the operation of the Law of Priority.

31.

The Law of Priority obtains, and consequently the oldest available name is retained, even :

- a. When any part of an animal is named before the animal itself, as, for example, in the case of fossils.
- b. When the larva is named before the adult.

(Exception must be made, at least for the present, in the case of the cestodes, trematodes, nematodes, acanthocephali, and acarines—in a word, for animals which submit to a metamorphosis and change of host ; otherwise many of these would have to submit to a nomenclatural revision, which would be only temporary in character and lead to deep confusion, the final result and extent of which it is now impossible to foresee.)

- c. When the two sexes of a species have been considered as distinct species or as belonging to distinct genera.
- d. When an animal presents a regular succession of dissimilar generations which have been considered as belonging to different species, or even to different genera.

32.

When several genera or species have been proposed simultaneously, so that it is impossible to establish priority, preference is to be decided as follows :—

- a. A generic name accompanied by specification of a type has precedence over a name without such specification. If all or none of the genera have types indicated, that generic name takes precedence the diagnosis of which is most pertinent.
- b. A specific name accompanied by both description and figure shall stand in preference to one accompanied only by a diagnosis or only by a figure.
- c. Other things being equal, the name is to be preferred which stands first in the book or article (Page-precedence*).
- d. **But in all cases** the name adopted by the first reviser of the group shall stand, even if such adoption is contrary to these conditions.

B.—RECOMMENDATIONS.

33.

When the word *varietas* is interposed between the specific and

* The expression "Page-priority" contains a contradiction.—C. W. S.

varietal names, the varietal name, if adjectival, agrees with it grammatically.

Example: *Corvus corax* var. *kamtschatica*.

If the word *varietas* is not used, the varietal name agrees grammatically with the generic name.

Example: *Corvus corax kamtschaticus*.

34.

a. In the notation of hybrids the name of the male parent precedes that of the female parent, and is united to it by the sign of multiplication (\times). The use of the sexual signs is not necessary.

Examples: *Capra hircus* \times *Ovis aries*, or *Capra hircus* ♂ \times *Ovis aries* ♀.

b. Hybrids may also be cited in form of a fraction, the male parent forming the numerator and the female parent the denominator.

Example: $\frac{Capra\ hircus}{Ovis\ aries}$.

The fractional form is better, in that it permits the citation of the observer when this is desirable, also in case one of the parents is a hybrid.

Examples:

$\frac{Branta\ canadensis}{Cygnopsis\ cygnoides}$ & $\frac{Tetrao\ tetrax \times Tetrao\ urogallus}{Gallus\ gallinaceus}$.

In the latter case, however, parentheses may be used.

Example: $(Tetrao\ tetrax \times Tetrao\ urogallus) \times Gallus\ gallinaceus$.

c. When the parents of a supposed hybrid are not definitely known, the latter takes provisionally a specific name, the same as if it were a true species; but the generic name may be preceded by the sign of multiplication.

Example: $\times Helminthophila\ leucobronchialis$.

35.

The following words may be taken as generic names:—

a. Greek substantives, for which the rules of Latin transcription should be followed.

Example: *Ancylus*, *Amphibola*, *Pompholyx*, *Cylichna*.

The transcription should be made according to the following list:—

$\epsilon = e$ ($\upsilon\alpha\lambda\acute{\epsilon}\omicron\varsigma$) *Hya*l*e*a, not *Hyl*l*e*a.

$\eta = e$ ($\pi\epsilon\iota\rho\acute{\eta}\nu\eta$) *Pir*e*n*a, not *Pir*i*n*a.

Final $\eta = a$ ($\pi\epsilon\iota\rho\acute{\eta}\nu\eta$) *Pir*e*n*a, not *Pir*i*n*e.

$\theta = th$ ($\tau\eta\theta\acute{\upsilon}\varsigma$) *Teth*y*s*; $\sigma\tau\eta\theta\omicron\varsigma$ —*steth*u*s*, not *sthet*u*s*.

$\iota = i$ ($\beta\alpha\lambda\acute{\iota}\omicron\varsigma$) *Bal*i*a*, not *Bal*e*a*.

| | |
|--|---|
| $\kappa = c$ (ἵπποκρήνη) | <i>Hippoc<u>r</u>ena</i> , not <i>Hippoch<u>r</u>enes</i> . |
| $\xi = x$ (ξένος) | <i>X<u>e</u>nus</i> , <i>X<u>e</u>nophora</i> . |
| $\rho = r$ (πτερόν) | <i>P<u>t</u>erum</i> . |
| $\upsilon = y$ (ὑβός) | <i>H<u>y</u>bolithus</i> , not <i>H<u>i</u>bolithus</i> . |
| $\alpha\iota = \alpha e$ (λιμναῖος) | <i>L<u>i</u>mn<u>æ</u>a</i> , not <i>L<u>i</u>mn<u>e</u>a</i> . |
| $\alpha\upsilon = au$ (γλαυχός) | <i>G<u>l</u>auc<u>u</u>s</i> . |
| $\epsilon\iota = i$ (χειλος) | <i>Ch<u>i</u>lostoma</i> , not <i>Ch<u>e</u>ilostoma</i> . |
| $\epsilon\upsilon = eu$ (εὐρος) | <i>E<u>u</u>rus</i> . |
| $\varphi, \sigma = \alpha e$ (οἰκίω) | <i>D<u>i</u>ac<u>æ</u>, <i>D<u>e</u>ndr<u>æ</u>ca</i>, not <i>D<u>i</u>o<u>i</u>ca, <i>D<u>e</u>ndr<u>o</u>ica</i>.</i></i> |
| Final $ou = um$ (ἐφίππιον) | <i>Eph<u>i</u>pp<u>i</u>um</i> , not <i>Eph<u>i</u>pp<u>i</u>on</i> . |
| Final $os = us$ (ὀμφαλός) | <i>Euomph<u>u</u>lus</i> , not <i>Euomph<u>o</u>s</i> . |
| $ou = u$ (λουτήριον) | <i>L<u>u</u>ter<u>u</u>m</i> , not <i>L<u>o</u>torium</i> . |
| $\gamma\gamma = ng$ (ἀγγαρεία) | <i>Ang<u>a</u>ria</i> . |
| $\gamma\chi = nch$ (ἀγχίστομον) | <i>Anch<u>i</u>stoma</i> , not <i>Ang<u>i</u>stoma</i> . |
| $\gamma\kappa = nc$ (ἄγκιστρον) | <i>Anc<u>i</u>strodon</i> , not <i>A<u>g</u>kistrodon</i> . |
| $\acute{\rho} = rh$ (ῥήα) | <i>R<u>h</u>ea</i> . |
| $' = h$ (ἑρμαῖα) | <i>H<u>e</u>rm<u>æ</u>a</i> , not <i>E<u>r</u>m<u>æ</u>a</i> . |

b. Compound Greek words, in which the attribute should precede the principal word.

Examples: *Stenogyra*, *Pleurobranchus*, *Tylodina*, *Cyclostomum*, *Sarcocystis*, *Pelodytes*, *Hydrophilus*, *Rhizobius*.

Words formed like *Hippopotamus*, *Philhydrus*, *Biorhiza*, in which the attribute follows the principal word, are to be avoided.

c. Latin substantives; adjectives and past participles are not recommended.

Examples: *Ancilla*, *Auricula*, *Cassis*, *Conus*, *Dolium*, &c.

d. Compound Latin words.

Examples: *Stiliger*, *Dolabrifer*, *Semifusus*.

e. Greek or Latin derivatives expressing diminution, comparison, resemblance, or possession.

Examples: *Lingularius*, *Lingulina*, *Lingulinopsis*, *Lingulella*, *Lingulepis*, *Lingulops*, all derived from *Lingula*.

f. Mythological or heroic names; if not Latin these should be given a Latin termination.

Examples: *Osiris*, *Venus*, *Brisinga*, *Velleda*, *Crimora*; *Ægirus*, *Gondulia*.

g. Names used by the ancients.

Examples: *Cleopatra*, *Belisarius*, *Melania*.

h. Modern family names, to which is added an ending to denote dedication. In using such names the following principles should be observed:—

a. Family names taken from the Latin or Germanic tongues, or from languages in which the Latin alphabet is used, retain their exact original spelling including diacritic marks.

Examples: *Selysius*, *Lamarckia*, *Köllikeria*, *Mülleria*, *Stålia*, *Kröyeria*, *Ibañezia*.

β. Names terminating with a consonant take the ending *us*, *ia*, or *ium*.

γ. Names terminating with the vowels *e*, *i*, *o*, *u*, *y*, take the ending *us*, *a*, or *um*. Names terminating with *a* take *ia*.

Examples: *Blainvillea*, *Cavolinia*, *Fatioa*, *Bernaya*, *Poeya*; *Danaia*.

δ. In cases of patronymics consisting of two words only one of these is used in the formation of a generic name.

Examples: *Selysius*, *Targionia*, *Duthiersia*.

ε. In generic names formed from patronymics the particles are omitted if not coalesced with the name; the articles, however, are retained.

Examples: *Selysius*, *Blainvillea*, *Lacazia*, *Lacopoda*, *Benednia*, *Chiujeu*; *Dumerilia*.

ζ. The use of proper names (*f*, *g*, *h*, *i*) in the formation of compound generic names is objectionable.

Names like *Eugrimmia*, *Buchicrus*, *Pseudogratuloupia*, *Mobiusispongia*, are to be avoided.

ι. Names of ships, which should be treated the same as mythological names or as modern patronymics.

Examples: *Blakea*, *Hirondellea*, *Challengeria*.

ϰ. Barbarous names, *i. e.* words of non-classical origin; these names should have a Latin termination.

Examples: *Vanikoro*, *Agouti*, *Chilosa*, *Fossarus*, *Yetus*.

k. Words formed by arbitrary combinations of letters or by anagram; these should also be given a Latin termination. It is desirable that recourse to arbitrary combinations and to anagrams should be used as little as possible.

Examples: *Dacelo*, *Verlusia*, *Linospa*.

36.

a. The best specific name is a Latin adjective, short, euphonious, and of easy pronunciation. Latinized Greek words and indeclinable barbarous words may, however, be used.

b. The prefixes *sub* and *pseudo* should be used only with adjectives and substantives—*sub* with Latin words, *pseudo* with Greek words. They should not be used in combination with proper names (*sub-wilsoni* &c.); but if such words are once introduced, they are not subject to emendation.

c. The terminations *oides* and *ides* should be used in combination only with Greek or Latin substantives. They should not be used in combination with proper names; but if once so used are not subject to emendation.

d. If a specific name is a geographical name it should be placed in the genitival or adjectival form, if it was known to the Romans or Latinized by the writers of the middle ages. If adjectival it is written with a small initial letter.

e. All other geographical names should be changed into adjectives, following the rules of Latin derivation, and should retain the exact spelling (including diacritic marks) of the radical, if this latter has not been used in Latin; names of islands, however, which are derived from names of persons, may preserve their substantive form, but are then to be placed in the genitive.

f. (BLANCHARD, JENTINK):

If from the radical of a geographical name two adjectives are derived (*hispanus* and *hispanicus*), they cannot be used as specific names in the same genus.

f. (CARUS, STILES):

If from the radical of a geographical name two adjectives are derived (*hispanus* and *hispanicus*, *moluccensis* and *mollucanus*), it is not advisable to use both as specific names in the same genus, but such use of names is not sufficient reason for rejecting either of them.

g. Geographical and other proper names of countries which have no recognized orthography or which do not use the Latin alphabet should be transcribed into Latin according to the rules adopted by the Geographical Society of Paris.

Examples: *Bogdanovi*, *Metshnikovi*.

37.

a. In case of words of identical etymology, differing only in spelling but not in form, the later name is to be considered a homonym of the earlier.

Examples: *silvestris* and *sylvestris*, *cœruleus* and *coruleus*, *Linnei* and *Linnæi*, *Rhopalophorus* and *Ropalophorus*.

b. BLANCHARD and JENTINK favour:

1. If from the radical of a common name two or more adjectives are formed, these cannot be used as specific names in the same genus.

Examples: *fluvialis*, *fluviatilis*, *fluviaticus*, *fluviorum*.

2. Words distinguished only by the masculine, feminine, and neuter endings are to be considered as homonyms.

b. CARUS and STILES favour:

Words of the same etymology, differing in form or gender, are not to be changed or rejected on this account.

Examples: *fluvialis*, *fluviatilis*, *fluviaticus*, and *fluviorum*; *Distomus*, *Distoma*, *Distomum*.

c. In case of words of different etymology, but identical in form and spelling, the later name is to be considered a homonym of the earlier.

Examples : *Abeona* Girard, 1854, and *Abeona* Stål, 1876.

d. But words of different etymology, differing from each other even in a single letter, are to be retained.

Examples : *Macrodon* and *Microdon* ; *Tenia furcifera* and *Tenia furcifera*.

e. Similar generic names are not to be rejected when they are not absolutely identical if correctly spelled.

38.

When the name of the author of a species or other group is abbreviated, the writer will do well to conform to the list of abbreviations proposed by the Zoological Museum of Berlin, adopted and enlarged by the Paris Congress.

39.

In selecting a type authors should govern themselves by the following:—

1. A genus which contains a species bearing the same name, either as a valid name or a synonym, takes that species as its type.

2. To select as type some species which the original author studied, unless it can be definitely shown that he had some other species more particularly in mind.

3. (If the genus has already been divided by former authors, without the specification of types, the only available method of fixing the original name to some part of the genus to which it was originally applied is, of course, by the process of elimination ; but)

If the genus contains both exotic and non-exotic species, from the standpoint of the original author, the process of elimination is to be restricted to the non-exotic species.

4. To select as the type the species which is best described, or best figured, or best known.

40.

It is very desirable that the original description of any group should be accompanied by a diagnosis both individual and differential, and written either in Latin, French, German, English, or Italian. This diagnosis should also state in what museum the type specimen has been deposited.

41.

In works not published in any of these five languages it is desirable that the explanation of the figures and an abstract of the article be translated into one of these tongues.

42.

Authors are urged to use only the metric system of weights and measures and the centigrade thermometer of Celsius.

43.

The indication of enlargement or of reduction, which is necessary to the comprehension of an illustration, should be expressed in figures rather than by mentioning the system of lenses used.

44.

It is useful to indicate whether the enlargement is linear, or of the surface, or of the mass. This may be easily expressed as follows:— $\times 50^1$ indicates a linear enlargement of 50 times, $\times 50^2$ an enlargement of the surface, and $\times 50^3$ an enlargement of the mass.

BIBLIOGRAPHICAL NOTICE.

Rhopalocera Ecotica: being Illustrations of New, Rare, and Unfigured Species of Butterflies. By H. GROSE-SMITH and W. F. KIRBY. Vol. II. London: Gurney and Jackson, 1892-97.

THE second volume of this well-known work should have received notice at our hands before now; but, as sometimes happens in the case of a serial publication still in course of issue, the fact of the volume's completion was overlooked.

Unduly retarded, however, as our notice has been, the authors may rest assured that there is no lack of appreciation on our part of the manner in which the high standard of their work has been maintained. As they mention in their preface, nearly 250 species are figured in this volume, the figures occupying sixty quarto plates, and representing not only both upper and under sides, but in a large number of cases both sexes of each species. The colouring throughout is excellent, but the drawing of a few of the smaller figures is somewhat unequal in quality. It will be admitted, however, that the best executed figures in point of drawing are those representing Oriental Lycaenidae (of the extremely beautiful genera *Thysonotis*, *Waigmann*, &c.), which for accuracy as well as for artistic merit are admirable; they are the work of Mr. Horace Knight.

Butterflies of all families except the Hesperidae find illustration in this volume; but in the number of species described and figured the Lycaenidae (109) far exceed the other groups. Next come the

Pierinæ with 43 species, and in this subfamily we would call attention to the three plates devoted to the remarkable and most interesting genus *Dismorphia*, exhibiting very strikingly the extraordinary differences (mostly traceable to mimetism in various directions) presented by no fewer than 16 species. Of the Satyrinæ 33 species are given, belonging chiefly to the genera *Mycalesis* and *Pedaliodes*. Some very fine Nymphalinae are figured, notably several rare species of *Mynes*, of which *M. Websteri* from New Guinea presents an underside of quite isolated character, while that of *M. cottonis* from New Britain is curiously imitative of the underside shown by a section of the Pierine genus *Delias*. The Morphinae are represented by as many as nine species of the singular genus *Tenaris*, mostly natives of New Guinea.

We notice the announcement of a change as regards the issue of future parts of this valuable work, viz. that, instead of the regular quarterly publication of a part containing three plates, the parts will be published at such intervals as may be found convenient, the number of plates varying, and the price of each part being regulated accordingly. We may add, however, that, notwithstanding this announcement, there has been but little alteration either in the dates of issue or in the number of plates in each part as yet published in the third volume, which is being continued by Mr. Grose-Smith without the cooperation of Mr. Kirby. R. T.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

April 20th, 1898.—W. Whitaker, B.A., F.R.S.,
President, in the Chair.

The following communication was read:—

‘*Petalocrinus*.’ By F. A. Bather, Esq., M.A., F.G.S.

Certain curious fan-like objects, obviously echinodermal, have for a long time been preserved in the Riks-Museum at Stockholm, but their significance was first definitely ascertained when similar fossils were found in Iowa, and brought to England by Mrs. Davidson. The latter were described by Mr. Stuart Weller in a paper entitled ‘*Petalocrinus mirabilis* (n. sp.), and a New American Fauna;’ and the former, with fresh material obtained by Mr. Weller from various American localities, are the subject of the present communication.

The Silurian crinoid genus *Petalocrinus*, Weller, is discussed, on the evidence of all the original material from Iowa and of the further material above mentioned. The replacement of the original

material of the Iowan fossils by silica has taken place only in certain parts, forming a number of siliceous boxes, as it were, which are either hollow or more or less filled with chalcedony or cryptocrystalline silica. They are therefore neither casts nor impressions, and details of structure are frequently destroyed.

Petalocrinus is shown to have a dicyclic base—not monocyclic, as originally described. The structure of the tegmen is shown to be that of the Cyathocrinoidea. The arm-fans characteristic of the genus are proved to have been formed by fusion of the branches of an arm of Cyathocrinid type. In them, description is given for the first time of axial canals, covering-plates, the articular facet, and various minor structures. The species *P. major*, Weller, is shown to be an *Omphyma*; but *P. mirabilis*, Weller, the genotype, is redescribed, and with it five new species—two from Iowa; three, as well as a possible mutation of one of them, from Gotland. A family Petalocrinidæ, descended from the Cyathocrinidæ, probably by way of *Arachnoerinus*, is founded for the reception of this genus.

MISCELLANEOUS.

The Generic Name Thylacomys. By EDGAR R. WAITE.

SINCE revising the proofs of my article "Observations on Muridæ from Central Australia"*, I find that the name *Thylacomys* may be in jeopardy. Though not contained in the classic catalogues of Agassiz and Scudder, and therefore apparently available, it has yet made an appearance, if an accidental one, in literature.

A footnote in the 'British Museum Catalogue of Marsupialia' (pp. 221-222) reads as follows:—"Blyth (Cuv. An. K. p. 104, 1840) states that Prof. Owen had separated off 'The Philander, *Perameles lagotis*,' as a genus under the name of *Thylacomys*. I am, however, quite unable to find any distinction of the genus in Prof. Owen's papers, and therefore retain the well-known name [*Peragale*] given to the genus by Gray. Blyth's statement was, perhaps, based on a confused account of Gray's *Thylamys elegans* (= *Didelphys elegans*), a member of the group of Opossums to which the latter author applied the name of 'Philander.'"

I am unable to verify Thomas's quotation in the original (1840) edition; but in the only two editions available to me, namely 1849 (p. 104) and 1863 (p. 92), the genus is rendered *Thalacomys*, not *Thylacomys*.

Australian Museum, Sydney,
10th May, 1898.

* Proc. Roy. Soc. Victoria, x. (new series) 1898, pp. 114-128.

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SEVENTH SERIES.]

No. 9. SEPTEMBER 1898.

XXV.—*The Arachnida from the Province of Natal, South Africa, contained in the Collection of the British Museum.*
By R. I. POCKOCK.

[Plate VIII.]

A GREAT majority of the spiders recorded in this paper were obtained at Durban by Mr. H. A. Spencer while acting as medical officer on board the S.S. 'Mexican,' and by Mr. G. A. K. Marshall during a stay of some months at Estcourt and other parts of Natal. The remaining spiders have been received from various sources, and many of them have been in the Museum collection for a great many years.

Order SOLIFUGÆ.

Solpuga hostilis, White.

Solpuga hostilis, White, Methuen's Life in the Wilderness, p. 317, pl. ii. fig. 5 (1846).

Loc. Estcourt, 4000 feet (*G. A. K. Marshall*).

Solpuga caffra, Poc.

Solpuga caffra, Poc. Ann. & Mag. Nat. Hist. (6) xx. p. 262.

Loc. Estcourt, 4000 feet (*G. A. K. Marshall*).

Ann. & Mag. N. Hist. Ser. 7. Vol. ii.

Order SCORPIONES.

Opisthophthalmus pugnax, Thor.

Opisthophthalmus pugnax, Thor. Act. Soc. Ital. Sci. Nat. xix. p. 232.

Loc. Durban (*Capt. Munn*); Estcourt, 4000 feet (*G. A. K. Marshall*).

Opisthacanthus validus, Thorell.

Opisthacanthus validus, Thor. Act. Soc. Ital. Sci. Nat. xix. p. 243.

Loc. Newcastle, 4000 feet, Lower Umkomaas River, and Isipingo (*G. A. K. Marshall*); Natal (*E. Howlett*).

Hadogenes pallidus, sp. n.

Colour. Trunk brownish above, terga blackish in front; tail yellowish brown, vesicle clear yellow; legs yellow; chelæ yellow, with digits and crests brownish.

Carapace almost as long as the first and second caudal segments, as long as the third and $\frac{3}{4}$ of the fourth, a little longer than movable digit and than hand-back.

Tail short, considerably less than four times as long as carapace; first segment scarcely keeled above; inferior keels of second, third, and fourth denticulated, of fifth with about 15 or more teeth; vesicle large, its height about one third the length of the fourth caudal segment.

Hands rather wide; width of the upper surface much more than half the length of the movable digit.

Pectinal teeth 15.

Measurements in millimetres.—Total length 74; length of carapace 12; length of tail 40, of its fifth segment 7.5; width of upperside of hand 6.8; length of movable digit 11.

Loc. Junction of Blaauwkrantz and Tugela Rivers, Natal, 2500 feet, under stone (*G. A. K. Marshall*).

Differing from *H. trichiurus* principally in its shorter tail and wider hand; *trichiurus* also has the legs and chelæ deep brown.

Uroplectes formosus, Poc.

Uroplectes formosus, Poc. Proc. Zool. Soc. 1890, p. 134, pl. xiii. fig. 3; Ann. & Mag. Nat. Hist. (6) xvii. pp. 383 and 390.

Loc. Natal (*E. Howlett*); Lower Umkomaas River (*G. A. K. Marshall*).

Uroplectes Marshalli, Poc.

Uroplectes Marshalli, Poc. Ann. & Mag. Nat. Hist. (6) xvii. p. 392.

Loc. Durban and Tugela River (*G. A. K. Marshall*).

Uroplectes planimanus (Karsch).*Lepreus planimanus*, Karsch, Mitth. Münch. ent. Ver. 1879, p. 125.Loc. Durban (*G. A. K. Marshall*).

Order PEDIPALPI.

Damon annulatipes (Wood).*Phrynus annulatipes*, Wood, Tr. Am. Phil. Soc. xiii. p. 441 (1869);
Pocock, Ann. & Mag. Nat. Hist. (6) xiv. p. 293.Loc. Natal (*Gueinzus*); Durban (*H. A. Spencer*); Est-
court, 4000 feet (*G. A. K. Marshall*).

Order ARANEÆ (SPIDERS).

Suborder MYGALOMORPHÆ.

Family Ctenizidæ.

Genus STASIMOPUS, Simon.

Stasimopus rufidens, Auss.? *Actinopus caffrus*, C. Koch, Die Arachniden, ix. p. 98, fig. 751.*Cyrtocarenum rufidens*, Auss. Verh. z.-b. Wien, 1871, p. 160.*Pachylomerus natalensis*, O. P. Cambridge, P. Z. S. 1889, p. 35, pl. ii.
fig. 1.*Stasimopus rufidens*, Auss., Pocock, P. Z. S. 1897, pp. 927 and 929.Loc. Estcourt, 4000 feet (*G. A. K. Marshall*).

Family Dipluridæ.

Genus BRACHYTHELE, Auss.

Brachythele bicolor, Pocock.*Brachythele bicolor*, Pocock, Proc. Zool. Soc. 1897, p. 735.Loc. Durban (*H. A. Spencer*).

Family Theraphosidæ.

Subfamily HARPACTIRINÆ.

Genus HARPACTIRA, Auss.

Harpactira curator, sp. n. (Pl. VIII. fig. 1.)

♂.—Colour a tolerably uniform mouse-grey or brown; carapace black, with radiating pale lines; extremities of the leg-segments pale; coxæ and sternum blackish.

Carapace about one fourth longer than wide, length much

shorter than patella and tibia of first leg, and also shorter than those of fourth leg, as long as tarsus and protarsus of third, exceeding protarsus and tarsus of first, and tibia, protarsus, and tarsus of palp; its width a little less than length of fourth protarsus and a shade more than that of patella and tibia of third leg. Clypeus about one fourth the length of the ocular tubercle.

Legs 4, 1, 2, 3, fourth exceeding first by half the length of its tarsus, patella and tibia of first longer than of fourth, protarsus of fourth equal to protarsus and three fourths of the tarsus of the first; tibiae of all legs with a pair of inferior apical spines, protarsi of third and fourth with about five spines at the apex and three or four in the proximal half near the base of the scopula; protarsus of first leg convex above at the base; palpus normal, its tibia with one internal apical spine. Palpal bulb less spherical than in *H. atra* and *chryso-gaster*, the posterior side of the spine continuous with that of the bulb.

♀.—Coloured as in male.

Carapace exceeding in length patella and tibia of first as well as of fourth leg, less than tarsus and protarsus of fourth, distinctly less than tibia, protarsus, and tarsus of third, and shorter by half the length of the tarsus than the same segments of the second leg; width just equal to tibia and protarsus of third leg, length from fovea to anterior border equal to patella and tibia of third leg.

Stridulating-organ on mandible consisting of an upper series of seven bristles running obliquely downwards across the naked space and of a lower irregular series of about nine shorter bristles presenting a distinct sigmoidal curve, the four posterior being shorter than the rest, a little further removed from the marginal bristles, and in a straight line. Marginal teeth on the mandible consisting of a series of eleven larger and smaller, with a few granuliform teeth at the posterior end.

Measurements in millimetres.—♀. Total length 30; length of carapace 15, width 11·8; length of first leg 37, of second 33·5, of third 31, of fourth 41; patella and tibia of first 14, of fourth 13·5; tarsus and protarsus of fourth 16.

♂. Total length 25; length of carapace 13, width 11; length of first leg 41, of second 36, of third 33, of fourth 44; patella and tibia of first 15·4, of fourth 14.

Lcc. Malvern in Natal.

Mr. Guy Marshall, who procured these specimens, sent the following note as to their habitat:—"Female found under a stone in a large web-lined chamber with two exit-passages. Male under a neighbouring stone. Sept. 1897."

In leg-measurements this new species closely resembles *H. lineata*, Poc. (P. Z. S. 1897, p. 749), but it may be readily distinguished by the construction of the mandibular stridulating-organ, the upper series of setæ being more compact and oblique and the lower more isolated from the adjacent setæ of the oral fringe. The male differs both from *H. atra*, Latr., and *H. chrysogaster*, Poc., in colouring and shape of palpal bulb.

Harpactira curvipes, Poc.

Harpactira curvipes, Poc. Proc. Zool. Soc. 1897, p. 750.

Loc. Natal (*Gueinzus*).

Suborder ARACHNOMORPHÆ.

Family Eresidæ.

Genus STEGODYPHUS, Simon.

Stegodyphus gregarius, O. P. Cambridge.

Stegodyphus gregarius, O. P. Cambridge, Proc. Zool. Soc. 1889, p. 42, pl. ii. figs. 4, 5.

Loc. Durban (*Col. Bowker*). Specimens from the same nest as those described by Mr. Cambridge.

Stegodyphus dunicola, sp. n. (Pl. VIII. fig. 7.)

♀.—*Colour* (in alcohol). Carapace nearly black, reddish at the sides above the base of the legs and on the facial portion; mandibles blackish brown; maxilla and labium reddish brown; sternum blackish at the sides, reddish brown in the middle, this reddish central portion expanding posteriorly; abdomen testaceous above and at the sides, mottled (especially in front) with black spots and patches, forming along the row of sigilla an irregular band on each side of the pale dorsal middle line; lower side of abdomen black, with a longitudinal yellow stripe on each side behind the stigma; epigastric area black in the middle, with a large yellow opercular patch on each side, bordered externally with a broad black band, continuous in front with the black area above the pedicel, and behind with an irregular black band which passes back on the outer side of the yellow stripe as far as the spinning-mamillæ, which are deep brown; legs and palpi infuscate, banded with yellow; femora and tibiæ with a median yellow band; protarsi with basal yellow band; tarsi

reddish. When dry the hairy clothing of the carapace is white, rusty red on the face, with a fine median white stripe between the eyes and a broader white stripe running from the top of the head to the lateral angles; the upper half of the mandibles is clothed with white hairs; on the abdomen the hairs along the median pale band are white intermixed with rusty yellow, at the sides rusty yellow intermixed with white and spotted with black in front, beneath the hairs on the black areas are black, white on the yellow areas; on the anterior pairs of legs the hairs are mostly whitish, concealing the banding, the posterior pairs being much more strongly striped black and white, the femora and tibiae of the fourth having two jet-black spots on the protarsus, with its apex white and its basal third yellow; the hairs of the coxæ and sternum are greyish white.

Carapace as long as patella and tibia and as protarsus and tarsus of first leg, longer than patella and tibia and than tibia and protarsus of fourth; width of head equal to length of first protarsus and to length of patella and tibia of second; ocular quadrangle a little narrowed in front, wider than long, the posterior median eyes about a diameter apart and about half their diameter from the anterior medians, which are about a diameter from each other and from the edge of the clypeus; their diameter is about two thirds of the diameter of the posterior medians.

Measurements in millimetres.—Total length 11; length of carapace 4.5; width of head 2.8; length of first leg 12.2, of second 9, of third 7, of fourth 10.5.

♂.—*Colour* as in the female, but with more rusty-red hair upon the upperside of the head and upon the sides of the upper surface of the abdomen, the median fusiform white stripe on the abdomen strongly defined; legs yellow, banded with black, as in female. Much smaller than the female, with the head higher and the legs longer; carapace as long as protarsus of first leg and as protarsus and tarsus of second, barely as long as patella and tibia and as protarsus and tarsus of fourth, width of head about equal to protarsus of second. Tibia of first leg without tuft of hairs. Palp with patella and tibia short, subequal, shorter together than the tarsus; tibia with long hairs forming a distinct fringe; tarsus also thickly hairy, externally concave at the base, internally convex; palpal organ as in Pl. VIII. fig. 7.

Measurements in millimetres.—Total length 7; length of carapace 3.2; width of head 2; length of first leg 12, of second 8.5, of third 7.5, of fourth 10.

Loc. Estcourt, 4000 feet (*G. A. K. Marshall*).

This species and *S. gregarius* may be readily distinguished as follows:—

- a. Total length of ♀ about 8 mm.; ocular quadrangle much narrowed in front; anterior median eyes very much smaller than posterior medians; femora and tibiæ of first legs and in a lesser degree of the second black, especially within; tarsi and protarsi of these legs not banded; tibia of first leg in ♂ furnished with thick fringe of long hair *gregarius*, O. P. Cambr.
- b. Total length of ♀ 11 mm.; ocular quadrangle much less narrowed in front; anterior medians much larger as compared with posterior medians; femora, tibiæ, and protarsi of legs distinctly banded; tibia of first leg in ♂ like that of ♀, not plumose *dumicola*, sp. n.

Genus *DRESSERUS*, Simon.

Dresserus obscurus, sp. n. (Pl. VIII. fig. 8.)

Colour. Carapace and posterior legs reddish brown, anterior legs and mandibles blacker; abdomen mouse-brown; the whole body covered with greyish-black hairs.

Carapace high in front, nearly vertically elevated just in front of the fovea, its length about equal to that of tibia, protarsus, and tarsus of first leg; width of head as long as patella, tibia, and protarsus of third leg, scarcely as long as patella and tibia of fourth leg or as tibia and protarsus of first, longer than protarsus and tarsus of first by about one third the length of the tarsus, also about equal to tibia and protarsus of fourth; space between posterior median eyes about equal to twice their diameter, space between posterior medians and anterior laterals about four times the diameter of the former.

Legs of first pair a little longer than those of fourth, patella and tibia of fourth longer than of first, tarsus and protarsus of first about equal to patella and tibia of first.

Measurements in millimetres.—Total length 15; length of carapace 7; width of head 5; length of first leg 13·5, of fourth 12·8; patella and tibia of first 5, of fourth 5·5.

Loc. Estcourt, 4000 feet (*G. A. K. Marshall*).

The only known species of this genus up to the present time is *D. fuscus*, Simon (Bull. Soc. Ent. France, 1876, p. lxxxvii), from Zanzibar. This species, based upon an immature female, is too briefly described to make any comparison between it and *D. obscurus* possible. The difference of locality, however, is, apart from other considerations, sufficient justification for describing the Natal form as new.

Family Dinopidæ.

Genus DINOPIS, Macleay.

Dinopis cylindricus, sp. n.

♂.—*Colour*. Carapace and abdomen with a dark olive-green clothing of hair; abdomen with a broad silver-white band on each side; carapace also with silver-white marginal band on its thoracic portion and a V-shaped silver mark on the head; face silvery white; mandibles with two silver bands; legs and palpi brown, clothed with greyish-white hairs; labium and maxillæ with silvery hairs; sternum dark at the sides, with broad, posteriorly pointed, median silver stripe; lower side of abdomen variegated with silver and brown.

Carapace flat, narrowed behind, very broad at the base of the anterior legs, the width at this spot about two thirds the length of the carapace; cephalic area narrower in front than behind, produced into a horn covered with white hairs and projecting over the upper rim of the posterior median eyes, these eyes not very large, separated by a space which equals their radius, and not occupying the entire width or height of the face; anterior median eyes about a diameter apart.

Palpi slender; femur sinuate; tarsus globular, considerably shorter than tibia.

Legs long and slender (*cf.* measurements).

Abdomen long, slender, parallel-sided, flat above and below, about five times as long as wide, its apex projecting and bifid.

Measurements in millimetres.—Total length 19; length of carapace 5, width 3.5; length of abdomen 13, width 2.5; length of palp 8, of first leg 66, of second 50, of third 39, of fourth 40; length of anterior femur 18.5, posterior femur 13.5.

Loc. Durban (*H. A. Spencer*).

Apparently resembling *D. cornigera*, Gerstaecker (Von der Decken's 'Reisen' &c. iii. 2, p. 478, pl. xviii. fig. 5), from Aruscha, in East Africa, in the form of the carapace, but differing at least in its much longer legs and palpi. In *cornigera* the femur of the first leg is barely twice as long as the carapace ($9\frac{1}{2} : 5$); the palpus is much shorter than the carapace, with its tarsus longer than its tibia.

It more nearly resembles *D. bubo*, Brito Capello (Mem. Ac. Sci. Lisboa, (3) iv. pt. 1, p. 16, 1867, pl. ii. fig. 3), from the Quilo River, W. Africa, but may be at once recognized by the length and narrowness of the abdomen, this region in *D. bubo* being less than three times as long as wide.

From *D. bubalus*, Simon (Ann. Soc. Ent. France, 1890, p. 126), from Kilimanjaro, which is, perhaps, the female of *D. cornigera*, *D. cylindricus* at least differs in the form of the abdomen, this region in *bubalus* being described as strongly bituberculate in front of the middle.

Family Argiopidæ.

Genus NEPHILA, Leach.

Nephila madagascariensis (Vinson).

Epeira madagascariensis, Vinson, Aranéides des Iles Réunion &c. p. 191, pl. vii.

Loc. Pietermaritzburg (*F. J. Quekett*).

Ranges throughout East Africa from Natal to Masailand.

Nephila annulata, Thorell.

Nephila annulata, Thorell, Öfv. Vet.-Akad. Förhandl. xvi. p. 299; Eugénies Resa, Araneæ, p. 34.

Nephila transvaalica, Poc., W. L. Distant's Naturalist in the Transvaal, p. 180, pl. v. fig. 4.

Loc. Estcourt, 4000 feet (*G. A. K. Marshall*).

Nephila cruentata (Fabr.).

Loc. Durban (*H. A. Spencer*).

Nephila pilipes (Lucas).

Epeira pilipes, Lucas, Thomson's Arch. Ent. ii. p. 416, pl. xiii. fig. 7.

Loc. Estcourt, 4000 feet (*G. A. K. Marshall*).

Genus ARGIOPE, Aud.

Argiope nigrovittata, Thorell.

Argiope nigrovittata, Thorell, Öfv. Vet.-Akad. Förhandl. xvi. p. 300; Eugénies Resa, Araneæ, p. 31 (1868).

(= *caudata*, Blek.; *suavissima*, Gerst.)

Loc. Durban (*H. A. Spencer*); Estcourt, 4000 feet (*G. A. K. Marshall*).

Ranging throughout tropical and subtropical Africa from Somaliland and the Congo to Cape Colony.

Argiope clathrata, C. Koch.

Argiope clathrata, C. Koch, Die Arachniden, v. p. 40, fig. 362 (1839). (= *australis*, Walck.; *lata*, Thorell.)

Loc. Estcourt, 4000 feet (*G. A. K. Marshall*).

Argiope trifusciata (Forskål).

Loc. Estcourt, 4000 feet (*G. A. K. Marshall*).

Genus ARANEUS (Linn.).

(= *Epeira* of authors.)

Araneus rufipalpis (Lucas).

Araneus rufipalpis (Lucas), Thomson's Arch. Ent. ii. p. 422.
(= *semiannulatus*, Karsch and others.)

Loc. Durban (*H. A. Spencer*), ♀; Estcourt, 4000 feet
(*G. A. K. Marshall*), ♂.

Abundant throughout tropical East and West Africa.

Araneus mimosicola (Simon).

Araneus mimosicola (Simon), Bull. Soc. Zool. France, 1884, p. 17.

Loc. Durban (*H. A. Spencer*).

Originally recorded from Khartoum and subsequently from Somaliland (*Donaldson Smith*), whence the British Museum has examples identified by M. Simon.

Araneus cyrtoscapus, sp. n. (Pl. VIII. figs. 2-2*b*.)

Colour yellow, like a pale example of *A. diadema*; the bristles and spines on the thorax, abdomen, and legs arising from fuscous spots; the spines themselves, being dark at the tips, impart a somewhat speckled appearance to the integument; the patellæ, tibiæ, and protarsi lightly infuscate apically, tibiæ and protarsi also marked with the median fuscous patch; tarsi apically black; sternum infuscate, paler at the sides; upperside of abdomen with two pale yellow spots between the shoulder-points and a pale faint transverse line running inwards and slightly backwards from each shoulder-point to the middle line of the abdomen; the area behind this marked with similar faint lines, emphasized anteriorly by a greyish tint; a faint greyish irregular band running along the middle line from the anterior end of the abdomen between the two yellow spots, past the middle line; lower side of abdomen behind the epigastric fold infuscate, the median infuscate area bounded on each side by a crescentic yellow band, passing on each side from the stigma to meet a short yellow bar running forwards from the sides of the anterior spinner.

Cephalic region of *carapace* distinctly convex from before backwards; ocular quadrangle wider in front, posterior

medians close together, barely a radius apart, anterior medians about a diameter apart; eyes of anterior line recurved, the laterals higher than the medians, space between medians and laterals about three times as great as that between medians. Carapace much longer than first tibia, almost as long as patella and tibia of fourth leg, a little longer than protarsus and tarsus of first and fourth legs; width greater than length of first tibia.

Mandibles prominent at the base; the fang-groove armed with four teeth in front, three behind the tooth at the posterior or upper extremity of the groove the largest.

Legs strong and short; femur of first incrassate distally on the inner side and spined, tibiæ and protarsi of first and second biserially spined below.

Abdomen heart-shaped, with low shoulder-points, widely rounded anteriorly, ovally elongate from the shoulders backwards.

Measurements in millimetres.—Total length 15; length of carapace 7, width 5.5; length of abdomen 10, width 8.5; length of first leg 19, of second 19, of third 14, of fourth 18.5.

♂.—Smaller than female, with long deep thoracic groove; ocular region produced over base of mandibles, eyes on a median and lateral prominence.

Legs strongly spined; femora with a series of strong spines, each rising from a tubercle below; coxa of first with elongate process; tibia of second mesially thickened in front, armed with about 12 or 13 strong black spines arranged in two longitudinal rows.

Loc. Estcourt, 4000 feet (*G. A. K. Marshall*), ♂ ♀; Durban (*H. A. Spencer*), ♂.

Allied to *A. suedicola*, Sim., *similis* and *striata*, Bösenberg and Lenz, *mossambicensis*, Pavesi, &c.

Araneus Marshalli, sp. n. (Pl. VIII. fig. 3.)

Colour. Carapace black posteriorly, its cephalic region reddish brown, blackish at the sides; mandibles reddish brown, black distally; maxillæ yellowish brown, darker basally; labium brownish; sternum mostly yellow, brownish at the sides; palpi yellow, infusate apically, the spiniform hairs black; femora and patellæ of first and second pairs of legs red, blackish at distal end; tibiæ and protarsi yellow, blackish at the distal ends, with a faint median dark spot on the middle of the protarsi; third and fourth legs coloured like the others, but the femora yellower, with a median and a distal darker band. Abdomen variegated, anterior portion

brown, with a large sooty-black patch on each side, the upper surface ornamented in front with three longitudinally fusiform brown spots on a yellowish field; these spots are narrowed in front, the median lying longitudinally, the laterals obliquely and rather behind the others; the folium extending from the large central sigilla and consisting of a brown triangular area divided along the middle line by a pale yellowish-grey band, continuous in front with a transverse stripe of the same tint, the two forming a somewhat dagger-shaped pattern, the handle of which is in contact in front with the posterior extremity of the median fusiform spot; sides of abdomen dirty yellowish grey, with a series of indistinct stripes above and a second series of darker longer stripes below; lower surface yellow and black; a transverse yellow stripe behind the epigastric fold, this is followed by a pair of large black spots, from the posterior inner ends of which a black line passes backwards and joins with a transverse brown ring surrounding the spinners below and laterally; the area between these black spots is brownish yellow and is in contact in front with the yellow band behind the epigastric fold; immediately behind the black spot there is a bright yellow spot, bordered internally by the black line and in contact posteriorly with a transverse yellow spot at the sides and in front of the anterior mamillæ; mamillæ deep reddish brown.

Carapace with cephalic region flattened above, but more convex longitudinally than in *A. Spenceri*; ocular quadrangle wider in front than behind, posterior medians less than a diameter apart, anterior medians about one diameter apart; eyes of anterior line slightly procurved, distance between medians less than half as great as distance between median and lateral on each side; carapace about as long as first and fourth femora, only slightly longer than first tibia, a little longer than fourth tibia, its width scarcely as long as first tibia and a little shorter than first protarsus.

Mandibles basally prominent, armed below as in *Spenceri*—4 teeth in front, 3 behind.

Legs long, first more than $3\frac{1}{2}$ times as long as carapace; femora, patellæ, tibiæ, and protarsi armed with many spines.

Abdomen a little longer than broad, heart-shaped, without shoulder-points, broadest in its anterior third, widely rounded in front, gradually narrowed to an acute angle in its posterior two thirds, its apex rounded, scarcely surpassing the mamillæ.

Measurements in millimetres.—Total length 15; length of carapace 6, width 5; length of abdomen 10, width 9; length of first leg 22.5, of fourth 21.

Loc. Estcourt, 4000 feet (*G. A. K. Marshall*).

Araneus Spenceri, sp. n. (Pl. VIII. fig. 4.)

Colour. Carapace deep blackish brown, with a yellowish spot on each side of the thoracic portion and one on each side involving the lateral eyes; labium and maxillæ deep brown in the basal half, yellowish brown distally; sternum black, with its median third bright yellow; palpi yellow, with the distal end of the segments black; mandibles deep brown; legs mostly yellow, the patellæ and the distal end of the femora, tibiæ, protarsi, and the distal half of the tarsi black; abdomen above and at the sides yellowish grey, black in front above the pedicle, the lower surface and spinners black; a smallish subcircular yellow spot on each side of the anterior spinners, preceded by a posteriorly expanded, anteriorly pointed, longitudinal yellow spot, and in front of this a transverse posteriorly pointed yellow spot lying immediately behind the pulmonary stigmata; epigastric area mesially black, laterally yellow.

Carapace about as long as femora of first and fourth legs, much longer than their tibiæ, its width also longer than the first tibia and about as long as the protarsus; cephalic region flat above longitudinally; ocular quadrangle wider in front than behind, the posterior medians about a diameter apart, the anterior medians about two diameters; eyes of anterior line at most slightly recurved.

Mandibles not basally prominent, the fang-groove armed with 4 teeth in front, 3 behind.

Legs short, first three and a half times as long as the carapace; femora, tibiæ, and protarsi spiny.

Abdomen voluminous, almost as wide as long, widely rounded in front and behind, without shoulder-prominences.

Basal pillar of *vulva* scarcely wider than the scape; scape longish, bent at right angles, the distal end of the basal portion not projecting above its proximal extremity.

Measurements in millimetres.—Total length 15; length of carapace 6, width 5; length of abdomen 12, width 11·8; length of first leg 21, of fourth leg 18·5.

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

Araneus haploscapus, sp. n. (Pl. VIII. fig. 5.)

Colour. Carapace and legs reddish brown, the legs indistinctly banded on femora and tibiæ; abdomen a uniform creamy yellow, a richer yellow on the area between the epigastric fold and the spinners; sternum with broad median yellow band.

Carapace only a little longer than tibia of first leg,

distinctly shorter than patella and tibia of fourth; width of carapace less than first tibia. Eyes of anterior line slightly procurved; posterior medians about a diameter apart, anterior medians about two diameters; distance between median and lateral of anterior line more than twice as great as that between the medians.

Mandibles basally prominent; fang-groove armed below with 4 teeth in front, 3 behind.

Legs longish and slender, spiny.

Abdomen at least as wide as long, voluminous, without shoulder-points, widely rounded in front, shortly ovate behind.

Vulva differing from that of *A. Spenceri* and *A. Marshalli* in that, viewed from the side, the scape is seen to rise from the anterior end of the basal pillar, the posterior part of which is separated from the scape by a deep notch, smaller, but of the same nature as that which obtains in *rufipalpis*.

Measurements in millimetres.—Total length 14.5; length of carapace 4.5; length and width of abdomen 9.5; length of first leg 15, of fourth 14.

Loc. Estcourt, 4000 feet (*G. A. K. Marshall*).

The females of the species of *Araneus* here mentioned may be distinguished as follows:—

Female.

- a. Basal portion of vulva expanded at the sides and projecting laterally beyond the lateral margins of the scape; scape broad at the base, narrower posteriorly, its basal half horny and hairy, its distal half soft and membranous, bent upon itself and folded within the vestibule of the vulva in such a way that the somewhat heart-shaped expanded terminal portion is in contact with the hairy portion of the vulva. (Eyes of anterior line slightly recurved; carapace much longer than tibia of first leg.) *cyrtoscapus*, sp. n.
- b. Basal (vestibular) portion of vulva not expanded laterally beyond the side-margins of the scape, forming a horny pillar; scape entirely horny and not folded or bent upon itself.
- a. When viewed from the side the scape is seen to be much narrower than the distal end of the basal portion, and to rise from its anterior edge, being separated by a deep notch or narrow space from the posterior edge of the distal end of the basal portion.
- a². Eyes of anterior line recurved; legs of anterior pair reddish, those of posterior two pairs reddish, with deep black stripe on distal end of patella, tibia, protarsus, and tarsus; carapace much longer than tibia 1 and longer than tarsus and protarsus 4 *rufipalpis*, Luc.

- b*². Eyes of anterior line straight or slightly procurved; legs reddish brown, indistinctly multiannulate; carapace in adult scarcely as long as protarsus and tarsus 4 and a little longer than tibia 1 *haploscapus*, sp. n.
- b*¹. When viewed from the side the scape of the vulva is seen to be as thick as the basal portion, to rise without constriction or notch from the entire distal end of the basal portion.
- a*³. Of very small size, total length about 5 mm.; abdomen with very large angular prominences, posteriorly pointed *mimosicola*, Sim.
- b*³. Of large size, about 15 mm. in length; abdomen without large shoulder-prominences.
- a*⁴. Legs shorter, tibia of first much shorter than carapace; abdomen subcircular; femora yellow *Spenceri*, sp. n.
- b*⁴. Legs longer, tibia of first only a little shorter than carapace; abdomen oval; femora not uniformly yellow *Marshalli*, sp. n.

Araneus coccinella, sp. n. (Pl. VIII. fig. 6.)

Colour. Carapace black, scantily clothed with white hairs; mandibles black, with reddish anterior spot at distal end; labium, maxillæ, and sternum black; abdomen orange-yellow above, ornamented with eight large black oval spots, forming two parallel lines, lower side entirely black; coxæ and trochanters of legs black, remainder of legs orange-yellow, with a broad black band on the distal end of the protarsus; tarsi black, with basal yellow band and paler apex; femur of third leg black basally, of fourth black in its basal half.

Cephalic region of *carapace* coarsely coriaceous, high, elevated behind, strongly compressed posteriorly, its upper surface mesially depressed. *Eyes* of posterior line procurved when viewed from above, the medians rather more than a diameter apart; ocular quadrangle about as long as wide, wide in front, the anterior eyes about two diameters apart and about the same distance from the posterior medians, the clypeus receding, exceeding the diameter of the median eyes; anterior line of eyes procurved, lateral eyes not in contact, the space between them nearly equal to their radius.

Legs shortish, scarcely spined, the protarsi and tarsi furnished with rigid setæ; carapace about as long as patella and tibia of first pair.

Abdomen large, oval, about one third longer than broad, projecting some distance beyond the spinners behind, but rounded and not pointed posteriorly; evenly rounded in front,

without shoulder-points, flattened above, its height about half its length.

Vulva as in Pl. VIII. fig. 6; the scape much narrower than the subjacent portion, deeply excavated above, ending posteriorly in a rounded apex which overlaps the latter.

Measurements in millimetres.—Total length 6; length of abdomen 4·5, width 3·5.

Loc. Estcourt, 4000 feet (*G. A. K. Marshall*).

This peculiar species, apparently mimicking a *Coccinella*, is recognizable at once from all the species described in this paper and from all known to me by its peculiar colouring. The exact generic position of the species appears to me to be doubtful. In spite of the separation of the lateral eyes, it appears to me to fall rather into *Araneus* than into *Cyrtophora*. The coloration suggests that of *Paraplectana Walleri* (Blek.).

Genus CYRTOPIHORA, Simon.

Cyrtophora citricola (Forsk.).

Loc. Estcourt, 4000 feet (*G. A. K. Marshall*).

Genus ARGYROEPEIRA, Emerton.

Argyropeira Antinorii (Pavesi).

? *Epeira undulata*, Vinson, *Aranéides des Iles Réunion* &c. p. 207, pl. v. fig. 3 (1863).

? *Meta Rabli*, Karsch, *Zeits. gesamt. Naturwiss.* 1878, p. 771.

Meta Antinorii, Pavesi, *Ann. Mus. Genova*, xx. p. 22 (1883).

Argyropeira blanda, O. P. Cambridge, *P. Z. S.* 1890, p. 626, pl. liii. fig. 6.

Argyropeira undulata, Vinson, Simon in Donaldson Smith's 'Through Unknown African Countries,' p. 388.

Loc. Durban (*H. A. Spencer*); Estcourt, 4000 feet (*G. A. K. Marshall*).

These Natal specimens appear to me to be specifically identical with examples from Shoa named *M. Antinorii* by Pavesi and presented to the British Museum by the Marquis G. Doria, and also with Somaliland specimens identified as *undulata*, Vinson, by Simon. If they are in reality identical with *undulata*, the latter name, having priority, must stand. Judging, however, from Vinson's figures, the abdomen of *undulata* is longer and more pointed behind than in the African species.

Genus CÆROSTRIS, Thorell.

Cærostris seæcuspidata (Fabr.).

Loc. Durban (H. A. Spencer); Estcourt, 4000 feet (G. A. K. Marshall).

Genus GASTERACANTHA, Sund.

Gasteracantha cicatricosa, C. Koch.

Loc. Estcourt, 4000 feet (G. A. K. Marshall).

Gasteracantha tabulata, Thor.

Loc. Port Natal (Gueinzius).

Gasteracantha ensifera, Thor.

Loc. Durban (W. L. Distant); Port Natal (J. Sanderson).

Genus PARAPLECTANA, Brit. Cap.

Paraplectana Thorntoni (Blackw.).

Eurysoma Thorntoni, Blackwall, Ann. & Mag. Nat. Hist. (3) xvi. p. 348 (1865).

Peniza testudo, Thorell, Eugenes Resa, Araneæ, p. 10.

Loc. Estcourt, 4000 feet.

According to a note affixed by Mr. Marshall to this specimen, the spider when living is coral-red and mimics very exactly a common local ladybird (Coccinellid), *Chilomenes lunata*.

Genus PYCNACANTHA, Blackw.

Pycnacantha tribulus (Fabr.).

Aranea tribulus, Fabr. Ent. Syst. ii. p. 428.

Pycnacantha Meadii, Blackwall, Ann. & Mag. Nat. Hist. (3) xvi. p. 351 (1868).

Pycnacantha tribulus, Fabr., Simon, Hist. Nat. Araignées, i. p. 889, fig. 958.

Loc. Estcourt, 4000 feet (G. A. K. Marshall).

Family Theridiidæ.

Genus LATHRODECTUS, Walck.

Lathrodectus tridecim-guttatus (Rossi).

Loc. Estcourt, 4000 feet (G. A. K. Marshall).

Lathrodectus geometricus, C. Koch.

Loc. Durban (H. A. Spencer).

Family *Hersiliidæ*.Genus *HERSILIA*, Aud.*Hersilia sericea*, sp. n. (Pl. VIII. fig. 9.)

Colour (in alcohol). Carapace testaceous, clouded with black; clypeus yellow; mandibles black, with pale transverse median band; abdomen testaceous, mottled with black, with an irregular median black band anteriorly; legs yellow, spotted and mottled with black; distal segment of posterior spinners yellow, with two black spots and black at the apex; lower side of trunk and limbs yellow. When dry the integument is seen to be covered with silky white hairs.

Carapace as wide as long, its width about equal to distal protarsal segment of second leg and to patella, tibia, and half the protarsus of the third; ocular quadrangle longer than wide, a little wider in front. *Eyes* subequal; the posterior medians rather less than a diameter apart, the anterior medians a little more than a diameter apart, the anterior and posterior median on each side about a diameter apart; clypeus exceeding the length of the ocular quadrangle.

Legs: femora with superior spines black, anterior and posterior spines white; patellæ with two superior spines and one posterior; protarsi with a pair of superior spines at the base above and four (rarely three) additional spines, two superior, one anterior, and one posterior; tibiæ of first and second armed with 8-9 spines.

Spinners with distal segment of posterior pair rather short, about as long as tibia of fourth leg, shorter than tibia of first.

Vulva with lateral portion projecting beyond the median and ending in an inwardly directed spiniform process.

Measurements in millimetres.—Total length 8.5; length and width of carapace 3; length of abdomen 4.5, of posterior spinners 6.2, its distal segment 5; length of first leg 24, of second 25, of third 8, of fourth 22.5.

Loc. Estcourt, 4000 feet (*G. A. K. Marshall*).

Apparently resembling in colour *H. albicomis*, Simon (Ann. Soc. Ent. France, 1887, p. 273), from Assinie, W. Africa, but certainly differing from it in having the ocular quadrangle wider in front and not perfectly parallel; nor does the description of the vulva in *albicomis* apply to that organ in *H. sericea*.

It is also closely allied to *H. Hildebrandti*, Karsch (Zeits. ges. Naturwiss. 1878, p. 312), from Zanzibar; but without

figure or description of the vulva of the latter it is not possible to make any satisfactory comparison between the two.

Family Oxyopidæ.

Genus PEUCETIA, Thorell.

Peucetia pulchra (Blackw.).

Pasithea pulchra, Blackwall, Ann. & Mag. Nat. Hist. (3) xvi. p. 335 (1865).

Loc. Natal (*J. Sanderson*).

Family Pisauridæ.

Genus EUPROSTHENOPS, Poc.

Euprosthénops australis, Simon.

Euprosthénops australis, Simon, Ann. Soc. Ent. Belg. xlii. p. 12 (1898).

Loc. Durban (*H. A. Spencer*); Estcourt (*G. A. K. Marshall*).

The South-east African form of the genus *Euprosthénops*, which M. Simon regards as distinct from *E. bayonianus*, I had identified as that species, having no West-African examples with which to compare it.

Genus SPENCERELLA, nov.

Allied to *Euprosthénops* and *Tetragonophthalma*; differing from the former in that the anterior lateral eyes are subsessile and close together in the middle line, the distance between them being about equal to the distance between the posterior medians; in *Euprosthénops* these eyes are strongly stalked and far apart, the distance between them being equal to the distance between the posterior laterals. In *Tetragonophthalma* the anterior laterals, although sessile, are widely separated and above the edge of the clypeus.

Type *S. lineata*, sp. n.

Spencerella lineata, sp. n. (Pl. VIII. fig. 17.)

Colour. Carapace ochre-brown, covered with yellowish hairs at the sides and a broad pale median longitudinal stripe; hairs on face silvery, two silver stripes on the mandible; legs and palpi covered with yellowish-brown hairs, speckled below on the femora; lower side of third leg darkened with a fuscous longitudinal stripe; abdomen yellowish brown, spotted at the sides with black, with two faint longitudinal infuscate stripes,

separated by a paler median area running along the upper-side; sternum mesially infuscate, with a fine median white longitudinal line.

Carapace longer than wide, width equal to distance between posterior border and posterior lateral eye; facial portion more vertical than in *Euprosthénops*; the median band of pale hairs running out into a crest between the eyes; posterior median eyes about a diameter apart, anterior medians much smaller and about half a diameter apart; the ocular quadrangle longer than wide, and narrowed in front as in *Euprosthénops*; inferior angles of head prominent; carapace shorter than palpus by distal half of its tarsus, about as long as tibia of third leg.

Legs long and slender, 1 and 2, 4, 3, apparently normally spiny.

Palpi with patella a little shorter than tibia; tibia with an external nodular prominence in its basal half and a somewhat quadrate subbifid spine on its anterior half; tarsus broad at the base, narrowed and pointed distally.

Abdomen long and slender, gradually narrowed posteriorly, nearly four times as long as broad.

Measurements in millimetres.—Total length 13; length of carapace 4·2, of abdomen 9, width of latter 2·5; length of first and second legs 23·5, of third 18·5, of fourth 23.

Loc. Durban (*H. A. Spencer*). Two adult male examples.

Family Lycosidæ.

Genus LYCOSA, Latr.

Lycosa Spenceri, Poc.

Lycosa Spenceri, Poc. Ann. & Mag. Nat. Hist. (7) i. p. 313, figs. 1, 1 a.

Loc. Durban (*H. A. Spencer*); Estcourt, 4000 feet (*G. A. K. Marshall*).

Lycosa Darlingii, Poc.

Lycosa Darlingii, Poc. Ann. & Mag. Nat. Hist. (7) i. p. 314, figs. 3, 3 a.

Loc. Estcourt, 4000 feet (*G. A. K. Marshall*).

Family Palpimanidæ.

Genus PALPIMANUS, Duf.

Palpimanus armatus, sp. n. (Pl. VIII. fig. 11.)

♀.—*Colour.* Carapace, anterior legs, palpi, sternum and

mouth-parts, and epigastric area mahogany-brown, remaining legs yellowish red, these parts rather scantily covered with greyish-yellow hairs; abdomen more thickly covered with hairs of the same tint, brownish yellow beneath.

Carapace granular, high, its height about equal to the width of the cephalic area, its length equal to that of patella and tibia of first leg, a little longer than tibia, protarsus, and tarsus of second, and a little less than the same segments of the third leg, its width about equal to the length of the elevated portion, to femur of first leg, patella and half the tibia of this same appendage, and to patella and tibia of second, a little less than patella and tibia of fourth. *Eyes* of posterior line nearly straight, a little recurved, distance between medians a little less than between medians and laterals and equal to about five diameters; ocular quadrangle a little narrowed in front, about one fourth longer than wide; eyes of anterior line strongly procurved, medians less than a radius apart and about their diameter from the anterior laterals, which are much smaller and well in advance of them.

Mandibles and *sternum* granular.

Legs: height of femur of first about half its length; tibia and patella subequal; tibia and protarsus with complete internal scopular fringe; tarsus scopulate in the median third of its length; the rest of the legs with protarsi and tarsi distally scopulate below.

Epigastric area of *abdomen* marked with a pair of transverse crescentic grooves, its posterior border very lightly emarginate.

Measurements in millimetres.—Total length 13; length of carapace 5.5, width 4; length of first leg (from base of femur) about 11, of fourth 12.

♂.—Differing from female principally in the structure of the anterior legs, the femur of which is higher; the patella is armed externally with a stout conical process, and the tibia is arched and is furnished with a thinner backwardly directed process close to the base.

Total length 11 millim.

Loc. Durban (*H. A. Spencer*), ♀; Estcourt, 4000 feet (*G. A. K. Marshall*), ♀; and Port Natal (*Gueinzus*), ♂, type.

In the arrangement of the eyes this species approaches *P. capensis*, Sim., and *P. globulifer*, Sim., both of which were obtained at Port Elizabeth, and especially the latter, in having the eyes of the posterior line almost straight, but certainly differs from both in the male in the structure of the

legs of the first pair, which in *globulifer* and *capensis* are not armed as in *P. armatus* (see Simon, Ann. Soc. Ent. France, 1893, p. 312, and Hist. Nat. Araignées, i. p. 406, 1893).

Family Zodariidæ.

Genus CYDRELA, Thorell.

Cydrela spinimanus, sp. n. (Pl. VIII. fig. 10.)

Colour. Carapace deep blackish brown; abdomen black, ornamented above with symmetrically arranged yellow spots; femora of legs blackish brown; patellæ, tibiæ, protarsi, and tarsi yellowish red; patellæ, tibiæ, and protarsi, especially of anterior pairs, with a dark longitudinal stripe along the sides.

Carapace long, about one third longer than wide, its length about equal to protarsus and tarsus of first leg, a little longer than protarsus and than patella and tibia of fourth, its width equal to patella and tibia of third; head high. *Eyes* of posterior line recurved, the medians less than a diameter apart; ocular quadrangle narrowed in front, much longer than wide.

Legs long and slender, the distal segments from the patella to the tarsus scantily clothed above with yellow hairs; patellæ, tibiæ, and protarsi strongly spined, especially of third and fourth legs, tarsi of latter also strongly spined; tarsi of third and fourth, and in a lesser degree of the second, lightly scopulate below, scopulate hairs also traceable upon the protarsus, at least of the third leg.

Palpi short and robust; femur much swollen and produced below; patella and tibia short, subequal, the latter with a conspicuous external spur; tarsus large, armed at the apex and internally with strong spines.

Measurements in millimetres.—Total length 7; length of carapace 4, width 2.5; length of first leg 10, of second 9, of third 10, of fourth 12.

Loc. Estcourt, 4000 feet (*G. A. K. Marshall*).

Differs from the previously described species, at least in the pattern of the upperside of the abdomen, which consists of circular yellow spots. In *C. unguiculata*, Cambr., from Natal (Proc. Zool. Soc. 1870, p. 731), the upperside is ornamented with a broad pale orange-yellow band.

In *C. stigmatica*, Simon (Bull. Soc. Ent. Fr. 1876, p. lxxxvii), from Zanzibar, the abdomen is furnished in front with a transverse arched stripe, two white spots in the middle, and a broad longitudinal band behind. *C. aculeata*, Karsch, from S. Africa (Zeits. gesammt. Naturw. 1878, p. 779), has the abdomen ornamented with a horseshoe-shaped anterior stripe, followed by a pale longitudinal band on each side.

C. approximata, Karsch, from Walfisch Bay (*loc. cit.* p. 780), is, judging from the description of the eyes, a different genus, perhaps belonging to *Capheris*. Lastly, *C. rutilans*, Simon (*Ann. Soc. Ent. France*, 1888, p. 370), from Kálahari, differs from all the other species in having the abdomen uniformly coloured above.

Family Gnaphosidæ*.

(=*Drassidæ* of authors.)

Genus PLATYOIDES, O. P. Cambridge.

Platyoides laterigradus, sp. n. (Pl. VIII. fig. 12.)

Colour. Carapace and mandibles mahogany-brown; sternum and basal three segments of legs ochre-yellow; legs from patellæ to tarsi lightly infusate, though paler below; abdomen ashy grey, paler beneath.

Carapace a little longer than broad, about as long as the tibia and half the protarsus of the first and as the femur of the fourth leg; anterior median eyes separated by a space slightly exceeding their diameter, but separated from the anterior laterals by a space which equals almost two diameters.

Mandibles with one largish tooth near the base of the inferior border; hairy below, the hairs arising from the summits of little papillæ; front of mandibles sparsely setose.

Legs also sparsely setose, not spined; protarsi and tarsi of first and second lightly scopulate below; the scopulæ of the second thinner than of first; patella and tibia of first and fourth about equal, and less than patella and tibia of second; fourth leg exceeding second leg by the length of its tarsus.

Abdomen oval, nearly twice as long as wide.

Vulva as in Pl. VIII. fig. 12; inferior spinners short and conical, scarcely longer than broad.

Measurements in millimetres.—Total length 13; length of carapace 4, width 3.3; length of first leg 11, of second 13, of third 10, of fourth 12 (measured from base of femur).

Loc. Estcourt, Natal, 4000 feet.

In size and colouring this species certainly resembles *P. Abrahami*, O. P. Cambridge (*P. Z. S.* 1890, pp. 624-5, pl. liii. fig. 4), which is described vaguely as from S. Africa; but the omission in the description of certain important characters, such as the armature of the mandible and the

* Since the name *Drassus* disappears as a synonym, the name *Drassidæ* should be discarded for the same reasons that have led to the substitution of *Argiopidæ* for *Epeiridæ*.

scopulation of the protarsi and tarsi of the first and second legs, makes the identification of the two types as co-specific extremely hazardous. Moreover, the spinners of *P. Abrahami*, as represented in fig. 4 e, showing the anterior pair to be much longer than broad and subcylindrical, and the nearness of the eyes of the anterior line, as shown in fig. 4 b, make such a reference of the species here described impossible. The vulva of *P. Abrahami* also appears to be different.

Lastly, according to Simon (Hist. Nat. Araignées, i. p. 342 &c.) the superior edge of the lower surface of the mandible presents only rudimentary teeth. This statement, I venture to think, applies not to the single largish tooth present in *P. laterigradus*, but to the papilliform supports of the hairs, which M. Simon describes as granules. Consequently since neither Mr. Cambridge nor Mons. Simon detected in *P. Abrahami* the tooth that I have described in *laterigradus*, one is compelled to assume that it is absent in the former species.

Platyoides pusillus, sp. n. (Pl. VIII. fig. 13.)

Colour. Carapace yellowish ochre-brown, with narrow blackish rim; legs practically a uniform ochre-yellow, the femora not noticeably paler than the remaining segments; abdomen testaceous above, clouded with fuscous at the sides.

Carapace about as wide as long, a little shorter than patella and tibia of first leg; eyes of anterior line subequally spaced, the medians about their own diameter from the laterals.

Legs as in the preceding species, but with the setæ more rigid, those on the lower side of the tibiæ and protarsi of the first converted into spines; protarsi and tarsi of first and second without scopulate hairs.

Vulva as in Pl. VIII. fig. 13.

Measurements in millimetres.—Total length 7; length and width of carapace 2·3.

Loc. Estcourt, 4000 feet (*G. A. K. Marshall*).

This species, based upon a single immature female, may, apart from the form of the vulva, be readily distinguished from *laterigradus* as follows:—

- a. Carapace narrower, noticeably longer than wide;
 distance between anterior median eyes only about
 half as great as that between median and lateral;
 protarsi and tarsi of first and second legs lightly
 scopulate, tibiæ and protarsi of first not spined:
 length of adult 13 mm. *laterigradus*, sp. n.

- b. Carapace almost as wide as long; distance between eyes of anterior line subequal, that between the medians only a little less than that between the median and lateral on each side; anterior legs not scopulate, tibiae and protarsi of first spined below: adult 7 mm. long *pusillus*, sp. n.

Family Clubionidæ.

Genus CLUBIONA, Latr.

Clubiona valens, Simon.

Clubiona valens, Simon, Ann. Soc. Ent. Belg. xli. p. 10.

Loc. Durban (*H. A. Spencer*).

Three examples (two females, one male) are doubtfully referred to this species, recorded from Natal, but insufficiently diagnosed. The two females present a small difference in the form of the vulva, and are, perhaps, not conspecific. The description of the vulva of *valens* applies to both examples.

Genus CORINNA, C. Koch.

Corinna natalis, sp. n. (Pl. VIII. fig. 14.)

Colour. Carapace deep brown, yellow at the sides of the thoracic portion, nearly black on the cephalic area, covered with greyish-yellow hairs; palpi and legs yellowish brown, darker distally; labium, maxillæ, and sternum deep brown; abdomen greyish black, covered above with greyish-white hairs.

Carapace about as long as patella, tibia, and tarsus of palp and as protarsus of fourth leg, a little shorter than patella and tibia of third and second leg, its width as long as protarsus and one third of the tarsus of the second leg, and just about equal to protarsus of third. *Eyes* of posterior line very slightly procurved, subequal and subequally spaced, posterior medians rather more than a diameter apart; quadrangle a little wider in front; anterior medians larger than posterior medians and about half a diameter apart; anterior medians considerably larger than anterior laterals and a little nearer to them than to each other; anterior line procurved when viewed from the front.

Mandibles prominent, strongly geniculate at the base; fang-groove armed with 4-5 teeth behind and 3 in front.

Tarsus of palp longer than tibia.

Maxilla and *labium* normal.

Sternum circular.

Legs: (first pair missing); third a little longer than

second, patellæ unarmed; tibia of second armed with 3 pairs of spines below, of third and fourth with 2 pairs, protarsus of second and third with 2 pairs of inferior spines.

Abdomen oval, not twice as long as wide.

Vulva marked with two subcircular impressions, separated by a narrow partition.

Measurements in millimetres.—Total length 14; length of carapace 7, width 5.5; length of palpus 9, of second leg 21, of third 23, of fourth 26; patella and tibia of fourth 8.5.

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

Family Heteropodidæ.

Genus PALYSTES, L. Koch.

Palystes natalius (Karsch).

Heteropoda natalia, Karsch, Zeits. gesamt. Naturwiss. 1878, p. 772.

Palystes Spenceri, Pocock, Ann. & Mag. Nat. Hist. (6) xvii. p. 58, pl. viii. fig. 3 (1896).

Loc. Durban (*H. A. Spencer*); Estcourt, 4000 feet, and the Lower Umkomaas River (*G. A. K. Marshall*).

The species that I named *P. Spenceri* is so abundant in Natal and the neighbouring parts of South Africa, that it seems to me almost certainly identical with the form that Karsch previously described as *Heteropoda natalia*.

Genus SPARASSUS, Walck.

Sparassus (Olios) Spenceri (Pocock).

Olios Spenceri, Pocock, Ann. & Mag. Nat. Hist. (6) xvii. p. 62, pl. viii. fig. 6.

Loc. Durban (*H. A. Spencer*).

Sparassus (Midamus) Marshalli, sp. n. (Pl. VIII. fig. 15.)

Colour of integument ochre-yellow, paler on abdomen, but darker towards the extremities of the appendages; mandibles lightly tinted with fuscous; carapace with a faint fuscous rim behind the head; abdomen marked dorsally with a median purplish-red band, which in the anterior half of its length is divided into two, the two branches enclosing a darker brown area; the carapace, abdomen, and legs covered with a short coating of silky white hairs.

Carapace high, convex, a little wider than long, its length a little exceeding patella, tibia, and tarsus of palp, equal to protarsus and tibia of fourth leg, almost equal to tibia of first.

Legs long and slender, 2, 1, 4, 3, the second exceeding

first by its tarsus and about one fourth of the protarsus, fourth exceeding third by the length of its tarsus; patella and tibia of first a little greater than of fourth, patella and tibia of second about twice the length of the carapace; patellæ without spines.

Eyes of posterior line procurved, distance between the medians greater than that between median and lateral; ocular quadrangle narrowed in front, its posterior width exceeding its length; eyes of anterior line subequal, subequally spaced, distance between medians less than their diameter.

Labium with convex border, distinctly wider than long; maxillæ short, scarcely longer than broad.

Abdomen nearly twice as long as wide.

Measurements in millimetres.—Total length 14; length of carapace 4·5, width 4·8; length of abdomen 10, width 5·5; length of first leg 21, of second 24, of third 17, of fourth 19.

Loc. Estcourt, 4000 feet (*G. A. K. Marshall*).

Sparassus (Vindullus) stictopus, sp. n.
(Pl. VIII. figs. 16, 16 a.)

Colour. Carapace ochre-yellow, with a dark brown stripe extending from the fovea and dividing anteriorly and passing along the cephalic groove, circumscribing the cephalic area behind, the thoracic portion bearing a brownish spot on each side behind the head; head with a faint median fuscous band; legs ochre-yellow, spotted with black at the base of the spines; tibiæ and protarsi with three spots; patella fuscous at base; abdomen with a faint median fuscous band.

Carapace a little longer than wide, resembling that of *Talystes*, distinctly shorter than tibia of third leg, a little longer than patella, tibia, and protarsus of palp, about half the length of the patella and tibia of second leg. *Eyes* of second line straight, laterals a little larger than medians and nearer to them than the medians are to each other; ocular quadrangle scarcely narrowed in front, about as long as wide; eyes of anterior line straight, medians much larger than laterals, distance between them greater than that between median and lateral.

Labium nearly as long as wide; maxillæ longer than wide.

Legs long and slender, patella unspined, second exceeding the first by the length of its tarsus, patella and tibia of first considerably longer than those of fourth; tibiæ with 3 pairs of long inferior spines.

Palp as in Pl. VIII. fig. 16 a, its tibia armed externally with a long inferior spine and a superior bidentate process.

Abdomen oval, one third longer than wide.

Measurements in millimetres.—Total length 12; length of carapace 5, width 4.5; length of first leg 29, of second 32, of third 21, of fourth 24.

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

This species may prove to be based upon the male specimen belonging to the same species as the immature female from Natal which M. Simon makes the type of his *S. (Vindullus) guttipcs* (*Hist. Nat. Araignées*, ii. p. 36, 1897). The coloration of the legs and carapace, however, seems to differ in the two. No great reliance must be placed either upon the ocular or other characters of an immature specimen.

The three species of this genus here recognized may be readily distinguished as follows:—

- a. Eyes of posterior line procurved; carapace slightly wider than long; ocular quadrangle much wider behind than in front; second leg exceeding the first by much more than the length of its tarsus .. *Marshalli*, sp. n.
- b. Eyes of posterior line straight or very slightly recurved; carapace not wider than long; second leg exceeding first by the length of its tarsus.
 - a¹. Distance between anterior median eyes less than that between anterior and lateral; eyes of anterior line subequal; tibiæ with two pairs of short spines below *Spenceri*.
 - b¹. Distance between anterior median eyes greater than between medians and laterals; anterior medians much larger than anterior laterals; tibiæ with three pairs of spines below *stictopus*, sp. n.

Genus SELENOPS, Latr.

Selenops Spenceri, Pocock.

Selenops Spenceri, Pocock, *Ann. & Mag. Nat. Hist.* (6) xvii. p. 55, pl. viii. fig. 8 (1896).

Loc. Durban (*H. A. Spencer*); Estcourt, 4000 feet (*G. A. K. Marshall*).

This species was based upon a female collected by Mr. H. A. Spencer. Mr. Guy Marshall was fortunate enough to procure the male.

Family Thomisidæ.

Genus THOMISUS, Walck.

Thomisus granulatus, Karsch.

Thomisus granulatus, Karsch, *Zeits. gesammt. Naturwiss.* 1880, p. 382.

Loc. Durban (*H. A. Spencer*); Port Natal (*Dr. Krauss*).

Thomisus albus (Gmelin).

Loc. Durban (*H. A. Spencer*).

Two immature females are referred with some doubt to this common European species. They do not appear to differ from immature examples of *albus*. Simon has recently recorded the latter from King William's Town in Cape Colony (*Bull. Soc. Zool. France*, 1896, p. 221).

Thomisus anthobius, sp. n. (Pl. VIII. fig. 18.)

Colour yellow; carapace with a large brown patch on its lateral slope, the upper surface and sides mottled with white; ocular region white, ornamented with black stripes, forming an obtuse angle, the longest side of which runs along the upperside of the head from horn to horn, the obtuse angle being on the middle of the clypeus; from the centre of the basal line runs a pair of black lines to the opposite sides, involving the anterior median eyes; edge of clypeus white; mandibles mottled with white in front; tibia of palp with a median white stripe; femora, patellæ, and tibiæ of first and second legs mottled with white below; abdomen mostly creamy yellow, transversely infusate behind the points.

In colour and in almost all structural details this species resembles the West-African *T. tripunctatus*, Lucas (*golphus*, Doum.), but may be distinguished by the form of the vulva and by its lower carapace. The vulva consists of a transversely oval or subquadrate elevated plate, marked with a pair of subcircular pits, separated by a broad partition, which widens posteriorly. In a specimen from Sierra Leone which I identify as *T. tripunctatus* the pits on the vulva are elongate, at least twice the length that they are in *T. anthobius*.

Measurements in millimetres.—Total length 14; length and width of carapace 5; length of abdomen 9.5, width 12; length of first leg 15, of second 16, of third 9, of fourth 11.

Loc. Estcourt, 4000 feet (*G. A. K. Marshall*).

Genus DLÆA, Thorell.

Diaa decens, Karsch.

Diaa decens, Karsch, Zeits. gesammt. Naturwiss. 1878, p. 773

Loc. Estcourt, 4000 feet (*G. A. K. Marshall*).

Originally recorded from Natal.

EXPLANATION OF PLATE VIII.

- Fig. 1. *Harpactira curator*, sp. n. External aspect of palpal organ.
 Fig. 2. *Araneus cyrtoscapus*, sp. n. Vulva from below.
 Fig. 2 a. Ditto. Vulva from the side.
 Fig. 2 b. Ditto. Left palpal organ of ♂, from below.
 Fig. 3. *Araneus Marshalli*, sp. n. Vulva from the side.
 Fig. 4. *Araneus Spenceri*, sp. n. Vulva from the side.
 Fig. 5. *Araneus haploscapus*, sp. n. Vulva from the side.
 Fig. 6. *Araneus coccinella*, sp. n. Vulva from below.
 Fig. 7. *Stegodyphus dumicola*, sp. n. Palpal organ of ♂, outer view.
 Fig. 8. *Dresserus obscurus*, sp. n. Vulva.
 Fig. 9. *Hersilia sericea*, sp. n. Vulva.
 Fig. 10. *Cydrela spinimanus*, sp. n. Palp of ♂, outer view.
 Fig. 11. *Palpimanus armatus*, sp. n. Anterior leg of ♂, outer view.
 Fig. 12. *Platyoidea laterigradus*, sp. n. Vulva.
 Fig. 13. *Platyoidea pusillus*, sp. n. Vulva.
 Fig. 14. *Corinna natalis*, sp. n. Vulva.
 Fig. 15. *Sparassus Marshalli*, sp. n. Vulva.
 Fig. 16. *Sparassus stictopus*, sp. n. Tibia of palp of ♂, outer view.
 Fig. 16 a. Ditto. Palpal organ from below.
 Fig. 17. *Spencerella lineata*, gen. et sp. n. Right palpal organ from below.
 Fig. 18. *Thomisus anthobius*, sp. n. Vulva.

XXVI.—*Descriptions of some new Species of Heterocera from Tropical America.* By HERBERT DRUCE, F.L.S. &c.

Fam. Syntomidæ.

Neacerea brunnea, sp. n.

Male.—Dark red-brown; palpi in front and pectus greyish. Fore wing with faint traces of sinuous antemedial and curved postmedial lines and of discoidal lunule. Hind wing fuscous brown, with diffused semihyaline streak below median nervure. The anal angle produced to a pointed lobe, the inner area with a fold containing a tuft of hair.

Expanse 30 millim.

Hab. Brazil, Espiritu Santo.

Type in Mus. Oxon.

Fam. Thermesiidæ.

Selenis cades, sp. n.

Male.—Primaries dark brown, crossed from the costal to the inner margin by a number of fine black lines, with a pale brown rather wide submarginal line extending from the apex

to the anal angle, and some white spots and a greyish line at the end of the cell: secondaries dark brown, crossed below the middle by some very fine waved dark brown lines; a pale brown line extends from near the apex to the anal angle; the fringe alternately dark and light brown. Head, antennæ, thorax, and abdomen dark brown, the underside of the latter and the legs pale brown.—*Female* very similar to the male, but considerably larger.

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

Hab. Guatemala, Volcan de Atitlan (*Champion*).

Capnodes rhoda, sp. n.

Primaries and secondaries fawn-colour; the primaries crossed beyond the middle from the costal to the inner margin by two narrow waved yellow lines, edged with black and brown scales, with a dark yellowish-brown oval spot at the end of the cell and a few whitish spots crossing the wing near the base, the marginal line spotted with black, the fringe dark fawn-colour: the secondaries crossed below the middle from the costal to the inner margin by a yellowish-white line, which is widened towards the inner margin, and with a submarginal row of minute yellow and black dots extending from the apex to the anal angle; the marginal line black; the fringe fawn-colour. Head, antennæ, thorax, and abdomen pale brown; the legs brown.

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

Hab. Mexico, Teapa in Tabasco (*H. H. Smith*).

Capnodes (?) *pira*, sp. n.

Primaries and secondaries brown; the primaries crossed from the costal to the inner margin by two narrow yellow lines—the first near the base, the second beyond the middle—and with a large black spot at the end of the cell, and a submarginal row of very indistinct dark brown spots extending from the apex to the anal angle: the secondaries very similarly marked to the primaries, but with only one yellow line crossing the wing. Head, antennæ, thorax, abdomen, and legs brown.

Expanse 1 inch.

Hab. Guatemala, Volcan de Atitlan, San Gerónimo (*Champion*).

Varies in colour and in the distinctness of the black spot at the end of the cell of the primaries, this being almost obliterated in some specimens.

Fam. Deltoidæ.

Subfam. PLATYDINÆ.

Gustiana intermedia, sp. n.

Primaries and secondaries pale brown; the primaries crossed from the costal to the inner margin by two yellowish-brown lines—the first near the base, the second beyond the cell, extending from near the apex to the middle of the inner margin—and with a faint submarginal line extending from the apex to the anal angle, and two small black spots at the end of the cell. Head, antennæ, thorax, and abdomen pale brown.

Expanse 1 inch.

Hab. Mexico, Jalapa (*M. Trujillo*).

Gustiana mecyanalis, sp. n.

Male.—Primaries cream-colour, slightly irrorated with brown scales at the apex and along part of the outer margin, with two yellow lines crossing the wing from the costal to the inner margin—the first about the middle, the second beyond—the marginal line black: secondaries brownish cream-colour. Head, antennæ, and thorax cream-colour, the abdomen yellow.—*Female* very similar to the male, but paler.

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

Hab. Mexico, Northern Sonora (*Morrison*), Milpas in Durango (*Forrer*).

Gustiana nigripalpis, sp. n.

Male.—Primaries and secondaries uniformly brownish cream-colour. Head, antennæ, thorax, abdomen, and legs brownish cream-colour; the palpi black.

Expanse 1 inch.

Hab. Mexico, Presidio de Mazatlan (*Forrer*).

Subfam. HYPENINÆ.

Hypena philomedea, sp. n.

Male.—Primaries reddish brown, with a large greyish spot on the costal margin near the apex; the base and a space along the inner margin greyish brown; the fringe dark brown: secondaries dark greyish brown. Head, palpi, antennæ, abdomen, and legs brown.

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

Hab. Guatemala, Guatemala city (*Rodriguez*).

Subfam. HERMINIINÆ.

Cyclopteryx oculata, sp. n.

Male.—Primaries and secondaries pale greyish brown, thickly irrorated with white scales and zigzag brown lines; the primaries with a large round black spot, edged with yellow and with a white dot in the middle, at the end of the cell; the fringe of both wings pale brown. Head, thorax, and abdomen pale brown, the antennæ blackish brown.—*Female* similar to the male, but with simple antennæ.

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

Hab. Guatemala, Totonicapam, 8500 to 10,500 feet (*Champion*).

Mr. Champion obtained a good series of this species; the insect was found in plenty on tree-trunks in a cacao-plantation; it rests with the wings horizontally expanded, and flies off on being approached.

Epizeuxis (?) *lineata*, sp. n.

Male.—Primaries and secondaries slate-colour; the primaries crossed from the costal to the inner margin by three dark brown lines—the first close to the base, the second about the middle, the third beyond—and with a submarginal row of very indistinct brown dots extending from the apex to the anal angle; the marginal line black; the fringe slate-colour: the secondaries very similarly marked to the primaries, but without the brown line at the base. Head, antennæ, thorax, and abdomen slate-colour.—*Female* very similar to the male.

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

Hab. Mexico, Dos Arroyos and Rio Papagaio (*H. H. Smith*).

XXVII.—*On a Collection of Dragonflies from the Transvaal and Nyasaland.* By W. F. KIRBY, F.L.S., F.E.S., &c.

DURING his stay in the Transvaal Mr. W. L. Distant collected some dragonflies, as well as other insects, and he also received collections formed by Dr. P. Rendall in Nyasaland and by Herr Kæssner at Zoutpansberg in the Transvaal. These collections have been placed in my hands for examination, and I find that they consist collectively of upwards of forty species. Among these I have ventured to describe

eight species as new, one of which will form the type of a new genus. Two or three others are also apparently undescribed; but the material before me is not sufficient to render it advisable to describe them at present.

The full synonymy of the known species will be found in my 'Synonymic Catalogue of Neuroptera Odonata.'

The new species are as follows:—

| | |
|--------------------------------|-----------------------------|
| Rhyothemis ducalis. | Orthetrum flavidulum. |
| Urothemis Rendalli. | Acisoma variegatum. |
| — iridescens. | Phyllomacromia flavicincta. |
| Stoëchia (gen. nov.) Distanti. | Lestes obscurus. |

List of Species of Neuroptera Odonata in the Collection.

Libellulidæ.

LIBELLULINÆ.

1. *Tholymis*, sp.

Four specimens.

Fort Johnston, Nyasaland (*P. Rendall*).

A species resembling the Indian *T. tillarga*, Fabr., in coloration, but as large as the West-African *T. pallida*, Beauv. The abdomen is damaged in all the specimens, so that it is desirable to defer describing them at present.

2. *Pantala flavescens*.

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

Two specimens.

Fort Johnston, Nyasaland (*P. Rendall*).

The most widely distributed of all dragonflies, found almost everywhere in the warmer parts of the world outside Europe.

3. *Tramea basilaris*.

Libellula basilaris, Beauv. Ins. Afr. Amér. p. 171, pl. ii. fig. 1 (1805).

One specimen.

Warm Baths, Waterberg (*Distant*).

Appears to be identical with West-African specimens.

4. *Rhyothemis ducalis*, sp. n.

Long. corp. 30–33 millim.; exp. al. 58–67 millim.; long. pter. 2–2½ millim.

Male.—Inky black, vertex violet-purple, face yellow, with

the rhinarium and lower part of the mentum black or blackish; sides of thorax more or less varied beneath with black or greenish and rufo-testaceous; head and thorax thickly clothed with hair; abdomen with a rufo-testaceous band on the lower part of the sides of the first two or three segments. Wings hyaline, slightly iridescent, and slightly clouded on the outer half. Fore wings with 8 or 9 antenodal cross-nervules, the first discontinuous, and 9 or 10 upper postnodal nervules before the pterostigma, of which the first is somewhat oblique; in the lower space there are 7 or 8 before the pterostigma, rarely coinciding with those above. Pterostigma rather short, covering more than one cell, usually extending beyond the ends of two cross-nervules in the lower postnodal space beneath it. Triangle usually at least twice as long as broad, crossed by two nervules (rarely one), and followed by a row of 3, 4, or 5 cells, and then usually by 3, not increasing till beyond the middle of the wing. One supratrangular nervule. Subtriangular space consisting of from 3 to 5 cells. Pterostigma dark brown, between black nervules; fore wings very slightly marked with smoky at the extreme base. Hind wings deep violet-purple at the base to beyond the penultimate cross-nervule before the nodus; the outer edge of this patch is irregular, but offers two prominent projections; there is a more or less conspicuous yellowish subhyaline line just below the costa in the purple patch, and an irregular yellowish-hyaline isosceles triangle lying over the arculus, with its base directed towards the base of the wing. Anal appendages rather slender, more than twice as long as the last segment of the abdomen, and upcurved at the tip.

Female similar to the male, but the vertex is metallic green instead of violet-purple, and the face below is almost wholly yellowish tawny. The thorax is metallic green above, bordered on the sides and behind with rufo-testaceous; the thorax beneath rufo-testaceous, with metallic green markings below the wings. The lower part of the abdomen is broadly rufo-testaceous beneath, over $3\frac{1}{2}$ segments from the base.

Four specimens from Fort Johnston, Nyasaland (*P. Rendall*), and one from Pretoria (*Distant*).

The British Museum possesses specimens apparently belonging to this species from Gambia, Angola, Natal, and Madagascar.

The specimens from Fort Johnston are to be considered typical.

This species is evidently closely allied to *R. separata*, De Selys, from Algeria; but whereas the face below the vertex is almost entirely yellow in *R. ducalis*, *R. separata* is

thus described:—"Tête d'un noir-violet métallique; une tache jaunâtre sur la lèvre inférieure, une bande transverse de même couleur au front."

I have no specimens of *R. separata* to compare.

5. *Palpopleura lucia*.

Libellula lucia, Drury, Ill. Exot. Ent. ii. pl. xlv. fig. 1 (1773).

Four specimens.

♂, Pretoria (*Distant*); 1 ♀, Zoutpansberg (*Kæssner*); ♀, Durban, March 1896 (*Distant*); 1 ♀, Delagoa Bay (*Distant*).

A common species in most parts of Africa.

The female varies in the intensity of the yellow suffusion, and in the width of the dusky markings.

6. *Palpopleura jucunda*.

Palpopleura jucunda, Ramb. Ins. Névr. p. 134 (1842).

Five specimens.

Pretoria (*Distant*). One specimen is dated October 1895.

There are specimens in the Natural History Museum from Knysna and Delagoa Bay.

7. *Sympetrum Fonscolombei*.

Libellula Fonscolombei, De Selys, Mon. Lib. Eur. p. 49 (1840).

Five specimens.

Three from Pretoria (*Distant*), one dated Aug. 26, 1894; one from Zoutpansberg (*Kæssner*); and one without locality.

This species is rare in Central Europe, where it reaches the northern extremity of its range, but is common in Southern Europe, Africa, and Central and Western Asia as far as North India.

8. *Trithemis arteriosa*.

Libellula arteriosa, Burm. Handb. Ent. ii. p. 850. n. 14 (1839).

Two specimens — one from Fort Johnston, Nyasaland (*P. Rendall*), and one from Pretoria (*Distant*).

A common African species, extending to the Canaries and Aden.

9. *Trithemis rubrinervis*.

Libellula rubrinervis, De Selys, Rev. Zool. Cuv. 1841, p. 244.

Four specimens.

Fort Johnston, Nyasaland (*P. Rendall*).

Found throughout Africa and also in Sicily and Syria.

10. *Trithemis lacustris*.

Trithemis lacustris, Kirb. Trans. Zool. Soc. Lond. xii. p. 329 (1839).

Two specimens.

Pretoria (*Distant*) and Zoutpansberg (*Kæssner*).

In the collection of the Natural History Museum from Abyssinia and Wadelai.

T. ardens, Gerstaecker, is, perhaps, a form of this species with blacker legs.

11. *Trithemis ferrugaria*.

Libellula ferrugaria, Ramb. Ins. Névr. p. 82 (1842).

One specimen.

Pretoria (*Distant*).

Apparently a rather scarce species, as the Natural History Museum only possesses a single specimen from Natal. It is easily recognized by the short black dashes on the middle of the back and sides of most of the segments of the abdomen.

12. *Helothemis dorsalis*.

Libellula dorsalis, Ramb. Ins. Névr. p. 89 (1842).

Two specimens.

Pretoria (*Distant*).

This species varies much in intensity of colour, and in specimens in which the markings of the thorax have become black, the yellow suffusion of the wings has generally disappeared.

I doubt if the genus *Helothemis* is sufficiently distinct from *Trithemis*.

13. *Crocothemis erythræa*.

Libellula erythræa, Brullé, Expéd. de Morée, iii. (1) p. 102, pl. xxxii. fig. 4 (1862).

Seven specimens.

Four from Fort Johnston, Nyasaland (*P. Rendall*), and three from Delagoa Bay (*Distant*).

A widely-distributed species in South Europe, Africa, and the East Indies. My *Orthetrum Lorti* from Somaliland appears to be synonymous with it.

14. *Urothemis designata*.

Libellula designata, De Selys, Rev. Zool. (2) xxiii. p. 177 (1872).

Two specimens.

Fort Johnston, Nyasaland (*P. Rendall*).

A widely-distributed African species. The Museum possesses specimens from the Gold Coast, Gaboon, and Natal.

15. *Urothemis Rendalli*.

Long. corp. 37 millim.; exp. al. 74 millim.; long. pter. 4 millim.

Female.—Yellow, darkest on the sides and lower surface of the abdomen. Head with the vertex and frontal tubercle orange-yellow, separated by a black band in the depression between, which passes over the ocelli; the occipital triangle and the hinder orbits, which are marked on each side with two black spots, are likewise orange-yellow, but the occiput itself is black. The lower part of the face is paler yellow, the mentum, except a narrow black median line, being almost white; the rhinarium is a little darker than the surrounding parts. On the thorax is a black band in front of each wing, and a narrower one behind, connecting the hinder part of their bases; and the hinder sutures on the pleura are also marked with black. On the abdomen is a black band down the middle, very broad on the first segment, less so at the base of the second, and expanding at the extremity of each of the following ones; beneath, there is a black band, interrupted in the middle, at the extremity of most of the segments. Legs yellow beneath nearly to the tips of the femora, otherwise black. Wings iridescent hyaline, slightly clouded towards the tips, costal nervures and the adjacent cross-nervules mostly yellow, but the principal radius conspicuously black as far as the nodus. Fore wings slightly tinged with yellow at the base and with six antenodal and postnodal cross-nervules. Hind wings deeply tinged with yellow at the base as far as the triangle, and over this space the nervures are pale yellowish white; lower costal cell filled with blackish nearly to the extremity; below this is a roughly oblong blackish space, divided into spots by the pale yellow nervures; and towards the lower extremity of the yellow tinge, which extends along the inner margin, but ceases before reaching the anal angle, is a more or less regular, slightly curved row of blackish spots, separated by the pale nervures. Membranule white.

One specimen.

Fort Johnston, Nyasaland (*P. Rendall*).

A very distinct species; perhaps allied to the Algerian *U. Edwardsii*, Selys, which is not before me.

16. *Urothemis iridescens*.

Long. corp. 38–40 millim. ; exp. al. 68–75 millim. ; long. pter. 5 millim.

Male.—Deep black, clothed with pruinose blue on the thorax and abdomen; head shining, the inner orbits ivory-white; the rhinarium and mentum, except a black median line, testaceous yellow. Wings iridescent hyaline, with dusky nervures; costal nervure dusted with blue at the base, and bordered with yellow beyond; pterostigma yellow, between brown nervures, and extending beyond one cell on both sides; transverse nervules mostly yellow towards the costa. Fore wings with 7 antenodal and 6 postnodal cross-nervules, membranule blackish. Hind wings with the first cell of the lower costal space more or less marked with dark brown, and with a long oval blackish-brown patch extending downwards from below the upper basal cell; its rounded lower extremity, which does not extend to the inner margin, though it covers the greater part of the membranule, is slightly bordered with smoky yellow.

Three specimens.

Fort Johnston, Nyasaland (*P. Rendall*).

Besides these there is a specimen from the Shire country in the Museum which differs from the Nyasa specimens in having seven postnodal cross-nervules on the fore wings instead of six. The species is easily recognizable by its very dark colour, which is unusual in this genus.

17. *Hemistigma albipuncta*.

Libellula albipuncta, Rambur, Ins. Névr. p. 93 (1842).

One specimen.

Delagoa Bay (*Distant*).

A common African species originally described from Senegal.

Genus STÆCHIA.

Eyes very large, rounded, with a slight expansion behind, frontal tubercle rounded above; the rhinarium, nasus, and labrum all rather long, narrow, and transverse, the nasus strongly arched downwards at the sides of the rhinarium. Legs long, rather slender, with a double row of soft bristles on the inside, which are very long on the front tibiæ; upper-side of legs but slightly hairy, and on the hind legs not at all; hind femora denticulated on the underside. Abdomen rather shorter than the hind wings, moderately stout, and hardly

tapering. Wings with the sectors of the arculus stalked; no supra-triangular nervules; one cross-nervule only in the lower basal cell; nodal sector very slightly waved. Fore wings with the triangle traversed, followed by three rows of cells, only increasing to four towards the extremity, three cells in the subtriangular space. Hind wings much broader than the fore wings, the triangle free, its base slightly nearer the base of the wing than the arculus. On the fore wings the arculus lies between the first and second antenodal cross-nervules, on the hind wings it lies just within the level of the second. Sectors of the arculus slightly separated at the base on both the fore and hind wings.

Agrees with *Corduliops*, Karsch, in many of its characters; but in *Corduliops* the triangle of the fore wings shows a tendency to become trapeziform, and the hind wings are not narrower than the fore wings.

18. *Stæchia Distanti*, sp. n.

Two specimens.

Pretoria (*Distant*).

Long. corp., ♂ 36 millim., ♀ 34 millim.; exp. al., ♂ 59 millim., ♀ 56 millim.; long. pter. 3 millim.

Male.—Inky black, front and frontal tubercle rich purple, the former edged below with buff; a very large orange spot on each side of the face within the lower part of each eye. Occiput black, hinder orbits orange, divided by a black spot. Legs black, front femora streaked with yellow to beyond the middle. Wings clear hyaline, only marked with smoky yellow at the base of the hind wings; nervures black; fore wings with 12 or 13 antenodal and 9 or 10 postnodal cross-nervules. Pterostigma thick, dark brown, with a reddish line at each extremity, covering about $3\frac{1}{2}$ cells. Hind wings with 9 or 10 antenodal and 11 postnodal cross-nervules. Anal appendages about as long as the eighth segment. Appendages of the second segment very prominent and clearly defined; anterior lamina short, hamule strongly hooked, genital lobe curved, oblique, slender, a little shorter than the hamule.

Female.—Orange. Head with the depression below the frontal tubercle and the middle of the mentum black; occiput black, the hinder orbits yellow, marked with two black spots on each side. Prothorax transversely banded with black; mesothorax with a broad blackish central band, narrowed behind and bisected by a yellow line; this is connected in front with a double black stripe on each shoulder, divided by

a yellow space. Below the shoulder-stripes is a black line, meandering on the lower part of the pleura and throwing up two or three irregular branches below the wings. On the abdomen the carinæ are mostly black, and there is a black central stripe, almost coalescing on the hinder segments with the black lateral borders of the abdomen. Abdomen black beneath, with the sutures and a double longitudinal stripe yellow. Legs black, the femora lined above with yellow. Wings hyaline, stained with yellow at the base and on the nodus. Pterostigma dark reddish brown, between black nervures, edged by a pale line below and at the sides. Fore wings with 13 antenodal and 10 or 11 postnodal cross-nervules; these and the areculus are mostly yellow. Hind wings with 9 or 10 antenodal and 11 postnodal cross-nervules.

19. *Orthetrum trinacria*.

Libellula trinacria, De Selys, Rev. Zool. 1841, p. 244.

Four specimens.

Fort Johnston, Nyasaland (*P. Rendall*).

A species previously recorded from Sicily, Egypt, and Senegal. The Natural History Museum possesses specimens apparently belonging to this species from Angola and Madagascar.

20. *Orthetrum chrysostigma*.

Libellula chrysostigma, Burm. Handb. Ent. ii. p. 857. n. 58 (1839).

Five specimens.

Two from Fort Johnston, Nyasaland (*P. Rendall*); one from Pretoria (*Distant*); and two from Zoutpansberg (*Kassner*).

A widely distributed species in Africa. Easily distinguished by the black stripe bordering the upperside of the yellow band on the pleura being slightly angulated downwards in the middle.

21. *Orthetrum caffrum*.

Libellula caffra, Burm. Handb. Ent. ii. p. 856. n. 52 (1839).

Four specimens.

Three from Pretoria (*Distant*), and one from Rustenburg (*Distant*).

If I have correctly identified this species, it is closely allied to *O. taniolatum*, Schneider, from Western Asia, and to *O. hyalinum*, Kirby, from India. Burmeister's description, however, is very short and somewhat ambiguous.

The specimens of *O. caffrum* in the Natural History Museum are from various parts of South Africa; but Prof. Calvert also records the species from Sierra Leone and the Congo.

When I published my 'Catalogue of Odonata' I referred three species to *Thermothermis* — *T. caffra*, Burm., and *T. madagascariensis* and *angustiventris*, Ramb. The second species is the type of the genus; but *T. caffra*, as pointed out by Karsch and Calvert, is an *Orthetrum* (in the broad sense); and on reconsidering Rambur's description of his *Lib. angustiventris*, I cannot identify it with any species before me, but doubt very much whether it belongs to *Thermothermis*.

22. *Orthetrum flavidulum*, sp. n.

Four specimens.

Two from Pretoria (*Distant*), one from Rustenburg (*Distant*), one from Piensaars River, March 1894 (*Distant*).

Long. corp. 34 millim.; exp. al. 53 millim.; long. pter. $3\frac{1}{2}$ millim.

Female.—Yellow, the antennæ, their bases, and sometimes the frontal tubercle black; two more or less developed transverse black stripes on the prothorax, two blackish lines on each shoulder, sometimes filled up with brown, and followed by a brown stripe at the base of the wings above. Abdomen with the basal segments scarcely broader than the others; a broad blackish stripe on each side, expanded at the ends of the segments; under surface paler yellow than above; terminal segments sometimes yellow in the middle above. Legs yellow, lined with black beneath; tarsi black. Wings clear hyaline; pterostigma yellow, between black nervures, the upper one much thickened, covering two and a half cells or more. Nervures brown, front of costa and at least the lower series of antenodal cross-nervures light yellow. Fore wings with 12–13 antenodal and 8–9 postnodal cross-nervures; the last antenodal continuous; one supra-triangular nervule, triangle traversed, followed by 3 cells increasing; subtriangular space consisting of 3 cells. Hind wings with 8–10 antenodal and postnodal cross-nervures.

These specimens might be taken for small immature females of *O. chrysostigma*, but appear to be distinct. There is a specimen marked "Cape Colony" in the collection of the Museum.

23. *Cacergates leucosticta*.

Libellula leucosticta, Burm. Handb. Ent. ii. p. 1849. n. 8 (1839).

Fourteen specimens, Fort Johnston, Nyasaland (*P. Rendall*); one specimen, Delagoa Bay (*Distant*).

A common species in most parts of Africa, and also found in Syria.

24. *Diplacodes Lefebvrei*.

Libellula Lefebvrei, Ramb. Ins. Névr. p. 112 (1842).

One specimen.

Fort Johnston, Nyasaland (*P. Rendall*).

A species found in all parts of Africa, and extending to Madagascar and Asia Minor.

25. *Acisoma variegatum*, sp. n.

Two specimens.

Fort Johnston, Nyasaland (*P. Rendall*).

Long. corp. 26–29 millim.; exp. al. 43–48 millim.; long. pter. $2\frac{1}{2}$ millim.

Male.—Black, varied with paler markings. Head behind, frontal tubercle, and mandibles black; face bluish black above and buff below. Thorax greenish above, with the sides yellowish in front and pale blue behind, rather closely reticulated with black. Abdomen pale blue on the inflated basal segments, with black carinæ and lateral markings, and a black central submacular band, which broadens hindwards so as to cover most of the abdomen beyond the third segment; on the sides of the second and third segments are two black dashes crossing the carinæ, and below them a black mark is thrown off from the lower end of each carina, the first trifid and the latter bifid. There is a long buff spot on the sides of segments 4–6. The upper appendages are as long again as the lower, and are pale blue above and black beneath. Legs black, coxæ and trochanters yellow, and the femora narrowly lined with yellow. Wings hyaline, slightly clouded at the tips: fore wings with 8 antenodal cross-nervules, the last not continuous, and 7 postnodal cross-nervules; pterostigma long, yellow, between black nervules, covering more than one cell; no supra-triangular nervules; triangle free, followed by two rows of cells, increasing towards the extremity; subtriangular space consisting of one cell: hind wings with 6 antenodal and 8 postnodal cross-nervules, and stained with smoky yellow at the base, especially on the inner margin.

Female.—Red; head with the front of the frontal triangle and the ocellar cavity black; two broad dashes and the lower end of the clypeus in the middle black, above which, on the inner orbits, is a black spot on each side, and just below which, also on the inner orbits, is a short black streak on each side. Occiput with two or three black spots on each side on the hinder orbits. Prothorax with two large black spots on the back and two more behind them on the front of the mesothorax; thorax with numerous slender black lines and small spots on the back and sides and at the base of the wings. Abdomen with two large black spots at the base, and the sutures and carinæ all black; from the first carina runs a submacular black band, contracted behind each carina and suture, but widening behind till it covers the greater part of the contracted hinder segments of the abdomen. On the back of segments 3 and 4 is a large black dash on the sides behind the carinæ, and on segment 5 is a corresponding black line, not extending to the base or extremity of the segment; below these are longitudinal black carinæ, and below these again the middle of the under surface of the abdomen is greenish yellow, and on the second segment a black curved mark runs downwards from the extremity of the lateral carina, forming with it and a smaller black spot a figure not unlike the Hebrew letter **ד**. Below the lateral carina of the third segment is a long fusiform black spot, with a black line obliquely below it. On the fourth segment the lateral carina is pale, and there is a broad black line below it not extending to the extremity of the segment; on the following segments the lateral carinæ are pale at the base and broadly black at the extremity, and without distinct black marks below them. Abdominal appendages rather long and pointed, yellow above, as are also the two short terminal segments of the abdomen, and black below. Legs black below and more or less red above. Wings clear hyaline, only slightly clouded with yellow on the inner margin of the hind wings. Fore wings with 8 antenodal cross-nervules, the last not continuous, and with 6 or 7 postnodal cross-nervules. Pterostigma very long, yellow, between black nervures.

Differs from the other described species of the genus by the extremely slender black markings of the thorax. The red colour may possibly be due to discoloration (?), but the curious markings on the sides of the abdomen should be enough to fix the species.

It is to be regretted that only one specimen of each sex was obtained. There appear to be several African species of *Acisoma*, but they are usually received only in small numbers and in poor condition.

CORDULINÆ.

26. *Phyllomacromia flavicincta*, sp. n.

Long. corp. 54 millim.; exp. al. 73 millim.; long. pter. 2 millim.

Two specimens.

The male from Rustenburg (*Distant*); the female from Pienaars River (*Distant*).

Male.—Black, with yellow and rufous markings. Head prevailing yellow; occiput black, occipital triangle yellow, lower half of the hinder orbits light shining mahogany. Frontal tubercle strongly bifid, the points yellow behind, bordered behind with blue-black; front of tubercle and ocellar cavity blue-black. Clypeus yellow, bordered below in front with light rufous, surmounted on each side with a purplish mark. Rhinarium, lower part of nasus, and middle and sides of mentum varied with light rufous brown. Face set with short black hair; mentum very coarsely punctured. Thorax light rufous brown in front and on the sides; three broad slightly oblique yellow bands on each side, in front of which the rufous colouring is varied with iridescent purple. The space between the wings is rufous brown; the scapulæ are yellow, corresponding to the first lateral stripes, bordered by a black carina in front, and there are apparently four yellow spots behind, one in the middle of the space between the fore wings, one just behind the fore wings on each side, being the continuation of the second lateral stripe, and one between the front of the bases of the hind wings. Abdomen with the first segment and the base of the second rufous brown; the rest of the abdomen black; the second segment with a broad yellow band, indented in the middle in front, in front of and slightly overlapping the carina; the third with a narrow tawny band in front and a broader one in the middle, almost divided by the median line; the fourth, fifth, and sixth similarly coloured, but the second tawny space narrower and more or less connected on the sides with the first; the seventh segment with the front half tawny, divided on the sides by a narrow black line; the terminal segments mostly rufous on the sides. Appendages of the second segment rather large, black in front, the last portion yellow; terminal appendages about as long as the ninth segment, the upper ones yellow, the lower one broad, truncated at the extremity, rather darker yellow, with the sides bordered with brown. Legs long, black, thickly set with long slender bristles; front legs yellow beneath to three fourths of the length of the femora.

Wings clear hyaline, with brown nervures; costal nervures and some of the cross-nervures yellowish; pterostigma tawny, between dark nervures, covering $1\frac{1}{2}$ cells. Fore wings with 12 antenodal and 5 postnodal nervures; 2 or 3 supra-triangular nervures, 4 cross-nervures in the lower basal cell, triangle free, followed by 1 or 2 rows of cells increasing. Hind wings with 8 or 9 antenodal and 7 postnodal cross-nervures; 1 supra-triangular nervule; 3 cross-nervures in the lower basal cell. Membranule white, blackish towards the extremity.

Female similar, but paler, the first six segments of the abdomen yellow at the base and beneath, with a short dusky streak on the back and sides. Head yellow, slightly varied with tawny. Wings clouded with smoky yellow on the outer third; fore wings with 12 or 13 antenodal cross-nervures; hind wings with 8 or 9 antenodal and postnodal cross-nervures; otherwise nearly as in the male, but slightly larger, measuring 78 millim. in expanse.

Closely allied to *P. trifasciata*, Ramb., from Madagascar, but differing in the yellow pterostigma, the smaller number of antenodal and postnodal cross-nervures, and in its general markings.

Æschnidæ.

GOMPHINÆ.

27. *Lindenia cognata*.

Gomphus cognatus, Ramb. Ins. Névr. p. 167 (1842)

Three specimens.

Pretoria (*Distant*).

A fairly common species in South Africa.

28. *Lindenia*, sp.

One specimen.

Zoutpansberg (*Kæssner*).

A broken specimen of what is probably a new species resembling the Indian *L. grammica*, Ramb., but with 12 or 13 antenodal and 11 or 12 postnodal cross-nervures on the fore wings.

29. *Ictinus ferox*.

Ictinus ferox, Ramb. Ins. Névr. p. 172 (1842).

One specimen.

Fort Johnston, Nyasaland (*P. Rendall*).

ÆSCHNINÆ.

30. *Anax tristis*.

Anax tristis, Hagen, Verh. zool.-bot. Ges. Wien, xvii. p. 35 (1867).

One specimen.

Fort Johnston, Nyasaland (*P. Rendall*).

One of the largest known species of the genus. It has been previously recorded from Guinea and Madagascar.

31. *Anax dorsalis*.

Æschna dorsalis, Burm. Handb. Ent. ii. p. 840. n. 17 (1839).

Two specimens.

Pretoria (*Distant*); Zoutpansberg (*Kæssner*).

The specimen from Pretoria is a female and that from Zoutpansberg is a male. The sexes differ little in this very handsome species.

32. *Anax mauricianus*.

Anax mauricianus, Ramb. Ins. Névr. p. 184 (1842).

Three specimens.

Two specimens from Pretoria (*Distant*) and one from Fort Johnston, Nyasaland (*P. Rendall*).

A common species in South Africa, Madagascar, Mauritius, &c.

Agrionidæ.

AGRIONINÆ.

33. *Libellago caligata*.

Libellago caligata, De Selys, Syn. Cal. p. 57 (1853)

Seven specimens.

Six from Pretoria (*Distant*); one from Pienaars River, March 1894 (*Distant*).

All males. There is a pair of this species from Natal in the Natural History Museum.

CENAGRIONINÆ.

34. *Chlorolestes longicauda*.

Agrion longicaudum, Burm. Handb. Ent. ii. p. 823. n. 26 (1839).

Five specimens.

Four specimens from Barberton (*P. Rendall*) and one from Zoutpansberg (*Kæssner*).

Several other species of this genus are found in South Africa.

35. *Allocnemis leucosticta.*

Allocnemis leucosticta, De Selys, Bull. Acad. Belg. (2) xvi. p. 174 (1863).

Three specimens.

Two from Barberton (*P. Rendall*) and one from Zoutpansberg (*Kæssner*).

36. *Micronympha senegalensis.*

Agrion senegalense, Ramb. Ins. Névr. p. 276 (1842).

Twenty-one specimens.

Eight from Pretoria (*Distant*); one from Barberton (*P. Rendall*); one from Zoutpansberg (*Kæssner*); seven from Fort Johnston, Nyasaland (*P. Rendall*); two from Zomba (*P. Rendall*); and two without locality.

A widely distributed species. Four specimens from Fort Johnston, Zomba, and Zoutpansberg exhibit the rufous dimorphism met with in most of the species of this genus.

37. *Enallagma*, sp.

Two specimens.

Fort Johnston, Nyasaland (*P. Rendall*).

38. *Enallagma*, sp.

Two specimens.

One from Pretoria (*Distant*), and one from Fort Johnston, Nyasaland (*P. Rendall*).

I do not care to describe these two species without a longer series.

39. *Pseudagrion Deckeni.*

Agrion Deckeni, Gerst. Arch. f. Nat. xxxv. p. 222 (1869).

Eight specimens.

Seven from Pretoria (*Distant*) and one from Fort Johnston, Nyasaland (*P. Rendall*).

All the males are very dark, but appear to belong to this species. There are only two females in the series, one much larger than the other.

According to Karsch this species, which stands under *Cænagrion* in my Catalogue, is the same as *Pseudagrion præteclatum*, De Selys, described in 1876.

40. *Pseudagrion nubicum*.

Pseudagrion nubicum, De Selys, Bull. Acad. Belg. (2) xlii. p. 591 (1876).

Two specimens.

Fort Johnston, Nyasaland (*P. Rendall*).

41. *Brachybasis rhomboidalis*.

Agriion rhomboidalis, Beauv. Ins. Afr. Amér. p. 85, *New.* pl. vii. fig. 1 (1805).

Seventeen specimens.

Fourteen from Fort Johnston, Nyasaland (*P. Rendall*); two from Delagoa Bay (*Distant*); and one from Durban, March 1896 (*Distant*).

42. *Lestes obscurus*, sp. n.

One specimen.

Barberton.

Exp. al. 50 millim.; long. pter. 2 millim.

Male.—Head and thorax black, dusted with pulverulent blue; front of head greenish above, occiput and lower surface of head pale, lower part of eyes pale, and two or three small pale spots near the inner edge of the eyes above. Central carina and three lines on each side of the thorax pale. Legs black. Abdomen bronzy green above towards the base and cupreous beyond; terminal segments broken off; sides and under surface pale, with a black central line beneath. Wings brownish hyaline, with 13 postnodal cross-nervules on the fore wings; pterostigma rather large, uniform black, covering two cells, edged above by a slender reddish line.

This is a very distinct species, somewhat resembling *L. barbarus*, Fabr., but much darker.

XXVIII.—*Descriptions of new Bornean and Sumatran Mammals.* By OLDFIELD THOMAS.

THE mammals now described were contained in, or examined in connexion with, the last collection made by Mr. A. H. Everett, whose death, after nearly thirty years' work and study in the East Indian Archipelago, will be lamented by every naturalist, and especially by those who had the privilege of his personal acquaintance. To no one is our knowledge of the fauna, both mammalian and avian, of that part of the world more deeply

indebted, as is evidenced by the large number of species that bear his name, while no one also has done more to encourage younger travellers to take up the subject on which he spent the whole energy of his life.

Taphozous longimanus albipinnis, subsp. n.

Similar to the typical form in all essential respects, but with the wing-membranes white, below throughout, above external to a line drawn from the forearm to the ankle. The forearms themselves, a narrow fringe of membrane just external to them, and the upper surfaces of the fingers are brown above as usual.

Forearm of the type (an adult female) 56 millim.

Hab. Labuan. Coll. A. Everett, Sept. 1892.

Type B.M. no. 93. 4. 1. 29.

Four other Bornean specimens* are similarly white-winged, and there is also a white-winged specimen in the Museum collection from Malacca collected long ago by Mr. A. Charlton. It is probable therefore that this subspecies will prove to range all over Western Malaysia. On the other hand, in Flores there occurs *T. longimanus leucopleurus*, Dobs., which, while with white sides, has the brown wings of *T. longimanus typicus*. All the names in the synonymy of *T. longimanus* were founded on Indian specimens, none on Malayan.

Chimarrogale phæura, sp. n.

Closely allied to *Ch. himalaica*, but slightly smaller, and with the uppersides of the hands and feet, the fringes of swimming-hairs surrounding the digits, and the whole underside of the tail uniformly dark brown. In *Ch. himalaica* the outer halves of the hands and feet, the swimming-bristles on the fingers and toes, and the underside of the tail are all white, in the last-named part contrasting markedly with its brown upper surface.

Dimensions of the type (an adult male, measured in skin):—

Head and body (much overstretched) 120 millim.; tail 82; hind foot 21. Of another specimen in spirit (female): head and body 92; tail 75; hind foot 21·3.

Skull (♀): basal length to front of incisors 23; greatest breadth 12·7; breadth across palate 7·3; length of upper tooth-series 11·8; tip of incisors to tip of large premolars 5·5.

* In one Bornean specimen, however, without exact locality, the wings are browner than usual above, although still white below.

Hab. Saiap, Mount Kina Balu. Coll. A. Everett, October 1895.

This Bornean representative of the genus was first discovered on Mount Kina Balu by Mr. John Whitehead in 1888* ; but his specimen being rather imperfect, and little material being then available, I did not at that date distinguish it from the Himalayan water-shrew, only noting its smaller size. Now, however, that Mr. Everett has sent two further examples of it, while the Museum has been enriched, thanks to the generosity of Mr. W. T. Blanford, by four Sikim specimens of *Ch. himalaicus*, I am enabled to make a comparison between the two forms on a fairly secure basis.

The Japanese water-shrew, *Chimarrogale platycephala*, is a still larger species, the hind foot of a specimen before me measuring 25·5 millim.

It is curious that while our European water-shrew (*Neomys † fodiens*) varies so remarkably in colour, the analogous forms of the other parts of the world (*Neosorex* and *Atophyrax* in America, *Chimarrogale* in Asia) should be so locally constant.

Crocidura (Croc.) baluensis, sp. n.

Allied to *C. fuliginosa*, as determined by Dobson, with which it shares the nearly complete suppression of the long hairs on the tail, but very much larger, with longer, softer, and more smoky-coloured fur. Fur of back about 8 millim. in length. General colour deep uniform smoky grey, the muzzle and the tops of the hands and feet darker brown. Under surface little lighter than upper, the hairs slaty grey for four fifths of their length, their tips pale brown. Tail about equal to the body without the head, closely haired and almost or quite without longer bristle-hairs, deep brown throughout. Lateral gland large, 8·5 × 4 millim. in an adult male, placed about its own length behind the elbow, and almost exactly covered by the hand when the fore limb is directed backwards.

Upper incisors of median size, their points in about the same line as those of the second incisor and large premolar. Second and third unicuspid about equal in height, the latter rather the larger in area. Last premolar and first two molars deeply hollowed out posteriorly. Upper edge of large lower incisors sinuous.

* Cf. P. Z. S. 1889, p. 229.

† *Neomys*, Kaup, antedates *Crossopus*, Wagl. See 'Zoologist,' 1893, p. 102.

Dimensions of an adult male specimen in spirit (not the type) :—

Head and body 98 millim.; tail 77; hind foot 18·5; ear 10·5.

Skull: basal length to front of incisors 23·3; anterior breadth 7·9; posterior breadth 11·2; interorbital breadth 5·4; palate length from front of incisors 12; length of upper tooth-row 11·6; tip of *i*.¹ to tip of *p*.⁴ 5·9.

The type specimen is a skin, and has a hind foot measuring when damped 18 millim.

Hab. Mount Kina Balu. Coll. A. Everett.

As with the water-shrew, so in this case, the first discoverer of the species was Mr. John Whitehead; but it is only with the additional material obtained by Mr. Everett that I have now felt myself justified in describing the species. Two skins and two spirit-specimens are contained in the collections sent by the latter gentleman, besides a considerable number of shrews referred to the allied, but much smaller, *C. fuliginosa*, Blyth.

Funambulus insignis diversus, subsp. n.

Similar to the typical Sumatran form in essential respects, though perhaps averaging slightly larger, but distinguished by the fur between the black dorsal lines being ashy grey and contrasting markedly with the lateral body-colour, which is brilliant rufous throughout, on shoulders, flanks, and haunches, and is especially noticeable in the lower view, in contrast to the whitish belly. The belly itself is even sometimes washed with rufous. In *typicus*, on the other hand, the lateral colour is more grizzled greyish and less rufous, while the colour between the stripes is almost or quite the same in tone as that outside them.

Dimensions of the type (in skin) :—

Head and body 230 millim.; tail 138; hind foot (wet) 46.

Hab. Baram River, Eastern Sarawak.

Other specimens from Mount Penrisen and Tagora, Sarawak (Everett); Tutong River and Mount Mulu (*Waterstraat*).

Type B.M. no. 93. 1. 2. 1. Presented and collected by Charles Hose, Esq.

This brilliantly red-sided squirrel seems to be the Bornean representative of *S. insignis*, the typical form ranging from Malacca through Sumatra to Java. I have long recognized that these two geographical races should be separated, and the occurrence of a number of *S. i. diversus* in Mr. *Waterstraat*'s N. Bornean collection confirms my opinion as to the constancy of its characters.

Funambulus niobe, sp. n.

Closely allied to *F. insignis*, and, like that species, with three black lines running down the back from shoulders to rump, but the general colour is a uniform dark olivaceous brown, the hairs brown, finely ringed subterminally with yellow. This brown colour extends quite uniformly over the whole upper surface, the head, back (both between the lines and outside them), flanks, and uppersides of both fore and hind limbs being of one uniform tint. No lighter line round eye. Edge of ear black. Top of fingers and toes also black. Under surface and inner sides of limbs dirty smoky yellowish, the hairs smoky grey for their basal halves, dull yellowish terminally, the resulting colour being very different from that found in *F. insignis*. Tail-hairs ringed with black and yellow.

Skull with rather a more slender muzzle and a flatter frontal region than *F. insignis*.

Dimensions of the type (an adult female in skin):—

Head and body 205 millim.; tail imperfect; hind foot 44.

Skull: greatest breadth 27.5; nasals 16 × 5.9; interorbital breadth 12.8; tip to tip of postorbital processes 21; intertemporal breadth 15.5; palate length from hensenion 21.5; diastema (to *p.*⁴) 13.8; length of upper tooth-series (excluding *p.*³) 7. Lower jaw: condyle to incisor-tip 35.

Hab. Pajo, Sumatra. Collected by Mr. Carl Bock.

Type B.M. no. 79. 6. 28. 9.

The single specimen on which this species is based has hitherto been considered, though with doubt, as a variety of *F. insignis*; but while the general darkening of the body-colour might alone be thought of merely subspecific value, the entire difference in the coloration of the under surface makes me think that intergrades are not likely to occur, and I am therefore compelled to make it a distinct species.

For the information of workers in the East to whom all the literature may not be accessible it may be noted that, by the recent splitting up of *Sciurus* into several genera, the species mentioned under that name in Hose's 'Mammals of Borneo' fall into the restricted genera as follows:—*S. ephippium* is a *Ratufa*; the species from *hippurus* to *tenuis* (except *Everetti*) remain in *Sciurus*; *laticaudatus*, *Hosei*, *Everetti*, and *insignis* come into *Funambulus*; while the pygmy squirrels (*melanotis*, *exilis*, and *Whitcheadi*) take the generic name of *Nannosciurus*.

In the same way, of the Indian squirrels—taking Blanford's 'Mammals of India' as a standard—" *Sciurus* " *bicolor*,

indicus, and *macrurus* belong to *Ratufa*; the species (except *rufigenis* and *lokriah*) from *ferrugineus* to *atr dorsalis* and also *Maclellandii* to *Sciurus*; and "*S.*" *rufigenis*, *lokriah*, *palmarum*, *tristriatus*, *Layardi*, *sublineatus*, and *Berdmorei* to *Funambulus*. The excessively long-nosed Chinese forms, *Davidianus*, *Pernyi*, and *pyrrhomerus*, are also, of course, members of the last-named group.

GLYPHOTES*, gen. nov. (of *Sciuridæ*).

Size small. Colour-pattern as in *Sciurus notatus*. Skull with the muzzle excessively short and broad, the nasals parallel-sided, nearly as broad behind as in front; nasal opening flattened from above downwards. Postorbital processes small, situated far back. Anterior end of zygoma more vertical than in *Sciurus*, its base opposite the anterior edge of *m.*¹. Lower jaw weak, the coronoid minute, not surpassing the condyle in height; condyloid process slender, drawn out backwards; angular process narrow.

Upper incisors very broad transversely, shallow antero-posteriorly, their depth not exceeding their breadth, their front faces very convex; as an additional peculiarity they are curved slightly *outwards*, so that along their inner edges they diverge from each other for their terminal millimetre, and their outer edges, when viewed from in front, can be seen to be distinctly concave. Lower incisors exceedingly broad and shallow, divergent, their front faces smoothly *concave*, their edges worn into broad chisel-shaped blades, of which the outer corners are longer than the inner. Cheek-teeth very small in proportion, their pattern as in *Sciurus*; premolars $\frac{2}{1}$.

Glyphotes simus, sp. n.

Size about half that of *Sciurus notatus orestes*. Character of fur, proportions of ears and limbs, and colour throughout almost precisely as in *S. notatus*, if one of the buffy-bellied Bornean examples of that species be selected for comparison. The white lateral band is, however, rather broader and more strongly marked, especially anteriorly. But, with this trivial exception, the resemblance is astonishingly complete, although the small size and stumpy nose would always serve to distinguish the species externally. Upper surfaces of fingers and toes, sides of nose, rims of eyes, and edges of ears buffy yellowish; indistinct whitish postauricular patches present;

* γλύφω, I chisel; in reference to the broad chisel-shaped lower incisors.

white lateral line commencing broadly and abruptly just behind the elbow; tip of tail blackish. Chest and belly dull buffy yellow, on the latter part somewhat suffused with a blackish extension from the dark lateral lines.

Skull and teeth as described above.

Dimensions of the type (an adult skin of doubtful sex):—

Head and body 129 millim.; tail 106 (with hairs 128); hind foot (wet) 28; ear (wet) 11.

Skull: basilar length (c.) 21; greatest breadth 18.2; nasals 6.9×5.1 anteriorly, 4.3 posteriorly; interorbital breadth 11.8; intertemporal breadth 14.5; breadth of braincase 16.5; palate length from henselion 11.2; diastema (to $p.^4$) 6.4; length of upper tooth-series (from $p.^4$ only) 4.1; breadth of each upper incisor 1.6, of each lower incisor 1.5. Lower jaw: condyle to incisor-tip 19.6; height from coronoid to angle 7.5; back of condyle to notch behind coronoid 6.6.

Hab. Mount Kina Balu, N. Borneo. Coll. A. Everett.

The proper treatment of this most extraordinary little squirrel is a problem of the greatest difficulty, and one for whose correct solution further material is sorely needed. Externally it looks simply a small form of *Sciurus notatus*, not smaller than *S. n. orestes* to a greater extent than the latter is than *S. n. typicus*, so that it might at first sight be thought merely a still more diminutive subspecies of that widely distributed and variable squirrel. On the other hand, its skull and dentition, notably the incisors, are so strikingly different from those of all ordinary squirrels, that it would seem necessary to make a peculiar genus for its reception. It might, in fact, be said that we have in it the curious combination of an animal at the same time different generically and almost the same specifically as *Sciurus notatus*.

Of course there are two obvious alternatives as to its origin—either it is an offshoot of *S. notatus* which has retained its colour and specialized its dentition, or it is a wholly different animal which has independently developed the highly characteristic coloration of *S. notatus*. Which of these alternatives is the true one may be solved by further material, for, on the one hand, links may be found connecting it with *S. notatus* through the subspecies *orestes* (which has broader incisors than *typicus*), or, on the other, further species allied to it may turn up without the characteristic coloration of *S. notatus*. In any case, however, bearing in mind the great importance of the shape of the skull among the Sciuridae, it seems advisable to have a generic name for a species with such a peculiar skull and highly modified teeth.

XXIX.—*The Origin of the Vertebrates.*

By EDMOND PERRIER*.

SINCE the researches of Kowalevsky (1866) the Vertebrates have been successively derived by authors from indeterminate animals (Scolecida), which were considered to have given rise at the same time to the Tunicates (Hæckel, 1866); from the Annelid Worms (Semper, Balfour, 1874; Dohrn, 1875; E. Perrier, 1881; Leydwick Minot, 1897); from the primary Merostomata (Albert Gaudry, 1883); from *Balanoglossus* (Bateson, 1884); from the Nemertines (Hubrecht, 1887); from the Arachnids (Patten, 1891); from the Crustaceans (Gaskell, 1891); from an animal allied to the Appendiculariæ (Brooks, 1893; Willey, 1894).

Differences of opinion such as these evidently imply either that the principles of zoology are still badly defined, or else that they are too frequently lost sight of, or else again that sufficient attention has not been paid to determining the nature of the characters of Vertebrates, the explanation of which had to be demanded from ancestral forms. We hope to show in the present paper that a rigorous application of undisputed principles leads to a unique solution of the problem, and that this solution is in every respect satisfactory.

The following essential characters are exhibited by every Vertebrate:—

(1) The body is bilaterally symmetrical and metamericly segmented throughout its entire length; (2) an important extent of its external or internal surfaces, especially those devoted to the respiratory function, is clothed with vibratile cilia; (3) during the embryonic period, at the very least, the anterior region of the alimentary canal always communicates with the exterior by means of lateral clefts; (4) the circulatory apparatus is closed, and exhibits a heart situated below the alimentary canal; (5) the secretory apparatus is constituted by a system of ducts which are repeated, in the embryo, throughout the whole length of the body, and provide the genital apparatus with its excretory ducts; (6) above the digestive tract there extends, in the embryo, a solid cord of cells, the *notochord*, around which are formed the vertebræ of the adult animal; (7) above the notochord lies the central nervous system, all on the same side of the alimentary canal, deprived of an œsophageal ring, and exhibiting a considerable bulk; (8) with

* Translated by F. E. Austen from the 'Comptes Rendus,' t. cxxvi. no. 21 (May 23, 1898), pp. 1479-1486.

reference to the outer world, the heart and the longitudinal nervous axis occupy contrary positions in the Vertebrates and the segmented Invertebrates, so that if we apply the term *ventral* to the side of the body turned towards the ground, and call the opposite side *dorsal*, the nervous axis is dorsal in the Vertebrates and ventral in the segmented animals, and the contractile vessels are situated on the side of the body opposite to the nervous system.

These are the only characters common to all Vertebrates, including *Amphioxus*; and since no one disputes that all these animals can easily be derived from the simplest forms among them, once these eight groups of characters are explained it must be admitted that the theory of the Vertebrate is complete; conversely, every system of genealogy which should fail to explain these eight groups of characters must be rejected.

(1) *Metamerism of the Vertebrate Body*.—Whatever be the cause of metamerism—a cause that we shall examine in a subsequent communication—the formation of the segments in all the metamericly segmented animals is a precocious developmental phenomenon, the mechanism even by which the body is constituted; by this process many organisms are formed the segments of which may afterwards become obliterated, but an organism not formed by this process once constituted never divides again into well-defined segments. The law of patrogeny (repetition of the genealogy by the embryogeny)—a fundamental law universally accepted—is therefore opposed to the possibility of attributing to the Vertebrates an ancestor whose body was not clearly segmented in the adult state, or at the very least multisegmental during the embryonic period. This at once excludes the Nemertines, *Balanoglossus*, and the Appendiculariæ, and leaves only the Arthropods and the Annelid Worms. In truth, in the embryos of these animals the septa between the segments are complete, while in those of the Vertebrates they are confined to the dorsal half of the body; but the embryogeny of *Amphioxus* shows that this is a result of *tachygenesis* or *embryogenic acceleration*. The segmentation of the embryos of *Amphioxus* is at first complete (Hatschek), and consequently identical with that of the Annelid Worms; afterwards the ventral portion of the septa is absorbed again; this condition is realized at once in the Vertebrates proper.

(2) *The Vibratile Cilia*.—The entire organization of Arthropods is to some extent dominated by the property which their epithelial elements possess of forming, in their superficial region, a deposit of chitin, which causes this region

to mortify, and renders it unsuited to the development of vibratile cilia. This property manifests itself in these animals almost at the very beginning of the development of the embryo (*Nauplius*); it has rendered necessary the ecdyses which have in their turn occasioned the metamorphoses; the absence of the cilia has had to be compensated for by the formation of jointed legs, moved by striped muscles and having the respiratory apparatus dependent upon them. Commencing at any rate from the precocious period which the *Nauplius* represents in their ontogeny, the evolution of the Arthropods has therefore taken quite a peculiar direction, and they have remained isolated from all animals the epithelia of which have continued to be wholly or partially ciliated. If the law of patrogeny is correct, which no one disputes, there cannot exist beyond the Rotifers (SCIRTOPODA) a transitional form between them and the long uninterrupted series of the Nephridiates which proceeds from the Rotifers to the Vertebrates inclusively. This excludes them from the lineage of the Vertebrates, the apparent resemblances between which and the Merostomata, the Arachnids, or the Crustaceans are only cases of convergence. In particular the protective shields of the placoid fishes are actual bones formed in the derm, and not a simple epidermic covering like the pieces of the Arthropod carapace.

(3) *Branchial Clefts*.—The presence of lateral branchial clefts in *Balanoglossus* and in the Appendicularidæ has been one of the great arguments that have been invoked in favour of their relationship with the Vertebrates. This relationship is undeniable in the case of the Appendicularidæ, but the absence of embryonic segmentation in these animals proves (law of patrogeny), as we have already pointed out, that they are not ancestral Vertebroids, but degraded Vertebroids; the same remark would apply to *Balanoglossus*, in case we were to admit as real the resemblances which people have *striven* to find between it and the Vertebrates, apart from its branchial clefts. But this latter resemblance is itself open to suspicion. The branchial clefts of the Vertebrates and the primary and secondary branchial clefts of *Amphioxus* are repeated, in fact, exactly like the metameres; although the embryo of *Balanoglossus* exhibits manifest traces of metameric segmentation, there is no relation between the metameres and the branchial clefts. This would be explained, for once in a way, as is shown by the discord which finally supervenes in the case of *Amphioxus* itself, under the supposition of a degeneration on the part of *Balanoglossus*, but not on the hypothesis which makes it an ancestral form. The absence of branchial clefts

in the Annelid Worms is an objection that may be lodged against the annelidan theory of the Vertebrates. It is easily disposed of. The branchial clefts are, in fact, but adventitious orifices of lateral diverticula of the alimentary canals. Now many Annelid Worms exhibit such diverticula; they are also produced in the Turbellaria and the Nudibranch Mollusks, which are nephridiates, and in this case these diverticula may open to the exterior (*Yungia*, *Cycloporus*, *ÆOLIDIDÆ*).

Balanoglossus itself, were it the ancestor of the Vertebrates, would come to be intercalated between them and the Annelid Worms, and would bear witness to the possibility of the appearance of pharyngeal clefts in these latter. The phenomena of budding in various CTENODRILIDÆ, SYLLIDÆ, and SERPULINÆ, as well as in the NAIDOMORPHA, also demonstrate the possibility of the appearance of adventitious orifices to the digestive canal in the case of the Annelid Worms properly so-called.

(4) *Circulatory Apparatus*.—Among the ancestors attributed to the Vertebrates, the Annelid Worms, the Nemertines, and *Balanoglossus* have, like the Vertebrates themselves, a closed circulatory apparatus; on the other hand, no Arthropod is known the circulatory apparatus of which is not in part lacunar. On this head the Arthropods are therefore excluded for the second time. The circulatory apparatus of the Nemertines has no differentiated propulsive centre; that which is called the *heart* in *Balanoglossus* is an organ situated on the same side of the alimentary canal as the nervous axis, and cannot consequently be homologous with the heart of the Vertebrates; the Annelid Worms therefore alone exhibit the typical relations of the circulatory centres, alimentary canal, and nervous axis, which are observed in the case of the Vertebrates.

(5) *Nephridial Apparatus*.—The urinary apparatus of the true Arthropods* is constructed after quite a different type from that of the nephridial apparatus of the Annelid Worms, the Nemertines, *Amphioxus*, and the Vertebrates; this apparatus appears to be wanting in *Balanoglossus*, which thus furnishes a new motive for its exclusion; in the case of the Annelid Worms and in *Amphioxus* it is formed of independent ciliated tubes, opening into the general cavity on the one side and to the exterior on the other, and recurring regularly either in almost all the segments of the body or only in a certain

* Among these *Peripatus* cannot be included with certainty, in spite of the attempts that have recently been made to connect it with them.

number of them, the anterior segments, for instance (AMPHICTENIDÆ, AMPHARETIDÆ, TEREBELLIDÆ, *Amphioxus*). The nephridia of the Nemertines are also confined to the anterior region of the body, and eventually open into a collecting duct on each side; herein they seem to present a further resemblance to those of the Vertebrates: but analogous conditions exist in the case of the Annelid Worms (*Loimia medusa*, *Lanice conchylega*); in certain Lumbricidæ (*Octochatus*, *Perichæta*) and some Hirudineans (*Pontobdella*) the nephridia form throughout the body but one and the same system of reticulated tubes. Moreover, in the Annelid Worms the nephridia almost always place themselves more or less at the service of the genital apparatus, as in the case of the Vertebrates. In the Earthworms (LUMBRICIMORPHIA) there even occurs a doubling of the renal apparatus and of the excretory apparatus of the genital glands, the analogies between which and that which is observed in the case of the Vertebrates (Wolfian and Müllerian ducts) I set forth as early as 1881*. The advantage therefore rests with the Annelid Worms, of which the Nemertines are in all probability nothing but highly modified forms. The Annelid Worms being henceforth alone concerned, it remains for us to explain how it has been possible for them to be the point of departure for the organic conditions which are peculiar to the Vertebrates.

(6) *Notochord*.—If it has been possible to compare for one moment the endodermic diverticulum of the proboscis of *Balanoglossus*, or even the proboscis of the Nemertines with the *notochord* of the embryos of Vertebrates and of the Tunicates, it is in default of having rigorously defined the conditions which have brought about the formation of the notochord and the necessary relations which result from this formation. The embryogeny of *Amphioxus*, like that of the Tunicates, shows in fact that the notochord is originally not a cord of cells, but the entire region of the endoderm included between the rudiment of the nervous system and the two rudiments of the mesoderm. These three rudiments are three regions of active development, which are only able to derive the reserve of nutriment which is necessary for them from the endodermic area comprised between them. As a result of this the elements belonging to the area thus circumscribed empty themselves, become vacuolate and to a certain extent mortified; the rest of the endoderm, on the contrary, continues to develop, glides in consequence underneath the inert area and eliminates it from the endoderm, and it is this

* 'Les Colonies animales,' pp. 677 and 684.

eliminated area, the origin of which is quite clear, which, by the grouping of its elements into a cord, constitutes the notochord. The cord thus constituted has nothing except the mortification of its cells in common with the endodermic diverticulum which penetrates into the proboscis of *Balanoglossus* and which has its analogue in the case of *Cephalodiscus*. These structures can be no more likened to a notochordal rudiment than could the median diverticulum, entirely analogous this time to that in *Balanoglossus*, which is thrown out in front by the main intestine of the majority of the polyclad and triclad Turbellarians. On the contrary, it will easily be understood how it has been possible for a notochord to be formed in an Annelid Worm, of which the nervous system, developed to an exceptional degree, and the mesodermic rudiments have been affected by tachygenesis. Now the formation of the nervous system by an invagination of the ectoderm and that of the mesoderm by two evaginations of the endoderm are evident proofs of the intervention of tachygenesis*. The considerable proportions assumed by the nervous system furnish, moreover, the explanation of the two latter distinctive characteristics of the Vertebrates.

(7) *Disappearance of the Œsophageal Ring.*—The exceptional volume assumed by the nervous system in all Vertebrates excludes from their genealogy *Balanoglossus*, in which, on the contrary, the axial cord is reduced to a very short rudiment which does not exceed the collar in length. The proportions to which the nervous axis attains necessarily induce its precocious development, its formation by rapid processes. It originates, in fact, at the expense of a fairly large area of the ectoderm, which buries itself beneath the neighbouring regions at a period well in advance of that at which the mouth is constituted. The nervous system being outlined before the mouth has no longer to concern itself with the existence of the latter, as it does in the case of the Annelid Worms, by developing around it. There is no longer a *raison d'être* for the œsophageal ring †; it disappears, and the brain proceeding to its completion on the median neural line stands in the way of the formation of the mouth upon this line. It is the cause of the reversal of the attitude of the Vertebrates, as already pointed out by Geoffroy Saint-Hilaire.

(8) *Reversal of Attitude in the Vertebrate.*—The mere comparison of a section of the embryo of a dog-fish and of a

* See 'Comptes Rendus,' December 1896: Report on the Competition for the Serres Prize, by the author.

† E. Perrier, 'Les Colonies animales,' p. 695 (1881).

section of an Annelid Worm suffices to demonstrate, as was proved by Semper, after Geoffroy Saint-Hilaire, that the inverse arrangement of the organs in the two branches is easily explained by a simple change of attitude. If we consider the embryogeny of *Amphioxus*, such as it has been described by Hatschek and, most recently, by Willey, keeping before us the considerations of which a *résumé* has been given above, all the apparently inexplicable peculiarities in the development of this animal not only become cleared up of themselves, but show the way in which the inversion of the higher Vertebrates has come to pass. The mouth of *Amphioxus* does not pass indeed all at once to the median line, opposite to the line of the nervous axis; it is formed at the nearest possible point to its primitive situation, on the left side of the body. The mouth having become lateral, the animal cannot feed except on condition that it lies on the left side of the body, which becomes its habitual attitude. According to Lamarck's principle (*use and disuse of organs*), of which the entire history of the Invertebrates is also a striking confirmation, it results from this new attitude that the organs of sense of the left half of the body, being more in touch with the nutriment supplied by the food, alone develop: the young animal exhibits but one olfactory pit and one gustatory organ (Hatschek's organ), both situated on the left. In consequence of this same attitude all the branchial clefts on the left side are covered up, and it is rendered impossible for them to perform their normal function. The animal is therefore induced to twist the region of its body which corresponds to them, so as to bring all its branchial clefts on to the right side. This is no mere hypothesis; this torsion is exhibited by the young *Amphioxus* in the course of its development (Willey), without any present physiological necessity being able to explain it; its two series of branchial clefts, the projecting folds between which they are enclosed, which are the first traces of the subbranchial cavity of the adult animal, are formed on the right side of the body exclusively and mark out the curves along which the torsion has been accomplished. The application of the law of patrogeny necessitates the conclusion that the ancestors of *Amphioxus* passed through a period at which they lived lying on the left side, with the mouth in contact with the ground, and when they were obliged, in order to ensure the regularity of their respiration, to twist the branchial region of the body. This permanent attitude has produced, in consequence of the constant contraction of certain muscles and the relaxation of those opposed to them, an asymmetry of the body which has been transmitted

by heredity (*Lamarck's principle*), and this phase in the history of *Amphioxus* is still found inscribed upon its embryogenic development. Later on the animal adopted the habit of burying its posterior extremity in the sand; it found itself subjected to a life in a homogeneous medium; the symmetrical shapes, acting in harmony with a more ancient heredity unopposed by contrary efforts, and in accordance even with the conformation of the regions of the body which have escaped the torsion, caused the mouth, by means of successive distortions, to take its place in the plan of symmetry, and, since it was unable to regain its position in the dorsal median line, it passed over to the ventral side. Thus was brought about the new attitude and the return to a perfect symmetry on the part of the Vertebrates descending from *Amphioxus* or from analogous Vertebroids*.

XXX.—*Descriptions of new Coleoptera from East Africa.*
By C. O. WATERHOUSE, F.E.S.

THE following interesting new Coleoptera have been lent me for description. They form part of a valuable collection made by Mr. Hollis in Usambara in 1893 and 1894.

* *Amphioxus* in the adult state has not yet recovered this symmetry, as is shown by the presence on the left side of the body of a single olfactory pit, the continuity of the right half of the oral hood with the cephalic expansion of the fin, the continuity of the right metapleure alone with the ventral fin, the overlapping of the right and left muscle-segments, and, finally, the abortion of the genital organs of the left side in *Amphioxus cutellus*, from Torres Straits, and *A. lucayanus*, from the Bahamas, for which have been founded the genera *Épigonichthys* and *Asymmetron*.

The inductions by means of which we have interpreted the phenomena of torsion which are proved to take place in the development of *Amphioxus*, and the deductions which we have drawn from these phenomena with reference to the history of the reversal of the Vertebrates, are but strictly scientific applications of general laws, recognized by all in principle, but too often forgotten in each particular case. We observe, moreover, phenomena of torsion, which are analogous to the above and are explained by the principle of Lamarck, likewise in the development of many fixed animals (Cirripedes, Bryozoa, Echinoderms, Tunicates), in the case of the Gastropod mollusks and the Pleuronectid fishes. The rule which governs all these phenomena, and which may be termed the *rule of the fixation of attitudes*, may be expressed thus:—

When, in passing from one mode of life to another, an animal is led, in order to ensure that its organs shall perform their functions properly, to assume habitually a definite attitude, this attitude is capable of becoming fixed and hereditarily transmitted.

Cetoniidæ.

Gonochilus nigerrimus.

Entirely black and shining. Head distinctly punctured, the punctures moderately close together, but not crowded. Thorax distinctly punctured, the punctures widely separated on the back part of the disk, rather close together near the front angles; the deflexed anterior lateral margin is densely obliquely striolate. Scutellum very acuminate, with very few punctures. Elytra impressed at the suture, rather finely punctured, the punctures separated from each other by three to four diameters of a puncture. The margins behind the middle are transversely finely striolate, the striolæ extending on the margin nearly to the humeral enlargement.

This species closely resembles a species which I believe is *G. rufiventris*, but differs in being entirely black or with only the faintest tinge of brown on the pygidium. The punctuation of the thorax is much closer. The punctures on the disk of the elytra are much closer, and the transverse rugæ on the sides extend nearer to the humeral enlargement. The clypeus is slightly narrowed in front.

Length 9 lines.

Trichiidæ.

Calemetopus Hollisii, sp. n.

Black, rather narrow, depressed, pubescent. Head quadrangular in front, very slightly concave, finely and closely punctured, with sparse white pubescence; anterior margin rather strongly emarginate, with the angles rounded. Eyes very prominent. Antennæ with the club very long. Thorax at its widest part a trifle broader than the head, slightly narrowed in front and towards the base, broadest in front of the middle; clothed above with reddish-brown pubescence, with a little black on the anterior margin and near the front angle, with a streak of white scale-like hairs down the middle, and with four small white spots on each side, placed . . . Scutellum elongate-triangular, clothed with white scales. Elytra flat on the back, with the sides abruptly deflexed, considerably broader than the thorax, somewhat narrowed towards the apex, dull, obscure yellow, with the suture and margins black, the black on the suture a little dilated below the scutellum; the deflexed margins are black, with a yellow mark below the shoulder. Each elytron has several lines of black punctures. The pygidium is very prominent, conical,

shining, rather finely reticulate-striolate, with a median stripe of white scales. Anterior tibiae simple. Tarsi very long. Body beneath shining, sparsely clothed with greyish-white pubescence. Four lateral whitish spots are visible from above.

One of the specimens has the pubescence above rather more yellow.

Length 6-7 lines.

Polyplastus ovatus, sp. n.

Oblong-ovate, moderately convex, shining, black. Thorax and scutellar area of elytra reddish yellow. Head with the forehead strongly punctured in the middle; the epistome closely and rugosely punctured, slightly narrowed in front, very gently emarginate. Thorax gently convex, a little broader than long, narrowed anteriorly from the middle, the posterior angles slightly projecting, but not very acute; the base broadly lobed in the middle, sinuate on each side. The punctures on the surface are rather large and not very close together. There is a black spot on each margin in front of the middle. Scutellum as long as broad, curvilinear, with a few very fine punctures. Elytra very strongly grooved, the grooves catenate-punctate and rather dull; the interstices very convex except near the base, of unequal width; the second broad at the base, very narrow at the apex, the fourth much narrower than the third and fifth, the sixth very narrow posteriorly. Pygidium prominent, densely and finely striolate. Anterior tibiae with three small teeth, the second and third near together. Tarsi not very long. Mesosternal process slightly prominent, rounded. Body beneath shining, with few punctures.

Length 8 lines.

This species must, I think, be congeneric with *Polyplastus assuarius*, Janson. It is, however, a more robust and more convex insect, in which respect it resembles *Myoderma*. The form of the head is quite unlike any species of that genus, but resembles that of *Polyplastus*.

The discovery of this species is of great interest as showing more clearly the affinity of *Polyplastus* with the Trichiidæ.

Cerambycidæ.

Lygrus trifasciatus, sp. n.

Long, narrow, depressed, dull, brown. Head densely punctured, appearing granulose on the vertex; the face and

sides yellow. Eyes moderately prominent, round, emarginate above, finely granular. Thorax about one third longer than broad, with a sharp constriction just before the anterior angles, then nearly parallel to about the middle, where it becomes broader, and then gradually narrowed to the base. The upper surface is densely punctured, but on each side of the basal portion there is a space which has very few punctures. On each side there is a yellow spot extending nearly the whole length, nearly meeting the spot from the other side in front, constricted at its middle. Elytra flat, long, slightly narrowed towards the apex; yellow and light brown in nearly equal proportions; the basal area is yellow, there is a yellow fascia before the middle (narrow at the side, broad at the suture), and a yellow fascia behind the middle, a little broader at the suture than at the side. Antennæ very slender, twice the length of the entire insect, the two basal joints brown, the rest sordid yellow, the joints dusky at the tips. Legs long and very slender, the femora rather abruptly clavate, yellow, the clavate portion of the femora dark brown, the apex of the tibiæ and the tarsi dusky.

Length 7 lines.

Lamiidæ.

Monohammus Hollisii, sp. n.

Robust, dull, entirely clothed with a light brown, closely adpressed tomentum. Antennæ extending a little beyond the apex of the elytra; the basal joint stout, long, gradually enlarged towards the apex, which is black, the posterior margin and apex fringed with rather long black hair. The second joint small, black. The third joint a trifle longer than the first, with its apical half black, fringed with black hair. The following joints are more or less tipped with black. Thorax with a strong, acute, conical tubercle at the side; anterior margin a little raised above the level of the disk, which has three slightly raised spots, the anterior ones of irregular shape, the median one behind the middle somewhat resembling the Greek Ω . On each side of the disk there are some very small, slightly raised tubercles, each with a black central puncture. Scutellum orange-yellow. Elytra a little flattened at the base, evenly convex posteriorly, with numerous small punctures at the base, and some shining black tubercles, unequal in size and irregularly placed; some of the larger ones have a puncture in the centre. Each elytron is separately rounded at the apex.

Length 18 lines.

Cherostes Gahani, sp. n.

Robust, broad, clothed with light brown tomentum. Head rather narrow, the antennal tubercles separated by a narrow channel. Antennæ stout, extending to two thirds the length of the elytra; the basal joint dark brown, the rest lighter brownish grey. Thorax dark brown, with impressed parts of the disk lighter brown; lateral tubercle obtusely conical. The disk with a small median tubercle in front of the middle, somewhat the shape of the figure 8, and behind the middle is an oblong raised space, divided by an impressed line down its centre; on each side of the disk is an oval tubercle, and beyond this (nearer the anterior angle) there is a smaller round obtuse tubercle. Elytra broad, parallel-sided, only very slightly narrowed before the middle. The basal area is strongly punctured, the punctures about the shoulder rather large and often confluent; the punctures about the scutellum smaller; the punctures gradually diminish in size and disappear soon after the middle. The basal quarter is very dark brown, but there is paler pubescence about the scutellum. There is a broad pale brown fascia about the middle, somewhat *M* in outline; behind this the surface is again dark brown; the apical area pale brown, the pale colour ascending at the suture, with a dark brown spot at a short distance from the apex. Abdomen speckled with dark brown.

Length 15 lines.

Prosopocera uniformis, sp. n.

Robust, subcylindric, dull, entirely clothed with sordid brownish-ochraceous tomentum. Antennæ and legs rather greyish. Thorax with an impressed transverse line in front, obtusely angulated in the middle, and with a similar rectilinear line near the base; the lateral tubercle small, acute. Elytra uniform, convex, with a few black shining tubercles at the extreme base, and with some black punctures below the shoulders. Mesosternal process slightly prominent, slightly angular at its apex, longitudinally impressed in the middle.

Length 12 lines.

Idactus albo-variegatus, sp. n.

Brownish black, variegated with white. Head black, the epistome and vertex variegated with white, front finely punctured. Antennæ reaching considerably beyond the apex of the elytra, white, with the apex of each joint black, the basal joint with black punctures. Thorax white, with minute

black punctures; the lateral tubercle prominent, acutely conical; the disk with fine, small, obtuse tubercles, the central one scarcely noticeable. There is a transverse quadrate black spot on the front margin, two black spots at the base, and the sides are black. Scutellum white, blackish at the sides. Elytra much broader than the thorax at the base, a little narrowed posteriorly; white, with a pale grey triangular patch at the base, a rather large black triangular spot at the middle of the side, a transverse black spot a short distance from the apex across the suture, and a small black spot on the margin; there are also some very small black dots on the suture and margin. The grey basal patch is bordered by six small tubercles, three on each elytron. The black lateral spot is marked out by about six small tubercles, and there are about six other small tubercles in the apical area. The legs are black and white in about equal proportions. Body beneath black, with a little grey pubescence.

Length 6 lines.

Stathmodera grandis, sp. n.

Pale brownish testaceous, ornamented with dark brown. Head with the front pale, yellower on the clypeus; vertex dark brown. Antennæ light brown. Thorax dark brown above, broadest at the middle, slightly narrowed in front, gently sinuate at the sides behind the middle; on the disk in front are two obscure, light brown, approximate stripes and a central one at the base; there are eight or ten rather sharply cut longitudinal grooves, extending from the base to nearly the middle of the disk (these are best seen when the insect is locked at sideways). Elytra at the base considerably broader than the thorax, gradually narrowed to near the apex, and then more rapidly narrowed, the outer apical angle of each elytron produced into a strong acute spine. The sutural area and posterior half of the elytra are brown, leaving the basal outer half of each pale testaceous, the part nearest the scutellum very dark; the posterior part is paler and shades off to brownish testaceous at the sides; each elytron has on the disk behind the middle two almost black vittæ and near the apex three nearly white spots, which, with the three on the other elytron, form a crescent; at the sides there is a very fine brown costa extending from the humeral callus to beyond the middle; there is a pale spot just above the apical spine. The legs are reddish brown, with a black velvety spot at the apex of the tibiæ. The characteristic spines on the tarsal joints are long, very acute, black.

Length $4\frac{1}{2}$ lines.

XXXI.—*Descriptions of new Mammals from South America.*
By OLDFIELD THOMAS.

Sciurus pyrrhinus, sp. n.

Size of *S. variabilis*. General colour rich grizzled rufous all over above, and in some specimens below; the whole of the upper surface uniformly of this tint, not darker on the posterior back, as is usually the case. The rufous is heavily grizzled with black on the back, but becomes clearer on the sides and limbs, which are of a vivid rufous throughout. Under surface either rufous, vivid and sharply defined, without black intermixture, or white, or a patchy mixture of the two. Backs of ears short-haired, dark rufous, a spot of lighter rufous behind their posterior bases. Tail rather shorter than head and body, grizzled black and yellowish at base, broadly washed with vivid rufous for its terminal half, the long hairs of this part black at base and with two other black rings further up, the ends bright rufous.

Skull and teeth about as in *S. variabilis*.

Dimensions of the type (an adult female in skin):—

Head and body 240 millim.; tail 208; hind foot (wet) 59; ear (wet) 21.

Skull: greatest length 52; basilar length 46; greatest breadth 33.5; nasals 16.5 × 8.4; interorbital breadth 18; intertemporal breadth 19; diastema 15.2; palate length from henselion 26.7; length of upper tooth-series 9.6.

Hab. Garita del Sol, Vitoc, Peru. Coll. J. Kalinowski, Oct. 1, 1891.

Type B.M. no. 97. 10. 3. 12. Received in exchange from the Branicki Museum, Warsaw.

Two other specimens were obtained at Chanchamayo by Mr. Kalinowski.

This handsome squirrel is clearly that referred to by Tschudi* as *Sciurus variabilis*, and is equally clearly not the true Colombian *S. variabilis*, Is. Geoff., which, among other differences, may be readily distinguished by its posterior back being much darker and less rufous than its fore back and shoulders. *S. tricolor*, Pöppig, of Tschudi, is also a darker coloured animal, and, by the dimensions given, is evidently of decidedly greater size.

* 'Fauna Peruana,' p. 155, pl. x. (1845). Also by myself, P. Z. S. 1893, p. 337.

Sciurus (Microsciurus) mimulus, sp. n.

Of the small size and with the cranial and dental characters of the other species of *Microsciurus*, but with almost precisely the coloration and general appearance of *Sciurus medellinensis*, Gray (probably a synonym of *S. Pucherani*, Fitz.). General colour deep brown, profusely grizzled with yellowish fulvous and with a marked black dorsal stripe. Crown and nape indistinctly blackish. Ears finely edged with fulvous; no whitish postauricular patch. Shoulders grizzled fulvous, with a tinge of rufous. Dorsal line shining black and strongly marked on the middle of the back, fading away anteriorly and posteriorly. Throat and chest rich fulvous, passing on the belly into blackish grizzled olivaceous grey. Limbs like back, the tips of the digits fulvous; inner sides of hips also more fulvous than the belly. Tail-hairs ringed with fulvous and black, their tips dull yellowish.

Skull narrower and more elongate than in *S. chrysurus*, the muzzle especially slender and lengthened. Interparietal very broad transversely.

Dimensions of the type (an adult female, measured in the flesh by the collector):—

Head and body 130 millim.; tail 109; hind foot, without claws, 33; ear 16.

Skull: greatest length 38; basilar length 29; greatest breadth 23; nasals 10.6×5 ; interorbital breadth 13.5; interparietal 4×9 ; palate length from henselion 15.8; diastema (to *p.*⁴) 9.5; length of upper tooth-row (excluding *p.*³) 5.6.

Hab. Cachavi, N. Ecuador, alt. 167 m. Coll. W. H. F. Rosenberg, Jan. 23, 1897.

Type B.M. no. 97. 11. 7. 39. Three specimens examined.

This little squirrel differs markedly from the other *Microsciuri*—*S. (M.) chrysurus*, *alfari*, and *peruanus*—by its black dorsal line, the yellow grizzled-brown of its body-colour, and its rich fulvous chest, but has a very striking resemblance to the larger Colombian species of true *Sciurus* to which Gray applied the name *S. medellinensis*. The latter, however, is in all probability the same as *S. Pucherani*, Fitz. (*S. rufoniger*, Puch., nec Gray), of Bogotá, the type of which, as M. de Pousargues has been so kind as to inform me, appears to have only one upper premolar, while its hind foot is 39 millim. long without the claws. Its position has been hitherto very doubtful, so that M. de Pousargues's information about it is exceedingly welcome.

In any case, however, whether *S. medellinensis* is or is not a synonym of *S. Pucherani*, *S. (M.) mimulus* has nothing

to do with either, in spite of its extreme resemblance to them externally.

Among some Muridæ recently presented by Mr. L. Söderström from Ecuador there are three specimens of a mouse corresponding so closely with Tomes's description of his "*Hesperomys minutus*" that there can be no reasonable doubt that they really represent that animal. On comparing them with the skin from Pallatanga provisionally referred by me to *minutus* in 1891*, the latter proves to be quite a distinct species, which does not seem to have been described, and may therefore be called

Oryzomys dryas, sp. n.

A small *Oryzomys* of a deep rufous colour, but little lighter below. Zygoma-root without anteriorly projecting plate.

Size about as in *O. longicaudatus*, rather larger than *O. minutus*. Fur thick, close, and woolly, about 7-8 millim. in length on the back. General colour above rich fulvous rufous, lined with black on the back; sides clearer fulvous, and this colour extends without line of demarcation all over the under surface, where the hairs are slaty basally and fulvous terminally. Ears of medium length, thinly clothed with black hairs. Upper surface of hands and feet dull whitish. Fifth hind toe reaching to the base of the second phalanx of the fourth. Tail longer than head and body, very finely scaled, thinly haired, brown above, rather paler below.

Skull delicate, little ridged. Interorbital space narrow, square-edged, but not ridged. Brain-case smooth, temporal ridges scarcely perceptible. Interparietal broad transversely, narrow antero-posteriorly. Zygomatic root very narrow, without anterior projecting plate, the anterior edge vertical and in the same line with the front edge of the bridge above. Anterior palatine foramina rather large, parallel-sided, their posterior extremity barely reaching to the front edge of *m*.¹. Teeth small and delicate, apparently of the usual pattern, but very much worn down in the type.

Dimensions of the type (an old specimen of doubtful sex), in skin:—

Head and body 87 millim.; tail (doubtfully perfect at tip) 109; hind foot, without claws (moistened) 23; ear (shrunk) 12.

Skull: greatest length 24.5; basilar length 18; greatest breadth 12.4; nasals 8.7 × 2.6; interorbital breadth 3.2;

* Ann. & Mag. Nat. Hist. (6) xiv. p. 357.

breadth of brain-case 10·8; interparietal 2·8 × 8·8; anterior zygoma-root 1·6; palate length from henselion 9·8; diastema 6·5; palatal foramina 4·5 × 2; length of upper molar series 3·1.

Hab. Pallatanga, Ecuador.

Type B.M. no. 59. 11. 1. 11. Collected by L. Fraser, December 1858.

“ Found among the bananas and plantains ” (*L. F.*).

The doubt as to its being *O. minutus* being once settled in the negative, there is no described species from which this animal may not be readily distinguished by its thick fur, rufous under surface, and narrow anterior zygoma-root.

A second form of the same group occurs at Bogotá, and may be provisionally regarded as a subspecies of *O. dryas*.

Oryzomys dryas humilior, subsp. n.

Closely allied to the typical subspecies in all important respects, but smaller (as shown by the skull and hind-foot measurements) and less rufous in colour, the general tone being a dull brownish yellow, this colour being, just as in *O. d. typicus*, continued all over the belly, without any line of demarcation on the sides. Fur shorter and more woolly in texture. The ears are blacker, more in contrast with the general colour. The skull is similar to that of *O. d. typicus*, but the supraorbital edges are less sharply square, there is slightly more of an anterior projection of the zygoma-root, and the palatine foramina are shorter.

Dimensions of the type (an adult male in skin) :—

Head and body (stretched) 90 millim.; tail 122; hind foot (moistened) 20; ear 14.

Skull: greatest length 26; basilar length 16·7; greatest breadth 12·1; nasals 8·5 × 2·6; interorbital breadth 3·2; breadth of brain-case 10·5; interparietal 3·3 × 8·5; anterior zygoma-root 1·8; palate-length 9·2; diastema 6·1; palatal foramina 4 × 1·7; length of upper molar series 3.

Hab. Plains of Bogotá. Coll. G. D. Child, May 10, 1895.

Type B.M. no. 98. 7. 3. 3.

Oryzomys flavicans subluteus, subsp. n.

Similar to the typical subspecies* in size and general characters, but distinguished by its darker belly. In *O. f. typicus*, as exemplified in more than a dozen specimens from the type locality, the under surface is whitish with a

* Described in *Ann. & Mag. Nat. Hist.* (6) xiv. p. 351 (1894).

faint buffy tinge, the hairs on the throat and chest being entirely of this colour, while those of the belly are slaty just at their bases. In the present form, of which three quite similar adult examples are available, the hairs of the chest and belly are slaty for their basal halves, while their terminal halves are deep yellowish buffy, little lighter than the yellow of the back and sides. The throat is, however, still white, as in the typical form. Ears, limbs, and tail apparently as in *typicus*.

Dimensions of the type (measured in skin) :—

Head and body 120 millim. ; tail 127 ; hind foot (wet) 26.

Skull : greatest length 30·3 ; greatest breadth (c.) 16 ; palatal foramina $5 \times 2\cdot2$; length of upper molar series 4·8.

Hab. W. Cundinamarca. Coll. G. D. Child.

Type B.M. no. 98. 7. 3. 2.

The number of specimens examined seems to indicate that this animal, slight as its differences are from the true *O. flavicans* of Merida, is yet locally constant, and therefore should have a distinguishing name. It is also evidently different from the brilliantly yellow-bellied form inhabiting the Sierra de Santa Marta, a specimen of which I have seen by the kindness of Mr. Outram Bangs.

Zygodontomys brunneus, sp. n.

Closely allied and very similar in all respects to *Z. brevicauda*, Allen, from Trinidad, but rather larger, with longer, softer fur (hairs of back 12–14 millim. in length), and the general colour markedly different owing to the absence of the rufous tinge so evident, especially posteriorly, in that species. The colour is therefore a very uniform finely grizzled brown, not more rufous posteriorly than anteriorly. Belly dirty greyish, the tips of many of the hairs buffy. Ears short, their hairs black. Upper surface of hands and feet dull white. Tail about as long as the body without the head, finely haired, blackish above, whiter below, though less distinctly bicolor than in *Z. brevicauda*.

Skull with the nasals broad and square posteriorly and the palatal foramina markedly broadened mesially, especially in old age.

Dimensions of the type (an adult female, in skin) :—

Head and body 152 millim. ; tail (c.) 117 ; hind foot (wet) 25 ; ear (wet) 19.

Skull (of another specimen) : greatest length 34 ; basilar length 28 ; greatest breadth 17·7 ; interorbital breadth 5 ; palate length to henselion 15 ; diastema 9·5 ; palatal foramina $7\cdot2 \times 3$; length of upper molar series 5.

Hab. El Saibal, W. Cundinamarca. Coll. G. D. Child, Dec. 22, 1895.

Type B.M. no. 98. 7. 3. 4.

This species is evidently the mainland representative of the insular *Z. brevicauda*, but is so different in colour as to require specific separation.

I use provisionally Dr. Allen's generic term *Zygodontomys*, as these short-tailed rats allied to *Oryzomys* seem to form a natural group, and there is a convenience in their having a special name. At the same time the dental character which he states to be peculiar to them, and on which he bases the name (the presence of a longitudinal ridge connecting the pairs of cusps), appears to occur in all *Oryzomys*, including the typical species *O. palustris*, Harl. But *Zygodontomys* (as represented by *Z. brevicauda* and *Z. brunneus*) has a distinguishing character in the *absence* of the transverse ridge running outwards from the longitudinal yoke between the pairs of cusps, and the consequent unusual simplicity of the molars*. The absence of this transverse crest, which somewhat fills up the valley between the laminae, tends to make the longitudinal yoke much more prominent in *Zygodontomys*, and therefore no doubt accounts for the stress which Dr. Allen lays on the latter crest.

The species described by myself as *Oryzomys macrotinus* † from Surinam will also fall into *Zygodontomys*.

Phyllotis Haggardi, sp. n.

Very similar to *Ph. Darwini* in colour and other essential respects, but much smaller, and with the ears only about half as large.

Fur about 11 millim. long on the back. General colour soft fawny grey, liberally mixed with blackish on the back. Sides clearer fawn, especially where edging the white of the belly. Under surface white, not sharply defined, the grey bases of the hairs showing through. Ears large, but not of abnormal proportions, both their surfaces well haired, blackish, finely mixed with yellow; a few bright orange hairs round their anterior base. Eyes without marked orbital rings. Upper surfaces of hands and feet silvery white. Tail little longer than the body without the head, well haired, its upper surface brown or black, its sides and under surface white.

* Reference to the absence of the transverse ridge in certain *Cricetine* has been made by Winge ('Gnavere fra Lagoa Santa,' p. 11) and Major (P. Z. S. 1897, p. 716).

† Ann. & Mag. Nat. Hist. (6) xiv. p. 358 (1894).

Skull essentially similar to that of *Ph. Darwini*, but differing by its much smaller size.

Dimensions of the type (in skin):—

Head and body 97 millim.; tail 86; hind foot (wet) 23; ear (wet) 18.

Skull: back of frontals to tip of nasals 18; greatest breadth 13·5; nasals 11·3 × 3·5; interorbital breadth 4·6; palatal length from henselion 12·2; diastema 7; upper molar series 4·4; extreme length of lower jaw 16·5.

Hab. Mount Pichincha, Ecuador, altitude 3400–4000 metres.

Type B.M. no. 98. 5. 1. 11. Collected October 1897, and presented to the British Museum by Consul L. Söderström.

This species, for whose discovery we have again to thank Mr. L. Söderström, of Quito, is evidently the Ecuadorean representative of the Chilean *Ph. Darwini*, but may be readily distinguished by its smaller size and much smaller ears. At the request of Mr. Söderström I have named it in honour of Mr. W. H. D. Haggard, Her Majesty's Minister at Caracas, to whose kindness he has been at various times indebted.

Akodon lenguarum, sp. n.

Closely allied to *A. obscurus*, Waterh., but lighter in general colour, less heavily lined on the back, and without the dark yellowish suffusion of the upper and under surfaces. As a consequence the colour is a comparatively clear grey above, though more yellowish on the rump, and lighter on the sides, while the belly is whitish, the tips of the hairs being white, with scarcely a tinge of yellowish. Hands and feet uniformly pale grey above. Tail blackish above, whiter below.

Size and proportions about as in *A. obscurus*.

Skull, as compared to a number of skulls (both older and younger) of *A. obscurus*, rather more heavily ridged in the supraorbital region, the interparietal rather smaller, the top of the anteorbital projection more slanted downwards, and both the palatal foramina and posterior nares narrower.

Dimensions of the type (measured in the flesh by Mr. Kerr):—

Head and body 115 millim.; tail 76; hind foot 21; ear 14.

Skull: greatest length 28·5; basilar length 24·3; greatest breadth 16; nasals 9·7 × 3·3; interorbital breadth 4·9; interparietal 2 × 8·8; palate length from henselion 12·8; diastema 8·4; palatal foramina 6·2 × 2; length of upper molar series (c.) 4·7.

Hab. Waikthlatingmayalwa, Northern Chaco of Paraguay, May 10, 1897.

Type B.M. no. 98. 5. 14. 4. Collected and presented by Mr. J. Graham Kerr.

Lengua native name "Pōmōō."

Another specimen of this species, collected on the 31st of May, 1897, at Puerto 14 de Mayo, in the Department of Bahía Negra, Northern Chaco, by Dr. Boggiani, has been submitted to me for determination by Dr. Gestro, of the Genoa Museum.

For comparison with *A. lenguarum* I have had a small series of modern skins of *A. obscurus*, collected by myself in May 1896 at Colon, near Montevideo, where I found it very common, living in company with *A. arenicola* in the long grass.

Dasyprocta aguti and the Species allied to it.

All the red- and yellow-rumped Agutis have hitherto been lumped together under the above name, apparently without much examination, for the most superficial comparison shows that those at least of Guiana and Brazil are different from each other, not to mention that other forms may prove to exist.

But the fixing of Linnæus's "*Mus aguti*" on to one or other of these animals has proved a matter of much difficulty. In his original description * he refers to Brisson, Ray, Maregrave, Pison, and Johnston. Tracing these notices back, they prove all to depend on the account of an animal given at about the same time by Maregrave and Pison, but actually published first by the former †. In these accounts the animal is distinctly stated to be Brazilian, and in Maregrave's geographical work ‡ Brazil is strictly limited to a country corresponding very nearly to modern Brazil, and does not therefore include Guiana. In spite, therefore, of Linnæus's mention of "Surinam, Guiana," after Brazil, I would propose to assign "*Mus aguti*" to the true Brazilian species. Moreover, the "*abdomine flavescens*" mentioned in all the descriptions, including Linnæus's, is alone applicable to the latter animal, and might be thought by itself to settle the question, even if the body-colour is rather yellow than "rufuscescentibus."

* Syst. Nat. (12) p. 80 (1766).

† Hist. Nat. Brasil. p. 224 (1648).

‡ 'Tractatus Topographicus Brasilie,' p. 5 (1658).

As no other pertinent names have been given, for the red hips and white incisors will readily distinguish the Amazonian *D. croconota*, Wagl., the red-rumped Aguti inhabiting Trinidad and Guiana will need a new name, and may be called

Dasyprocta rubrata, sp. n.

Fur of fore back and sides broadly ringed with black and dark yellow, the general effect being decidedly darker than in *D. aguti*. On the posterior back, as the hairs lengthen, the black rings tend to die out and the yellow gradually becomes more reddish, that of the ends of the long rump-hairs deep chestnut-red; but beneath the surface the bases of these hairs are more orange—in fact, they are orange at their base, reddening outwards to the small subterminal black ring, and with their tips chestnut. Nape and upper surfaces of hands and feet black. Under surface dirty grizzled brownish, not lighter than, and quite continuous with, the colour of the flanks; the inferramia, a few hairs on the middle line of the belly, and the inguinal region are inconspicuously yellowish or white.

Skull with the nasals short, evenly rounded behind. Ridge running forward above from the upperside of the infraorbital foramina continuous with the line of the incisors, instead of being nearer the nasals as in *D. aguti*. Bullæ smaller.

Dimensions of the type (a nearly adult female, measured in the flesh by the collector):—

Head and body 499 millim.; tail 28; hind foot, without claws 98, with claws 108; ear 40.

Skull: greatest length 100; basilar length 72.5; greatest breadth 46.5; nasals 36.5 × 17; interorbital breadth 28; palate length from henselion 37.5; diastema 25; length of upper tooth series 17.5.

Hab. (of the type). Savannah Grande, Trinidad.

Type B.M. no. 97. 6. 7. 17. ♀. Collected Feb. 11, 1897, by Dr. Percy Rendall.

Another example from Trinidad, presented by Mr. H. Caracciolo, is in the Museum collection, while three specimens of different ages are labelled as coming from Surinam and Cayenne.

The black nape, black feet, darker body-colour, and darker belly will readily separate this animal from the Brazilian *D. aguti*.

Dasyprocta rubrata flavescens, subsp. n.

Similar to the typical form and equally different from *D. aguti* in the dark tone of the fore back, sides, and under surface, the black nape and black limbs, but with the ends of the rump-hairs orange-yellow instead of red as in the Brazilian species, to which, however, there seems no real relationship.

Hab. Caripé, Cumana, Venezuela.

Type B.M. no. 94. 9. 25. 17. Immature. Collected January 1894 by Mr. A. Mocquerys.

The yellow rump gives this animal a superficial resemblance to *D. aguti*, but it is evidently most nearly allied to *D. rubrata*, from which it is different enough to deserve subspecific separation.

Marmosa regina, sp. n.

Larger than *M. cinerea*, and therefore the largest species of the group as yet described. Fur comparatively short and close, about 11 millim. in length on the back. General colour above buffy grey, finely speckled with brownish. Sides gradually becoming more buffy yellowish, passing into deep yellowish, almost ochraceous, on the under surface. The hairs of the under surface are slaty-based on the sides of the belly, deep yellowish to their bases on the chin, throat, chest, groins, and middle line of belly. On the chest in the type (an old male) there is a skin-gland whose secretion has darkened the neighbouring fur to a reddish brown. Dark orbital marks of medium development; forehead between them light buffy. Ears apparently rather small, their anterior basal projection well marked. Upper surface of hands and feet dull buffy. Tail furry, though not very thickly so, for its basal inch, the remainder practically naked, pale brown throughout, not lightening terminally.

Skull, as compared to that of *M. cinerea*, showing a tendency to the narrowness of brain-case and interorbital region characteristic of *Metachirus*, towards which this species seems to show some approximation. Nasals expanded behind, but less so than in the allied forms. Supraorbital ridges well developed, but not widely expanded; narrowest part of brain-case behind the tips of their postorbital processes. Temporal ridges approaching to within 2.5 millim. on the top of the brain-case. Teeth light and delicate, the molars particularly small in proportion to the size of the animal.

Dimensions of the type (an old male, measured in skin):—
 Head and body (probably stretched) 229 millim.; tail 226;
 hind foot (wet) 29; ear (wet) 23.

Skull: basal length 43·5; greatest breadth 25·4; nasals, length 21·7, least breadth 3·7, greatest breadth 5·4; inter-orbital breadth 8; tip to tip of postorbital processes 9; inter-temporal breadth 6; palate length from hensenion 23·6; palate breadth 13·8; combined length of *ms.*¹⁻³ 6·8.

Hab. W. Cundinamarca (Bogotá region). Coll. G. D. Child, November 1, 1895.

Type B.M. no. 98. 5. 15. 4.

This handsome species may be readily distinguished from *M. cinerea*, its nearest ally, by its dark yellowish belly, uniformly brown tail, and the narrowness of its nasals and interorbital region.

MISCELLANEOUS.

Malacostraca from Puget Sound, N.W. America.

By ALFRED O. WALKER.

ON the occasion of the visit of the British Association to Toronto in 1897 Prof. W. A. Herdman, F.R.S., made a trip to the Pacific coast, and had two or three days' dredging off Port Townsend in Puget Sound and Victoria, B.C. Among other marine animals taken were 33 species of Malacostraca, of which 7 appear to be new to science and 4 are European species, of which I can find no record from the west coast of North America. These last are all Amphipoda, viz. *Leucothoë spinicarpa* (Abild.), *Melita dentata* (Kröyer), *Ischyrocerus minutus*, Lillj., and *Podocropsis excavata* (Sp. Bate).

Trichocarcinus (*Platyarcinus*) *recurvidens* (Sp. Bate, Ann. & Mag. Nat. Hist. ser. 3, vol. xv. p. 488) is redescribed, and the family Trichoceridæ, De Haan, abolished, the genus *Trichocarcinus* being placed next to *Cancer*, from which it differs in the greater prominence of the regions of the carapace.

The new species, which, like the last, are fully described and figured in the Trans. Liverpool Biological Society, vol. xii. pp. 268-287, pls. xv. and xvi., are as follows:—

Crangon munitellus.

Near *C. munitus*, Dana, but differing in its much smaller size and in the second thoracic carina from the median terminating in a tooth halfway to the orbital margin, while in *C. munitus* it reaches the margin and has no tooth.

Spirontocaris Herdmani.

No postocular spine; dorsal carina beginning rather in front of the middle of the carapace; rostrum horizontal, with subparallel margins reaching a little beyond the end of the peduncle of the inner antennæ; upper margin with five teeth, of which two are on the thorax, lower with one tooth near the point.

Heteromysis odontops.

Differs from the other species of the genus in having a tooth on the ocular peduncles, in the shorter carpus of the first pair of legs and the different jointing of the remaining tarsi, and in the lateral margins of the telson being spinous along their whole length.

Janira occidentalis.

Front of the head 3-lobed; telson with entire lateral margins produced into an acute posterior tooth; the posterior margin wider than the length of each lateral margin.

Paramphithoë pacifica.

Very near *P. assimilis*, G. O. Sars, but differs in having no teeth on the lower margins of the first three coxal plates, in the smooth margin of the first joint of the peræopods, and in the different form of the hind margin of the third pleon segment.

MÆROIDES, gen. nov.

Differs from *Mæra* in having a strong mandibular palp, equal upper and lower antennæ and last two pair of peræopoda; the last pair of uropoda scarcely projects beyond the second pair.

Mæroides Thompsoni.

The second gnathopod has a strong tooth on the propodos at the base of the dactylus, across which it projects.

AOROIDES, gen. nov.

Characters of female as in *Microdeutopus* and *Aora*, except that the mandible has a very slight and almost naked palp and the upper antennæ are entirely destitute of an accessory appendage. Only females were taken.

July 10, 1898.

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XXXII.—*On some new Earthworms in the British Museum.*
By DANIEL ROSA, D.Sc., Assistant in the Royal Zoological
Museum, Turin.

[Plate IX.]

THROUGH the kindness of Prof. Jeffrey Bell I have received for identification a small collection of earthworms from various parts of the world.

In this collection, which belongs to the British Museum, fourteen species are represented, of which seven prove to be new to science. These species I propose to describe in the following pages. Mention will also be made of the already-known species in this collection and of their localities.

Anteus potarensis, sp. n. (Pl. IX. figs. 1-3.)

Hab. Higher Potaro River Districts (British Guiana).
Collected by Rose Lloyd; presented by J. J. Queleh, Esq.

The examination of this worm has convinced me that the conclusions I had arrived at* regarding the general characters of the genus *Anteus* were correct. In my chapter on the

* Mem. R. Accad. Sc. di Torino, ser. ii. t. xlv. 1895, p. 115.

organization of *Anteus* I have urged that, in spite of several statements to the contrary which have been made, we must assume that in *Anteus* the first pair of nephridiopores are always to be sought for on the third segment, and that, therefore, in front of the first pair of nephridiopores we must admit the presence of two segments, which in many cases may be hardly recognizable, as they are short and capable of being introverted, so that the secretion of the first nephridia may flow into the buccal cavity.

I have shown that if we admit this point we find that, with regard to the internal organs, the species of this genus agree very closely, while if we are guided by the actual descriptions we shall be compelled to admit profound discrepancies between the various species.

These views are conclusively supported by the examination of this new species, which shows the leading characters in a remarkably clear way.

This species is of considerable size, measuring 380 millim., with a diameter of 13 millim. (at the level of the clitellum). There are only 170 segments.

The colour (in spirit) is brown all over the præclitellian region; the succeeding part is brown only on the dorsal side, the remaining portion being much lighter coloured.

The first segment, which is only partially introverted, is very short, pale, and of a soft consistence; the second segment, too, is short, but it is already brown-coloured and more consistent; the third segment is quite normal and carries the first pair of nephridiopores. These pores are connected with the mouth by a longitudinal (nephrobuccal) groove, which is well marked on the second somite, while on the first somite, owing to its soft consistence, the groove cannot be further traced.

The prostomium is small and partially retracted.

The ventral setæ are visible from the third segment backwards, the dorsal setæ from the fourth or fifth; they are all paired, the dorsals, however, more closely than the ventrals. This applies to the anterior portion of the body; on the posterior portion the two setæ of the dorsal pairs are wider apart than the ventrals, which retain the primitive distance. The lateral interval (*bc*) is a little wider than the ventral (*aa*).

The copulatory setæ, under the clitellum, have a length of about 2 millim.; they are large, sigmoid, provided with a nodulus, and ornamented only on the extreme half of the distal portion with slight and indistinct arches.

The clitellum ends abruptly on the 27th segment, but its

anterior boundary is not well marked: however, we may assume that the clitellum extends over about eleven segments (17-27); these are not fused together. The longitudinal margins of the clitellum are indicated for a great extent by the tubercula pubertatis; they are otherwise but ill-defined.

The tubercula pubertatis form a continuous red-brown band on segments 21-27 = 7, and lie immediately external to the ventral setæ. This band has at its outer side a narrow white line, which can also be followed for about a segment in front of the tubercula.

The male pores are well visible as simple perforations on the tubercula pubertatis, between segments 21 and 22.

The oviducal openings, which in the majority of the other species of *Anteus* have not been detected, are here represented by two minute pores lying in the interssegmental groove 13-14 on a line with the inner ventral setæ.

Four pairs of spermathecal pores are visible between segments 5-6, 6-7, 7-8, 8-9 in a line with the dorsal setæ.

The nephridiopores lie near the anterior boundary of every segment from the third inclusive; they are, as a rule, in a line with the outer couple of setæ, but it must be noted that on the præclitellian somites they lie a little more dorsally.

There are no dorsal pores.

The septa in front of the gizzard are very thin and incomplete; the first three septa behind it (6-7, 7-8, 8-9) are also very thin, and as they are deeply infundibulated they overlap one another and form a three-fold coating on the gizzard; further on, from septum 9-10 to the end of the generative organs, the septa are, at least in their central part, somewhat thicker.

The pharyngeal bulb is but feebly developed and is followed by the first œsophageal tract, which is thin-walled and bent upon itself. The gizzard has an irregular spheroidal shape and is morphologically confined to somite vi., as I have shown to be the rule in the genus *Anteus*; its diameter reaches 9 millim.

From the sides of the second œsophageal tract arise eight pairs of calciferous glands, occupying segments 7-14 inclusive; they are kidney-shaped bodies, and by means of the peduncle attached to their hilum communicate with the cavity of the œsophagus; through this peduncle they receive from the suprainestinal vessel a lateral branch, which ramifies on their surface. The dorsal lobe of the calciferous glands terminates in an ovate appendix constricted at the base.

The true intestine begins at the 18th segment with a

strongly sacculated region, which extends over eight somites (18-25). I have found no trace of intestinal cæca*.

The dorsal vessel, where it runs above the surface of the gizzard, is very narrow; anteriorly it soon breaks up into small branches; behind the first pair of lateral hearts it begins to increase in diameter, but it becomes markedly ampullated only in somites 13, 14, 15; posteriorly to these it retains its large diameter, but the moniliform appearance becomes gradually inconspicuous.

In each of the somites 7, 8, 9 the dorsal vessel gives off a pair of narrow lateral hearts which join the ventral vessel. Behind these, in somites 10 and 11, there are two pairs of large intestinal hearts which arise from the suprainestinal vessel.

Further back, in each of the somites 16 and 17, we notice the presence of a pair of very large lateral branches which arise, like the lateral hearts, from the dorsal vessel, and soon biturate and break into small branches entering the wall of the intestine. Each pair of these bifurcated vessels is evidently homologous with the two pairs of much smaller branches which arise in each intestinal segment from the dorsal vessel and give rise to the intestinal network.

The two pairs of sperm-sacs occupy segments 11 and 12; they are very large, discoidal, with a continuous outline. Each pair communicates with a pair of large sperm-reservoirs belonging to somites 10 and 11, which are fused together on the median ventral line, while the anterior ones are quite distinct from those of the second pair.

The spermathecae (in segments 6, 7, 8, 9) are also large bodies and end in an ovate pouch not sharply distinct from its duct, which is long, about half the length of the pouch, and has no diverticula.

The first pair of nephridia are not much larger than the following; the anterior nephridia are, as usual, very long and have a longitudinal course, while the posterior ones are more transverse, but I could not determine the somite on which the nephridial cæca commence to appear.

A comparison with the diagnoses given by me in 'Terricoli neotropicali,' pp. 126-128, will show at once that the species above described is well-defined.

* These intestinal cæca are not at all constant in *Anteus*. The contrary would appear from my expression "nel 26 segmento partono due brevi ciechi digitiformi" ('Terricoli neotropicali,' p. 122), where the word *talora* has unfortunately been omitted.

Pontodrilus ephippiger, sp. n. (Pl. IX. figs. 4, 5.)

Hab. Christmas Island (east coast). Coll. by C. W. Andrews, Esq.

The length of our specimens ranges from 43–47 millim., with a diameter of 3 millim.; the number of segments varies from 85 to 100; the colour (in spirit) is an intense yellow.

The prostomium is short, only slightly dovetailed in the peristomium, which is longer than the second segment.

The setæ are distant: behind the clitellum the ventral interval *aa* is twice that between setæ *ab*; the lateral intervals between setæ *ab*, *bc*, *cd* are about equal, though slightly increasing from below upwards; the dorsal middle space *dd* is about three times as wide as *cd*. These distances vary slightly in front of the clitellum; for instance, at the height of the spermathecae the setæ *bc* are slightly wider apart than setæ *ab* or *cd*, so that the setæ are here paired, though, of course, not very close together.

The clitellum extends over segments 13–17=5; it may be termed saddle-shaped, ceasing near the outer ventral seta (*b*): this clitellum is well developed dorsally, where its rings are completely fused together, while on the ventral area the setæ as well as the intersegmental furrows are tolerably visible.

There is a deep transverse fossa on segment 18; the transverse margins of this fossa show a slight inward convexity, but are not specially swollen, whereas the longitudinal margins, which overhang the fossa, are in fact the ventral end of a pair of large glandular swellings which are also visible from the dorsal side, where they gradually disappear near the outermost setæ (*d*). The whole has much the appearance figured by Akira Jizuka for *P. matsushimensis*. The male openings are difficult to see lying in the fovea at the base of the overhanging walls, approximately in a line with the outer ventral seta (*b*).

A deep slit-like sucker, with pale somewhat raised margins, lies ventrally on the intersegmental furrow between segments 19 and 20, reaching laterally the line of the innermost ventral setæ.

The oviducal openings are two minute pores on the anterior part of segment 14, almost in a line (though a little ventrad) with the innermost ventral setæ (*a*).

The spermathecal pores are on small projecting tubercles between segments 7–8 and 8–9, on a line with the outer ventral setæ (*b*).

There are no dorsal pores. The nephridiopores lie at the

level of the outer ventral setae, but I could not determine which segment bears the first of them.

Septa 5-6 to 8-9 inclusive are thin, the following 9-10, 10-11, 11-12, and also, but to a less degree, 12-13, are thickened.

A gizzard is not recognizable, but septum 6-7 is more deeply infundibulate than its neighbours, and we may connect this with the earlier existence of a gizzard in the 6th segment. There are no calciferous glands; the intestine begins behind the 18th segment, perhaps in 16 or 17.

The hearts occupy segments 11, 12, 13, the last being the largest.

The two pairs of large spermathecae belong to segments 8 and 9; each spermatheca consists of a pyriform pouch not distinctly marked off from its duct, and of a narrow tubular diverticule which is longer than the main pouch.

The broad grape-like ovaries are readily seen in segment 13, as well as the testes in segments 10 and 11, all these gonads being attached to the anterior septum on each side of the neurochord. In front of the gonads, that is, on the anterior face of septa 10-11, 11-12, and 13-14, the funnels of both pairs of vasa deferentia and of the oviduct are plainly visible.

The small sperm-sacs in segments 11 and 12 have a botryoidal appearance.

The prostates occupy segments 16, 17, and 18, and recall very nearly those of *P. insularis* (Rosa). Their glandular portion has the appearance of a large sausage-like body, formed by the apposition of the several parts of a slightly-coiled lesser duct. The muscular duct which arises from the front end of the glandular tube is moderately bent, with the convexity inwards, and gradually increases in diameter as it proceeds backwards, reaching at last the external openings on the 18th segment.

I could not see exactly where the vas deferens joins the prostate, but I have little doubt that the connexion between both structures will be found to be the same as that which has been described by Akira Jizuka for *P. matsushimensis*.

Our species seems to be closely allied to *P. insularis* (Rosa), which I first described from specimens obtained in the Aru Islands*, and which has been more recently found also at Ceylon (Michaelsen)†. Still a marked difference between the two species exists, as in the spermathecae of *P. insularis* both

* Ann. d. naturh. Hofmuseum, Wien, Bd. vi. 1895.

† Mitth. aus d. naturhistor. Museum, xiv. (Hamburg, 1897).

Michaelsen and I failed to find any diverticulum. Our specimens were not fully mature, but on the hypothesis of an identity between these two species it seems highly improbable that even in a series of sections no traces could be found of an organ which in the adult reaches so great a development. Moreover, in the descriptions of *P. insularis* no mention is made of a ventral sucker.

Another allied species is undoubtedly *P. matsushimensis*, for a clear description of which we are indebted to Akira Jizuka*. However, this Japanese *Pontodrilus* seems to be really different from our species.

First it is a larger species than ours, as its length ranges from 90 to 110 millim., with a diameter of 3-3.5 millim., while our specimens, with a diameter too of 3 millim., have only a length of 43-47 millim. Besides it may be noted that the clitellum of *P. matsushimensis* is described as being well developed all round the body (and the same is shown by the figures), whilst in our species the clitellum is distinctly saddle-shaped. Finally the appearance of the prostate is (so far as one can judge from the figures) somewhat different.

Perichata brevis, sp. n. (Pl. IX. figs. 6, 7.)

Hab. Christmas Island (east coast). Coll. by C. W. Andrews, Esq.

A very small species measuring only 15-20 millim. in length by a diameter of 2-2.5 millim.; it consists of about 70-80 segments; the colour (in spirit) is a deep yellow.

The setæ on segment 25 are approximately 50.

The clitellum occupies somites 14, 15, 16.

The male pores are on high conical and almost lateral porophores, which are partially visible from behind. The boundaries of these porophores are laterally indistinct; in front and behind they are marked by the intersegmental furrows 17-18 and 18-19, which are here deflected. 14 setæ are visible between the male pores.

The oviducal pore is single and lies in a whitish spot on the 14th segment.

There are three pairs of spermathecal pores between somites 5-6, 6-7, and 7-8, close to the lateral line.

I have not been able to determine the position of the first dorsal pore. There are no copulatory papillæ.

None of the septa are noticeably thick and none are wanting.

The gizzard is between conical and tun-shaped; it is as

* *Annotationes Zoologicae Japonenses*, vol. ii. pars i. (Tokyo, 1898).

long as two somites, but is nevertheless comprised between septa 7-8 and 8-9; this last septum is pushed backwards and comes nearly in contact with septum 9-10.

The last heart lies in segment 13.

The spermathecae lie in segments 6, 7, 8; each consists of a nearly globular sac with a short narrow duct, which is connected at the inner side with a narrow tubular diverticulum; this diverticulum is straight, not enlarged at the end, and extends a little over the middle of the large sac.

The sperm-sacs in segments 11 and 12 are each connected with a minute sperm-reservoir; the sperm-reservoirs of the 10th segment are laterally produced into a large lobe, which looks exactly like another pair of sperm-sacs, but it should be mentioned that the true sperm-sacs lying in segment 10 prove to be connected with the sperm-reservoirs of the 11th, and not with those of the 10th segment.

The prostates extend through six segments; they are very irregular in shape and consist of many lobules, which are only loosely connected; the ejaculatory duct is of moderate length, sigmoid, and does not open into a muscular bulb.

This species somewhat recalls *P. acrophyla*, Rosa*, from Sumatra.

Perichæta recta, sp. n.
(Pl. IX. figs. 8-10.)

Hab. — ?

Of this species I have seen only one specimen, measuring 70 × 5 millim, with 110 somites; its colour (in spirit) is greyish yellow, darker on the clitellum.

The prostomium is broad and very short, extending only over one fourth of the buccal segment.

The setæ number 44 on segment v., 54 on xii., 60 on xxv.

The clitellum occupies three segments and shows no setæ.

The male pores are in a line with seta 9; they are 3 millim. apart and 12 setæ can be counted between them; each lies on a narrow, flat, round area of a brown colour.

The oviducal pore on segment 14 is surrounded by a light circle.

There are two pairs of spermathecal pores between segments 7-8 and 8-9, only 2 millim. apart, and lying in a line with setæ 6-7.

This species has a number of copulatory papillæ, which show the following arrangement: in somite ix. a median papilla lies near the posterior intersegment; three median papillæ are also to be seen respectively on somites xviii., xix.,

* Ann. Mus. Civ. Genova, vol. xvi. 1896.

and xx., near the intersegmental groove; further there is a pair of papillæ on segment xvii. near the posterior groove and nearly in a line (a little dorsal) with the male pore, and two pairs on somite xviii. behind the male pore and making with it a regular triangle; there are thus 10 papillæ, which are all similar and look like small tubercles.

The first dorsal pore is between segments xii.—xiii.

None of the septa are noticeably thickened; septa 8-9 and 9-10 are wanting.

The gizzard is an elongate truncated cone and is placed immediately after septum 7-8; from its hind margin a number of muscular bands are given off which are attached to the body-walls. The two intestinal cæca are slightly lobulated. The last heart lies in somite xiii.

The sperm-sacs, which are tongue-shaped and thick, occupy as usual somites xi. and xii.; each of them is connected with a small sperm-reservoir lying in the front segment at the inner corner of the sperm-sacs.

The prostates extend over five segments and may be described as tolerably compact oval bodies, deeply notched as if a posterior inner quadrant had been excised; in this notch runs obliquely the ejaculatory muscular duct, which is short and fusiform.

There are two pairs of spermathecae in somites viii. and ix.; they end in a heart-shaped sac with a duct half its length, which (at the inner side) is furnished with a diverticulum ending in a short tubular and a longer sausage-like portion. The whole of the diverticulum is twice as long as the main sac with its duct. The aspect of this spermatheca is much the same as that of the spermatheca of *P. musica*, Horst.

Perichaeta pura, sp. n. (Pl. IX. figs. 11-13 b.)

Hab. Lombok, 1500 feet (*A. Everett*).

This species was represented by one fine specimen measuring 250 × 11 millim., with 92 segments; the colour (in spirit) is entirely white.

The setæ are closer together ventrally, and number 51 on somite v., 72 on xiii., 96 on xxv.

The clitellum occupies the three usual segments and bears no setæ.

The male pores, in line with seta 9, are carried on slight swellings without well-marked boundaries; between the two pores 14 setæ are visible.

The oviducal pore lies on the anterior half of the 14th segment and is surrounded by a whitish circle.

Two pairs of spermathecal pores are visible on small papillæ between segments 6-7 and 7-8, in line with setæ 8-9.

The first dorsal pore is between segments 12 and 13.

There are no copulatory papillæ.

Septa 5-6, 6-7, 7-8 are rather thickened; the four septa 10-11 to 13-14 are also somewhat thickened; septa 8-9 and 9-10 are wanting.

A greater number of strong muscular bands start from the pharyngeal bulb intersecting the septa and connecting the bulb with the body-walls, some of them reaching as far back as somite x. Another set of similar bands are given off from the hinder portion of the gizzard and are attached to the parietes of segments xi. and xii.

A dense network of blood-glands covers the anterior side of septa 5-6 and 6-7.

The gizzard is bell-shaped and extends from septum 7-8 for almost the entire length of the three segments viii., ix., and x. The large intestine commences in segment xvi.; in somite xxvi. it gives off one pair of cæca, which are simple sacs extending forward through segments xxv. and xxiv.

The last hearts lie in segments xi., xii., and xiii.

The sperm-sacs are in segments xi. and xii.; each sperm-sac is provided at its free end with a lobulate appendage, which in our specimen had a spongy appearance and was filled withregarines (pseudonaviculæ).

The prostates are comprised between septa 17-18 and 18-19; their length is, however, equal to three segments, so that the septa are much swollen. These prostates consist of two principal and many secondary lobes, which are compressed together, so that the general outline (nearly pentagonal, with rounded corners) is almost continuous. The ejaculatory duct, which is rather short and slightly sigmoid, ends in a round muscular bulb, which is usually hidden by the prostate, as is also the duct itself.

The spermathecae are two pairs in segments 7 and 8; they are much developed and consist of an oval pouch with a duct nearly half its length; their diverticulum consists of a proximal dilated portion, of an intermediary tract, which is narrow and contorted, and of a swollen distal portion. The diverticulum is partially hidden by the nephridial tufts which cover the duct of the spermathecae.

Perichæta Belli, sp. n. (Pl. IX. figs. 14, 15.)

Loc. Mindoro, 5000 feet.

The only specimen I have seen of this species measures 75 × 5 millim.; its segments are 100 in number; the

colouring is zebra-like on the back, there being large brown bands which alternate with the light chaetal bands; these brown bands are widest dorsally, in correspondence with the dorsal gaps, and are laterally evanescent.

The prostomium is short, its dovetailed portion extends over $\frac{2}{3}$ of the first segment.

The setæ are closer together ventrally than dorsally; they number 48 on segment xii., 60 on xxv. There are no setæ on the clitellum, which occupies the three usual segments.

The male pores are in a line with setæ 6-7 and are separated by 8 setæ; these pores are not placed on prominent porophores and appear only as short slits with slightly granulated margins.

The oviducal opening is placed on a small oval tubercle contoured by a slight furrow.

There are four pairs of spermathecal openings between somites 5-6, 6-7, 7-8, 8-9, in a line with seta 8.

The first dorsal pore opens between somites 12 and 13; no copulatory papillæ.

None of the septa are thickened, two (the 8-9 and 9-10) are wanting.

The gizzard is bell-shaped, occupying nearly the whole length between septa 7-8 and 10-11.

Two simple cæca arise from the intestine in segment 26 and are seen to lie transversely on its dorsal surface in segment 25.

The sperm-sacs in segments 11 and 12 are thick, tongue-shaped, and not lobate, save for a very small terminal lobe.

The prostates are not large, between discoid and crescent-shaped, incompletely divided by a transverse groove. The ejaculatory duct arising from their notch is very short and slightly sigmoid, terminating in a spherical bulb.

The main sac of the oval spermathecæ is anteriorly enlarged; its duct is short and thick and gives off from the inner side a tubular diverticulum, ending in a slight dilatation; this diverticulum (which is usually bent at an angle) is, if straightened out, equal in length to the main pouch with its duct.

This species seems to come near to *P. Floweri**, Benh., which, however, differs externally, having a clitellum provided with setæ (on the 16th segment) and not stretching over the whole of segments 14 and 16. *P. Floweri* differs, too, in the number of the setæ, which on the xxvth segment only amount to 45, while in our species they number on the xxvth segment as many as 60. The internal differences consist in the absence (in *P. Floweri*) of a muscular

* Journ. Linn. Soc., Zool. vol. xxvi. p. 217.

duct at the end of the ejaculatory duct, and in the shape of the spermatheca.

Perichæta zonopora, sp. n. (Pl. IX. fig. 16.)

Hab. — ? (with *P. recta*).

Of this species I have been able to examine several specimens measuring 80–90 × 4 millim., with 105–110 segments; the colour (in spirit) is light fleshy grey.

The prostomium is small and dovetailed in the first segment for one third of the length of the latter.

The setæ number 30 on segment v., 44 on xii., and 60 on xxv.; they are closer together ventrally.

The clitellum extends over three entire segments, without visible setæ.

The large male openings are on yellow, radially corrugated areas which extend to the intersegmental furrows; the pores are in a line with seta 7; between the two pores there are six setæ.

The oviducal pore on segment 14 lies in a darker oval areola surrounded by a light ring.

The spermathecal pores (one pair only) lie between segments vii. and viii. at the level of the 9th seta.

The dorsal pores begin between segments 11–12; in all the specimens these pores are conspicuous also upon the girdle, a character which is rarely met with among *Perichæta*. There are no copulatory papillæ.

Septa 5–6, 6–7, and (a little more) septa 10–11, 11–12 are thickened, but not very much; septa 8–9 and 9–10 are absent or rudimentary.

The gizzard is long, tun-like, and comes immediately after septum 7–8; the two intestinal cæca are simple.

The last heart is in segment xiii.

The two pairs of sperm-sacs occupy segments 11 and 12; they are but little developed.

The prostates extend through three segments; they are relatively narrow, with two deep notches on the outer side; the ejaculatory duct is very long, U-shaped, and terminates in a moderate bulb. The inner wall of the body presents at the inner (mediad) side of the bulb a glandular swelling, which is enlarged in front of the bulb and behind it, so that its outline recalls that of a figure of 8.

The only pair of spermatheca, which opens between segments 7–8, does not lie in segment 8 but in segment 7, that is, the spermatheca lie in front of the groove which bears their external openings and not, as usual, behind it. They

consist of an ovate sac, from the anterior larger extremity of which arises a thick duct, the length of which is only a little less than that of the sac; the diverticulum is equal in length to the main pouch with its duct, and consists of a narrow nearly straight tube with a small terminal dilatation.

I am not aware of more than ten species of *Perichæta* with only one pair of spermathecæ opening between segments 7 and 8; of these species only *P. novaræ*, Rosa (= *P. taitensis*, Grube, partim), and *P. sangirensis*, Michaelsen, may suggest an identity with our species.

Unfortunately we know nothing concerning the anatomy of *P. novaræ* *, as I did not like to injure the only specimen that had come into my hands (it was one of the two types of *P. taitensis*, under which name Grube has confounded together two distinct species). Nevertheless I believe that we can discard the idea of an identity between *P. novaræ* and *P. zonopora*, as *P. novaræ* shows no dorsal pores upon the clitellum, while *P. zonopora* [as well as *P. Grubei*, Rosa (*P. taitensis*, Gr., partim)] shows them very clearly.

As to *P. sangirensis* †, it is a larger species, provided with a smaller number of setæ and also with large sperm-sacs and sperm-reservoirs. The ejaculatory duct, too, differs, being described by Michaelsen as short (and therefore probably straight); moreover, no mention is made by Michaelsen of the presence of dorsal pores upon the clitellum.

Perichæta peguana, Rosa ‡.

Hab. Chantaboon (Siam).

This species was described by me eight years ago from specimens collected by Signor L. Fea at Rangoon.

In the specimens from Chantaboon the copulatory papillæ lying on the intersegmental grooves between segments 17-18 and 18-19 show a very convex surface, and are surrounded by a slightly raised ridge, giving them an eye-like appearance.

As regards the internal characters I have been able to satisfy myself that the gizzard belongs to the 8th segment (not to the 9th), and that the missing septa are those between segments 8-9 and 9-10.

Perichæta posthuma, Vaill.

Hab. Christmas Island.

* Ann. k. k. naturh. Hofmuseum, Wien, Bd. vi. p. 396.

† Jahrb. d. Hamburg. wiss. Anstalten, viii. p. 36.

‡ Ann. Mus. Civ. Genova, ser. 2, vol. x. (1890) p. 113.

Megascolex armatus (Bedd.).*Hab.* Christmas Island.*Microscolex dubius* (Fletch.).*Hab.* Colon, near Montevideo. Coll. by Mr. Oldfield Thomas.*Allolobophora caliginosa* (Sav.).*Hab.* Colon, near Montevideo. Coll. by Mr. Oldfield Thomas.*Allolobophora cyanea* (Sav.), subsp. *profuga*, Rosa.*Hab.* Colon, near Montevideo. Coll. by Mr. Oldfield Thomas.*Allolobophora putris*?, Hoffm.*Hab.* Behring Island.

EXPLANATION OF PLATE IX.

Anteus potarensis, sp. n.*Fig.* 1 *a.* A copulatory seta (ventral seta of the clitellum), enlarged.*Fig.* 1 *b.* A normal seta (dorsal seta of the clitellum), enlarged.*Fig.* 2. A calciferous gland (in somite xiv.).*Fig.* 3. A spermatheca.*Pontodrilus ephippiger*, sp. n.*Fig.* 4. Prostate.*Fig.* 5. Spermatheca.*Perichæta brevis*, sp. n.*Fig.* 6. Sperm-sacs (*cs.*), sperm-reservoir (*cs.*), and diverticulum (*cs. dir.*).*Fig.* 7. Spermatheca.*Perichæta recta*, sp. n.*Fig.* 8. Copulatory papillæ behind the clitellum.*Fig.* 9. Prostate.*Fig.* 10. Spermatheca.*Perichæta pura*, sp. n.*Fig.* 11 *a.* Sperm-sacs in somite xii. (outer side).*Fig.* 11 *b.* One sperm-sac in somite xii. (inner side).*Fig.* 12. Prostate.*Fig.* 13 *a.* Right spermatheca (dorsal view).*Fig.* 13 *b.* Ditto (ventral view).*Perichæta Belli*, sp. n.*Fig.* 14. Prostate.*Fig.* 15. Spermatheca.*Perichæta zonopora*, sp. n.*Fig.* 16. Prostate.

XXXIII.—*Felis chaus* and its Allies, with Descriptions of new Subspecies. By W. E. DE WINTON.

THE British Museum has lately received a fine series of the short-tailed Cats of the *Chaus* group from Egypt, collected and presented by Mr. R. J. Cunninghame. While comparing these with the typical *Chaus* from West-Central Asia, Mr. Oldfield Thomas drew my attention to a specimen from Palestine which has been in the Museum for some thirty years, and kindly suggested that I should overhaul the whole of this group.

The result of my investigation is given below, and to make the paper as concise as possible I limit it to a list of the several forms, with a table of measurements of the teeth and skulls. One form—*Felis chaus pallida* (Büchn. Bull. Ac. St. Pétersb. 1892, iii. p. 341), from the province of Gensan in China—I have not seen, but it is said to belong to this group.

Felis chaus typica.

Felis chaus, Gùldenst. Nov. Comm. Ac. Petrop. xx. 1776, p. 483.

Felis catolynx, Pall. Zoog. Ross.-As. i. p. 23 (1811).

The type of Gùldenstädt's species came from the shores of the Caspian Sea. The True *Chaus* is found in the Caucasus, Persia, and Turkestan. Pallas simply renamed the same animal, as it was not quite clear that Gùldenstädt had given the name in the orthodox manner, but only generically, as distinguished from *Felis* and *Lynchus*; however, the name was used specifically by other writers in the meantime, so that it must in any case be the proper name for the animal, and I follow all recent writers in giving the credit to Gùldenstädt.

Felis chaus affinis.

Felis affinis, Gray, Ill. Ind. Zool. i. pl. iii. (1830).

Felis kutas, Pearson, J. A. S. B. i. 1832, p. 75.

Felis (Lynchus) erythrotis, Hodgson, J. A. S. B. 1836, p. 233.

Felis Jacquemontii, Geoffroy, Jacquemont's Voy. p. 58 (1844).

The Indian *Chaus* or Jungle-Cat is readily distinguished from the True *Chaus* by its rather longer tail, bright fox-red ears, and lighter build. The skull is narrower and the teeth are not nearly so heavy and not so crowded together. The British Museum contains a number of specimens from Nepal, the Punjab, Rajpootana, and the Central Provinces. Gray's type came from Gangootra.

Felis chaus nilotica, subsp. n.

Felis Rüppellii, Brandt. Bull. Soc. Nat. Moscou, 1832, tom. iv. p. 209
(nec Schinz).

Brandt, recognizing the distinctness of the Egyptian Chaus, named it after the great collector who had obtained the first specimens; but unfortunately this name had already been applied by Schinz to another cat (*F. maniculata*), also found in Egypt.

As I believe this animal to differ essentially from the typical form found in Western Asia, it is necessary to provide it with a distinguishing name, and I take as the type of the subspecies an adult male, no. 98. 6. 5. 1 in the British Museum, collected by Mr. R. J. Cunninghame near Cairo, 22nd January, 1898.

The collector's measurements, taken from the fresh-killed specimen, are:—

Head and body 720 millim.; tail 270; hind foot 170; ear 64. Weight 11 lbs. 2 oz.

The measurements of another large male are given as:—

Head and body 760 millim.; tail 280; hind foot 174; ear 72. Weight 14 lbs. 3 oz.

Of a female: Head and body 620 millim.; tail 210; hind foot 145; ear 63. Weight 8 lbs. 7 oz.

The Egyptian Chaus closely resembles the True Chaus in form and colour; it is, however, rather larger, and the ears are darker and more grizzled, so do not show out against the colour of the head, as do the more foxy-red ears of both the True Chaus and the Indian species. The front of the chest is also more grizzled and darker.

In comparing the skulls of *F. chaus nilotica* with those of *F. chaus typica*, besides the greater size of the teeth, which is at once very obvious, there are several characters which seem to be quite constant. Looking at the skulls in true profile, the highest point of the cranium in *F. chaus typica* is equidistant between the nose and the occiput—that is, just behind the supraorbital processes, while in *F. ch. nilotica* the highest point is just *in front of* a line drawn between the points of the supraorbital processes, and so noticeably nearer to the point of the nasals than to the occiput. The intermaxillary processes in the typical form are rather more evenly tapered, while in the Egyptian form they are practically straight on the inner edge and convex or much bowed on the outer margin. In the latter form also the nasal bones are longer, reaching well beyond the back of the maxillary processes, and the palate is rather broader in the Egyptian animal.

Felis chaus furax, subsp. n.

In general colour and proportions very closely resembling the Egyptian *Chaus*, though probably rather smaller. The hind foot of the single specimen measures 145 millim., which is about equal to the hind foot of a female from Egypt.

The enormous size of the teeth distinguish this cat from any of its allies, and I cannot believe that this peculiarity is individual. The size of the canines, which are 20 millim. long and 8 broad at the alveolus, points to the specimen being a male; but the top of the skull, with a broad shield-pattern and small sagittal crest, more resembles that of a female.

The type (♂, no. 64. S. 17. 4 in the British Museum) was obtained by Canon Tristram near Jericho in Palestine, 12th January, 1864.

In proportion to its size this cat has the largest teeth of any living member of the family Felidæ.

| | Pm. 2. | Pm. 3. | Across palate outside pms. 3. | Length of skull. | Width of skull. |
|--|---------|----------------|----------------------------------|------------------|-----------------|
| <i>Felis chaus typica</i> , ♂ | mm. 9.3 | mm. 14.5 × 8.5 | mm. 45.6 | mm. 119 | mm. 78.5 |
| " " " ♂ | 9.5 | 14.5 × 7.5 | 48 | .. | 76.2 |
| <i>Felis chaus affinis</i> , ♂ | 8.5 | 13 × 7 | 41.5 | 122 | 75.5 |
| <i>Felis chaus nilotica</i> , ♂ (type) | 9.5 | 15.5 × 8 | 51 | 132 | 84.5 |
| " " " ♂ | 10.2 | 15.5 × 8.7 | 50 | 120.5 | 78 |
| " " " ♀ | 9 | 14 × 7.5 | 45 | 108 | 70 |
| " " " ♀ | 9.5 | 14.1 × 7.9 | 47 | 115 | 74.5 |
| <i>Felis chaus furax</i> , ♂ (type) .. | 10.5 | 17.6 × 9.6 | 49.5 | 110 | 71.6 |

Simple figures do not convey much idea as to the size of teeth; but the importance of the above figures may be understood when it is realized that there is as little difference between the teeth of the Palestine *Chaus* and those of a female Leopard as there is between those of the European Wild Cat and the Indian *Chaus*—in fact, the flesh-teeth are actually larger than those of the Ocelot, and had the separate teeth been found fossil they would have been put down to an animal of the size of a Leopard. Therefore in this

group of Cats we have all the intermediate steps in size between the teeth of *Felis catus* and *Felis pardus*, though the animals themselves do not vary greatly in size and are not much larger than the former; they form a very distinct group, the skulls not being easily confused with those of any other Cat.

XXXIV.—*Rhynchota* from the Transvaal, Mashonaland, and British Nyasaland. By W. L. DISTANT.

PART I.

THIS paper refers to the Heteropterous family Pentatomidæ, and is based on my own and other collections acquired in the Transvaal; one made near Salisbury, Mashonaland, by Mr. Guy A. K. Marshall; and another received from Dr. Percy Rendall, when that excellent collector sojourned in Nyasaland. These three collections are enumerated separately.

Since I last wrote a faunistic paper on the Rhynchota some parts have appeared of the 'Catalogue Général des Hémiptères' by Lethierry and Severin, and as this publication in its arrangement generally reflects the present views of most hemipterists, and will probably be accepted as a convenient standard of classification and nomenclature, it is followed here. It is largely based on the excellent work achieved by the late Dr. C. Stål, whose 'Enumeratio Hemipterorum' has long held the ground, and is even now not altogether superseded, but rather brought up to date by the thorough work of the above catalogue so far as it has yet been published. After all, there is no finality in classification. As it has been well observed—"He that has fewest faults is the best man; and so it is with scientific systems."

In this first family, Pentatomidæ, the following species are enumerated for the three localities:—

| | Species. | Sp. nov. | Gen. nov. |
|-------------------------|----------|----------|-----------|
| Transvaal..... | 120 | 16 | 2 |
| Mashonaland | 36 | 5 | 1 |
| British Nyasaland | 45 | 8 | 2 |

Some interesting facts in geographical distribution become apparent. Thus *Nezara pallido-conspersa*, Stål, a species hitherto recorded from Madagascar, I took myself at Pretoria; the West-African species *Bithyælia buonopoziensis*, Pal.

Beauv., and *Piezosternum calidum*, Fabr., are found across the continent at Fort Johnston and Zomba; whilst *Audinetia spinidens*, Fabr., a species common to both the Neotropical and Oriental Regions, and recorded from Abyssinia, has now been found in British Nyasaland.

Heteroptera from the Transvaal.*

Fam. Pentatomidæ.

Subfam. PLATASPINÆ.

Plataspis semiglobosa, Stål. Pretoria (*W. L. D.* and *Pret. Mus.*).
Brachyplatys pallipes, Fabr. Barberton (*Dr. P. Rendall*).

Subfam. SCUTELLERINÆ.

Solenosthedium liligerum, Thunb. Rustenburg (*W. L. D.*), Lydenburg District (*Pret. Mus.*).
Steganocerus multipunctatus, Thunb. Pretoria (*W. L. D.*), Barberton (*Dr. P. Rendall*).
Sphærocoris ocellatus, Klug. Lydenburg District (*Pret. Mus.*).
 — *testudo-grisea*, de Geer. Pretoria (*W. L. D.*), Barberton (*Dr. P. Rendall*).
Cryptacrus pinguis, Germ. Pretoria District (*Pret. Mus.*).
Graptocoris aulicus, Germ. Pretoria District (*Pret. Mus.*).
Callidea Dregei, Germ. Lydenburg District (*Pret. Mus.*).
 — *duodecimpunctata*, Fabr. (*W. L. D.*), Rustenburg (*W. L. D.*).
 — *natalensis*, Stål. Pretoria (*W. L. D.*).
Hotea subfasciata, Westw. Barberton (*Dr. P. Rendall*).
Deroplax circumducta, Germ. Lydenburg District (*Pret. Mus.*).
 — *obscura*, Dall. Lydenburg District (*Coll. Dist.*).
Alphocoris indutus, Stål. Waterberg (*Wilde*).

Subfam. GRAPHOSOMIDÆ.

Phymatocoris strumosus, Stål. Warm Baths, Waterberg (*W. L. D.*).

Subfam. CYDNINÆ.

Cydnus, sp. Pretoria (*W. L. D.*).
 —, sp. Lydenburg District (*Pret. Mus.*).
Macroscythus acutus, Sign. Pretoria (*W. L. D.*).
Cydnus indicus, Westw. Pretoria (*W. L. D.*).

Subfam. PENTATOMINÆ.

Cananomorpha nervosa, Dall. Pretoria (*W. L. D.*), Barberton (*Dr. P. Rendall*).
Scribonia lydenburgi, sp. n. Lydenburg District (*Pret. Mus.*).

* All the new species will be figured in my forthcoming 'Insecta Transvaaliensia.'

- Atelocera stictica*, Westw. Pretoria (*W. L. D.*), Barberton (*Dr. P. Rendall*), Lydenburg District (*Pret. Mus.*).
- *limata*, Germ. Barberton (*Dr. P. Rendall*), Lydenburg District (*Pret. Mus.*).
- *natalensis*, Stål. Pretoria District (*Pret. Mus.*).
- Peltasticus punctatus*, Dall. Pretoria (*W. L. D.*).
- Orthoschizops reticulata*, Thunb. Pretoria District (*Pret. Mus.*).
- Phricodus hystrix*, Germ. Lydenburg District (*Pret. Mus.*).
- Pododus tenebrosus*, Germ. Pretoria District (*Coll. Dist.*).
- *mundus*, Germ. Barberton (*Dr. P. Rendall*).
- Pretorius tibialis*, gen. et sp. n. Pretoria (*W. L. D.*).
- Dymantus relata*, sp. n. Lydenburg District (*Pret. Mus.*).
- Parameocoris vittiventris*, Stål. Lydenburg District (*Pret. Mus.*).
- *ventralis*, Germ. Pretoria (*W. L. D.*).
- *atomarius*, Dall. Pretoria (*W. L. D.*).
- Ennius monteironis*, Dist. Lydenburg District (*Pret. Mus.*).
- Eractheus lutulentus*, Stål. Barberton (*Dr. P. Rendall*).
- Tropicorypha corticina*, Germ. Pretoria (*W. L. D.*), Barberton (*Dr. P. Rendall*).
- *placida*, Walk. Pretoria (*W. L. D.*), Zoutpansberg (*Kæssner*).
- Holc-stellus heterocera*, Walk. Pretoria (*W. L. D.*), Barberton (*Dr. P. Rendall*), Lydenburg District (*Pret. Mus.*).
- Halyomorpha viridescens*, Walk. Lydenburg District (*Pret. Mus.*).
- *capitata*, Dist. Pretoria, Zoutpansberg (*W. L. D.*).
- *pretoriae*, Dist. Pretoria (*W. L. D.*), Barberton (*Dr. P. Rendall*).
- Veterna sanguineirostris*, Thunb. Pretoria (*W. L. D.*), Johannesburg (*Ross*), Lydenburg District (*Pret. Mus.*).
- *patula*, Dist. Pretoria (*W. L. D.*), Lydenburg District (*Pret. Mus.*).
- *pugionata*, Stål. Pretoria (*W. L. D.*).
- *subreta*, Stål. Pretoria (*W. L. D.*), Lydenburg District (*Pret. Mus.*).
- Caura rufiventris*, Germ. Pretoria (*W. L. D.*), Barberton (*Dr. P. Rendall*).
- Panda signitenens*, gen. et sp. n. Pretoria (*W. L. D.*).
- Diploays fallax*, Stål. Pretoria (*W. L. D.*), Lydenburg District (*Pret. Mus.*).
- *hastata*, Fabr. Pretoria (*W. L. D.*), Warm Baths, Waterberg (*W. L. D.*), Zoutpansberg (*Kæssner*), Lydenburg District (*Pret. Mus.*).
- *cornuta*, sp. n. Pretoria (*W. L. D.*), Zoutpansberg (*Kæssner*).
- Steleocoris comma*, Thunb. Lydenburg District (*Pret. Mus.*).
- Acoloba luncolata*, Fabr. Pretoria (*W. L. D.*), Zoutpansberg (*Kæssner*).
- Æliomorpha bella*, Stål. Pretoria (*W. L. D.*).
- *nataicola*, Stål. Pretoria (*W. L. D.*).
- *scutellata*, sp. n. Pretoria (*W. L. D.*), Zoutpansberg (*Kæssner*).
- Æschrus inaequalis*, Spin. Pretoria District (*Pret. Mus.*).
- Eysarcoris inconspicuus*, H.-S. Pretoria (*W. L. D.*).
- Aspavia albidomaculata*, Stål. Pretoria District (*Pret. Mus.*), Barberton (*Dr. P. Rendall*).
- Carbula hampsonis*, Stål. Pretoria (*W. L. D.*), Warm Baths, Waterberg (*W. L. D.*).
- *trisinata*, Germ. Pretoria (*W. L. D.*), Barberton (*Dr. P. Rendall*).
- Durnia albido-fuscata*, Stål. Pretoria District (*Pret. Mus.*).
- *conjungens*, Germ. Pretoria (*W. L. D.*), Lydenburg District (*Pret. Mus.*).
- *Mulsanti*, Stål. Lydenburg District (*Pret. Mus.*).
- *lutulenta*, Stål. Pretoria (*W. L. D.*), Zoutpansberg (*Kæssner*), Lydenburg District (*Pret. Mus.*).

- Durmia tomentiventris*, Germ. Barberton (Dr. P. Rendall), Zoutpansberg (Kessner), Lydenburg District (Pret. Mus.).
 — *horizontalis*, sp. n. Pretoria (W. L. D.).
Ilipla crenosula, Stål. Lydenburg District (Pret. Mus.).
Agonoscelis puberula, Stål. Pretoria (W. L. D.).
 — *erosa*, Westw. Pretoria (W. L. D.), Warm Baths, Waterberg (W. L. D.).
 — *versicolor*, Fabr. Pretoria (W. L. D.).
Afrania Wahlbergi, Stål. Pretoria District (Pret. Mus.).
Bagrada hilaris, Burm. Pretoria (W. L. D.).
Dismegistus sanguinus, de Geer. Johannesburg (Ross), Lydenburg District (Pret. Mus.).
 — *fimbriatus*, Thunb. Pretoria (W. L. D.), Waterberg (W. L. D.).
Nezara viridula, Linn. Pretoria (W. L. D.), Barberton (Dr. P. Rendall), Lydenburg District (Pret. Mus.).
 — *pallido-conspersa*, Stål. Pretoria (W. L. D.).
 — *capicola*, Westw. Pretoria District (Pret. Mus.).
Flemingia natalensis, Dall. Pretoria District (Pret. Mus.), Rustenburg (Coll. Dist.).
Platacantha lutea, Westw. Pretoria District (Pret. Mus.), Zoutpansberg (Kessner).
Antestia variegata, Thunb. Pretoria (W. L. D.).
 — *transvaalica*, Dist. Pretoria (W. L. D.).
Menida annulifera, Walk. Barberton (Dr. P. Rendall).
 — *amœna*, Stål. Barberton (Dr. P. Rendall).
 — *decoratula*, Stål. Pretoria (W. L. D.), Warm Baths, Waterberg (W. L. D.).
 — *pæcila*, Dall. Pretoria (W. L. D.).
Piezodorus purus, Stål. Pretoria (W. L. D.).
 — *palescens*, Germ. Pretoria (W. L. D.).

Scribonia lydenburgi, sp. n.

Strongly pilose. Head piceous, anterior margin narrowly purplish red; basal area with a central narrow, longitudinal, ochraceous fascia, which is continued through the pronotum and scutellum. Pronotum piceous, coarsely punctate and ochraceously rugulose on disk, with the centre of anterior margin ochraceous, the lateral margins purplish red. Scutellum ochraceous, very darkly and coarsely punctate, a levigate black spot in each basal angle, a similar spot on each lateral margin near middle, and a smaller and more obscure spot at centre of basal margin. Corium very thickly covered with black punctures, its basal lateral margin purplish red, and with an obscure levigate discal spot a little beyond middle. Membrane greyish, veins piceous. Connexivum piceous, obscurely marked with purplish red. Body beneath piceous, greyishly pilose; coxæ, trochanters, femora (excluding apices), anterior and intermediate tibiæ (excluding apices), central area of posterior tibiæ, and basal disk of abdomen dull reddish.

Antennæ with the second and third joints very strongly pilose; lateral angles of the pronotum subprominent.

Long. 12 millim.

Hab. Transvaal, Lydenburg District (*Pret. Mus.*).

Allied to *S. pilosa*, Stål, but differing by the smaller size, different colour of the legs, spots to scutellum, &c.

PRETORIUS, gen. nov.

Body ovate. Head ovate; lateral lobes a little longer than the central, their margins acutely reflexed. Rostrum about reaching the posterior coxæ. Ocelli much nearer to the eyes than to each other. Antennæ with the basal joint short, not nearly reaching apex of head, second longer than the third. Pronotum with the lateral margins somewhat laminate and moderately reflexed. Scutellum triangular, moderately sinuate before apical area, its apex just passing inner angle of corium. Membrane short, not reaching apex of abdomen, veins simple. Mesosternum sulcated. Legs moderate in length, femora minutely spined, tibiæ sulcated; anterior tibiæ distinctly dilated and profoundly sulcated.

This genus is allied to *Dymantis*, from which it is at once separated by the dilated anterior tibiæ &c.

Pretorius tibialis, sp. n.

Ochraceous, thickly and coarsely piceous. Head and antennæ piceous, central lobe more or less ochraceous. Pronotum with the lateral areas piceous, the extreme lateral margins ochraceous, and with five obsolete ochraceous lines—one central and two oblique on each side. Scutellum with an obsolete central ochraceous line. Corium with the basal lateral margin and some linate levigate lines ochraceous. Membrane brownish ochraceous, the veins darker. Connexivum, body beneath, rostrum, and legs piceous; intermediate and posterior tibiæ (excluding apex and extreme base) pale luteous.

Long. 11 millim.

Hab. Transvaal, Pretoria (*Distant*).

Dymantis relata, sp. n.

Brownish ochraceous, coarsely punctate; a central longitudinal levigate pale luteous fascia crossing pronotum and scutellum—narrow and obsolete on the former, broad and distinct on the latter; apical margins of the scutellum and the membrane piceous. Body beneath and legs ochraceous; sternum and legs punctured and freckled with brownish; abdomen with a central black spot on sixth abdominal segment, a discal

fascia of brown punctures on each side, spiracles piceous, extreme lateral margins brownish.

Antennæ reddish ochraceous, fifth joint, and fourth joint excluding base, piceous.

Long. 10 millim.

Hab. Transvaal, Lydenburg District (*Pretoria Mus.* and *Coll. Dist.*).

Allied to *D. subcittata*, Stål, but smaller, more ovate, pronotum not constricted, &c.

Tropicorypha placida, Walk.

Pentatoma placida, Walk. *Cat. Het.* ii. p. 297. n. 93 (1867).

Pentatoma immunitis, id. *ibid.* iii. p. 560 (1868).

Ochraceous; lateral margins of head near eyes and the eyes black, ocelli red; antennæ very pale ochraceous, fourth and fifth joints and the apex of the third reddish ochraceous. Pronotum with two small central discal dark spots. A sub-obsolete pale fascia traversing pronotum and scutellum. Body beneath, rostrum, and legs stramineous; apex of rostrum and sometimes a central spot on posterior margin of fifth abdominal segment piceous; apices of tibiæ and the tarsi reddish ochraceous.

Antennæ with the fourth joint longest, third and fifth subequal in length.

Long. 15 millim.

Hab. Transvaal, Pretoria (*Distant*); Zoutpansberg (*Kassner*).

A somewhat variable species above, but always to be determined by the colour of the antennæ, the two discal spots on pronotum, and, in the Transvaal specimens now before me, by the fascia to pronotum and scutellum.

PANDA, gen. nov.

Body ovate above, convex beneath. Head broad, long, laterally sinuate, rounded in front, lateral lobes longer than the central. Antennæ short, basal joint not nearly reaching the apex of the head, second a little longer than the third, fourth and fifth moderately incrassated. Pronotum with the anterior angles acute, the lateral margins crenulated, the lateral angles prominent.

Other characters generally as in *Horda*, Stål, to which this genus is allied.

Panda signitenens, sp. n.

Ochraceous; head and anterior area of pronotum darker; two transverse levigate pale ochraceous spots on disk of pronotum. Head transversely rugulose and punctate; antennæ stramineous, fourth and fifth joints roseate. Pronotum levigately rugose, coarsely punctate, lateral angles robust, spinous, directed forward, sometimes roseate at apices; a central pale levigate line not reaching anterior margin. Scutellum coarsely punctate; corium more finely punctate; membrane pale. Body beneath, legs, and rostrum stramineous; anterior and lateral margins of sternum and abdominal spiracles piceous.

Long. 9-10 millim.; exp. pronot. angl. $5\frac{1}{2}$ -6 millim.

Hab. Transvaal, Pretoria (*Distant*).

I also possess a specimen collected by Mr. Mansel Weale in Cape Colony.

Diploxya cornuta, sp. n.

Head with the lateral lobes meeting in front, their apices non-exserted, ochraceous; lateral margins black, central lobe and its margins thickly punctured with black. Pronotum ochraceous, with the whole basal area paler, somewhat greyish, and coarsely punctate, its anterior area with two central patches of black punctures, and the anterior sublateral margins also blackly punctate; lateral angles black, robustly and acutely spinous, the spines directed forward. Scutellum ochraceous, blackly punctate at base and basal lateral margins; a long levigate ochraceous spot in each basal angle; the whole apical area very coarsely punctate, with a central raised levigate line. Corium pale purplish, finely and darkly punctate, the lateral margin ochraceous. Membrane silvery grey. Connexivum ochraceous, the apical angles piceous. Body beneath and legs ochraceous, a fascia of black punctures extending from pronotal spines to near apex of abdomen; sternum fasciately punctured with black. Antennæ ochraceous, fifth joint, and fourth joint excluding base, piceous. Apex of rostrum piceous.

Long. 10 millim.

Hab. Transvaal, Pretoria (*Distant*); Zoutpansberg (*Kaessner*).

Æliomorpha scutellata, sp. n.

Ochraceous, thickly and coarsely punctate; head with the lateral margins and the marginal areas of the central lobe piceous; antennæ ochraceous. Pronotum with a central pale

levigate line, and with three—sometimes subobsolete—oblique fasciæ on each side; two transverse marks on anterior area and the lateral margins paler ochraceous. Scutellum with a central double lineate fascia, a short oblique stripe on each side of base, and the extreme basal angles piceous; near basal angles is also a small pale ochraceous levigate spot. Corium more or less piceous at its inner angle. Membrane greyish brown. Connexivum ochraceous, spotted with piceous. Body beneath, rostrum, and legs ochraceous; apex of rostrum, lateral margins of sternum, a few sternal spots, and a central fascia to abdomen piceous.

Long. 6 millim.

Hab. Transvaal, Pretoria (*Distant*); Zoutpansberg (*Kessner*).

This species is of a variable nature; in one specimen the transverse marks on the anterior area of the pronotum are piceous, not ochraceous. The markings to the scutellum appear to be always constant.

Allied to *Æ. natalicola*, Stål.

Durmia horizontalis, sp. n.

Head ochraceous, thickly and darkly punctate; antennæ reddish ochraceous. Pronotum ochraceous; basal area purplish, coarsely punctate; lateral margins moderately crenulate; lateral angles black, robustly spinous, strongly and straightly produced outward. Scutellum pale ochraceous and levigate, a cluster of piceous punctures on basal area and at each lateral margin, the apex concolorously punctate. Corium purplish, finely punctate, base of lateral margin ochraceous. Membrane greyish. Connexivum ochraceous. Body beneath ochraceous; legs reddish ochraceous. A few scattered black spots on sternum and abdomen, the spiracles and a broken lateral fascia to abdomen also black. Rostrum reaching the posterior coxæ, its apex black.

Long. 7–9 millim.

Hab. Transvaal, Pretoria (*Distant*).

Subfam. ASOPINÆ.

Dorycoris pavoninus, Westw. Pretoria District (*Pret. Mus.*).

Macrorhaphis biprosæ, Germ. Pretoria (*W. L. D.*), Lydenburg District (*Pret. Mus.*).

— *spurcata*, Walk. Lydenburg District (*Pret. Mus.*).

Afrius figuratus, Germ. Pretoria (*W. L. D.*), Barberton (*Dr. P. Rendall*), Waterberg (*Wilde*), Lydenburg District (*Pret. Mus.*).

Glypsus moestus, Germ. Pretoria (*W. L. D.*), Johannesburg (*Ross*).

— *conspicuus*, Westw. Pretoria (*W. L. D.*).

Subfam. *TESSARATOMINÆ*.

Natalicola pallida, Westw. Pretoria (*W. L. D.*), Barberton (*Dr. P. Rendall*), Zoutpansberg (*Kæssner*).

Subfam. *DINIDORINÆ*.

- Asponiopis jayatus*, Dist. Pretoria (*W. L. D.*), Lydenburg District (*Pret. Mus.*).
 — *nubilus*, Westw. Pretoria (*W. L. D.*), Johannesburg (*Ross*), Barberton (*Dr. P. Rendall*), Lydenburg District (*Pret. Mus.*).
 — *mysticus*, Stål. Pretoria District (*Pret. Mus.*).
 — *lividus*, Dist. Barberton (*Dr. P. Rendall*).

Subfam. *PHYLLOCEPHALINÆ*.

- Dalsira foreata*, Dall. Klerk-dorp (*Coll. Dist.*), Lydenburg District (*Pret. Mus.*).
 — *affinis*, A. & S. Lydenburg District (*Pret. Mus.*).
 — *lentiginosa*, Stål. Lydenburg District (*Pret. Mus.*).
 — *alata*, sp. n. Lydenburg District (*Pret. Mus.*).
 — *crassa*, sp. n. Pretoria District (*Pret. Mus.*), Barberton (*Dr. P. Rendall*).
 — *maura*, sp. n. Lydenburg District (*Pret. Mus.*).
Basicyrptus antennatus, Dist. Pretoria District (*Pret. Mus.*).
 — *elongatus*, Dist. Rustenburg (*Coll. Dist.*).
 — *gibbosus*, Dall. Pretoria (*W. L. D.*).
 — *costalis*, Germ. Barberton (*Dr. P. Rendall*).
 — *projectus*, sp. n. Barberton (*Dr. P. Rendall*).
Gonopsis mantis, Stål. Rustenburg (*Coll. Dist.*).
 — *natalensis*, Stål. Lydenburg District (*Pret. Mus.*).
 — *lydenburgi*, sp. n. Lydenburg District (*Pret. Mus.*).
Dicloborkinus rustenburgi, sp. n. Rustenburg (*Coll. Dist.*), Lydenburg (*Pret. Mus.*).
Phyllocephala Gunningi, sp. n. Lydenburg District (*Pret. Mus.*).
 — *serrata*, sp. n. Lydenburg District (*Pret. Mus.*).
 — *testacea*, sp. n. Lydenburg District (*Pret. Mus.*).
Gellia angulicalis, Stål. Pretoria (*W. L. D.*), Lydenburg District (*Pret. Mus.*).
 — *albivittis*, Germ. Lydenburg District (*Pret. Mus.*).

Dalsira alata, sp. n.

Brownish ochraceous, somewhat thickly and darkly punctate. Antenna with the apical joint piceous. Pronotum with two discal, transverse, somewhat piceous calli near anterior margin, the basal area also subpiceous; lateral margins obscurely crenulate, posterior angles obliquely truncate. Scutellum with an elongate, levigate, piceous spot in each basal angle. Corium with a large discal piceous spot which reaches the interior apical margin. Membrane greyish, the veins spotted with piceous. Connexivum ochraceous, thickly covered with piceous punctures. Body beneath piceous,

mottled with ochraceous, margins of sternum and legs piceous; intermediate and posterior tibiæ and the rostrum brownish ochraceous. Spiracles pale luteous.

Long. 12 millim.

Hab. Transvaal, Lydenburg District (*Pret. Mus.*).

Dalsira crassa, sp. n.

Robust; brownish ochraceous, corium somewhat paler in hue. Head rugulose; antennæ brownish ochraceous. Pronotum rugose, with a central carina about middle, from which it is obliquely deflected to head, the lateral angles broadly rounded and subprominent, the anterior lateral margins crenulated, with a short distinct spine at anterior angles. Scutellum rugose, excepting the apical area, which is coarsely punctate. Corium thickly, finely, and darkly punctate, base of lateral margins ochraceous. Membrane greyish brown, speckled with piceous. Body beneath castaneous, slightly irrorated with ochraceous; legs greyish brown, sometimes castaneous.

Long. 18 millim.; exp. pronot. angl. 11 millim.

Hab. Transvaal, Barberton (*Dr. P. Rendall*), Pretoria District (*Pret. Mus.*).

Apparently allied to *D. porosa*, Stål, but differing by having the second and third joints of the antennæ subequal in length, rugose surface of the pronotum and scutellum, &c.

Dalsira maura, sp. n.

Head, pronotum, and scutellum piceous, the first coarsely punctate, the second and third rugose. Corium obscure ochraceous, coarsely punctured with piceous, and with the inner apical area piceous. Membrane greyish, spotted with piceous. Coxæ brownish ochraceous, inwardly darkly punctate. Body beneath pale piceous, margins of the abdomen more or less mottled with ochraceous; legs piceous, the tibiæ (and sometimes the posterior femora) spotted with pale luteous.

Long. 15 millim.

Hab. Transvaal, Lydenburg District (*Pret. Mus.*).

Basicryptus projectus, sp. n.

Pale ochraceous, with a few small scattered black spots, and with a much larger black spot in each basal angle of the scutellum. Antennæ, body beneath, and legs darker ochraceous; sternum and abdomen somewhat thickly speckled with

small black spots, and some similar spots on coxæ and trochanters. Pronotum with the lateral angles prominent and obtusely angulated, the anterior lateral margins finely dentate. Lateral margins of the corium crenulated.

Long. 18 millim.; exp. pronot. angl. 12 millim.

Hab. Transvaal (*Dr. P. Rendall*).

Allied to *B. gibbus*, Dall, from which it differs by the subacutely produced (not rounded) lateral angles of the pronotum.

Gonopsis lydenburgi, sp. n.

Brownish ochraceous; basal area of pronotum, the scutellum, and corium brownish; antennæ, basal lateral margin of corium, and the connexivum pale ochraceous; head with the apices of the lateral lobes and the eyes piceous; membrane greyish, spotted with piceous. Body beneath ochraceous, more or less darkly punctate; a levigate pale luteous fascia extending from base of antennæ through pro- and mesosternum, and beyond this fascia the prosternum is brownish; abdomen with two fasciate series of piceous punctures on each side, the innermost narrowest; spiracles black. Legs brownish ochraceous.

Antennæ with the third and fourth joints subequal in length, second a little shorter, and fifth a little longer. Pronotum with the lateral angles prominent, obtusely angulate, anterior lateral margins dentate; a levigate line between the angles, in front of which the surface is depressed.

Long. 13 millim.

Hab. Transvaal, Lydenburg District (*Pret. Mus.*).

Allied to *G. hottentotta*, Stål, but differing by the different colour of the antennæ, fasciæ to abdomen, &c.

Dichelorhinus rustenburgi, sp. n.

Ochraceous; apices of lateral lobes of head, basal angles and apical margins of scutellum, and lateral and apical margins of corium piceous. Lateral and central areas of pronotum and central lobe of head pale castaneous. Extreme lateral margins of head, a curved narrow levigate fascia between lateral angles of pronotum, connected at centre with its base, a central levigate line and a short longitudinal fascia near each basal angle of scutellum, base of lateral margins of corium and the connexivum pale luteous. Membrane pale brownish. Body beneath ochraceous; abdomen reddish ochraceous; sternum with a broad fascia on each side and a central lineate one pale luteous; abdomen with two narrow

lineate series of black punctures on each side; legs more or less speckled with piceous.

Head furrowed between the lateral lobes; pronotum with a lateral and two central furrows, base entire and punctate. Antennæ mutilated.

Long. 13 millim.

Hab. Transvaal, Rustenburg (*Coll. Dist.*).

Allied to *D. histricus*, Stål.

I have examined a specimen from the Lydenburg District belonging to the Pretoria Museum, which seems to be clearly a varietal form of this species, though the prominent piceous markings to the scutellum and corium are entirely absent.

Phyllocephala Gunningi, sp. n.

Fuscous. Head piceous, rugulose; antennæ brownish ochraceous. Pronotum with the discal area irrorated with ochraceous, with three short ochraceous fasciæ on basal area, which are continued through the whole length of the scutellum. Membrane pale greyish, speckled with brown. Body beneath reddish ochraceous; a lateral fascia to sternum, a central fascia to abdomen, and the spiracles pale luteous; head beneath, lateral margins of sternum, two indistinct narrow fasciæ on each side of abdomen, and the legs piceous; intermediate and posterior tibiæ brownish ochraceous.

The pronotum has the anterior lateral margins crenulate, its surface is rugulose excepting the central basal area, which is coarsely punctate; scutellum transversely rugulose; corium finely punctate.

Long. 10 millim.

Hab. Transvaal, Lydenburg District (*Pretoria Mus.* and *Coll. Dist.*).

Phyllocephala serrata, sp. n.

Piceous; pronotum with a broad, transverse, discal, ochraceous fascia; antennæ piceous, fourth and fifth joints ochraceous. Body beneath ochraceous, speckled with piceous; head beneath, margins of sternum and abdomen, legs, and six narrow fasciæ to abdomen—two contiguous and central, and two on each side, of which one is spiracular—piceous; rostrum (excluding base) ochraceous; femora speckled with ochraceous; membrane brownish, spotted with piceous. Lateral margins of the pronotum very strongly dentate; head longitudinally rugulose; pronotum with a distinct ridge between the lateral angles, beyond which it is obliquely

depressed to head; scutellum subrugulose; corium finely and obscurely punctate.

Var.—Wholly piceous; pronotum without the ochraceous fascia.

Long. 11 millim.

Hab. Transvaal, Lydenburg District (*Pret. Mus.* and *Coll. Dist.*).

Phyllocephala testacea, sp. n.

Testaceous; head and pronotum darker in hue; base of pronotum in front of scutellum piceous, divided by three ochraceous lines. Head with the apical margins infuscated; antennae ochraceous, apical joint somewhat infuscated. Scutellum somewhat rugulose, thickly and darkly punctate, with a faint central levigate line. Corium thickly and finely punctate. Membrane greyish. Body beneath testaceous, three sublateral black spots to sternum; femora speckled with fuscous; apex of rostrum piceous.

Long. 11 millim.

Hab. Transvaal, Lydenburg District (*Pret. Mus.*).

Heteroptera from Mashonaland.

Fam. Pentatomidæ.

Subfam. SCUTELLERINÆ.

Steganocerus multipunctatus, Thunb.

Spharocoris testudo-grisea, de Geer.

Callidea duodecimpunctata, Fabr.

Subfam. PENTATOMINÆ.

Cœnomorpha nervosa, Dall.

Atelocera stictica, Westw.

— *natalensis*, Stål.

Dymantis subvittata, Stål.

Tropicorypha corticina, Germ.

Halyomorpha capitata, Dist.

— *pretoriae*, Dist.

Veterna sanguineirostris, Thunb.

— *patula*, Dist.

Diploxys thoracia, sp. n.

Tijoma cryptorhyncha, Germ.

Durmia lutulenta, Stål.

— *tomentiventris*, Germ.

— *albido-fuscata*, Stål.

— *horizontalis*, Dist.

Agonoscelis puberula, Stål.

— *versicolor*, Fabr.

Afrania Wahlbergi, Stål.

Dismegistus fimbriatus, Thunb.

Nezara viridula, Linn.

— *robusta*, sp. n.

Euryaspis mashonæ, sp. n.

Antestia cincticollis, Schaum.

— *mauritiï*, Stål.

Menida loriventris, Germ.

Diploxys thoracia, sp. n.

Head ochraceous, lateral margins and margins of central lobe piceous, apex brownish; antennæ reddish, fifth joint, and fourth joint excluding base, piceous. Pronotum ochraceous, thickly covered with coarse black punctures; lateral margins, a narrow central fascia, and two discal levigate spots on anterior area pale ochraceous; lateral angles piceous, strongly produced and directed forward. Scutellum piceous, subrugulose; a slightly raised, levigate, pale ochraceous, elongate spot in each basal angle, after which the lateral margins and apical area are pale ochraceous, coarsely punctured with piceous, and with a narrow, central, pale ochraceous fascia. Corium piceous, somewhat coarsely punctate, bases of lateral margins ochraceous; membrane dull greyish. Connexivum ochraceous. Body beneath ochraceous, coarsely and darkly punctate; a short anterior submarginal fascia to prosternum; a somewhat broken fascia on each lateral area of pro-, meso-, and metasternum; a broad submarginal fascia extending from pronotal angles to apex of abdomen, two central abdominal fasciæ, and the spiracles piceous. Legs reddish ochraceous.

Head with the lateral lobes meeting in front, their apices non exerted. Antennæ with the second and fourth joints shorter than the third and fifth; rostrum reaching the posterior coxæ, its apex piceous; posterior angles of the connexivum acute, piceous.

Long. 12 millim.; exp. pronot. angl. 6 millim.

Hab. Mashonaland, near Salisbury (*G. A. K. Marshall*).

Nezara robusta, sp. n.

Pale green, much suffused with ochraceous. Head rugulose, ocelli purplish red; antennæ with the first, second, and third joints green, apices of second and third purplish red, fourth and fifth joints reddish ochraceous. Pronotum greenish ochraceous, crossed by irregular green fasciæ, of which three discal are most distinct; lateral margins purplish red. Scutellum green, with two broad central fasciæ, ochraceous spotted with green. Corium green, with claval and

marginal ochraceous suffusions, bases of lateral margins purplish red; membrane pale greenish. Connexivum with its margins purplish red. Body beneath and legs pale greenish; femora and tarsi shaded with ochraceous; rostrum reddish ochraceous.

Var.—Body above uniformly green, without the ochraceous suffusions.

Body broad, pronotal angles subprominent and rounded. Antennæ with the second and third joints subequal in length and shorter than fourth and fifth. Rostrum just passing the posterior coxæ.

Long. 18 millim.; exp. pronot. angl. 10 millim.

Hab. Mashonaland, near Salisbury (*G. A. K. Marshall*).

Euryaspis mashonæ, sp. n.

Body above and beneath with legs and rostrum luteous. Ocelli and eyes reddish; antennæ with the third, fourth, and fifth joints more or less reddish ochraceous. Body above sparingly and irregularly punctate; scutellum with a large concolorous levigate spot in each basal angle. Antennæ robust, apex of the third joint and the whole of the fourth and fifth joints considerably thickened.

Long. 9 millim.

Hab. Mashonaland, near Salisbury (*G. A. K. Marshall*).

The specimen from which the above description is taken, like most pale-coloured species, is more or less shaded or discoloured. I have considered such shadings as discolorations, though there are suggestions of a large darker bifid spot near apex of scutellum.

Subfam. *ASOPINÆ*.

Mecosoma Marshalli, sp. n.

Macrorhaphis spurcata, Walk.

Afrinus figuratus, Germ.

Glypsus conspicuus, Westw.

Mecosoma Marshalli, sp. n.

Head pale reddish; apical third of lateral lobes, extreme apex of central lobe, and a basal patch behind each eye bluish green; eyes and antennæ piceous, ocelli red. Pronotum pale red; a lateral and anterior (connected) submarginal fascia bluish green; a very large discal, coarsely punctate, pale piceous patch, extending from near base to two thirds of the pronotal area, its lateral margins oblique. Scutellum red, sparingly and coarsely punctate; a bluish-black spot in each

basal angle and a very large central, basal, bluish-black spot continued as a narrow, central, levigate fascia to apex, which is of the same colour. Corium pale reddish, claval and lateral margins (the last not extending to apex) with a broken connecting fascia on apical area bluish green. Membrane æneous, with its apex paler. Body beneath red, thickly and coarsely punctate; legs, rostrum, posterior margins of abdominal segments, margins of sternal segments, and a large central spot on mesosternum bluish black. Ventral spine pale ochraceous.

Long. 13 millim.

Hab. Mashonaland, near Salisbury (*G. A. K. Marshall*).

Subfam. *TESSARATOMINÆ*.

Natalicola pallidus, Westw.

Malabama ethiops, gen. et sp. n.

MALABAMA, gen. nov.

Head concave, subfoliaceous, the lateral lobes recurved, directed upward, much longer than central lobe, and united in front of same; ocelli a little nearer to eyes than to each other. Rostrum short, reaching the anterior coxæ. Antennæ short; basal joint about reaching apex of the head; second joint short, not clearly separated from third. Pronotum with the posterior angles obtusely rounded, the lateral margins obsoletely serrated. Scutellum, membrane, sulcated prosteronum, carinated mesosternum, and metasternal keel emarginate behind for reception of ventral spine as in *Haplosterna*.

This genus is allied to *Haplosterna*, Stål (*Aplosterna*, Westw.), from which it differs by the concave head and the non-attenuated body posteriorly, thus somewhat, and in that respect superficially, having a resemblance to *Pycanum*.

Malabama ethiops, sp. n.

Head, antennæ, pronotum, scutellum, membrane, connexivum, body beneath, rostrum, and legs pale ochraceous. Corium pale greenish ochraceous. Extreme lateral edges of head, pronotum, and base of corium black. Lateral margins of meso- and metasternum pale luteous.

Head, pronotum, scutellum, connexivum, and body beneath very finely rugulose and punctate; corium very finely and indistinctly tessellate.

Long. 25 millim.; exp. pronot. angl. 14 millim.

Hab. Mashonaland, near Salisbury (*G. A. K. Marshall*).

Subfam. *DINIDORINÆ*.*Aspongopus nubilus*, Westw.Subfam. *PHYLLOCEPHALINÆ*.*Basicyptus antennatus*, Dist.*Dalsira crassus*, Dist.*Heteroptera from British Nyasaland.*Fam. *Pentatomidæ*.Subfam. *SCUTELLERINÆ*.*Steganocerus multipunctatus*, Thunb. Fort Johnson.*Sphærocoris ocellatus*, Klug. Fort Johnson, Zomba.— *testudo-grisea*, de Geer. Fort Johnson.*Callidea natalensis*, Stål. Fort Johnson.*Deroplax nigrofasciata*, sp. n. Zomba.*Hotea subfasciata*, Westw. Zomba.*Deroplax nigrofasciata*, sp. n.

Dark fuscous brown, thickly and coarsely punctate; lateral margins of head and pronotum dull ochraceous; a broad central fascia to head, submarginal lateral fasciæ to pronotum, and a large spot near each basal angle of scutellum black. Body beneath and legs piceous, lateral and anterior margins of prosternum dull ochraceous.

Lateral margins of pronotum slightly sinuate, the posterior angles prominent and obtusely angulate; head large, deflexed; antennæ piceous, third joint shortest, fourth and fifth longest; rostrum reaching the posterior coxæ.

Long. 13 millim.

Hab. Nyasaland, Zomba (*Dr. P. Rendall*).

Subfam. *GRAPHOSOMINÆ*.*Scotinophora fibulata*, Germ. Fort Johnson.Subfam. *PENTATOMINÆ*.*Scribonia bipustulata*, Walk. Zomba.*Cœnomorpha splendidula*, sp. n. Fort Johnson.*Chipatula typica*, gen. et sp. n. Fort Johnson.*Atlocera raptoria*, Germ. Fort Johnson, Zomba.*Eractheus lutulentus*, Stål. Zomba.*Tropicorypha corticina*, Germ. Zomba.*Halyomorpha viridescens*, Walk. Fort Johnson, Zomba.*Caura rufiventris*, Germ. Fort Johnson, Zomba.

- Carbula decorata*, Sign. Fort Johnson.
 — *trisinata*, Germ. Fort Johnson.
Agonoscelis erosa, Westw. Fort Johnson.
 — *versicolor*, Fabr. Fort Johnson, Zomba.
Afrania Wahlbergi, Stål. Fort Johnson.
Stenozygum alienatum, Fabr. Fort Johnson.
Bagrada hilaris, Burm. Fort Johnson.
Nezara viridula, Linn. Fort Johnson.
 — *Fieberi*, Stål. Zomba.
 — *robusta*, Dist. Zomba.
Flaminia maxima, sp. n. Fort Johnson.
Platacantha lutea, Westw. Zomba.
Antestia cincticollis, Schaum. Fort Johnson.
 — *variegata*, Thunb. Fort Johnson.
Menida nyasee, sp. n. Fort Johnson.
Bathycælia buonopoziensis, Pal. Beauv. Fort Johnson.
Aspavia pallidispina, Stål. Fort Johnson.
 — *carbula*, sp. n. Fort Johnson, Zomba.

Scribonia bipustulata, Walk.

Atelocera bipustulata, Walk. Cat. Het. i. p. 214. n. 17.

Brownish ochraceous, punctured and mottled with piceous. Head with a central ochraceous fascia, its base and the eyes black; antennæ piceous. Pronotum rugose and coarsely punctate, anterior halves of lateral margins strongly dentate; anterior margin and a central longitudinal line levigate, ochraceous; an irregular-formed transverse piceous patch enclosing a small ochraceous levigate spot on each side of anterior area. Scutellum rugose and coarsely punctate; three large levigate black spots at base—one at each angle and slightly raised—the central much less raised and narrowly margined with reddish, and with a central, raised, levigate, linear, ochraceous fascia terminating before the apical area. Corium coarsely punctate, interspersed irregularly with small levigate ochraceous spots, and with a large black spot on posterior discal area; membrane greyish, with an inner apical black margin. Connexivum black, spotted with brownish ochraceous. Body beneath and legs piceous; head and sternum greyishly pubescent; rostrum piceous, reaching the base of the penultimate segment of the abdomen. Antennæ with the second and third joints strongly pilose, third and fourth joints longest, subequal in length, fifth slightly longer than second. Legs pilose.

Long. 23 millim.

Hab. Nyasaland, Zomba (*Dr. P. Rendall*).

Cænomorpha splendidula, sp. n.

Bright emerald-green. Head coarsely punctate and with

the reflexed margins very narrowly ochraceous; antennæ with the first, second, and third joints bluish green, bases of first and third narrowly ochraceous, fourth joint bluish green at base, then annulated with ochraceous, remaining portion fuscous (fifth joint mutilated). Pronotum coarsely punctate, ochraceously dentate on anterior half of lateral margins; posterior angles prominent and obtusely acute. Scutellum coarsely punctate, with a small levigate ochraceous spot in each basal angle and the apex broadly ochraceous. Corium less shining green, with a few linear ochraceous markings; membrane cupreous. Body beneath emerald-green; coxæ, trochanters, femora, central annulation to tibiæ, and a broad central fascia to abdomen ochraceous; tibiæ bluish green; rostrum ochraceous, streaked with bluish green and reaching apex of second abdominal segment.

Long. 20 millim.; exp. pronot. angl. 10 millim.

Hab. Nyasaland, Fort Johnson (*Dr. P. Rendall*).

CHIPATULA, gen. nov.

Head long and broad; lateral lobes longer than the central, their apical areas obtusely angulate, raised and recurved. Antennæ inserted about the middle of the lateral margins of the head, basal joint about reaching apex of the head; margins of the abdomen slightly angulate at segmental incisures. Ventral furrow and other characters as in *Cœnomorpha*.

This genus may be roughly defined as having all the general characters of *Cœnomorpha*, but with the head resembling *Apodiphus*.

Chipatula typica, sp. n.

Purplish green. Head coarsely punctate, extreme lateral margins and a basal spot behind each eye ochraceous. Antennæ bluish green; third joint ochraceous at base, *fourth and fifth joints mutilated*. Pronotum coarsely punctate and somewhat rugulose; lateral crenulated margins, apices of posterior angles, and a small central spot at base ochraceous. Scutellum coarsely punctate and somewhat rugulose, with a slightly raised central line (more or less continued through pronotum), a levigate spot in each basal angle, and the apical area pale ochraceous. Corium thickly and finely punctate, with some pale purplish irrorations; membrane cupreous. Coxæ alternately green and pale purplish. Body beneath emerald-green; coxæ, trochanters, femora, central annulation to tibiæ, tarsi, a broad central fascia to abdomen,

lateral margins of meso- and metasternum, and marginal abdominal spots ochraceous. Tibiæ bluish green. Rostrum reaching the base of third abdominal segment; lateral pronotal angles prominent, obtusely angulated.

Long. 16 millim.

Hab. Nyasaland, Fort Johnson (*Dr. P. Rendall*).

Flaminia maxima, sp. n.

Black, sparingly punctate; anterior half of head, eyes, and antennæ (apical joint mutilated) reddish ochraceous. Pronotum with the lateral margins and a somewhat broad arched fascia extending from posterior angles to near anterior margin pale ochraceous. Scutellum with all the margins and a central longitudinal fascia (not reaching apex) pale ochraceous. Corium with the basal lateral margins pale ochraceous. Connexivum and body beneath ochraceous, a submarginal fascia to prosternum and abdomen black. *Legs mutilated*.

Long. 10 millim.

Hab. Nyasaland, Fort Johnson (*Dr. P. Rendall*).

One specimen in somewhat bad condition, but recognized at once from *F. natalensis*, Dall, by the very different markings of the scutellum.

Menida nyasa, sp. n.

Black, thickly and coarsely punctate. Antennæ dull ochraceous, extreme tip infuscated, basal joint black. Pronotum with the edge of lateral margins, a large irregularly-shaped spot on disk, with a smaller one on each side, levigate, ochraceous. Scutellum with five levigate ochraceous spots—three on basal margin and two a little beneath them—the apex pale luteous, with a few punctures, which are principally central and lineate. Membrane cupreous. Connexivum above and beneath ochraceous, with large piecous spots. Body beneath black; legs and two central rows of large spots to abdomen ochraceous. Rostrum reaching the posterior coxæ.

Long. 7 millim.

Hab. Nyasaland, Fort Johnson (*Dr. P. Rendall*).

Aspavia carbula, sp. n.

Brownish ochraceous, thickly, coarsely, and darkly punctate. Head piecous; antennæ ochraceous. Pronotum with the lateral angles piecous, prominent, and broadly and obtusely angulate, the lateral margins pale luteous, and with a

picuous patch on each side of anterior margin. Scutellum with a large levigate ochraceous spot in each basal angle, the apex also levigate and ochraceous. Corium with a small obscure levigate spot on posterior portion of disk; membrane cupreous, its apex paler. Connexivum brownish ochraceous, spotted with picuous. Body beneath ochraceous, sparingly, coarsely, and darkly punctate; legs and rostrum ochraceous, apex of rostrum picuous; femora with some picuous spots near apex.

Long. 8-9 millim.

Hab. Nyasaland, Zomba and Fort Johnson (*Dr. P. Rendall*).

Closely resembling *Carbula trisignata*, Germ., but differing generically by the shape of the head.

Subfam. ASOPINÆ.

Dorycoris pavoninus, Westw. Fort Johnson.

Moyara insignis, gen. et sp. n. Zomba.

Macrorhaphis spurcata, Walk. Fort Johnson.

Audinetia spinidens, Fabr. Fort Johnson.

Glypsus conspicuus, Westw. Fort Johnson.

MOYARA, gen. nov.

Head anteriorly concave; lobes of about equal length, lateral lobes foliaceous, upwardly recurved. Eyes prominent, situate at basal insertion of the head. Rostrum reaching the intermediate coxæ, first joint just passing base of head. Thorax broad, flat, depressed anteriorly, moderately constricted before middle; lateral margins prominently reflexed and concavely rounded, posterior angles produced in long spines. Scutellum narrowed apically and reaching the interior apical angle of the corium. Second abdominal segment with a somewhat obscure spinous tubercle directed forward. Anterior femora spined near apex.

This genus is allied to *Leptolobus*, Sign., from which it differs by the structure of the head and thorax, broader body, &c.

Moyara insignis, sp. n.

Head purplish, transversely rugulose, with some coarse punctures near base; antennæ dark indigo-blue. Pronotum pale reddish ochraceous; lateral margins and spines and a very large spot on each side of base dark indigo-blue. Scutellum dark indigo-blue, a spot in each basal angle and the apical area pale luteous. Corium pale ochraceous, with a large transverse discal spot (not reaching inner margin) bluish

black; membrane indigo-blue, apical margins pale greyish. Body beneath reddish, base of abdomen ochraceous; head beneath, rostrum, legs, lateral margins of pro- and mesosternum, a large spot on each side of metasternum, a series of lateral abdominal segmental spots, and the sixth abdominal segment dark indigo-blue.

The pronotum is sparingly and coarsely punctate, the lateral angles produced into long acute spines slightly excavated at their apices. Scutellum coarsely punctate, with a central raised longitudinal ridge. Corium very finely and sparingly punctured. Antennæ with the fourth joint longest; second and fifth joints subequal in length, each a little shorter than the third.

Long. 16 millim.; exp. pronot. angl. 10 millim.

Hab. Nyasaland, Zomba (*Dr. P. Rendall*).

Subfam. *TESSARATOMINÆ*.

Piezosternum calidum, Fabr. Zomba.

Natalicola pallidus, Westw. Fort Johnson.

Subfam. *DINIDORINÆ*.

Aspongopus pullus, Stål. Fort Johnson, Zomba.

— *nubilus*, Westw. Zomba.

— *patruelis*, Stål. Fort Johnson.

— *lividus*, sp. n. Fort Johnson, Zomba.

Aspongopus lividus, sp. n.

Black; fifth joint and apical two thirds of fourth joint of antennæ ochraceous; abdomen above dark olivaceous, the connexivum piceous.

Head with the lateral margins moderately sinuate, apex slightly notched between the meeting of the lateral lobes. Antennæ with the fifth joint longest; fourth a little longer than third, which is subequal in length to second. Pronotum and scutellum transversely rugulose and coarsely punctate. Corium opaque and slightly wrinkled.

Long. 15–16 millim.

Hab. Nyasaland, Fort Johnson, Zomba (*Dr. P. Rendall*).

I possess specimens of this species collected by Mr. Marshall at Isipingo in Natal and by Dr. Rendall at Barberton in the Transvaal, having the membrane dull cupreous.

Subfam. *PHYLLLOCEPHALINÆ*.

Basicryptus antennatus, Dist. Fort Johnson.

SYNONYMICAL NOTES.

Deroplax circumducta.

- Pachycoris circumductus*, Germ. in Silb. Rev. v. p. 190 (1837).
Hotea picea, Walk. Cat. Het. i. p. 56 (1867).

Cocalus leucogrammus.

- Cimex leucogrammus*, Germ. in Silb. Rev. v. p. 179 (1837).
Sciocoris leucogrammus, H.-S. Wanz. vii. p. 88, fig. 756 (1844).
Cocalus leucogrammus, Stål, Hem. Afr. i. p. 119. 1 (1864).
Sciocoris clausus, Walk. Cat. Het. i. p. 175 (1867).

Pododus orbicularis.

- Sciocoris orbicularis*, Burm. Handb. ii. 1, p. 373. 6 (1835).
Pododus orbicularis, Stål, Hem. Afr. i. p. 124. 1 (1864).
 — ? *æqualis*, Walk. Cat. Het. i. p. 179 (1867).

Holcostethus apicalis.

- Cimex apicalis*, H.-S. Wanz. vi. p. 95, fig. 666 (1842).
Holcostethus apicalis, Stål, En. Hem. v. p. 74 (1876).
Pentatoma confinis, Walk. Cat. Het. ii. p. 298. n. 95 (1867).

TYOMA.

- Tyoma*, Spinola, Gen. d'Ins. arthr. p. 133 (1850).
Oxycoris, Mayr, Verh. zool.-bot. Ges. Wien, xiv. p. 909 (1864).
Camara, Walker, Cat. Het. i. p. 237 (1867).

Tyoma cryptorhyncha.

- Cimex cryptorhynchus*, Germ. in Silb. Rev. v. p. 169 (1837); Herr.-Schäff. Wanz. vii. p. 74, fig. 742 (1844).
Camara limosa, Walk. Cat. Het. i. p. 237. 1 (1867).

Holcostethus heterocera.

- Pentatoma heterocera*, Walk. Cat. Het. ii. p. 297. n. 94 (1867).
Holcostethus obscuratus, Dist. Nat. in Transv.. Append. p. 249, t. iii. fig. 2 (1892).

Dismegistus fimbriatus.

- Cimex fimbriatus*, Thunb. Nov. sp. Ins. i. p. 47, t. ii. fig. 61 (1783).
Cydnus circumcinctus, Hahn, Wanz. ii. p. 115, fig. 195 (1834).
Strachia ænescens, Walk. Cat. Het. ii. p. 325. n. 52 (1867).

XXXV.—On the Zululand Form of Livingstone's Antelope
(*Nesotragus Livingstonianus*). By OLDFIELD THOMAS.

IN April 1892 the well-known sportsman Mr. Arthur H. Neumann obtained in Northern Zululand two specimens of a small antelope locally known as the "Inlilengane," and these specimens I exhibited at the Zoological Society* in the following year, provisionally identifying them with the *Nesotragus Livingstonianus* of the Zambezi.

Of the latter form there was at that date in the Museum only a flat scalp with the frontlet and horns, being the type on which the species was founded.

Recently, however, the Museum has received from Mr. Alfred Sharpe a female specimen of *N. Livingstonianus* from Nyasaland, and therefore from approximately the typical locality of the species.

This female specimen differed widely from Mr. Neumann's male Zululand examples, which were described both in my paper (*l. c.*) read before the Zoological Society and in the 'Book of Antelopes' †, by being of a generally grizzled fawn-colour, instead of deep rufous, while the fetlocks were only indistinctly blackish behind, instead of being prominently black all round.

As it still seemed possible, however, that these differences might be due to sex, Mr. Neumann was good enough to try and procure female examples of the Zululand form; and through the kindness of Mr. Saunders, of that country, he has now succeeded in getting a fine female skin, which he has presented to the National Collection.

This female proves to be precisely like the male specimens previously examined, and therefore shows that the above differences are not due to sex, and must be looked upon as indicating subspecific distinction.

This being the case, the Zululand subspecies may be termed *N. Livingstonianus zuluensis*, its type being B.M. no. 93. 2. 1. 1, the male specimen first given by Mr. Neumann and already sufficiently described in the works referred to.

So far as the material goes, the Zululand form seems also to have finer horns than that found on the Zambezi; but further males from the latter region will be necessary before the exact degree of difference can be determined.

* P. Z. S. 1893, p. 237.

† Vol. ii. p. 55 (1896).

XXXVI.—Notes on various American Mammals.

By OLDFIELD THOMAS.

Sphaeronycteris toxophyllum, Pet.

This remarkable bat was described by Peters on a specimen from unknown locality. It is therefore of interest to record that a skin with its skull, apparently quite agreeing with the original description and figure, has been received from Merida, Venezuela. It was collected by Señor S. Briceño.

Micronycteris hirsuta, Peters.

Another bat described by Peters without exact locality is *Schizestoma hirsutum* (MB. Ak. Berl. 1869, p. 396).

Among some specimens obtained by Mr. C. F. Underwood in Costa Rica are a pair of bats, unfortunately somewhat damaged, but apparently agreeing with Peters's and Dobson's descriptions of the type of the above species in the Paris Museum.

Mr. Underwood's specimens were obtained at Pozo Azul, at an altitude of 200 m., in Costa Rica. The male is ornamented with a tuft of long hairs situated just behind the band connecting the two ears.

Conepatus mapurito, Gm.

A skunk from Guatemala, collected by Mr. C. F. Underwood, closely agrees with what is practically a topotype of this species from Bogotá, sent home by Mr. G. D. Child. Both, as also another specimen from Costa Rica, agree in having two white dorsal stripes, which do not reach to the tail and are divided by a black line extending forward between them to the occiput. The hairs on the top of the neck are directed forward and those on the crown backwards, the two sets meeting in a crest running across from ear to ear.

The identification of the real *C. mapurito* is of some interest, as all the skunks of the genus *Conepatus* have been lumped under this name.

Oryzomys vestitus, Thos.*

The typical skin of this species has been remade, and now that it is properly shaped, certain reddish marks which were

* Ann. & Mag. Nat. Hist. (7) i. p. 454 (1898).

supposed to be due to accidental splashes of some preservative, and were therefore ignored in the description, appear almost or quite symmetrical. Consequently, although I still think my original idea about them may be correct (for they are not *exactly* symmetrical), yet some mention of them should be made on the chance that they are natural markings.

The most striking consist of five small red patches—one above and one below each eye and one on the face between the eyes (the latter is not exactly in the middle line). Round the base of each ear, and on the ears themselves, various hairs are of the same red colour. The upper anterior face of each forearm is washed with red, and there are some red-tipped hairs on each side of the rump. In addition, many of the hairs of the belly are of a dull red colour, not of the same shade as the face-markings; but this is nearly certainly due to staining, whatever may prove to be the case with the face- and arm-patches.

Æpeomys vulcani, Thos.*

Two further specimens of this interesting rat sent by Mr. L. Söderström from Mount Pichincha have considerably longer tails than the type, in which this member seems to have been unnaturally shortened. One has a tail of 125 and the other 135 millim. in length.

Lepus sylvaticus, Bachm.

(Journ. Ac. Philad. (1) vii. p. 403, 1837.)

In reference to this name, the following seems to be of unfortunate pertinence:—

Lepus borealis sylvaticus, Nilsson

(Illuminerade Figurer till Skandinaviens Fauna, i. Mammals, text to pl. xxii., 1832);

therefore antedating by five years the name given by Bachman to the common "Cotton-tail" of the Eastern United States.

Taking the species in the wider sense recognized by Dr. Allen in the 'Monographs of North-American Rodentia,' the next name (or, rather, by page-priority, an earlier name) would be

* Ann. & Mag. Nat. Hist. (7) i. p. 452 (1898).

Lepus Nuttalli, Bachm.

(t. c. p. 345),

and the various subspecies will be *L. Nuttalli transitionalis*, *Mearnsi*, *arizonæ*, *Holzneri*, &c.

But out of the evil of the change of name one slight compensating good may be made to result; for in giving a fresh name, as will be necessary, to what has hitherto been considered the typical subspecies of *L. sylvaticus*, a type locality may be settled, which will be a relief to naturalists so geographically accurate as are modern American mammalogists.

As a suitable name for the Carolinian subspecies of the common "Cotton-tail," I would suggest the Greek equivalent of that name, *L. n. mallurus**, and would take as type a specimen from Raleigh, North Carolina, presented by Mr. Outram Bangs to the British Museum (♀, B.M. no. 97. 2. 1. 30, formerly Bangs Collection, no. 735), which quite agrees with the description given in his excellent paper on the group †. Its measurements are:—Total length 440 millim.; tail 60; hind foot, with claws, 85; ear 60. Collected and measured by Messrs. H. H. & C. S. Brimley.

Lepus Bachmani, Waterh.

(P. Z. S. 1838, p. 103.)

This name has been treated by various American writers as a synonym of "*L. sylvaticus*" (*L. Nuttalli*), at first with doubt, but later with greater and greater apparent confidence. Quite recently it has been even revived as the term for a Texan subspecies of that animal, merely on the basis of a guess by Baird that the type might have come from that country.

The animal was said by Waterhouse, although with doubt, to have come from California, and on an examination of the type now in the British Museum ‡, I find that it is certainly a Californian hare, though not *L. Nuttalli*; for, without any room for doubt, it proves to be the species commonly known as *L. Trowbridgei*, Baird. As Waterhouse's name has priority by many years over that given by Baird, the species will have to be known as *L. Bachmani*, *L. Trowbridgei* falling into its synonymy.

* Strictly speaking, "wool-tail."

† P. Bost. Soc. N. H. xxvi. p. 404 (1894).

‡ B.M. no. 53. 8. 29. 36; received from the Zoological Society's Museum; collected by D. Douglas.

XXXVII.—*New North-American Insects.* By T. D. A. COCKERELL, Entomologist of the New Mexico Agricultural Experiment Station.

I.—*The second North-American Miscophus* (Fam. Larridæ).

HYPOMISCOPHUS, subgen. nov.

Only one recurrent nervure, that entering the first submarginal cell slightly beyond its middle. Marginal cell rather small; first submarginal extremely large, its area more than twice that of the marginal; second submarginal extremely minute, triangular, shorter than its petiole, and only about half as wide at base as the distance between it and the end of the recurrent nervure. Mandibles with a very deep outer notch, the basal portion of the mandible twice as broad as the portion beyond the notch. Tarsal comb little developed.

Type *M. arenarum*, sp. n.

Miscophus arenarum, sp. n.

♀.—Length about 3 millim.

Head, thorax, antennæ, and first four femora black; abdomen, mandibles, and legs (except the first four femora) ferruginous. Tubercles and tegulæ light ferruginous. Occipital region, face, sides of thorax, and hind margins of abdominal segments interrupted in the middle, shining silvery, with minute appressed pubescence. Apical half of abdomen somewhat infuscated. Wings iridescent, nervures piceous; apical margin very broadly smoky. Hind ocelli somewhat further apart than the distance of either from the eye-margin. Metanotum with a distinct median longitudinal raised line. Tibial spurs large and black. Thorax with a very minute rugose sculpture.

Hab. Mesilla Park, New Mexico, July 21, 1898, in a sandy place, in the zone of *Pluchea borealis*.

This is very different from *M. americanus*, Fox, and resembles more *M. chrysis*, Kohl, an African species, in its venation. I should be inclined to regard *Hypomiscophus* as a distinct genus but for the fact that the distinctive characters seem practically confined to the wings.

II.—*Two new Coccidæ from Massachusetts.**Lecanium (Eulecanium) Kingii*, sp. n.

♀ (after producing young).—Length 5, breadth 3, height $2\frac{1}{2}$ millim.

With an obscure dorsal keel. Shiny, dark chestnut-brown, irregularly wrinkled and pitted. Marginal area punctured, but not plaited. General appearance much like *L. persicæ*.

Skin (after boiling) chitinous, light yellowish brown, with scattered small round gland-spots, which are larger and more numerous near the margin. Marginal spines very few, minute, simple. Anal plates with their outer sides about equal. Antennæ and legs small and pale. Femur rather short, much shorter than tibio-tarsus; tarsus nearly as long as tibia; claw long, curved only at end; digitules all filiform. Antennæ 6-segmented, formula 3 6 2 1 (4 5); 3 very long, (about 93 $\mu\mu$), longer than 4, 5, and 6 together, constricted near its end; 2 about as long as broad and much less than half the length of 3; 6 about as long as 4 + 5.

Hab. Lawrence, Mass., June 14, 1898, on bark of *Vaccinium corymbosum*, L. (*G. B. King*, no. 32).

This species outwardly resembles *L. persicæ*, but the antennæ are quite different. I have not seen Goethe's *L. vaccinii-macrocarpum*; but that cannot be the present insect, as it is said to be very small and light brown. Goethe describes the eggs, so his specimens cannot have been immature. I wrote to Mr. Goethe concerning *L. vaccinii-macrocarpum*, and he replies from Geisenheim, June 25, 1898, that it can no longer be procured—"Upon the plants in our possession the *Lecanium* has disappeared. I wrote to the Botanic Garden at Karlsruhe, but there this species has quite died out." A couple of sketches kindly sent by Mr. Goethe indicate a different species from *L. Kingii*, apparently with a 7-segmented antenna.

I am glad to name the above species after Mr. King, in recognition of his good work among the Coccidæ of Massachusetts. Just recently he has sent me three other interesting species, which are new to the fauna of that State, viz. :—

Eriococcus quercus (Comst.).—On white oak, Andover, Mass., June 28, 1898.

Eriococcus azalæ, Comst.—On *Cratægus coccinea*, Methuen, Mass., June 21, 1898.

Kermes pubescens, Bogue.—On white oak (*Quercus alba*), Lawrence, Mass.

Aspidiotus Fernaldi, sp. n.

This name is applied to a puzzling form found by Mr. Kirkland on *Gleditschia triacanthos* in Charlesbank Park, Boston. The scale resembles that of *A. Forbesii*, but the exuviae, at least in the specimens seen by me, are dark brown. The female insect is also like *A. Forbesii*, but the median lobes are broad and practically entire, just like those of *A. ostreaformis*. From *ostreaformis* it is easily distinguished by the great inequality of the chitinous processes at the first interlobular interval; the inner of these processes is straight, instead of being curved as in *Forbesii*, the inequality being about the same as in *Forbesii*. *A. Fernaldi* also differs from *ostreaformis* in the close proximity of the second lobe to the first; the second lobe is usually more developed and less notched than in *Forbesii*.

Mr. W. G. Johnson, when describing *Forbesii*, enumerates its food-plants, and adds that it occurs "possibly" on honey-locust. I suppose it probable that he found *A. Fernaldi* on the honey-locust, and was in doubt as to whether it was distinct. It may fairly be said of *A. Fernaldi* that it has about the same relation to *A. Forbesii* that *A. ostreaformis* has to *A. ancylus*. *A. Fernaldi* has five groups of circumgenital glands, the median group of three, anterior laterals 4 to 9, posterior laterals 2 to 7.

The specimens were sent to me by Mr. R. A. Cooley, of the Massachusetts Agricultural College. The species is named after the well-known entomologist of that institution.

A. ancylus, Putn., was found by Mr. Kirkland on the *Gleditschia triacanthos* in Charlesbank Park along with the *A. Fernaldi*. It was also found on the same food-plant by Mr. Cooley at Everett, Mass., here not accompanied by *Fernaldi*.

III.—*The first-described Eremopedes* (Fam. Locustida).*Eremopedes Scudderi*, sp. n.

♀.—Length of body 19–21 millim., of pronotum 6 millim., of hind femora $21\frac{1}{2}$ millim., of hind tibiae 23 millim., of ovipositor 19–20 millim., of antennae about 51 millim.

Sepia-brown in effect, but in reality ochreous, closely and finely marbled with blackish; the density of the black marbling somewhat variable, but the lateral margins of the pronotum always broadly pale ochreous. Pronotum truncate in front and behind, the margin narrowly castaneous and

slightly concave; lateral lobes not greatly developed. Ovipositor dark brown, only moderately curved. Hind femora with five to seven very short spines on the inner side; hind tibiæ with 28 to 33 spines in the outer row. Spines of anterior tibiæ pale ochreous, tipped with black, and having a black longitudinal line on the upperside; there is also sometimes a black patch immediately at the base of each spine. Spines of hind tibiæ brown tipped with black, but the ridge from which they spring is whitish.

Mut. *viridis*.—Similar to the type, but entirely bright apple-green.

Hab. Mesilla Park, New Mexico, on the campus of the New Mexico Agricultural College. Eight of the brown form and two of the green. They were found in an outhouse, and are doubtless nocturnal in their habits. One specimen was found in the jaws of a *Scelopendra heros* which had killed it.

The genus *Eremopedes* was made known by Scudder in the 'Canadian Entomologist,' July 1894. It was founded on a single female from Arizona in the National Museum at Washington, which was not described. Up to the present no species of the genus has been described or named so far as I can ascertain.

I sent an example of *E. Scudderi*, asking whether it was the same as the Arizona insect, to Mr. Scudder, who replied: "The *Eremopedes* from Arizona is unnamed in the U.S. Nat. Mus. I have no specimen. Your species appears to be a good one."

IV.—A new Humble-Bee from the Pribilof Islands.

Bombus Kincaidii, sp. n.

♀.—Length about 20 millim., anterior wing 15 millim.

Black, with dense black and pale dull ochreous pubescence. Pubescence of head entirely black, except that the labrum presents some short orange-brown hairs and the trisulcate mandibles have a patch of shining ochreous pile in the lowest sulcus at the tip. Facial quadrangle about or hardly as long as broad, groove beneath middle ocellus distinct, front with minute punctures; clypeus rather prominent, with small punctures of different sizes, becoming sparse on the disk; area between eyes and base of mandibles smooth and shining, about as broad as long; flagellum with the third segment a little longer than the second, but shorter than the first. Mesothorax dull from very small extremely dense punctures, except on the posterior portion, where there is a median

smooth area; pleura extremely densely punctured. Pubescence of thoracic dorsum ochreous in front and on scutellum, but the black band between the wings larger than either of the ochreous areas; pubescence on sides of metathorax black, on pleura dirty ochraceous in front, passing through sooty to black behind. Tegulæ black; wings brownish hyaline, with dark brown nervures, along the courses of which the wing is irregularly stained with brown; third submarginal cell narrowed about half to marginal. Legs with brown-black hair, tending to chocolate; on the outer side of the tarsi the pubescence is whitish and appressed, on the inner anterior edge of the basal joints it is shining coppery, very brilliant, and each tarsal joint has a short apical fringe of ferruginous bristles. Abdomen above with the first three segments covered with ochreous hair, the remaining ones with black; pubescence of venter black.

♂.—Length about 15 millim.

Differs from the female in having the light hair somewhat yellower; a patch of yellow hair on the face below the antennæ; some yellow hair among the black on middle of vertex; band between the wings not black, but ill-defined, marked by the duller, more sooty, tint of the hair; third abdominal segment with some black hair mixed with the yellow; following segments with long whitish hairs, reddish at base, intermixed with the black. Venter with yellowish hair. Legs with more of the coppery or ferruginous hair. Second segment of flagellum barely shorter than first and much shorter than third.

♀.—Like the female, but much smaller. Length about 15 millim.

Hub. Pribilof Islands, Bering Sea; 4 ♀, 2 ♂, 1 ♀ (*Trevor Kincaid*). The specimens were all collected on St. Paul, Aug. 1 and 25, 1897. Several (3 ♀, 1 ♂) were at flowers of *Lathyrus*, Aug. 1. This *Lathyrus* was, I presume, *L. maritimus*, Bigel., the only species of the genus recorded by Dr. Merriam from the Pribilof Islands.

This *Bombus* was the only bee to be found on the islands, notwithstanding that there is a tolerably extensive series of bright-flowered plants, as enumerated by Dr. Merriam in *Proc. Biol. Soc. Wash.*, July 1892.

So many northern *Bombi* have been described that it requires some courage to add another name to the list. The present species is, I believe, endemic in the Pribilof Islands, for I cannot find anything described from the mainland or any of the other islands which agrees with it; and Mr. Kincaid brought me a series of *Bombi* from Sitka and Unalaska, none

of which agree with *B. Kincaidii*. It is not identical either with any of the rather numerous species which Radoszkowski recorded in 1877 from Siberia. Using Schmiedeknecht's table of European *Bombi*, the female runs to *B. hyperboreus*, but differs from that in the paler pubescence, and especially in having the first three abdominal segments always with light hair instead of the first two only. The male differs from that of *hyperboreus* in the proportions of the flagellar joints, as described, and in the absence of the long black hairs on the posterior tarsi. *B. hyperboreus* inhabits the arctic regions of Europe and Siberia, also Greenland; it is, I think, the nearest ally of *Kincaidii* at present known.

V.—*Some new Gall-gnats (Cecidomyiidae).*

Diplosis atriplicicola, sp. n.

Gall.—A small circular pustule-like swelling in the leaf of *Atriplex canescens*, about $2\frac{1}{2}$ millim. diam.

Pupa shell light brown, uniform in colour.

Imago about $1\frac{1}{2}$ millim. long, black, the abdomen densely covered with coarse white hairs. Legs pallid, faintly yellowish, clothed (especially the femora) with white hair. Wings white.

♂.—Antennæ 2 + 12-jointed; first joint elongate, obconical, second a depressed sphere, remaining joints stout and cylindrical (sausage-shaped), very shortly petiolate; irregularly and rather densely clothed with simple depressed hairs, these hairs much shorter than the joints and not distributed in separable whorls; third joint longest, the others about equal.

Eyes united, covering most of head, vertex projecting, apparently conical. Scutellum with some long slender hairs. Genitalia reddish brown. Wings with scattered simple hairs; first (subcostal) longitudinal vein arising from the cross-vein some distance from the base of the wing, the cross-vein thence slanting a little backwards in both its upper and lower portions, but not very oblique; no other cross-vein is apparent; costal margin uniformly and densely bristly until the end of the second longitudinal vein just before the tip of the wing, after which the wing-margin is without hairs; third longitudinal vein weak. Legs long; first tarsal joint extremely short; claw-joint of hind tarsus scarcely more than half the length of the one before it.

Hab. Mesilla Park, New Mexico, on the campus of the Agricultural College, end of July, 1898.

This is not a true *Diplosis*; it seems to differ from all

genera at present recognized in North America. It is possible that it may be referable to one of the numerous genera lately proposed for European species allied to *Diplosis*.

Lasioptera Willistoni, sp. n.

Gall.—An elongate cylindrical swelling of a twig of *Atriplex canescens*, about 35 millim. long and $3\frac{1}{2}$ to 4 broad.

Larva.—Colour pale orange.

Imago (♀).—Length $2\frac{2}{3}$ millim. Black, ornamented with white. Antennæ rather stout, cylindrical, not so long as the width of the thorax; head hardly visible from above, concealed by the gibbous thorax; sides of thorax white, mid-dorsal area whitish; abdomen with seven pairs of white spots, those of the first pair close together; tip of abdomen orange. Wings with the costa black, except for a white spot; fringe black. Legs hoary.

Hab. Mesilla, New Mexico; also common on the campus of the Agricultural College, Mesilla Park, N.M.

The imago described emerged May 2, 1897; there appears to be a second brood, emerging in August. Great numbers of parasites, determined by Mr. Ashmead as *Polygnotus atriplicis*, Ashm., have been raised from the galls (collected at Mesilla Park) by Miss Ivah Mead and the present writer. When I first bred this species I was unable to identify it with anything described, so I sent a drawing of it to Dr. Williston, who informed me that it was a new *Lasioptera* without doubt. Since then I have found two closely allied species, described below. *L. Willistoni* is the fourth Cecidomyiid found on *Atriplex canescens*, the other three being *Diplosis atriplicicola*, sp. n., *Asphondylia atriplicis* (Twins.), and *A. neomexicana* (Ckll.).

Lasioptera ephedra, sp. n.

Gall.—A fusiform swelling on twigs of *Ephedra trijorca*, about 12 millim. long and 5 broad, with a depression on one side subbasally, where the wall is thinner and through which the insect emerges.

Larva orange.

Imago.—Repeated attempts to breed the fly from these galls have been unsuccessful; but on May 18, 1897, I found what is doubtless the gall-producer hovering over an *Ephedra* on which were many galls.

♀.—Length about 2 millim. Differs from *L. Willistoni* by having the margins of the abdominal segments more or less fringed with white scales, but no well-defined spots.

Apical structures of abdomen brownish rather than orange. Costa blackish, with white hairs intermixed, but no distinct white spot. Wing-margin white.

Hab. Mesilla Park, N.M., abundant; also at Paraje, N.M.

Prof. C. H. T. Townsend described the gall in *Entom. News*, Sept. 1893, pp. 242-243.

Lasioptera tertia, sp. n.

Gall.—A potato-shaped smooth swelling on the twigs of some asteroid composite. The galls are of various shapes, sometimes subglobular, 11 × 9 millim., or elongated, 17 millim. long, constricted in the middle; they are always quite broad and more or less irregular.

Imago.—Similar to the two described above. The abdomen has distinct white bands, more or less interrupted in the middle line. Costa black, with a distinct but small white spot, margin of wing black. Legs more or less pallid, grey or brown.

Hab. Paraje, New Mexico; galls collected in April 1898.

The following table separates the above three species of *Lasioptera*:—

| | |
|--|--------------------|
| Abdomen distinctly spotted; orange at tip; wing-margin black | <i>Willistoni.</i> |
| Abdomen more or less banded; not orange at tip. | |
| Wing-margin black | <i>tertia.</i> |
| Wing-margin white | <i>ephedra.</i> |

VI.—*A Case-bearing Tineid on Portulaca.*

Coleophora portulacæ, sp. n.

Head and thorax above heavily clothed with pale ochreous (nearly putty-coloured) scales. Primaries with the same general tint, with some admixture of blackish scales on the apical half, but no distinct markings; fringe of the same general colour. Secondaries silvery grey, with a very long mouse-coloured fringe. Abdomen above silvery grey, cream-coloured at the apex. Thorax and abdomen beneath, also the legs, satiny white.

Penultimate joint of palpi tufted at the apex. Antennæ simple, heavily scaled, but not tufted at base; conspicuously annulate with grey and white, the grey rings equal to the white; 35-jointed, first rather longer than the next three together, second and third very short, broader than long; two last joints with bulging sides, not narrow-cylindrical like the ones before them.

Expanse about 10 millim.

Case 6 millim. long, about 1 broad, cylindrical, cream-colour, roughened much like a silkworm cocoon; some grains of sand attached behind the mouth; hind end briefly tricarinate.

Hab. Mesilla Park, New Mexico, abundant on *Portulaca* on the campus of the Agricultural College; moths emerging Aug. 5 to 7, 1898.

Allied apparently to *C. unicolorella*, Chamb.; but that is smaller and does not have annulate antennæ. *C. pulchricornis*, Walsm., is named from the similarly annulate antennæ, but it has a whitish costal streak, and while the moth is no larger, the case is more than twice as long.

VII.—*The Cecidomyiid of the Mesquite.*

Asphondylia prosopidis, sp. n.

Gall.—Consists of the aborted fruits of *Prosopis juliflora*, var. *glandulosa*. They hang on the stalk something like grapes, and are subglobose, with a pointed apical projection, which represents the end of the pod. Globose portion about 8 millim. long and 7 broad, pointed portion about as long or shorter. Colour green, becoming yellowish and tinged with red.

Pupa-shell red-brown. Imago emerged Aug. 13, 1898.

Imago.—♂. Length about $3\frac{1}{2}$ millim. Face extremely narrow, hardly broader than the femur; eyes black; antennæ dark brown, 2+12-jointed; joints cylindrical, very shortly petiolate, with numerous very short hairs not longer than the width of a joint, not arranged in regular whorls; first joint more than twice as long as second, these two together not so long as third. Last joint of palpi long. Occiput with a collar of large bristles. Thorax above leaden grey, nearly naked; scutellum rounded, prominent, bristly; prothorax at sides and a part beneath wing light scarlet; halteres with a large white knob, stem and base of knob brown; legs pale greyish brown. Wings hairy, dull hyaline, iridescent, nervures and costa blackish; second vein terminating just at tip of wing, third weak, its upper branch almost obliterated; a fold between second and third veins; cross-vein absent. The wings extend beyond the tip of the abdomen about the length of the last abdominal segment. Abdomen grey, last segment scarlet.

Hab. Mesilla Park, New Mexico.

Some years ago I found some of the galls at Las Cruces, but was not then able to rear the flies. *A. prosopidis* differs

from *A. neomexicana* in the dark (instead of pallid) second nervure and the impressed lines of the thorax being feebly or not pubescent. The life-history is quite different.

VIII.—Two new Species of Kermes (*Fam. Coccidæ*) from the Eastern States.

Kermes nivalis, King and Ckll., sp. n.

♀.—Rather *Lecanium*-like, with a broad base of attachment, outline much like that of a convex *Lecanium*, the sides depressed, not bulging. Length $4\frac{1}{2}$, breadth $4\frac{1}{2}$, height about 3 millim. Dark sepia-brown, irregularly marbled with blackish and pale ochreous, the latter colour inclined to be arranged in transverse bands, and beset with numerous minute dark dots. All of the scale except the middle of the back is powdered with snow-white secretion, which becomes very abundant at the sides. Microscopical characters ordinary; skin fairly closely beset with small round glands, and showing some larger glands at irregular intervals, on brown patches. Mouth-parts ordinary. Antennæ distinct, but rudimentary, obscurely 6-jointed, last joint bristly.

Larva (newly hatched).—Pale yellow, rather more elongate than usual, lateral spines very small and short. Antennæ 6-jointed, 3 at least as long as 4+5. Formula 3 6 (1 2 4 5).

Hab. Lawrence, Mass., on *Quercus alba* (*G. B. King*, no. 48). The larvæ hatch about the beginning of August.

This pretty species differs from all those described from North America by its shape, and especially the snow-like meal on its sides. It agrees in some respects with the European *K. Bauhinii*. I have not seen this latter species, but there are specimens in the U.S. Nat. Museum, and Dr. L. O. Howard has kindly compared them with *K. nivalis*, and finds them "very different."

Kermes Kingii, sp. n.

♀.—Very convex, but the sides hardly bulging; length 5, breadth $4\frac{1}{2}$, height about $3\frac{1}{2}$ millim. Colour light ochreous, of quite a bright tint, marbled with a slightly darker redder tint; the marbling is absent in the mid-dorsal line, leaving a more or less distinct longitudinal pallid band; segmentation vaguely indicated by transverse rows of small black spots; entire surface very closely beset with minute dark dots. The scale is evenly rounded dorsally, without any prominences or depressions. Microscopical characters as usual in the genus,

except that the skin is unusually thickly beset with the small round glands, which are very distinct. Mouth-parts and antennæ ordinary. Caudal tubercles represented by brown chitinous bristly patches.

Larva (according to King) yellow, of a different colour from that of *K. galliformis*.

Hub. Lawrence, Mass., July 28, 1898, on red oak, not common (*G. B. King*, no. 44). Also from Delaware, sent by Prof. C. P. Gillette (no. 557).

Easily known from the common *K. galliformis*, Riley, to which it is most allied, by the smaller size, more regularly globose form, lively colour, and the very distinct and numerous dark points. I received two specimens years ago from Prof. Gillette, and at that time regarded them as a form of *galliformis*; but Mr. King now draws my attention to the fact that the species is distinct, and on making a detailed study of it I am surprised that I ever thought otherwise.

Mesilla Park, New Mexico, U.S.A.,
Aug. 15, 1898.

XXXVIII.—*On Ostracoda from the "Cambridge Greensand."*

By FREDERICK CHAPMAN, A.L.S., F.R.M.S.

THE Ostracoda from the Cambridge Greensand in the neighbourhood of Cambridge were remarked upon, and a list of seven species was given, by Prof. Sollas in 1872*. These, with some useful corrections in nomenclature, were repeated by Messrs. Jones and Hinde in their "Supplement to the Monograph on the Cretaceous Entomœstraca of England and Ireland" †.

In this latter work, at pp. 59 and 60, Messrs. Jones and Hinde also insert a list of thirteen species of Ostracoda from the Cambridge Greensand, collected by the late Mr. G. R. Vine in 1889. This list, which had been compiled for him by Messrs. Jones and Sherborn, was published earlier in a paper by Vine ‡.

Latterly the author of the present paper has had the opportunity of examining some material from the Cambridge Greensand collected at Swaffham, and which was kindly furnished him, through the courtesy of Mr. A. J. Jukes-Browne, by Mr. H. Woods, of Cambridge. The results have

* Quart. Journ. Geol. Soc. vol. xxviii. pp. 398-9.

† Pal. Soc. vol. xliii. for 1889 (1890), p. 59.

‡ Proc. Yorkshire Geol. and Polytech. Soc. vol. xi. (1889) p. 274.

proved of much interest, and to facilitate the comparison of the microzoic fauna of this with other Cretaceous groups the following notes have been put together.

Family Cyprididæ.

PARACYPRIS, G. O. Sars, 1865.

Paracypris siliqua, Jones and Hinde.

Paracypris siliqua, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. pp. 2, 3, pl. ii. figs. 48, 49, 51, pl. iii. figs. 33, 34.

This species has been described mainly from Upper-Chalk specimens; it has also been recorded from the Gault of Folkestone from zones x., xi., and xiii., but was not met with in the Greensand seam zone xii.* It is by no means a common form. One valve was found in the Greensand of Swaffham.

PONTOCYPRIS, G. O. Sars, 1865.

Pontocypris Bosquetiana, Jones and Hinde.

Pontocypris Bosquetiana, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. pp. 4, 5, pl. ii. fig. 65, pl. iv. fig. 3.

This species was known from the Gault and the Chalk-marl.

Four characteristic and well-preserved carapaces were found in the Cambridge Greensand at Swaffham.

Pontocypris triquetra (Jones).

Bairdia triquetra, Jones, 1849, Monogr. Entom. Cret. p. 27, pl. vi. figs. 19 a-c.

Pontocypris triquetra, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. p. 4, pl. iii. figs. 22-24, 35-37.

A well-distributed form, but apparently always rare. It has been found in the Gault of Folkestone in zones v., vi., x., and xiii.; in the Greensand (Cenomanian) of Blackdown, Devon; the "Chalk detritus"; and the Upper Chalk.

One carapace and a single valve were found at Swaffham.

* Chapman and Sherborn, Geol. Mag. vol. x. 1893, p. 346.—N.B. Zones xi. to xiii. were then included in one bed, zone xi. The writer now regards the Greensand seam at 20 feet from the top of the Gault at Folkestone as zone xii., whilst above this is zone xiii. See also Journ. R. Mic. Soc. 1898, p. 17.

Family Bairdiidæ.

BAIRDIA, M'Coy, 1844.

Bairdia subdeltoidea (Münster).

Cythere subdeltoidea, Münster, 1830, Jahrb. für Min. &c. p. 64, no. 13, 1835, p. 446.

Bairdia subdeltoidea, Jones, 1849, Mon. Ent. Cret. p. 23, pl. v. fig. 15; Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. pp. 5-7, pl. ii. figs. 31-34.

A well-known form throughout Cretaceous strata as well as in some Tertiary beds, *B. subdeltoidea* is already known from the Cambridge Greensand. It occurs in some abundance at Swaffham.

Bairdia Harrisiana, Jones.

Bairdia Harrisiana, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. p. 8, pl. ii. figs. 52-55.

With a range through the Gault to the Chalk, this species has been previously noted from the Cambridge Greensand.

Five carapaces of *B. Harrisiana* were found at Swaffham.

Bairdia Harrisiana, Jones, var. *amplior*, Jones and Hinde.

Bairdia Harrisiana, Jones, var. *amplior*, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. pp. 8, 9, pl. ii. fig. 57, pl. iv. fig. 4.

This variety was obtained by the above authors from the Chalk of Kent, and it is now represented for the first time from the Cambridge Greensand by two left valves, found at Swaffham.

MACROCYPRIS, G. S. Brady, 1867.

Macrocypris siliqua, Jones.

Macrocypris siliqua, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. p. 9, pl. ii. figs. 38-41.

We have hitherto known this species to occur in various beds of the Upper Cretaceous from the Upper Greensand to the Upper Chalk, as well as in the Eocene of Transylvania; but it has not occurred before in the beds now under notice, nor does it appear in the Gault.

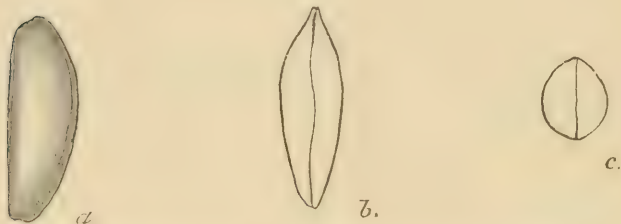
One carapace of *M. siliqua* was found at Swaffham.

Macrocypris simplex, sp. n. (Figs. 1 a-c.)

Carapace as seen from the side elongated, siliquose; height greatest just above the middle; ventral border incurved

towards the lowest third; the dorsal margin well arched; the extremities of the valves rather obliquely rounded, with the anterior broader than the posterior. Surface of valves well and evenly rounded. Edge-view long and acutely oval; end-view broadly oval. Length 1·3 millim.; height ·48 millim.; thickness ·38 millim.

Fig. 1.



Macrocypris simplex, sp. n. a, left side; b, ventral aspect; c, end aspect. $\times 20$.

This form comes nearest to *Macrocypris concinna*, J. & H.*, amongst Cretaceous species, but differs in being proportionately longer; its ventral margin is more distinctly incurved and the anterior extremity, as seen from the side, is more acute than in *M. concinna*. *Macrocypris setigera* of G. S. Brady † is, perhaps, the nearest in outline to the above species, but the ventral side of the recent form is nearly straight and the dorsal more strongly arched; the anterior end is also less acute in edge-view.

One carapace from the Greensand of Swaffham.

Macrocypris Muensteriana, Jones and Hinde.

Macrocypris Muensteriana, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. pp. 10, 11, pl. ii. figs. 42 and 45-47.

This species is already known from the White Chalk and the "Chalk detritus" of Kent, and also from the Gault of Meux's Well, London.

One carapace, measuring only ·475 millim. in length and probably a young form, was obtained from the Cambridge Greensand of Swaffham.

* Suppl. Mon. Cret. Entom. p. 11, pl. ii. figs. 66, 67.

† 'Challenger' Reports, 1850, Zoology, part iii. p. 43, pl. i. figs. 1 a-d.

BYTHOCYPRIS, G. S. Brady, 1880.

Bythocypris Brownei, Jones and Hinde.

Bythocypris Brownei, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. pp. 13, 14, pl. iii. figs. 38, 39, 42, 43.

One carapace of this rare form, occurring hitherto in the Chalk and the Chalk-rock, was obtained from the Cambridge Greensand of Swaffham.

Bythocypris Reussiana, Jones and Hinde.

Bythocypris Reussiana, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. p. 12, pl. ii. figs. 56 and 61-63.

This species has been described and noted from the Chalk, the "Chalk-detritus," and the Gault. One carapace was found in the Cambridge Greensand at Swaffham.

Bythocypris? iernica (Jones).

Bythocypris? iernica, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. pp. 14, 15, pl. iii. figs. 31, 32.

Formerly recorded from the Upper Chalk of the North of Ireland, this rare species is represented in the Cambridge-Greensand washings from Swaffham by one carapace.

Family Cytheridæ.

CYTHERE, Müller, 1785.

Cythere Harrisiana, Jones.

Cythere Harrisiana, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. pp. 16, 17, pl. i. figs. 47-52.

Several valves of the type-form occur in the Greensand washings from Swaffham.

This species has already been noticed in the Cambridge Greensand, and it ranges from the Lower Greensand to the Upper Chalk.

Cythere Harrisiana, Jones, var. *setosa*, Jones and Hinde.

Cythere Harrisiana, Jones and Sherborn, 1887, Geol. Mag. vol. iv. p. 452, woodcut fig. 1.

Cythere Harrisiana, var. *setosa*, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. pp. 17, 18, pl. i. figs. 43-45.

To this variety three of the valves found at Swaffham can be assigned. It was described by the above authors from the Gault of Kent and Surrey and the Chalk of Ireland, and

by Messrs. Jones and Sherborn from the London Clay of Piccadilly (Sherborn and Chapman coll.). In the Gault of Folkestone it occurred in the washings from zones iii., v., x., and xi.

Cythere Harrisiana, Jones, var. *reticosa*, Jones and Hinde.

Cythere Harrisiana, Jones, var. *reticosa*, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. p. 18, pl. i. fig. 46.

This variety was originally described from Gault specimens. At first sight it is perhaps difficult to separate this variety from those varieties of *Cythere Koninckiana*, Bosquet, which have a weak ornamentation; the surface of the carapace in *C. Harrisiana*, var. *reticosa*, is, however, merely pitted, whilst *C. Koninckiana* has a raised mesh-like ornament.

C. Harrisiana, var. *reticosa*, is represented in the series of Ostracoda from Swaffham by one valve only.

Cythere gaultina, Jones.

Cythere gaultina, Jones, 1849, Monogr. Entom. Cret. p. 17, pl. ii. figs. 7 a-c; Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. p. 18, pl. i. figs. 35, 36.

The specimens from Swaffham, of which five valves were found, are somewhat smaller than those found in the Gault of Kent and Surrey, but the surfaces of the valves are characteristically marked with the tessellated ornamentation and with the low pyramidal elevation.

Cythere gaultina, Jones, var. *excavata*, Chapman and Sherborn. (Figs. 2 a, b.)

Cythereis excavata, Chapman and Sherborn, 1893, Geol. Mag. vol. x. p. 348, pl. xiv. fig. 8.

This appears to be a variety of the type *C. gaultina*, but

Fig. 2.



Cythere gaultina, Jones, var. *excavata*, Chapman and Sherborn.
a, left valve; b, edge of valve. $\times 40$.

differs in the exaggerated form of the surface-ornament both

in the enlargement of the pits and of the marginal elevations; also the central area of the valve-surface is more depressed. The anterior border is flange-like, and within this runs a fenestrated ridge. From the invariably large size of the specimens it is just possible that we have here a senile form of *C. gaultina*; but since the specimens are so exceptionally rare and the carapace extraordinarily developed, it seems advisable to regard it as distinct, although indicating its relationship with *C. gaultina*.

One valve was found in the washings from Swaffham.

Cythere subtuberculata, sp. n. (Figs. 3 a, b.)

One of the valves from the Cambridge Greensand of Swaffham, perhaps somewhat allied to the foregoing species, *C. gaultina*, is rather more elongate than that species and

Fig. 3.



Cythere subtuberculata, sp. n. a, left valve; b, edge of valve. $\times 40$.

differs materially in the ornamentation by having the polygonal reticulation of the surface emphasized by extra shell-growth, tubercular processes being disposed along the dorsal border and towards the posterior extremity of the valve.

Cythere Koninckiana, Bosquet. (Figs. 4 a, b.)

Cythere Koninckiana, Bosquet, 1854, Mém. Comm. géol. Neerlande, vol. ii. p. 110, pl. ix. fig. 7; Chapman and Sherborn, 1893, Geol. Mag. vol. x. p. 346, pl. xiv. fig. 4 (non fig. 2).

Messrs. Jones and Hinde refer some specimens in my collection of Ostracoda from the Gault of Folkestone to this species (Suppl. Mon. pp. 52 and 61). None of them are quite comparable with Bosquet's figured specimens, but their relationship is sufficiently evident to warrant their association with this species.

The figures of *Cythere Koninckiana* and *C. lineatopunctata*

numbered 2 and 4 on the plate in the 'Geological Magazine' above referred to have been obviously transposed. Moreover the raised rim or mesh-wall surrounding the pittings, so

Fig. 4.



Cythere Koninckiana, Bosquet. *a*, left valve; *b*, edge of valve. $\times 40$.

characteristic of *C. Koninckiana*, is not very clear in the specimen from which the drawing was made.

This species is represented in the Cambridge Greensand by four separate valves and a carapace from Swaffham.

(Subgenus) CYTHEREIS, Jones, 1849.

Cythereis triplicata (Römer).

Cytherina triplicata, Römer, 1840, Verstein. norddeutsch. Kreidegeb. p. 104, pl. xvi. fig. 16.

Cythereis triplicata, Jones, 1849, Mon. Entom. Cret. p. 18, pl. iii. figs. 9*a-h*; Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. p. 19, pl. i. figs. 56-61.

This species, which ranges from the Gault to the Chalk, has been previously noticed in the Cambridge Greensand. It is fairly frequent in the Greensand of Swaffham.

Cythercis triplicata (Römer), var. *lineata*, Chapman and Sherborn.

Cythereis triplicata (Römer), var. *lineata*, Chapman and Sherborn, 1893, Geol. Mag. vol. x. p. 348, pl. xiv. fig. 5.

Four separate valves of this variety were found at Swaffham.

Cythereis auriculata (Cornuel).

Cythere auriculata, Cornuel, 1846, Mém. Soc. géol. France, sér. 2, vol. i. pt. 1, p. 200, pl. viii. figs. 14-16.

Cythereis auriculata, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. pp. 19, 20, pl. i. figs. 53-55.

This species seems to be well distributed through the Cretaceous formation, but is new to the Cambridge Greensand. It is somewhat common in the washings from Swaffham.

Cythereis quadrilatera (Römer).

Cytherina quadrilatera, Römer, 1840, Verstein. norddeutsch. Kreidegeb., p. 105, pl. xvi. fig. 19.

Cythereis quadrilatera, Jones, 1849, Mon. Entom. Cret. p. 18, pl. iii. figs. 10 *a-f*, pl. iv. figs. 10 *g-j*; Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. pp. 20, 21, pl. i. figs. 69-75.

This species is represented in the Cambridge Greensand of Swaffham by several well-grown individuals and numerous young specimens, which in some cases are difficult to separate from *C. Lonsdaleana*, Jones. It is a persistent form nearly throughout the Cretaceous formation, and it has also been recorded from the Great Oolite and Lower-Greensand beds of the Richmond well-boring. *Cythere orchidea* of Bosquet* is perhaps comparable with some young individuals of *Cythereis quadrilatera*.

Cythereis ornatissima (Reuss).

Cytherina ornatissima, Reuss, 1846, Verstein. böhm. Kreideform. pt. ii. p. 104, pl. xxiv. figs. 12, 18.

Cythereis ornatissima, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. pp. 21, 22, pl. ii. figs. 1-7, 15, 16, pl. iv. figs. 7, 8.

The earliest appearance of this species is in the Lower Greensand of Surrey (Chapman). It is a very characteristic form throughout the succeeding strata to the Chalk. It has been noticed in the Cambridge Greensand and it is not uncommon at Swaffham, although there, as in other strata, the varieties are more frequently met with.

Cythereis ornatissima (Reuss), var. *paupera*, Jones and Hinde.

Cythereis ornatissima (Reuss), var. *paupera*, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. p. 23, pl. ii. figs. 10, 11.

This variety has been obtained from the Chalk-rock. Several specimens were found in the Greensand of Swaffham.

Cythereis ornatissima (Reuss), var. *nuda*, Jones and Hinde.

Cythereis ornatissima (Reuss), var. *nuda*, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. pp. 23, 24, pl. i. fig. 76, pl. ii. figs. 9, 12-14, pl. iv. fig. 14.

The range of this variety is from the Gault to the Upper Chalk. It has also been observed in the Cambridge Greensand by Messrs. Jones and Sherborn (Vine coll.).

Three separate valves of this variety were found at Swaffham.

* Mém. Comm. géol. Neerlande, 1854, vol. ii. p. 98, pl. vi. *a-d*.

Cythereis ornatissima (Reuss), var. *reticulata*, Jones and Hinde.

Cythereis ornatissima (Reuss), var. *reticulata*, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. p. 24, pl. i. figs. 67, 68, 77, pl. iv. figs. 9-12.

This form is by far the commonest variety of the group of *Ostracoda* of which *C. ornatissima* is the type; and this is especially so of the lower part of the Upper Cretaceous, where it is apparently at home in the more shallow-water deposits of this part of the formation. In such deposits the carapace often exhibits a striking redundancy of shell-growth.

Its earliest appearance is probably in the Lower Greensand of Surrey, and its range extends to the Upper Chalk.

C. ornatissima, var. *reticulata*, has already been recorded from the Cambridge Greensand, and it is very common in the material from Swaffham.

Cythereis ornatissima (Reuss), var. *radiata*, Jones and Hinde.

Cythereis ornatissima (Reuss), var. *radiata*, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. p. 25, pl. iv. fig. 13.

This unique variety was described by the above authors from a specimen in the Vine collection from the Cambridge Greensand.

It has not been met with at Swaffham.

Cythereis ornatissima (Reuss), var. *stricta*, Jones and Hinde.

Cythereis ornatissima (Reuss), var. *stricta*, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. p. 25, pl. i. fig. 63.

Previously described from the Chalk-marl of Didcot and the Upper Chalk of Swanscombe. It is represented in the series from Swaffham by three individuals.

Cythereis Wrightii, Jones and Hinde, var. *aculeata*, Chapman and Sherborn.

Cythereis Wrightii, Jones and Hinde, var. *aculeata*, Chapman and Sherborn, 1893, Geol. Mag. vol. x. p. 349, pl. xiv. fig. 9.

The original specimens were from the Gault of Folkestone.

One specimen of *C. Wrightii*, var. *aculeata*, was found in the Cambridge Greensand of Swaffham.

Cythereis tuberosa, Jones and Hinde.

Cythereis tuberosa, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. p. 26, pl. iii. figs. 2, 3.

A specimen resembling very closely that originally described and figured from the Upper Chalk of Norfolk was found in the Greensand of Swaffham.

Cythereis Lonsdaleana, Jones.

Cythereis Lonsdaleana, Jones, Mon. Entom. Cret. 1849, p. 20, pl. v. figs. 12 a-c; Suppl. Mon. Cret. Entom. 1890, p. 27, pl. i. figs. 40-42, 64-66.

This species has been noticed in strata as old as the Upper Oolite; it also occurs in the Lower Greensand of Surrey and in the Chalk-rock and Upper Chalk.

One undoubted specimen was found in the Cambridge Greensand of Swaffham.

CYTHERIDEA, Bosquet, 1852.

Cytheridea perforata (Römer).

Cytherina perforata, Römer, 1838, Neues Jahrb. für Min. &c. p. 516, pl. vi. fig. 11.

Cytheridea perforata, Jones, 1857, Mon. Tert. Entom. p. 44, pl. iv. fig. 14; Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. p. 29, pl. i. figs. 1-4.

This familiar and widely distributed species has a geological range extending from the Gault (and possibly the Upper Oolite) to the Oligocene of Colwell Bay. It is already known as a Cambridge Greensand fossil.

C. perforata is a common form in the series from the Greensand of Swaffham.

CYTHEROPTERON, G. O. Sars, 1865.

Cytheropteron concentricum (Reuss).

Cytherina concentrica, Reuss, 1846, Verstein. böhm. Kreideform. pt. ii. pp. 104, 105, pl. xxiv. figs. 22 a-c.

Cytheropteron concentricum, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. pp. 31, 32, pl. i. figs. 5-10, pl. iv. fig. 19.

This striking and very variable form is found in strata of Lower-Greensand age in Surrey, and also in the Neocomian of Haute-Marne, France, and from thence its range extends to the Upper Chalk.

It has already been noticed in the Cambridge Greensand. In the material from Swaffham it is very abundant, and presents a remarkable series of variations in the ornament of the surface, ranging from those with delicate pittings and the prickly meshwork in concentric lines to others with a relatively coarse and wrinkled surface of sinuous furrows, but without the punctules.

Cytheropteron concentricum (Reuss), var. *virginica*, Jones.

Cythere punctatula (non Römer), var. *virginica*, Jones, 1849, Mon. Entom. Cret. p. 12, pl. i. fig. 2 n.

Cytheropteron concentricum, var. *virginica*, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. pp. 32, 33, pl. i. figs. 14-17.

This is a feebly marked, or even smooth, variety of the preceding species. One of the carapaces from Swaffham is translucent and most delicately marked with a minute punctation; other specimens from the same locality show a slight wrinkling on an otherwise smooth surface. *C. concentricum*, var. *virginica*, has already been recorded from the Cambridge Greensand, and it occurs with some frequency at Swaffham.

Its geological range extends from the Lower Greensand to the Upper Chalk.

Cytheropteron sphenoides (Reuss).

Cythere sphenoides, Reuss, 1854, Denkschr. Akad. Wiss. Wien, math.-nat. Class. vol. vii. p. 141, pl. xxvi. fig. 2.

Cytheropteron sphenoides, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. pp. 33, 34, pl. i. figs. 18-20.

One specimen only of this *Cytheropteron* was found in the Cambridge Greensand of Swaffham. It had previously been recorded from the Chalk-rock in this country.

Cytheropteron cuspidatum, Jones and Hinde, var. *montuosa* (Jones).

Cythere (*Cythereis*) *montuosa*, Jones, MS., 1875, Syst. Lists &c., Belfast Nat. Field Club, vol. i., Appendix iii. pp. 81, 92.

Cytheropteron cuspidatum, var. *montuosa*, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. p. 38, pl. iii. figs. 14-16.

One valve, agreeing very closely with the above authors' figured specimen in the arrangement of the prominences on the carapace, was found in the Cambridge Greensand at Swaffham. The previously recorded specimens were from the Greensand of Warminster and the Antrim Chalk.

Cytheropteron umbonatum (Williamson), var. *acanthoptera* (Marsson).

Cythere acanthoptera, Marsson, 1880, Mittheil. naturw. Ver. Neu-Vorpommern und Rügen, p. 45, pl. iii. figs. 14 a-c.

Cytheropteron umbonatum (Will.), var. *acanthoptera* (Marsson), Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. p. 41, pl. i. figs. 11-13, pl. iv. figs. 22-29.

This variety has not hitherto been found below the Chalk-rock. The Cambridge-Greensand specimens show a marked

tumidity of the carapace, with a deep dorsal furrow and a prickly surface, thus agreeing in all particulars with the specimens found by Messrs. Jones and Hinde rather than with those from Rügen.

Two valves of this variety were found at Swaffham.

Cytheropteron umbonatum (Will.), var. *longispinata*,
Jones and Hinde.

Cythere umbonata, Marsson, 1883, Mittheil. naturw. Ver. Neu-Vorpommern und Rügen, p. 45, pl. iii. figs. 15 a-c.

Cytheropteron umbonatum (Will.), var. *longispinata*, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. pp. 41, 42, pl. iii. figs. 11-13, pl. iv. figs. 30, 31.

One specimen, with the spine damaged, was found in the Cambridge Greensand at Swaffham. It has hitherto been observed in the Gault of Folkestone, zones iii., iv., and v. (Chapman and Sherborn); in the Chalk of Surrey and Norfolk (Jones and Hinde); and in the White Chalk of Rügen (Marsson).

Family **Cytherellidæ**.

CYTHERELLA, Jones, 1849.

Cytherella ovata (Römer).

Cytherina ovata, Römer, 1840, Verstein. nordd. Kreidegeb. p. 104, pl. xvi. fig. 21.

Cytherella ovata, Jones, 1849, Mon. Entom. Cret. p. 28, pl. vii. figs. 24 a-i; Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. pp. 44, 45, pl. iii. figs. 48-54, pl. iv. fig. 39.

This widely distributed Cretaceous form has been found in this country in the Gault at Folkestone, occurring in all the zones, the Cambridge Greensand, and upward through most of the beds to the top of the Chalk. It is one of the commonest forms of the Ostracoda in the material from Swaffham.

Cytherella obovata, Jones and Hinde.

Cytherella obovata, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. p. 46, pl. iii. figs. 46, 47.

C. obovata was originally described from the Chalk of Kent, and it has since been found in other strata at different localities, notably from the Chalk-marl of Arlesey, the base of the Upper Chalk at Southerham, and the *Micraster* Chalk of Swanscombe.

Four separate valves were found in the Cambridge Greensand of Swaffham.

Cytherella Muensteri (Römer).

Cytherina Muensteri, Römer, 1838, Neues Jahrb. für. Min. &c. p. 516, pl. vi. fig. 13.

Cytherella Muensteri, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. pp. 46, 47, pl. iii. figs. 63-67.

The geological range of this common Cretaceous form is from the Gault to the Upper Chalk, and somewhat similar specimens have also been found in the Eocene beds of Bracklesham Bay, Sussex.

C. Muensteri is already known from the Cambridge Greensand, and it is common at Swaffham.

It is probable that the specimen recorded from the Gault of Folkestone as *Cytheropteron folkestoniense** is a deformed or unusual variety of the above species of *Cytherella*. There is a somewhat similar variation shown in Dr. G. S. Brady's Report on the 'Challenger' Ostracoda † in the species *Cytherella punctata*, Brady, and referred to as the young form by that author.

Cytherella Williamsoniana, Jones.

Cytherella Williamsoniana, Jones, 1849, Mon. Entom. Cret. p. 31, pl. vii. figs. 26*a-h* (and fig. 26*i*, var.); Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. p. 48, pl. iii. figs. 55-62.

This species begins to make its appearance in the Gault formation as far down as zone v. at Folkestone. The type form is found through all succeeding strata to the Upper Chalk. It has not been found before in the Cambridge Greensand. At Swaffham it is of frequent occurrence.

Cytherella Williamsoniana, Jones, var. *stricta*,
Jones and Hinde.

Cytherella Williamsoniana, Jones, var. *stricta*, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. pp. 48, 49, pl. iii. fig. 71.

The carapace of this variety generally exhibits a greater proportionate length than the type form, as well as having distinctive sharp ridges. It is fairly common in the Greensand at Swaffham.

C. Williamsoniana, var. *stricta*, was originally described from Gault specimens. In that formation it begins to make its appearance in zone v. at Folkestone.

* Geol. Mag. 1893, vol. x. p. 349, pl. xiv. fig. 13.

† 'Challenger' Reports, 1880, Zoology, part iii. p. 174, pl. xlv. fig. 4*e*.

Cytherella Chapmani, Jones and Hinde.

Cytherella Chapmani, Jones and Hinde, 1890, Suppl. Mon. Cret. Entom. p. 49, pl. iii. fig. 70.

A single valve, comparable with the specimens found in the Gault, occurred in the washings of Greensand from Swaffham. At Folkestone this species makes its appearance in zone iv., and was also found in zones v., vii., and viii.

In concluding these notes I must express my great obligations to Prof. Rupert Jones, F.R.S., who has given me the benefit of his extensive knowledge of these forms and many valuable suggestions herein incorporated.

The Foraminifera of the Cambridge Greensand will shortly be dealt with, in continuation of these notes on the Ostracoda.

The Genera and Species of Cambridge-Greensand Ostracoda, and their Occurrence in the Beds below and above that Horizon.

| | Upper Gault. | Chalk Marl. |
|--|--------------|-------------|
| Family CYPRIDIDÆ. | | |
| 1. <i>Paracypris siliqua</i> , <i>J. & H.</i> | * | * |
| 2. <i>Pontocypris Bosquetiana</i> , <i>J. & H.</i> | * | |
| 3. — <i>triquetra</i> (<i>Jones</i>) | * | |
| Family BAIRDIIDÆ. | | |
| 4. <i>Bairdia subdeltoidea</i> (<i>Münster</i>) | * | * |
| 5. — <i>Harrisiana</i> , <i>Jones</i> | * | * |
| 6. — —, var. <i>amplior</i> , <i>J. & H.</i> | | |
| 7. <i>Macrocypris siliqua</i> , <i>Jones</i> . | | |
| 8. — <i>simplex</i> , sp. n. | | |
| 9. — <i>Muensteriana</i> , <i>J. & H.</i> | | |
| 10. <i>Bythocypris Brownei</i> , <i>J. & H.</i> | .. | * |
| 11. — <i>Reussiana</i> , <i>J. & H.</i> | | |
| 12. — ? <i>iernica</i> (<i>Jones</i>). | | |
| Family CYTHERIDÆ. | | |
| 13. <i>Cythere Harrisiana</i> , <i>Jones</i> | * | |
| 14. — —, var. <i>setosa</i> , <i>J. & H.</i> | * | |

| | Upper Gault. | Chalk Marl. |
|--|--------------|-------------|
| 15. <i>Cythere Harrisiana</i> , var. <i>reticosa</i> , J. & H. | | |
| 16. — <i>gaultina</i> , Jones | * | |
| 17. — —, var. <i>excavata</i> , Chap. & Sherb. | * | |
| 18. — <i>subtuberculata</i> , sp. n. | | |
| 19. — <i>Koninckiana</i> , Bosquet | * | * |
| 20. <i>Cythereis triplicata</i> (Römer) | * | * |
| 21. — —, var. <i>lineata</i> , Chap. & Sherb. | * | |
| 22. — <i>auriculata</i> (Cornuel) | * | * |
| 23. — <i>quadrilatera</i> (Römer) | * | * |
| 24. — <i>ornatissima</i> (Reuss) | * | * |
| 25. — —, var. <i>paupera</i> , J. & H. | | * |
| 26. — —, var. <i>nuda</i> , J. & H. | * | |
| 27. — —, var. <i>reticulata</i> , J. & H. | * | * |
| 28. — —, var. <i>radiata</i> , J. & H. | | |
| 29. — —, var. <i>stricta</i> , J. & H. | * | |
| 30. — <i>Wrightii</i> , J. & H., var. <i>aculeata</i> , Chap. & Sherb. | | |
| 31. — <i>tuberosa</i> , J. & H. | | |
| 32. — <i>Lonsdaleana</i> , Jones | * | |
| 33. <i>Cytheridea perforata</i> (Römer) | * | * |
| 34. <i>Cytheropteron concentricum</i> (Reuss) | * | * |
| 35. — —, var. <i>virginea</i> , Jones. | | |
| 36. — <i>sphenoides</i> (Reuss). | | |
| 37. — <i>cuspidatum</i> , J. & H., var. <i>montuosa</i> (Jones). | | |
| 38. — <i>uslanianum</i> (Woll.), var. <i>acanthopygum</i> (Mason) | | * |
| 39. — —, var. <i>longipinna</i> , J. & H. | | |
| Family CYTHERELLIDÆ. | | |
| 40. <i>Cytherella ovata</i> (Römer) | * | * |
| 41. — <i>obovata</i> , J. & H. | | * |
| 42. — <i>Muensteri</i> (Römer) | * | * |
| 43. — <i>Williamsoniana</i> , Jones | * | * |
| 44. — —, var. <i>stricta</i> , J. & H. | * | * |
| 45. — <i>Chapmani</i> , J. & H. | * | |

XXXIX.—Description of a new Genus of Odonata.
By W. F. KIRBY, F.L.S., F.E.S.

LEPTHEMIA BLACKBURNI, McLachlan, has been represented in the Natural History Museum collection for some years by a broken specimen, which I had indicated as a new genus; but having lately received a good series of this species

from Mr. R. C. L. Perkins, who found the insect abundant in the Hawaiian Islands, I am at length able to characterize the genus.

Genus NESOGONIA.

Frontal tubercle broad, slightly concave at the extremity; eyes very large, contiguous for a short space. Abdomen considerably inflated at the base, the second and third segments carinated, joints 4 to 6 of about equal length, long and slender, expanded at the tip and slightly also at the base, and more or less contracted in the middle, the succeeding segments successively shorter. Wings long and moderately broad, shaped much as in *Eschna*: fore wings with 11 antenodal cross-nervules (exceptionally 10 or 12), the last only exceptionally continuous, and 9 (rarely 8) postnodal cross-nervules; sectors of the arculus stalked, nodal sector not waved, triangle rather broad, the outer side very oblique, the inner side slightly waved; triangle traversed, followed by three rows of cells increasing; no supratrangular nervules; subtriangular space consisting of 3 cells; one cross-nervule in the lower basal cell: hind wings broader than the fore wings; one (rarely two) cross-nervules in the lower basal cell; triangle free (exceptionally traversed by one or two nervules); a supra-triangular nervule occasionally present. On the hind wings the upper side of the triangle strikes the outer side considerably below the level of the lower sector of the arculus, instead of meeting the sector at an acute angle as in most dragonflies. The same thing is frequently observable in the fore wings too, but not invariably. Head and thorax very hairy, and even the abdomen visibly clothed with fine short hairs. Legs long, thickly clothed with rather long bristles and fine hairs. Claws toothed considerably before the tip.

Typical species:

Nesogonia Blackburni.

Lepthemis Blackburni, McLachlan, Ann. & Mag. Nat. Hist. (5) xii. p. 229 (1883), (6) x. p. 177 (1892).

Sympetrum Blackburni, Karsch, Berl. ent. Zeitschr. xxxiii. p. 373 (1890).

Orthetrum Blackburni, Kirby, Cat. Neur. Odon. p. 36 (1890).

Hab. Hawaiian Islands.

I need not describe this species here, especially as Mr. Perkins is about to publish a fuller account of it than has yet appeared, in his forthcoming work on the Insects of Hawaii.

He has given his consent to my publishing the present paper in advance of his own.

The insect appears to be most nearly related to the American genus *Leptemis*, to which it was originally referred by Mr. McLachlan, but it differs widely in the armature of the legs. From *Orthetrum sabina*, Drury (a rather aberrant species in its genus), with which it has considerable external resemblance, it differs in the absence of supra-triangular nervules, the usually discontinuous last antenodal cross-nervule of the fore wings, and the much broader triangle of the fore wings. From *Sympetrum*, which it resembles in the shape of the triangle of the fore wings and in the upper-side of the triangle of the hind wings being distinctly separated from the lower sector of the arculus, it differs in the much longer wings, with much more numerous cross-nervures, and the long slender abdomen, much more distinctly inflated at the base. I am unable to refer the species to any of the foregoing genera, and therefore think it best to propose a new one for it without further delay.

XI.—*Descriptions of Three new Species of Spiders of the Genus Selenops, Latr.* By R. I. POCKOCK.

Selenops oculatus, sp. n.

Colour (specimen rubbed).—Carapace pale castaneous, with greyish-white hairs at the sides; eyes surrounded with black pigment; legs bright ochre-yellow, with indistinct dark bands on tibiæ; abdomen testaceous, with yellowish-white hairs above.

Carapace much higher than in *S. radiatus*, a little wider than long, its length equal to length of protarsus of fourth leg, barely equal to length of tibia of either second, third, or fourth leg. Four median *eyes* close together and forming a strongly recurved line, the inferior edge of the posteriors a little higher than those of the anteriors, about on a level with their centres; the posteriors much larger, about twice the diameter of the anteriors; distance between the anteriors equal to about half their diameter, but twice as great as that between the anteriors and posteriors; anterior lateral eyes on a level with inferior edge of anterior medians; posterior laterals very large and prominent, their diameter at least one third greater than that of the posterior medians, a little more than their own diameter above the inferior margin of the carapace.

Legs long, those of the fourth pair, measured from base of femur, four times as long as carapace; tarsi of second, third, and fourth pairs, although rubbed, apparently not scopulate; tibia of second with three pairs of inferior spines, protarsus with two pairs (first legs absent).

Vulva formed on the same plan as in *S. radiatus*, but with the two lappets forming the area behind the heart-shaped fovea much longer (fig. 1).

Measurements in millimetres.—Total length 12; length of carapace 5, of second leg 22, of third and fourth 21.

Loc. Hadramaut, Arabia.

A single specimen collected by Dr. Anderson's collector during the expedition of the late Mr. Theodore Bent into the Hadramaut.

Although resembling *S. radiatus* and others in the spine-armature of its leg, this new species more nearly approaches the South-African species *S. atomarius* and *Spenceri* in the arrangement of its eyes. These organs, however, differ in relative size and position from those of all the species known to me.



Vulva of (1) *S. oculus*, (2) *S. vigilans*, (3) *S. Kraussii*.

Selenops vigilans, sp. n.

Coloured as in *S. radiatus*, which it closely resembles structurally, with the same spine-armature of the first and second leg—that is to say, with three pairs of spines on the underside of the tibiæ and two pairs on the protarsi; but the posterior median eyes are larger as compared with the anterior medians, are much closer to them and form a more strongly recurved line; the posterior lateral eyes are also larger and more prominent.

Vulva very different from that of *S. radiatus*, the lateral lobes being widely separated behind by a prolongation of the median sclerite (fig. 2).

Measurements in millimetres.—Total length 14; length of carapace 6.2, of first leg 20, of fourth leg 21.

Loc. Giriama, near Fuladoya, Masailand (*J. W. Gregory*).

Selenops Kraussii, sp. n.

In size and colour much resembling *S. radiatus*, Latr.; the legs strongly banded, femora with three black stripes, tibiae with two.

Eyes of very nearly the same relative size and position as in *S. vigilans*, the four medians more strongly recurved than in *radiatus*, the posteriors very noticeably larger than the anteriors, the diameter being nearly one third longer; a line touching the lower rims of the posteriors would pass about through the centres of the anteriors; posterior lateral eyes not so prominent as in *vigilans*.

Tibiae of first and second legs with five or six pairs of spines below; protarsus with three pairs.

Vulva as in fig. 3, the median area not so wide as in *radiatus* and passing posteriorly between the lateral lobes or lappets, which thus do not unite.

Loc. Cape Colony (*Dr. Krauss*).

Allied to *S. atomarius*, Simon, from Port Elizabeth (Bull. Soc. Zool. France, xii. p. 466, 1887), in the spine-armature of the legs, but with the four median eyes much less strongly recurved and farther apart, the anterior laterals closer to the edge of the clypeus, &c. (see Hist. Nat. Araignées, ii. pl. i. p. 25).

S. fugitivus of Walckenaer (Ins. Apt. i. p. 546), from Caffraria, may be identical either with *S. atomarius*, *S. Spenceri*, or *S. Kraussii*, or with neither.

The Tropical-African species of *Selenops* known to me may be distinguished as follows:—

- a. Protarsus of legs of first and second pairs with 2 pairs of spines; tibia with 3 pairs.
- a¹. Lateral lobes of vulva meeting, or almost so, in the middle line and circumscribing a heart-shaped area; four median eyes subequal in size, less strongly recurved, the posterior farther from the medians *radiatus*, Latr.
- b¹. Lateral lobes of vulva widely separated posteriorly; four median eyes noticeably unequal in size, the posteriors larger than the anteriors and closer to them *vigilans*, sp. n.
- b. Protarsus of first and second legs with 3 pairs of spines; tibia with 5-7 pairs.
- a². Tibia with 7 pairs of spines; lobes of vulva fusing posteriorly and circumscribing an oval heart-shaped area, behind which they form a broad plate; eyes of ocular quadrangle very strongly recurved, posteriors much larger than the medians, lower rim of posteriors on a level with upper rim of anteriors *Spenceri*, Poc

- ♂². Tibiæ with 5-6 pairs of spines; lobes of vulva separated posteriorly by a prolongation of the median sclerite; eyes of ocular quadrangle much less strongly recurved, inferior edge of posteriors on a level with centre of anteriors *Kraussii*.

The British Museum has examples of *S. radiatus*, Latr. (= *egyptiacus*, Aud.) from the following localities in Tropical Africa:—E. Africa (*Capt. Speke*); Kinyamhola, Lake Tanganyika (*W. H. Nutt*); Nyika plateau, Nyasaland, 6000-7000 feet (*H. H. Johnston*). We also possess many examples from the following localities:—Cape Verde Islands (*Lieut. Boyer* and *F. O. P. Cambridge*); Bushire (*Karachi Mus.*); Bareilly, India (*G. T. P. Cambridge*); Dahanee, Thana District (*A. G. Edie*); and Tharrawaddy (*E. W. Oates*). The specimens from Tharrawaddy were described by Thorell as *S. birmanicus*.

MISCELLANEOUS.

On the Geographical Distribution and the Evolution of Peripatus.
(Preliminary Note.) By E.-L. BOUVIER.

THE Onychophora are the terrestrial Articulata which approach most nearly to the Annelids; zoologists are to-day unanimous in considering them as very primitive animals, and, although their remains are unknown in the fossil state, it seems natural to trace back their appearance to a very distant epoch. Distributed in America (Antilles, Central, and a portion of South America), Africa (in the region of the Cape), and in Oceania (from Eastern Australia into New Zealand), they have been considered hitherto as very distinct one from the other according to the area which they occupy; and Mr. Pocock, attributing this fact to their great antiquity, has taken the step of dividing them into three genera, each of which would be peculiar to one of the three geographical zones mentioned above.

The object of this note is to show that this narrow localization does not exist, and that the Onychophora have undergone progressive evolution in the course of the ages, while they receded from their centre of origin.

The specimens which have enabled me to attack this problem were collected in Africa by the lamented M. Thollon, who presented them to the Paris Museum; they belong to a new species, which I propose to call *Peripatus Tholloni*, in memory of the brave and unfortunate explorer by whom it was discovered.

Since this curious species is intermediate between the American forms and those of the Cape, I shall pass successively in review the characters which have rendered it possible, up to the present day, to distinguish the species from the various regions.

(1) *Geographical Distribution*.—*Peripatus Tholloni* comes from the Gaboon, that is to say, from a zone intermediate between the Cape and the parts of America where *Peripatus* is found. These animals had hitherto remained unknown in this region.

(2) *Number of Limbs*.—The American species have many more limbs than the others, generally from 27 to 42 pairs, and, moreover, the number of these appendages varies in different individuals: in the African and Oceanian forms it appears constant for each species; there are from 17 (14?) to 21 pairs in the case of the former and 15 pairs in the latter. In *P. Tholloni* the number of limbs is 24 or 25 pairs.

(3) *Rudimentary Limbs, position of the Sexual Orifice*.—In the American species the genital orifice is situated between the limbs of the penultimate pair, and the limbs of the posterior pair, which are slightly smaller than the rest, have only two arches of spinules instead of four. In the species from the Cape the orifice is subterminal and situated far behind the posterior limbs, which are not modified; in the Oceanian forms the orifice is found at a fairly long distance from the anus, between the posterior limbs, which are also normal. In *P. Tholloni* the genital aperture occupies the same place as in the American species, but the last pair of limbs, which is furnished with only two arches, is still more reduced; it is clear that this pair has atrophied in the Oceanian species and that the two posterior pairs have disappeared in *P. capensis*. From this point of view mention must be made of a species from the Cape, *P. Balfouri*, in which the genital orifice, situated near the anus, is found between the greatly reduced posterior limbs, which correspond to the penultimate pair of appendages of *P. Tholloni* and the American species.

(4) *Structure of the Limbs*.—The limbs of the American species are furnished near their extremity with four spinulous arches; in the species from the Cape and from Oceania the proximal arch no longer exists, and only three arches are to be seen. The same applies to *P. Tholloni*. Moreover, in this species, as in the Australian forms, we do not find papillæ at the base of the pedal portion of the limbs, whereas two of these papillæ exist in the case of the species of *Peripatus* from America and the Cape.

(5) *Nephridial Pores of the Fourth and Fifth Limbs*.—On the limbs of the fourth and fifth pairs the nephridial pore is found included between the two proximal spinulous arches in the case of the American species. In *P. Tholloni* it occupies the same place, but, the proximal arch having disappeared, it appears to lie outside the arches, and even makes a slight indentation in the first of these. In the Oceanian species the indentation is much more pronounced, and the nephridial papilla is found to be almost entirely included in the arch; lastly, in the species from the Cape the papilla lies completely in the centre of the latter.

(6) *Wrinkles on the Body*.—In the American species the wrinkles on the body are not interrupted on the dorsal median line and are

composed of a single row of papillæ; in the species from the Cape they exhibit a solution of continuity in the middle of the back and usually comprise several rows of papillæ. *P. Tholloni* has continuous wrinkles like those of the American species, but it exhibits in each wrinkle one or two rows of little accessory papillæ.

(7) *Jaws*.—In the American species the two blades of each jaw are provided with an accessory tooth on the inner margin of the principal tooth; moreover, the inner maxillary blade is armed with a long row of denticles. In the species from the Cape the accessory tooth disappears on the inner blade, and the denticles of this blade are much less numerous; the same applies to the Oceanian forms, but here the accessory tooth disappears on the outer blade also. In *P. Tholloni* the jaws are of the same type as those of the American species.

It results from the foregoing that *P. Tholloni* constitutes the transition between the American species of *Peripatus* and those of South Africa. More closely related to the former, it must be regarded as having originated from the American species of *Peripatus*, which gradually spread towards the East at an epoch at which a continental barrier still united the New World to the Old. In proportion as this eastward dispersion of *Peripatus* came to pass, the evolution of these animals accentuated itself in a determined direction: the limbs atrophied in succession posteriorly, and, at the same time, their number became more and more constant; the proximal spinulous arches followed, up to a certain point, the same regressive course; the nephridial papille of two pairs of limbs advanced by degrees towards the following arch; the wrinkles in the skin became more complicated, then interrupted on the dorsal median line; lastly, the dentiform armature of the jaws underwent successive reduction.

Since, in many respects, the species belonging to Oceania mark the present limit of the evolution of the Onychophora, it would be possible to believe that the species of *Peripatus* of this region are derived from African species which had emigrated eastwards in geological times. But since certain characters of these animals are somewhat primitive (position of the sexual orifice and of the nephridial pores of the fourth and fifth limbs), we may also suppose that the dispersal of the group took place in both directions at the same time—towards the east in the case of Africa and towards the west as regards Australia and the adjacent regions. The study of the Chilian *Peripatus* will perhaps enable us to solve this problem.

In any case, it appears to be quite certain that Central America and the Caribbean Region have been the centre of origin and migration of the species of *Peripatus*; their dispersion towards the East is likewise scarcely open to doubt, and we must expect to discover them in all the tropical portions of West Africa, at least as far as the region of the Cape Verd Islands.--*Comptes Rendus*, t. cxxvi, No. 19 (May 9, 1898), pp. 1358-1361.

New Observations on Peripatus.

By E.-L. BOUVIER.

The object of the Note which I recently published in the 'Comptes Rendus de l'Académie des Sciences'* was to show that *Peripatus* is probably of American origin and that transitional forms exist between the species belonging to the New World and those that occur in the Old; to-day my purpose is to make known a new *Peripatus*, the peculiar interest of which is that it clearly demonstrates the characteristics of the most primitive representatives of the genus.

This *Peripatus* belongs, like *P. Tholloni*, to the collection of the Paris Museum; it was obtained at Popayan, in New Granada (Colombia), by a traveller whose name has escaped us. Captured in a house, it had ejected a copious fluid from its posterior tentacles, and was found to be partially enclosed in this secretion, which had been coagulated by the alcohol in which the specimen was preserved.

Difficult as it is to separate one from another in the case of the majority of the American species, the present form possesses some eminently characteristic features.

In the general form of the body the animal somewhat resembles *Peripatus Mosleyi*: it presents a great and regular expansion from the extremities to the middle, at which point its diameter amounts to 8.8 millim.; its total length, excluding the tentacles, is 73 millim.

The transverse wrinkles in the integument are not interrupted on the dorsal median line, which is depressed, but they become perceptibly attenuated there; on the back they are adorned with little conical and transversely elongated papillæ, which form several irregular rows in each furrow; here and there these rows are interrupted by very large conical or sub-cylindrical papillæ, which occupy the entire width of the furrow. These large papillæ are few in number and resemble warts scattered about on the integument of the animal; more abundant and slightly reduced in size in the neighbourhood of the limbs, they are entirely wanting on the ventral surface and on the appendages, and are replaced in these regions by papillæ similar to those of *Peripatus Edwardsii*.

The antennæ are scarcely dilated in front and exhibit about forty-seven rings. Including the large internal tooth the number of teeth on each jaw is four; on the inner jaw we find, in addition, a row of five or six smaller teeth. No known species exhibits so complicated a dental armature.

The number of pairs of limbs is thirty-seven; we know that there are as many as thirty-six in *Peripatus quitensis*, Schmarda, and more than forty in *P. torquatus*, Kennel. They are very much flattened in the antero-posterior direction, almost laminiform, and, although this appearance may be partly due to the action of the alcohol, it is certain that the living animal must attract attention

* *Vide supra*, p. 351.

owing to the flattened and, up to a certain point, annelidan form of its appendages. Moreover, this is not the only interesting peculiarity exhibited by the latter. Their horseshoe-shaped spinulous arches are five in number, and sometimes there may even be observed the indications of a sixth arch; the limbs belonging to the penultimate and antepenultimate pairs have only four of these arches, like the normal limbs of the other American species, and those of the last pair, as usual, have no more than two. The portion of the limbs which terminates in the claws is no less well characterized, for it bears at the tip two papillæ in front and two behind, while the other species of *Peripatus* have only one papilla on the posterior portion of their appendages.

The pit with a delicate lining exhibited by the limbs on their ventral surface is at least as well developed as in the other American species; but the nephridial pores on the limbs of the fourth and fifth pairs have a slightly different situation: they occasion a deep notch and even a break of continuity in the intermediate spinulous arch. In reality they occupy the very place where they are found in all the species of *Peripatus*.

The genital orifice is enclosed between the limbs of the penultimate pair, as in the other American species.

The specimen that I have studied belongs to the female sex; it had no embryos in its uteri.

In its very numerous and flattened limbs, the complex armature of its jaws, the four papillæ, and the five spinulous arches of its extremities this species exhibits characters more primitive than those found in any other *Peripatus*, and consequently presents a greater resemblance to the annelidan form whence the group is derived. Since it is besides very easily recognizable owing to the great tuberculiform papillæ which are borne on the dorsal surface, I propose to designate it *Peripatus tuberculatus*.—*Comptes Rendus*, t. cxxvi. No. 21 (May 23, 1898), pp. 1524–1525.

On the Presence of the Common Eel in the Open Sea.

By LÉON VAILLANT.

In the collections handed over by His Serene Highness Prince Albert of Monaco to the Ichthyological Laboratory of the Muséum d'Histoire naturelle there is a fish which is rendered curious owing to the circumstances under which it was obtained. It was removed by Captain Chaves, Director of the Observatory of Punta Delgada, from the stomach of a Cachalot, and, as we know, these Cetodonts feed upon lower animals, especially Cephalopods, the remains of which are met with in their alimentary canal, to the exclusion, as it seems, of all other prey.

The fish, which is eel-like in shape, is about 90 centimetres in length and of the thickness of a man's arm; its weight may be estimated at 1500 or 2000 grammes; the action of the digestive juices has had but little effect upon it, so that it is possible to determine its characters very precisely. It is an Apod; the osseous

tissue, examined on one side and on the transverse apophysis of a vertebra, exhibits genuine osteoplasts; the vomer is intimately united with the intermaxillæ to form a single mass, and the maxillæ, greatly elongated and armed with fine teeth of uniform size, enter into the composition of the upper jaw—peculiarities which agree very exactly with the characteristics of the suborder to which I assign this fish; moreover, no ventral fins are to be seen; the pectoral fins, which are very distinct, are situated behind a narrow lateral branchial orifice.

For the determination of the genus an important character is to be drawn from the presence of scales, of the form which is habitual in this group when they occur, that is to say of the subepidermic type. Five genera may be quoted as being provided with these organs, namely *Simenchelys*, *Hypophis*, *Histiobranchus*, *Synaphobranchus*, and *Anguilla*. In the case of the first three the dorsal fin commences very far forwards, above the pectoral fin or very little behind it; in the present specimen it arises 27 centimetres from the snout, that is to say towards the anterior third of the body, at more than twice the length of the head behind the branchial orifice. In *Synaphobranchus* the branchial orifices are united in a common pit on the ventral median line. The individual under examination therefore belongs to the genus *Anguilla*—a conclusion which is also confirmed by the other characters. It must even, without entering into more ample details, be regarded as resembling the Common Eel (*Anguilla anguilla*, Linn.).

This capture, under such circumstances, not only confirms the incontestable fact that the Eel descends to the sea, but also shows that in certain cases after arrival there it advances sufficiently far to become the prey of animals which only live out at sea, like the great Cetaceans. On the other hand, it has been supposed by several ichthyologists that the individuals of unusually large size, exceeding 500 to 800 grammes in weight, which are met with from time to time in ponds, must be regarded as sterile females which have taken up their abode permanently in fresh water; the observation of Captain Chaves would oppose this hypothesis.

In consideration of the obscurity which still surrounds the mode of reproduction of this species, the fact is worthy of attracting attention, for I believe that no analogous case has been mentioned, the presence of Eels in their annual migration having been substantiated hitherto, in salt water, only at the mouth of watercourses and in absolutely littoral regions, never in the open sea. It may be that they then form part of that pelagic fauna, which never appears at the surface and likewise never touches the bottom—a fauna of the existence of which the discoveries already made by His Serene Highness Prince Albert of Monaco, under analogous circumstances*, enable us to-day to catch a glimpse.—*Comptes Rendus*, t. cxxvi. No. 20 (May 16, 1898), pp. 1429–1430.

* "Notes sur un Cachalot" (Bull. Muséum Hist. nat. t. i. p. 305, December 24, 1895).

THE ANNALS

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[SEVENTH SERIES.]

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XLI.—*Some new or rare Parasitic Copepods found on Fish in the Indo-Tropic Region.* By P. W. BASSETT-SMITH, Staff-Surgeon R.N., F.R.M.S., F.Z.S.

[Plates X.-XII.]

IN this paper, following two others published in the 'Annals,' I have adduced a few more interesting new forms of these parasitic animals, and also examples of some in which one sex alone has been described. With constant examination of the fresh fish at the markets and at the places where they were landed there was found no dearth of material to work upon; in fact, one is astonished at the great number and variety which are discovered, also how particularly prolific some fish are—the genus *Caranx* being the most noticeable; it was very rare not to find one or more species on a fish: from the inside of the operculum or attached to the head-kidney might be obtained *Caligus tenax*, Hell., *C. carangis*, Kr., *C. robustus*, sp. n.; and on *Caranx djeduba*, *Bomolochus megaceros*, Hell; attached to the gills themselves *Lernanthropus giganteus*, Koll., or a second undescribed species found on *Caranx Rottleri*, the long dark-coloured egg-tubes making them very apparent; once on the surface-skin of a large *Caranx* I found specimens of a fourth species of *Caligus*

(*Caligus longipedis*, sp. n.); on the tongue of *Caranx djedaba* was frequently found an ulcerated patch of mucous membrane covered by a small variety? of *C. tenax*; on the roof of the mouth of another species (*Caranx jerdoni*) were seen the tumours produced by *Caligodes carangis*, sp. n., and once I found the chitinous head and neck of a *Lernæa* deeply buried in the roof of the mouth, the body having rotted away.

In contradistinction to these stand out the fish of the family Sparidae, which have strong crushing-teeth in the jaws; I very rarely found any parasites in these fish, the different character of the food, perhaps, causing the peculiarity.

The sharks have many parasites, as described by Krøyer, Steenstrup and Lütken, M.-Edwards, Leach, Van Beneden, Heller, &c.; but, though there are plenty of these fish in the waters round Aden, it was rarely one saw them before the surface had become too dry &c. A female specimen of *Alebion carchariæ*, however, was found.

The genus *Lernæanthropus* appeared frequently, the regular flushing and pallor of the laminate processes representing the third and fourth thoracic feet at every vascular contraction make it evident that they act as branchiæ, as Hesse pointed out in his elaborately illustrated paper in 'Revue des Sciences Naturelles,' tome vii. (June 1878).

Ergasilidæ.

BOMOLOCHUS, Nordm.

Bomolochus megaceros, Hell. (Pl. X. fig. 1.)

As the male of this species has not been recorded, nor has one of any other species of this genus, so far as I have been able to find in published works, been obtained, it seems worthy of placing here on note, especially as though I have examined a large number of the female *Bomolochus*, both living and dead, yet only once was a male discovered. The minute size renders them undoubtedly very difficult to see, and it is only when attached to the female, as occurred in this case, that they are likely to be found. The peculiar elegance of the anterior antennæ, and the large hooked maxilliped with which it firmly attaches itself, were remarkable, being very unlike those of the female, of a much less degraded type. The drawing was made very quickly after capture, but in preparing the specimen for a permanent preparation it was unfortunately spoilt; therefore there are many points which require further elucidation. The female *Bomolochus megaceros* I have taken from *Stromateus niger*, Bombay, Colombo, and

Beluchistan, and often on *Caranx djedaba*, Aden. The species is well defined and easily recognized.

Length 1 millim. Transparent.

Body distinctly segmented; the cephalothorax elongate, forming a solid carapace, followed by two free short thoracic segments and a large oval genital segment; the caudal portion is biarticulate, the first joint is almost square, the second elongated and tapering, carrying at its extremity two rather large caudal plates, each of these terminating in a very long strong simple bristle, having a minute hair at its base, and also a small one at the base of the caudal plate.

Anterior antennæ long, elegant, five-jointed, the first being short, carrying a long plumose hair on its under border; the second joint is very long, cylindrical, and tapering, bearing along its front border about twelve fine ciliated hairs and one long plumose hair near its termination; the third joint is about half the length of the last, with three plumose hairs near the end, one being extremely long; the fourth of much the same size, with two terminal plumose hairs; the last joint is half as long again as the fourth, terminating in six plumose hairs.

Posterior antennæ spring from close under the first; they are three-jointed, and resemble much the same organs in the female.

Second maxilliped is distinctly three-jointed, being very large and powerful; the basal joint is oval and muscular, the second broad and flattened, the surface being minutely granular, its front edge having a fine tooth about halfway down; the terminal joint is in the form of a long slender claw, with the concave edge minutely toothed; near the base of this and on the opposing joint one sees a fine bristle.

First, second, and third true limbs biramous, each branch three-jointed, the outer branch of the third bearing dentate spurs as in the female, all the others provided with ciliated hairs. Fifth pair uniramous, the terminal joint having its border fringed with fine hairs and terminating in three short thick ones.

Caligidæ.

CALIGUS, Müller.

Caligus longipedis, sp. n. (Pl. X. figs. 2, 3.)

This species was taken from the skin-surface of a *Caranx melampygus* at Aden; both the male and the female were obtained. In the gills of the same fish were present, especially in the neighbourhood of the gland, numbers of *C. tenax*,

Hell., *C. errangis*, Kr., and attached to the gills themselves many specimens of *Lernanthropus giganteus*, Kr.

This *Caligus* appears at first sight to resemble *C. infestans* of Heller (which I have found also out here attached to the gills of "*Cybbium Commersonii*"), but is quite distinct, my species being chiefly distinguished by the structure of the first maxilliped, the narrow flat furcula, the presence of only three joints on the fourth peræopod, the large caudal plates, and the surface being spotted with blue instead of red.

Female.—*Carapace* slightly broader than long, with obtusely rounded posterior angles, narrowing considerably in front, where it unites with the anterior cephalic segment; this is the frontal plate, rather deeply emarginate in the centre, but thick antero-posteriorly, the lunula being on the outer third, large and very conspicuous, extending the whole width of the plate.

Anterior antennæ: first joint equal in length to the width of the lunule, bearing about fourteen delicate plumose papillæ; second joint longer and slender, bearing at its end a number of fine hairs, with an isolated one on its posterior edge.

Second antennæ of moderate size, the terminal claw being rather slender, the spur from the basal joint being distinct.

Hamulus anterior long, narrow, and curved, springing from a globose base.

Palp large, sharp-pointed, rising from a bifid base and having a slight curve outwards.

First maxilliped has the basal joint of the usual shape, the second of a peculiar form, becoming broader at its termination, with the whole inferior border minutely crenate, almost dentate at the end; this joint terminates in two long curved processes, the outer being the longer and articulate.

Second maxilliped of comparatively very small size, the terminal claw being short and simple.

Furcula very distinct, though of only moderate size; from a dilated base with a narrow neck rise the two branches, which are nearly parallel to one another on the inner border, somewhat rounded on the outer, blunt-ended, and of an extremely flattened appearance, the width of the aperture being less than the length of the arms.

First peræopod of the usual form, the palmar joint carrying three short terminal claws, a slender bristle at the angle, and three moderately long plumose hairs from the under border.

Second peræopod of the usual form.

Third peræopod of very considerable size, the posterior

border of the apron extending over the upper part of the genital segment; the paddle-joints are placed some distance apart, the outer having four short plumose bristles on the inner border and three simple hairs on the outer, the penultimate joint having a long ciliated hair on the inner border and a short one on the outer side. Hamulus posterior rather long and slightly curved.

Posterior thoracic segment very large (about one third as long as broad), giving off the *fourth pereopods*, which are three-jointed and extremely long, extending as far as the caudal plates; the first joint is long and muscular, the second one third as long, giving off on its inner border a single slender curved claw nearly equal to the length of the terminal joint; this last ends in a pectiniform edge and three curved elongate claws placed close together near it, each of these having fine dentations at their bases.

Genital segment heart-shaped, about one third the length of the carapace and rather less broad.

Abdomen indistinctly two-jointed, equalling in length the last segment, the first joint being of a narrow oblong shape; the second is rather longer, broadening at its extremity, where it gives off the two caudal plates; these are very large, with narrow pedicles and square-cut extremities; the inner border runs nearly parallel to the outer and is covered with long cilia; these plates terminate in three long, straight, stout, plumose bristles and a shorter one on the outer border; the stout terminal bristles and caudal plates are pigmented blue; the egg-sacs are long and of a green colour in life.

Length 5 millim.

Male.—This differs from the female in being rather smaller, the carapace is narrower, the genital segment is oblong, the abdomen broader and more distinctly two-jointed, and the caudal plates are oval in shape: of the organs the *posterior antennae* are smaller, terminating in a very short hook; the *hamulus anterior* is longer and more robust; the second maxillipeds have a thicker basal joint, with a double tooth on its inner border, and the terminal claw-joint also has a minute tooth near its extremity.

Length 4·5 millim.

Caligus robustus, sp. n. (Pl. XI. figs. 1, 2.)

A large number of specimens of both sexes were found of this species freely moving about, generally on the inner side of the operculum or on the bony gill-rays of various species of *Caranx* and *Thynnus*, viz. *T. macropterus*, *C. affinis*, and *C. djedaba* at Trincomalee, and *C. Rottleri* at Aden.

This species bears a resemblance to *Caligus irritans*, Hell.*, having the double long-shaped posterior thoracic segment and elongated biarticulate abdomen; it may readily be differentiated by its broader, more arched carapace and strong four-jointed fourth pair of legs, besides many structural details; the male too varies considerably.

Female.—Colour pure white; oculi pink.

Carapace strongly arched upwards, considerably broader than long, narrowing rapidly anteriorly, posterior angles rounded, posterior median lobe broad, sulcus on each side moderately deep. Frontal plate narrow, its anterior edge almost straight; lunulae at the outer end shallow, small comparatively to those of *C. irritans*.

Anterior antenna having the first joint about equal in length to width of the lunula; second joint longer and club-shaped.

Second antenna of the usual form, but the terminal claw is more slender than in general.

Hamulus anterior very small, slightly curved; rostrum short.

Palp elongate, curved, with blunted end and an apparent constriction; but no bifurcation is seen near the extremity.

First maxillipeds of the usual form.

Second maxillipeds: these are very strong, the basal joint, both in young and old, having a very strong bifid tooth near the extremity of its inner border, to which the end of the strong terminal claw approximates; at the base of the latter is a fine hair on the concave border.

Furcula of moderate size; a long base with parallel sides and rounded extremity giving off direct two short, flattened, slightly divergent branches with blunted ends, the aperture between them being considerably more narrow than the length of the branch.

First pereopod has three short terminal claws, with three long plumose hairs on the under border of the last joint; but I have been unable to discover the usual simple bristle at the angle.

Second pereopod of the usual form, but the bent short claws on the upper border of the first and second joints of the outer branch are strong, and at the end of the last joint there is a very small spur, with a stronger one deeply fringed with fine hairs on the underside; plumose hairs from beneath as usual.

Third pereopod: paddle-joints rather widely separated, the

* 'Reise der Fregatte Novara,' pp. 177-179.

terminal joint of the outer with four ciliate hairs, increasing in length from without inwards; a longer one is seen from the inner side of the penultimate joint; the inner paddle has six plumose hairs on the last joint.

Hamulus with a dilated base and a short, thick, curved claw.

Fourth pereopods, rising from an elongate posterior thoracic segment, are robust in form, four-jointed, the basal joint being of a long oval shape, the three last of nearly equal size, the first two each giving off a strong claw; the last has three placed close together.

Genital segment heart-shaped, having a constriction above, giving the appearance of a double posterior thoracic segment; the whole length equals about two thirds that of the cephalothorax; the rudiments of the fifth pair of limbs are visible on the posterior rounded border.

Abdomen slightly longer than the last segment; it is very constricted at its origin, becoming rapidly broader to near the extremity, where there is another constriction, forming a joint as long as broad.

Caudal plates longer than broad, giving off three short terminal ciliate hairs and two smaller ones on the outer side.

Length 7-10 millim.

Male.—This is smaller, and has the cephalothorax more oval in shape; the genital segment is narrower, terminating posteriorly in two stout spines; two fine hairs are also seen on the outer border; the abdomen is made up of a short broad joint and a second oblong one; the caudal plates are rather large, with the inner borders finely fringed with hairs. The *second antennae* have the last joint reduced to a short though rather powerful hook, and the hamulus anterior remains of the same size as in the female, which is unusual.

Length 5 millim.

Caligus tenax, Heller. (Pl. XI. fig. 3.)

As the male of this has not yet been described, I here take the opportunity of putting it on record. Heller found specimens of the species on *Caranx carangis*, Brazil; in these eastern seas I have taken very large numbers from the gill-chambers of various species of *Caranx* found at Trincomalee, Colombo, Muscat, and Aden, the males being fairly plentiful; these specimens were seen to have the abdominal segment generally shorter than those described by Heller*, but agree in detail of structure, except that on careful examination the

* 'Reise der Fregatte Novara,' pp. 172-173.

hamulus anterior will be seen to have a short basal spur, which he does not mention; they were generally taken with *C. carangis* of Kröyer *, which is easily distinguished from them by the absence of the small chitinous hooklets on the basal plate of the third peraeopods, by the much smaller furcula, by the more rounded genital segment, and the greater size of the fourth pair of legs.

Male.—Taken from *Caranx melampygus*.

Carapace much broader than long, narrowing quickly anteriorly and slightly at the posterior angles. Frontal plate very wide, deeply concave in front, the lunulae, which are large, projecting considerably forward.

The *posterior antennae* have a very short strongly curved terminal claw, which is very different from the long slender one of the female.

Hamulus anterior of moderate size; both basal and terminal spurs are much larger than in the other sex; the thoracic appendages are not altered.

Genital segment about one third as long as the cephalothorax, oblong in form, though narrowing anteriorly; about the juncture of the middle and the last third are three fine hairs placed close together and a single one at the posterior angle.

Abdomen nearly square, about one third the length of the genital segment, bearing the two short caudal plates.

Length 3-4 millim.

CALIGODES, Heller.

Caligodes carangis, sp. n. (Pl. XI. fig. 4.)

This genus was formed by Heller † to include an animal described by Kollar as *Chondrocanthus lanciniatus*, afterwards referred by Kröyer ‡ to Van Beneden's genus *Sciænophilus* as *S. lanciniatus*.

The original specimens were taken from a species of *Belone* and are preserved in the Vienna Museum, being fully described by Kröyer.

On examining large numbers of the larger specimens of fish of the genus *Caranx* in the Aden market, I was struck by the frequency with which one saw on the palate of *C. jerdoni* two small hæmorrhagic tumours, placed far forwards near the middle line; on closer inspection there were seen hanging

* 'Bidrag til Kundskab,' 1863, pp. 69-70.

† 'Reise der Fregatte Novara,' p. 180.

‡ 'Bidrag til Kundskab,' 1863, pp. 153-157.

from them slender opaque white bodies, often ten from a single tumour; on dissecting the tumours the head and neck of these peculiar parasites were seen to be deeply buried, the neck often being incased in a sort of red fibrinous tube; on first removing them I thought they were either Chondracanthi or one of the nearly allied genera. To the fish they must be a great inconvenience, situated as they invariably were. Only females were found.

The before-mentioned authors describe the elongated portion as a drawn-out posterior thoracic segment, but in these it appears to be a produced neck-like commencement of the true genital segment; my specimens, too, differ in having the fourth pair of thoracic legs well formed, as in *Synestius*, Steenstrup & Lütke.*, instead of being rudimentary.

The four-jointed fourth pair of thoracic limbs, the large furcula, and the two laminate prolongations of the abdomen distinguish this species.

Female.—*Carapace* almost circular, very small, equal to about one seventh of the whole animal length. Frontal plate distinct, deeply excavated in the centre between the two lunule, which are of moderate size, projecting somewhat in front, but less in diameter than half the frontal plate.

Anterior antennæ have a short basal joint provided with the usual plumose hairs and a much longer second joint with simple hairs at the end.

Posterior antennæ placed well forward near the base of the rostrum; they are three-jointed, the last joint in the form of a moderately strong curved hook.

Hamulus anterior small; it has a broad base, and is in the shape of a simple short claw.

Palp short, simple, and blunt-ended; a second smaller one is seen in front a little to the outside.

Rostrum about twice as long as broad.

First maxilliped of the usual form of *Caligus*.

Second maxilliped powerful; basal joint long and thick, having on its inner surface a curious bifid tooth; the terminal claw is markedly curved.

Furcula very large and prominent; from a narrow neck spring the two branches, which diverge widely and are sharp-pointed, the width of the opening being greater than the length of the arms; seen from the side the furcula has the appearance of a grapple, being most admirably adapted for fixation of the animal. Oculi of a pink colour, placed over the centre of the rostrum.

* 'Bidrag til Kundskab,' 1861, p. 24.

First pereopod three-jointed; the first joint has a single hair from the upper border, the second is cylindrical, the third or palmar joint is provided with three short terminal claws, the outer being the longest, and a single bristle at the angle; I was unable to detect any trace of the usual plumose hairs from the under border.

Second pereopod has each branch provided with three joints; the upper border of each of the outer ones has a single claw; plumose hairs as in *Caligus*.

Third pereopod has the basal flap broad; on the inner surface near the centre on each side is a patch of small tooth-like processes about twelve in number, also a single row extending from the hamulus upwards; the hamulus is of moderate size and strongly curved; the paddles are small, placed near together, provided with feathered hairs as in *Caligus*, differing from that described by Kröyer. The last thoracic joint is ill-defined, but it appears of a square form, not projecting below the apron of the third pair of limbs.

Fourth pereopod well formed, four-jointed, the first joint being cylindrical and muscular, four times as long as broad; the other three joints are welded together as in *Caligus*, the terminal giving off three short curved claws placed close together, the outer one being the longest, each of the other joints has a claw of about the same length on its inner border.

Genital segment of a pyriform shape, with a long neck uniting it to the thorax, the whole being three and a half times the length of the cephalothorax, and three times as long as broad; the intestinal canal and ovaries are easily visible in the dilated portion, the ducts of the latter being placed near together; from the under posterior border outside these openings is given off on either side a long laminate process more than one third as long as the last segment, protecting the external ovarian tubes.

Abdomen broad and flat, terminating in two laminate appendages not quite so long as the ventral ones, differing thus markedly from the abdomen of *C. lanciniatus*.

The *caudal plates* are exceedingly small, wedged in between these two processes; they are slightly longer than broad, and give off three fine terminal plumose hairs, with a minute one on the outer border.

Egg-sacs very long, of a brown colour.

Length 11-12 millim.

ALEBION, Kröyer.

Alebion carchariæ, Kr. (Pl. XII. fig. 1.)

As only a single example of this animal is on record,

being described by Kröyer * from a male specimen obtained on a large shark in the Atlantic, I here give a short account of the female, which seems, without doubt, to be the same species, taken from a small shark at Aden, which I was fortunate enough to be able to examine immediately after its capture, before the parasites had been washed off, finding two mature females on the surface of the pectoral fin. The description of Kröyer is very full, so that it is unnecessary to enter into too great detail, only to point out the chief differences which appear.

In outward form the dorsal plate covering the last thoracic segment was much less apparent; the genital segment, though of almost equal proportional size to that of the male, had extending between the posterior processes a much shorter biarticulate abdomen, the first joint of which was rounded, slightly broader than long, the second being oval, more than twice as long as the first, giving off two caudal plates of an elongated oblong form, terminating in three large plumose bristles and a small outer one. On minute examination the posterior lobe of the carapace was seen to have on either side four small teeth, and laterally there are three others. The dentations at the posterior border of the genital segment are bicuspid, and those on the elongated portion are larger than the ones represented by Kröyer. The posterior antennæ are larger than in the male; the second maxilliped has a very short robust terminal claw, bearing a hair on the inner surface near the base. The first two peræopods do not vary, but in the third the detail seems to be somewhat different: the outer paddle is large and has three distinct joints, the first having on its inner border a long plumose hair, on the outer border, which is ciliated, there are two short thick bristles, the lower one being the longer; the second joint has a plumose hair on the inner border and one short bristle on the outer, on it is seen one reniform body; the third joint bears two reniform bodies and on the inner border are six plumose hairs: the inner paddle has an elongated stalk-like joint and the final one bears five distinct plumose hairs; the glandular (?) apparatus described by Kröyer is also seen. Fourth peræopods very rudimentary, the proportional size being given in the Plate. On the genital segment three bright red pigment-spots on either side are very apparent.

Length 7 millim.

* 'Bidrag til Kundskab,' 1863, pp. 165-168.

Dichelesthina.**PSEUDOCYCNUS, Heller.***Pseudocyclus appendiculatus*, Hell.

Ten specimens of this rare animal were found attached to the gills of *Thynnus macropterus* at Aden; they were all mature females. These I kept alive for some time. The vascular system is very elaborate, and apparently these animals, like those of the genus *Lernanthropus*, are essentially "blood-suckers," being full of red blood. The specimens originally described by Heller* were taken in the Indian Ocean on a species of "*Coryphæna*," with which these agree in almost every detail, except that in my specimens stump-like rudiments of the fifth pair of limbs carrying a single small hair were present at the extreme end of the genital segment on either side just in front of the flap-like processes which protect the ovarian openings.

Length 10 millim.

LERNANTHROPUS, Nordm.*Lernanthropus nudus*, sp. n. (Pl. XII. figs. 2, 3, 4.)

While at Aden I was astonished by the great number of specimens of an animal of this genus which were present attached to the gills of a large grey mullet (*Mugil*, sp.) very common in the market. Scarcely a fish would be examined without finding many specimens; as they attached themselves very firmly, they were not easily washed away. It seems to be a genus widely distributed, and I have taken out here a good many species. This one appears to be very remarkable. Obtaining them fresh and in large numbers, one was able to keep specimens alive for some time, when their brilliant red colouring and movements made them very interesting to watch, as described by Hesse. Both males and females were found separately, and also once "in copulâ," as shown in the figure; the males are much smaller than the females, but did not show the more brilliant colouring, as in Hesse's plates; the free-swimming embryos were taken from a watch-glass about twelve hours after the eggs were discharged. The chief characteristics of this species are the entirely exposed condition of the abdomen and the great length of the processes representing the fourth pair of limbs.

* 'Reise der Fregatte Novara,' pp. 218-219.

Female.—*Head* of large size, longer than broad, largest at the base, which is slightly rounded; it is strongly arched dorsally from side to side, the margin folding inwards on the under surface; in front the border is convex and prominent, showing no median notch, from the underside of which frontal border the six-jointed setiferous anterior antennæ are seen.

Thorax seen from the dorsal surface divided into three segments, each having a median indentation posteriorly; they are broader than the head and are together somewhat longer: the anterior segment is but indifferently marked off; this is the true second thoracic segment bearing the second pair of thoracic limbs, the first being united with the cephalic portion; it is less wide than the following segments and very short: the second free segment is much broader than long, with rounded sides, from under which can be seen projecting the third pair of limbs; the third free thoracic ring is slightly smaller than the last, but of similar shape, being not so long as broad and deeply cut away posteriorly; the sides of these segments are deeply pigmented, and the alimentary canal is easily visible down the centre; the usual posterior tunic or plate common to the whole genus appears to be, however, entirely absent, the abdomen being quite bare, projecting between the two greatly elongated processes representing the fourth pair of limbs; on either side of it from the posterior edge of the lobe of the last segment, is seen a small rounded flap or plate partially covering the base of the fourth pair of limbs; these may be the rudiments of the dorsal tunic.

The *abdomen* is rather longer than the last thoracic segment; it is composed of three distinct portions, the second partially overlapping the third: the first is of a rounded shape, but broader than long; the second is pointed at the extremity, it is constricted in the middle, dividing it into two parts; to the upper and wider are attached the ovarian tubes, to the narrower the two stalked dark spermatophores. The third abdominal joint is oblong in shape, traversed by the intestinal tube; the anal opening is seen at the end between the two caudal plates, which are oval in shape, somewhat divergent, and placed on the under border.

From the ventral side one sees the six-jointed setiferous *anterior antenna*, and placed far forward the triarticulate *posterior antenna*; the first two joints of the latter are very broad and muscular, the last in the form of a curved hook: beneath these on the median line is found the mouth, of a pointed conical shape; on each side of this near the base a slender triarticulate and a thicker biarticulate process can be

made out, probably the mandible and palp; on either side a little backwards are placed the two pair of maxillipeds, the first are much the most slender, the second joint having the point somewhat sickle-shaped.

The *second maxilliped* is very strong, the outer extremity of the large muscular joint extending a little beyond the margin of the cephalothorax; the terminal hook-like joint has a small tooth on the concave border about one third from the point. Under the lower margin of the cephalic border are seen the rudimentary first thoracic limbs; they are two-branched and single-jointed, the outer branch being of a square shape, having five short digitations with crenate edges on the border; the inner branch is very small, terminating in a single short bristle. The rudimentary second pair of limbs are placed a little further back and are much smaller than the first, the outer branch carrying four small digitations only; on the inner I could see no bristle. The third pair of limbs are converted into curved foliate processes as usual; they spring from the side and posterior border of the second free thoracic segment; these are very vascular and act as claspers for the animal. The fourth pair of limbs rise on the side of the abdomen from the last thoracic segment; they quickly become split into two processes, very long and narrow, their length being greater than that of the whole of the rest of the animal; they are pale red in colour, pulsatile, and no doubt act as branchiæ, as Hesse suggests; they are in constant motion, curling up and straightening out.

Length without processes 5 millim., with processes 11 millim.

Male.—Much smaller than the female, having the head proportionally larger and more oval in shape. The body is divided into two parts—the first is very short, carrying the second pair of rudimentary thoracic feet: the second portion, which is of a much more regular oval shape, carries on both sides two pair of appendages, the first pair being single-branched, springing from the anterior part, and equal in length to that of the body; the second pair are divaricate, proceeding from the posterior part of the body, and much longer than the anterior pair: between these is seen the genital segment, this tapers considerably to the abdomen, which is oblong in shape, terminating in two leaf-like caudal plates of almost equal length with the abdomen, but rather less than half as broad. The appendages are like those of the female, except that the structure of the terminal joint of the first maxilliped is quite peculiar, being dilated along its concave border and

thickened near the end, where the dentations are coarser; the point is more curved and minutely toothed.

Length without processes ♂ millim., with processes 8 millim.

The embryos when first hatched are rounded, with an anterior projecting portion, and are sharp-pointed posteriorly, on each side of which is seen a long bristle; these bear on either side three pair of limbs, the first ending in a single hair, the second with three, the third pair with four. When a little older the body is more distinctly segmented, the second and third limbs become bipartite, each branch of the second has a single joint terminating in two fine hairs; each branch of the third consists of two joints, the end one giving off four long hairs.

The male is seen to attach itself firmly to the abdomen of the female by its powerful posterior antennæ, the body hanging freely between the long laminate processes.

NOTE.

The name "*Helleria*" being already appropriated for more than one genus of crustacean animals, I propose to alter the one so called by me (described in the Ann. & Mag. Nat. Hist. ser. 7, vol. i., January 1898, pp. 10-11, pl. v., and August 1898, vol. ii. pp. 93-94) to "*Cybicola*," to avoid any confusion.

EXPLANATION OF THE PLATES.

PLATE X.

Fig. 1. Bomolochus megaceros, ♂, Heller, highly magnified.

1 *a.* Anterior antenna. 1 *b.* Posterior antenna. 1 *c.* Second maxilliped. 1 *d, e, f.* First, second, and third peræopods. 1 *g.* Fifth peræopod. 1 *h.* Last abdominal joint and caudal plates.

Fig. 2. Caligus longipedis, ♀, sp. n., from the back, enlarged.

2 *a.* Cephalothorax from beneath, much magnified. 2 *b.* First maxilliped. 2 *c.* Third peræopod. 2 *d.* Fourth peræopod. 2 *e.* Caudal plates.

Fig. 3. Male of the same from the back, enlarged.

3 *a.* Posterior antenna. 3 *b.* Hamulus. 3 *c.* Second maxilliped.

PLATE XI.

Fig. 1. Caligus robustus, ♀, sp. n., from the back, enlarged.

1 *a.* Cephalothorax, much enlarged. 1 *b.* Outer branch of the second peræopod. 1 *c, d.* Third and fourth peræopods. 1 *e.* Caudal plate.

Fig. 2. Male of the same from the back, enlarged.

2 *a.* Posterior antenna. 2 *b.* Posterior extremity of genital segment.

Fig. 3. Caligus tenax, ♂, Heller, from beneath.

3*a.* Hamulus anterior.

Fig. 4. Caligodes carangis, ♀, sp. n., from the back, enlarged.

4*b.* The same in profile. 4*c.* Genital segment and abdomen. 4*d.* Cephalothorax from beneath, much enlarged. 4*e.* Last joint of the first peræopod. 4*f.* Third peræopod. 4*g.* Caudal plates. 4*h.* Last joint of the posterior antenna. 4*i.* Second maxilliped. 4*j.* Fourth peræopod. 4*k.* Furcula from the side.

PLATE XII.

Fig. 1. Alebion carchariæ, ♀, Kr., from the back, enlarged.

1*a.* Second maxilliped, much enlarged. 1*b.* First and second peræopods. 1*c.* Third and fourth peræopods. 1*d.* Margin of the genital segment. 1*e.* Extremity of posterior process of the genital segment.

Fig. 2. Lernanthropus nudus, ♀, sp. n., seen from the back, enlarged.

2*a.* The same seen from the side. 2*b.* Cephalothorax, much enlarged, from beneath. 2*c.* Part of the margin of the first peræopod. 2*d.* Abdomen and posterior processes, showing ovarian tubes and spermatophores attached.

Fig. 3. Male of the same, enlarged.

3*a.* Male and female "in copulâ." 3*b.* Anterior and posterior antennæ. 3*c.* Extremity of first maxilliped. 3*d.* Abdomen and caudal plates.

Fig. 4. Embryos in two stages of development.

N.B.—The line to the right of a figure shows the natural length of the animal.

XLII.—*Extraordinary Vitality of Entomostraca in Mud from Jerusalem.* By EDWARD ATKINSON, F.L.S.

JUST forty years ago, when, residing in Jerusalem, I was in the habit of using my scanty leisure in natural-history pursuits, I chanced upon a little discovery which has proved to be of no small interest.

Strolling one hot day in May 1858 by the margin of the old reservoir outside the Jaffa Gate, known as the Birket Mamilla, or Upper Pool of Gihon—then dry—I took a fancy to explore its bed. A few weeks had elapsed since the last of the water had been drawn off through its ancient conduit into the so-called Pool of Hezekiah within the city.

This Pool of Gihon, more than 2500 years old, was probably, when originally constructed, part of the system of pools and aqueducts by which water was brought from the Pools of Solomon at Urtas, beyond Bethlehem, for the supply of the capital; but now little or no water enters it from that source,

the pool being for the most part filled with surface-water during the rainy season.

On descending into it I observed that at the end where the water had rested last the thick layer of alluvial mud, which covered the floor of the pool to a depth of a foot or more, was densely silvered over with minute shells. These on examination proved to be the shields or carapaces of several kinds of Entomostraca.

It occurred to me that, as the pool only contained water during two months in the year, these animals, after so brief a life, must leave their ova in the mud, to reproduce their several species in the next rainy season, after entombment in the sun-baked mud for ten months.

The idea of testing the truth of this artificially occurred to me, and I took up carefully several pieces of the mud which had cracked in drying; these, as I knew nothing of the Entomostraca myself and was without books of reference, I sent to my friend Mr. Denny, A.L.S., then Curator of the Leeds Museum, with instructions when to moisten the mud. The result in his hands was such as to surprise and delight him. One after another new species of several genera sprang into life. Wisely he had not moistened all his mud; so he sent a little to Dr. Baird, of the British Museum, who was equally charmed with the experiment. Dr. Baird described and figured five new species in the *Ann. & Mag. Nat. Hist.*, Oct. 1859 (1 *Daphnia*, 1 *Diaptomus*, 1 *Estheria*, 2 *Cypris*), and, lastly (in Sept. 1861), a new *Branchipus*.

In order to ascertain whether the ova deposited in captivity would develop another year, I suggested to Mr. Denny that in the summer he should decant the water and dry off the mud without disturbing its surface. This he did by means of a syphon, leaving the mud dry till the following spring, in imitation of nature, when the glass jar was again filled. The experiment was quite successful, most, if not all, of the species reappearing.

At the end of 1860 I returned to England, and brought a fresh supply of the mud, portions of which were given to several gentlemen, who repeated the experiment, with similar results.

By alternating the seasons in the manner above described the crop was renewed year by year, most of the species living for two months, several for three months or more, then depositing their ova and dying. This was repeated at the Leeds Philosophical Society's Museum for eight years; and it was only in the winter of 1836 that an accidental exposure of the jar to a severe frost on the housetop destroyed them all.

An interesting fact illustrating the great vitality these ova possess is that a small quantity of the original stock of mud given to a friend had by him been put away in a pill-box and forgotten. Nine years after it turned up in his desk; little expecting any result, he placed it in a small glass jar and added water to it, but a fortnight later a single specimen of the *Estheria gihoni*, the rarest and most beautiful form, made its appearance.

Another friend, a clergyman in the South of England, to whom I gave a portion of the mud, and who had continued the process of alternating the wet and dry season for twenty-four* years with unvarying results, removed to Tunbridge Wells. During the change of residence the globe containing his dried mud was accidentally broken and thrown with other rubbish at the back of a rockery in the garden. Next spring its owner discovered it, to his dismay, in its ruined condition; but finding that the mud still remained adherent to the main fragment, he transferred it to a new globe of water, when, to his surprise, three weeks later his old friends appeared, as if nothing had happened, although the winter had been very severe and the broken globe was frequently buried in snow!

In 1896—an interval of thirty years having elapsed since I lost the succession of crops in my own aquarium—I availed myself of a friend's visit to Jerusalem to obtain a new supply from the same spot; and both last year and this I have had the pleasure of renewing my acquaintance with the now familiar forms. Together with my friend Mr. H. Crowther, F.R.M.S., the present Curator of the Leeds Museum, I have had six jars under observation. The same forms described by Baird appear regularly each season, especially the smaller species (*Daphnia* and the Cyprids), in every jar, whereas I observe that the larger forms (*Estheria* and *Branchipus*) were often one or both absent from one jar while numerous in another, which seemed to suggest that their ova did not in every case retain their vitality so well as the smaller kinds, or else that the ova of the larger species were less equally distributed, lying, as it were, in nests in one fragment of the mud and not in another; and, indeed, this seems to be the more likely explanation.

The following is Dr. Baird's list:—

* I learn from my friend that after 1884, "in the spring of which year all the forms seen before came to vigorous life, the mud remained carefully put away until given in 1894 to another friend," who, after the ten years' interval, again restored them to their annual activity, and this is maintained.

Branchipus eximius.

Estheria gihoni.

Daphnia Atkinsoni.

Cypris celtica.

Cypris orientalis.

Diaptomus similis.

The only additions I have ever observed were a *Cyclops* and several *Planariae*.

The habits and movements of these Entomostracous Crustacea are most interesting to watch, especially the larger forms. *Branchipus*, which closely resembles our British *Chirocephalus*, from which it differs chiefly in the morphology of its cephalic horns or prehensile organs, swims, like *Chirocephalus*, upon its back, and, when shaded from a strong light, may be seen balancing itself near the surface by means of its numerous branchial feet, which are in constant motion. On the least disturbance, however, it strikes the water rapidly with the tail from right to left, darts away like a fish, and will often dive to the bottom to conceal itself in the soft mud. They are white and semitransparent, with the compound stalked eyes conspicuous as large black dots. The elegance and ease of their movements are very attractive, the male especially, which is somewhat larger than the female, with its singular curved horns lying forward on its thorax as it bends for a spring, and then suddenly straightening its body, glides along—the uninterrupted undulatory motion of its branchial feet gracefully waving like a tiny cornfield in the summer breeze—forms a charming study. Neither *Branchipus* nor the other forms seem dependent upon vegetable diet—at any rate, there is no plant-life in their native pool, unless it be some minute *Confervæ* invisible to the naked eye, and I have never detected any diatoms under the microscope. They seem, however, to derive their nourishment from the mud. It is pretty to watch the *Branchipus* use its prehensile horns like a pair of calipers to seize a mass of it, which raises a dense cloud in the water; then, turning on to its back, the undulating branchiæ form a current flowing along the sort of canal between them and leading to the mouth. M. Joly, in describing its congener, *Artemia salina*, says that the mother, surrounded by her newly-hatched brood, not unfrequently sweeps some of her own young into her omnivorous jaws by a similar process. This cannot happen to *Branchipus*, inasmuch as the brief existence of the individual never allows of the mother living to see her offspring.

Estheria gihoni seen in a glass of clear water is a beautiful object; it swims upright, with the finely-sculptured valves of its carapace slightly open, so as to allow part of its bright red body to be seen. The branchial feet are in constant motion except when the animal, after a lengthened swim, goes to the bottom and either burrows in the mud or falls over on its side on the surface, when the branchiæ move very feebly. When fully grown the male (which is somewhat larger than the female) measures 5 lines in its longest diameter. For the first month of life they seem to be continually active, but when adult are often in repose, sometimes for many hours together. When copulating the female is seized by the prehensile feet and held firmly by the strong hooks with which they are armed, and in this attitude, which looks as if she were carried in the male's mouth (almost like a dog with a rat), she is hurried along round and round the jar, the male retaining his hold for hours, and occasionally expanding the valves of the carapace in his flight.

The same evolution as above described in the case of *Branchipus*, of throwing up mud and sweeping it with the branchiæ towards the mouth, while turned on its back, is equally true of *Estheria*. I have kept the *Estheria*, *Daphnia*, and *Cypridæ* for four months, but *Branchipus*, *Diaptomus*, and *Cyclops* are more short-lived.

XLIII.—*A Revision of the Pontoniidæ.* By L. A. BORRADAILE, M.A., Lecturer in Natural Sciences at Selwyn College, Cambridge.

THE first of the species of the Pontoniidæ was described by Forskål in the year 1775, when he gave the name of *Cancer custes* to a small prawn found living in the mantle-chamber of a bivalve mollusk. In 1829, after certain wanderings, this species, under the name of *P. tyrrhena* (Risso), found a home in the genus *Pontonia*, established for it by Latreille; and by 1837, the date of publication of H. Milne-Edwards's 'Crustacées,' the number of species of *Pontonia* had risen to four. A closely allied genus, *Conchodytes*, was described by Peters in 1851.

After the appearance of Milne-Edwards's work no step of great importance in the history of the family was taken till Dana, in 1852, reporting on the Crustacea of the United States Exploring Expedition, separated from *Pontonia* groups

of species which he erected into the genera *Ædipus* and *Harpilius*. At the same time he described a genus *Anchistia*, allied to the foregoing in the nature of the antennules and mandibles, and indicated in a footnote that the true position of *Typton*, Costa, 1844, was in this neighbourhood. The name *Ædipus* was already in use, and Stimpson accordingly changed it to *Coralliocaris* in 1860. *Anchistia*, on the other hand, must yield to *Perichinens*, Costa, 1844, on the ground of priority. *Pelias* is a name that has also been applied by Roux and Heller to species of this genus, but, though prior to *Perichinens*, it was already preoccupied when made use of by Roux.

In 1879, Kingsley, revising the Palæmonidæ, dealt with the above group of genera as a coherent section of his subfamily Palæmoninæ, suppressing only the somewhat ill-characterized *Conchodytes*. Bate, in the Report on the 'Challenger' Macrura (1888), raised them to the rank of a separate family, and Ortmann, writing in 1891, has some valuable remarks on the Pontoniidæ. The genera, however, have not been considered together since Kingsley's paper.

The description of the important species *Harpilius inermis*, Miers, 1884, and *H. Miersi*, de Man, 1888, and the occurrence of several interesting forms, both old and new, in some material from the South Seas, have led the writer to think that the time is ripe for a further revision of the family. To this end the present synopsis is offered.

The characters of the Pontoniidæ are first summarized and a list of the genera given, including one here defined for the first time. This is followed by a discussion of the inter-relationships of the genera. Then the characteristics of each genus are given separately, with a list of the species to be assigned to it. New species are diagnosed but briefly, since full descriptions and figures are to be given in reports on the Crustacea collected in the South Seas by Dr. A. Willey* and Mr. J. Stanley Gardiner. Finally, an empirical key to the genera follows.

The systematic position of the Pontoniidæ may be defined as follows:—

* In the 'Zoological Results' of Dr. Willey's voyage, now being published by the Cambridge University Press.

Suborder *MACRURA*.Tribe *CARIDEA*.Subtribe *MONOCARPINEA*.Family *Pontoniidæ*, Bate, 1888.

Pontoniidæ, Bate, 'Challenger' Macrura, p. 927 (1888); Ortmann, Zool. Jahrb. v., Syst. p. 460 (1891).

Monocarpinea with the body often depressed; rostrum not movable on carapace, often short, compressed or depressed, with or without dentations; outer flagellum of first antenna consisting of a thick hairy part, bearing a thin hairless part, the latter usually arising from the former at a short distance from the free end, and thus giving it a bifid appearance; mandible deeply cleft into two divisions and always without a palp; endopodite of second maxilliped not biramous; third maxilliped pediform, but usually with some of the joints broadened; all the legs without exopodites or mastigobranchs; first two pairs of legs chelate, first pair slender, second pair larger than the first, not foliaceous. Mode of life often semi-parasitic.

Genera:—*Periclimenes*, Costa, 1844; *Coralliocaris*, Stimpson, 1860; *Harpilius*, Dana, 1852; *Anchistus*, gen. nov.; *Pontonia*, Latreille, 1829; *Conchodytes*, Peters, 1851; *Typton*, Costa, 1844.

The new genus *Anchistus* included in the above list is proposed for the reception of *Harpilius inermis*, Miers, *H. spinuliferus*, Miers, *H. Miersi*, de Man, and a new species from New Guinea. These species differ from *Harpilius* in the structure of the rostrum and second pair of maxillipeds and also somewhat in that of the third maxillipeds. The rostrum is deep, but owes its depth to the inferior keel, which is well developed along its whole length, the superior dentate crest being absent. The free end of the structure is rounded (in *A. spinuliferus* it diminishes abruptly to a point) and is bent downwards. In *A. Miersi* there are a few dentations on the rounded free end. The second maxillipeds have the penultimate joint broader than the last joint and bearing it terminally. The third maxillipeds have the antepenultimate joint of moderate breadth and somewhat different in shape from that of *Harpilius*.

On consideration of the mutual relationships of the genera enumerated above, they appear to fall into four groups:—

(a) *Periclimenes*.

(b) *Coralliocaris*, *Harpilius*.

(c) *Anchistus*, *Pontonia*, *Conchodytes*.

(d) *Typton*.

(a) *Periclimenes* stands out at once as the most primitive genus of the family. Its *Palaemon*-like form of body, compressed dentate rostrum (except in *P. aurantiacus*), dactyles of the last three pairs of legs straight and not swollen at the base, narrow third maxillipeds, and its free-living habits, all point to this conclusion.

(b) In the second group the compressed dentate rostrum of *Periclimenes* usually becomes broader and shallower, and is often shorter; but the dentations, though showing signs of reduction, are generally present, at least on the upper surface, and the free end is pointed both in dorsal and in lateral view, and is not curved downwards. The last joint of the second maxilliped is as broad as—usually broader than—the preceding joint, and the antepenultimate joint of the third maxilliped is broadened, though not to a great extent, in *Coralliocaris*. The dactyles of the last three legs are short, stout, curved, and without small teeth on the underside. The two genera of the group differ between themselves in the attachment of the last joint of the second maxilliped to the penultimate, which takes place terminally in *Coralliocaris*, but laterally on the inner side in *Harpilius*. A further distinction is afforded by the third maxilliped, which in *Coralliocaris* has the antepenultimate joint of moderate breadth and the last two joints about equalling it in this dimension. In *Harpilius*, on the other hand, the last two joints are narrow and the preceding joint is broad. Lastly, the dactyles of the hinder three pairs of legs are provided in the former genus with a large basal protuberance on the underside. This protuberance is wanting in *Harpilius*.

(c) In the third group the rostrum is more or less depressed at its base, but distally is deep and strongly compressed (except in some species of *Pontonia*). Dentations are absent or restricted to the tip, which is bent downwards and in side view rounded or diminishing abruptly to a point. The penultimate joint of the second maxilliped is broader than the last joint and bears it terminally. The third maxilliped, fairly narrow in *Anchistus*, is broad in the antepenultimate joint in *Pontonia* and in all the joints in *Conchodytes*. The dactyles of the last three pairs of legs are straight in some of the species and of varying degrees of curvature in others. They may or may not bear teeth on the underside, and in

Conchodytes they present also a basal prominence somewhat recalling that of *Coralliocaris*. It is worth noting that the latter two genera are not without resemblances in the structure of their third maxillipeds and second pair of legs.

(d) *Typton* shows considerable likeness to *Pontonia*. The flagella, however, of the first antenna are both simple and the scale of the second is rudimentary. The evidence of these characters, which by themselves might be disregarded as due to reduction consequent on a protected mode of life, is strengthened by the narrowness of the third maxilliped, the (short) upturned rostrum, compressed along its whole length and narrowing to a point at the free end, and the two very large supraorbital spines. These peculiarities, taken together, mark out *Typton* as the most aberrant genus of the family.

The foregoing remarks may be illustrated by a graphic table as follows:—

Pontonia. *Conchodytes.* *Coralliocaris.* *Harpilius.*

Typton.

Anchistus.

Periclimenes.

Genus PERICLIMENES, Costa, 1844.

Pelias, Roux, Mém. sur les Salicoques, p. 25 (1831); H. M.-Edwards, H. N. Crust. ii. p. 381 (1837); Heller, Sitz. k. Ak. Wiss. Wien, xlv. 1, p. 400 (1862).

Periclimenes, Costa, Ann. Ac. degl. Aspir. Nat. Nap. ii. (1844); Faun. Reg. Nap. ii. 1 (1846).

Anchistia, Dana, U.S. Expl. Exped., Crust. i. p. 577 (1852); Kingsley, Proc. Ac. N. Sci. Philad. 1879, p. 423 (1880); Carus, Prodr. Faun. Médit. i. p. 474 (1885).

Tennisia, Norman, Ann. & Mag. Nat. Hist. (3) viii. p. 278 (1861).

Pontoniidae with rostrum long, compressed, usually dentate, in side view diminishing gradually to a sharp point at the free end, not bent downwards; thicker flagellum of first antenna long or moderate, bifid; scale of second antenna long, usually narrow; second maxilliped with penultimate

joint as broad as—usually broader than—the last joint, which it bears terminally; third maxilliped narrow, last two joints together may be longer or shorter than the preceding joint; dactyles of the last three pairs of legs slender, nearly straight, without basal protuberance.

1. *Periclimenes scriptus* (Risso), 1826. (Type.)

Alpheus scriptus, Risso, Hist. Nat. Eur. MÉR. v. p. 78 (1826).

Pelias scriptus, Roux, Mém. sur les Salicoques, p. 25 (1831); Heller, Sitz. k. Ak. Wiss. Wien, xlv. 1, p. 406 (1862).

Periclimenes insignis, Costa, Ann. Ac. degl. Aspir. Nat. Nap. ii. (1844); id. Faun. Regn. Nat. Nap. ii. 1, pl. vi. figs. 1-6 (1846).

Dennisia sagittifera, Norman, Ann. & Mag. Nat. Hist. (3) viii. p. 278, pl. xiii. figs. 8-13 (1861).

Anchistia scripta, Carus, Prodr. Faun. Med. i. p. 476 (1885).

Palaemon biunguiculatus, Lucas (fide Carus).

Mediterranean; Guernsey.

2. *Periclimenes amethysteus* (Risso), 1826.

Alpheus amethysteus, Risso, Hist. Nat. Eur. MÉR. v. p. 77, pl. iii. fig. 16 (1826).

Pelias amethysteus, Roux, Mém. sur les Salicoques, p. 25 (1831); Heller, Sitz. k. Ak. Wiss. Wien, xlv. 1, p. 406 (1862).

Anchistia amethystea, Carus, Prodr. Faun. Med. i. p. 476 (1885).

Mediterranean, European shores.

3. *Periclimenes Petithouarsi* (Aud.).

Palaemon Petithouarsi, Audouin, Deser. Egypt., Hist. Nat. i. 4, p. 91; Savigny, Atlas Crust. pl. x. fig. 3.

Anchistia inequimana, Heller, Sitz. k. Ak. Wiss. Wien, xlv. p. 283 (1861); Crust. 'Novara,' p. 109.

Anchistia Petithouarsi, Kossmann, Zool. Ergebn. Reise Rot. Meer. p. 83 (1880); de Man, Arch. Naturg. liii. 1, p. 541 (1887).

Red Sea; East Indies; Tahiti.

4. *Periclimenes gracilis* (Dana), 1852.

Anchistia gracilis, Dana, U.S. Expl. Exped., Crust. i. p. 578, pl. xxxvii. figs. 5 a-l (1852).

Sooloo Sea.

5. *Periclimenes longimanus* (Dana), 1852.

Anchistia longimana, Dana, *loc. cit.* p. 579, pl. xxxvii. figs. 6 a, b (1852).

Loc. — ?

6. *Periclimenes ensifrons* (Dana), 1852.

Anchistia ensifrons, Dana, *loc. cit.* p. 580, pl. xxxviii. figs. 1 *a-g* (1852); Müller, *Verh. nat. Ges. Basel*, 8, ii. p. 471 (1887); de Man, *Arch. Naturg.* liii. 1, p. 515 (1887); Ortmann, *Semon's Forschungsreisen in Austral.* v. 1, p. 16 (1894).

East Indies; Ceylon; East Africa.

7. *Periclimenes aurantiacus* (Dana), 1852.

Anchistia aurantiaca, Dana, *loc. cit.* p. 581, pl. xxxviii. figs. 2 *a-d* (1852).

Fiji.

8. *Periclimenes grandis* (Stimpson), 1860.

Anchistia grandis, Stimpson, *Proc. Ac. N. Sci. Philad.* 1860, p. 39.
(?) *Anchistia Petitthoursi*, Miers, 'Alert' Report, *Crust.* p. 293 (1884).

Ousima Island.

9. *Periclimenes brachiatus* (Stimpson), 1860.

Anchistia brachiata, Stimpson, *Proc. Ac. N. Sci. Philad.* 1860, p. 39.

Ousima Island.

10. *Periclimenes Danæ* (Stimpson), 1860.

Anchistia Danæ, Stimpson, *Proc. Ac. N. Sci. Philad.* 1860, p. 39.

Tahiti; [Ellice Group] *.

11. *Periclimenes migratorius* (Heller), 1862.

Pelias migratorius, Heller, *Sitz. k. Ak. Wiss. Wien*, xlv. 1, p. 409 (1862).

Egypt.

12. *Periclimenes æsopius* (Bate), 1863.

Anchistia æsopia, Bate, *P. Z. S.* 1863, p. 502, pl. xli. fig. 5; Haswell, *Cat. Austral. Crust.* p. 194 (1887).

Gulf St. Vincent, Australia.

13. *Periclimenes notatus* (Heller), 1868.

Anchistia notata, Heller, *Voyage of 'Novara,' Crust.* p. 109, pl. x. fig. 3 (1868).

Nicobar Islands.

* Localities in brackets are recorded for the first time.

14. *Periclimenes americanus* (Kingsley), 1878.

Anchistia americana, Kingsley, Proc. Ac. Nat. Sci. Philad. 1878, p. 96.
Florida.

15. *Periclimenes tenellus* (S. I. Smith), 1882.

Anchistia tenella, S. I. Smith, Bull. Mus. C. Z. Harv. x. p. 55, pl. ix.
figs. 1, 1 b (1882).
North America, east coast.

16. *Periclimenes amboinensis* (de Man), 1887.

Anchistia amboinensis, de Man, Arch. Naturg. 53, i. p. 546 (1887).
Amboina.

17. *Periclimenes Brockii* (de Man), 1887.

Anchistia Brockii, de Man, Arch. Naturg. 53, i. p. 546 (1887).
Amboina.

18. *Periclimenes spinigerus* (Ortmann), 1891.

Anchistia spinigera, Ortmann, Zool. Jahrb. v., Syst. p. 511, pl. xxxvi.
figs. 23, 23 a (1891).
Samoa; [Rotuma; Loyalty Islands].

19. *Periclimenes vitiensis*, sp. n.

A *Periclimenes* with rostrum nearly as long as thicker flagellum of first antenna, with 6 teeth above and 4 below; supraorbital, antennal, hepatic spines present; scale of second antenna nearly equal to thick flagellum of first; merus of second pair of legs with a spine below, slightly longer than carpus, which bears a spine inside and exceeds the antennal scales; palm somewhat longer than carpus, fingers more than half the length of palm.

Length to end of rostrum 20 millim.

[Fiji.]

20. *Periclimenes rotumanus*, sp. n.

A *Periclimenes* with rostrum barely longer than peduncle of first antenna, almost straight, with 6 teeth above and 2 below; antennal and hepatic spines present; scale of second antenna longer than rostrum, shorter than thick flagellum of first antenna; carpus about as long as palm and with one spine above; merus with one spine below.

Length 11 millim.

[Rotuma.]

21. *Periclimenes lifuensis*, sp. n.

A *Periclimenes* with rostrum longer than antennal scales, straight, with 6 teeth above; thick flagellum of first antenna slightly longer than rostrum; supraorbital spine present, hepatic absent; merus not armed; carpus short, with one spine on dorsal surface.

Length 11 millim.

[Loyalty Islands.]

22. *Periclimenes parvus*, sp. n.

A *Periclimenes* with rostrum slightly shorter than peduncle of first antenna, which in turn is shorter than the antennal scale, though the thick flagellum exceeds it; rostrum armed with 6 teeth above, 1 below; no supraorbital spine; no teeth on carpus or merus of second legs; merus short.

Length 8.5 millim.

[New Britain.]

23. *Periclimenes parasiticus*, sp. n.

A *Periclimenes* with rostrum convex above, armed with 7 teeth above, none below; antennal scale almost as long as thick flagellum of first antenna; no supraorbital spines; no spines on the second legs; carpus short.

Length 7 millim.

Found on black *Linckia*.

[British New Guinea.]

24. *Periclimenes tenuipes*, sp. n.

A *Periclimenes* with all the appendages very elongate; rostrum with 10 teeth above, 7 below, longer than antennal scale, shorter than thick flagellum of first antenna; antennal scale longer than peduncle of first antenna, narrow; merus of second leg with spine beneath; carpus longer than palm, with spine above; propus of last three legs armed with spines.

Length 25 millim.

[New Britain.]

Genus CORALLIOCARIS, Stimpson, 1860.

Ædipus, Dana, U.S. Expl. Exped., Crust. i. p. 572 (1852).

Coralliocaris, Stimpson, Proc. Ac. N. Sci. Philad. 1860, p. 38;

Kingsley, Proc. Ac. N. Sci. Philad. 1879, p. 423 (1880).

Pontoniidae with rostrum long or moderate, with or without dentations, usually somewhat depressed, shallow, at most

only slightly bent downwards; flagella of first antenna of moderate length, thicker of the two bifid; scale of second antenna long, broad; flagellum of same not short; second maxilliped with last joint as broad as or broader than the penultimate joint, which bears it terminally; third maxilliped with antepenultimate joint moderately broad, last two joints of about the same breadth as, and together as long as or longer than, the antepenultimate; chelæ of second pair large; dactyles of last three legs short, strong, curved, with a large basal protuberance on the underside.

1. *Coralliocaris superba* (Dana), 1852. (Type.)

Ædipus superbus, Dana, *loc. cit.* p. 573, pl. xxxvii. figs. 2 a-f (1852).

Coralliocaris superba, Stimpson, *loc. cit.* p. 38; de Man, Arch. Naturg. 53, i. p. 536 (1887).

East Indies; Tongatabu; Tahiti.

Var. *japonica* Ortmann, 1891.

Coralliocaris superba, var. *japonica*, Ortmann, Zool. Jahrb. v., Syst. p. 509 (1891).

Japan.

2. *Coralliocaris macrophthalma* (H. M.-Edwards), 1837.

Pontonia macrophthalma, H. M.-Edwards, H. N. Crust. ii. p. 359 (1837); id. Cuvier's R. An., Crust. Atlas, pl. lii. figs. 3, 3 a-k.

Ædipus macrophthalmus, Dana, *loc. cit.* p. 573 (1852).

"Mers d'Asie."

3. *Coralliocaris graminea* (Dana), 1852.

Ædipus gramineus, Dana, *loc. cit.* p. 574, pl. xxxvii. figs. 3 a-e (1852).

Coralliocaris graminea, Stimpson, *loc. cit.* p. 38; Miers, 'Alert' Report, Crust. p. 563 (1884); de Man, Arch. Naturg. 53, i. p. 536 (1887).

Seychelles; East Indies; Hongkong; Fiji.

4. *Coralliocaris lamellirostris* Stimpson, 1860.

Coralliocaris lamellirostris, Stimpson, *loc. cit.* p. 38.

Loo-Choo Island.

5. *Coralliocaris nudirostris* (Heller), 1862.

Ædipus nudirostris, Heller, Sitz. k. Ak. Wiss. Wien, xlv. 1, p. 279, pl. iii. fig. 25 (1882).

Red Sea.

6. *Coralliocaris inæqualis* Ortmann, 1891.

Coralliocaris inæqualis, Ortmann, Zool. Jahrb. v., Syst. p. 510, pl. xxvi. figs. 21, 21 *d-i* (1891).

Japan; Samoa; [Loyalty Islands].

7. *Coralliocaris brevirostris*, sp. n.

A *Coralliocaris* with rostrum unarmed, reaching only the middle of the antepenultimate joint of the peduncle of the first antenna; inner flagellum of first antenna reaching to some distance beyond the fringe of the antennal scales; last two joints of peduncle of first antenna subequal; immovable finger of chela with two swellings, separated by a notch, into which the single small tooth on the movable finger fits.

Length 19 millim.

[Ellice Islands.]

(?) *Coralliocaris tridentata* Miers, 1884.

Coralliocaris (?) *tridentata*, Miers, 'Alert' Report, Crust. p. 294, pl. xxxii. fig. *c* (1884).

Thursday Island.

Genus HARPILIUS, Dana, 1852.

Harpilius, Dana, U.S. Expl. Exped., Crust. i. p. 575 (1852); Kingsley, Proc. Ac. N. Sci. Philad. 1879, p. 423 (1880).

Rostrum long, compressed, dentate, pointed at the tip in side view, not curved downwards; thicker flagellum of first antenna of moderate length, bifid; scale of second antenna large; second maxilliped with penultimate joint narrower than last joint, which it bears laterally on the inner side; third maxilliped with the last two joints narrow, together longer than preceding joint, which is broad; dactyles of last three legs short, stout, curved, not bearing teeth or protuberances below.

1. *Harpilius lutescens* Dana, 1852. (Type.)

Harpilius lutescens, Dana, *loc. cit.* p. 576, pl. xxxvii. figs. 4 *a h* (1852); de Man, Arch. Naturg. 53, i. p. 536.

East Indies.

2. *Harpilius Beaupresii* (Aud.).

Palæmon Beaupresii, Audouin, Savigny, Egypte, Atlas Crust. pl. x. fig. 4. *Harpilius Beaupresii*, Heller, Sitz. k. Ak. Wiss. Wien, xlv. p. 280 (1861); de Man, Arch. Naturg. 53, i. p. 539 (1887).

- (?) *Harpilius depressus*, Stimpson, Proc. Ac. N. Sci. Philad. 1860, p. 38.
 (?) *Pontonia* (*Harpilius*) *dentata*, Richters, Decap. Mauritius, p. 165,
 pl. xvii. figs. 36-38.

Red Sea ; East Indies.

Genus ANCHISTUS, nov.

Pontoniidæ with rostrum long, compressed, in side view deep, bent downwards, with broad, usually rounded end, dentate at the tip only or without teeth ; thicker flagellum of first antenna moderate, bifid ; scale of second antenna large ; second maxilliped with penultimate joint broader than last joint and bearing it terminally ; third maxilliped with last two joints narrow, together longer than preceding joint, which is moderately broad ; dactyles of last three pairs of legs short, curved, of at least moderate breadth, with or without a small tooth on the lower border, without a basal protuberance.

1. *Anchistus Miersi* (de Man), 1888. (Type.)

Harpilius Miersi, de Man, Journ. Linn. Soc., Zool. xxii. p. 274, pl. xxii. figs. 6-10 (1888) ; Whitelegge, Fumafuti Atoll, Crust. p. 148 (1897).

Mergui Archipelago ; Ellice Group ; [British New Guinea].

2. *Anchistus inermis* (Miers), 1884.

Harpilius inermis, Miers, 'Alert' Report, Crust. p. 291, pl. xxxv. fig. B (1884) ; Müller, Verh. nat. Ges. Basel, 8, ii. p. 471 (1887).

East West Australia ; Ceylon.

3. *Anchistus spinuliferus* (Miers), 1884.

Harpilius spinuliferus, Miers, 'Alert' Report, Crust. p. 292 (1884).

Loc. — ?

4. *Anchistus biunguiculatus*, sp. n.

An *Anchistus* with rostrum not exceeding antepenultimate joint of antennular peduncles, much bent downwards, without teeth ; antennal scale rather longer than the peduncle of the first antenna ; immovable finger of legs of second pair much longer than movable finger and curved at the end ; dactyles of legs of last three pairs with a hooked spine in the middle of the under edge.

Length 50 millim.

[British New Guinea.]

(?) *Anchistus armatus* (H. M.-Edwards), 1837.

Pontonia armata, H. M.-Edwards, H. N. Crust. ii. p. 359 (1837).

New Ireland.

Genus PONTONIA, Latreille, 1829.

Pontonia, Latreille, Cuvier's R. An. 2nd ed. iv. p. 96 (1829); Roux, Mém. sur les Salicoques, p. 26 (1831); H. M.-Edwards, H. N. Crust. ii. p. 358 (1837); De Haan, Faun. Jap. p. 175 (1850); Dana, U.S. Expl. Exped., Crust. i. p. 570 (1852); Kingsley, Proc. Ac. N. Sci. Philad. 1879, p. 422 (1880); Joliet, Arch. zool. expér. x. p. 119 (1882); Carus, Prodr. Faun. Medit. i. p. 475 (1885).

Pontoniidæ with body depressed; rostrum short, depressed, bent downwards, not dentate, with or without a keel below at the free end; both flagella of first antenna short, thicker of two bifid; scale of second antenna of moderate length only, broad; flagellum of same not short; second maxilliped with penultimate joint broader than last joint and bearing it terminally; third maxilliped with last two joints narrow, together shorter than the preceding joint, which is broad; dactyles of last three legs straight, simple or with small teeth on the underside, without basal protuberance; one of the second pair of legs with very large chela.

1. *Pontonia custos* (Forskål), 1775. (Type.)

Cancer custos, Forskål, Descrip. anim. p. 94 (1775).

Astacus tyrrhenus, Petagua, Ent. pl. v. fig. 5 [fide Risso].

Gnathophyllum tyrrhenus, Desmarest, Consid. sur les Crust. p. 229.

Alpheus pinnophylax, Otto, Mém. Ac. cur. nat. Bonn, xiv. pl. xxi. fig. 2.

Pontonia tyrrhena, Latreille, Encycl. pl. cccxxvi. fig. 10; id. Cuvier's R. An. 2nd ed. p. 96 (1829); H. M.-Edwards, Crust. ii. p. 360 (1837); id. Atlas Crust. in Cuvier's R. An. pl. lii. fig. 4; Heller, Crust. südl. Eur. p. 251, pl. viii. figs. 10, 11 (1863); Ortman, Zool. Jahrb. v., Syst. p. 509, pl. xxvii. figs. *d-i* (1891).

Callianassa tyrrhenus, Risso, Hist. Nat. Eur. Méc. p. 54 (1826).

Pontonia custos, Guérin, Expéd. Morée, Zool. p. 36, pl. xxxvii. fig. 1; Carus, Prodr. Faun. Medit. p. 475 (1885).

(?) *Pontonia parasitica*, Roux, Mém. sur les Salicoques, p. 26 (1831).

Mediterranean.

2. *Pontonia nipponensis* De Haan, 1850.

Pontonia nipponensis, De Haan, Faun. Japon., Crust. p. 180 (1850).

Hymenocera nipponensis, De Haan, loc. cit. pl. xlvi. fig. 8 (1850).

Japan.

3. *Pontonia flavomaculata* Heller, 1864.

Pontonia flavomaculata, Heller, Verh. zool.-bot. Ges. Wien, xiv. p. 51 (1864); Carus, Prodr. Faun. Medit. i. p. 475 (1885); Ortman, Zool. Jahrb. v., Syst. p. 509 (1891).

Pontonia diazone, Joliet, Arch. zool. expér. x. p. 101 (1882).

Pontonia phallusia, Marion, Ann. Mus. N. H. Marseille, Zool. i. (1883); Gourret, Compt. Rend. civ. p. 187 (1887).

Mediterranean.

4. *Pontonia unidens* Kingsley, 1830.

Pontonia unidens, Kingsley, Proc. Ac. N. Sci. Philad. 1879, p. 422, pl. xiv. fig. 9 (1880).

(?) *Pontonia mexicana*, Guérin, de la Sagra's Hist. Cuba (1856).

West Indies.

5. *Pontonia brevisrostris* Miers, 1884.

Pontonia brevisrostris, Miers, 'Alert' Report, Crust. p. 562, pl. li. fig. B (1884).

Seychelles.

6. *Pontonia pinnæ* Ortmann, 1894.

Pontonia pinnæ, Ortmann, Semon's 'Forschungsreisen in Austral.' p. 16, pl. i. (1894).

East Africa.

7. *Pontonia ascidicola* sp. n.

A *Pontonia* with antennal scale barely reaching end of peduncle of first antenna and with rostrum short, barely reaching middle of antepenultimate joint of peduncle of first antenna, without keel below.

Length 18 millim.

[New Britain.]

(?) *Pontonia domestica* Gibbes, 1851.

Pontonia domestica, Gibbes, P. Am. Assoc. iii. p. 196 (1851); Kingsley, Proc. Ac. N. Sci. Philad. 1878, p. 95.

Bahamas.

Genus CONCHODYTES, Peters, 1851.

Conchodytes, Peters, Ges. natuf. Freunde Berlin, 1851 (vide Heller); id. Ber. k. Ak. Wiss. Berlin, 1852, p. 591; Hilgendorf, Monatsber. k. Ak. Wiss. Berlin, 1878, p. 835.

Pontoniidæ with body much depressed; rostrum short, depressed, bent downwards, without dentations, bearing a keel below at the free end; both flagella of the first antenna very short, thicker of the two bifid; scale of second antenna short, broad; flagellum of same short; second maxilliped with penultimate joint broader than last joint, which it bears terminally; third maxilliped with last two joints fairly broad, together shorter than preceding joint, which is broad; dactyles of last three legs short, stout, curved, bearing on the underside a hooked spine and a low basal protuberance.

1. *Conchodytes tridacnæ* Peters, 1881. (Type.)

Conchodytes tridacnæ, Peters, Ges. naturf. Freunde Berlin, 1851 (fide Heller); Ber. k. Ak. Wiss. Berlin, 1852, p. 594; Hilgendorf, Monatsber. k. Ak. Wiss. Berlin, 1878, p. 835.

Pontonia tridacnæ, Dana, *loc. cit.* p. 571, pl. xxxvii. figs. 1 *a-d* (1852); ? Ortmann, Zool. Jahrb. v., Syst. p. 509, pl. xxxvi. figs. 10 *d-i* (1891).

Samoa; East Africa; Red Sea.

2. *Conchodytes meleagrincæ* Peters, 1851.

Conchodytes meleagrincæ, Peters, Ber. k. Ak. Wiss. Berlin, 1852, p. 594; Hilgendorf, Monatsber. k. Ak. Wiss. Berlin, 1878, p. 836.

Pontonia meleagrincæ, Bate, 'Challenger' Macrura, p. 707, pl. cxxiv. figs. 1, 2 (1888).

(?) *Pontonia maculata*, Stimpson, Proc. Ac. Nat. Sci. Philad. 1830, p. 38.

(?) *Pontonia tridacnæ*, Miers, 'Alert' Report, Crust. p. 290 (1884).

(?) *Pontonia enflée*, H. M.-Edwards, H. N. Crust. ii. p. 360 (1837).

East Africa; Torres Straits; [British New Guinea; Conflict Group; Loyalty Islands; Rotuma].

Genus TYPTON, Costa, 1844.

Typton, Costa, Ann. Ac. degl. Aspir. Nat. Nap. ii. (1844); id. Faun. Regn. Nap. ii. 1 (1846); Heller, Crust. südl. Eur. p. 254 (1863); Bate, Ann. & Mag. Nat. Hist. (4) ii. p. 119 (1868); Kingsley, Proc. Ac. N. Sci. Philad. 1879, p. 422 (1880); Costa, Prodr. Faun. Medit. i. p. 475 (1885); Ortmann, Zool. Jahrb. v., Syst. p. 508 (1891).

Pontonella, Heller, Verh. zool.-bot. Ver. Wien, vi. p. 629 (1856).

Pontoniidæ with rostrum small, compressed, bent upwards at the free end, pointed towards the tip, not dentate; thicker flagellum of first antenna short, not bifid; scale of second antenna rudimentary; second maxilliped with penultimate joint somewhat broader than last joint, which it bears terminally; third maxilliped narrow, last two joints together somewhat longer than preceding joint; dactyles of last three thoracic legs moderately straight and slender, with a small tooth below, without basal protuberance; one of the second pair of legs with very large chela.

1. *Typton spongicola* Costa, 1844. (Type.)

Typton spongicola, Costa, Ann. Ac. degl. Aspir. Nat. Nap. ii. (1844); id. Faun. Regn. Nap. ii. 1 (1846); Heller, Crust. südl. Eur. p. 254 (1863); Norman, Ann. & Mag. Nat. Hist. (4) ii. p. 176 (1868); Costa, Prodr. Faun. Med. i. p. 475 (1885); Ortmann, Zool. Jahrb. v., Syst. p. 508, pl. xxxvii. fig. 8 (1891).

Typton spongiosus, Bate, Ann. & Mag. Nat. Hist. (4) ii. p. 119 (1868).

Alpheus Edwardsii, Couch, Proc. Linn. Soc., Zool. v. p. 210 (1860).

Pontonella glabra, Heller, Crust. südl. Eur. p. 254, pl. viii. figs. 12-17 (1863).

Mediterranean; Cornwall.

Key to the Genera of Pontoniidæ.

- I. Scale of second antenna not rudimentary.
- A. Antepenultimate joint of third maxilliped never more than moderately broad. Last two joints not contrasting sharply in breadth with the antepenultimate.
1. Dactyles of last three pairs of legs without basal protuberance. Last two joints of third maxilliped narrow.
- a. Dactyles of last three pairs of legs straight. Rostrum almost always with dorsal dentate crest, not bent downwards, not with abrupt or rounded end *Periclimenes*, Costa, [1844.
- b. Dactyles of last three pairs of legs curved. Rostrum without dentate dorsal crest, bent downwards, with abruptly pointed or rounded end *Anchistus*, gen. nov.
2. Dactyles of the last three pairs of legs with basal protuberance. Last two joints of third maxilliped broad *Coralliocariss*, Stimpson, 1860.
- B. Antepenultimate joint of third maxilliped broad. Last two joints usually contrasting sharply in breadth with the antepenultimate.
1. Last two joints of third maxilliped together longer than the preceding joint. Last joint of second maxilliped borne laterally by the penultimate joint *Harpilius*, Dana, 1852.
2. Last two joints of third maxilliped together shorter than the preceding joint. Last joint of second maxilliped borne terminally by the penultimate.
- a. Dactyles of last three pairs of legs curved, with a low basal prominence. Flagellum of second antenna short. Last two joints of third maxilliped fairly broad *Conchodytes*, Peters, [1851.
- b. Dactyles of last three pairs of legs straight, without basal prominence. Flagellum of second antenna not short. Last two joints of third maxilliped narrow *Pontonia*, Latreille, [1829.
- II. Scale of second antenna rudimentary *Typton*, Costa, 1844.

XLIV.—On the *Pierine Butterflies* of the Genus *Catophaga*.

By ARTHUR G. BUTLER, Ph.D., F.L.S., F.Z.S., &c.

WHEN Wallace described his extensive genus *Tachyris*, based chiefly upon the tuft at the base of the claspers in the males, he seems to have been unaware that Hübner had already proposed three generic names, viz. *Appias*, *Catophaga*, and *Hyposcritia* (recte *Hyposcritia*) for species having this secondary sexual character.

I find that *Appias* (type *A. zelmira*) is undoubtedly generically distinct, the club of the antennæ being broadly spoon-shaped and flattened; but I see no reason for regarding *Catophaga*, *Hyposcritia*, and *Tachyris* (restricted) as more than groups of one genus, differing chiefly in outline of wing and style of coloration. In the case of *Salotara* the structural difference in neuration is inconstant, and consequently only of subgeneric value; I therefore regard this also as a group, though perhaps a little better defined than the others.

Group 1. HYPOSCRITIA, Hübn.

The species of this group have the apex of the primaries usually more or less falcate; the males of the wet-season phase are either cream-coloured or ochraceous on the under surface of the secondaries, rarely (perhaps never) heavily speckled or striated; whereas the dry-season phase of the male more or less resembles a dead leaf in tint on the under surface.

Type of the group *H. pandione*.

1. *Hyposcritia indra*.

Pieris indra, Moore, Cat. Lep. E. I. C. i. p. 74 (1857); P. Z. S. 1857, p. 103, pl. xlv. fig. 5.

Appias mahana, Moore, Ann. & Mag. Nat. Hist. ser. 4, vol. xx. p. 48 (1877).

Appias imbecilis, Moore, Journ. As. Soc. Beng. liii. p. 46 (1884).

Tachyris indigis, Weymer, Stett. ent. Zeit. 1886, pl. i. fig. 3, 1887, p. 11.

N.E. India and Burma. ♀, type, B. M.

We have one male labelled "Celebes," but I believe this to be an error; it was received from the Godman and Salvin collection (ex coll. Druce). *H. indra* is the wet-season phase, *H. mahana* dry, *H. imbecilis*=*indigis* an extreme dry phase.

2. *Hyposcritia shiva*.

Hyposcritia shiva, Swinhoe, P. Z. S. 1885, p. 138, pl. ix. figs. 1, 2.

Poona, Manipur, and Burma. ♂, type, B. M.

The female much resembles that sex of *H. leptis* on the upper surface, but the male looks like *H. indra* starved.

3. *Hyposcritia narendra*.

Hyposcritia narendra, Moore, Ann. & Mag. Nat. Hist. ser. 4, vol. xx. p. 48 (1877).

Ceylon. B. M.

Var. (?). Nilgiris. B. M.

I have only seen dry forms of this species; the Nilgiri type may possibly be a large form of *H. shiva*, which it resembles almost as closely as it does the Ceylonese species.

4. *Hyposcritia leptis*.

Pieris leptis, Felder, Reise der Nov., Lep. ii. p. 163 (1865).

Tachyris Lucasi, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 381 (1867).

Java. Wet-season phase, B. M. Dry-season phase, coll. Hewitson.

5. *Hyposcritia plana*.

Appias plana, Butler, Trans. Linn. Soc. 2, Zool. i. p. 551 (1879).

Borneo, Sumatra, Malacca, Batchian. Type, B. M.

I have only seen the wet-season phase of this species, and it is possible that no dry phase may exist.

6. *Hyposcritia pandione*.

Hiposcritia pandione, Hübner, Zutr. exot. Schmett. figs. 651, 652 (1832).

Pieris ida (?), Lucas, Rev. et Mag. de Zool. 1852, p. 335.

Java. B. M.

I have only seen a dry phase of this species; but it is quite likely that *H. ida* may be the wet-season form.

7. *Hyposcritia Whiteheadi*.

Appias Whiteheadi, Grose-Smith, Ann. & Mag. Nat. Hist. ser. 5, vol. xx. p. 434 (1887); Rhop. Exot. i., *Pier.* ii. figs. 4, 5 (1889).

Kina Balu. B. M.

8. *Hyposcritia montana*.

Appias montanus, Rothschild, Nov. Zool. iii. p. 325 (1896).

Philippines.

I have not seen this species, but it is said to be related to *H. phæbe*.

9. *Hyposcritia* (?) *ambigua*.

Appias ambigua, Grose-Smith, Nov. Zool. ii. p. 76 (1895).

Wetter, Dili, and Gilolo.

Judging from the description, I imagine that this must be a *Hyposcritia*; but no hint of its affinities is given.

10. *Hyposcritia phæbe*.

Pieris phæbe, Felder, Wien. ent. Monatschr. v. p. 299 (1861); Reise der Nov., Lep. ii. p. 163, pl. xxv. fig. 5 (1865).

Philippines.

Not in the Museum collection.

11. *Hyposcritia lagela*.

Catophaga lagela, F. Moore, P. Z. S. 1878, p. 838.

Tenasserim. Type, B. M.

12. *Hyposcritia lalage*.

Pieris lalage, Doubleday in Gray's Zool. Misc. p. 76 (1842); Doubleday and Hewitson, Gen. Diurn. Lep. pl. vi. fig. 5 (1847).

Pieris durvasa, Moore, Cat. Lep. E. I. C. i. p. 73 (1857); P. Z. S. 1857, p. 103, pl. xlv. fig. 6.

Catophaga pseudolalage, Moore, P. Z. S. 1879, p. 142.

Hyposcritia argyridina, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xvi. p. 340 (1885).

N.E. India to E. Pegu. ♀, type, B. M.

H. durvasa is the extreme wet-season form of the species; *H. lalage* (typical) is also a wet-season phase, probably appearing at the end of the rains; *H. pseudolalage* is a smaller form, probably occurring at the commencement of the dry season; and *H. argyridina* is a true dry-season phase.

13. *Hyposcritia indroides*.

Pieris indroides, Hornrath, Berl. ent. Zeitschr. xxxiii. p. 403 (1889).

Perak.

Not in the Museum collection. Weymer says that it is the *H. lalassis* of Grose-Smith, but I cannot agree with him.

14. *Hyposcritia lalassis*.

Appias lalassis, Grose-Smith, Ann. & Mag. Nat. Hist. ser. 5, vol. xx. p. 265 (1887); Rhop. Exot. i., *Pier.* pl. ii. figs. 1-3 (1889).

East Pegu and Burma. 2 ♂, B. M.

Group 2. *CATOPHAGA*, Hübn.

In this, the typical group, the primaries show little tendency to falcation at apex, the sexes are usually very dissimilar, and the colouring of secondaries below varies seasonally from ochraceous or yellow to pearl whitish.

1. *Catophaga ega*.

Pieris ega, Boisduval, Sp. Gén. Léop. i. p. 536 (1836).

Pieris melania, var. *caledonica*, Felder, Verh. zool.-bot. Ges. Wien, xii. p. 495 (1862).

Pieris psyche, Felder, Reise der Nov., Lep. ii. p. 166 (1865).

Australia to New Caledonia and the Loyalty group. B. M.

This species apparently varies but little, all the specimens which I have seen showing a wet-season character. There are forty-two examples in the Museum series.

2. *Catophaga agave*.

Pieris agave, Felder, Wien. ent. Monatschr. vi. p. 283 (1862).

Tachyris alope, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 372 (1867).

Tachyris mata (?), Kheil, Lep. Ins. Nias, p. 34, pl. iv. fig. 21 (1884).

Tachyris agatha, Staudinger, Iris, 1889, p. 20.

Malacca, Java (Nias ?), Borneo, Philippines. B. M.

Kheil's illustration agrees well with one of our male examples; but in his description he calls the upper-surface coloration hoary greyish, and he states that it belongs to the *T. celestina* group, in which (as is well known) the upper surface is pale chalky bluish. The figure, being a photograph, distinctly proves that "*T. mata*" is not a *Tachyris*, but a male *Catophaga*, and therefore that it is not nearly related to *T. celestina*, the dusky spot on the primaries being placed between veins 3 and 4, not between 4 and 5; and my opinion is that it is merely a feebly marked (perhaps dry-season) discoloured male of *C. agave*. I believe Staudinger's *Tachyris agatha* to be a variety of the female. The *Tachyris maculata* of Grose-Smith (compared with *C. agave*) appears to me to be closely related to *Huphina acrisa*, Boisduval.

3. *Catophaga urania*.

♂. *Tachyris urania*, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 371 (1867).

♀. *Appias Dohertyi*, Rothschild, Deut. ent. Zeit., Lep. v. p. 441, pl. v. fig. 1 (1892).

♂, Celebes (ex coll. Godm. & Salv.). Type, coll. Hewitson.

I have not seen the female of this species, but believe *A. Dohertyi* to represent that sex.

4. *Catophaga melania*.

♀. *Papilio melania*, Fabricius, Syst. Ent. p. 475 (1775).

Appias melania, Butler, Cruise of the 'Curaçoa,' p. 471, pl. xlix. figs. 4, 5 (1873).

♂. *Pieris zoe*, Vollenhoven, Mon. Pier. p. 37, pl. iv. fig. 3 (1865).

♀ (as ♂). *Tachyris asteria*, Miskin, Proc. Linn. Soc. N. S. W. 2, iii. p. 1514 (1888).

Type, ♀, coll. Banks; 2 ♂, 2 ♀, Batchian, colls. Hewitson and B. M.

The secondaries of the female vary much in colouring on the upper surface, but whether the differences are seasonal or not is not known; one of our examples has these wings bright yellow, with the usual broad deep brown borders. I think *T. asteria* is only a variety of this sex.

5. *Catophaga Jacquinotii*.

♂. *Pieris Jacquinotii*, Lucas, Rev. et Mag. de Zool. 1852, p. 326.

♀. *Appias korridana*, Grose-Smith, Novit. Zool. i. p. 335 (1894).

♂, Ceram; ♀, Biak, New Guinea. B. M.

A local representative of *C. melania*.

6. *Catophaga galathea*.

♂. *Pieris galathea*, Felder, Reise der Nov., Lep. ii. p. 165 (1865).

Catophaga Roepstorffi, Moore, Journ. As. Soc. Beng. lii. p. 44 (1884).

♂, Camorta. B. M.

I consider typical *C. galathea* to be the wet- and *C. Roepstorffi* the dry-season phase.

7. *Catophaga sawela*.

Tachyris sawela, Frühstorffer, Soc. Ent. 14, xi. pp. 115, 116 (1896); Berl. ent. Zeitschr. xli. p. 390, pl. ix. fig. 8, ♀ (1897).

♂ ♀, Lombock (*Frühstorffer*). B. M.

8. *Catophaga eurosundana*.

Appias eurosundana, Grose-Smith, Novit. Zool. ii. p. 75 (1895).

Timor, Sambawa, and Wetter.

Said to be nearly related to *C. paula*, which it nearly resembles in both sexes.

9. *Catophaga paula*.

Catophaga paula, Rüber, Tijd. Ent. xxxiv. p. 232, xxxv. pl. iv. figs. 1, 2 (1892).

Wetter.

This species seems nearly related to the preceding, but I have not seen examples.

10. *Catophaga paulina*.

♀. *Papilio paulina*, Cramer, Pap. Exot. ii. pl. cx. E, F (1779).

Catophaga leis, Hübner, Zutr. exot. Schmett. figs. 771, 772 (1832).

♂. *Pieris darada*, Feld. Reise der Nov., Lep. ii. p. 166 (1865).

♂ ♀. *Catophaga lankapura*, Moore, P. Z. S. 1879, p. 142.

N.W. and N.E. Provinces of India, Burma, Tonkin, Ceylon, Penang, Java, Borneo. B. M.

I regard *C. lankapura* as the wet-season phase, *C. paulina* intermediate, and *C. leis* = *darada* as the dry-season phase.

11. *Catophaga albina*.

♂. *Pieris albina*, Boisduval, Sp. Gén. Léop. i. p. 480 (1836).

♂. *Pieris Rouvii*, Boisduval, t. c. p. 481 (1836).

♀. *Pieris neombo*, Boisduval, t. c. p. 539 (1836).

♂. *Pieris galene*, Felder, Reise der Nov., Lep. ii. p. 165 (1865).

♂. *Tachyris albata*, Hopffer, Stett. ent. Zeit. 1874, p. 22.

♀. *Catophaga venusta*, Moore, Lep. Ceylon, i. p. 132, pl. li. fig. 3 (1880-81).

Ceylon, Southern and Eastern India, Pegu, Burma, Tonkin, Philippines, Batchian, Ceram, Bourou, Celebes, Borneo, Penang, Sumatra, Java, Timor-Laut, and Northern Australia. (81 examples.) B. M.

I take the representative of the extreme wet-season phase to be that in which the male has the secondaries and apex of primaries below butter-yellow and the female a bright daffodil-yellow above, with the secondaries and apex of primaries below bright ochreous. Flying with this form *C. neombo* is obtained (an intermediate phase), in which the female is milky white, the male below with the secondaries and apex of primaries sericeous cream-coloured, varying to pale ochreous, and the female with the same parts pearl-white;

the dry form is represented by *C. albina* and *Rouxii*, in which the dusky border of the male primaries is either almost wholly absent or is reduced to a slender abbreviated black marginal line, and the female differs from *C. neombo* in the reduction of the black markings on the upper surface.

Whether *C. albina* is really a distinct species from *C. paulina* can only be finally settled by breeding from the egg; the *C. leis=larada* form runs *C. neombo* rather close in both sexes.

12. *Catophaga Wardii*.

Catophaga Wardii, Moore, Journ. As. Soc. Beng. lii. p. 43 (1884).

Nilgiris, Mysore, Rangoon. B. M.

What I take to be wet-season males of this species resemble females of *C. neombo* in the character of the upper surface. I am not sure that two females without locality standing next to the male of this species in Hewitson's collection do not represent the wet-season phase of the female, the secondaries and apex of primaries below being deep orange; but they may be merely unusually large examples of female *C. lankapura*. I think *C. Wardii* is a good species, distinct from *C. paulina*.

13. *Catophaga cynisca*.

♀. *Tachyris cynisca*, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 375 (1867).

Tachyris agatha, Staudinger, Deut. ent. Zeit., Lep. 1889, p. 20.

Bourou. Type, coll. Hewitson.

14. *Catophaga maria*.

Tachyris maria, Semper, Stett. ent. Zeit. 1875, p. 405; Reisen im Arch. Philipp. vol. v. p. 247, pl. xxxix. figs. 1-4 (1891).

Philippines. B. M.

The male has a female character of upper surface.

15. *Catophaga saina*.

Appias saina, Grose-Smith, Novit. Zool. i. p. 336 (1894).

New Guinea.

16. *Catophaga athama*.

♀. *Pieris athama*, Lucas, Rev. et Mag. de Zool. 1852, p. 336; Herrich-Schäffer, Aus. Schmett. ii. fig. 104 (1869).

♂. Above milky white; costal border grey almost to end of cell, thence black-edged to apex and along outer margin

to first median branch : under surface with the secondaries and apex of primaries creamy buff, shading into brighter yellow on the borders.

Samoa. 3 ♂, 3 ♀, B. M.

17. *Catophaga Wallacei*, sp. n.

♀. *Tachyris athama*, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. pl. ix. fig. 1 (1867).

♂. Chiefly differing from that sex of the preceding species in its more acute primaries.

Mallicollo, New Hebrides, and New Caledonia. B. M.

When describing the female of this species Wallace commented upon its differences from M. Lucas's description and figure, and indeed admitted that the latter was "hardly recognizable" as the same insect. As subsequently evidenced by Herrich-Schäffer's second figure and by three typical females now in the Museum, the illustration criticized by Wallace was an accurate one, and therefore not the same insect as the female figured by himself from New Caledonia.

Group 3. SALETARA, Dist.

The species all have acutely triangular wings with tolerably regular external blackish borders and a good deal of yellow of various shades on the under surface; the females vary a good deal in the colouring of the upper surface, the differences being probably seasonal; there seems, however, very little to distinguish the supposed seasonal phases of the males excepting in *S. nigerrima*.

This group was erected into a genus on the ground that in some of the species the males show an extremely short terminal furcation of the third subcostal branch. This character, however, is not only valueless for generic, but for specific differentiation, inasmuch as males of the Malayan representative of *S. panda* sometimes have it well marked and sometimes show no trace of it, proving clearly its unstable, individual, and therefore utterly unreliable nature. As a group, however, it is a natural one, but characters have yet to be discovered which will warrant its being called a distinct genus.

1. *Saletara corinna*.

♂ ♀. *Tachyris corinna*, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 377 (1867).

Port Moresby, New Guinea. 6 ♂, 1 ♀, B. M.
Described from Waigiou.

2. *Saletara cycinna*.

♂. *Pieris cycinna*, Hewitson, Exot. Butt. ii., *Pier.* pl. iv. figs. 23, 26 (1861).

♀. *Pieris ocina*, Hewitson, *l. c.* figs. 24, 25 (1861).

Aru Islands. 3 ♂, 2 ♀, B. M.

The upper surface of the female varies from white to yellow.

3. *Saletara liberia*.

Papilio liberia, Cramer, Pap. Exot. iii. pl. cex. G, H (1782).

Ceram. 7 ♂, 2 ♀, B. M.

4. *Saletara eliada*.

Pieris eliada, Hewitson, Exot. Butt. ii., *Pier.* pl. iv. figs. 27, 28 (1861).

Batchian. 5 ♂, B. M.

5. *Saletara nathalia*.

Pieris nathalia, Felder, Wien. ent. Monatschr. vi. p. 285 (1862).

♀. *Tachyris panthea*, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 376 (1867).

Philippines. 12 ♂, 8 ♀, B. M.

6. *Saletara Distanti*, sp. n.

The males sometimes with and sometimes without a terminal furcation of the third subcostal branch of the primaries; the secondaries and sometimes all the wings often tinted with sulphur; the females varying from white to yellow, the outer borders narrower (usually considerably so) than in *S. nathalia*, and the pale areas consequently broader; the under surface in both sexes (excepting in what I take as the dry phase of the female) more suffused with bright ochreous.

Expanse of wings, ♂ 54-64, ♀ 59-64 millim.

Malacca, Singapore, Sumatra, Borneo. 9 ♂, 8 ♀, B. M.

7. *Saletara panda*.

♂. *Pieris panda*, Godart, Enc. Méth. ix. p. 147 (1819).

♀. *Pieris sulphurea*, Vollenhoven, Mon. Pier. p. 32, pl. iv. fig. 4 (1865).

Java. 5 ♂, 4 ♀, B. M.

The males of this species are always more or less suffused with sulphur-yellow, and I have seen no white forms of the female; the outer border in this sex is narrower than in the preceding species, and the ochreous suffusion of the under surface in both sexes is more marked.

8. *Saletara gisco*.

♂. *Appias gisco*, Grose-Smith, Ann. & Mag. Nat. Hist. ser. 6, vol. xv. p. 229 (1895).

Solomon Islands.

Allied to *S. panda*, and said to resemble the female of that species on the upper surface.

9. *Saletara nigerrima*.

♀. *Appias panda*, var. *nigerrima*, Holland, Proc. Bost. Soc. xxv. p. 76, pl. iv. fig. 3 (1891).

♂. *Saletara Schombergi*, Semper, Reisen im Arch. Philipp. vol. v. p. 249 (1891).

♂. *Tachyris aurantiaca*, Staudinger, Deut. ent. Zeit., Lep. vii. p. 352 (1894).

Celebes and Sula Islands. B. M.

Our male from the Celebes is white above and nearly resembles *S. nathalia*. I consider this as probably the male of the wet phase and Dr. Holland's female as belonging to the same phase. *S. Schombergi* from Borneo and *S. aurantiaca* from the Sula Islands probably represent the dry phase, which will doubtless be found in the Celebes also.

[To be continued.]

XLV. — *New North-American Insects*. By T. D. A. COCKERELL, Entomologist of the New Mexico Agricultural Experiment Station.

IX.—*Two new Coccidæ of the Genus Orthezia*.*Orthezia garryæ*, sp. n.

♀ (adult).—Length about $2\frac{1}{2}$ millim., with ovisac about 7 millim.

Body pale pea-green; ovisac strongly curved upwards, composed of ribbon-like longitudinal bands, which are contiguous, but little or not coherent; lateral dorsal areas only clothed with thin meal; middle of back with a double crest of long erect white lamellæ; sides with long thick curling white lamellæ, the two at the beginning of the ovisac on each side very long and curving downwards over the side of the ovisac; caudal lamellæ rather short; legs light brown, femora and ends of tarsi piceous; the legs measure as follows in μ :—femur + trochanter 746; tibia 696–779; tarsus 381; claw 90.

The last six antennal segments measure thus in $\mu\mu$:—(3) 199, (4) 182, (5) 140, (6) 124, (7) 116, (8) 232; there is a hyaline process at the end of the eighth segment.

Larva.—Pale yellow, covered with white lamellæ, which form a high and thick dorsal crest, covering the back; the lateral lamellæ are also well developed, with an especially long one at each corner.

Hab. On leaves of *Garrya*, Dripping Spring, Organ Mountains, New Mexico, middle of August, 1898 (*Ckl.* and *José Mendoza*). The females were producing young.

O. garrya is a very distinct species, remarkable for its green colour, high dorsal crest, and the very long tibia. The *Garrya* is a tall shrub; I find it in the herbarium of the N. M. Exper. Station labelled "*G. ovata*, var. *Lindheimeri*," but it cannot well be that, having glabrous leaves. It agrees with the description of *G. Wrightii*, Torrey.

Orthezia monticola, sp. n.

♀ (adult).—Length about $1\frac{1}{2}$ millim., with ovisac 4 millim.

Body rather pale brown, legs and antennæ dark chestnut-brown. Dorsal surface naked, except for a very little mealy powder, and two median rows of small white waxy tufts; lateral lamellæ rather short; caudal lamellæ fairly long, about equal in size. Ovisac broad, not curled upwards, dorsally with the usual longitudinal ridges. Antennæ 8-segmented, the eighth with a little hyaline elongate-conical process at the end. The antennal segments, measured in $\mu\mu$, are as follows:—(1) 133, (2) 99, (3) 116, (4) 99, (5) 99, (6) 83, (7) 75, (8) 149; formula 8 1 3 (2 4 5) 6 7. The legs, measured in $\mu\mu$, are thus:—coxa 149; femur + trochanter 514; tibia 514; tarsus 282; claw 66.

Hab. At roots of grass, Dripping Spring, Organ Mountains, New Mexico, middle of August, 1898 (*Ckl.*). The locality is about 5600 feet above sea-level.

O. monticola differs from *O. graminis*, Tinsley, by its smaller size and much shorter ovisac and the arrangement of the dorsal secretion in two lines with a dark space between. From *O. nigrocincta*, Ckl., it differs again by the two separate lines of white dorsal tufts, and also by having the ridges on the ovisac weaker, but sharper, and not quite so numerous. From *O. insignis*, Dougl. (which is a tropical insect), it differs by the dorsal stripes of waxy secretion being hardly divergent at the middle, and the tufts composing them, especially the anterior ones, being thicker and longer, whereas in *insignis* the secretion is reduced to fine lines.

X.—Two new Case-bearing Lepidoptera.

Coleophora suædicola, sp. n.

Expanse about 8 millim.

Head, thorax, abdomen, legs, and primaries white; secondaries and all the fringes very pale ochreous. Primaries without streaks or lines, but conspicuously, though irregularly, speckled with black scales. Palpi clothed with white scales, but the penultimate segment on the outer side with a distinct black streak, running up to the small but well-formed apical tuft. Antennæ ringed with black and white, the extreme base rather thickly clothed with white scales.

Case about 5 millim. long and 1 broad, cigar-shaped, dark brown, roughened, the mouth like that of a *Clausilia* shell; hind end tricarinate.

Hab. Common on *Sueda* at Mesilla Park, New Mexico (*Ckl.*). Moths emerging at the middle of August.

I will take this opportunity to mention that *Lycæna exilis* breeds in numbers on the same *Sueda* plants; this is quite a new food-plant for it.

Coleophora atriplicivora, sp. n.

Expanse 18 millim.

Head and thorax above and primaries white, with a delicate ochreous tint. Secondaries, abdomen, legs, and underparts of body silvery white; hind tibiæ pale ochreous, clothed with long white hair. Fringes pale, faintly greyish, tinged with ochreous; fringe on primaries at its longest longer than the greatest diameter of the wing. Primaries apparently without streaks, but a close examination shows that the courses of the veins are broadly ochreous-tinged, while the intervals are narrowly white, producing an obscure longitudinal streaking, which is somewhat intensified by the fact that the intervals are peppered with minute dark grey specks. Palpi quite long, the penultimate segment with a well-marked terminal brush of scales. Antennæ delicately annulate with white and pale grey, the basal two fifths heavily clothed (especially above) with ochry-white scales, so as to appear considerably thickened. Abdominal segments 2 to 6 each with a pair of longitudinal narrow brown (*i. e.* scaleless) marks, one on each side of the median line.

Case cigar-shaped, 12 millim. long, 3 broad; white, with the faintest yellowish tinge, roughened, tricarinate at hind

end; plane of mouth forming a distinct angle with the longitudinal axis.

Hab. Common on *Atriplex canescens* at Mesilla Park, New Mexico (*Ckll.*). Moths emerging at the middle of August.

I have known the cases for several years, but until recently have been unable to breed the moth.

Mesilla Park, New Mexico, U.S.A.,
Aug. 26, 1898.

XLVI.—*Descriptions of Two new Species of Butterflies of the Genus Thysonotis.* By H. GROSE-SMITH, B.A., F.E.S., F.Z.S.

Thysonotis zuleika.

Male.—*Upperside.* Differs from *T. apollonius*, Fchl., in the following respects:—On the anterior wings the white band which crosses the middle of the wings to the inner margin is much less distinct, being irrorated with blue scales, in this respect approaching *T. lampros*, Druce, and the costal and outer-marginal black bands are narrower than in either of those species. On the posterior wings the white central area is considerably wider, and the dark outer marginal area is narrower than in those species.

Underside with the white areas on both wings much more extended, the black outer-marginal areas being correspondingly narrower; the blue submarginal bands on the posterior wings are also narrower, and the black spots in them are smaller and rounder.

Female.—*Upperside.* Both wings black; anterior wings crossed about the middle, from the upper discoidal nervule to the inner margin, by an irregular, curved, transverse white band; the apical third of the costal and outer margins is rather broadly white. Posterior wings crossed a little before the middle by a broader white band than in *T. apollonius*.

On the *underside* the apex of the anterior wings is also broadly white, and the white central band extends at its apex to the subcostal blue band; in other respects the underside is as in the male. Cilia of both wings narrowly white.

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

Hab. Rossel Island, Louisiade Archipelago (*Meek*).

In the collections of Mr. Grose-Smith (types, ♂ ♀) and the Hon. Walter Rothschild.

The female approaches that sex of *T. dispar*, Grose-Smith, but the white bands on both wings are very much broader. It is a smaller insect than any of the above-mentioned species.

Thysonotis zuleima.

Male—*Upperside* more greenish blue than *T. zuleika*; anterior wings with the costal margin at the base and the outer margin more broadly black, and the central white band is not irrorated by blue scales.

On the *underside* of the anterior wings the blue band which traverses the outer marginal black area is narrower along the outer margin than in *T. zuleika*; on the posterior wings the inner edge of the submarginal blue band is lunulate between the veins, and the black spots in it are larger than in *T. zuleika*.

Female.—*Upperside* closely resembles the same sex of *T. zuleika*, but on the anterior wings the apical area is not tipped with white, and the white band which crosses the middle is more oblique.

On the *underside* the apex of the anterior wings is not tipped with white, and on the posterior wings the submarginal blue band is also lunulate on its inner edge, the spots in this band being likewise larger. Cilia rather broadly white, crossed by grey at the ends of the veins.

Expanse of wings $1\frac{5}{8}$ inch.

Hab. St. Aignan Island (*Meek*).

In the collections of Mr. Grose-Smith (types, ♂ ♀) and the Hon. Walter Rothschild.

This species is closely allied to *T. zuleika*, but the different colouring of the male, the absence of the white tips on the anterior wings of the female, and other distinctions are sufficient to separate them.

XLVII.—*Notes on some Type Specimens of Cretaceous Fishes from Mount Lebanon in the Edinburgh Museum of Science and Art.* By A. SMITH WOODWARD, F.L.S.

THE descriptions and figures given in the memoir on the Cretaceous fishes of Mount Lebanon by the late Mr. James W. Davis* are scarcely adequate for the purposes of ichthyology. To understand this important extinct fish-fauna it is necessary

* J. W. Davis, "The Fossil Fishes of the Chalk of Mount Lebanon, in Syria," *Trans. Roy. Dublin Soc.* [2] vol. iii. (1887), pp. 457-636, pls. xiv.-xxxviii.

to examine the original specimens further and determine their essential features; moreover, it is desirable in connexion with them to make a renewed study of some of the type specimens described by Pictet and Humbert* in the Natural History Museum at Geneva. I have recently been attempting this task, so far as the Physostomous Teleosteans are concerned, and the general results will shortly be summarized in the fourth volume of the British Museum Catalogue of Fossil Fishes. The majority of the specimens described by Davis are to be found in the British Museum, and will thus be noticed in detail in the official work just mentioned. A considerable number, however, are now preserved in the Edinburgh Museum of Science and Art, and some of them seem to demand detailed description elsewhere. The following notes relate to the latter specimens, and furnish, so far as their fragmentary nature will permit, the essential characters by which to determine their systematic position. Through the kindness of Dr. Traquair, to whom I would express my best thanks, I have received the whole series on loan from Edinburgh, and have thus been able to make direct comparisons with the similar collection in London.

1. *Osmeroides megapterus* (Pictet), J. W. Davis, *loc. cit.* p. 557, pl. xxxii. fig. 4. [= *Sardinius crassapinna*, Davis.]

From an examination of Pictet's type specimen of *Osmeroides megapterus* in Geneva I am convinced that this species is referable to the genus *Sardinioides* of W. von der Marek †, which has the pelvic fins large, but the pectoral fins rudimentary or absent. It is thus evident that both of the specimens figured by Davis under the same specific name are wrongly determined. The second (*loc. cit.* pl. xxxii. fig. 6) is clearly an example of *Osmeroides* (regarding the English *O. lewesiensis* as type), as indicated by its branchiostegal rays, gular plate, fins, and scales. The first (*loc. cit.* pl. xxxii. fig. 4), however, belongs to another genus and requires further consideration.

The latter specimen exhibits remains of a series of about ten branchiostegal rays beneath the head, all very slender except the two uppermost. The abdominal vertebræ must have been approximately 20 in number, and the ribs do not appear to have completely encircled the abdominal cavity. The caudal vertebræ are shown to have been 19 or 20 in

* F. J. Pictet, "Description de quelques Poissons Fossiles du Mont Liban" (1850); Pictet and Humbert, "Nouvelles Recherches sur les Poissons Fossiles du Mont Liban" (1866).

† Palæontogr. vol. xi. (1863), p. 45.

number, with moderately robust arches. Behind the clavicular arch there are traces of smooth, expanded, postclavicular plates, while the pectoral fin, which exhibits about 18 rays, is truncated distally, and when adpressed would probably reach the insertion of the pelvic pair. The pelvic fin preserved is about two thirds as large as the pectoral, and shows 8 stout rays, all divided distally. The dorsal fin arises considerably further from the caudal fin than from the occiput, opposite the origin of the pelvic pair. Its two foremost rays are slender spines, the second longer than the first; the third ray is still longer and articulated, though not divided, distally; the following rays, which are at least ten in number, but too crowded for precise counting, are all both divided and articulated distally, and gradually decrease in length backwards. The anal fin is shown to be two thirds as elevated as the dorsal, and about 16 supports can be counted at its base. The caudal fin is very deeply forked. The squamation seems to have been uniform, all the scales cycloidal and deeply overlapping.

An example of the same species in the British Museum (no. 48155*b*), which is considerably elongated by distortion, is important as having the mouth widely open, and thus displaying the jaws. Nearly the whole of the upper border of the gape is shown to be formed by the stout arched maxilla, which bears a single close series of minute conical teeth, and above this bone there are two large supramaxillaries, as in the herring. Impressions of teeth like those of the maxilla are also seen on the border of the dentary bone.

A third specimen, apparently of the same fish, in the Edinburgh Museum, is described and figured (*loc. cit.* p. 567, pl. xxxii. fig. 5) as the type of *Sardinius crassapinna*, Davis. A direct comparison of this fish with the original of fig. 4 seems to leave no doubt that their differences are due solely to accidents in preservation and the mode of crushing. The so-called *S. crassapinna* is evidently much shortened, while the specimen now under consideration is shown to be somewhat elongated by distortion. They may thus be placed in one and the same species.

Assuming that this determination of the specific identity of the three specimens just mentioned is correct, it becomes clear that although the jaws of *Sardinius crassapinna* resemble those of the typical *Osmeroides*, the fish is distinct from the latter genus at least in the slenderness of its branchiostegal rays, the comparatively small number of its abdominal vertebrae, and the relatively large size of its paired fins. It is indeed in all these respects generically identical

with *Sardinius macrodactylus* of W. von der Marek *; but whether or not the latter is correctly placed in the same genus as the typical *Sardinius Cordieri* is a question that admits of further discussion.

2. *Clupea elongata*, J. W. Davis, *loc. cit.* p. 581, pl. xxxiii. fig. 2. [= *Thrissopteroides tenuiceps*, sp. n.]

The head in the type specimen of this species is so much crushed and distorted that its characters can only be very imperfectly observed. The mandibular articulation, however, appears to be beneath the hinder margin of the orbit, and the finely toothed border of both maxillæ can be distinguished, that of one side in almost complete impression, that of the other side only partly exposed. The former is erroneously described by Davis as a series of "minute orifices, where numerous teeth have been attached." The axial skeleton of the trunk is slender, the ribs being especially delicate, but completely encircling the abdominal cavity. The vertebræ are approximately 60 in number, and about 18 may be regarded as caudal. As shown by the original figure, the pelvic fins are only about half as large as the pectoral pair and arise considerably behind the middle point of the trunk. The rather elevated dorsal fin, with about 12 or 14 rays, is directly opposed to the space between the pelvic and anal fins. The anal fin is comparatively low and delicate, with about 15 rays. The length of the head with opercular apparatus is twice as great as the maximum depth of the trunk and contained about three times in the length from the pectoral arch to the base of the caudal fin. There are no traces of ridge-scales.

As shown by the general characters of the skeleton, this fish is closely related to *Spaniodon*, and a second specimen, evidently of the same species, in the British Museum (no. 49592) exhibits the characteristic enlarged tooth at the anterior end of the dentary. The fine denticulation of the maxilla, however, and the position of the dorsal fin remove the fish from *Spaniodon* to the allied genus *Thrissopteroides* †, in which it forms a new species requiring a name. The type species of *Thrissopteroides* is termed *T. elongatus*, so that it is necessary to propose a new name for the species now described, *T. tenuiceps*.

3. *Clupea pulchra*, J. W. Davis, *loc. cit.* p. 578, pl. xxxiii. fig. 3. [= *Thrissopteroides pulcher*.]

This very small fish, evidently of the same genus as the

* Palæontogr. vol. xi. (1863), p. 44, pl. vi. fig. 1.

† W. von der Marek, Palæontographica, vol. xxii. (1873), p. 61.

preceding species, differs from all the known forms of *Thrissopteroides* in its general proportions; the length of the head with opercular apparatus not much exceeding the maximum depth of the trunk and contained nearly three times in the length from the pectoral arch to the base of the caudal fin. The axial skeleton and fins are essentially identical with those of the last species, and there are no ridge-scales.

4. *Clupea curta*, J. W. Davis, *loc. cit.* p. 579, pl. xxxiii. fig. 5. [= *Osmeroides*, sp.]

The crushed and distorted fragment thus described is clearly excluded from the genus *Clupea* by the shortness of its ribs and the absence of ventral ridge scutes. It is, however, too imperfect for precise determination. The axial skeleton is most suggestive of that of *Osmeroides*, and it is quite possible that the fossil may belong to the species of this genus to which Davis gave the name of *Clupea Lewisii* (*loc. cit.* p. 571, pl. xxxiii. fig. 1).

5. *Clupea attenuata*, J. W. Davis, *loc. cit.* p. 580, pl. xxxiii. fig. 4. [= *Osmeroides attenuatus*.]

The cranium in this specimen is almost completely destroyed, but the parasphenoid is shown to be straight and comparatively stout. Below this are remains which may perhaps be interpreted as a fragment of a stout maxilla. As noted by Davis, the mandible exhibits traces of very minute clustered teeth at its symphyseal end, while the outer face of the dentary is marked by two irregular longitudinal series of pits, evidently connected with the sensory canal. Between the mandibular rami there are fragments which might be parts of a gular plate; but this is uncertain. The opercular apparatus of the right side is imperfectly exposed from within, and there seem to be traces of a much-expanded preoperculum marked with radiating ridges. The vertebral axis is much obscured by the thick squamation; but the centra in the anterior abdominal region are shown to be comparatively short and deep, while those in the caudal region are a little elongated. The stout neural spines in the anterior abdominal region seem to be separate from their supporting arches, and the ribs clearly do not completely encircle the abdominal cavity. The stout neural and hæmal arches in the caudal region are sharply inclined backwards. The total number of vertebræ is approximately 35 in the abdominal, 20 in the caudal region. Remains of one of the pectoral fins prove these to have been small and delicate, while the insertion of the pelvic fins is shown to have been opposite the

anterior half of the dorsal, midway between the pectorals and the anal. The short dorsal fin is depressed and the number of its rays cannot be counted; its origin is nearly as far from the occiput as is its hinder end from the base of the caudal fin. The anal fin, also depressed in the fossil, is shown to have been very small, arising somewhat nearer to the caudal fin than to the pelvic pair. The large caudal fin is clearly forked. It is difficult to determine the characters of the squamation; but a careful study of the specimen proves the scales to be cycloid, moderately large, and very deeply overlapping. The large overlapped area is truncated at the front border and is marked by a few deep furrows slightly radiating forwards from the centre of the scale. These furrows give the false appearance of elongated scales described by Davis "on the abdominal surface." There are no traces of thickened ridge-scales.

The fish thus described cannot belong to the genus *Clupea*, and no characters are known by which it can be separated from the Cretaceous Elopine genus *Osmeroides*. It differs from all the known species of the latter in its general proportions, the length of the head with opercular apparatus considerably exceeding the maximum depth of the trunk and contained nearly three times in the length from the pectoral arch to the base of the caudal fin.

6. *Engraulis* (?) *tenuis*, J. W. Davis, *loc. cit.* p. 583, pl. xxx. fig. 4. [= *Telepholis* (?) *tenuis*.]

The type specimen of this species described by Davis is exposed from the dorsal aspect as far back as the anterior end of the caudal region, which is displayed in side view. The cranium is shown to be long and narrow, while the right quadrate bone and other remains prove that the mouth was small, the mandible not being more than half as long as the skull. There are no clear indications of teeth. All the vertebral centra seem to be slightly longer than deep; they are delicate constricted cylinders, which must have been pierced by a continuous notochord, the space for the latter being filled with calcite in the abdominal region of the fossil, still hollow in the caudal region. There are about 26 abdominal vertebræ, each bearing a pair of robust transverse processes and short delicate ribs. The caudal vertebræ are somewhat fewer, perhaps 21, and the neural and hæmal spines are both short and slender. The pectoral fins comprise about 16 delicate rays, all divided and articulated distally, and the longest, in the middle of each fin, are as long as the head with opercular apparatus. The pelvic fins are inserted

upon expanded pelvic bones within the anterior quarter of the space between the pectoral and caudal fins, and that of the right side is shown to comprise 7 rays, of which the anterior two are stoutest and very closely articulated distally, while the others are both divided and articulated distally. The dorsal fin arises opposite a point midway between the paired fins, and is borne by very large triangular supports, which expand downwards as they approach the vertebral column; most of the rays are shown to be both divided and articulated distally, but they are too much crushed for precise counting, although probably about twelve in number as mentioned by Davis. The anal fin is destroyed and the caudal is only imperfectly preserved. The rays of the latter, however, are clearly divided and articulated distally, and the fin must have been forked. There seem to be traces of cycloidal scales over part of the fossil, but their precise characters are not distinguishable.

This fish is excluded from *Engraulis* by the proportions of the mouth, and both from *Engraulis* and from the family Clupeidæ by the characters of the abdominal vertebræ. It has been referred to the genus *Exocoetoides* of Davis by Kramberger*; but it is distinctly separated from the latter by its more numerous vertebræ, its divided median fin-rays, and its forked tail. It seems to me to belong most probably to the genus *Telepholis* of W. von der Marck†, with which it agrees in every essential character that can be compared; but unfortunately the jaws and dermal armature are not clear in the unique specimen of the Lebanon fish, and its generic determination thus remains provisional. One of the Westphalian type specimens of *Telepholis* in the Münster Academy exhibits a characteristically Scopeloid upper jaw. Its cycloidal dorsal scales, each with a median tubercle, have already been noticed by von der Marck.

7. *Engraulis tenuis*, J. W. Davis, *loc. cit.* p. 635, pl. xxx. fig. 5. [= *Prionolepis cataphractus*.]

The second specimen referred by Davis to the so-called *Engraulis tenuis* without description, is the counterpart of a small example of *Prionolepis* (or *Aspidopleurus*) in the British Museum (no. P. 4871), which seems to be an immature individual of *P. cataphractus*. Though not indicated in the drawing, the complete series of characteristic lateral scutes is well shown in impression, while the proportions and

* Gorganovic Kramberger, "De Piscibus Fossilibus," Djela Jugoslav. Akad. xvi. (1895), p. 39.

† Palæontogr. vol. xv. (1868), p. 276.

arrangement of the fins are precisely as in the larger typical specimens of *P. cataphractus*. The pelvic fins are about as large as the pectorals, though with fewer rays, the former comprising only 8, while the latter exhibit approximately 14 rays. The dorsal fin is very imperfect, but clearly shows 14 or 15 rays, while the anal is relatively small, but also comprises about 14 rays.

8. *Spaniodon hakelensis*, J. W. Davis, *loc. cit.* p. 591, pl. xxxiv. fig. 4. [= *Charitosomus hakelensis*.]

In the type specimen of this species the long and low cranium is exhibited chiefly in longitudinal section, and the stout parasphenoid is slightly arched, the concavity being downwards. Remains of the delicate and toothless pterygoquadrate arcade are seen, proving the mandibular suspensorium to be much inclined forwards, with the mandibular articulation below the anterior margin of the orbit. The mandible, shown chiefly in impression, is remarkably short and deep, the height of the coronoid region apparently equalling nearly two thirds of the total length of the jaw; and although the impression may be imperfect in front, it is clear that the gape of the mouth must have been very small. Below the end of the rostrum and above the mandible there is a large stout arched bone, which must have been either maxilla or premaxilla, and its form specially recalls the maxilla of the Gonorhynchidæ. Below and behind the mandibular articulation an obscure fragment of bone bears a cluster of smooth, rounded, grinding teeth of unequal and irregular size; and there seem to be traces of similar teeth obscured by the pterygoid bones immediately beneath the parasphenoid. The opercular apparatus is too imperfect for description, and there are only fragments of a few broad branchiostegal rays. The axial skeleton of the trunk is well exposed and comprises about 42 vertebræ, of which 14 are caudal. The centra are much constricted, about as long as deep, with very stout neural arches throughout the column and similar hæmal arches in the caudal region. All the neural spines seem to be firmly fused with their supporting arches, and the four foremost spines in the abdominal region are expanded into distally truncated laminae, while a few of the succeeding spines are also a little broad. The ribs are very delicate and do not completely encircle the abdominal cavity. The neural and hæmal arches in the caudal region are slender, except close to the base of the caudal fin, where they become longer and stouter. The hæmals do not appear to fuse into a hypural bone at the base of the caudal fin.

There are remains of short intermuscular bones above the vertebral column throughout its length and also beneath it in the caudal region. None of the fins are remarkably large, but the pelvic pair is not much inferior in size to the pectorals. The pelvic fins arise opposite the middle of the dorsal, somewhat nearer to the anal than to the pectorals, and each seems to comprise seven rays, the foremost articulated, the others both articulated and divided distally. The dorsal fin comprises 12 rays, and their supports exhibit small laminar expansions; its origin is about as far from the occiput as its hinder end from the base of the caudal fin. The anal fin, with 7 rays, is comparatively small and arises slightly nearer to the caudal than to the origin of the pelvic pair. The caudal fin is very stout and somewhat forked, with a few short fuleral rays at its base above and below. The squamation is delicate and does not appear to extend over the head. It is impossible to determine the form of the scales with certainty, but appearances suggest that they are comparatively small and antero-posteriorly elongated.

The form of the jaws and branchiostegal rays, the presence of grinding-teeth, the shortness of the ribs, and the noteworthy expansion of the foremost neural arches are characters indicating that this fish does not belong to the genus *Spaniodon*. The composition of the upper jaw is uncertain; but comparison of the stout upper lateral bone with *Gonorhynchus* and *Notogoneus*, of the family Gonorhynchidæ*, suggests that it is a maxilla of the same type as in the latter genera, excluded from the border of the mouth. The great depth of the mandible is also paralleled in these small-mouthed Gonorhynchid fishes, but its characteristic shape cannot be distinguished. The inner teeth resemble those of *Gonorhynchus*. The expansion of the anterior neural spines is exactly similar to that observed in *Notogoneus*. The vertebral column and fins also resemble those of the latter genus, except that the abdominal vertebræ are fewer. The squamation, though obscure, might also be interpreted as resembling that of the Gonorhynchidæ in character; but there are no traces of its extension over the head.

It thus seems extremely probable that the so-called *Spaniodon hakelensis* is a Gonorhynchid fish, differing from the Tertiary and Recent members of the family in the absence of scales on the head. It appears to belong to the same genus as *Charitosomus formosus* † from the Upper Cretaceous

* Smith Woodward, "On some Extinct Fishes of the Teleostean Family Gonorhynchidæ," Proc. Zool. Soc. 1896, pp. 500-504, pl. xviii.

† W. von der Marck, Paleontogr. vol. xxxi. (1885), p. 257, pl. xxiv. fig. 1.

of Westphalia, though the only known specimen of the latter is unfortunately too imperfect for precise comparison. The so-called *Solenognathus lineolatus**, from Sahel Alma, will also most likely prove to be a smaller species of the same generic type when its osteology is more fully known.

XLVIII.—Descriptions of Two new Snakes from Queensland.

By G. A. BOULENGER, F.R.S.

Typhlops Broomi.


Snout rounded, very prominent; nostrils lateral. Rostral nearly half the width of the head, truncate posteriorly, extending to the level of the eyes; nostril between two nasals, the anterior in contact with the first and second labials; a præocular, much narrower than the ocular, in contact with the second and third labials; eyes perfectly distinct; præfrontal, supraocular, and parietal scales distinctly enlarged; four upper labials. Diameter of body 40 times in the total length; tail a little longer than broad, ending in a spine. 20 scales round the body. Pale buff above, with 11 brown streaks following the series of scales, white beneath.

Total length 125 millim.

Allied to *T. Guentheri*, Ptrs., and *T. leucoproctus*, Blgr.

A single specimen from Muldiva.

Pseudelaps albiceps.

Eye longer than its distance from the mouth. Rostral large, rather prominent, twice as broad as deep, the portion visible from above measuring two thirds its distance from the frontal; internasals nearly as long as the præfrontals; frontal once and a half as long as broad, longer than its distance from the end of the snout, as long as the parietals; nasal entire, separated from the præocular by the præfrontal; one præ- and two postoculars; temporals 2 + 2; six upper labials, third and fourth entering the eye; two pairs of subequal small chin-shields, the anterior in contact with three lower labials. Scales in 15 rows. Ventrals 141; anal divided; subcaudals 20. Body yellow (red?) above, white beneath; head white, snout and lips speckled with black; a -shaped black band between the eyes and a black spot behind each eye; a large black blotch on the nape.

Total length 160 millim.; tail 14.

A single specimen from Port Douglas.

The two snakes here described were obtained in Northern Queensland and presented to the British Museum by Dr. R. Broom.

* Pictet and Humbert, *op. cit.* p. 56, pl. iv. figs. 4-7.

XLIX.—Description of a new Siluroid Fish from West Africa. By G. A. BOULENGER, F.R.S.

Synodontis obesus.

Præmaxillary teeth in several irregular series, forming a broad band; mandibular teeth 20 to 28, hooked, simple, measuring less than half diameter of eye. Depth of body 3 to $3\frac{1}{2}$ times in total length, length of head 4 times. Head not or but slightly longer than broad, convex on the occiput; snout obtusely conical, half as long as the head; eye supero-lateral, its diameter 5 times in length of head, a little more than twice in interorbital width; upper surface of head strongly granulate or vermiculate from between the eyes; frontal fontanelle narrow. Occipito-nuchal shield obtusely tectiform, longer than broad, granulate or vermiculate like the upper surface of the head, and terminating in two pointed or rounded processes. Gill-cleft not extending below base of pectoral. Maxillary barbel with a broad membranous fringe, longer than the head, not reaching much beyond middle of pectoral spine; mandibular barbels inserted on a straight transverse line, outer shorter than the head, more than twice as long as inner. Lips much developed. Humeral process granulate, acutely pointed, extending as far as occipito-nuchal shield. Dorsal II 6; spine strong, as long as the head, striated, with one or two very feeble serræ in front near its extremity, and about 10 feeble serræ behind in its upper half. Adipose fin 4 times as long as deep, as long as or a little shorter than the head, $1\frac{1}{2}$ to $2\frac{1}{2}$ as long as its distance from the dorsal. Anal IV 7-8. Pectoral spine nearly as long as dorsal, striated, feebly serrated on the outer edge, with 14 to 16 strong serræ on the inner edge. Ventral reaching or nearly reaching anal. Caudal deeply bifurcate. Skin of body smooth. Brown above and beneath, spotted and dotted with darker.

Total length 220 millim.

This species is founded on three specimens, two from the Gaboon, and a larger one which, collected by Miss Kingsley in the Opobo River, Old Calabar, has been referred by Günther to *S. serratus*, Rüpp. (Ann. & Mag. Nat. Hist. (6) xvii. 1896, p. 277). *S. serratus* differs in the more numerous mandibular teeth, the more elongate body, the stronger anterior serrature of the dorsal and pectoral spines, the longer occipito-nuchal shield, the longer adipose fin, and the absence of spots. *S. obesus* stands much nearer to *S. gambiensis*, Gthr., which differs in the thicker barbels, the maxillaries lacking every trace of a fringe.

L.—*On the Species of Polypterus.*

By G. A. BOULENGER, F.R.S.

IN a paper published in the 'Denkschriften' of the Vienna Academy, 1881, Steindachner has shown that the three species from the Nile, which had been well distinguished by earlier authors and unfortunately united by Günther, are perfectly distinct, and the concise descriptions he has given of *Polypterus senegalus*, Cuv., *bichir*, Geoffr., and *Endlicheri*, Heck., accompanied by excellent figures, leave little to be desired. The forms occurring in West Africa have not been considered on that occasion, an omission the more regrettable from the fact that they seem to bridge over the differences so readily perceptible in dealing with the Nile species. Having experienced some difficulty in the determination of specimens from the Niger and the Congo, I have found it necessary to review the whole material preserved in the British Museum. This work has resulted in a more rigid definition of the West-African species and in the addition of two new species from the Congo. Although, in spite of Steindachner's observations, several authors have continued to designate specimens under the collective name of *P. bichir*, the specific distinction of the various forms cannot be questioned, for, even if there be a continuous chain connecting the specimens with 5 dorsal spines with those with as many as 18, examination of large series shows the range of variation in the number of spines never to exceed 4 in specimens otherwise similar, the differences in these numbers being accompanied by others which cannot even be regarded as correlative. Most of the species could be identified from specimens stripped of their dorsal fin. For instance, the number of dorsal spines is not correlated with the elongation of the body, nor is this with the number of scales in the lateral line. The head also furnishes important specific characters.

In order to enable the reader to form a better idea of the amount of variation within the limits of a species, I have recorded the numbers of spines and scales and the proportions of the head in all the specimens at my disposal. The figures are arranged in four columns, which read as follows:—

- A. Number of spines in the dorsal fin.
- B. Number of scales between the upper extremity of the opercle and the middle rays of the caudal fin.
- C. Length of the head compared to its width in front of the opercular bones.
- D. Length of the head to the extremity of the opercular bone in the total length, caudal fin excluded.

Synopsis of the Species.

I. Mandible projecting very slightly beyond the snout; subopercle larger than the eye; dorsal with 12 to 18 spines; pectoral extending as far as first dorsal spine or beyond; 42-52 scales round middle of body.

A. 60 to 68 scales along the body.

15 to 18 dorsal spines; head $1\frac{3}{4}$ to 2 as long as broad, 5 to $5\frac{2}{3}$ times in total length; interorbital region slightly convex

1. *P. bichir.*

14 dorsal spines, rarely 13 or 15; head 2 to $2\frac{1}{2}$ as long as broad, $4\frac{1}{4}$ to 5 times in total length; interorbital region flat

2. *P. Lapradii.*

B. 54 to 57 scales along the body; head $1\frac{1}{2}$ to $1\frac{3}{4}$ as long as broad.

13 or 14 dorsal spines; head 4 to $4\frac{2}{3}$ times in total length; an azygos shield between the nasals

3. *P. congicus.*

12 or 13 dorsal spines; head $4\frac{1}{2}$ to $5\frac{2}{3}$ times in total length; all the head-shields paired

4. *P. Endlicheri.*

II. Snout projecting very slightly beyond the mandible; subopercle smaller than the eye; dorsal with 5 to 10 spines; pectoral not reaching first dorsal spine; head $1\frac{2}{3}$ to 2 as long as broad.

9 dorsal spines; 57 scales along the body, 44 round the middle; head $4\frac{1}{2}$ times in total length

5. *P. Weeksii.*

8 to 10 dorsal spines; 55 to 59 scales along the body, 36 to 38 round the middle; head $5\frac{3}{4}$ to 7 times in total length

6. *P. senegalus.*

5 to 8 dorsal spines; 52 to 55 scales along the body; head $4\frac{1}{2}$ to $5\frac{2}{3}$ times in total length

7. *P. palmas.*

1. *Polypterus bichir*, Geoffr.

Head $1\frac{3}{4}$ to 2 as long as broad, 5 to $5\frac{2}{3}$ times in total length; interorbital region slightly convex; all the head-shields paired; subopercle larger than the eye; mandible projecting very slightly beyond the snout. Dorsal spines 15-18, anterior 5 or 6 times as long as broad, overlapping when folded. Pectoral reaching first dorsal spine or a little beyond. 60-68 scales along the body, 46-50 round the middle. Body with more or less distinct dark stripes and cross-bars; fins spotted or streaked.

Total length 570 millim.

Nile, Senegal, Gambia.

| | A. | B. | C. | D. |
|--------------|-------|----|----------------|----------------|
| 1. Cairo | XVIII | 65 | 2 | $5\frac{1}{2}$ |
| 2. Nile | XVI | 67 | 2 | $5\frac{1}{2}$ |
| 3. „ | XV | 67 | 2 | 5 |
| 4. Senegal | XV | 68 | 2 | $5\frac{2}{3}$ |
| 5. Gambia | XV | 63 | 2 | 5 |
| 6. W. Africa | XV | 60 | $1\frac{4}{5}$ | $5\frac{2}{5}$ |
| 7. „ | XV | 63 | $1\frac{4}{5}$ | 5 |
| 8. —? | XVII | 65 | $1\frac{3}{4}$ | ? |

2. *Polypterus Lapradii*, Stdr.

Head 2 to $2\frac{1}{5}$ as long as broad, more depressed than in *P. bichir*, $4\frac{1}{4}$ to 5 times in total length; interorbital region flat; all the head-shields paired; subopercle larger than the eye; mandible projecting very slightly beyond the snout. Dorsal spines 13-15, usually 14, slender, 5 or 6 times as long as broad, overlapping when folded. Pectoral reaching first dorsal spine or a little beyond. 61-66 scales along the body, 48-52 round the middle of the body. Body with more or less distinct dark stripes and cross-bars; fins spotted or streaked.

Total length 520 millim.

Senegal, Niger.

| | A. | B. | C. | D. |
|--------------------|------|----|----------------|----------------|
| 1. Niger | XIV | 62 | $2\frac{1}{5}$ | $4\frac{1}{4}$ |
| 2. " | XIV | 61 | $2\frac{1}{6}$ | 5 |
| 3. " | XIV | 62 | $2\frac{1}{6}$ | $4\frac{1}{5}$ |
| 4. " | XIII | 63 | 2 | $4\frac{3}{5}$ |
| 5. " | XIV | 64 | 2 | $4\frac{2}{3}$ |
| 6. " | XIV | 66 | $2\frac{1}{5}$ | $4\frac{1}{3}$ |
| 7. " | XIV | 66 | 2 | $4\frac{2}{3}$ |
| 8. " | XV | 65 | $2\frac{1}{5}$ | $4\frac{2}{5}$ |
| 9. W. Africa | XIV | 64 | 2 | 5 |

3. *Polypterus congicus*, sp. n.

Head $1\frac{1}{2}$ to $1\frac{3}{4}$ as long as broad, 4 to $4\frac{2}{3}$ times in total length; interorbital space flat; a small azygos shield between the nasals; subopercle larger than the eye; mandible projecting very slightly beyond the snout. Dorsal spines 13 or 14, anterior 4 or 5 times as long as broad, overlapping when folded. Pectoral reaching first dorsal spine or beyond. 55-57 scales along the body, 48-50 round the middle. Body with 6 or 7 more or less regular, narrow, dark cross-bars; fins spotted or streaked.

Total length 720 millim.

Congo.

Specimens with external gills have been exhibited by me at a recent meeting of the Zoological Society under the erroneous name of *P. Lapradii*, Stdr. (*cf.* P. Z. S. 1898, p. 493).

| | A. | B. | C. | D. |
|------------------------|------|----|----------------|----------------|
| 1. Stanley Falls | XIV | 55 | $1\frac{2}{3}$ | $4\frac{2}{3}$ |
| 2. New Antwerp | XIV | 57 | $1\frac{3}{4}$ | 4 |
| 3. Leopoldville | XIII | 57 | $1\frac{3}{4}$ | $4\frac{1}{2}$ |
| 4. Manyanga | XIII | 57 | $1\frac{1}{2}$ | $4\frac{1}{2}$ |

4. *Polypterus Endlicheri*, Heck.

Head $1\frac{1}{2}$ to $1\frac{3}{4}$ as long as broad, $4\frac{1}{2}$ to $5\frac{2}{3}$ times in total

length; interorbital space flat or slightly concave; all the head-shields paired; mandible projecting very slightly beyond the snout. Dorsal spines 12 or 13, anterior scarcely overlapping when folded, 3 or 4 times as long as broad. Pectoral reaching first dorsal spine or beyond. 54-56 scales along the body, 42-46 round the middle. Body with 4 or 5 more or less regular dark cross-bars; fins spotted or streaked.

Total length 50 millim.

Upper Nile, West Africa?

| | A. | B. | C. | D. |
|--------------------|------|----|----------------|----------------|
| 1. Chartoum | XII | 54 | $1\frac{2}{3}$ | $5\frac{3}{5}$ |
| 2. Nile | XIII | 56 | $1\frac{2}{3}$ | $4\frac{4}{6}$ |
| 3. W. Africa | XIII | 56 | $1\frac{2}{3}$ | 5 |
| 4. " | XII | 56 | $1\frac{2}{3}$ | $5\frac{1}{3}$ |
| 5. " | XII | 55 | $1\frac{2}{3}$ | 5 |

5. *Polypterus Weeksii*, sp. n.

Head $1\frac{3}{4}$ as long as broad, $4\frac{1}{2}$ times in total length; interorbital region slightly convex; all the head-shields paired; snout projecting very slightly beyond the mandible; suboperculum very small, smaller than the eye. Dorsal spines 9, anterior 3 to $3\frac{1}{2}$ times as long as broad, not overlapping when folded. Pectoral widely separated from dorsal fin. 57 scales along the body, 44 round the middle, all with granular asperities. Dark olive above, yellow beneath, the two colours sharply delimited on the side; six narrow black bars across the back, with some black spots between them, the last followed by irregular marblings; a large black spot on the membrane to each dorsal spine; soft fins with dark and light spots; pectoral with three blackish cross-bands.

This species is founded on a single young specimen with external gills, measuring 170 millim., recently obtained at Monsembe, Upper Congo, and presented to the British Museum by the Rev. J. H. Weeks, in whose honour it is named.

In the reduction of the suboperculum this and the following species lead to *Calamichthys*, in which the bone has entirely disappeared.

6. *Polypterus senegalus*, Cuv.

Head $1\frac{2}{3}$ to 2 as long as broad, $5\frac{3}{4}$ to 7 times in total length; interorbital region convex; all the head-shields paired; subopercle smaller than the eye; snout projecting slightly beyond the mandible. Dorsal spines 8-10, anterior separated from each other when folded, 3 to 4 times as long as broad. Pectoral widely separated from dorsal fin. 53-59

scales along the body, 36-38 round the middle. No markings, even in the young.

Total length 300 millim.

Nile, Lake Rudolf, Senegal, Gambia, Niger.

| | A. | B. | C. | D. |
|------------------------|------|----|----------------|----------------|
| 1. Nile | X | 58 | $1\frac{2}{3}$ | 7 |
| 2. " | IX | 59 | $1\frac{3}{4}$ | $6\frac{2}{3}$ |
| 3. " | X | 59 | $1\frac{3}{4}$ | 7 |
| 4. " | IX | 57 | $1\frac{3}{4}$ | $6\frac{1}{2}$ |
| 5. " | IX | 58 | $1\frac{3}{4}$ | $6\frac{1}{2}$ |
| 6. Senegal | X | 58 | $1\frac{2}{3}$ | 6 |
| 7. Gambia | VIII | 57 | 2 | 6 |
| 8. " | X | 58 | $1\frac{4}{5}$ | 6 |
| 9. " | VIII | 58 | 2 | $5\frac{3}{4}$ |
| 10. Sierra Leone | VIII | 57 | $1\frac{2}{3}$ | 6 |
| 11. Niger | IX | 57 | 2 | $6\frac{1}{2}$ |
| 12. " | IX | 57 | 2 | $6\frac{1}{3}$ |
| 13. " | X | 59 | 2 | $6\frac{1}{3}$ |
| 14. " | X | 59 | 2 | $6\frac{1}{4}$ |
| 15. " | X | 55 | 2 | 6 |
| 16. " | IX | 56 | 2 | 6 |
| 17. W. Africa | X | 57 | 2 | $6\frac{1}{2}$ |
| 18. " | IX | 58 | 2 | $6\frac{1}{4}$ |
| 19. " | IX | 58 | 2 | $5\frac{4}{5}$ |
| 20. " | IX | 58 | 2 | 6 |
| 21. " | IX | 57 | $1\frac{4}{5}$ | $6\frac{1}{4}$ |
| 22. " | IX | 59 | 2 | 6 |
| 23. " | X | 56 | $1\frac{3}{4}$ | $6\frac{1}{2}$ |

7. *Polypterus palmas*, Ayres.

Head $1\frac{3}{4}$ to 2 as long as broad, $4\frac{1}{2}$ to $5\frac{2}{3}$ times in total length; interorbital region convex; all the head-shields paired; subopercle smaller than the eye; snout projecting slightly beyond the mandible. Dorsal spines 5 to 8, anterior separated from each other when folded, 3 to $3\frac{1}{2}$ times as long as broad. Pectoral widely separated from dorsal fin. 52 to 55 scales along the body, 36-38 round the middle. Above with dark marblings enclosing light spots, these markings more distinct in the young.

Total length 290 millim.

Liberia, Cape Palmas, Congo.

This species is nearly completely connected with *P. senegalus*.

| | A. | B. | C. | D. |
|------------------------------|-----|----|----------------|----------------|
| 1. Lower Congo | VII | 55 | $1\frac{4}{5}$ | $5\frac{1}{2}$ |
| 2. Mangala, Upper Congo | VII | 54 | $1\frac{3}{4}$ | $4\frac{3}{4}$ |
| 3. " " " | VI | 52 | $1\frac{3}{4}$ | $4\frac{1}{2}$ |
| 4. " " " | V | 53 | $1\frac{1}{2}$ | $4\frac{1}{2}$ |
| 5. Monsembe, Upper Congo .. | VI | 55 | $1\frac{3}{4}$ | 5 |
| 6. Stanley Falls | VI | 53 | 2 | $5\frac{2}{3}$ |

LI.—Short Diagnoses of Two new Species of Coralliidæ from Madeira. By JAMES YATE JOHNSON, Corr. Mem. Z.S.

PLEUROCORALLIUM, Gray.

1. *Pleurocorallium tricolor*, J. Y. Johnson.

Branching essentially in one plane, to the fourth degree of subdivision; branches irregularly flexuose. Axis white, hard, compact, its surface smooth. Cortex cream-coloured. Polype-cells red, very prominent, cylindrical below, ovate above, the mouths surrounded by eight lobes, which, when the coral is dry, are erect and in contact. The polype-cells are irregularly distributed at the sides of the front face of the coral and at the tips of the ultimate branchlets.

Spicula of the cortex of three forms:—

(a) Abundant; shaped like an opera-glass or two carafes, the bodies being necked and the necks distinct.

(b) A short stout cylindrical staff with two whorls of thick rays on the axis, making with the projecting ends of the staff a ten-rayed spicule.

(c) Very numerous; apparently a contracted form of (b) much varied in shape.

In addition to these the polype-cells yield (d) numerous monaxile spicula one and a half times or twice the length of the spicula (b) with two whorls of rays; some are cylindrical, others fusiform or clavate, and all are more or less spined. Besides these are (e) a few cruciform spicules somewhat varied in form, but essentially consisting of four arms at right angles, meeting at the centre with equal acute-angled bases.

2. *Pleurocorallium madeirense*, J. Y. Johnson.

Luxuriantly branched, essentially in one plane, to the seventh or eighth degree of subdivision; branches dense, irregularly flexuose. Axis white, hard, compact, its surface smooth. Cortex and polype-cells cream-coloured. Polype-cells very prominent and numerous, cylindrical, with eight vertical ribs, above which are eight upright lobes meeting at their tips over the mouth. The polype-cells are on the anterior face of the coral, and are placed for the most part at the sides of the branches and at the tips of the ultimate branchlets.

The *spicula* consist of four forms :—

(a) Shaped like a pair of opera-glasses, or like two globose bottles or carafes united at their sides and having two necks. The sides bear large tubercles and the mouths of the necks are set with small conical tubercles.

(b) A cylindrical staff with two whorls, each of four thick rays; the projecting ends of the staff make up a ten-rayed spicule. The ends of the rays are tuberculated. Contracted and irregularly-formed spicules of this type frequently occur.

(c) A few cruciform spicules of various shapes, but essentially composed of four arms at right angles, meeting at the centre with equal acute-angled bases.

(d) Monaxile spicules, cylindrical, fusiform, or clavate, all more or less tuberculated. These belong to the polype-cells.

LII.—*Description of a new Species of Hare from Algeria.*

By G. E. H. BARRETT-HAMILTON.

THE following is a description of a new hare which was obtained by Dr. F. D. Drewitt at Col. de Sta, in the Aures Mountains, near Biskra, in Algeria, in March 1896. In its size and form and in the peculiar narrowness of its skull this hare is very similar to *Lepus kabylicus*, de Wint., but it is remarkably different in its conspicuously lighter coloration; it appears to be a desert form of *Lepus kabylicus*, in which all the rich cinnamon tints of that species are replaced by pale grey or yellowish buff.

Lepus pallidior, sp. n.

In size, form, and skull similar to *L. kabylicus*, but with the coloration conspicuously lighter on all parts of the body. The colour of the underfur* in *L. kabylicus* is rich cinnamon, but in *L. pallidior* pale grey or yellowish buff. The white of the belly of *L. pallidior* is clearer, the cinnamon of the flanks almost replaced by pale buff, the chin white, the cheeks light grey instead of rufous, the nuchal patch and the fringes of the ears a much lighter buff, and on the back the cinnamon annulations of the hairs of *Lepus kabylicus* are replaced by annulations of a silvery-grey colour. The size of the black tips of the dorsal hairs is very much reduced, so that the back

* Except the bases of the hairs in both species, which are bluish.

of the animal presents to the eye a mixture of silver-grey and black, in which the former colour pre-lominates, whereas in *Lepus kabylicus* the mixture is one of cinnamon and black, the black predominating.

The type was presented by Dr. Drewitt to the Cambridge Museum, the authorities of which have been good enough to cede it in exchange to the British Museum, where it is now no. 98. 10. 14. 1.

LIII.—Note on the European Dormice of the Genera *Muscardinus* and *Glis*. By G. E. H. BARRETT-HAMILTON.

THE British Museum of Natural History has recently received a small collection of North-Italian mammals, purchased from Cav. Sigismundo Brogi, of Siena, and presented to the Museum by Dr. Edward Hamilton.

The dormice of the genera *Glis* and *Muscardinus* included in this collection are of very great interest and represent two very distinct and hitherto unnoticed species, for permission to describe which I am indebted to the kindness of the Museum authorities.

The following is a description of the two new species. The first, a *Muscardinus*, is a most beautifully coloured little animal. I propose to call it

Muscardinus pulcher, sp. n.

The general coloration is rich chestnut, but the species is larger and finer than the average *M. avellinarius* of France or England, all the colours being far more vivid than in the latter species, and the tail more bushy. The colour of the upper surface of the body and of the anal region is rich chestnut, the colour being deepest and richest on the back and tail and paler on the flanks. The underside is white, stained with cream-colour, purer on the breast and upper neck, and there is a sharp line of demarcation between the colours of the upper and under sides. This line of demarcation passes along the cheeks just above the upper lip to just below each eye, where the cream-colour is interrupted on each side by a weak band of chestnut passing from under each eye to the inner surface of the fore legs, and cutting off a patch of the cream-colour just in front of each ear. On the remainder of

the body the line of demarcation runs along the flanks and legs, leaving the internal sides of the fore legs cream-coloured and their external sides chestnut. The tail is uniformly bright chestnut above and below.

In *M. avellanarius* there is no distinct line of demarcation, but the tawny yellow of the upperside shades into dirty yellowish on the flanks and yellowish white on the belly, being, as in *M. pulcher*, purer on the breast. The cream-coloured spot before each ear is also absent.

The following are the dimensions of the type, together with those of three French specimens for comparison:—

| | <i>M. pulcher.</i> | <i>M. avellanarius.</i> | | |
|-------------------|--|--|---|--|
| | ♂. | ♂. | ♀. | |
| | Siena, Italy (Mar. 3, '98). S. Brogi. | Forest of Guines, Pas de Calais, France (May 6, '94). O. Thomas. | Forest of Guines, Pas de Calais, France (May 20, '94). | Manon- ville, France (Oct 18, '95). M. Lomont. |
| | mm. | mm. | mm. | mm. |
| Head and body. | 90 | 72 | 77 | 70 |
| Tail | 68 | 71 | 74 | 68 |
| Hind foot | 16 | 16.2 | 16.4 | 15 |
| Ear | 12 | .. | .. | 10 |

The type is a male, number 98. 10. 2. 17 of the British Museum collection; it was purchased from Cav. Sigismundo Brogi, who obtained it at Siena, in Italy, on March 3rd, 1898.

The second new species is a *Glis*, and although not so remarkable for its beauty as the *Muscardinus*, it is equally so for its novelty, it being at once recognizable as distinct from the ordinary *Glis glis* of Europe, from which species it differs in that the tail is black and more bushy and the colour of the upperside darker. In fact, the brown coloration of *Glis glis* is in the new species everywhere replaced by a nearly black colour. The following is a description of this new species:—

Glis italicus, sp. n.

The general appearance is somewhat similar to that of *Glis glis*, but the size is larger and the colour of the upper surface is very much darker, especially on the median dorsal line in some specimens. The tail is more bushy and squirrel-like, and its colour, especially near the tip, is black or dark

brown and not uniform in coloration as in the latter species. Similarly, the dark markings of the fore parts of the feet and legs are black instead of brown, and contrast very sharply with the white colour of the rest of the limbs. These peculiarities are equally observable in animals of all ages. The coloration of the underside is very similar to that of *Glis glis*, but appears to be in most specimens decidedly richer, being washed with rust red, which colour attains its greatest intensity on the chest, neck, and inside of the fore legs.

Altogether *Glis italicus* is a larger, more robust, and more handsomely coloured animal than *Glis glis*. Its greater size is well shown in its skull, which is far larger and more strongly made than that of the latter animal. The total length of the skull of *Glis italicus* is from 42 to 45 millim., as against a corresponding measurement of 37 to 38 millim. for *Glis glis*.

The first specimens of this animal received at the British Museum were a male and two females presented by the Marquis G. Doria, and came from Begato, near Genoa; there is also a specimen collected by Mr. A. H. Savage Landor near Florence, and another collected by D. Graeffe at Trefail, on the borders of Krain and Steiermark, Austria, and presented by the late Lord Lilford. Of *Glis glis* the Museum possesses specimens from France, Central Germany, Bavaria, and Switzerland.

The following are the dimensions of a series of specimens:—

Glis italicus.

| | Head and body. mm. | Tail. mm. | Hind foot*. mm. | Ear. mm. | Total length of skull. mm. |
|--|--------------------------|--------------|-----------------------|-------------|-------------------------------------|
| ♂. Siena. B.M. 98. 10. 2. 11. July 4, 1898. (<i>Brogi</i>) | 190 | 152 | 32 | 24 | .. |
| ♀ (juv.). Florence. B.M. 97. 3. 7. 2. Feb. 19, 1897. (<i>Savage Lan-</i> <i>dor</i>) | 181 | 140 | 30 | 14† | 41 |
| —, Siena. Coll. G. E. H. B.-H. 388. Sept. 9, 1897. (<i>Brogi</i>) | 170 | 152 | 32 | 23 | .. |
| —, Siena. Coll. G. E. H. B.-H. 389. Sept. 12, 1897. (<i>Brogi</i>) | 152 | 140 | 28 | 21 | .. |

* I make the dimensions of the hind feet and ears of three Genoa specimens, which are in spirit (B.M. coll. nos. 89. 12. 11. 1 to 3), a little smaller than the dimensions recorded above on the labels of the skins, viz. hind foot 27–28 mm., ear 17–18 mm.

† Possibly a mistake for 24, but the ear of the dried skin measures only 16 mm.

| | | Head and body. mm. | Tail. mm. | Hind foot. mm. | Ear. mm. | Total length of skull. mm. |
|-----------|---|--------------------------|--------------|----------------------|-------------|-------------------------------------|
| ♀. | Siena. B.M. 98. 10. 2. 12. Aug. 19, 1898. (<i>Brogi.</i>) .. | 187 | 130 | 28 | 23 | 44 |
| ♀. | Siena. B.M. 98. 10. 2. 13. Aug. 23, 1898. (<i>Brogi.</i>) .. | 160 | 151 | 28 | 21 | .. |
| ♀. | B.M. 98. 10. 2. 14. Aug. 25, 1898. (<i>Brogi.</i>) | 180 | 153 | 32 | 23 | 4 |
| ♀. | Siena. B.M. 98. 10. 2. 15. Aug. 26, 1898. (<i>Brogi.</i>) .. | 174 | 160 | 37* | 20 | 42 |
| ♀ (juv.). | Siena. B.M. 98. 10. 2. 16. Sept. 1, 1898. (<i>Brogi.</i>) | 124 | 110 | 33 | 20 | .. |

Glis glis.

| | | | | | | |
|----|--|-----|-----|------|----|----|
| ♀. | Germany. July 27, 1895. (<i>R. Schüchardt.</i>) | 170 | 130 | 30 | .. | .. |
| ♀. | Germany. Aug. 18, 1898. (<i>R. Schüchardt.</i>) | 140 | 120 | 20.5 | .. | .. |
| ♀. | Ekenkrug, near Magdeburg, Germany. July 27, 1895. (<i>Dr. Wolterstorff.</i>) | 156 | 137 | 30 | .. | 38 |

The type (Brit. Mus. coll. no. 98. 10. 2. 14) is a female and one of Cav. Brogi's Siena specimens.

While working at the above species I found it necessary to consider what interpretation should be placed on Rafinesque's descriptions of two small mammals from Sicily, which he named † *Musculus frugivorus* and *Musculus dichrurus*. The former is too large to be a mouse, having a length of 15 inches; its cylindrical tail and Rafinesque's remark that it is "un vrai rat" seem to stamp it as almost certainly some form of *Mus alexandrinus*.

The description of *Musculus dichrurus*, however, does not quite fit any known mammal of Sicily, nor can I follow Lesson ‡, who evidently had in his mind a dormouse of some kind when he renamed it as *Myoxus sicula*. If, however, we ignore Rafinesque's remark, "il tombe en léthargie durant l'hiver," on which point he may have been wrongly informed, we may without greatly stretching our imagination identify *Musculus dichrurus* with *Mus sylvaticus*.

* Probably a mistake for 27 mm., which is more nearly the measurement of the foot in the dried skin.

† 'Précis des découvertes et travaux Somiologiques,' 1814, p. 13.

‡ 'Manuel de Mammalogie, ou Histoire Naturelle des Mammifères,' 1827, p. 274.

PROCEEDINGS OF LEARNED SOCIETIES.

GEOLOGICAL SOCIETY.

May 4th, 1898.—W. Whitaker, B.A., F.R.S.,
President, in the Chair.

The following communication was read:—

‘The Graptolite-Fauna of the Skiddaw Slates.’

By Miss G. L. Elles.

This paper deals, not only with the collections of the Author, but with the Dover Collection and others preserved in the Woodwardian Museum, with the collections of Prof. H. A. Nicholson, Mr. Postlethwaite, and that of the Keswick Museum of Natural History. An account of the literature, both stratigraphical and palæontological, of the Skiddaw Slates is given, followed by a list of all the graptolites known from the beds. This list comprises 22 genera and 59 species.

In the ensuing description all the known genera and species are noted, and corrections and additions made to existing knowledge concerning the diagnosis, structure, and development of many of them.

The following 7 species, new to this country,—*Bryograptus ramosus* (Brög.), *Clonograptus tenellus* (Linn.), *Trochograptus diffusus* (Holm), *Pterograptus* (Holm) sp., *Leptymograptus gracilis* (Tqt.), *Azagograptus succicus* (Mbg.), *Diplograptus appendiculatus* (Törnq. MS.),—and 10 new species and varieties are described.

A table showing the distribution of the Skiddaw graptolites in the Arenig rocks of Great Britain, in the *Phyllograptus*-Skiffer, etc., of Sweden, and the Quebec Group of Canada is given, and the accompanying (contracted) table (p. 428) expresses the relationships of the divisions of the Skiddaw Slates with the rocks of these areas.

In conclusion the Author is struck with the remarkable resemblances existing between the species of various genera; these can be so easily explained by supposing that the forms in question are the results of development along certain lines, that she offers the suggestion that this is their real origin. In dealing with the phylogeny she divides these graptolites into two groups:—

(1) Those derived from a *Bryograptus*-form.

(2) “ “ *Clonograptus*-form.

To the first group belong 15 named graptolites from the Skiddaw Slates and 4 species from other localities; and to the second 12 Skiddaw species and 2 others.

| Lake District. | S. Wales. | S. Scotland. | Canada. | Sweden (Scania), after Tullberg. |
|--|--|----------------------------------|------------------|--|
| (Borrowdale Volcanic Series.) Upper Skiddaw Slates. (a) Millburn Beds. (b) Ellergill Beds, with <i>Diplograptus</i> . | ? Llandello. Llanvirn. | ? Lower parts of Barr Series. | | Lower part of <i>Dicellograptus</i> -Skiffer. Higher Zones of <i>Dicellograptus</i> -shales. Zone (n) <i>Glossograptus</i> , " (o) <i>D. geminis</i> . |
| Middle Skiddaw Slates. (a) Upper <i>Tetragraptus</i> -beds. (b) <i>Dichograptus</i> -beds. (c) Lower <i>Tetragraptus</i> -beds. | Upper Arenig. Middle Arenig. Lower Arenig. | Bennane Shales. | Quebec Group. | <i>Phyllograptus</i> - Skiffer. Zone of <i>Phyllograptus</i> , cfr. <i>typus</i> , [(Hall). <i>Orthoceras</i> -limestone. <i>Tetragraptus</i> -beds. |
| Lower Skiddaw Slates. (a) <i>Bryograptus</i> -beds. (b) ? | Tremadoc. ? <i>Lingula</i> -flags. | | | <i>Ceratopogy</i> -beds. |

THE ANNALS

AND

MAGAZINE OF NATURAL HISTORY.

[SEVENTH SERIES.]

No. 12. DECEMBER 1898.

LIV.—*The Arachnida from the Regions of Lakes Nyasa and Tanganyika contained in the Collection of the British Museum.* By R. I. POCKOCK.

[Plate XIII.]

THE few species of Arachnida from Lake Tanganyika recorded in this paper were collected by Mr. Alexander Carson and Mr. W. H. Nutt. For the more extensive series from Nyasaland the Museum is indebted principally to Mr. A. Whyte, acting under the direction of Sir H. H. Johnston. A few from this neighbourhood were also obtained by Mr. R. Crawshay, by Dr. Percy Rendall, and by the members of the Universities' Mission to Central Africa. The specimens which Sir Harry Johnston used his influence to procure were received in two instalments: the first comprised the species collected on Mount Zomba, at the southern extremity of Lake Nyasa; the second, those from the Nyika plateau and neighbouring localities at the northern end of Lake Nyasa and between it and the southern end of Lake Tanganyika. Unfortunately, there are no exact localities for most of the examples received from the Universities' Mission.

Order SCORPIONES.

Family Scorpionidæ.

Scorpio viatoris, Poc.

Scorpio viatoris, Pocock, Ann. & Mag. Nat. Hist. (6) vi. p. 100, pl. i. fig. 1.

Loc. Zomba, 3000–9000 feet; Fort Hill, Nyasaland, 4000 feet; Nyika plateau, 6000–7000 feet; between Kondowe and Karonga, N. Nyasa (*A. Whyte*); Fwambo, Lake Tanganyika (*A. Carson*).

Opisthophthalmus glabrifrons, Pet.

Opisthophthalmus glabrifrons, Pet. Mon. Ak. Wiss. Berl. 1861, p. 514.

Loc. Lake Nyasa (*Universities' Mission, Capt. Maclear, Mr. Bellingham*).

Opisthacanthus rugulosus, Poc.

Opisthacanthus rugulosus, Pocock, Ann. & Mag. Nat. Hist. (6) xvii. p. 314.

Loc. Ishiromo, Nyasaland (*H. H. Johnston*).

Opisthacanthus rugiceps, Poc.

Opisthacanthus rugiceps, Pocock, Ann. & Mag. Nat. Hist. (6) xix. p. 117.

Loc. Lake Nyasa, east coast (not Kota Kota, as originally stated).

Family Buthidæ.

Babycurus pictus, Poc.

Babycurus pictus, Pocock, Ann. & Mag. Nat. Hist. (6) xvii. p. 426.

Loc. Niomkolo, Lake Tanganyika (*A. Carson*).

Buthus Eminii, Poc.

Buthus Eminii, Pocock, Ann. & Mag. Nat. Hist. (6) vi. p. 99, pl. i. fig. 2.

Loc. Fwambo, Lake Tanganyika (*A. Carson*).

Archisometrus burdoi (Sim.).

Isometrus burdoi, Sim. Bull. Soc. Ent. Belg. 1882, p. lviii.

Loc. Lake Nyasa (*Universities' Mission*); Zomba, 3000–9000 feet (*H. H. Johnston*).

Uroplectes flavoviridis, Pet.

Uroplectes flavoviridis, Pet. Mon. Ak. Wiss. Berlin, 1861, p. 516
(=*chlorodermus*, Poc.).

Loc. Lake Nyasa (*Universities' Mission*).

Described from Tete. Also occurs in Mashonaland.

Uroplectes xanthogrammus, Poc.

Uroplectes xanthogrammus, Pocock, Ann. & Mag. Nat. Hist. (6) xix.
p. 118.

Loc. Lake Nyasa (*Universities' Mission*).

I have been informed by Mr. Webb, who brought home the examples of this scorpion, that the published locality, Kota Kota, is erroneous, and that they came in reality from the east shore of the lake.

Order PEDIPALPI.

Genus DAMON, C. Koch.

Damon diadema (Simon).

Phrynus diadema, Simon, Bull. Soc. Zool. France, 1876, p. 13.

Nanodamon diadema, Pocock, Ann. & Mag. Nat. Hist. (6) xiv. p. 203.

Loc. Lake Nyasa (*Universities' Mission*).

Order SOLIFUGÆ.

Genus CEROMA, Karsch.

Ceroma Johnstonii, Pocock.

Ceroma Johnstonii, Pocock, Ann. & Mag. Nat. Hist. (6) xx. p. 253,
fig. 1.

Loc. Nyika plateau, 6000–7000 feet (*A. Whyte*).

Genus SOLPUGA, Licht.

Solpuga paludicola, Poc.

Solpuga paludicola, Poc. Ann. & Mag. Nat. Hist. (6) xvi. p. 84, pl. iv.
fig. 4 (1895).

Loc. Nyasaland (*Universities' Mission*).

Solpuga Darlingii, Poc.

Solpuga Darlingii, Poc. Ann. & Mag. Nat. Hist. (6) xx. p. 259, fig. 5
(1897).

Loc. Fort Johnston, S. Nyasaland (*P. Rendall*).

Solpuga nigrescens, Poc.*Solpuga nigrescens*, Poc. Ann. & Mag. Nat. Hist. (6) xvi. p. 83.Loc. Fort Johnston, S. Nyasaland (*P. Rendall*).

Also known from the "Lower Zambesi" and Lake Victoria Nyanza.

Order ARANEÆ.

Suborder MYGALOMORPHÆ.

Family Theraphosidæ.

Genus PTERINOCILUS, Poc.

Pterinochilus vorax, Poc.*Pterinochilus vorax*, Pocock, Proc. Zool. Soc. 1897, p. 752, pl. xliii. fig. 3.Loc. Fwambo, Lake Tanganyika (*A. Carson*); Kondowe, Nyasaland (*R. Crawshay*); Zomba, S. Nyasaland (*Dr. P. Rendall*).

Genus ANOPLOSCELUS, Poc.

Anoploscelus celeripes, Poc.*Anoploscelus celeripes*, Poc. Proc. Zool. Soc. 1897, p. 760, pl. xli. fig. 3.Loc. Komboli, Lake Tanganyika (*W. H. Nutt*).

Family Migidæ.

Genus MOGGRIDGEA, Cambr.

Moggridgea Whytei, Pocock.*Moggridgea Whytei*, Pocock, Proc. Zool. Soc. 1897, p. 733, pl. xlii. figs. 1-1 b.Loc. Nyika plateau, 6000-7000 feet (*A. Whyte*).

Family Ctenizidæ.

Genus HELIGMOMERUS, Simon.

Heligmomerus Carsonii, Pocock.*Heligmomerus Carsonii*, Pocock, Proc. Zool. Soc. 1897, p. 730.Loc. Niomkolo, Lake Tanganyika (*A. Carson*).

Genus ACANTHODON, Guérin.

Acanthodon lacustris, Pocock.

Acanthodon lacustris, Pocock, Proc. Zool. Soc. 1897, p. 731, pl. xli. fig. 7.

Loc. Kinyamkolo, Lake Tanganyika (*W. H. Nutt*).

Suborder ARACHNOMORPHÆ.

Family Eresidæ.

Genus ERESUS, Walck.

Eresus inornatus, sp. n. (Pl. XIII. fig. 1.)

Colour. Carapace and limbs a uniform blackish brown; abdomen ashy grey; hairy covering greyish black.

Carapace as long as patella, tibia, and protarsus of fourth leg and the four distal segments of first leg; width of head less than patella and tibia of fourth leg, about equal to patella and tibia and protarsus and tarsus of first.

Vulva with narrower septum between the fovea than in *fumosus*.

Measurements in millimetres.—Total length 17; length of carapace 7; width of head 4·5; length of first leg 13·5, of fourth 13.

Loc. Nyika plateau, 6000–7000 feet (*A. Whyte*).

Allied to *E. fumosus*, C. Koch, from Cape Colony, but differing in its smaller size, narrower septum of vulva, head lower just in front of fovea, and shorter first leg as compared with width of carapace.

Family Argiopidæ.

Genus NEPHILA, Leach.

Nephila cruentata (Fabr.).

Aranea cruentata, Fabr. Ent. Syst. ii. p. 427 (1793) (= *genualis*, Gerst.).

Loc. Zomba, 3000–9000 feet (*H. H. Johnston*); Lake Nyasa (*Universities' Mission*).

Nephila pilipes (Lucas).

Epeira pilipes, Lucas, Thomson's Arch. Ent. ii. p. 416.

Loc. Zomba, 3000–9000 feet, S. Nyasaland; Kondowe to Karonga and Masuku, N. Nyasaland (*A. Whyte*).

Nephila senegalensis (Walckenaer).

Epeira senegalensis, Walckenaer, Ins. Apt. ii. p. 94 (1837), ♀.

Epeira Aubryi, Lucas, in Thomson's Arch. Ent. ii. p. 36; Brito Capello, Journ. Math. Sci. Lisboa, 1866, p. 7, pl. ii. fig. 3 (*Nephila*), ♀.

Epeira armillipes, Doumerc, Ann. Soc. Ent. Fr. 1864, p. 231, pl. v. fig. 1, ♀.

Nephila Grayii, Blackwall, Ann. & Mag. Nat. Hist. (3) xvi. p. 96 (1865).

Nephila senegalensis, Simon, Ann. Soc. Ent. France, 1885, p. 371, ♂.

This species appears to be spread throughout the whole of Africa from Senegal and Somaliland southwards to the borders of Cape Colony, and is represented over this area by several more or less well-marked "forms," which, pending the discovery of the male sex in each case, I propose to regard as subspecies or local races.

The following subspecies are represented in the Museum collection from the region of the great African lakes:—

Subspecies *Keyserlingii*, Blackwall.

Nephila Keyserlingii, Blackwall, Ann. & Mag. Nat. Hist. (3) xvi. p. 343 (1865).

Loc. Zomba, 3000–9000 feet (*H. H. Johnston*); Lake Nyasa (*Universities' Mission*).

Blackwall's species was based upon specimens procured in the valley of the Shiré. The examples in the Museum collection agree exactly with the description published by that author.

Subspecies *hymenæa*, Gerstäcker.

Nephila hymenæa, Gerstäcker, Von der Decken's Reisen in Ost-Afrika, iii. pt. 2, p. 497, pl. xviii. fig. 11.

Loc. Kondowe, near Karonga, N. Nyasaland, 2000 feet (*A. Whyte*).

Very closely allied to *Keyserlingii*, and perhaps identical with it; but the representatives of *hymenæa* that I have seen may be distinguished from the others by the black patch on the sternum being divided by a narrow longitudinal yellow stripe, exactly as Gerstäcker describes.

Subspecies *bragantina*, Brit. Capello.

Nephila bragantina, Brit. Capello, Mem. Ac. Sci. Lisboa, (3) iv. pt. 1; Descrição de Algumas Arachnideos, &c. p. 11, pl. ii. fig. 4 (1867).

Loc. Kinyankolo, Lake Tanganyika (*W. H. Nutt*).

Described from Braganza, in Angola.

Subspecies *nyikæ*, nov.

Colour. Carapace black, with silvery pubescence; maxillæ black; labium black, with median longitudinal yellow line; sternum yellow, narrowly black at the sides; palpi with femur, patella, and tibia yellow, lightly and imperfectly ringed with black, tarsus black; legs brownish black, with a yellow ring round the distal end of the femora and tibiæ, these yellow bands scarcely or not traceable on third leg: abdomen varying in colour; the upperside usually furnished with four (five) broad transverse yellow stripes, as in *N. bragantina*; the anterior of these is the broadest and extends inferiorly almost as far as the epigastric fold, the others expand at their extremities and sometimes become united, though more often remaining distinct; sometimes these bands break up into a series of median and lateral yellow blotches; the lower side of the abdomen is dark, with a yellow \times -shaped mark in the middle of the area between the spinners and the epigastric fold; behind the fold there is a transverse yellow stripe, from the ends of which a narrow yellow stripe sometimes extends backwards.

Tibiæ of legs, except of third pair, tufted, the tuft scanty on the apical yellow band.

Measurements in millimetres.—Total length up to 28; length of carapace 9, of first leg 49, of second leg 40, of third leg 20, of fourth leg 35 (all measured from base of femur).

Loc. Nyika plateau, 6000–7000 feet (*A. Whyte*).

Resembling the subspecies *N. senegalensis bragantina*, Brito Capello, but recognizable by having the palpi mostly yellow instead of mostly black, and by the presence of a yellow ring round the end of the femora of the legs.

Of the typical form of this species the British Museum possesses examples from the Cape Verde Islands (*B. Cambridge*) and from Jifa Uri, inland of Zeyla, Somaliland (*R. M. Hawker*).

The only other subspecies represented in the British Museum collection is the more southern form occurring in Natal, the Transvaal, and Mashonaland, which I described as *transvaalica*, and which is probably identical with *annulata*, Thorell, but not with *hymenæa* as M. Simon asserts.

Genus ARGIOPE, Aud.

Argiope flavipalpis (Lucas).

Epeira flavipalpis, Lucas, in Thomson's Arch. Ent. ii. p. 423 (= *Pechueli*, Karsch).

Loc. Kondowe, near Karonga, 2000 feet, N. Nyasa (*A. Whyte*).

Abundant on the West Coast of Africa, whence it was originally recorded by Lucas. According to Bösenberg and Lenz, it has recently been received from Mhonda, Unguru, in E. Africa.

Argiope nigrovittata, Thor.

Argiope nigrovittata, Thor. Öfv. Vet.-Akad. Förh. 1859, p. 300
(=*caudata*, Blekw., *suavissima*, Gerst.).

Loc. Fort Johnston, Nyasaland (*P. Rendall*); Kinyamkoio, Lake Tanganyika (*W. H. Nutt*).

Genus CYRTOPHORA, Simon.

Cyrtophora citricola (Forsk.).

Loc. Nyika plateau, 6000–7000 feet (*A. Whyte*).

Genus ARANEUS, Clerck.

(=*Epeira* of authors.)

Araneus rufipalpis (Lucas).

Epeira rufipalpis, Thomson's Arch. Ent. ii. p. 422 (= *semiannulatus*, Karsch and others).

Loc. Nyika plateau, 6000–7000 feet (*A. Whyte*).
Abundant throughout tropical Africa.

Araneus streptoceros, sp. n. (Pl. XIII. figs. 2, 2 a.)

In colour and structural features so closely resembling *A. cyrtoscapus*, Poc. (Ann. & Mag. Nat. Hist. (7) ii. p. 206, pl. viii. figs. 2–2 b), from the province of Natal, that no detailed description is necessary.

Differing from *A. cyrtoscapus* in the form of the generative organs in the male and female. In the female the vulva is formed upon the same plan as in *A. cyrtoscapus*, but the hairy basal portion of the scape (fig. 2 a) is much longer in *A. streptoceros*, and the sclerite marked *b* intervenes to a much greater extent between the sclerite in front of it and the membranous distal extremity of the scape. (For vulva of *A. cyrtoscapus* see Ann. & Mag. Nat. Hist. (7) ii. pl. viii. fig. 2.)

In the male the piece of the palpal organ marked *a* (fig. 2) is straighter and without the strong curvature seen in *A. cyrtoscapus*, while the horny sheath which protects its fine point (*c*, fig. 2) has its edges much more folded over; the sclerite marked *b* has also a different form from that of *A. cyrtoscapus*. (For palpal organ of *A. cyrtoscapus* see Ann. & Mag. Nat. Hist. (7) ii. pl. viii. fig. 2 b.)

Measurements in millimetres.—♀. Total length 17; length of carapace 8·5, of abdomen 11·5; width of abdomen 10; length of first leg 27, of fourth 25, of tibia of first 6·5, of patella and tibia of fourth 9·5.

♂. Total length 11; length of carapace 6·5, of second leg 20, of fourth 18.

Loc. Zomba, 3000–9000 feet (*H. H. Johnston*).

Like *A. cyrtoscapus*, this species is certainly related to *A. suedicola*, Simon, *A. striatus* and *similis*, Bösenberg and Lenz, and probably to *A. mossambicanus* of Pavesi (recently wrongly quoted by me as *mossambicensis*). But since no figures of the generative organs of *mossambicanus* and *suedicola* have been published, and since those of *striatus* and *similis* are too small to convey any accurate idea of the structures they represent, I find it impossible to compare the two species that I have established with the others here named.

Genus GASTERACANTHA, Sund.

Gasteracantha ornata, Thorell.

Gasteracantha ornata, Thorell, Öfv. Vet.-Akad. Förhandl. xvi. p. 302 (1860); id. Eugénies Resa, Arachn. p. 16 (1868).

Loc. Between Ukala Bay and Ruarwee, Kondowe, near Karonga, 2000 feet; Nyika plateau, 6000–7000 feet (*A. Whyte*)

Also occurs in Mashonaland and the Transvaal.

Gasteracantha formosa, Vinson.

Gasteracantha formosa, Vinson, Aranéides des Iles Réunion, Madagascar, &c. p. 244, pl. ix. fig. 7.

Subspecies *milvoides*, Butler.

Gasteracantha milvoides, Butler, Tr. Ent. Soc. 1873, p. 159, pl. iv. fig. 2.

Loc. Zomba, 3000–9000 feet (*H. H. Johnston and Dr. Percy Rendall*).

The posterior lateral spines in this subspecies average a much greater length than in the typical Madagascar form.

Gasteracantha resupinata, Gerstäcker.

Gasteracantha resupinata, Gerstäcker, Von der Decken's Reisen in Ost-Afrika, iii. pt. 2, p. 490, pl. xviii. fig. 8.

Loc. Between Kondowe and Karonga, 2000 feet (*A. Whyte*). The specimens referred to this species do not agree exactly

with the typical form, the posterior lateral spines being on an average thinner and with less of a posterior curvature. This character, however, is not, I think, sufficiently definable to admit of being regarded as the basis for a subspecific form.

Gasteracantha macrura, sp. n. ((Pl. XIII. fig. 3.)

Somewhat intermediate in structural characters between *G. milvoides* and the species which I identify as *G. ensifera*, Thorell, but readily distinguishable from both.

Abdomen with anterior border lightly convex, the anterior lateral spines considerably the smallest of the six, directed externally, their length a little less than the width of the head and greater than the interval that separates these spines from the posterior laterals; posterior laterals very long, straight, thick, thickly hairy, nearly as long as the width of the abdomen, and nearly three times as long as the width of the head, a little more than three times as long as the anterior lateral spine, and a little more than twice as long as the posterior spines; posterior spines long, much longer than width of head.

Measurements in millimetres.—Width of head 3; length of patella and tibia of first leg 3·5, of fourth leg 3·3; length of abdomen along the middle line 5·5, width between spines 11, width from tip to tip of anterior lateral spines 14·5, of posterior lateral spines 28; length, including posterior spine, 9; length of anterior lateral spine 2·3, of posterior lateral spine almost 9, of posterior spine 4.

Loc. Nyasaland (*Universities' Mission*).

Resembling *G. milvoides* and differing from *ensifera* in the great length of the posterior lateral spine, and differing from *milvoides* and somewhat resembling *ensifera* in the length of the posterior spine.

Family **Pisauridæ**.

Genus **EUPROSTHENOPS**, Poc.

Euprosthenops australis, Simon.

Euprosthenops australis, Simon, Ann. Soc. Ent. Belg. xlii. p. 12 (1898).

Loc. Nyika plateau, 6000–7000 feet (*A. Whyte*); Lake Nyasa (*Universities' Mission*); Lake Tanganyika (*A. Carson*).

The Nyasaland examples of this genus that I have examined agree with M. Simon's description of *E. australis* and differ from his description and from Capello's figure of

the West-African form, *E. bayonianna*. The British Museum also has the same form from Mashonaland and, as I have recently recorded, from the Transvaal and Natal. It appears highly probable therefore that the specimens from Inhambane, in Gasaland, identified by Pavesi * and Karsch † as *Podopththalma bayonianna*, Br. Capello, will prove to be identical with those that Simon described as *E. australis*.

Family Lycosidæ.

Genus OCYALE, Aud.

Ocyale atalanta, Aud.

Ocyale atalanta, Audouin, in Savigny's Description de l'Égypte, p. 149, pl. iv. fig. 10 (1825-27) (see Simon, Ann. Soc. Ent. France, 1885, pp. 357-359).

Loc. Zomba, 3000-9000 feet, and between Ukala Bay and Ruarwee (*A. Whyte*).

Family Oxyopidæ.

Genus PEUCETIA, Thor.

Peucetia pulchra (Blekw.).

Pasithea pulchra, Blackwall, Ann. & Mag. Nat. Hist. (3) xvi. p. 338 (1865).

Loc. Zomba, 3000-9000 feet (*A. Whyte*).

Recorded originally from the country drained by the Shiré River, and extending at least as far to the south as Natal.

Peucetia foliifera (Butler).

‡ *Peucetia striata*, Karsch, Zeits. ges. Naturw. li. p. 317, pl. viii. fig. 6 (1878).

Pasithea foliifera, Butler, Ann. & Mag. Nat. Hist. (5) iv. p. 41, pl. i. fig. 1 (1879).

Loc. Nyika plateau, 6000 feet (*A. Whyte*).

This species was originally recorded from Johanna, an island of the Comoro group. Its occurrence in East Africa is therefore of great interest. It closely resembles *P. striata*, Karsch, from Zanzibar †, but the prolongations of the vulva,

* Ann. Mus. Genova, xvi. p. 553 (1881).

† Mon. Ak. Wiss. Berlin, 1878, p. 326.

‡ Not from West Africa, as Simon asserts (Ann. Mus. Genova, xviii. p. 218, 1882).

although long, are thick, and could only be described and figured as bristle-like as the result of very defective vision*.

Family Zodariidæ.

Genus STORENA, Walck.

Storena nyikæ, sp. n. (Pl. XIII. fig. 4.)

Colour. Carapace, sternum, and mandibles deep reddish black; legs ferruginous; palpi ferruginous, with the tarsus infusate; abdomen greyish black above, paler below, with a median dorsal series of indistinct yellowish spots, paired on the anterior half of the abdomen, united in the middle line in the posterior half.

Carapace high, its length equal to that of patella and tibia of fourth leg; clypeus vertical, high, its height from the anterior lateral eye equal to the length of the mandible and a little greater than the length of the ocular area. Eyes of anterior line strongly procurved, the inferior edges of the medians slightly higher than the superior edges of the laterals; anterior medians the largest of the eyes, about half a diameter apart, about their own diameter from the anterior laterals and a little more than that from the posterior medians; ocular quadrangle oblong, longer than wide, the posterior medians about a diameter apart, anterior medians and posterior laterals forming a slightly recurved line, anterior and posterior laterals about a radius apart.

Legs slender, 4, 1, 2, and 3; spiny. *Palpi* with patella and tibia short, the latter with a stout down-bent external tooth; tarsus long and high, twice as long as patella and tibia taken together.

Abdomen broadest in its posterior half.

Measurements in millimetres.—Total length 7; length of carapace 4, of first leg 10, of second and third 9.5, of fourth 11.

Loc. Nyika plateau, 6000–7000 feet (*A. Whyte*).

Seems to differ from *S. senegalensis*, Simon (Ann. Soc. Ent. France, 1885, p. 373), based upon an immature female from Senegal, at least in the pattern of the abdomen and in having the eyes of the anterior line unequally spaced.

* Simon's statement (Hist. Nat. Araignées, 1898, p. 376) that *foliifera* is without doubt identical with *P. Lucasii*, Vinson, from Madagascar, has no justification in fact.

Family Ctenidæ.

Genus CTENUS, Walck.

Ctenus Johnstoni, F. Cambridge.

Ctenus Johnstoni, F. Cambridge, Proc. Zool. Soc. 1898, p. 21, pl. iii. fig. 7.

Loc. Zomba, 3000–9000 feet (*II. II. Johnston*).

Ctenus Carsoni, F. Cambridge.

Ctenus Carsoni, F. Cambridge, Proc. Zool. Soc. 1898, p. 24, pl. iii. figs. 4 a–b, 5 a–c.

Loc. Kavala Island, Lake Tanganyika (*A. Carson*).

Family Heteropodidæ.

Genus SELENOPS, Latr.

Selenops radiatus, Latr.

Selenops radiatus, Latr. Nouv. Dict. xxx. p. 579 (1819) (= *S. omalissima*, Duf.; *ægyptiacus*, Aud.; *annulipes* and *peregrinator*, Walck., &c.: *teste* Simon).

Loc. Nyika plateau, 6000–7000 feet (*A. Whyte*); Kinyamkolo, Lake Tanganyika (*W. H. Nutt*).

Genus PALYSTES, L. Koch.

Palystes Johnstoni, Poc.

Palystes Johnstoni, Poc. Ann. & Mag. Nat. Hist. (6) xvii. p. 57, pl. viii. fig. 1.

Loc. Zomba, 3000–9000 feet (*II. II. Johnston*).

Palystes Elliotti, Poc.

Palystes Elliotti, Poc. Ann. & Mag. Nat. Hist. (6) xvii. p. 58, pl. viii. fig. 2.

Loc. Between Kondowe and Karonga, 2000 feet; Nyika plateau, 6000–7000 feet; Masuku Mountain, 6000–7000 feet (*A. Whyte*); also Lake Nyasa (*Universities' Mission*).

This species was based upon specimens reported to be from Uganda. Since, however, the species is evidently abundant in Nyasaland, it is possible that there was an error in the original locality, especially as Mr. Scott Elliot passed through Nyasaland on his return journey from Mount Ruwenzori.

Genus SPARASSUS, Walck.

Sparassus croceiceps, sp. n. (Pl. XIII. fig. 5.)

Colour. Carapace and legs a bright ochre-yellow, covered with yellow hairs; scopolæ dark grey; mandible ferruginous; abdomen testaceous, its upperside studded with ill-defined fuscous patches of hair, some of which form a distinct double series in the middle line.

Carapace high, strongly convex, longer than broad, its length equal to protarsus of second, patella and tibia of third leg and to palpus, its width equal to protarsus of first leg. *Eyes* of anterior line slightly recurved, subequal, subequally spaced, the medians a little nearer each other than either is to its lateral, about a diameter apart; eyes of posterior line about straight, the laterals a little larger and a little further from the medians than the latter are from each other; ocular quadrangle narrowed in front, a little longer than wide. *Clypeus* a little less than the diameter of anterior median eye.

Mandibles robust, scantily hairy, armed with four posterior and two anterior teeth.

Legs 2, 1, 4, 3; when extended, second surpassing first by its tarsus and third by tarsus and three fourths of protarsus; fourth exceeding third by nearly its tarsus; femora armed with 3, 2, 3 spines above (fourth with 3, 2, 1); patellæ unspined; tibiæ with 2, 2 spines below (the apical pair absent), 2 in front, 2 behind; protarsi armed like the tibiæ, that of the fourth with 2 extra apical spines in front; protarsus of first and second scopulate to base, of third and fourth less scopulate basally.

Abdomen about one fourth longer than wide.

Vulva consisting of a pair of horny black plates meeting in a suture and circumscribing in front a deep narrowly oval or lanceolate pit.

Measurements in millimetres.—Total length 18; length of carapace 7, width 6; length of first leg 23, of second 25, of third 18.5, of fourth 21.

Loc. Zomba, 3000–9000 feet (*H. H. Johnston*).

This species may be allied to *S. abnormis*, Blackwall, from the Shiré (*Ann. & Mag. Nat. Hist.* (3) xviii. p. 457), and to *S. (Heteropoda) africanus*, Karsch (*Mon. Ak. Wiss. Berlin*, 1878, p. 325, pl. ii. fig. 6), from Querimba, both of which are based upon immature female examples. Karsch, however, gives the length of the second leg in *africanus* as 26 and of the fourth 18 millim.; the difference between the two is therefore very much greater than in *S. croceiceps*. Apart from other characters, *S. abnormis* differs from the form here described in having the carapace as wide as long.

Sparassus Fornasinii, Pavesi (Ann. Mus. Genova, xvi. 1881, p. 548), from Inhambane, is also quite a distinct species, having the tibiæ of the legs banded below, the first leg longer than the second, &c. This species is almost certainly referable to the genus *Palystes*.

SAROTESIUS, gen. nov.

Carapace as wide as long, low, only lightly convex, resembling that of *Isopoda*; width of head about two thirds length of carapace. *Eyes* of anterior line straight, subequal, distance between medians a little less than their diameter and about half the distance between median and lateral on each side; eyes of posterior line straight, the laterals considerably larger, sessile; the medians about three diameters apart, about twice as far from the laterals as from each other; median ocular quadrangle scarcely wider behind than it is long; slightly narrowed in front; posterior medians smaller than anterior medians; clypeus low, about half the diameter of anterior median eye.

Legs 2, 1, 4, 3, third and fourth much shorter than first and second; patella and tibia of fourth a little shorter than tibia of second.

Mandible with 3—3 teeth below, those of the posterior series larger and subequal.

Labium wider than long, anterior edge transversely truncate.

Maxillæ short, convex, their lateral edge without emargination in front of the palpus.

In the arrangement of its eyes this genus resembles the West-African form *Remmius* of Simon, except that the laterals are less prominent. In *Remmius*, however, the cephalic region is very broad and very high, whereas in *Sarotesius* this area is not at all elevated in front of the thoracic fovea. From *Isopoda*, which has a carapace of the same form, this new genus differs in the disposition of the eyes, those of *Isopoda* being much more closely spaced.

Sarotesius melanognathus, sp. n. (Pl. XIII. figs. 6, 6 a.)

Carapace castaneous, covered with yellow hairs, its length about equal to that of tibia or protarsus of fourth leg, shorter than palp by rather more than half the tarsus, equal to about half the tibia and patella of second leg.

Mandibles black, scantily clothed with greyish hairs, moderately prominent at the base.

Maxillæ and *labium* piceous.

Palpus ferruginous, with tarsus blacker; tibia a little longer than the patella and armed externally with a strong down-curved spur; the tarsus less than twice as long as the tibia and rather more than twice as long as broad. (For palpal organ see fig. 6 a.)

Legs long, ferruginous, covered with yellow hairs; when extended the second exceeds the first by the tarsus and one fifth of the protarsus, the fourth exceeding the third by its tarsus, and the second exceeding the third by its tarsus, protarsus, and a fifth part of the tibia; patella and tibia of first equal to tarsus and protarsus of second; patella, tibia, and protarsus of third about equal to patella and tibia of second; femora usually armed with 3, 1, 3 spines above, no superior distal spine; patella with 1 posterior spine; tibiæ with 2, 2, 2 spines below, 2 in front, and 2 behind; protarsi with 2, 2 spines in basal half below, 2 in front and 2 behind, and 1 or 2 (inconstant in occurrence) above; scopulæ broad, thickish, greyish black, extending, though scantily, to base of protarsus.

Abdomen ovally elongate, about one third longer than wide, covered with golden-yellow hairs, intermixed with darker spots above.

Measurements in millimetres.—Total length 20; length and width of carapace 9; width of head 5; length of first leg 42, of second 47, of third 31, of fourth 34.

Loc. Ishiromo (*H. H. Johnston*).

Family Thomisidæ.

Genus PHRYNARACHNE, Thorell.

Phrynarachne rugosa (Latreille).

Phrynarachne rugosa, Latreille, *Nouv. Dict. d'Hist. Nat.* xxxiv. p. 62 (= *Thomisus foka*, Vinson).

Loc. Deep Bay, Lake Nyasa (*R. Crawshay*).

The specimen procured by Mr. Crawshay seems to be identical with Madagascar examples referred by me to *P. foka*, Vinson.

Genus THOMISUS, Walck.

Thomisus granulatus, Karsch.

Thomisus granulatus, Karsch, *Zeits. ges. Naturw.* 1880, p. 382.

Loc. Nyasaland (*Universities' Mission*).

Recorded from Niassa by Karsch.

Thomisus anthobius, Pocock.

Thomisus anthobius, Pocock, Ann. & Mag. Nat. Hist. (7) ii. p. 225, pl. viii. fig. 18.

Loc. Nyika plateau, 6000–7000 feet.

Recorded from Estcourt, Natal, 4000 feet (*A. Whyte*).

Genus PLATYTHOMISUS, Thorell.

Platythomisus pantherinus, sp. n. (Pl. XIII. fig. 7.)

Colour. Carapace orange-yellow, ornamented with six black patches, one on each side of the face involving the four eyes and extending to the edge of the clypeus, one smaller on each side on the margin opposite the base of the first leg, and one on each side of the dorsal middle line about the same distance from each other as from the lateral edge of the carapace; mandibles orange-yellow, with a black ring round the base of the fang; legs of first and second pairs with femora and patellæ lemon-yellow, tibiæ, protarsi, and tarsi jet-black, except the base of the tibia, which is yellow, with a faint yellow spot on outer side of the apex; legs of third and fourth pairs with tarsi and protarsi and a narrow strip at the apex of the tibia black, the rest lemon-yellow; abdomen lemon-yellow, with the spinning-mamilla black, and seven small black spots on the sigilla of the dorsal surface, the anterior spot unpaired, those of the third and posterior pair small, of the second pair the largest.

Carapace shining, coriaceous, cephalic region sloped downwards; clypeus not vertical, with prominent inferior edge; posterior line of eyes wider than anterior, but a little less strongly recurved, so that the space between the two laterals on each side is less than that between the two medians; posterior medians further from each other than either is from the lateral; eyes of anterior line about equally spaced; quadrangle of median eyes at least twice as wide as long; clypeus slightly narrower than length of ocular quadrangle; length of carapace less than patella and tibia of first leg and a little less than its protarsus and tarsus.

Mandibles with fringe of hai. below.

Protarsi of legs scarcely spined; tarsal and protarsal scopulæ thick on posterior legs and at apex of tarsus on anterior legs.

Measurements in millimetres.—Total length 20; length of carapace 9.5, width 8.5.

Loc. Nyasaland (*R. Crawshay*).

Ann. & Mag. N. Hist. Ser. 7. Vol. ii.

Allied to *P. sex-maculatus*, Simon, from Somaliland (in Donaldson Smith's 'Through Unknown African Countries,' p. 388), but at once recognizable by having the carapace spotted and not bordered with black; from *P. heraldicus*, Karsch (Zeitsch. ges. Naturw. 1878, p. 315), recorded from Zanzibar and Tanganyika, it differs in the coloration of the abdomen. In the last-mentioned feature it also differs from the Malaysian form *P. octo-maculatus*, C. Koch (Die Arachn. xii. p. 55).

NOTE.

I take this opportunity of characterizing representatives of two apparently new species of spiders obtained by Emin Pasha at Karagesi:—

Cyrtarachne lactea, sp. n. (Pl. XIII. fig. 8.)

Colour. Carapace and legs uniform ochre-yellow; abdomen cream-white, with a black tubercle on each side at its lateral angles, which are of a somewhat greenish-grey tint.

Carapace low, lightly convex from side to side, flattish along the top; ocular quadrangle much wider in front, anterior median eyes much the largest; eyes of anterior line recurved; clypeus about as high as anterior median eye.

Legs not spiny, hairy; the first and second pairs, and to a less extent the third and fourth, tubercular; patella and tibia of first about as long as carapace and longer than those of fourth.

Abdomen more than twice as wide as long, its anterior border transverse, sinuate, its posterior forming a very obtuse angle, lateral portions elevated, obtusely rounded, and furnished with about a dozen low, rounded, hyaline tubercles, the inner of which on each side is of a black colour; the area between the lateral prominences transversely hollowed; integument of abdomen striate and punctulate; sigilla small, three in an anterior transverse line, and behind them two longitudinal series of three each, the median sigilla of the three the largest.

Measurements in millimetres.—Length of carapace 4, width 3.6; length of abdomen 5, width 12; length of first leg 10, of second 9.

Differs from the rest of the species of *Cyrtarachne* in the form of its abdomen, its lower carapace, &c.

Araneus pachanus, sp. n. (Pl. XIII. fig. 9.)

Colour. Carapace ferruginous, darker towards the margin; mandibles ochre-yellow, blackish distally; palpi and legs mostly ferruginous, and clothed, like the carapace, with whitish hairs; patellæ lightly fuscous distally, tibiæ and protarsi with two indistinct fuscous bands, one distal, one median; tarsi distally fuscous, yellow at the base; femora of posterior leg infuscate; abdomen yellowish brown above and below, the lower side nearly uniformly coloured, ornamented only with a pair of indistinct yellow spots a short distance in front of the spinners; upperside with an indistinct pattern, consisting in front of a longitudinal black patch shaped like an arrow-head, with the point directed forwards; this is followed by a pair of irregular black longitudinal bands, which converge and meet posteriorly, leaving a paler lanceolate area between them, and give off externally faint dark stripes which extend on to the sides of the abdomen. *Hairs* on trunk and limbs mostly yellowish white, those on upperside of abdomen black at base. Spines on limbs white, with black base and apex.

Carapace flattish longitudinally between the fovea and the eyes, considerably longer than first tibia and longer than protarsus and tarsus of fourth, a little shorter than patella and tibia of fourth, and about equal to femur of first and fourth; ocular quadrangle much wider in front than behind, posterior medians less than a diameter apart, anterior medians larger and about a diameter and a half apart; eyes of anterior line about straight, not recurved, distance between medians about half the distance between median and lateral on each side; clypeus a little wider than anterior median eye.

Fang-groove of mandible armed with 4 teeth in front, 3 behind.

Legs moderately long, first more than three times as long as carapace; spiny.

Abdomen heart-shaped, widely rounded in front, ovally elongate behind, without shoulder-points.

Vulva with long scape; scape as wide at its distal end as the basal portion, which posteriorly projects beneath it, leaving only a narrow notch between.

Measurements in millimetres.—Total length 26; length of carapace 6.5, width 5; length of abdomen 10; length of first leg 22.5, of fourth 19.

Emin Pasha procured one specimen of this species at Karagesi, and Mr. Scott Elliot a second on Mount Ruwen-

zori. The latter, on account of the better state of its preservation, has been selected as the type.

In the form of its vulva this species approaches both *A. rufipalpis* (*semiannulatus*) and *A. haploscapus*, and in other features most nearly resembles the latter, but certainly differs in the actual form of the vulva &c.

EXPLANATION OF PLATE XIII.

- Fig. 1. *Eresus inornatus*, sp. n. Vulva.
 Fig. 2. *Araneus streptoceros*, sp. n. Vulva.
 Fig. 2a. Ditto. Palpal organ.
 Fig. 3. *Gasteracantha macrura*, sp. n.
 Fig. 4. *Storena nyikæ*, sp. n. Palpal organ, outer view.
 Fig. 5. *Sparassus croceiceps*, sp. n. Vulva.
 Fig. 6. *Sarotesius melanognathus*, gen. et sp. n. Palpal organ from below.
 Fig. 6a. Ditto. Tibial spur of palp.
 Fig. 7. *Platythomisus pantherinus*, sp. n.
 Fig. 8. *Cyrtarachne lactea*, sp. n.
 Fig. 9. *Araneus pachanus*, sp. n. Vulva.
 Fig. 10. *Araneus coccinella*, Poc. [This species, based upon a specimen from Natal, was described by me in the Ann. & Mag. Nat. Hist. for September last (p. 211). I take this opportunity of publishing a full figure of this interesting spider.]

LV.—*New and little-known Hymenoptera taken by Prof. C. H. T. Townsend and Mr. C. M. Barber in New Mexico in 1898.* By T. D. A. COCKERELL, Professor of Entomology, New Mexico Agricultural College.

Andrena Barberi, sp. n.

♀.—Length about 13 millim.

Rather stoutly built, black. Head rather broad, facial quadrangle about square, vertex granulate, front below ocelli strongly longitudinally striate; clypeus minutely tessellate and strongly punctured, the median line free from punctures but not smooth; mandibles wholly dark, *process of labrum broad and deeply emarginate; antennæ wholly black*, first joint of flagellum as long as the three following together; face, especially at sides, cheeks, and occiput with fairly abundant greyish-white conspicuously plumose hair, on the vertex more or less blackish. Thorax with greyish-white pubescence, *except on the mesothorax and scutellum, where it is sooty*; mesothorax dull, minutely tessellate, and with rather large shallow punctures; enclosure of metathorax triangular,

bounded by a raised line, strongly roughened, only feebly plicate at extreme base. Tegulæ piceous, minutely tessellate, with sparse feeble punctures. Wings dusky hyaline, nervures and stigma dark brown; *stigma small*; submarginal cells large, *but the first remarkably short, not longer than the third on the cubital nervure; second little shorter than the first on the cubital nervure*, receiving the first recurrent nervure slightly beyond its middle; third narrowed less than one half to marginal. Legs black, with pale pubescence, that on inner side of first tarsal joints becoming orange. *Abdomen minutely tessellate, with only a few minute scattered punctures*; hind margins of segments 2 to 4 and extreme lateral margins of 1 with *white hair, forming narrow bands; apex with soot-coloured hair*.

♂.—Length about 12 millim.; similar to the female, with the usual sexual differences. *Clypeus primrose-yellow, with two black spots*.

Hab. Ruidoso region, New Mexico. Ruidoso, below Big Rock crossing, about 6600 feet, Aug. 1, 1898, on flowers of *Heliothis scabra* (C. H. T. Townsend); South Fork of Eagle Creek, about 8300 feet, Aug. 19, on flowers of *Sicyos parviflorus*, 1 ♀ (Townsend); South Fork of Eagle Creek, about 8100 feet, Aug. 13, on flowers of *Rudbeckia laciniata*, 3 ♀, 1 ♂ (Townsend); Forks of Ruidoso Creek, July 30, 1898 (C. M. Barber).

Easily known by the venation and the colour of the pubescence. Nearest, perhaps, to *A. helianthi*, Rob., which has the small stigma and the same general build and sculpture. On the same day and at the same locality as *A. Barberi* Mr. Barber took the second known specimen of *A. apacheorum*, Ckll.

Andrena argemonis, Ckll.

♀.—Resembles the male; basal joints of tarsi broader, first four tibiæ black instead of ferruginous; antennæ a trifle shorter; tegulæ larger, base of metathorax smoother; apex of abdomen with very brilliant orange-rufous hair.

Hab. Ruidoso, New Mexico, about 6500 feet, July 25, 1898, on flowers of *Erysimum asperum*; side cañon north of Ruidoso, about 6800 feet, July 22, on flowers of *Verbascum thapsus*. Collected by Prof. C. H. T. Townsend.

This female differs hardly at all from the description of *A. fastuosa*, Sm., from Orizaba; but without seeing Smith's types or specimens from the same region it is impossible to say whether the species are identical.

Halictus aquilæ, sp. n.

♀.—Length about 8 millim.

Dark *olive-green*, with black legs and antennæ, shining, with thin, erect, *pale yellowish* pubescence. Head rather large, facial quadrangle broader than long, cheeks unarmed, ocelli prominent and very close together; vertex very densely punctured, as also the front, the face below the antennæ more sparsely punctured; lower half of clypeus purple-black, lower corners of face black; mandibles black, obtusely bidentate; scape punctured, flagellum wholly dark; mesothorax with a minute lineolate or subtessellate sculpture and *rather strong but sparse punctures*; *metathorax strongly truncate, the truncation rough and sculptured with ridges*, and bounded by a strong rim; base of metathorax bounded by a rim, minutely radiately wrinkled; *tegulae piceous, the anterior half punctured*; wings hyaline, with a yellowish tinge, nervures and stigma a rather dark yellowish brown, third submarginal cell narrowed less than half to marginal; legs quite hairy; abdomen dark green, black at the extreme base, very minutely and not densely punctured, little pubescent, without hair-bands.

Hab. South Fork of Eagle Creek, about 8000 feet, foot of east slope, on foliage, Aug. 21, 1898 (*C. H. T. Townsend*). *H. aquilæ* is closely related to *H. nymphæarum*, Rob., of the Eastern States; it is also related to *H. connexus*, Cress., from Texas.

Perdita phaceliæ, sp. n.

♀.—Length $3\frac{1}{2}$ millim.

Head ordinary, face dark bluish green, vertex dark olive-green; vertex minutely roughened; clypeus rather convex, shiny, with very sparse punctures; a suffused pallid spot near each lower corner of clypeus; mandibles dull yellowish, grooved, tips dark ferruginous; antennæ piceous above, mostly ferruginous beneath; mesothorax minutely granular, with some scattered white hairs, its colour black, shining greenish in certain lights; scutellum and postscutellum black; metathorax dark blue-green, strongly contrasting; the metathorax may be dark blue and the pleura of the same colour; legs black, with white hairs, small joints of tarsi more or less pallid, anterior tibiæ entirely pale in front; tegulae hyaline, colourless; wings perfectly clear, splendidly iridescent, nervures and margin of the hyaline stigma white; marginal cell squarely truncate, very short, its substigmatal portion almost twice as long as the poststigmatal; second submarginal

triangular, narrowing to a point above; third discoidal distinct; abdomen shining piceous, without bands or spots, apex fringed with white hairs; venter piceous.

Hab. La Cueva, Organ Mountains, N. M., Sept. 2, 1898, at flowers of *Phacelia congesta*. Collected by C. H. T. Townsend. Three females.

P. phaceliae is related to *P. aneifrons*, but will be easily known by its small size and the venation.

Panurginus neomexicanus, sp. n.

♂.—Length about $6\frac{1}{2}$ millim.

Black, with scanty white pubescence; clypeus and a very small spot on each side of it pale primrose-yellow. Head somewhat broader than long, face little hairy, mandibles black, anterior edge of clypeus black, front and vertex strongly and very densely punctured; antennæ quite long, wholly black, scape punctured; mesothorax with strong punctures of unequal size, becoming sparse on the shining disk; scutellum with punctures of unequal size; base of metathorax subcancellately wrinkled all over, but the longitudinal wrinkles strongest and most numerous; tegulæ shining, very dark brown; wings rather dusky, nervures and stigma black, first recurrent nervure joining second submarginal cell about the end of its first quarter; legs black, including tarsi, anterior tibiæ with a short yellow stripe in front; abdomen elongate-cylindrical, sparsely hairy, first segment impunctate on disk.

Hab. Top of ridge south of Big Rock, Ruidoso, N. M., about 7400 feet, Aug. 3, 1898, at flowers of *Solidago* (C. H. T. Townsend).

This is closely allied to *P. Bakeri*, but is readily distinguished by the small spot on each side of clypeus, black anterior edge of clypeus, and especially the sparsely punctured middle part of mesothorax. From *P. picipes*, Cr., it will be known by the scanty pubescence, lateral face-marks reduced to a spot, mesothorax without a well-impressed central line, black tarsi, &c. Of the palæartic species, it seems to come nearest to *P. Herzi*, Mor., from Eastern Siberia.

Exomalopsis compactulus (Ckll.).

Anthophorula compactula, Ckll. Bull. 24 N. M. Agr. Exp. Sta. (1897) p. 44, ♀.

Prof. C. H. T. Townsend has taken a male and female at La Cueva, Organ Mountains, N. M., on flowers of *Phacelia congesta*, Sept. 2, 1898. These both have three submarginal

cells and belong to *Exomalopsis*; my type of *Anthophorula*, having but two submarginals, was evidently an aberration, so the latter generic name must fall. It should be added to the original description of the female that the scopa on the posterior tarsi is sooty; the pubescence on the mesothorax and scutellum is fuscous, contrasting with the white pubescence of the hind edge of the prothorax, the pleura, and the base of the metathorax. The margins of the mesothorax have a little very short white hair, conspicuous only in certain lights. The flagellum is a very fine orange-fulvous.

The male is about $5\frac{1}{2}$ millim. long, with the clypeus, labrum, and mandibles except tips yellow. The bright orange flagellum has a black or blackish spot on each joint beneath, that on the last being intensely black and occupying the apical half of the joint. The scape has an orange streak.

The species is, I think, allied to *E. pulchella*, Cress.

Exomalopsis solidaginis, sp. n.

♂.—Length about 5 millim.

Black, with rather abundant *entirely pale pubescence*. Head broader than long, vertex quite broad, shining; face densely covered with plumose shining white hair; *clypeus and labrum black*; mandibles black, dark rufous at the middle; scape black, *flagellum yellowish brown, black above*; pubescence of pleura pure white, of thoracic dorsum dirty white; mesothorax smooth and shining, punctured only at the sides; base of metathorax nude, smooth and shining; tegulæ pale testaceous, hairy all over; wings perfectly clear, nervures and stigma very dark brown; *second submarginal cell extremely small and narrow*, twice as high as long, narrowest above; *transverso-medial nervure joining first discoidal cell almost at its extreme base*; legs black, with abundant white hair; *the tarsi, especially the small joints, ferruginous*; hair on inner side of basal joint of hind tarsi fulvous; abdomen short, as usual in the genus, covered with dull white hair, except the disk of the first segment, which is exposed and shining, though not free from hair. Instead of a transverse ridge, with a strongly punctured area behind it, as in *E. compactulus* ♂, the first segment has a rounded contour and no conspicuous punctuation.

Hab. Las Cruces, N. M., in the town, on flowers of *Solidago canadensis*, subsp. *arizonica*, Gray, on the bank of the Acequia, Aug. 27, 1898 (C. H. T. Townsend).

Exomalopsis eriocarpi, sp. n.

♀.—Length 9 millim.

Black; quite densely clothed with short pale ochreous hair, white on pleura, metathorax, face, cheeks, and femora; head considerably broader than long; face thickly clothed with white hair, but *the lower half of clypeus nude, strongly and confluent punctured, with a broad yellow transverse band just above the rufescent anterior margin*; labrum yellow; mandibles with a large yellow patch, suffused with rufous, at base; ocelli large; sides of vertex punctured; scape black; *flagellum blackish above, ferruginous beneath except the first joint*; mesothorax and scutellum very strongly punctured, the punctures numerous but well separated; base of metathorax with irregularly placed punctures; tegulae dark reddish brown, with only a small patch of hair in front; wings clear, nervures dark brown, stigma obsolete; second submarginal cell large, nearly square, *receiving the recurrent nervure at the beginning of its last third*; third submarginal cell little longer than first; legs black, small joints of tarsi pale testaceous, *scopa of hind legs wholly light*; abdomen suboval, less globose than usual, covered with a velvet-like creamy pubescence, the dorsal portion of the first segment and a little of the second bare, *these bare parts finely punctured*; hind edge of first segment colourless; first segment without any distinct transverse keel.

Hab. Fillmore Cañon, Organ Mountains, N. M., about 5400 feet, Sept. 1, 1898, on flowers of *Eriocarpum gracile*. Coll. C. H. T. Townsend, six females.

Hardly a typical *Exomalopsis*. At the same time and on the same flowers was taken a female *Calliopsis coloradensis*, Cress.

Lithurgus echinocacti, sp. n.

♀.—Length 11½ millim.

Black, with scanty white pubescence. Head rather large, broader than long, strongly and closely punctured; white hair conspicuous only at base of antennae, extreme sides of face, anterior margin of clypeus (here orange-fulvous in the middle), and hind part of cheeks; two prominent tubercles beneath antennae, and between them a concave shining area, *with scattered, very minute punctures; no distinct depression between the hind ocelli*; anterior edge of clypeus little produced, *presenting a rounded notch on each side, but none in the middle*; labrum transverse, inconspicuous; mandibles black, abruptly truncate, not meeting (? worn); thoracic dorsum

coarsely roughened, nude; hind margin of prothorax marked by a line of snow-white pubescence; base of metathorax dull, hardly sculptured, more or less overlapped by a thin tuft of long hairs springing from just behind it; pleura and sides of metathorax with white hair; tegulae dark brown, pubescent in front and behind; wings perfectly clear, nervures piceous, a small but distinct stigma; second submarginal cell receiving the first recurrent nervure almost at its extreme base, the second near its end; legs black, with white hair, small joints of tarsi ferruginous, basal joints of tarsi with orange-fulvous hair on inner side; tibiae conspicuously dentate-tuberculate on the outer side; abdomen shining, sparsely punctured, bare, hind margins of segments with narrow pure white hair-bands; apex with dark purplish-ferruginous hair; ventral scopa white.

Hab. La Cueva, Organ Mountains, N. M., on flowers of *Echinocactus Wislizenii*, Sept. 4, 1898 (*C. H. T. Townsend*).

This is clearly distinct from *L. apicalis*, as determined by Mr. Fox; it also differs from the other described species.

Melissodes crenulaticornis, sp. n.

♂.—Length about 10 millim., antennae about $8\frac{1}{2}$ millim.

Black, with dull white pubescence, *that on anterior part of mesothorax fulvous, on hind part of mesothorax and scutellum, except the hind border, fuscous, but not mixed at all with black.* Head considerably broader than long, facial quadrangle nearly square; clypeus with the upper half black, the lower half primrose-yellow; labrum and mandibles black; antennae wholly black, strongly crenulate, the joints without the longitudinal keels of *M. ruidosensis*; mesothorax with strong but shallow punctures; base of metathorax roughened, with a longitudinal impressed line; tegulae black, shining, with minute punctures; wings perfectly clear, nervures dark brown, third submarginal cell narrowing more than half to marginal; legs black, with white pubescence, pale orange on inner sides of tarsi; abdomen short and broad, dull and closely punctured; second to sixth segments with broad conspicuous apical white hair-bands; there is no trace of a band on the first segment, except perhaps at the extreme sides, but the segment is quite hairy.

Hab. Prude's Summit, Ruidoso, New Mexico, July 29, 1898 (*C. M. Barber*).

This is closely related to a male which Mr. Fox has identified as *M. dentiventris*, Sm., but differs from that at once by the black antennae and dark nervures. It may also be

confused with *M. perplexa*, Cress., but again differs by the black antennæ. It has also some resemblance to *Tetralonia flagellicornis*, Sm., from Oajaca. From *M. ruidosensis*, Ckll., common in the same localities, it may be known by the lower half of the clypeus only being yellow, the absence of the two raised lines or keels on the flagellum, and the pale instead of black hair on the abdominal segments above the bands. From *M. confusa*, Cr., it differs constantly in the clypeal coloration at least.

M. crenulaticornis was also collected by Prof. C. H. T. Townsend as follows:—Below Big Rock crossing, Ruidoso, N. M., Aug. 21, 1898, on flowers of *Geranium atropurpureum*, Heller, 1 ♂; Big Rock, Ruidoso, July 27, on flowers of *Vicia*, sp., also July 29, same place and flowers. The specimens from *Vicia* represent a form *maculata*, with a small yellow spot on the base of the mandibles.

Crabro Packardii, Cress., 1865.

Three, one much larger than the others, Ruidoso, N. M., 6500 feet, July 21, on flowers of *Cicuta occidentalis* (C. H. T. Townsend).

Ceropales fraterna, Sm., subsp. *occidentalis*, nov.

♂.—Length $5\frac{1}{2}$ millim.

Markings very bright yellow; scutellum with a transversely diamond-shaped yellow mark; postscutellum with a large nearly semilunar yellow mark; band on first abdominal segment deeply emarginate above, but not interrupted, band on second segment also emarginate above; femora black, rufous, and yellow, anterior femora rufous in front, with the base black and the extreme apex yellow; anterior tibiæ yellow in front and rufous behind; first joint of middle tarsi yellow; wings quite dusky, apical margin narrowly darker; abdomen very minutely roughened. Otherwise the insect seems to agree with *fraterna*. The front is extremely closely punctured, with scattered larger shallow punctures; the mesothorax has a similar double punctuation, but the larger punctures are large and deep, numerous, but irregularly arranged. The posterior orbital margins have only an inconspicuous interrupted yellow line.

Hab. Ruidoso, N. M., about 6500 feet, July 21, on flowers of *Cicuta occidentalis* (C. H. T. Townsend).

This is probably the western form mentioned by Fox (Trans. Am. Ent. Soc. 1892, p. 52).

Ichneumon ruidosensis, sp. n.

Length 11 millim.

Head, body, and legs deep Prussian-blue; wings clear but hairy, nervures and stigma black. Antennæ entirely black, minutely pubescent, 44-jointed; palpi, except first joint, whitish. Cream-coloured markings as follows:—a round spot on each side of clypeus; a broad band, narrowed to a point above, along the lower inner orbital margin; a narrow stripe running forwards in front of tegulæ; a short stripe beneath tegulæ; a large transversely oblong spot on middle of scutellum; a broad stripe on anterior femora in front; a spot at end of middle femora in front; anterior and middle tibiæ in front; and anterior and middle tarsi in front, except the last two joints and the extreme apical margins of the others. The tarsi, where not cream-colour, are black, and the tibiæ are not entirely blue. Head, thorax, abdomen, and hind coxæ and femora with strong very close punctures. Sides of metathorax with three longitudinal carinæ; first abdominal segment grooved on each side and longitudinally striate in the middle.

Hab. Side cañon north of Ruidoso, N. M., about 6800 feet, July 22, 1898, at a patch of *Verbascum thapsus* (C. H. T. Townsend).

Related to *I. caruleus*, Cresson, of which it may possibly be a variety, but it presents several differences, and is presumably a valid species.

Hylotoma humeralis, P. de Beauv., 1797.

Three females, Ruidoso, N. M., 6500 feet, July 18, on flowers of *Rhus glabra* (C. H. T. Townsend). New to New Mexico. One other specimen was taken, July 19, at flowers of *Cicuta occidentalis*.

Hylotoma mentzelicæ, sp. n.

Belongs to Section II. of Ashmead (Canad. Entom. 1898, p. 213).

Length 9 millim.

Entirely blue-black; the antennæ and legs black; the hind tibiæ with the upper two thirds pallid, but not white. This differs very little from *H. McLeayi*, Leach, but the tibiæ, except the hind pair, and all the tarsi are black; the hind tibiæ are sometimes all black; the costa is black, not yellowish; the wings vary in smokiness.

Hab. Five found dead, sticking to the leaves and stems

of *Mentzelia Rusbyi*, Wooton, Aug. 2, 1898, Ruidoso, N. M., one mile above Big Rock, about 6800 feet (*C. H. T. Townsend*).

This is hardly more than a geographical race of *H. McLewyi*.

Tenthredo pallicoxa, Provancher, 1878.

One from Ruidoso, N. M., about 8200 feet, foot of divide between Ruidoso and Eagle Creeks, Aug. 12, 1898 (*C. H. T. Townsend*).

This species has only been recorded from Canada, but the present specimen agrees so closely with the description, that we must assume it to be the same. It is $9\frac{1}{2}$ millim. long; the hind femora are entirely yellow beneath, the pale markings throughout being a light primrose-yellow. There is a minute light spot above the base of each antenna, and one at the summit of each eye, as in *T. nupera*, Cress.

Lophyrus Townsendi, sp. n.

♀.—Length $9\frac{1}{2}$ millim.; width of thorax $4\frac{1}{2}$ millim.

Antennæ ferruginous, blackish only at extreme tip, 22-jointed. Head and thorax ferruginous; face up to level of antennæ almost entirely yellowish; cheeks yellow; middle lobe of mesothorax with a suffused yellow stripe along each lateral margin, and a large black blotch occupying its hind angle; a yellow spot beneath tegulae; a black patch, on which is a yellowish spot, making a sort of ocellus, on pleura; a small black spot on each lateral lobe of the mesothorax near its lateral margin; scutellum pale yellow, tipped with ferruginous, its suture with the mesothorax black; legs ferruginous, the anterior knees slightly yellowish; wings hyaline, stained with ferruginous, especially about the marginal cell; abdomen cream-colour, the sutures more or less black, apex dark ferruginous. Head and thorax strongly and rather closely punctured; the large punctures on the vertex have minute ones scattered between them. Claws with a strong denticle on the inner side. Cross-nervure of lanceolate cell oblique, but only moderately so.

Hab. South Fork, Eagle Creek, White Mountains, N. M., about 8000 feet, found dead under a pine-tree, Aug. 17, 1898 (*C. H. T. Townsend*).

A distinct and interesting species.

LVI.—On the *Pierine Butterflies of the Genus Catopha*.
By ARTHUR G. BUTLER, Ph.D., F.L.S., F.Z.S., &c.

[Concluded from p. 401.]

Group 4. TACHYRIS, Wall.

The largest group in the genus, containing species of tolerably uniform outline, though differing considerably in coloration: the first and most typical species resemble the earlier forms of *Saletara* in the coloration of the males, whilst their females much more nearly resemble those of *Catopha*; then we meet with a series of bright scarlet or orange insects, gradually changing to species with the upper surface white and brown-bordered. In nearly the whole of the species the dark outer borders on the under surface of the wings are regular in outline, and in most of the white species the seasonal forms seem to be characterized by the width of these borders in the males and the amount of white on the upper surface of the females, the dry-season males having narrower borders and the dry-season females being marked with broad white patches*.

1. *Tachyris celestina*.

Pieris celestina, Boisduval, Voy. de l'Astr., Lép. p. 46 (1832); Lucas, Lep. Exot. pl. xxiii. fig. 1 (1835).
Appias delicata, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. ix. p. 153 (1882).

Waigiou, Mysol, Aru, Duke of York Island. B. M.

2. *Tachyris clementina*.

Pieris clementina, Felder, Sitzb. Ak. Wiss. Wien, math.-nat. Cl. xl. p. 448 (1860); Reise der Nov., Lep. ii. p. 162, pl. xxv. fig. 6 (1865).
Tachyris adelpha, Röber, Tijds. voor Ent. 1891, p. 281.

Tenimber, Timor-Laut. 2 ♂, 1 ♀, B. M.

3. *Tachyris placidia*.

Papilio placidia, Stoll, Suppl. Cramer, pl. xxviii. figs. 4, 4 c (1790).
Tachyris placidia, var. *maculata*, Staudinger, Exot. Schmett. p. 30, pl. xvi. (1884).

Amboina, Ceram, Batchian. B. M.

* I have not included *Tachyris maculata* of Grose-Smith in this paper, as I believe it to be a *Hypfina* near to *H. acrisa*.

4. *Tachyris zarinda*.

♂. *Pieris zarinda*, Boisduval, Sp. Gén. Lép. i. p. 486, pl. xviii. fig. 4 (1865).

♀. *Pieris fatima*, Vollenhoven, Tijd. voor Ent. 1866, p. 59, pl. ii. figs. 1, 2.

♀. *Tachyris phestus*, Westwood, Trans. Ent. Soc. 1888, p. 469, pl. xii. fig. 2.

Celebes. B. M.

The female sometimes has orange and sometimes white markings, but whether seasonally or not there is no evidence to show.

5. *Tachyris bouruensis*.

♀. *Tachyris bouruensis*, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 379 (1867).

Bourou.

Allied to *T. zarinda*. The type should be in Hewitson's collection, but was probably not in good enough condition to induce him to retain it.

6. *Tachyris nebo*.

Appias nebo, Grose-Smith and Kirby, Rhop. Exot., Pier., *Appias*, i. figs. 1, 2 (1894).

Burma.

Nearest to *T. galba*; much more yellow and without discal band on primaries.

7. *Tachyris galba*.

Tachyris galba, Wallace, Trans. Ent. Soc. ser. 3, vol. iv. p. 378 (1867).

Manipur and Silhet. B. M.

8. *Tachyris nero*.

Papilio nero, Fabricius, Ent. Syst. iii. 1, p. 153 (1793); Donovan, Ins. Ind. pl. xxxii. fig. 1 (1800).

Pieris thyria, Godart, Enc. Méth. ix. p. 147 (1819); Lucas, Lep. Exot. pl. xxv. fig. 3 (1835).

Pieris figulina, Butler, Ann. & Mag. Nat. Hist. ser. 3, vol. xx. p. 399, pl. viii. fig. 1 (1867).

Burma, Malacca, Penang, Singapore, Java, Sumatra, Borneo. B. M.

This species varies a good deal both in depth of colour above and below and in dusky veining and clouding. *T. thyria* and *T. figulina* are both separable as varieties, but whether they are seasonal forms or mere sports remains to be discovered.

9. *Tachyris domitia*.

Pieris domitia, Felder, Wien. ent. Monatschr. vi. p. 285 (1862); Semper, Reisen im Arch. Phil. v. pl. xl. figs. 1, 2, and 4 (1891).

Pieris zamboanga, Felder, l. c.

Pieris asterope, Felder, l. c. p. 286 (1862).

Appias mindanensis, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xi. p. 421 (1883); Semper, Reisen im Arch. Phil. pl. xl. figs. 3, 5 (1891).

Philippines. Twenty-seven examples. B. M.

A male from Borneo in the Hewitson collection agrees with Semper's male of *P. asterope*.

10. *Tachyris palawanica*.

Appias nero, var. *palawanica*, Staudinger, Lep. v. Palawan, p. 22 (1889).

The male varying above from brick-red to bright orange, the veins of primaries, and sometimes the veins on apical area of secondaries, dusky; the apex and outer margin of primaries sometimes with a soft graded brownish border: under surface much more ochraceous, without markings, the centre of primaries more orange than the remainder of the under surface.

Expanse of wings 72–77 millim.

The female varies above from bright orange, through mixed ochreous and tawny, to pure white with dusky basal area and spotted black-brown outer border (as in *T. nero* and allies); below also the wings vary from bright ochreous to ochreous and white commingled or to tawny and ochreous primaries with white subapical streak and pearl-white secondaries clouded with sandy greyish; the ordinary markings (corresponding with those of the upper surface) more or less defined.

Expanse of wings 59–66 millim.

Palawan and Labuan. Ten examples, B. M.

I cannot regard this as a variation of any known species; the primaries of the male are more acute than in *T. domitia* and the under surface unmarked, whilst the female is extremely variable, but has not at all the character of *T. zamboanga* (*T. domitia* ♀), but more nearly resembles *T. figulina* (*T. nero*, var., ♀); its small size and invariably paler colour readily mark it as a different species.

11. *Tachyris flavius*.

Appias flavius, Grose-Smith, Ann. & Mag. Nat. Hist. ser. 6, vol. x. p. 427 (1892); Rhop. Exot. ii., Pier., *Appias*, i. figs. 3–5 (1894).

Taganac Island, N.E. Borneo.

12. *Tachyris ithome*.

Pieris ithome, Felder, Wien. ent. Monatschr. iii. p. 180, pl. iv. fig. 1 (1859).

Celebes. 6 ♂, 1 ♀, B. M.

13. *Tachyris nephele*.

♂. *Pieris nephele*, Hewitson, Exot. Butt. ii., *Pier.* pl. v. fig. 33 (1861)

♀. *Pieris zamora*, Felder, Wien. ent. Monatschr. vi. p. 286 (1862).

Philippines, Celebes. 9 ♂, 6 ♀, B. M.

Local form *Tachyris dilutior*.

Tachyris nephele, var. *dilutior*, Staudinger, Lepid. v. Palawan, p. 21 (1889).

Palawan. 3 ♂, 1 ♀, B. M.

T. nephele is extremely variable as regards the amount of white on the primaries and the width of the blackish outer border of the secondaries; but whether these differences are seasonal we have no data to prove. The Palawan examples show as much white on the primaries of the males as in any of the males of typical *T. nephele*, and the border of the secondaries is slightly narrower than in any, whilst it is more or less abruptly excised at apex.

14. *Tachyris florentia*.

Appias florentia, Grose-Smith and Kirby, Rhop. Exot. ii., *Pier Appias*, i. figs. 6-8 (1894).

Solomon Islands. 3 ♂, 3 ♀, B. M.

We received three pairs of this species from the Godman and Salvin collection.

15. *Tachyris ada*.

Papilio ada, Cramer, Pap. Exot. iv. pl. cccxiii. C, D (1782).

Amboina. 1 ♂, 2 ♀, B. M.

16. *Tachyris solstitialis*, sp. n.

♂. Above similar to *T. florentia*, but with the dark brown outer border of the primaries more abruptly tapered; below also much like *T. florentia*, but with the dark brown outer border of the secondaries of only half the width, and the bright orange internal triangular patch consequently of twice the size.

Expanse of wings 75 millim.

Ann. & Mag. N. Hist. Ser. 7. Vol. ii.

32

♀. Above at once distinguishable from *T. florentia* ♀ by the much less lavender tint of the greyish basal suffusion, its almost entire absence from the secondaries, the dentate-sinuate inner edging of the external border, which narrows almost to a point at the external angle of the primaries, and is distinctly narrower than in *T. florentia* on the secondaries on both surfaces.

Expanse of wings 72 millim.

New Ireland (G. & S. coll.). Two pairs, B. M.

If this insect occurred in the same island with *T. florentia*, I should unhesitatingly regard it as the dry-season form of that species.

17. *Tachyris leucosticta*, sp. n.

Intermediate between the preceding and *T. cilla*, nearly resembling *T. solstitialis* above in both sexes, but below both sexes have the subapical spot of the primaries yellow instead of white and the orange on the secondaries considerably more restricted; the width of the outer border appears to vary seasonally, the wet-season form has the outer border of the secondaries decidedly narrower and less regular than in *T. florentia*, whilst the dry-season form is paler in colour and has a slightly narrower border than *T. solstitialis*.

Expanse of wings, ♂ 69-83, ♀ 72 millim.

Bourou, Ceram, Salwatty, Waigiou. 5 ♂, 1 ♀, B. M.

It is probable that this species has been confounded in collections with *T. cilla*.

18. *Tachyris cilla*.

Pieris cilla, Felder, Reise der Nov., Lep. ii. p. 165 (1865).

Tachyris clavis, Wallace, Trans. Ent. Soc. 3, vol. iv. p. 367 (1867).

Ké Island, Normanby Island, Aru. 3 ♂, B. M.

T. clavis is the wet-season form and *T. cilla* the dry. The females of both are in the Hewitson collection: that of *T. clavis* white above and not unlike that sex of *T. florentia*, excepting that the blackish border of the secondaries occupies nearly half the wing-surface; that of *T. cilla* is yellower and resembles that sex of *T. leucosticta* on the upper surface, excepting that it is greyer at base and has the inner edging of the outer borders less sharply defined, whilst below it has a broader outer border to the secondaries and the orange area deeper in colour and much more extended. Hewitson's examples of this species are from Ké, Aru, and New Guinea.

The males of *T. cilla*=*clavis* are characterized by the fact that the apical border of the primaries completely encloses

the subapical spot on the upper surface *, and on the under surface this spot is bright yellow ; but these differences alone would not be sufficient to separate it from *T. leucosticta* ; the much greater orange area on the under surface of the secondaries (corresponding with that of *T. solstitialis*) distinguishes it at once.

The following species was received in 1874 from the Godeffroy Museum under the name of *T. ada*.

19. *Tachyris ella*, sp. n.

Allied to *T. cilla*, but with the subapical spot white below in the male, as in *T. ada* ; it is considerably smaller than the latter in both sexes and the dark border to the secondaries on the under surface of only about half the width ; the orange on these wings is very much restricted, even more so than in *T. leucosticta*. On the upper surface the male resembles *T. cilla* in the extension of the dark brown apical area of the primaries so as to enclose the subapical spot ; the secondaries, however, have a narrower and very sharply defined dentate-sinuate outer border.

Expanse of wings, ♂ 68, ♀ 62 millim.

Yap, Caroline Islands. ♂ ♀, B. M.

The female has the under surface of the secondaries whiter than in any of the preceding species, the costa and veins towards the base feebly washed with sulphur and the apex clear ochreous.

20. *Tachyris ardens*, sp. n.

Appias andrea (part.), Semper, Reisen im Arch. Phil. v., Rhop. p. 242 (1891).

The Philippine representative of *T. cilla* ; invariably distinctly smaller. The primaries with the subapical spot completely enclosed by the blackish apical border as in that species, but the border of the secondaries with strongly dentate-sinuate internal edging ; the subapical spot on the under surface of the primaries varies from sulphur- to saffron-yellow, and the secondaries below are either daffodil-yellow, with rather less orange suffusion than in *T. cilla*, or are wholly orange from base to border †. The female nearly resembles in every respect that sex of *T. ella*, but shows less colour on the under surface, the yellow and ochreous being extremely weak.

* In our male example of *T. leucosticta* from Waigiou the same thing occurs, but to a slightly less prominent extent.

† Whether these are seasonal differences I am not in a position to say.

Expanse of wings, ♂ 68–69, ♀ 59–66 millim.

2 ♂, 4 ♀, Philippines, and ♀, Pelew Island. (Seven examples.) B. M.

This is also in the Hewitson collection; it certainly belongs to the *T. ada* (not *T. hippo* group), both sexes being at once distinguishable from *T. andrea*.

21. *Tachyris Dohertiella*, sp. n.

A very distinct little species; male milk-white, the costa bluish grey, browner on the costal border; apex and outer border occupied by a black-brown band, with acutely dentated inner margin; no subapical spot: secondaries with a rather narrow and tolerably regular black-brown border on a faintly blue-greyish ground from apex to below second median branch; fringe brown: body rather greyer than in any of the preceding species. Primaries with the costal border excepting at base chocolate-brown, continuous with the outer border, which is much broader than above, blackish internally, with much less dentated irregularly sinuated inner margin: secondaries slightly nacreous, with the outer border chocolate-brown and broader than above: body below white.

Expanse of wings 55 millim.

♀. Primaries dark brown, blackish towards apex; two narrow superposed creamy-yellowish streaks beyond the cell; an irregular white patch from just above second median branch to inner margin, its inner edge diffused, its outer edge acutely zigzag: secondaries with a smoke-grey basal patch; a moderately broad dark brown outer border on a pale brownish ground from apex to just beyond second median branch. Primaries below with the pale markings of the upper surface extended; the base and lower two thirds of the discoidal cell whitish: secondaries nacreous, the outer border paler and much wider than above.

Expanse of wings 55 millim.

♂ ♀, Wetter (May 1892, *W. Doherty*). B. M.

Received from the Godman and Salvin collection.

22. *Tachyris timorensis*, sp. n.

♂. Very like *T. lyncida*, but with the black-brown outer borders distinctly broader, less irregular, the subapical spot sometimes reduced to a short narrow streak.

Expanse of wings 54–60 millim.

♀. Very like *T. Dohertiella*, but the creamy streaks beyond the cell of primaries broader and confluent; the outer border

of secondaries rather wider and bordered internally by a smoky-brownish suffused belt.

Expanse of wings 54 millim.

♂ ♂, 1 ♀, Timor (ex Godman and Salvin coll.). B. M.

23. *Tachyris lyncida*.

Papilio lyncida, Cramer, Pap. Exot. ii. pl. cxxxii. B (1779).

Pieris enyo, Boisduval, Sp. Gén. Lép. i. p. 481 (1836).

Pieris lynceola, Felder, Reise der Nov., Lep. ii. p. 164 (1865).

Java, Bali, Lombok. B. M.

The females vary somewhat as regards the amount of creamy or buffish white on the wings. I suspect that these differences are seasonal.

24. *Tachyris floresiana*, sp. n.

A local representative of *T. lyncida*; the males with the dentated blackish border of primaries not reaching external angle and that of the secondaries reduced almost to a line on the upper surface; on the under surface the outer borders vary a good deal (probably seasonally) in width; the secondaries are more creamy than in *T. lyncida*.

Expanse of wings, ♂ 54–69 millim.

The females above show a much smaller whitish patch than any females of *T. lyncida*.

Expanse of wings, ♀ 61–63 millim.

Flores. Seven examples. B. M.

25. *Tachyris lycaste*.

Pieris lycaste, Felder, Reise der Nov., Lep. ii. p. 164 (1865).

Celebes, 4 ♂, 4 ♀. Eight examples. B. M.

The males of this species nearly resemble those of *T. floresiana*, but the secondaries on the under surface are suffused towards the base with sulphur-yellow (in what I regard as the wet-season form), the females being heavily suffused with smoky brown.

26. *Tachyris formosana*.

Pieris formosana, Wallace, P. Z. S. 1866, p. 356.

Appias inornata, Moore, P. Z. S. 1878, p. 700.

Formosa and Hainan. B. M.

We possess Dr. Moore's type and a similar male from Formosa. It appears to me that the differences between the typical forms are only seasonal; at any rate they have no specific value.

27. *Tachyris andrea*.

Colias andrea, Eschscholtz, Kotzeb. Reise, iii. p. 215, pl. xxiii. *a, b* (1821).

Philippines. ♂ ♀, B. M.

The males of this form differ very little from those of *T. hippo*, but the females have a decidedly broader dark outer border to the secondaries; what I regard as probably the dry-season form has also a much purer white ground to the wings on both surfaces.

28. *Tachyris hippo*.

♀. *Papilio hippo*, Cramer, Pap. Exot. iii. pl. cxv. B, C (1782).

♂. *Pieris eleonora*, Boisduval, Sp. Gén. Léop. i. p. 481 (1836).

♀. *Appias vacans*, Butler, Trans. Ent. Soc. 1870, p. 490; Lep. Exot. p. 90, pl. xxxiv. figs. 5, 6 (1872).

♂. *Appias hippoides*, Moore, Trans. Ent. Soc. 1881, p. 312.

Appias epicæna, Swinhoe, P. Z. S. 1889, p. 398.

N.E. India, Pegu, Burma, Tonkin, Malacca, and Penang.
B. M.

Our series is represented by sixty-eight examples, showing every possible gradation between the extreme wet form *T. hippoides* and the extreme dry form *T. epicæna*. The Indian forms have the subapical spot on the under surface of the male primaries bright yellow; in Pegu, Burma, Malacca, and Penang this spot is sometimes bright or pale yellow, but much more frequently quite white.

29. *Tachyris taprobana*.

Appias taprobana, Moore, P. Z. S. 1879, p. 143; Lep. Ceylon, i. pl. lii. figs. 1, 1 *a, b, c*.

Appias aperta, Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xviii. p. 188 (1886).

Ceylon. B. M.

I regard *T. aperta* as the dry form of *T. taprobana*. The species stands between *T. hippo* and *T. enarete*, the costal and subcostal veins on the under surface of the secondaries being blackened, though less prominently than in *T. enarete*.

30. *Tachyris enarete*.

Pieris enarete, Boisduval, Sp. Gén. Léop. i. p. 480 (1836).

Borneo. 15 ♂, 6 ♀. B. M.

31. *Tachyris latifasciata*.

Appias latifasciata, Moore, Trans. Ent. Soc. 1881, p. 312.

Kollar, Nilghiris. 5 ♂. B. M.

32. *Tachyris cardena*.

Pieris cardena, Hewitson, Exot. Butt. ii., *Pier.* pl. iii. figs. 17, 18 (1861).

Borneo, Sumatra, Malacca. 13 ♂, 1 ♀. B. M.

The examples from Malacca may have to be separated, the yellow on the under surface of the secondaries being replaced by a much more restricted abdominal patch of orange.

33. *Tachyris hagar*.

♂. *Pieris hagar*, Vollenhoven, Mon. Pier. p. 38, pl. iv. fig. 6 (1865).

Sumatra.

I think it quite likely that this is only a dry-season form of the preceding species.

34. *Tachyris Hombronii*.

Pieris Hombronii, Lucas, Rev. et Mag. de Zool. 1852, p. 325; ♀, Vollenhoven, Mon. Pier. p. 5, pl. ii. fig. 3 (1865).

Celebes. 3 ♂, 1 ♀. B. M.

This curious and handsome species leads pleasantly from the present group towards *Prioneris*, of which it has the general form and aspect, though without the serrated costa.

LVII.—*The Entomostraca of Lake Bassenthwaite.* By EDITH M. PRATT, B.Sc. *With an Introductory Note* by SYDNEY J. HICKSON, M.A., F.R.S., Beyer Professor of Zoology in the Owens College, Manchester.

Introduction.

THE splendid researches on the character of the fresh-water fauna which have of recent years been made by Zacharias at Plön, by Birge at Mendota, and by many others abroad, serve to remind us how ignorant we are of the fauna of our own English lakes.

Investigations of the inland waters of Scotland have been conducted for some years by Scott* ; but Beck's † paper is the only one that gives a systematic account of the Entomostraca of the English lakes.

As Beck's investigations were chiefly made in the autumn months it occurred to me that it might be of interest to inquire into the character of the fauna earlier in the year, with the

* Scott, T., Scottish Fishery Reports. Scient. Invest. 1899 onward. Invertebrate Fauna of Inland Waters of Scotland.

† Beck, C., J. R. Micr. Soc. (2) iii. p. 780

object of noting the principal differences that presented themselves in the early spring and in the autumn.

Accordingly in April 1897, when the weather was still very cold and blasts of icy wind blew down in gusts from the snow-capped Skiddaw, I took a few samples of the Plankton as a preliminary step to further investigations. The material I then obtained proved to be of considerable interest, containing among other things the interesting *Nauplius* larva of *Leptodora*.

In April of this year, the weather being decidedly warmer than in the corresponding time of 1897, I obtained the assistance of Mr. J. T. Wadsworth, and made with him a considerable number of gatherings in various parts of the Lake, so that it may be said that we obtained a fair sample of what the Plankton is at that time of year.

Again, in June, with the assistance of Mr. J. H. Ashworth, B.Sc., another long series of tow-nettings were taken which show the remarkable change that takes place in the character of the Plankton during the first two months of the summer.

I have to acknowledge here my thanks to Mr. Ashworth and Mr. Wadsworth for their skilled assistance in this investigation.

As my time was fully occupied during the summer months I entrusted the duty of identifying the species to my former pupil Miss Edith Pratt, B.Sc., of the Owens College; and the results of her investigations are recorded below.

It cannot be supposed that the list of Entomostraca which is now given as occurring in Lake Bassenthwaite is by any means complete. A complete list will be drawn up only when a series of gatherings are taken every month for two or three years; but it may be hoped that the publication of this paper will act as a stimulus for further investigation.

It is well known to fishermen that the lakes in Cumberland vary very considerably in their "trout" reputation. Bassenthwaite is not regarded as a very good lake for trout, but, on the other hand, it contains an abundance of perch and pike. It would be extremely interesting if in time a systematic study of the relations between the fish-fauna and the Entomostracan fauna could be undertaken. It would not be a very costly investigation, but it would require the whole time of a competent naturalist provided with a modest laboratory on the lake side for a period of two or three years. The results to be obtained might be of considerable value to the fishery.—S. J. H.

BASSENTHWAITE LAKE is particularly well suited for faunistic investigations, for while being one of the lowest of the English lakes, it has the largest drainage-area; it also receives the overflow from Derwentwater and Thirlmere; therefore in Bassenthwaite we should expect to find a typical lake-fauna, and, in addition, a concentration of the forms living within the drainage-area of the lake.

Bassenthwaite * is the same size as Derwentwater—a little over 2 square miles in area. It is 3·83 miles in length, its average breadth is ·054 mile or 950 yards. The widest part of the lake is exactly $\frac{3}{4}$ mile. The surface of the lake is 223·4 feet above the sea-level; the average depth is 18 feet; the greatest depth is 70 feet. Direct drainage-area 91½ square miles; total catchment-area 134 square miles.

The upper end of the lake is shallow, and depths over 25 feet are confined to a trough nearly 2 miles long in the middle of the lake. The section across the lake suggests a double-troughed depression separated by a broad central rise. Mill says:—"The steep slopes of the lake above and below water were always composed of smooth rounded stones, much smaller than the great blocks of Derwentwater; the stones were only observed to be covered with mud on the shallow flats at the north-west and southern ends, and except for some rushes and water-lilies in the south-eastern corner, there were remarkably few water-plants, and no signs of a peaty floor. Well out in the lake the sediment was always found to be soft mud." The soundings were taken on June 24th and 26th, 1893.

On 4th April, 1897, a few tow-nettings were roughly made in the lake, with the view of ascertaining the nature of the fauna. The following forms were taken:—COPEPODA: *Diatomus castor*, *Cyclops strenuus*, and *C. signatus* were fairly common; *Cyclops affinis* was rather rare. DAPHNIDÆ: *Bosmina longirostris* and the larvæ of *Leptodora hyalina* were fairly common.

On 21st and 22nd April, and 15th, 16th, and 17th June, 1898, the investigations were more thorough, and the middle and northern portions of the lake were carefully worked at.

In April ten tow-nettings were taken, six at the surface and four at a depth of from 5 to 6 feet. The preservatives used were (1) a solution of corrosive sublimate, and (2) a mixture of formol, spirit, and osmic acid; the latter obtained better results than the former.

On 21st and 22nd April, 1898, it was noticed that the

* For a complete description of Lake Bassenthwaite see 'Bathymetrical Survey of the English Lakes,' by H. R. Mill, D.Sc.

Copepods were most abundant some little distance below the surface, while the Daphnids were found in greatest numbers at the surface. The following forms were taken:—COPEPODA: *Cyclops Kaufmanni* was very abundant; *Cyclops signatus* and *Diaptomus gracilis* were abundant; *Cyclops insignis*, *C. Ewarti*, *C. strenuus*, and *Diaptomus castor* were less abundant; *Cyclops Thomasi* was rare. CLADOCERA—DAPHNIDÆ: *Bosmina longirostris* and *Sida crystallina* were abundant; *Chydorus sphericus* and the larvæ only of *Leptodora hyalina* were less abundant; *Bythotrephes longimanus*, *Polyphemus pediculus*, and *Daphnia pulex* were rare.

On 15th, 16th, and 17th June, 1898, sixteen tow-nettings were taken at different hours of the day at depths from 0 to about 10 feet from the surface.

This collection was characterized by the presence of the rotifer "*Asplanchna priodonta*" in immense numbers. As it occurred in the same proportion in all the tow-nettings, it must have been universally distributed.

In April the Copepods outnumbered the Daphnids, but in June the Copepods had diminished remarkably in numbers and were replaced by those Daphnids (*Bythotrephes*, *Polyphemus*, *Leptodora*, and *Daphnella*) which were rare in April.

The following COPEPODA were taken:—*Cyclops signatus* was fairly abundant; *C. phaleratus*, *C. strenuus*, *C. serrulatus* were rather rare; *C. insignis* was rare.

DAPHNIDÆ: *Daphnella brachyura*, *Leptodora hyalina*, *Polyphemus pediculus* were very abundant, with eggs, embryos, and young in various stages of development; *Bythotrephes longimanus* with eggs and embryos was abundant; *Sida crystallina* and *Chydorus sphericus* were rare.

A few water-mites were taken which have not yet been identified.

The following species were abundant in April 1898, but were rare or not taken in June:—*Cyclops Kaufmanni*, *C. insignis*, *C. Ewarti*, *Diaptomus gracilis*, *D. castor*, *Bosmina longirostris*, *Sida crystallina*, *Chydorus sphericus*.

Cyclops Thomasi and *Daphnia* were rare in April and were not taken in June.

The following species were common in June which were rare or not taken in April:—*Daphnella brachyura* (absent in April), *Leptodora hyalina* (only larvæ were taken in April), *Polyphemus pediculus*, *Cyclops phaleratus*, and *C. serrulatus* (fairly abundant, but not taken in April), *Bythotrephes longimanus*.

Cyclops signatus and *C. strenuus* were fairly abundant in April and in June.

*Brief Statement of recorded Distribution in Britain of the
Species taken in Lake Bassenthwaite.*

ENTOMOSTRACA.

CLADOCERA.

Bosmina longirostris, Baird.

Bosmina longirostris, Baird, British Entomostraca, p. 105, tab. xv. fig. iii.

This species appears to be fairly common and widely distributed in Britain. In Bassenthwaite it was very common in all the tow-nettings in April, but rare in June.

Sida crystallina, Straus.

Sida crystallina, Baird, Brit. Entom. p. 107.

Baird remarks that this species is of rare occurrence, but Scott records it as being common in Raith Lake in Scotland. It was the most common species taken in April 1898. In June very few specimens were taken, but these were of a large size, with well-developed ova and embryos.

Chydorus sphaericus, Baird.

Chydorus sphaericus, Baird, Brit. Entom. p. 126, tab. xvi. fig. 8.

Common in ponds and ditches in Britain almost all the year round.

Leptodora hyalina, Lilljeborg.

Leptodora hyalina, Bronn, Klass. und Ordn. des Thier., Arthrop. Crust., Erste Hälfte, Tafeln, Taf. xxi. fig. 1.

This species was first taken in England by Bolton* from the Olton reservoir, near Birmingham. Later it was taken by Beck in Lake Grasmere. Scott has taken it in the Scottish lakes (Loch Leven, Loch Morar), and remarks that while it is considered to be a rare species, it is not very rare in Loch Leven.

In April only the larvæ and very young forms were taken, chiefly at the surface, in Bassenthwaite. In June this species was exceedingly abundant, with eggs, embryos, and young, but no young larvæ were taken. It was, moreover, confined to the middle of the lake, where the water is deep

* Ann. & Mag. Nat. Hist. (5) vol. ix. p. 53. E. Ray Lankester, "On new British Cladocera discovered by Mr. Conrad Beck in Grasmere Lake, Westmoreland."

(see Map, p. 475). Very few mature specimens were taken at the surface, or at the depth of 2 to 4 feet; but from 6 to 10 feet (10 feet=greatest depth at which tow-nettings were taken) it was taken in great quantities.

Bythotrephes longimanus, Leydig.

Bythotrephes longimanus, Leydig, Naturgeschichte der Daphniden, p. 244, figs. 73-75, Taf. x.

British Habitat.—Scotland (*Scott*): Loch Ness, Loch Morar (frequent at surface), Loch Leven (frequent). Perthshire Lochs (*Sept.*): Loch Oich (common), Loch Tay (frequent at surface).

This species has not been recorded before from the English lakes. In Bassenthwaite it was very rare in April but very abundant in June, with eggs, embryos, larvæ, and young.

Beck describes the species "*cederstromii*" from Grasmere and other English lakes, and remarks that it appears to be more abundant in the autumn than in the spring.

Daphnia pulex, Latreille.

Daphnia pulex, Baird, Brit. Entom. p. 89, tab. xvi. fig. 5.

This species, while being widely distributed in ponds and ditches in Britain, occurs but rarely in large sheets of water; it was very rare in Bassenthwaite in April, and no specimens were taken in June.

Daphnia longispina.

Daphnia longispina, Baird, Brit. Entom. p. 91, tab. vii. figs. 3, 4.

This species was taken by Beck in the English lakes and by Scott in some of the Scottish lochs. It was rare in April, and no specimens were taken in June.

Polyphemus pediculus, Straus.

Polyphemus pediculus, Baird, Brit. Entom. p. 111, tab. xvii. fig. 1; Leydig, Naturg. der Daphniden, p. 232, Taf. viii. fig. 63, Taf. ix. fig. 71.

Baird took specimens of this species in a ditch near Richmond on Thames; he remarks that this species seems to be very limited in its range of habitat, as he only found it in one spot not more than 20 yards in extent. Scott, however, has taken it in many of the Scottish lakes, and describes it as being a fairly common species, especially in large sheets of water; in Loch Morar, in Perthshire, it was taken by him in

abundance near the surface all over the portion of the loch examined.

Beck took this species in the English lakes. It was very rare in Bassenthwaite in April, but very abundant and universally distributed at the surface and some little distance below the surface in June, with eggs, embryos, and larvæ in all stages of development.

COPEPODA.

Cyclops signatus, Kochl.

Cyclops signatus, Brady, Brit. Copep. vol. i. p. 100, pl. xvii. figs. 4-12; id. Revision Brit. Freshwater Cyclopidae and Calanidae, p. 6, pl. ii. fig. 5.

Examples with serrated and with simple ridge on antenna were taken. They are supposed to represent different stages in development (*Herrick*). This species is widely distributed and common in Britain.

Cyclops strenuus, Fischer.

Cyclops strenuus, Brady, Brit. Copep. vol. i. p. 104; id. Rev. Brit. Freshw. Cyc. and Cal. p. 8, pl. ii.

Widely and generally distributed in Britain, but not very common.

Cyclops Thomasi, Forbes.

Cyclops Thomasi, Brady, Freshw. Cyc. and Cal. p. 15, pl. vi. figs. 1-4.

This is not a common species. Scott has taken it in many of the Scottish lakes, but it seems to occur nowhere in great abundance. It was rare in Bassenthwaite in April, this being the first time that it has been recorded from the English lakes. No specimens were taken in June.

Cyclops insignis, Claus.

Cyclops insignis, Brady, Brit. Copep. vol. i. p. 108, pl. xxi.; id. Rev. Brit. Freshw. Cyc. and Cal. p. 18, pl. vii.

Brady describes it as being one of the less common species of *Cyclops*. I have not found it recorded from the Scottish lakes. Specimens of this species were fairly common in the middle of the lake in April, but rare in June.

Cyclops Ewarti, Brady.

Cyclops Ewarti, Brady, Rev. Brit. Freshw. Cyc. and Cal. p. 22.

Scott has taken this species in a small bay near Queensferry, Firth of Forth. Brady remarks that this is the only

undoubted member of this genus which has been found living in the sea. As it was first found in the Forth, he thought that its habitat must be in ponds and ditches which flow into the Forth. Since then it has been taken by Scott in Loch Morar (Inverness-shire) and in Loch Moray.

Only a few specimens of this species were taken in April and none were taken in June.

Cyclops affinis, Sars.

Cyclops affinis, Brady, Brit. Copep. vol. i. p. 112, pl. xv. figs. 11-14, pl. xxiv. B, figs. 10-15; id. Rev. Brit. Freshw. Cyc. and Cal. p. 21, pl. viii.

Brady says that this species seems to be of rare occurrence. Scott records it from some of the Scottish lakes. It was taken in Bassenthwaite in April 1897, and has not since been taken.

Cyclops Kaufmanni, Uljanin.

Cyclops Kaufmanni, Brady, Brit. Copep. vol. i. p. 113, pl. xxiv. figs. 6-12; id. Rev. Brit. Freshw. Cyc. and Cal. p. 24, pl. ii. fig. iii.

This species, although very limited from all accounts in its distribution, was by far the most abundant species taken in April 1898; in June it was rare.

Cyclops phaleratus, Koch.

Cyclops phaleratus, Brady, British Copepoda, vol. i. p. 116.

This species is not very common, though fairly widely distributed. It has been taken in a few of the Scottish lakes by Scott, in Ireland and north of England by Brady, but has not been recorded from the English lakes. It was taken in Bassenthwaite in April 1898, when it was rather rare. No specimens were taken in June.

Cyclops serrulatus, Fischer.

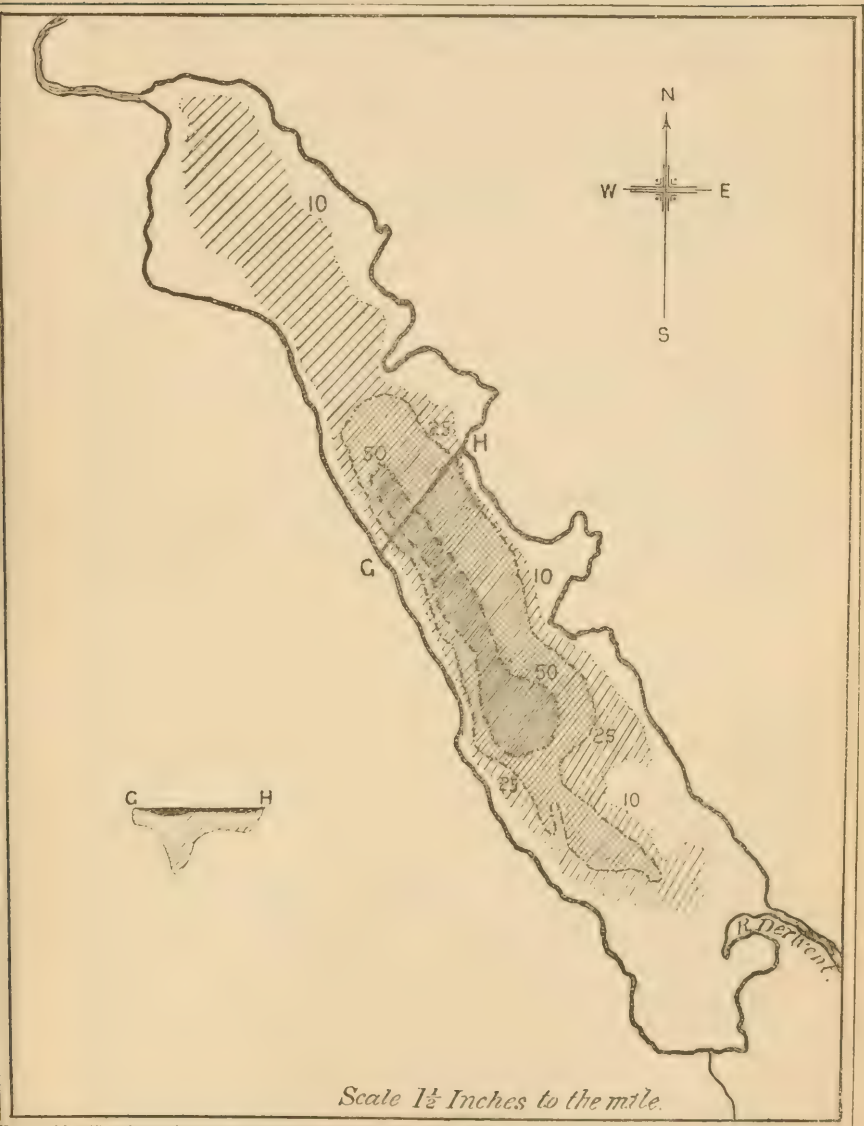
Cyclops serrulatus, Brady, British Copepoda, vol. i. p. 109, pl. xxii.; id. Rev. Freshw. Cyc. and Cal. p. 18, pl. vii. fig. 1.

This is the most common species of the genus. It occurs almost universally over Britain, and has been recorded by almost all continental writers. Specimens were only taken in Bassenthwaite in June.

Diaptomus castor, Jurine.

Diaptomus castor, Brady, Brit. Copepoda, vol. i. p. 59, pl. vi. figs. 6-13; id. Rev. Brit. Freshw. Cyc. and Cal. p. 27, pl. xi. figs. 1-6.

This species is generally distributed in Britain, but not



Bassenthwaite Lake. (Reproduced from 'Bathymetrical Survey of English Lakes,' H. R. Mill, D.Sc.)

common. Brady says that it rarely occurs in lakes or large sheets of water, but generally in ponds and ditches where there is much vegetation. This species was not very abundant in April, and no specimens were taken in June.

Diaptomus gracilis, Sars.

Diaptomus gracilis, Brady, Rev. Brit. Freshw. Cyc. and Cal. p. 29, pl. xi. figs. 7-9, pl. xii. figs. 1-8.

This species is universally distributed and abundant throughout Britain in large sheets of water where there is little vegetation.

ROTIFERA.

Asplanchna priodonta, Gosse.

Asplanchna priodonta, Gosse, Ann. & Mag. Nat. Hist. ser. 2, vol. vi. 1850, p. 18, pls. i. & ii.; Hudson and Gosse, Rotifera, p. 123, pl. xii. fig. 2.

Gosse found this species not uncommon in the Serpentine, Kensington Gardens, and in ponds and ditches near Birmingham. It was very sparingly but generally distributed in April, but in June occurred in vast quantities in all the tow-nettings taken at the surface and moderate depths.

In the Map accompanying this paper the areas of depth are signified by dotted lines.

The weather was calm and fine when the tow-nettings were made in June, but there had been heavy rains a few days before.

The tow-nettings were confined to the middle and northern portions of the lake.

In the 10-fathom area six tow-nettings were made, and were characterized by the presence of *Polyphemus* in greater numbers than elsewhere, and the almost complete absence of *Leptodora* and *Bythotrephes* (a few immature forms were taken).

In the 25-fathom area four tow-nettings were taken from 6 to 8 feet, in which *Leptodora* and *Bythotrephes* were fairly common.

In the 50-fathom area five tow-nettings were taken from 6 to 10 feet, and in these gatherings *Leptodora* and *Bythotrephes* were very abundant. (It is worthy of note that *Leptodora* and *Bythotrephes* very often occur together in great abundance.)

The remaining forms were distributed more or less universally over the portion of the lake examined.

LVIII.—*Descriptions of Two new Siluroid Fishes from Brazil.* By G. A. BOULENGER, F.R.S.

Brachyplatystoma platynema.

Vomerine teeth forming a very broad band, broader than the band in the upper jaw, angularly notched behind; another notch between it and the patch of palatine teeth. Head extremely depressed, twice as long as deep, $3\frac{1}{2}$ times in total length. Snout spatulate, rounded, projecting a little beyond the mandible; eye extremely small, in the posterior half of the head, its diameter 4 times in interorbital width; occipital process short, widely separated from the dorsal fin; upper surface of head covered with thin reticulate skin; fontanelle very small. Maxillary and mental barbels much flattened, band-like, the former reaching extremity of ventral, the anterior mentals nearly reaching extremity of pectoral, the posterior mental hinder third of ventral. Branchiostegal rays 12. Dorsal I 6, first ray $\frac{2}{7}$ length of head; adipose fin nearly three times as long as deep, $\frac{3}{4}$ its distance from the rayed dorsal. Anal IV 12, falciform, first branched ray $2\frac{1}{2}$ as long as last. Pectoral $\frac{2}{3}$ length of head, spine feebly serrated. Ventral as long as pectoral, widely separated from anal. Caudal deeply forked, the lobes produced into very long filaments. Caudal peduncle 3 times as long as deep. Dark brown above, lighter beneath.

Total length to middle caudal rays 430 millim.; upper caudal lobe with filament 250.

A single specimen from Pará; presented to the British Museum by Dr. E. A. Goeldi, Director of the Pará Museum.

This species is nearest allied to the recently described *Brachyplatystoma juruense*, Blgr.*, from which it is distinguished by the broader band of teeth on the palate, the longer snout, and the band-like barbels. From *B. Vaillanti*, C. & V., it differs in the above characters and in the smaller eye, the shorter barbels, and the wider separation between the occipital process and the dorsal fin.

LEPTODORAS, gen. nov.

Distinguished from *Oxydoras*, Kner, by the longer body

* The name *Platystoma*, Ag., being preoccupied, has been replaced by that of *Brachyplatystoma*, Eigenm.

and the longer anal fin with 15 to 17 rays. This genus is founded on *Oxydoras acipenserinus*, Gthr., and

Leptodoras juruensis.

No teeth. Depth of body 9 times in total length, length of head 5 times. Head $1\frac{1}{2}$ as long as broad, covered with skin, except on the occiput; snout depressed, pointed; posterior nostril equally distant from the anterior and from the centre of the eye; eye in posterior half of head, its diameter 3 times in length of snout, equal to interorbital width; occiput and occipito-nuchal shield granulated and striated; bases of the six barbels united by the fold of the lower jaw; maxillary barbel branched, not $\frac{1}{2}$ length of head, not reaching gill-opening; latter extending to below centre of eye. Humeral process striated, not $\frac{1}{2}$ as long as pectoral spine. Dorsal I 5, spine very feebly serrated in front, much produced beyond the soft rays, twice as long as head. Adipose fin very small. Anal V 12, its base $2\frac{1}{2}$ as long as that of the dorsal. Pectoral spine $\frac{3}{4}$ length of head, reaching base of ventral, with very strong serræ, especially on the inner side. Ventral a little shorter than pectoral. Lateral shields 44, not measuring $\frac{1}{2}$ the depth of the body, with serrated posterior border and very strong hooked spine. Caudal deeply bifurcate. Brown; pectoral, ventral, and adipose fins, and base of dorsal and anal, blackish.

Total length 235 millim.

A single specimen formed part of a small collection made in the Juruá River by Capt. Martins, and sent to me by Dr. Goeldi. This collection contained besides examples of two species not previously recorded from that river, viz. *Prochilodus insignis*, Schomb., and *Aphyocharax pusillus*, Gthr.

L. juruensis differs from *L. acipenserinus* in the more elongate body, the smooth snout and opercles, the smaller eye, the shorter maxillary barbel, the longer dorsal spine, and the smaller lateral shields.

LIX.—*A Revision of the Pierine Butterflies of the Genus Dercas*. By LIONEL DE NICÉVILLE, F.E.S., C.M.Z.S., &c.

THE name *Dercas* appears to have been a MS. name of Dr. Boisduval's; it first appeared in print in the 'Genera of Diurnal Lepidoptera,' vol. i. p. 70 (1847), and was briefly characterized, though not used in a generic sense, by Mr. Edward Doubleday, to whom, therefore, the genus should be credited, and not to Boisduval, as appears to have been more generally the custom.

In the 'Genera' Mr. Doubleday admits two species of the genus *Dercas*—No. 7, *Gonepteryx lycorias*, Doubleday, male only; and No. 8, *Gonepteryx Verhuellii* [recte *Verhuelli*], with *Rhodocera lycorias*, Doubleday, female only, as a synonym. With regard to *R. lycorias*, Dr. A. R. Wallace in 1867 wrote:—"Mr. Doubleday puts his *R. lycorias* ♀ as a synonym of *D. Verhuellii*, but retains *lycorias* ♂ as a distinct species from Sylhet. As no specimen answering to his description exists in the British Museum, or in any private collection with which I am acquainted, I am inclined to think that the specimen was probably compounded of the fore wings and body of *D. Verhuellii*, with the hind wings of a *Callidryas*" [= *Catopsilia*]. Mr. Hewitson in 1864 wrote:—"Gonepteryx lycorias [sic] of Doubleday does not differ from *G. Verhuellii*." Mr. W. F. Kirby, in his Syn. Cat., keeps *D. lycorias* distinct, but with the note "*An spec. fict.?*" Unfortunately the work in which *R. lycorias* is described is not to be found in the Calcutta libraries, so I propose to ignore the species altogether*.

The genus *Dercas* is found in the mountains of N.E. India (Nepal, Sikkim, and Bhutan), in Assam, Western, Central, and Southern China, Upper Burma (but not in Central and Southern Burma), in the Malay Peninsula, Sumatra, Java, and Borneo. Its headquarters would appear to be the Khasi Hills, as in that wonderfully rich region three species are found; Sikkim (and also probably Nepal and Bhutan, which are conterminous on either side of Sikkim) has two species; Southern China (Hongkong) has two species; the other regions one only. All the species appear to be extremely constant, and no seasonal dimorphism is known to occur in them. As far as is known they all inhabit large forests, except the species found in Hongkong, where no forest, strictly speaking, exists: when we took over that island from the Chinese it was bare of trees, but during the fifty-seven years of our occupation much has been done to reforest what was in 1841 almost entirely bare granite rocks. The Chinese have been well-named—though in joke—*Homo ligniperdus* by Mr. Sydney B. J. Skertchly, from their abominable wood-destroying characteristics.

* Since the above was put into type, Sir George F. Hampson, of the British Museum, has sent me very kindly a transcript of the description of *Rhodocera lycorias*, Doubleday (Gray's Zool. Misc. pp. 77, 78, fig. male, 1842), and a tracing of the figure, from which it is clearly evident that both sexes are synonymous with *Dercas Verhuelli*. The habitat given is "Silhet." In the description *D. Verhuelli* is not mentioned, so it may be safely assumed that Doubleday had never heard of it, or he would not have described his species.

The key to the species given below will enable anyone to easily recognize the various species.

- A. Of larger size; hind wing angulated, with a well-developed 'tail' at the termination of the third median nervule.
- a. Hind wing with no marginal orange mixed with black line.
 - a'. Fore wing on both sides with a large apical patch, black above, orange below.
 1. *D. Verhuelli*, van der Hoeven: N.E. Himalayas, Assam, Upper Burma, Southern China.
 - b'. Fore wing on both sides with no large apical patch.
 2. *D. Skertchlyi*, sp. n.: Southern China (Hongkong).
 - b. Hind wing with a marginal orange mixed with black line.
 3. *D. gobrius*, Hewitson: Malay Peninsula, Sumatra, Java, Borneo.
- B. Of smaller size; hind wing rounded, without a 'tail.'
- a. Fore wing with a large round black spot in the middle of the second median interspace.
 4. *D. Wallichii*, Doubleday: Sikkim, Khasi and Naga Hills, Assam.
 - b. Fore wing with no large round black spot in the middle of the second median interspace.
 - a'. Fore wing on the upperside with no apical and discal orange markings.
 5. *D. decipiens*, sp. n.: Khasi Hills.
 - b'. Fore wing on the upperside with the internal area of the apical black patch and a discal oblique fascia rich orange.
 6. *D. diffarmis*, sp. n.: Western and Central China.

1. *Dercas Verhuelli*, van der Hoeven.

Colias Verhuelli, van der Hoeven*, Tijdsch. voor Nat. Gesch. en Phys. vol. v. p. 341. n. 3, pl. vii. figs. 3 a, 3 b, female (1839). *Dercas Verhuelli*, Moore, Proc. Zool. Soc. Lond. 1865, p. 760; id., Elwes, Trans. Ent. Soc. Lond. 1888, p. 414. n. 372. *Gonepteryx Verhuelli* [sic!], Doubleday & Hewitson, Gen. Diurn. Lep. vol. i. p. 71. n. 8, pl. viii. fig. 3, male (1847). *Dercas Verhuelli*, Wallace, Trans. Ent. Soc. Lond. ser. 3, vol. iv. p. 398. n. 2 (1867); id., Butler, Cist. Ent. vol. i. pp. 36, 45, pl. ii. fig. 1, male (1870); id., Butler, Ann. & Mag. Nat. Hist. ser. 5, vol. xvi. p. 338. n. 83 (1885); id., Staudinger, Ex. Schmett. vol. i. p. 40, pl. xxii., male (1884-85); id., Schatz, Ex. Schmett. vol. ii. p. 68, pl. vii., male, palpus, and antenna (1886); id., Swinhoe, Trans. Ent. Soc. Lond. 1893, p. 308. n. 343; id., de Nicéville, Gazetteer of Sikkim, p. 167. n. 431 (1894); id., Watson, Journ. Bomb. Nat. Hist. Soc. vol. x. p. 671. n. 231 (1897); id., Adamson, Cat. Butt. Burmah, p. 42. n. 348 (1897).

Hab. China (van der Hoeven); Bengal (Moore); not uncommon in certain places in Sikkim up to 4000 feet from May to October (Elwes); China, N. India (Doubleday); N. India, Silhet (Wallace); Manipur, one pair (Butler); North India,

* Several writers—Staudinger, Schatz, Adamson, &c.—have attributed this species erroneously to Hewitson.

China (*Staudinger*); Khasia Hills, common (*Swinhoe*); Sikkim, local, but where it occurs abundant, found at about 4000 feet from May to October (*de Nicéville*); two specimens from the Chin Hills, 3500 feet, in the rains (*Watson*); rare in Burmah, one specimen captured in April at Tounggya Sekkan (*Adamson*); Sikkim, Jorhat, Sibsagar, Khasi Hills, Hongkong (*coll. de Nicéville*).

This species was originally described from China, probably from specimens obtained at Hongkong or close by in the Canton district. At Hongkong it does not appear to be very rare; Mr. E. F. Skertchly has sent me a good series taken in May. No species of *Dercas* is given by Mr. J. J. Walker in "A Preliminary List of the Butterflies of Hong-Kong" (Trans. Ent. Soc. Lond. 1895, pp. 433-477).

2. *Dercas Skertchlyi*, sp. n.

Hab. Hongkong, South China.

Expanse.—♂ 2·9, ♀ 3·2 inches.

Description.—*Male and female*. Differs from *D. Verhuelli*, van der Hoeven, in the fore wing lacking on both surfaces the large apical patch which is such a marked characteristic of that species; in *D. Skertchlyi* the costa from about the middle to the apex of the wing, and thence as far as the termination of the first median nervule, has a narrow black border of about equal breadth throughout. Otherwise the two species do not differ.

D. Skertchlyi cannot be a seasonal form of *D. Verhuelli*, as both species fly together in Hongkong in May, which is the only month in which Mr. E. F. Skertchly, after whom I have much pleasure in naming the species, has obtained it. It seems to be fairly common on the island, though I did not meet with it myself on the two occasions I was there.

3. *Dercas gobrias*, Hewitson.

Gonepteryx gobrias, Hewitson, Trans. Ent. Soc. Lond. ser. 3, vol. ii. p. 246. n. 5, pl. xvi. fig. 1, *male* (1864); id., Butler, Proc. Zool. Soc. Lond. 1865, p. 432. n. 4, pl. xxv. fig. 4, *male*. *Rhodocera gobrias*, Vollenhoven, Faune Ent. l'Arch. Indo-Néerl., Piérides, p. 63. n. 1 (1865). *Dercas gobrias*, Wallace, Trans. Ent. Soc. Lond. ser. 3, vol. iv. p. 398. n. 1 (1867); id., Druce, Proc. Zool. Soc. Lond. 1873, p. 356; id., Distant, Rhop. Malay. p. 308. n. 1, pl. xxvi. fig. 18, *male* (1885); id., Distant & Pryer, Ann. & Mag. Nat. Hist. ser. 5, vol. xix. p. 271. n. 152 (1887); id., de Nicéville & Martin, Journ. A. S. B. vol. lxiv. pt. 2, p. 500. n. 550 (1896).

Hab. Borneo (*Hewitson*); Borneo (*Butler*); Borneo (*Vollenhoven*); Sumatra, Borneo (*Wallace*); Borneo (*Druce*);

Province Wellesley, Perak, Sumatra, Java, Borneo (*Distant*); Northern Borneo, not common (*Distant & Pryer*); is rather rare in North-eastern Sumatra, and occurs from Bekantschan to the Central Plateau. Collectors never bring in more than two or three specimens at one time. We have specimens caught from February to August only (*de Nicéville & Martin*); Perak, N.E. Sumatra, N. & S.E. Borneo (*coll. de Nicéville*).

This is a very well-marked species. Mr. Distant has alone recorded it from Java, where it is probably rare.

4. *Dercas Wallichii*, Doubleday.

Gonepteryx Wallichii, Doubleday, Proc. Ent. Soc. Lond. ser. 1, vol. v. p. xlvii (1849). *Rhodocera Wallichii*, Butler, Proc. Zool. Soc. Lond. 1866, p. 452. *Dercas Wallichii*, Wallace, Trans. Ent. Soc. Lond. ser. 3, vol. iv. p. 398. n. 3 (1867). ? *Dercas Wallichii*, Elwes, Proc. Zool. Soc. Lond. 1882, p. 462; id., Elwes, Trans. Ent. Soc. Lond. 1888, p. 415. n. 373; id., Swinhoe, Trans. Ent. Soc. Lond. 1893, p. 308. n. 344; id., de Nicéville, Gazetteer of Sikkim, p. 167. n. 432 (1894). *Gonepteryx urania*, Butler, Proc. Zool. Soc. Lond. 1865, p. 458. n. 5, pl. xxvi. fig. 5, female. *Dercas urania*, Swinhoe, Trans. Ent. Soc. Lond. 1893, p. 308. n. 345.

Hab. North India (*Doubleday*); North India (*Butler*); N. India (*Wallace*); Sikkim, Khasias (*Elwes*); many examples, Khasia Hills (*Swinhoe*); Sikkim, Khasi Hills (*de Nicéville*); *urania*, Northern India (*Butler*); *urania*, several examples, Khasia Hills (*Swinhoe*); Lachung Valley in Native Sikkim, Khasi Hills, Upper Assam (*coll. de Nicéville*).

As far back as 1866 Dr. A. G. Butler sunk his *G. urania* under *R. Wallichii*, in which he has been followed by all writers except Col. Swinhoe, who in 1893 raises *D. urania* to specific rank, and notes:—"Kirby puts it as a synonym of the preceding [*D. Wallichii*], but I think it must be a good species, having never seen any intermediates." The specimens Col. Swinhoe refers to are probably *D. decipiens*, mihi, and he could not have looked up the literature on these species when he wrote this note. *G. urania* is undoubtedly a synonym of *D. Wallichii*. The home of this species in Sikkim has now been found, Herr Paul Möwis having obtained many specimens through his native collectors from the Lachung Valley. Mr. W. Doherty notes in Proc. Zool. Soc. Lond. 1891, p. 251, that he obtained a large set of *D. Wallichii* at or near Mao, Manipur, and that it is curiously like *Gonepteryx zanecka* [not *zaneeka*], Moore, of the North-west Himalayas. It flew in June and disappeared in July. Through the kindness of Mr. H. J. Elwes I have several of these Manipuri specimens in my collection. Dr. Butler notes

in 1866 that *R. Wallichii* "has been for years confounded with a smaller insect described last year by Mr. F. Moore," this species being *G. zaneka* probably.

5. *Dercas decipiens*, sp. n.

Hab. Khasi Hills.

Expanse.—♂ 2·2–2·4 inches.

Description.—*Male.* Differs from both sexes of *D. Wallichii*, Doubleday, in the absence of the large round spot placed in the middle of the second median interspace of the fore wing, touching the second and third median nervules, and which is black above and reddish below; in all other respects the two species are the same.

I have this species only from the Khasi Hills, where it appears to be quite as common as *D. Wallichii*, Doubleday, the Rev. Walter A. Hamilton having kindly sent me many examples of both from thence, obtained by his native collectors. As they occur synchronously, one species cannot be merely a seasonal form of the other.

6. *Dercas difformis*, sp. n.

Dercas Wallichii, Leech [nec Doubleday], Butt. from China, Japan, and Corea, vol. ii. p. 445, pl. xxxv. fig. 3, *male* (1893).

Hab. Western and Central China.

Expanse.—♂ 2·5 inches.

Description.—"Chinese specimens of *D. Wallichii*, Doubleday, are rather larger than those from India. In the male the costa towards the apex is marked with red, and there is an oblique streak of the same colour, interrupted by the nervules, from the apical black patch. The underside is identical with that of Indian specimens of the same sex. The females from both countries are alike. Fairly common throughout Central and Western China at moderate elevations; the female is scarcer than the male." (*Leech, l. c.*)

Mr. Leech described this species as above, but compared it with *D. Wallichii*, which has the round spot in the second median interspace of the fore wing on both surfaces, which spot is entirely absent from *D. difformis* and *D. decipiens*, mihi. From the male of the latter species it differs in the male in having the apex of the fore wing much less produced, in the presence of a rich orange suffusion within the black apical area of the fore wing on the upperside, and also of an oblique discal orange fascia running from the apex of the wing to the first median nervule. In size it is rather larger

than *D. decipiens*, and has the outer margin of the hind wing still more evenly rounded, with no trace of a projection at the apex of the third median nervule.

I possess three males of this very distinct species from Moupin, sent me by M. Charles Oberthür.

Indian Museum, Calcutta,
July 12th, 1898.

LX.—*A new Species of Shrew from Ashantee.*

By W. E. DE WINTON.

AMONG a few small mammals lately presented to the British Museum by Capt. W. Giffard, who collected them in Ashantee, is a very striking shrew, of such intense rich seal-brown colour that it appears almost black. I am indebted to Mr. Oldfield Thomas, who has kindly handed the collection over to me for description, and I have pleasure in associating the name of the discoverer with this fine new form, which may be described as follows:—

Crocidura (Cr.) Giffardi, sp. n.

The head and body above and below, with the legs and feet, dark seal-brown or brown-black; tail coal-black.

Measurements taken from the dried skin:—

Head and body (c.) 130 millim.; tail (c.) 100; hind foot without claws (c.) 23; from the nose to the termination of the thick body-fur 145; the thinly haired portion of the tail 85.

Measurements of skull:—

Greatest length 36.1 millim.; breadth 15; narrowest across interorbital constriction 7.1; basal length 33.7; front of incisors to back of palate 18.5; tooth-row 17; tip of incisors to tip of large premolar 8; greatest breadth across ms. 2 11.5. Mandible: length 23.9; height, angle to coronoid 11.6.

Type (♀) no. 98. 10. 24. 5 in the British Museum.

Collected by W. Giffard, 30th June, 1898, at Morsi, 600 feet, on the way to Kumassi. "Found dead."

This shrew is one of the largest true *Crociduras* known; its colour alone is sufficient to distinguish it from any other species.

Compared with *C. Manni* the skull is much larger in every measurement, and proportionately broader in the facial portion; the palate is broader and the teeth throughout much

heavier; the top of the skull is much flattened, especially over the fronto-parietal constriction, where it is also somewhat depressed.

The two small unicuspid teeth are subequal in size, the hindermost only being slightly larger in cross-section. Though the label records that this shrew was "found dead," there can be little doubt that its demise had not long taken place, for the skin is in perfect preservation throughout and reflects great credit on the collector, the fur being like shining velvet.

LXI.—Notes on some Type Specimens of Cretaceous Fishes from Mount Lebanon in the Geneva Museum. By A. SMITH WOODWARD, F.L.S.

WHEN Professor F. J. Pictet, in collaboration with Mons. A. Humbert, published an extended and revised memoir on the Cretaceous fish-fauna of Mount Lebanon in 1866*, he was still unable to elucidate further some of the more problematical fishes which he had already described in his original memoir on the subject in 1850 †. The much later researches of Davis ‡, based upon the Lewis Collection, also failed to contribute many facts of importance to our knowledge of these doubtful forms, and did not refer to Pictet's type specimens in the Natural History Museum of Geneva. During a recent study of the Cretaceous fish-fauna in question, I have therefore visited Geneva for the purpose of examining Pictet's original collection; and, thanks to the kindness of Dr. Maurice Bedot and Dr. Weber, I am now able to add a few interesting facts concerning some of the imperfectly understood types, regarded in the light of our present knowledge.

1. *Petalopteryx syriacus*, Pictet, *op. cit.* p. 22, pl. iii. fig. 1.

The unique type specimen of this species is very inadequately described and imperfectly figured by Pictet. The fish is displayed chiefly in side view on a small slab of fissile limestone from Hakel, but the trunk and dorsal fin are for the most part indicated only in impression. The hinder part of the cranial roof is well preserved and suggestive of that of *Amia*, with large parietal bones in contact mesially, and a

* Pictet & Humbert, 'Nouvelles Recherches sur les Poissons Fossiles du Mont Liban' (Geneva, 1866).

† F. J. Pictet, 'Description de quelques Poissons Fossiles du Mont Liban' (Geneva, 1850).

‡ J. W. Davis, "The Fossil Fishes of the Chalk of Mount Lebanon in Syria," *Trans. Roy. Dublin Soc.* [2] vol. iii. (1887), pp. 457-636. pls. xiv.-xxxviii.

single pair of transversely elongated supratemporals. These elements are ornamented with rugæ and tubercles of enamel, as in *Lophiostomus* from the English Chalk. One fragment of jaw, possibly maxilla, bears traces of small, slender, conical teeth; while among other remains in the region of the mouth there are also scattered numerous small blunt teeth, some distinctly cupped at the apex. Below the head there are a few very slender branchiostegal rays. The internal skeleton of the trunk is not observable, and the fins are not remarkably well preserved. The pectoral fins comprise each at least 15 stout rays, and seem to have been as large as represented by Pictet; but no fulera can be distinguished on their anterior border. The pelvic fins, each with 8 or 9 stout rays, are fringed with fulera, which rapidly decrease in size distally. The dorsal fin is observed to be much elevated in front, without fulera; but it is imperfectly preserved, and the number of its rays is uncertain. There is no trace of an anal fin. The caudal fin seems to have been forked, and its upper lobe is fringed with large fulera, which are erroneously represented as a bifurcating bundle in Pictet's figure. Fulera seem to have been absent on the lower lobe of the tail. The squamation, so far as distinguishable, is regular. The few scales preserved exhibit a smooth enamelled external face, while those near the dorsal and ventral borders of the fish are clearly much narrowed.

It thus seems probable that *Petalopteryx* is an Amioid ganoid of the family Macrosemiidae, as already maintained in the British Museum 'Catalogue of Fossil Fishes' (part iii. 1895, p. 181). Among new points to be added to the generic diagnosis may be mentioned the presence of stout crushing-teeth within the mouth and of well-developed fulera on the pelvic fins. It now remains to discover new specimens of *Aphanopygus* from the Cretaceous of Dalmatia, a genus referred to the "Macrosemii" by Bassani*; for it seems likely that the features in which this fish appears to differ generically from *Petalopteryx* will prove to be merely imperfections in the unique type specimen.

2. *Coccodus armatus*, Pictet, *op. cit.* p. 51, pl. ix. fig. 9.

Though the Pycnodont genus *Coccodus* is now tolerably well known from descriptions by Davis † and the present writer ‡, the original figure by Pictet has always been difficult to understand. An examination of the type specimen,

* F. Bassani, "Descrizione dei Pesci Fossili di Lesina," Denkschr. k. Akad. Wiss., math.-naturw. Cl. vol. xlv. (1882), p. 197, pl. i. figs. 1-9.

† J. W. Davis, *loc. cit.* p. 546, pl. xxx. fig. 1; also Quart. Journ. Geol. Soc. vol. xlvi. (1890), p. 565, pl. xxii.

‡ Catal. Foss. Fishes Brit. Mus. pt. iii. (1895), p. 266, pl. xvi. fig. 4.

however, in the light of present knowledge, readily explains it. The upper part of the figure represents the two splenial bones crushed together and exposed from their oral face. Two of the longitudinal series of teeth are shown on each element, and these together constitute the so-called four rows of palatal teeth of Pictet and Davis. To the left, and mostly below the splenials, the imperfect cranium is displayed in right side view, its snout pointing upwards. The mesethmoid and vomer are distinguishable, and on the edge of the latter is exposed one of the lateral series of small teeth, which is described by Pictet and Davis as pertaining to the mandible. The cranial roof-bones are shown to be ornamented with tubercles, and the top of the brain-case bears the characteristic, laterally-compressed, forwardly-directed spine. There is also a prominent ornamented angle at the occiput. The pectoral arch is vertically crushed, but obscured by the skull on the left side. On the right the anteriorly-directed spine of the clavicle is distinct, while on the left it seems possible to recognize parts of the two posteriorly-directed spines of the same element. Although Pictet mentions "vertebrae deformed by fossilization," there are no traces of vertebral centra in the anterior part of the abdominal region preserved; but the neural spines are shown to be fused with their somewhat expanded arches. There are no indications of scales or scutes.

3. *Osmeroides megapterus*, Pictet, *op. cit.* p. 27, pl. iii. fig. 3.

This species is founded on a specimen much too imperfect for precise determination and not exhibiting even so important a feature as the mouth. The suboperculum is rather large, and beneath it there are remains of seven branchiostegal rays, all comparatively slender, none laminar in form. The vertebral column is still more bent and broken than indicated in the figure, so that the abdominal region is much distorted and the number of vertebrae cannot be determined. There seem to be about 20 or 22 caudal vertebrae. As observed by Pictet, there are no traces of the pectoral fins; but the pelvic fins are relatively large, each comprising at least six stout rays, all of which are articulated and divided distally. The very slender pelvic fin-supports are seen in front, though not shown in the figure. The dorsal fin is situated rather far forwards, and seems to consist of 10 or 12 rays. The foremost ray preserved is probably short and spinous, but all the others are divided distally and with distant articulations. The fin-supports are very stout and dagger-shaped. The remains of the comparatively small anal fin comprise only 6 or 7 rays, which are similarly divided and articulated. The large scales are thick, smooth, and shining.

From this description it is evident that *O. megapterus* does not belong to the same genus as the typical *Osmeroides lewesiensis* from the English Chalk. So far as the parts preserved admit of judgment, indeed, the fish must be referred to the Scopeloid genus *Sardinioides* of W. von der Marck*.

4. *Clupea laticauda*, Pictet, *op. cit.* p. 39, pl. vii. fig. 3.

It is doubtful whether any of the supposed species of *Clupea* from the Cretaceous of Mount Lebanon are correctly referred to this genus; but there are none more readily separated from it than the so-called *Clupea laticauda*, of which the type specimen still remains the sole known example. This small fish is very unsatisfactorily figured by Pictet; but, on account of the absence of jaws, its precise affinities cannot be determined even by renewed examination in the light of present knowledge. In the cranium the frontal bones are partly preserved, and an impression of the outer face of their hinder portion seems to exhibit a lateral ornamentation in the form of tuberculated radiating lines. The parasphenoid is straight and comparatively thick; but the jaws are quite unrecognizable. The vertebræ appear to have been nearly 50 in number, half of them caudal; and the centra, which show fine longitudinal striations, are shorter than deep. One caudal vertebra seems to exhibit a lateral keel. The ribs are somewhat expanded proximally, and do not completely encircle the abdominal cavity. The pectoral fins are very delicate, crushed, and displaced. The pelvic fins comprise much stouter rays (probably 9 or 10) with robust supports, and are inserted far forwards. The dorsal fin exhibits 19, the anal fin 13 supports. There are slightly sinuous fulcral rays above and below at the base of the caudal fin, which is incomplete distally. There are no ridge-scales of any kind, and the squamation must have been either very delicate or absent. An impression of coprolitic matter, filling a comparatively slender intestine, occurs along the greater part of the abdominal region.

This fish probably belongs to the same family as *Enchodus* and *Pomognathus*. In many respects it is very suggestive of the latter genus; but it is distinguished among other features by its more numerous vertebræ.

5. *Pagellus libanicus*, Pictet, *op. cit.* p. 11, pl. i. figs. 2, 3.

The Acanthopterygians of the Cretaceous period are still very imperfectly known, and few are assigned to their correct systematic position. While, therefore, not attempting to express an opinion on the affinities of the two species

* Palæontogr. vol. xi. (1863), p. 45.

originally described by Pictet, but not subsequently noticed, it may be of interest to add a few notes which will be of service in eventually determining their true relationships.

Pagellus libanicus is represented by two specimens which seem to be correctly placed in one and the same species. The first (Pictet's fig. 2) exhibits about 24 vertebræ, of which half are abdominal and half caudal. The hinder abdominal vertebræ are shown to bear very strong downwardly-directed transverse processes. The clavicle bears a considerable laminar expansion, and there is also a long and slender post-clavicle. The pectoral fins seem to have been laterally placed, with the pelvic pair directly beneath them. The pelvic fin-rays cannot be counted. The dorsal fin comprises three small spines, gradually increasing in length, followed by 13 or 14 slender articulated and bifurcating rays. It is uncertain whether there are more than two short spines in front of the anal fin, which shows 10 or 12 soft rays. The second specimen (Pictet's fig. 3) confirms the characters of the vertebral column and dorsal fin already noted. Neither fossil exhibits satisfactory remains of the head and scales.

6. *Pycnosterinx dorsalis*, Pictet, *op. cit.* p. 17, pl. ii. fig. 3.

The description of the fossil thus named can be readily verified, so far as it extends. The articulations of the dorsal and anal fin-rays are rather distant, as in the so-called *Pagellus*. The dorsal fin seems to have comprised three gradually lengthening spines, though only the hinder two are clearly shown in the fossil; and these are much shorter than the 8 or 9 soft rays which follow and give the fin an acuminate form. The anal fin exhibits three spines similarly lengthening, but considerably stouter than those of the dorsal; and these are followed by about 6 soft rays.

BIBLIOGRAPHICAL NOTICE.

The Farmer and the Birds. By EDITH CARRINGTON. With Preface by Canon TRISTRAM, F.R.S. London: George Bell and Sons. 8vo. 1898.

THE object of this little compilation is a good one and the plan of it is methodical; but, unfortunately, like most works of a similar class, it asserts more than can be proved in some cases, and some things which can be disproved in others. The authoress also appears not to have had access to a very extensive library, whilst some of the books freely quoted from are themselves compilations, and very few (with the exception of Lydekker's *Natural History* and one or two works by Miss Ormerod, Mr. O. V. Aplin, and the Rev. Theodore Wood) can be regarded as recent.

In a book of instruction it is, before all things, important that statements made should be up-to-date; therefore, if the authoress, instead of abusing aviculturists, had taken them into her councils, she might have avoided the repetition of exploded fallacies. On p. 88 she observes:—"The bird-caging public, *who employ the bird-catcher*, are more to be blamed than he, since they merely gratify a caprice, and have not even the pretext of earning a living by it. That the Nightingale seldom long survives caging merely raises his price in the market, but does not deter the trade."*. In his preface the Rev. Canon Tristram rightly states that there are certain non-preventable causes, which he specifies, for the decrease in the numbers of certain birds; and I would add that it is to these, and not to the bird-catcher, that we must attribute the reduction of our Nightingales and Goldfinches.

Is it true that the bird-caging miscreant of the present day imprisons his feathered pets to gratify a mere caprice? I trow not. No bird can be thoroughly studied in all its ways when at liberty. To understand it one must keep it in flight-cage or aviary, watch every action, record every note, both when single and mated. When this has been exhaustively done in the case of every species, the useful work of the bird-catcher may be stopped without injury to mankind—not that his trade makes one iota of difference to the number of birds inhabiting these islands.

Before leaving this little book, I should like to call attention to one or two statements which need confirmation: personally I am very sceptical as to their credibility. According to Sweet, quoted by Macgillivray, quoted by the authoress, the Garden-Warbler is very fond of the larva of *Ganoris brassice*. I do not know any bird (and I have kept a minimum of over three hundred for some years) which will eat this caterpillar. I have no doubt that the larva of the small cabbage-butterfly is intended.

Woodlice are said to be eaten by numerous birds, but very few seem to care for them; they are almost invariably ignored.

The caterpillar of the buff-tip moth is said to be eaten by the Nuthatch; but my Nuthatch would not touch it.

Hairy caterpillars are said to be rejected by every bird but the Cuckoo: yet most of my Thrushes of various species have eaten them greedily.

The Wagtail is said to be very destructive to the turnip-beetle; yet when I had three species of Wagtails, and tried them all with these beetles, they rejected them with disgust, as did every other bird †.

The Nightingale is said not to live long in a cage; but this is almost as great a fallacy as it would be to make the same statement respecting a Canary.

It is suggested that the Cuckoo not only sucks eggs, but devours fruit and seeds. Perhaps it is as well that the kind-hearted authoress is not an aviculturist.

* A freshly caught Nightingale is worth about 3s. 6d.

† This statement is merely the guess of an entomologist, and a page and a half are devoted to enlarging upon it.

Finches are said to feed their young upon insects, which is, in a measure, true. The species of *Fringilla*, *Passer*, and *Emberiza* even give soft caterpillars and spiders to their young as soon as they become feathered; but the Fringilline method of feeding is *from the crop*, and it is to a certain extent carried on even after the young leave the nest.

A. G. B.

MISCELLANEOUS.

On the Dates of Jacob Hübner's 'Sammlung europäischer Schmetterlinge.'—Part I. By C. DAVIES SHERBORN. Part II. By JNO. HARTLEY DURRANT.

PART I.

AMONG some odd parts and numbers of different publications which were some years ago transferred as duplicates from the Library of the British Museum, Bloomsbury, to the Library of the British Museum (Natural History), occurs a portion of Hübner's 'European Butterflies' of great interest and value. This comprises:—

Zweyte Horde.—Sign. *b, c, d* (p. 32), and 2 unlettered signatures, Title, and the 2 Verzeichnisse (12 pp.). Total 44 pp.

Sechste Horde.—Sign. *a, b; a, b, c, d* (p. 32), and 1 unlettered signature, Title &c. (4 pp.). Total 36 pp.

Achte Horde.—Sign. *b, c, d, e, f, g, h, i, k* (p. 80), and 1 unlettered signature (*a*) (4 pp.). Total 84 pp.

Plates 1–60 of Geometers [figs. 1–312].

„ 1–16 of Sphinges [figs. 1–78].

„ 1–34 of Tineæ [figs. 1–237].

„ 1–16 of Tortrices [figs. 1–104].

„ 1–20 of Pyralides [figs. 1–134].

Pinned on to the titlepage of "Sechste Horde," with an old pin with the twisted wire head, is a manuscript of two quarto pages, in a handwriting I cannot identify, containing the following information:—

"Mr. Francillon has got only the Letter Press of Mr. Jacob Hübner's work on Insects from Page 1 Pyralides Pseudogeometræ, No. 1 Pyralis Emortualis—To page 30—No. 26 Pyralis Rufimitalis with an Index to this part from Pseudogeometræ page 1–7 to Verticalis 22 D 3, and in another part of Letter press from page 4 Pyralides Pseudogeometræ—Pyralides Ambigui—to page 15 No. 48 Pyralis Farinalis.

"This is all my Friend and myself have got of the Letter Press,

"The following is the Account of all the plates I have got, Viz'.

"Tineæ No. 1 Graminella to No. 209 Struthionipenes in all 30 plates.

Tortrices No. 1–2 Pariana to No. 104 Nebulana in all 16 plates.

Pyralides No. 1 Emortualis to No. 134 Radiatalis in all 20 plates.

Sphinges No. 1 Chimera to No. 74 Populi in all 15 plates.

Geometræ No. 1 Smaragdaria to No. 98 Remutaria in all 18 plates.

Plato 19 and 20 is wanting.

Geometræ No. 111 Rubicaria to No. 120 Piniaria in all . . 2 plates."

On the second page of manuscript is the following:—

“Decr. 24, 1799.

“Mr. Olivier’s Account of Mr. Hubners work up to the above time :

| | | |
|------------------------------------|-----------|--------------------------------------|
| “ Shinges [<i>sic</i>] | 17 plates | } with Letter Press. |
| Pyralides | 21 Do. | |
| Tiniæ | 37 Do. | } Letter press not yet Published. |
| Geometræ | 59 Do. | |
| Tortrices | 29 Do. | |
| Larva | 12 Do. | |

Total 175 Plates completed, of which I and Dr. Latham have only the Following :

| | |
|---------------------|------------|
| Geometræ | 20 plates. |
| Sphinges | 15 Do. |
| Pyralides | 20 |
| Tortrices | 16 |
| Tinia | 30 |

Total 101 Plates received.”

Here we have therefore a definite and careful account of no less than four copies of Hübner’s work before 24th Dec., 1799, a great step in advance; and this account agrees somewhat closely with the statements of Herrich-Schäffer in ‘*Corr.-Blatt Regensburg*,’ 23, 1869, p. 175, and completely with the portion acquired from the British Museum (Bloomsbury).

Now it is interesting to note that the titles and prefaces of these three portions (2, 6, and 8 Horde) are all dated 1796, while the titlepage of the 5th Horde is dated 1796, but the preface is dated 1800. The writer of the MS. had not met with the 5th Horde simply because it had not appeared by Dec. 24, 1799, but did so after 12th Jan., 1800. From these facts it appears highly probable that in this portion from the British Museum (Bloomsbury) we have a *complete and entire* example of Hübner’s *first* distribution, and I shall accept it as dating from 1796 and not later. Horde 5 I accept as dated 1800, and that is so far as I am at present prepared to go. The date of the ‘*Zeifer*’ will require some examination, those of the ‘*Nachträge*,’ “4th and 7th” Horde, do not appear to offer any difficulties.

With the plates I am not concerned, having given my reasons for rejecting names on plates unaccompanied by letterpress in *Proc. Zool. Soc.* 1896, p. 612. I do, however, record them in my ‘*Index Animalium*.’

C. DAVIES SHERBORN.

PART II.

In February 1892 Lord Walsingham purchased a copy of Hübner’s ‘*Europäischer Schmetterlinge*’ from Mr. Quaritch (Rough List 120, No. 598). This copy came from the library of E. Bellier de la Chavignerie and was accompanied by MS. indexes and coarse blue paper covers, the latter giving precise information as to the dates of

reception of the later parts of the work : whether these covers were in any way connected with the issue of the 'Sammlung' I am unable to say. Unfortunately some are missing, but, as supplementing Mr. Sherborn's valuable discovery, it is thought advisable to publish the information gathered from a study of this interesting copy.

Should any other copy contain similar notes, however fragmentary, it is to be hoped that they may be published at once, for it would appear that the many difficulties encountered in a study of the works of Hübner are gradually disappearing.

I. *Papiliones*. Pl. 1-207.

Pl. 198-207 are noted in pencil "hubner-Geyer." Cover missing ; 5 pp. MS. Index to the Sammlung and Geschichte.

II. *Sphinges*. Pl. 1-38.

In MS. on cover of coarse blue paper :—

"Sphinges, hübner. Catalogue Alphabetique des Sphinx figurés par hübner avec le renvoi aux numeros des planches, tout des Sphinx que de leurs larves, la première colonne renvoie au No. des pl. des Sphinx La Sec^e. au No. des pl. des chenilles. Au Nombre des chenilles figurées se trouve—celle nommée *Erixa* pl. 2 dont le Sphinx n'est pas figuré."

"en Novembre 1827 j'ai reçu les dernières planches supplémentaires qui ont paru jusqu'à ce jour ; au Novembre de 35 pour les Sphi[nx] et 27 pour les chenilles."

"du 28. 9bre. 1828 reçu une nouvelle pl. No. 36."

"en décembre 1829 reçu une planche nouvelle sur laquelle est représenté la chenille du Sphinx Dahlii." [=Pl. 28.]

Then follow 4 pp. of MS. index to both works, concluding with the additional note :—"Supplement reçu le 22 fevrier 1840 Achilleæ 37"—"hilaris 38."

III. *Bombyces*. Pl. 1-83.

In MS. on cover of coarse blue paper :—

"Catalogue Alphabetique des Bombyx d'Europe et de leurs chenilles figurés par hübner avec le renvoi aux Nos. des planches La 1^e Colonne renvoie au No. des planches des Bombyx la 2^e Colonne renvoie au No. des planches des chenilles. la 3^e Colonne renvoie au No. de l'espece dans l'Encyclopedie Methodique tom V. des insectes. le nombre des planches de Bombyx est de 70. sur lesquelles sont figurés 298 individus.

"le nombre des planches de chenilles de 70 au nombre des chenilles figurées, il y a celles des Bombyx *fascelina*, *Lunijera* et *unita* dont on ne trouve pas les figures des Bombyx."

"j'ai reçu, les dernières livraisons de supplement jusques y compris les pl. 70 des Bombyx et 70 de leurs chenilles en Novembre 1827.

"du 28. 9bre 1828 reçu les nouvelles planches 71, 72, 73 et 74."

“ en décembre 1829 reçu deux planches les 75 et 76, les especes en sont inscrites à leur places.”

“ en avril 1831, j'ai reçu un supplement de 4 planches les 77, 78, 79 et 80^e.”

“ En tout 83 planches.”

IV. *Noctuae*. Pl. 1-185.

Cover missing—no dates: 9 pp. MS. index to both works.

V. *Geometrae*. Pl. 1-113.

Pl. 110-113 noted in pencil “Geyer.” Cover missing—no dates: 6 pp. MS. index to both works.

VI. *Pyralides*. Pl. 1-32.

In MS. on cover of coarse blue paper:—

“Pyralideæ.

“ du 20 juillet 1832 reçu une planche, la 31.

“ du 20 mars 1834 reçu la planche 32 à porter a la table ?”

No MS. index.

VII. *Tortrices*. Pl. 1-53.

In MS. on cover of coarse blue (faded) paper: “Table des Tortrices (d'Hübner) et de leurs chenilles.”

“ en avril 1831 reçu une partie de texte, et 4 planches qui sont les 49, 50, 51 et 52^e.”*

“ du 20 mars 1834 reçu la pl. 53. à porter à la table.”

Then follow 6 pp. of MS. index to both works.

VIII. *Tineæ*. Pl. 1-71.

In MS. on cover of coarse blue paper:—

“Tineæ, 69 planches (avril 1827) table alphabetique; et Psyche

du 20 juillet 1832 reçu la pl. 70.”

Then follow 10 pp. of MS. index to both works, in which pl. 71 is referred to as “supplément.”

* [This part is reviewed, *Isis*, xxvi. (Heft 7) 674 (1833):—“Sammlung europäischer Schmetterlinge, errichtet von Jac. Hübner, fortges. von K. Geyer. Augsburg b. Verf. Heft 1, 30, 4, 16, 5 T. ill.” “Abgebildet sind hier *Tortrix dimidiana*” “*ambustana*.” [i. e. *dimidiana*, Pl. 48. fig. 239—*ambustana*, Pl. 52. fig. 333.] The collation of “Heft 1” is not easy to follow unless the “30” represents 1830, in which case it should be read thus:—“Heft 1” (of vii Horde. Die Wickler); “30” (=1830); “4” (=title pp. (2)+Geyer’s preface, pp. iii-iv [=4 pp.]); “16” (= Die Wickler by Frölich, pp. 1-16); “5 T. ill.” (= Pl. 48-52. fig. 299-333).

The MS. collation of the part received in April 1831 enumerates only “4 planches qui sont les 49, 50, 51 et 52^e,” while the ‘*Isis*’ collation enumerates 5 plates (= 48-52), and Geyer, preface, p. iv, writes “Die Abbildungen der fünf hier folgenden Tafeln” &c. I merely note the discrepancy without attempting to explain it.]

IX. *Alucitæ*. Pl. 1-7.

No cover nor index.

It is to be regretted that the covers of *Papiliones*, *Noctuæ*, *Geometræ*, and *Alucitæ* have been lost, as we are thus unable to ascertain the exact contents of the different parts: but it may be not uninteresting to reconstruct the parts indicated so far as we are enabled to do so by the MS. notes, hoping that additional information may be obtained from other copies of Hübner's 'Sammlung.'

Sammlung.

| Date of reception. | Contents ascertained. |
|---------------------------|---|
| April 1827 | <i>Tinea</i> , Pl. 69. |
| November 1827 | <i>Sphinx</i> , Pl. 35; <i>Bombyx</i> , Pl. 70. |
| 28th November 1828 .. | <i>Sphinx</i> , Pl. 36; <i>Bombyx</i> , Pl. 71-74. |
| December 1829 | <i>Bombyx</i> , Pl. 75-76. |
| April 1831 | <i>Bombyx</i> , Pl. 77-80; <i>Tortrix</i> , TEXT (pp. iv+16), Pl. 49-52. [? Pl. 48-52, teste Isis & Geyer.] |
| 20th July 1832 | <i>Pyralis</i> , Pl. 31; <i>Tinea</i> , Pl. 70. |
| 20th March 1834 | <i>Pyralis</i> , Pl. 32; <i>Tortrix</i> , Pl. 53. |
| 22nd February 1840 .. | <i>Sphinx</i> , Pl. 37-38. |

Geschichte.

| | |
|-------------------------|---|
| November 1827 | <i>Sphinx</i> , Pl. 27; <i>Bombyx</i> , Pl. 70. |
| December 1829 | <i>Sphinx</i> , Pl. 28. |

The following dates of reception may be of service to synonymists:—

Sammlung.

| | |
|------------------|---|
| <i>Sphinx</i> — | fig. 156-160 (Pl. 35), November 1827. |
| | fig. 161-164 (Pl. 36), 28th November 1828. |
| | fig. 165-173 (Pl. 37-38), 22nd February 1840. |
| <i>Bombyx</i> — | fig. 295-298 (Pl. 70), November 1827. |
| | fig. 299-314 (Pl. 71-74), 28th November 1828. |
| | fig. 315-322 (Pl. 75-76), December 1829. |
| | fig. 323-340 (Pl. 77-80), April 1831. |
| <i>Pyralis</i> — | fig. 193-200 (Pl. 31), 20th July 1832. |
| | fig. 201-207 (Pl. 32), 20th March 1834. |
| <i>Tortrix</i> — | [fig. 299-305 (Pl. 48), ? April 1831.] |
| | fig. 306-333 (Pl. 49-52), TEXT (pp. iv+16), April 1831. |
| <i>Tinea</i> — | fig. 451-457 (Pl. 69), April 1827. |
| | fig. 464-470 (Pl. 70), 20th July 1832. |

Geschichte.

| | |
|-----------------|---|
| <i>Sphinx</i> — | Pl. 27 (November 1827); Pl. 28 (December 1829). |
| <i>Bombyx</i> — | Pl. 70 (November 1827). |

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INDEX TO VOL. II.

- ABRÆUS, new species of, 181.
 Acanthophis, new species of, 75.
 Acisoma, new species of, 239.
 Adelpha, new species of, 71.
 Æliomorpha, new species of, 300.
 Æluroglena, characters of the new genus, 132.
 Akodon, new species of, 271.
 Alcock, A., on Indian deep-sea fishes, 136.
 Alebion carchariæ, description of female of, 366.
 Alphitopola, new species of, 50.
 Anaglymma, new species of, 161.
 Anchistus, characters of the new genus, 387.
 Andrena, new species of, 448.
 Anguilla anguilla, on the presence of, in the open sea, 355.
 Annelida, new, 277.
 Anteus, new species of, 277.
 Anuretes, new species of, 89.
 Aoroides, characters of the new genus, 276.
 Apiocephalus, characters of the new genus, 42.
 Apobletes, new species of, 159.
 Arachnida, new, 62, 100, 197, 348, 429.
 Araneus, new species of, 206, 436, 447.
 Aricoris, new species of, 72.
 Aspavia, new species of, 313.
 Asphondylia, new species of, 329.
 Aspidiotus, new species of, 25, 323.
 Aspongopus, new species of, 315.
 Atkinson, E., on the vitality of Entomostraca, 372.
 Bardistus, new species of, 135.
 Barrett-Hamilton, G. E. H., on a new hare from Algeria, 422; on the European dormice of the genera Muscardinus and Glis, 423.
 Basiocryptus, new species of, 303.
 Bassett-Smith, P. W., on new parasitic copepods on fish, 77, 357.
 Bather, F. A., on Petalocrinus, 195.
 Benthobatis, characters of the new genus, 144.
 Biobessa, characters of the new genus, 56.
 Bipinnaria asterigera, note on, 105.
 Bombus, new species of, 324.
 Bomolochus, new species of, 78.
 — megaceros, observations on, 358.
 Books, new:—Pilsbry's Catalogue of the Land-Shells of America, North of Mexico, 75; Grose-Smith and Kirby's Rhopalocera Exotica, vol. ii. 194; Carrington's The Farmer and the Birds, 489.
 Borradaile, L. A., on the Pontioidæ, 376.
 Boulenger, G. A., on a new genus of aglyphous colubrine snakes, 73; on a new death-adder, 75; on reptiles from Somaliland, 130; on two new fishes from Sind, 133; on two new snakes from Queensland, 414; on a new Siluroid fish from West Africa, 415; on the species of Polypterus, 416; on two new Siluroid fishes from Brazil, 477.
 Bouvier, E.-L., on new species of Peripatus, 351, 354.
 Brachiella, new species of, 96.
 Brachyplatystoma, new species of, 477.
 Broteas, new species of, 100.
 Buliminus, new species of, 127.
 Butler, Dr. A. G., on the butterflies of the genera Leptophobia and Pieris, 13; on the Pierine butterflies of the genus Catophaga, 392, 458.
 Calemetopus, new species of, 260.
 Caligodes, new species of, 364.
 Caligus, new species of, 82, 359.
 Capnodes, new species of, 227.
 Carcinops, new species of, 172.
 Catophaga, remarks on the genus, 392, 458.
 Centrophorus, new species of, 143.

- Ceropales fraterna*, new subspecies of, 455.
 Chapman, F., on Ostracoda from the Cambridge Greensand, 331.
Cherostes, new species of, 263.
Chimarrogale, new species of, 246.
Chipatula, characters of the new genus, 312.
Clione limacina, on the larval stages of, 103.
Clupea, notes on Cretaceous species of, 408.
Clupea laticauda, observations on, 488.
Coccidæ, new, 24, 322, 330, 401.
Coccodus armatus, remarks on, 486.
 Cockerell, T. D. A., on new *Coccidæ*, 24; on new North-American insects, 321, 401; on new Hymenoptera from Mexico, 448.
Cœnomorpha, new species of, 311.
Coleophora, new species of, 328, 403.
Coleoptera, new, 40, 156, 259.
Compsomera, new species of, 43.
 Copepods, new parasitic, 77, 357.
Coralliidæ, on new, from Madeira, 421.
Coralliocaris, new species of, 386.
Corinna, new species of, 221.
 Crangon, new species of, 275.
Crocidura, new species of, 247, 484.
Crossotus, new species of, 53.
Crustacea, new, 77, 275, 333, 357, 383.
Cyphophorus, new species of, 129.
Cyclopteryx, new species of, 229.
Cydrela, new species of, 218.
Cyrtarachne, new species of, 446.
Cythere, new species of, 337.
Dalsira, new species of, 302.
Dasyprocta, new species of, 273.
Dercas, revision of the genus, 478.
Deroplax, new species of, 310.
Dichelorhinus, new species of, 304.
Dinopis, new species of, 204.
Diplacanthopoma, new species of, 154.
Diplophos, new species of, 147.
Diplosis, new species of, 326.
Diploxys, new species of, 300, 307.
Discoscelis, new species of, 176.
 Distant, W. L., on new Hemiptera-Heteroptera, 134; on *Rhynchota* from the Transvaal &c., 294.
Dityloderus, characters of the new genus, 45.
Dresserus, new species of, 203.
 Druce, H., on new Heterocera from Tropical America, 226.
Durmia, new species of, 301.
 Durrant, J. H., on the dates of Hübner's 'Sammlung europäischer Schmetterlinge,' 492.
Dymantis, new species of, 298.
 Eel, on the presence of the common, in the open sea, 355.
 Elles, Miss G. L., on the graptolite-fauna of the Skiddaw slates, 427.
Encyrtus fuscicollis, on the dissociation of the egg and the cycle of development in, 28.
Engraulis, notes on Cretaceous species of, 410.
Ennea, new species of, 126.
 Entomostraca, on the vitality of, 372; on the, of Lake Bassenthwaite, 467.
Epierus, new species of, 171.
Epinephelus, new species of, 133.
Epizeuxis, new species of, 229.
Eremopedes, new species of, 323.
Eresus, new species of, 433.
Eumimetes, new species of, 53.
Eunidia, new species of, 57.
Euryaspis, new species of, 308.
Exomalopsis, new species of, 452.
Farnellia, characters of the new genus, 69.
Felis chaus and its allies, notes on, 291.
 Fishes, notes on palæozoic, 67; new, 67, 133, 143, 408, 415, 416, 477; on Cretaceous, from Mount Lebanon, 405, 485.
Flaminia, new species of, 313.
Funambulus, new species of, 248.
Funisciurus, new species of, 9.
 Gahan, C. J., on new longicorn Coleoptera from East Africa, 40.
Gasteracantha, new species of, 438.
 Geological Society, proceedings of the, 195, 427.
Gerbillus, new species of, 4.
Glis, new species of, 424.
Glyphotes, characters of the new genus, 250.
Gonochilus, new species of, 260.
Gonopsis, new species of, 304.
 Graptolite-fauna of the Skiddaw slates, on the, 427.
 Grose-Smith, H., on new butterflies from S. America, 70; on new species of *Thysonotis*, 404.
Gustiana, new species of, 228.

- Hadogenes, new species of, 198.
 Halictus, new species of, 450.
 Halosaurichthys, new species of, 149.
 Hapalus, new species of, 128.
 Harpactira, new species of, 199.
 Heliconius, new species of, 70.
 Hermilius, new species of, 80.
 Hersilia, new species of, 214.
 Heteromysis, new species of, 276.
 Hickson, Prof. S. J., on the Entomostraca of Lake Bassenthwaite, 467.
 Hister, new species of, 167.
 Histeridæ, new, 156.
 Hololepta, new species of, 157.
 Homalodes, new species of, 166.
 Homalopygus, new species of, 177.
 Hübner's 'Sammlung europäischer Schmetterlinge,' dates of, 491.
 Hyalomma, new species of, 456.
 Hymenoptera, new, 324, 329, 448.
 Hypargyra, new species of, 44.
 Hypena, new species of, 228.
 Hypomiscophus, characters of the new subgenus, 321.
 Ichneumon, new species of, 456.
 Idactus, new species of, 46, 263.
 Iguanognathus, characters of the new genus, 73.
 Insects, new North-American, 321, 401.
 Janira, new species of, 276.
 Johnson, J. Y., on new Coralliidæ from Madeira, 421.
 Kermes, new species of, 330.
 Kirby, W. F., on dragonflies from the Transvaal and Nyasaland, 229; on a new genus of Odonata, 346.
 Lasioptera, new species of, 327.
 Latastia, new species of, 131.
 Lecanium, new species of, 322.
 Lepeophtheirus, new species of, 86.
 Lepidonotus Wahlbergi, on the relation of, to *L. clava*, 108.
 Lepidoptera, new, 15, 70, 226, 328, 399, 403, 404, 461, 481.
 Leptodoras, characters of the new genus, 477.
 Leptophobia, new species of, 15.
 Lepus, notes on species of, 319; new species of, 422.
 Lernanthropus, new species of, 91, 368.
 Lestes, new species of, 245.
 Lewis, G., on new species of Histeridæ, 156.
 Lithurgus, new species of, 453.
 Lophyrus, new species of, 457.
 Lucilla, new species of, 72.
 Luidia, note on the larval stage of, 105.
 Lygrus, new species of, 261.
 McIntosh, Prof., on the larval stages of *Clione limacina*, 103; on *Bipinnaria asterigera*, 105; on *Lepidonotus Wahlbergi*, 108; on *Sigalion squamatum*, 111; on the Nemerteans in British text-books of zoology, 114.
 Macrocypris, new species of, 333.
 Mæroides, characters of the new genus, 276.
 Malabama, characters of the new genus, 309.
 Manmalls, new, 4, 9, 124, 245, 265, 292, 317, 422, 423, 484; notes on various American, 318.
 Marchal, P., on the dissociation of the egg and the cycle of development in *Encyrtus fuscicollis*, 28.
 Margites, new species of, 41.
 Marmosa, new species of, 274.
 Marshall, G. A. K., on seasonal dimorphism in the genus *Precis*, 30.
 Mecosoma, new species of, 308.
 Melissodes, new species of, 454.
 Melvill, J. C., on new Mollusca from S. Africa, 125.
 Menida, new species of, 313.
 Miller, G. S., jr., on a new bat from Lower California, 124.
 Miscophus, new species of, 321.
 Mollusca, new, 125.
 Monohammus, new species of, 262.
 Moyara, characters of the new genus, 314.
 Muscardinus, new species of, 423.
 Myotis, new species of, 124.
 Neacerea, new species of, 226.
 Nemerteans in British text-books of zoology, on the, 114.
 Nephila senegalensis, new subspecies of, 435.
 Nesogonia, characters of the new genus, 347.
 Nesotragus Livingstonianus, new subspecies of, 317.
 Nettekelys, characters of the new genus, 149.
 Nezara, new species of, 307.
 Nicéville, L. de, on the Pierine butterflies of the genus *Dercas*, 478.

- Nutting, C. C., on the sarcostyles of the Plumulariæ, 118.
- Odonata, new, 229, 346.
- Oniticellus, note on the genus, 75.
- Orthetrum, new species of, 238.
- Orthezia, new species of, 401.
- Orthoptera, new, 323.
- Oryzomys, new species of, 267.
- vestitus, note on, 318.
- Osmeroides, notes on Cretaceous species of, 406.
- Osmeroides megapterus, remarks on, 487.
- ‘Ostéographie,’ on the dates of Blainville’s, 76.
- Ostracoda from the Cambridge Greensand, on, 331.
- Pachycærus, new species of, 162.
- Pagellus libanicus, note on, 488.
- Palpimanus, new species of, 216.
- Panda, characters of the new genus, 299.
- Panurginus, new species of, 451.
- Paramphithoë, new species of, 276.
- Paridactus, characters of the new genus, 47.
- Pelorusus, new species of, 173.
- Perdita, new species of, 450.
- Perichæta, new species of, 283.
- Periclimes, new species of, 383.
- Peripatus, new species of, 351, 354.
- Peristethus, new species of, 152.
- Perrier, E., on the origin of the Vertebrates, 252.
- Petalocrinus, observations on, 195.
- Petalopteryx syriacus, note on, 485.
- Phyllocephala, new species of, 305.
- Phyllomacromia, new species of, 241.
- Phyllotis, new species of, 270.
- Physa, new species of, 129.
- Pieris, new species of, 18.
- Platyoides, new species of, 219.
- Platysoma, new species of, 160.
- Platythomisus, new species of, 445.
- Plectropygus, characters of the new genus, 54.
- Pleurocorallium, new species of, 421.
- Plocederus, new species of, 42.
- Plumulariæ, on the sarcostyles of the, 118.
- Pocock, R. I., on the Australian scorpions of the genus Urodacus, 59; on the scorpions of the genus Broteas, 98; on Arachnida from Natal, 197; on three new species of Selenops, 348; on Arachnida from Lakes Nyasa and Tanganyika, 429.
- Polyplastus, new species of, 261.
- Polypterus, on the species of, 416.
- Ponsonby, J. H., on new mollusca from S. Africa, 125.
- Pontodrilus, new species of, 281.
- Pontonia, new species of, 389.
- Pontoniidæ, revision of the, 376.
- Pratt, Miss E. M., on the Entomostraca of Lake Bassenthwaite, 467.
- Precis, on seasonal dimorphism in the genus, 30.
- Pretorius, characters of the new genus, 298.
- Propocera, new species of, 48, 263.
- Protomocerus, characters of the new genus, 48.
- Psammosteus, new species of, 67.
- Pseudelaps, new species of, 414.
- Pseudochromis, new species of, 134.
- Pseudoclavella, characters of the new genus, 92.
- Pulvinaria, new species of, 24.
- Pupa, new species of, 128.
- Raja, new species of, 145.
- Reptiles, new, 73, 75, 131, 414.
- Rhynchota, new, 24, 134, 294, 322, 330, 401.
- Rhythemis, new species of, 230.
- Rosa, Dr. D., on some new earth-worms, 277.
- Saccostomus, new species of, 6.
- Saletara, new species of, 400.
- Saprinus, new species of, 179.
- Sarotesius, characters of the new genus, 443.
- Sciurus, on the arrangement of the African groups of, 11; new species of, 265.
- Scribonia, new species of, 297.
- Selenis, new species of, 226.
- Selenops, new species of, 348.
- Sherborn, C. D., on the dates of Blainville’s ‘Ostéographie,’ 76; on the dates of Hübner’s ‘Sammlung europäischer Schmetterlinge,’ 491.
- Sigalion squamatum, note on, 111.
- Sophronica, new species of, 58.
- Spaniodon hakeiensis, remarks on, 412.
- Sparassus, new species of, 222, 442.
- Spencerella, characters of the new genus, 215.
- Spirontocaris, new species of, 276.
- Stathmodera, new species of, 264.

- Stegodyphus*, new species of, 201.
Stechia, characters of the new genus, 235.
Storena, new species of, 440.
Storthogaster, new species of, 134.
Succinea, new species of, 127.
Symmachia, new species of, 71.
Syndere, new species of, 44.
Synodontis, new species of, 415.
Tachyris, new species of, 461.
Taphozous longimanus, new subspecies of, 246.
Terapus, new species of, 178.
Termitoxenus, new species of, 175.
 Thomas, O., on new Bornean and Sumatran mammals, 245; on new mammals from South America, 265; on the Zululand form of Livingstone's antelope, 317; on various American mammals, 318.
Thomisus, new species of, 225.
Thrissopteroides, new species of, 408.
Thylacomys, note on the generic name, 196.
Thysonotis, new species of, 404.
Trachycystis, new species of, 125.
Tragiscoschema, new species of, 52.
 Traquair, Dr. R. H., on palæozoic fishes, 67.
Typhlops, new species of, 414.
Urodacus, on the Australian species of, 59.
Urothemys, new species of, 234.
 Vaillant, L., on the presence of the common eel in the open sea, 355.
 Vertebrates, on the origin of the, 252.
 Waite, E. R., on the generic name *Thylacomys*, 196.
 Walker, A. O., on Malacostraca from Puget Sound, 275.
 Waterhouse, C. O., on Scarabæidæ of the genus *Oniticellus*, 75; on new Coleoptera from East Africa, 259.
 Winton, W. E. de, on South-African rodents, 1; on West-African squirrels, 9; on *Felis chaus* and its allies, 291; on a new shrew from Ashantee, 484.
 Woodward, A. S., on Cretaceous fishes from Mount Lebanon, 405, 485.
Xenodermichthys, new species of, 148.
Xystrocera, new species of, 40.
 Zoological Nomenclature, report on the rules of, 181.
Zygodontomys, new species of, 269.

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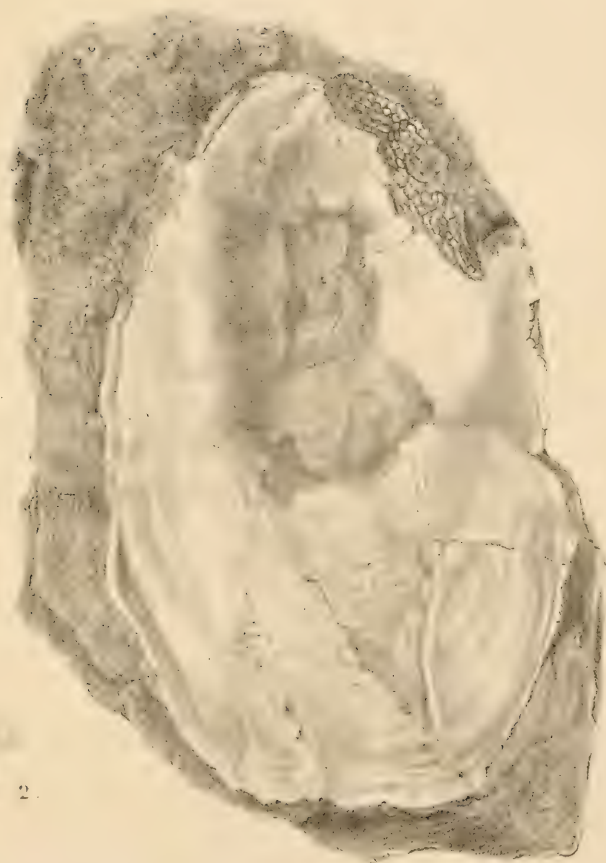
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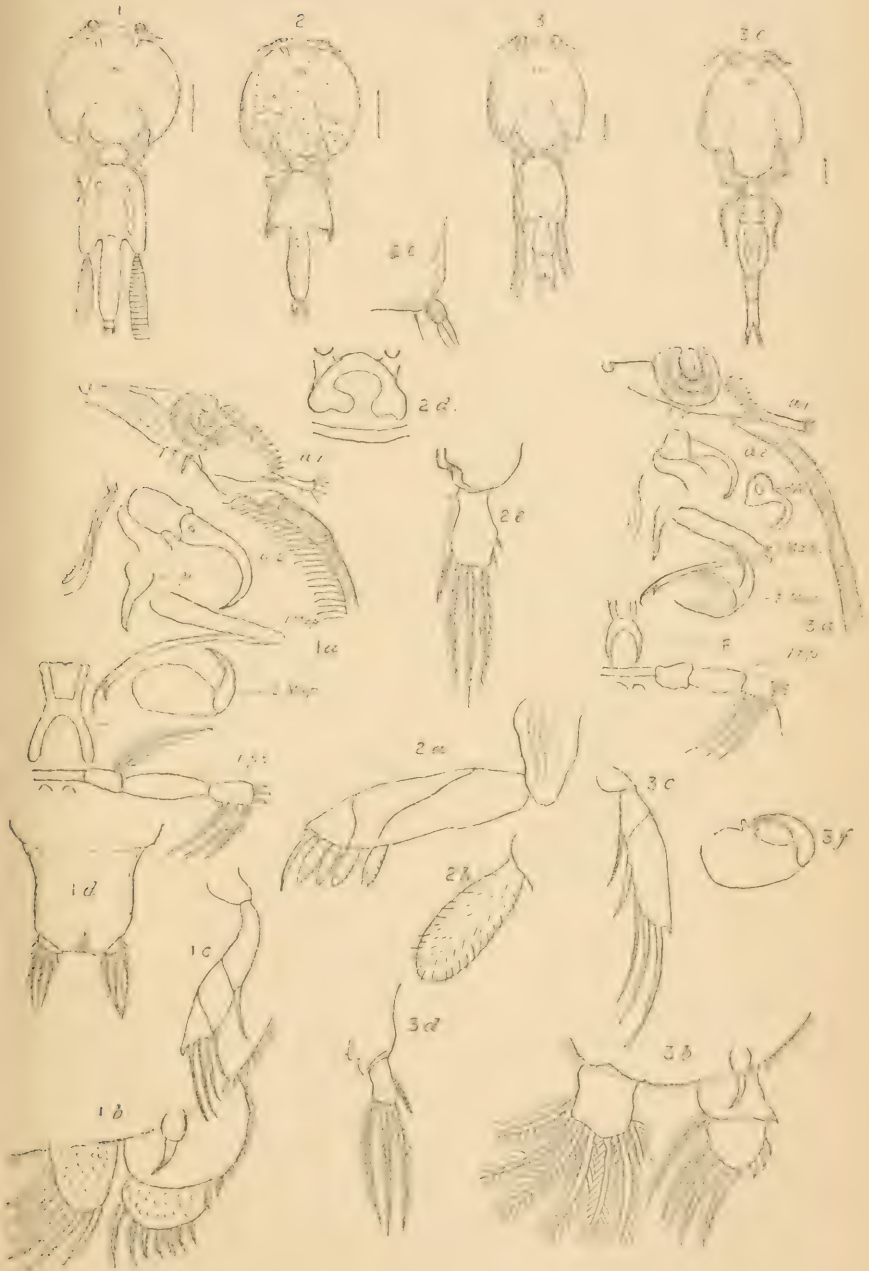


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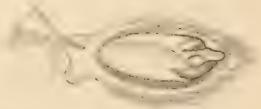
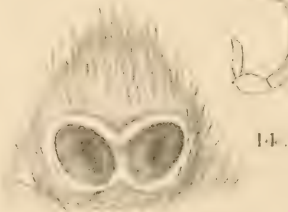
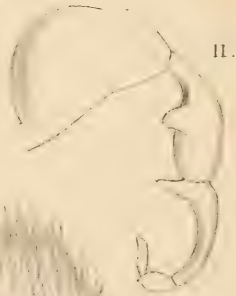
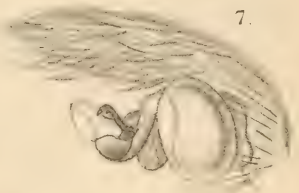
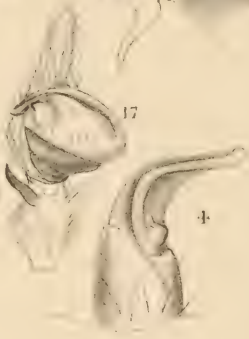
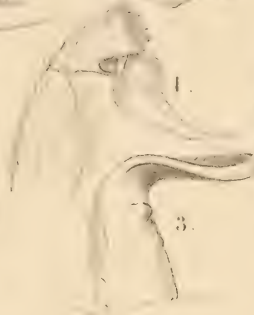
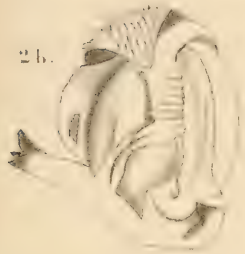
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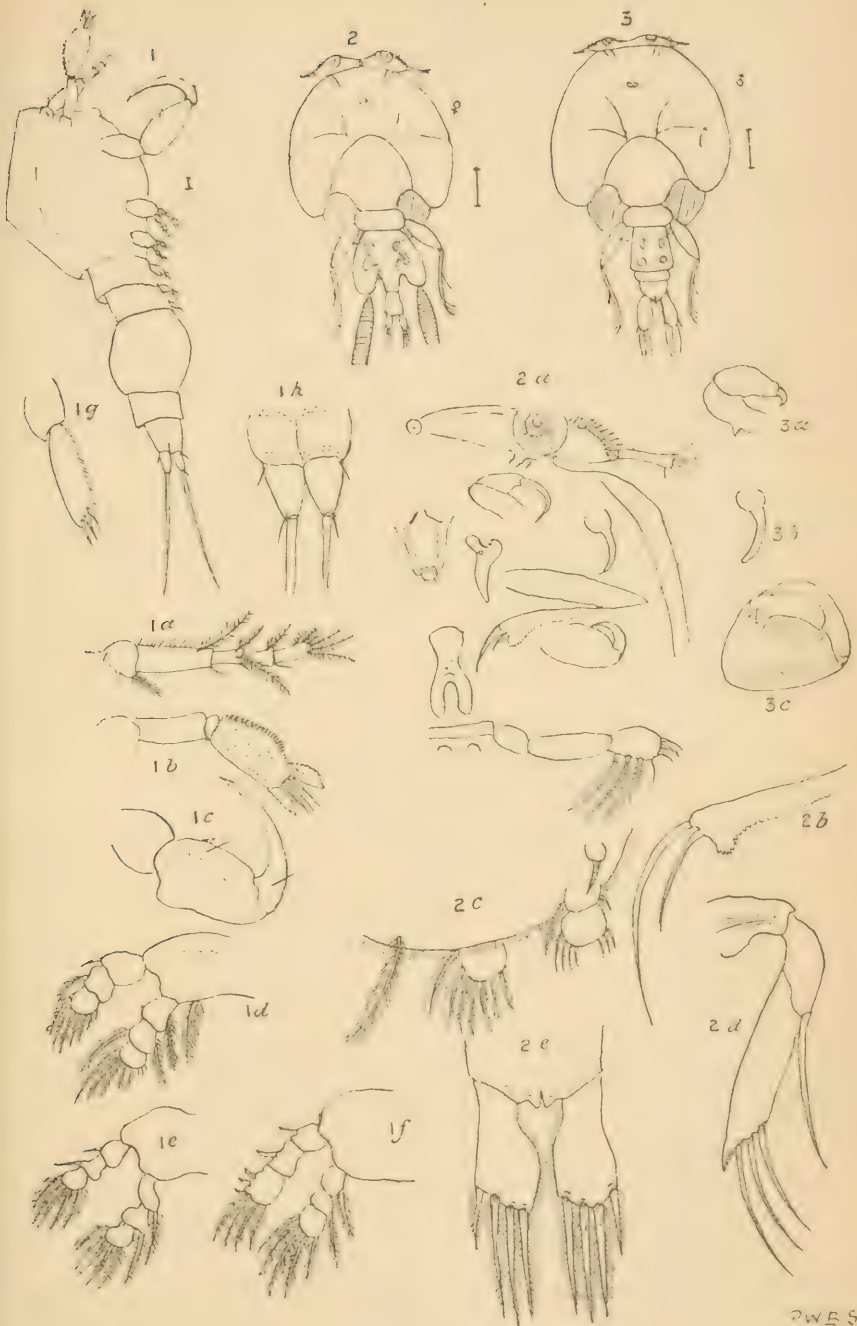
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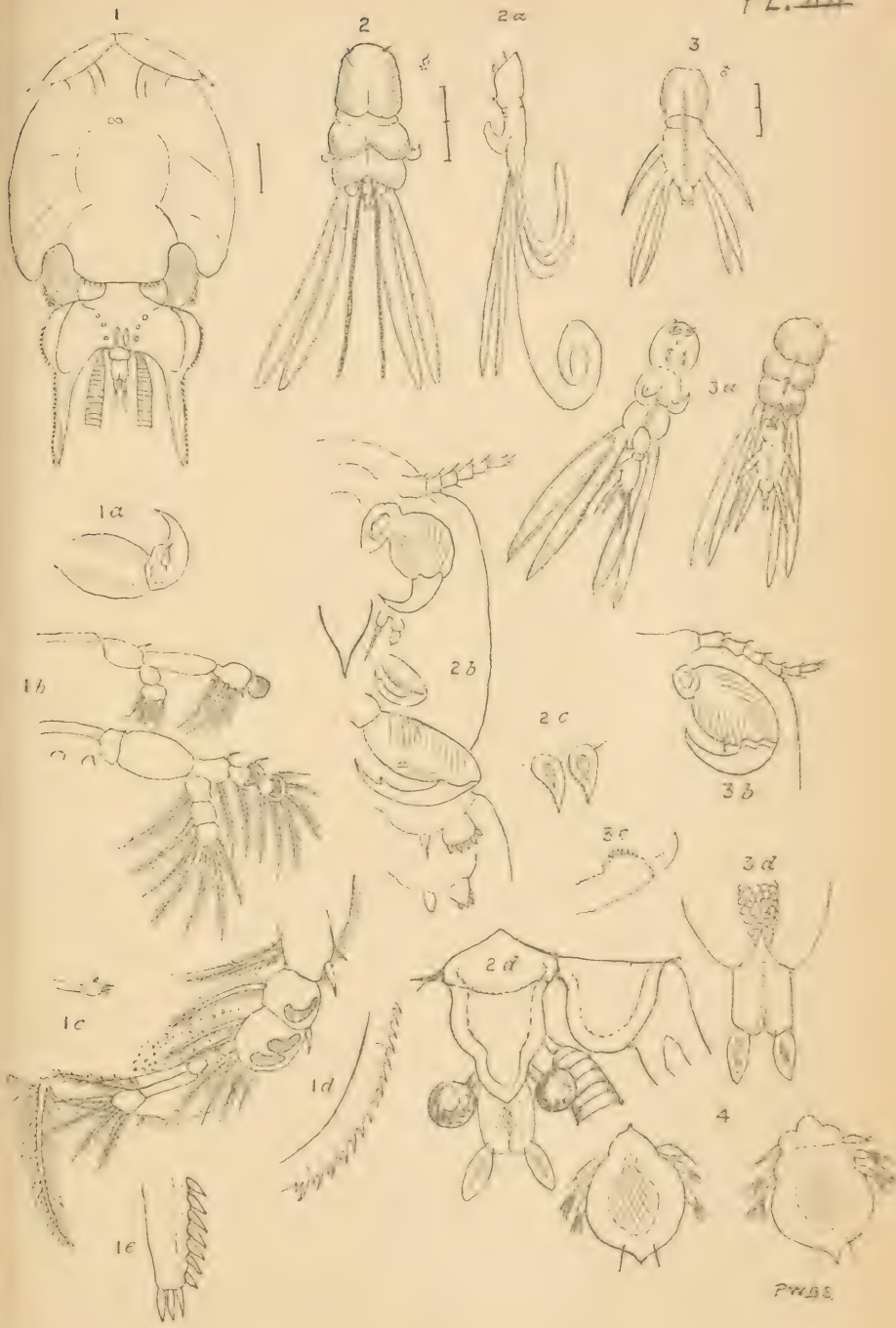


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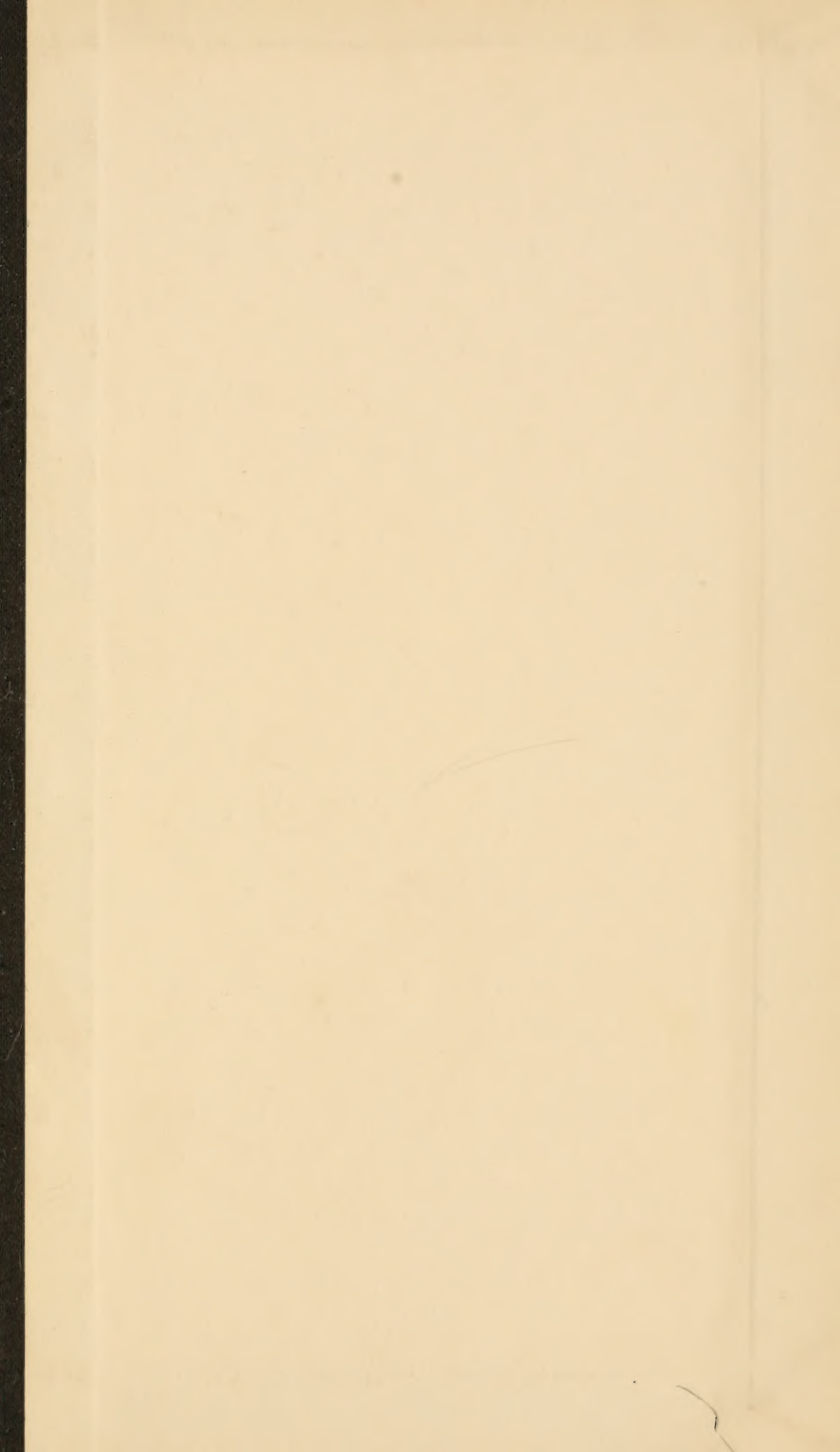
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